US 20080035317A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2008/0035317 A1**

CHOI et al. (43) **Pub. Date: Feb. 14, 2008**

(54) **AIR CONDITIONER**

(75) Inventors: **In Ho CHOI**, Gyeonggi-do (KR); **Dong Soo MOON**, Seoul (KR); **Jung Woo LEE**, Seoul (KR); **Nam Sik YIM**, Seoul (KR); **Seok Ho CHOI**, Seoul (KR); **Jeong Yong KIM**, Seoul (KR)

Correspondence Address:
GREENBLUM & BERNSTEIN, P.L.C.
1950 ROLAND CLARKE PLACE
RESTON, VA 20191 (US)

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

(21) Appl. No.: **11/836,395**

(22) Filed: **Aug. 9, 2007**

(30) **Foreign Application Priority Data**

Aug. 10, 2006 (KR) 10-2006-0075454

Publication Classification

(51) **Int. Cl.**
F28F 13/12 (2006.01)

(52) **U.S. Cl.** **165/122**; 165/125

(57) **ABSTRACT**

An air conditioner including a housing and a fan within the housing is provided. The fan may be configured to draw air into the housing and direct air radially outward. A heat exchanger may be configured to exchange heat with the air drawn into the housing. Also, at least one airflow guide may be configured to extend into a flow path of the air so that the flow of air is guided through the heat exchanger along a surface of the airflow guide.

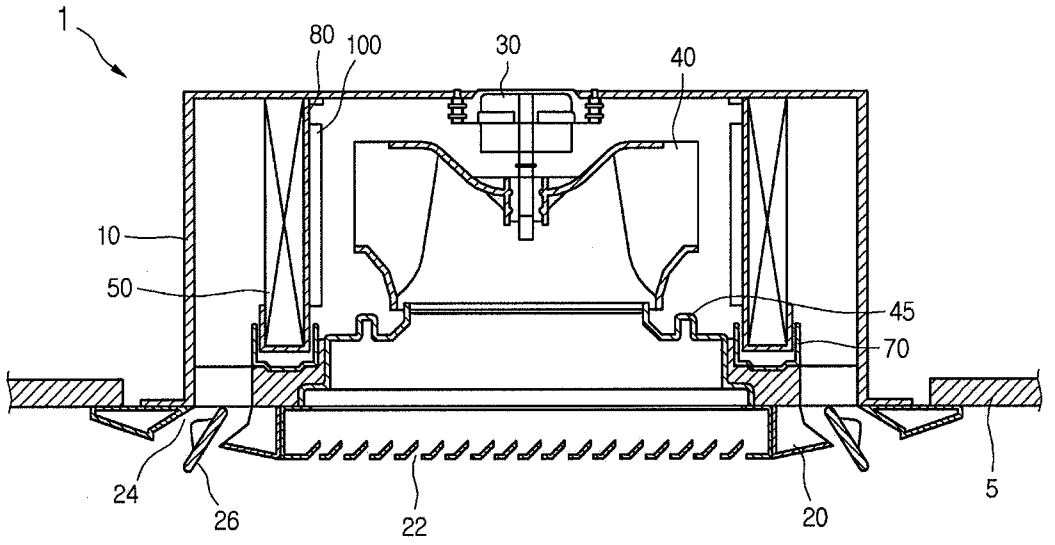


Fig.1

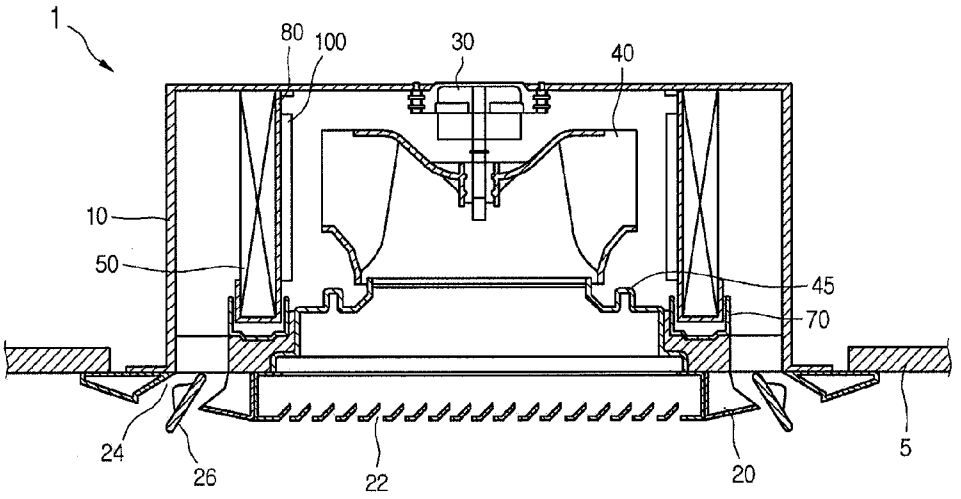


Fig.2

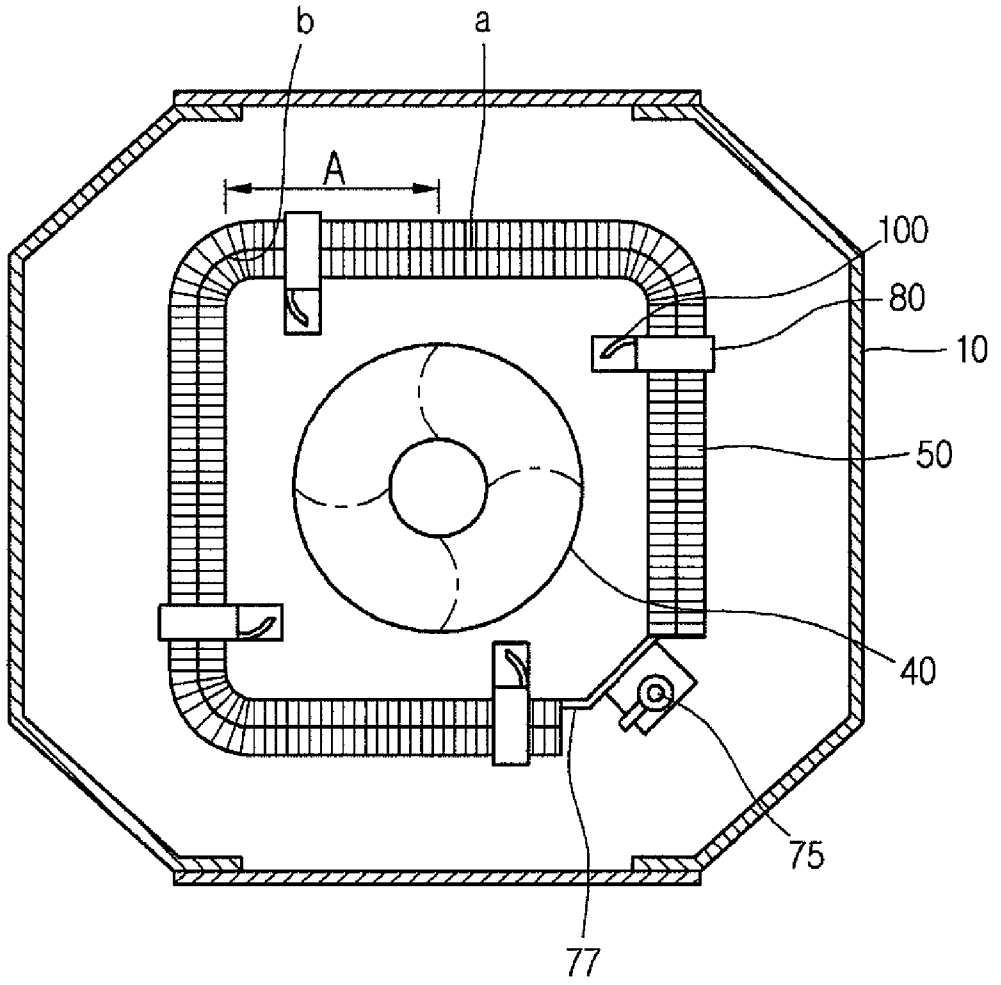


Fig.3

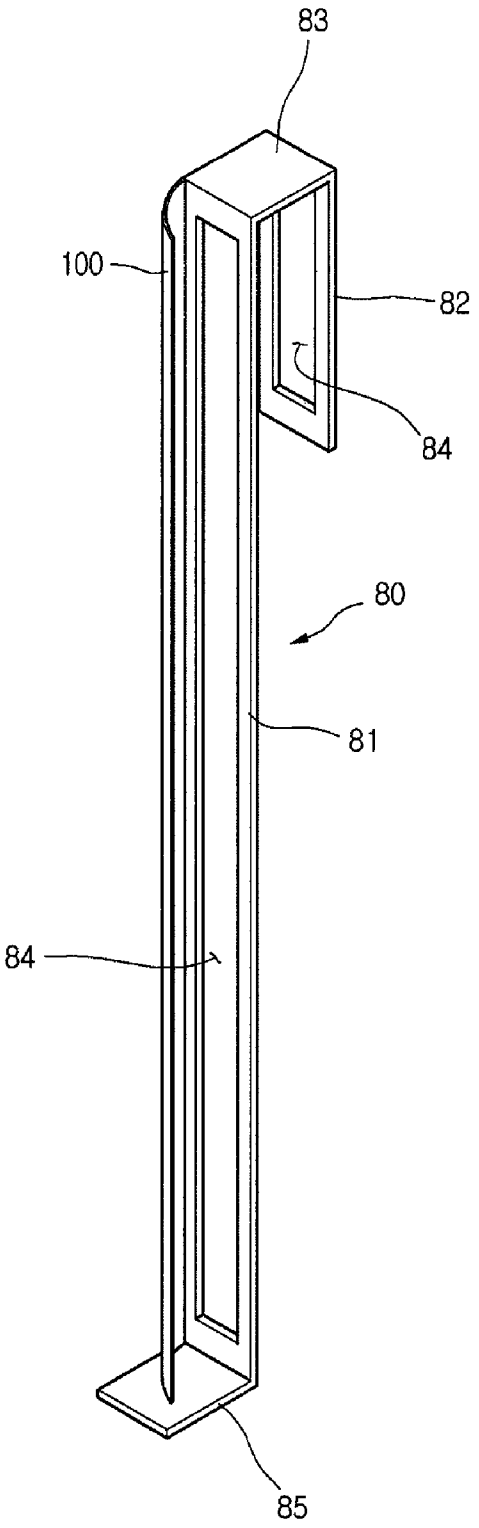


Fig.4

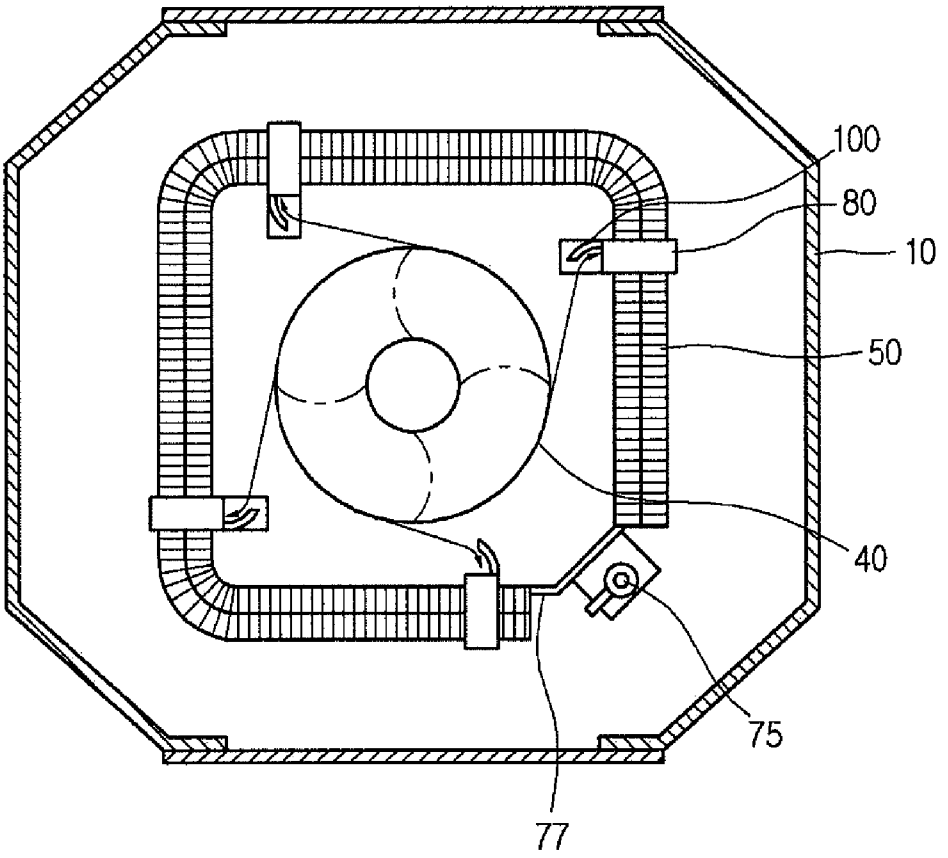


Fig.5

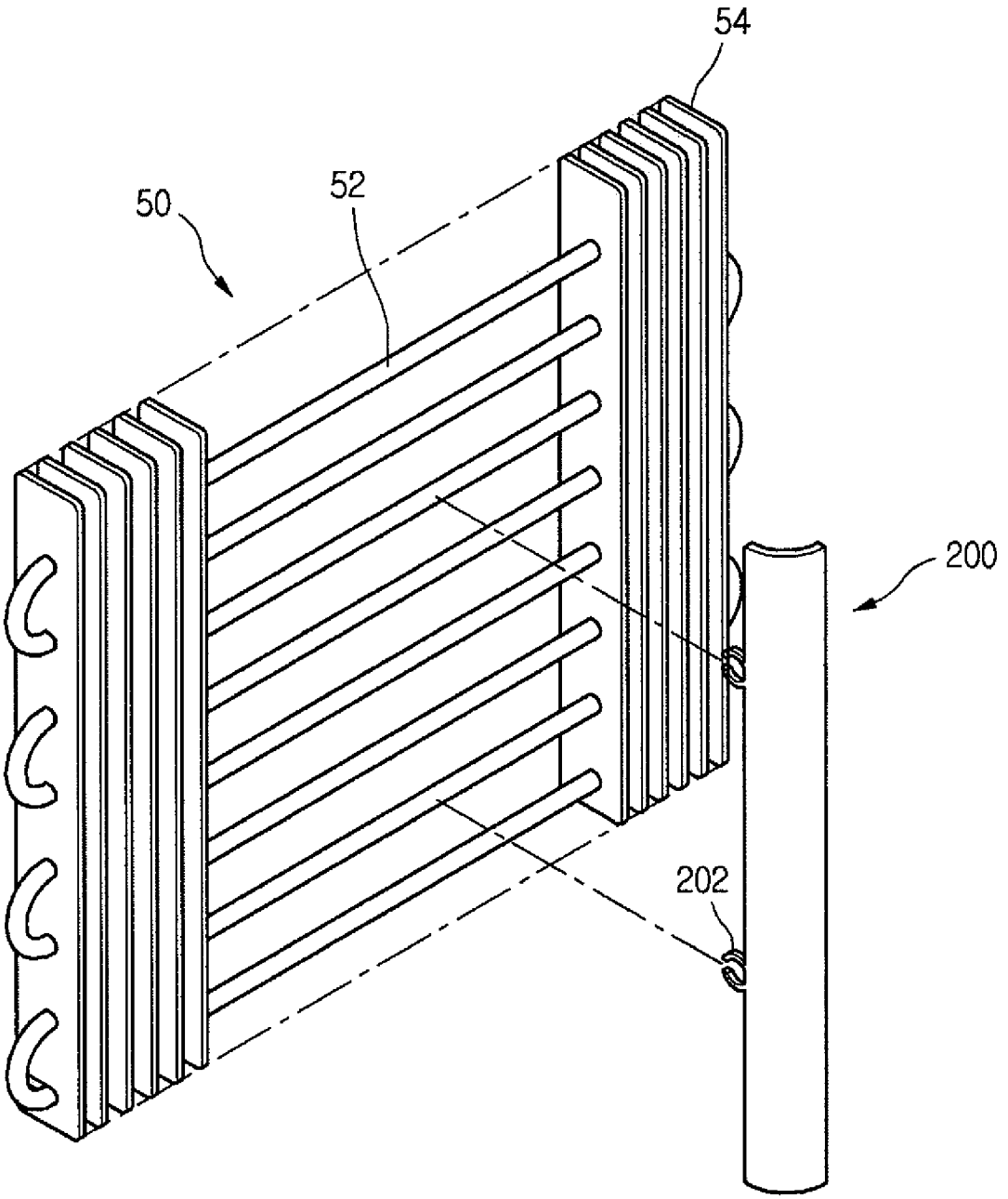
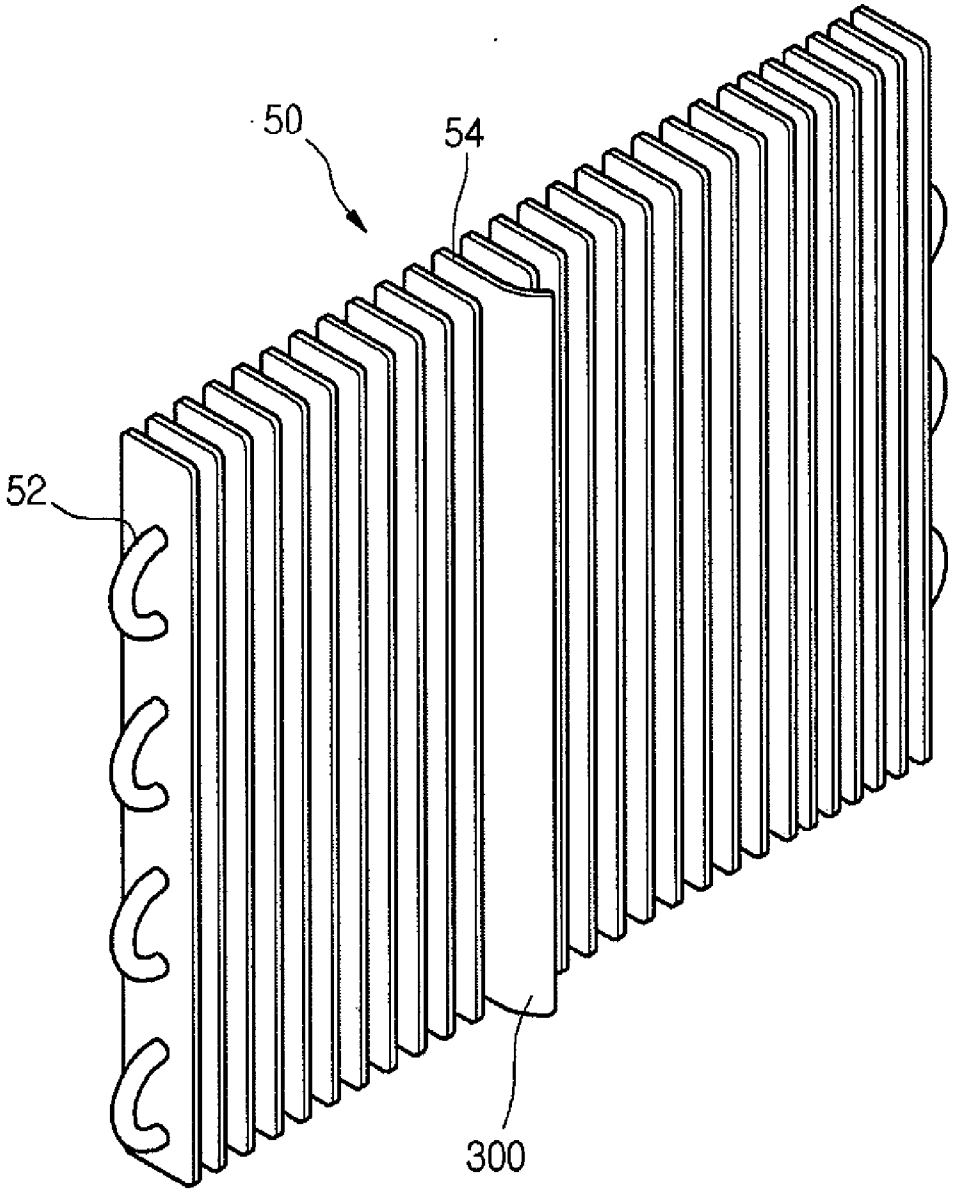


Fig.6



AIR CONDITIONER

[0001] The present disclosure relates to subject matter contained in priority Korean Application No. 10-2006-0075454, filed on Aug. 10, 2006, which is herein expressly incorporated by reference in its entirety.

BACKGROUND

[0002] The present disclosure relates to an air conditioner, and more particularly, to a ceiling mounted air conditioner that may be installed on a ceiling.

[0003] In general, an air conditioner is a home appliance which maintains the condition of air within an indoor space in an optimum state (e.g., a user selected temperature. Thus, an indoor space may be cooled in the summer and warmed in the winter, and the humidity level in the indoor space may also be controlled to provide a comfortable, clean indoor atmosphere.

[0004] Air conditioners may be categorized into many types according to purpose (or use) or installed location. In a typical ceiling mounted air conditioner, an indoor unit that suctions air from an indoor space, may exchange heat with a lower temperature air, and then may supply the air back into the indoor space. In this regard, the air conditioner may be installed between a ceiling wall and an outer ceiling surface.

[0005] A ceiling mounted air conditioner may include a cabinet or housing forming an outer shape of the air conditioning unit, a motor installed within the cabinet, a blower fan coupled to the motor, an inlet and outlet, and a front panel coupled to the bottom of the cabinet. A heat exchanger around the blower fan to exchange heat with air blown by the blower fan.

[0006] In the above configuration, air suctioned into the cabinet through the inlet by the blower fan is blown in a radial direction of the blower fan to pass through the heat exchanger. Then, the flow of air that passes through the heat exchanger is redirected as it contacts the surface of the cabinet so that it passes through the outlet into the indoor space below.

[0007] However, in a ceiling mounted air conditioner according to the conventional art, the air that is discharged in a radial direction of the blower fan is directed against the heat exchanger at a predetermined angle so that excessive noise is generated by the friction between the air and heat exchanger.

SUMMARY

[0008] Accordingly, a non-limiting feature of the present invention provides an air conditioner which may include a housing and a fan. The fan may be provided within the housing. In this regard, the fan may be configured to draw air into the housing and direct air radially outward. The air conditioner may also include a heat exchanger configured to exchange heat with the air drawn into the housing. Further, at least one airflow guide (configured to extend into a flow path of the air) may be provided so that the flow of air is guided through the heat exchanger along a surface of the airflow guide.

[0009] In another non-limiting feature, the heat exchanger may have multiple sides provided radially outward of the fan. In this regard, the airflow guide may be provided radially inward of the heat exchanger at a position spaced from a center of a corresponding side which the airflow guide is configured to guide air through.

[0010] According to another non-limiting feature, the airflow guide may be provided within a first region of a corresponding side of the heat exchanger such that an angle formed between the flow direction of air and the corresponding air flow guide is smaller than an angle formed between the flow direction of air and a center of the corresponding side of the heat exchanger.

[0011] In another non-limiting feature, a noise reduction hole may be provided in a surface at which the airflow guide and the flow of air meet. Additionally, the airflow guide may include a plurality of spaced-apart airflow guides provided on corresponding sides of the heat exchanger.

[0012] Further, the airflow guide may extend in a direction opposite to the flow direction of the air which is directed radially outward by the fan. Also, the airflow guide may be provided on a connector which connects the heat exchanger to the housing.

[0013] In a further non-limiting embodiment, the connector may include an inner surface provided at an inner side of the heat exchanger and an outer surface provided at an outer side of the heat exchanger. In this regard, the airflow guide may extend from the inner surface of the connector. Additionally, the inner surface and the outer surface may define a through-hole through which air passes.

[0014] In an additional non-limiting feature, the airflow guide may be coupled to a tube of the heat exchanger. For example, the airflow guide may include a coupling part which couples the airflow guide to the tube. Also, the airflow guide may extend from a fin of the heat exchanger.

[0015] In another non-limiting feature, the surface of the airflow guide may include a curved surface. The airflow guide may also be provided within a first region of a corresponding side of the heat exchanger so that an acute angle is formed between the flow direction of air and the corresponding air flow guide. Additionally, the airflow guide may protrude into the flow path of the air.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The present invention is further described in the detail description which follows, in reference to the noted plurality of drawings, by way of non-limiting examples of preferred embodiments of the present invention, in which like characters represent like elements throughout the several views of the drawings, and wherein:

[0017] FIG. **1** is a sectional view of a ceiling mounted air conditioner according to a first embodiment of the present disclosure.

[0018] FIG. **2** is a bottom view of a ceiling mounted air conditioner according to the first embodiment of the present disclosure.

[0019] FIG. **3** is a perspective view of a fixing member on which an airflow guide is formed according to the first embodiment of the present disclosure.

[0020] FIG. **4** is a plan view showing the flow of air in a ceiling mounted air conditioner according to the first embodiment of the present disclosure.

[0021] FIG. **5** is a perspective view of an airflow guide according to a second embodiment of the present disclosure.

[0022] FIG. **6** is a perspective view of an airflow guide according to a third embodiment of the present disclosure.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0023] The particulars shown herein are by way of example and for purposes of illustrative discussion of the embodiments of the present invention only and are presented in the cause of providing what is believed to be the most useful and readily understood description of the principles and conceptual aspects of the present invention. In this regard, no attempt is made to show structural details of the present invention in more detail than is necessary for the fundamental understanding of the present invention, the description taken with the drawings making apparent to those skilled in the art how the several forms of the present invention may be embodied in practice.

[0024] Reference will now be made in detail to the embodiments of the present disclosure, examples of which are illustrated in the accompanying drawings.

[0025] FIG. **1** is a sectional view of a ceiling mounted air conditioner according to the first embodiment of the present disclosure.

[0026] Referring to FIG. **1**, a ceiling mounted air conditioner **1** according to the first embodiment may include a housing **10** installed on a ceiling **5**, a front panel **20** coupled to the bottom surface of the housing **10**, a fan motor **30** fixed to the inner top surface of the housing **10**, a fan (e.g., a blower fan) **40** connected to the fan motor **30** which is configured to ventilate indoor air, a heat exchanger **50** configured to exchange heat between indoor air that is suctioned by the ventilating fan **40** and refrigerant within the heat exchanger **50**, and a fixing member **80** which fixes the heat exchanger **50** to the housing **10**.

[0027] The ceiling mounted air conditioner **1** may also include a bell mouth **45** provided below the fan **40** and configured to guide the flow of air suctioned (or drawn) into the housing **10**, a drain pan **70** provided below the heat exchanger **50**, the drain pan **70** being configured to collect condensed water that condenses while air passes through the heat exchanger **50**, and an airflow guide **100** provided between the heat exchanger **50** and the fan **40**, the air flow guide **100** being configured to guide the flow of air discharged in a radial direction to the fan **40**.

[0028] Specifically, the housing **10** may have a multi-faceted shape (e.g., multiple side surfaces) open bottom surface. Further, the front panel **20** may be coupled to the open portion of the housing **10** to seal the inside of the air conditioner.

[0029] An inlet **22**, through which indoor air is suctioned (or drawn) into the housing **10**, may be defined in the central portion of the front panel **20**. Additionally, a plurality of outlets **24**, through which air that passes through the heat exchanger **50** is discharged to the indoor space, may be defined around the inlet **22**.

[0030] Here, the inlet **22** may be formed in a rectangular shape, and the outlet **24** may be formed at each wall of the inlet **22**.

[0031] A discharge vane **26** configured to adjust the direction of air being discharged, may be pivotably coupled (e.g., via a hinge) to each outlet **24**.

[0032] Here, the fan **40** used may be a turbine fan which suctions or draws) air in an axial direction and discharges air in a radial direction.

[0033] The airflow guide **100** may be provided at the front of the heat exchanger **50** with respect to the flow of air, and may be configured to change the flow direction of the air flowing at an angle toward the heat exchanger **50**, thereby allowing air to pass through the heat exchanger **50**.

[0034] The flow of air in a ceiling mounted air conditioner will now be described by way of non-limiting example.

[0035] The blowing force generated by the rotation of the fan **40** may suction (or draw) air from below the housing **10** in a generally upwardly direction. In this regard, the suctioned air may enter the fan **40** in an axial direction and may be discharged in a radial direction. The flow of air that enters the heat exchanger **50** at an angle (from the air that is blown in a radial direction of the fan **40**) may be guided by the airflow guide **100** so as to pass through the heat exchanger **50**. The air that has exchanged heat may be redirected in a flow direction, and may flow downward and out through the outlet **24** and back into the indoor space.

[0036] A more detailed description of the structure of the airflow guide **100** is described below by way of non-limiting example.

[0037] FIG. **2** is a bottom view of a ceiling mounted air conditioner according to the first embodiment of the present disclosure, and FIG. **3** is a perspective view of a fixing member on which an airflow guide may be formed (or provided) according to the first embodiment of the present disclosure.

[0038] Referring to FIGS. **2** and **3**, a heat exchanger **50** may be disposed (or positioned) in an approximately rectangular formation (or configuration) within the housing **10**. The fan **40** may be positioned within the heat exchanger **50**.

[0039] The heat exchanger **50** may be fixed to the housing **10** by a plurality of fixing members. However, one of ordinary skill in the art would recognize that any fastener suitable for fixing a heat exchanger within a housing may be employed.

[0040] Also, a drain pump **75** may be provided at a side edge of the heat exchanger **50** for discharging water condensed in the drain pan **70** to the outside. Further, the drain pump **75** may be supported (or coupled) to the housing **10** by a bracket **77**, or any other suitable fastener.

[0041] In detail, the fixing member **80** may include a front surface **81** at the front of a heat exchanger **50** (with respect to the flow direction of air), a rear surface **82** at the rear of the heat exchanger **50**, a connecting portion **83** connecting the front surface **81** and the rear surface **82**, and a coupling portion **85** extending from the front surface **81** for fixing the fixing member **80** to the housing **10**.

[0042] In further detail, the coupling portion **85** may have a through-hole (not shown) formed therein so that the coupling portion **85** may be coupled to the inner-upper surface of the housing **10**.

[0043] For example, the coupling portion **85** may be coupled to the inner-upper surface of the housing **10**. Additionally, the fixing member **80** may be coupled to the housing **10** proximate a bottom opening, or t any other suitable position.

[0044] An air through-hole **84** may be formed (or provided to extend along a longitudinal length of the fixing member **80**. Additionally, the through-hole **84** may extend from the front surface **81** and the rear surface **82**, thereby providing a passage for air.

[0045] The airflow guide **100** may be provided on the front surface **81** and configured to guide the flow direction of air being discharged in a radial direction of the fan **40**, thereby reducing noise which may be generated by air colliding against the heat exchanger **50**.

[0046] Here, the fixing member **80** may be coupled to the heat exchanger **50** with the airflow guide **100** formed (or provided) on the fixing member **80**. In other words, the airflow guide **100** may be indirectly connected to the heat exchanger **50**.

[0047] More specifically, the airflow guide **100** may be formed (or provided) from a top-to-bottom direction along the length of the front surface **81**, may be curved to redirect the flow of air blown by the fan **40**.

[0048] That is, the direction in which the airflow guide **100** is curved, as shown in FIG. **2**, may be opposite to the direction in which the air is blown (or directed radially outward) by the fan **40**.

[0049] Here, the airflow guide **100**, as shown in FIG. **3**, may be formed along at least half the length or more of the front surface **81**, in order to achieve a smooth airflow.

[0050] Also, the airflow guide **100** may be disposed (or positioned) at a point at which the angle formed by the flow direction of air and the heat exchanger **50** is less than a predetermined angle. For example, the airflow guide **100** may be provided within a first region of a corresponding side of the heat exchanger **50** such that an angle formed between the flow direction of air and the corresponding air flow guide **100** is smaller than an angle formed between the flow direction of air and a center of the corresponding side of the heat exchanger **50**.

[0051] As shown in FIG. **2**, in the case of an approximately square heat exchanger **50**, the position of the airflow guide **100** may be provided at a location spaced from the center of a corresponding side of the heat exchanger **50** toward an end of the corresponding side at which an angle formed by the direction of air discharged from the fan **40** and the heat exchanger **50** is smaller than an angle formed by the direction of air discharged from the blower and a center of the corresponding side.

[0052] For example, the angle formed by the heat exchanger **50** of the present embodiment and the air, as shown in FIG. **2**, may be such that the direction of air with a point (a) on the heat exchanger **50** is less than an angle formed by the direction of air with a point (b) on the heat exchanger **50**.

[0053] In other words, the region of the smaller range of angles formed by the direction of air and the heat exchanger **50**, as represented by (A) in FIG. **2**, and the airflow guide **100** may be formed in any position in the region (A).

[0054] Also, at least one airflow guide **100** may be provided in region (A). In the case where a plurality of airflow guides **100** is provided, the front-to-rear length of airflow guides formed at point (a) on the heat exchanger **50** may be longer than that of airflow guides formed at point (b) on the heat exchanger **50**.

[0055] That is, the distance between the heat exchanger **50** at point (a) and the fan **40** may be less than the distance between the heat exchanger **50** at point (b) and the blower fan **40**. In order to form a passage for the flow of air, the length of the airflow guide provided at point (a) on the heat exchanger **50** may be formed (or provided) shorter than the length of the airflow guide provided at point (b) on the heat exchanger **50**.

[0056] A description will be given below on the effects of the above ceiling mounted air conditioner.

[0057] FIG. **4** is a plan view showing the flow of air in a ceiling mounted air conditioner according to the first embodiment of the present disclosure.

[0058] Referring to FIG. **4**, the operation of the fan motor **30** rotates the fan **40**, and indoor air below the housing **10** may be drawn into the housing **10** through the inlet **22**. The drawn air in may be directed radially outward of fan **40**.

[0059] In this regard, air moving toward the region (A) of the heat exchanger **50** from the air that is blown in a radial direction to the fan **40** may be guided by the airflow guide **100** such that the air passes through the heat exchanger **50**.

[0060] The air that passages through the heat exchanger **50** may be redirected as it contacts the housing **10**, and may subsequently be discharged downward through the outlet **24**.

[0061] In other words, the airflow guide **100** may guide the passage of the air through the heat exchanger **50** so that noise generated during the passage of air through the heat exchanger **50** is reduced.

[0062] FIG. **5** is a perspective view of an airflow guide according to the second embodiment of the present disclosure.

[0063] Because some aspects of the following embodiment are similar to those in the previous embodiment, the coupler of the following embodiment is discussed in detail. Therefore, a description will be given below of only certain aspects of the present embodiment.

[0064] Referring to FIG. **5**, an airflow guide **200** according to the present embodiment may be coupled directly to the tubes **52** of the heat exchanger **50** by a coupler. In this regard, one of ordinary skill in the art would readily understand that any suitable coupler capable of coupling a guide to an air conditioner may be employed.

[0065] More specifically, the airflow guide **200** may have at least one fastener **202** configured to fasten a tube **52** of the heat exchanger **50** formed (or provided) on a side of the airflow guide **200**. The fastener **202** may be formed (or provided) having a shape corresponding to the shape of the tube **52** of the heat exchanger **50**, and may enclose a portion of the tube **52** when coupled to the tube **52**.

[0066] In other words, the fastener **202** may be provided with a predetermined amount of tension so that it deforms elastically during coupling with the tube **52**, thereby allowing the coupler to be coupled with the tube **52**. When coupled to the tube **52**, the coupler may encircle the tube **52**.

[0067] In the present embodiment, the airflow guide **200** may be configured to couple directly to the tube **52** of the heat exchanger **50**, so that the position of the airflow guide **200** can be altered. That is, a user may be able to easily couple the airflow guide **200** to the tube **52** of the heat exchanger **50**.

[0068] FIG. **6** is a perspective view of an airflow guide according to the third embodiment of the present disclosure.

[0069] Referring to FIG. **6**, an airflow guide **300** according to the present embodiment may be configured as a fin **54** of the heat exchanger **50**.

[0070] Specifically, the heat exchanger **50** may include a tube **52** bent (or having a plurality of curvatures) a plurality of times, and a plurality of heat exchanger fins **54** coupled to the tube **52**.

[0071] Also, one of the plurality of heat exchanger fins **54** may be bent (or curved) in a direction opposite to the direction of air discharged from the fan **40**, and the curved portion may form the airflow guide **300** in the present embodiment.

[0072] In this regard, the curved heat exchanger fin **54** may, of course, be located in the region (A) shown in FIG. **2**.

[0073] For example, without adding additional elements which may lengthen the heat exchanger fin **54** in the present embodiment, and bending (i.e., providing a fin **54** having a curvature) the extended fin, the airflow guide **300** may be formed, thereby reducing manufacturing cost and processes.

[0074] Also, by extending the airflow guide **300** from a heat exchanger fin **54**, the contact area between air and the fin may be increased thereby improving heat-exchanging performance.

[0075] Thus, it should be appreciated that in the foregoing embodiments of the present disclosure, noise generated by air passing through the heat exchanger can be reduced by the airflow guide which is configured to guide the direction of airflow discharged by the fan.

[0076] It is further noted that the foregoing examples have been provided merely for the purpose of explanation and are in no way to be construed as limiting of the present invention. While the present invention has been described with reference to a preferred embodiment, it is understood that the words which have been used herein are words of description and illustration, rather than words of limitation. Changes may be made, within the purview of the appended claims, as presently stated and as amended, without departing from the scope and spirit of the present invention in its aspects. Although the present invention has been described herein with reference to particular means, materials and embodiments, the present invention is not intended to be limited to the particulars disclosed herein; rather, the present invention extends to all functionally equivalent structures, methods and uses, such as are within the scope of the appended claims.

What is claimed is:

1. An air conditioner comprising:

a housing;

a fan provided within the housing, the fan being configured to draw air into the housing and direct air radially outward;

a heat exchanger configured to exchange heat with the air drawn into the housing; and

at least one airflow guide configured to extend into a flow path of the air so that the flow of air is guided through the heat exchanger along a surface of the airflow guide.

2. The air conditioner according to claim 1, wherein the heat exchanger has multiple sides provided radially outward of the fan,

wherein the airflow guide is provided radially inward of the heat exchanger at a position spaced from a center of a corresponding side which the airflow guide is configured to guide air through.

3. The air conditioner according to claim 2, wherein the airflow guide is provided within a first region of a corresponding side of the heat exchanger such that an angle formed between the flow direction of air and the corresponding air flow guide is smaller that an angle formed between the flow direction of air and a center of the corresponding side of the heat exchanger.

4. The air conditioner according to claim 1, further comprising a noise reduction hole provided in a surface at which the airflow guide and the flow of air meet.

5. The air conditioner according to claim 1, wherein the airflow guide comprises a plurality of spaced-apart airflow guides provided on corresponding sides of the heat exchanger.

6. The air conditioner according to claim 1, wherein the airflow guide extends in a direction opposite to the flow direction of the air which is directed radially outward by the fan.

7. The air conditioner according to claim 1, wherein the airflow guide is formed on a connector which connects the heat exchanger to the housing.

8. The air conditioner according to claim 7, wherein the connector includes an inner surface provided at an inner side of the heat exchanger and an outer surface provided at an outer side of the heat exchanger, the airflow guide extending from the inner surface of the connector.

9. The air conditioner according to claim 8, wherein the inner surface and the outer surface define a through-hole through which air passes.

10. The air conditioner according to claim 1, wherein the airflow guide is coupled to a tube of the heat exchanger.

11. The air conditioner according to claim 10, wherein the airflow guide includes a coupling part which couples the airflow guide to the tube.

12. The air conditioner according to claim 1, wherein the airflow guide extends from a fin of the heat exchanger.

13. An air conditioner comprising:

a housing;

a fan provided within the housing, the fan being configured to draw air within the housing and direct air radially outward;

a heat exchanger provided within the housing and radially outward of the fan, to exchange heat with air; and

an airflow guide provided radially inward of the heat exchanger, the airflow guide being configured to extend into a flow path of the air such that air drawn by the fan passes through the heat exchanger along a surface of the airflow guide,

wherein the airflow guide is provided within a first region of a corresponding side of the heat exchanger such that an angle formed between the flow direction of air and the corresponding airflow guide is smaller than an angle formed between the flow direction of air and a center of the corresponding side of the heat exchanger.

14. The air conditioner according to claim 13, wherein the airflow guide extends in a direction opposite to the flow direction of the air which is directed radially outward by the fan.

15. The air conditioner according to claim 13, wherein the airflow guide is integrally formed with the heat exchanger.

16. The air conditioner according to claim 13, wherein the airflow guide is coupled to the heat exchanger.

17. The air conditioner according to claim 1, wherein the surface of the airflow guide comprises a curved surface.

18. The air conditioner according to claim 1, wherein the airflow guide is provided within a first region of a corresponding side of the heat exchanger so that an acute angle is formed between the flow direction of air and the corresponding air flow guide.

19. The air conditioner according to claim 1, wherein the airflow guide protrudes into the flow path of the air.

20. The air conditioner according to claim 13, wherein the airflow guide protrudes into the flow path of the air.

* * * * *