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- **Moon, Dong Soo**
Gwanak-gu
Seoul (KR)
- **Lee, Jung Woo**
Seoul (KR)
- **Yim, Nam Sik**
Seoul (KR)
- **Choi, Seok Ho**
Gwanak-gu
Seoul (KR)
- **Kim, Jeong Yong**
Seoul (KR)

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(71) Applicant: **LG Electronics Inc.**
Seoul, 150-721 (KR)

(72) Inventors:
• **Choi, In Ho**
Anyang-si
Gyeonggi-do (KR)

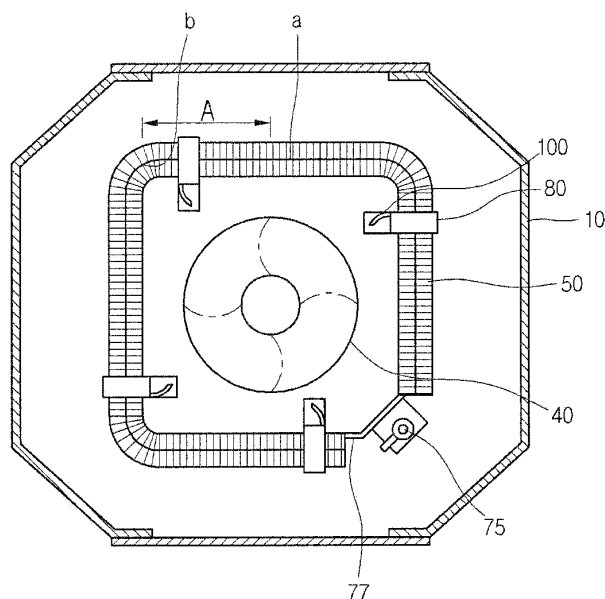
(74) Representative: **Vossius & Partner**
Siebertstrasse 4
81675 München (DE)

(54) **Air conditioner with air flow guide element for noise reduction**

(57) 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.2



Description

[0001] The present disclosure relates to an air conditioner, and more particularly, to a ceiling mounted air conditioner that may be installed on a ceiling.

[0002] 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.

[0003] 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.

[0004] 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 may be disposed around the blower fan to exchange heat with air blown by the blower fan.

[0005] 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.

[0006] 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.

[0007] 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.

[0008] 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.

[0009] 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.

[0010] 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.

[0011] 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.

[0012] 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.

[0013] 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.

[0014] 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.

[0015] 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:

Fig. 1 is a sectional view of a ceiling mounted air conditioner according to a first embodiment of the present disclosure.

Fig. 2 is a bottom view of a ceiling mounted air conditioner according to the first embodiment of the present disclosure.

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.

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.

Fig. 5 is a perspective view of an airflow guide ac-

cording to a second embodiment of the present disclosure.

Fig. 6 is a perspective view of an airflow guide according to a third embodiment of the present disclosure.

[0016] 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.

[0017] Reference will now be made in detail to the embodiments of the present disclosure, examples of which are illustrated in the accompanying drawings.

[0018] Fig. 1 is a sectional view of a ceiling mounted air conditioner according to the first embodiment of the present disclosure.

[0019] 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.

[0020] 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.

[0021] Specifically, the housing 10 may have a multifaceted shape (e.g., multiple side surfaces and an 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.

[0022] 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.

[0023] 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.

[0024] 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.

[0025] Here, the fan 40 used may be a turbine fan which suction or draws air in an axial direction and discharges air in a radial direction.

[0026] 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.

[0027] The flow of air in a ceiling mounted air conditioner will now be described by way of non-limiting example.

[0028] 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.

[0029] A more detailed description of the structure of the airflow guide 100 is described below by way of non-limiting example.

[0030] 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.

[0031] 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.

[0032] 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.

[0033] 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.

[0034] 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.

[0035] 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.

[0036] 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 to any other suitable position.

[0037] 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.

[0038] 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.

[0039] 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.

[0040] 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.

[0041] 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.

[0042] 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.

[0043] 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.

[0044] 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.

[0045] 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.

[0046] 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).

[0047] 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.

[0048] 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.

[0049] A description will be given below on the effects of the above ceiling mounted air conditioner.

[0050] 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.

[0051] 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.

[0052] 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.

[0053] 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.

[0054] 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.

[0055] Fig. 5 is a perspective view of an airflow guide according to the second embodiment of the present disclosure.

[0056] 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.

[0057] 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.

[0058] 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.

[0059] 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.

[0060] 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.

[0061] Fig. 6 is a perspective view of an airflow guide according to the third embodiment of the present disclosure.

[0062] 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.

[0063] 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.

[0064] 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.

[0065] In this regard, the curved heat exchanger fin 54 may, of course, be located in the region (A) shown in Fig. 2.

[0066] 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.

[0067] 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.

[0068] 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.

[0069] 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.

Claims

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 than 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 any of claims 1 to 3, 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 any of claims 1 to 4, 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 any of claims 1 to 5, 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 any of claims 1 to 6, 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 any of claims 1 to 9, 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 any of claims 1 to 11, 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 or 14, wherein the airflow guide is integrally formed with the heat exchanger.
16. The air conditioner according to any of claims 13 to 15, wherein the airflow guide is coupled to the heat exchanger.
17. The air conditioner according to any of claims 1 to 16, wherein the surface of the airflow guide comprises a curved surface.
18. The air conditioner according to any of claims 1 to 17, 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 any of claims 1 to 18, wherein the airflow guide protrudes into the flow path of the air.
20. A method of air conditioning using an air conditioner according to any of claims 1 to 19.

Fig.1

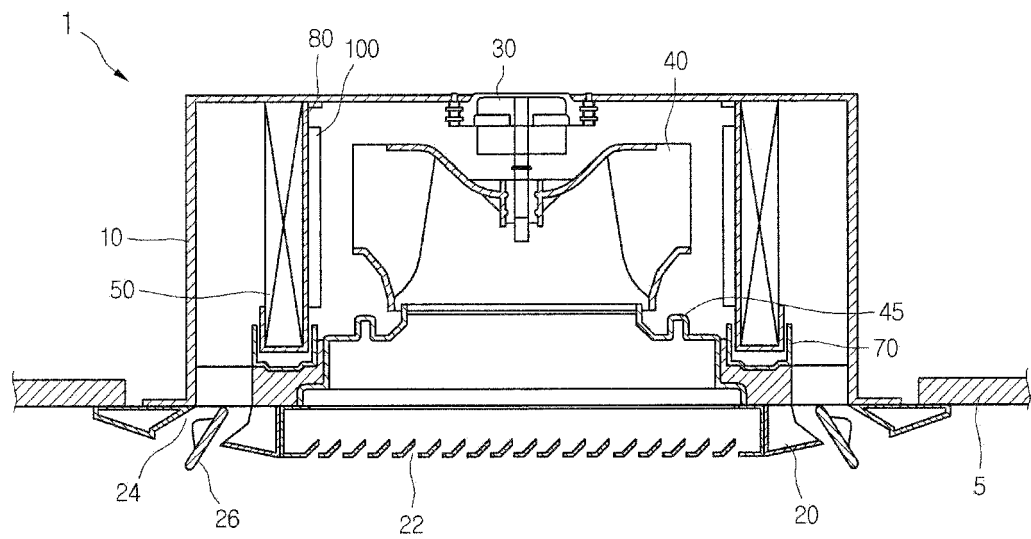


Fig.2

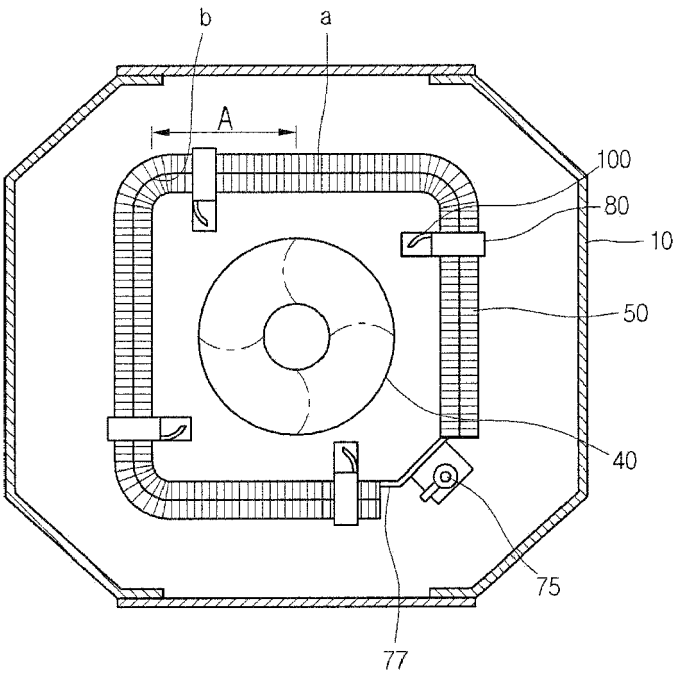


Fig.3

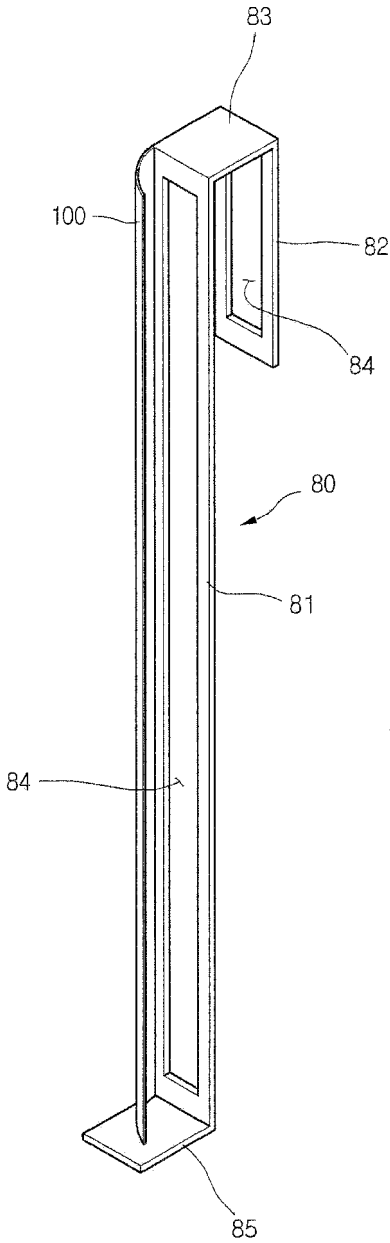


Fig.4

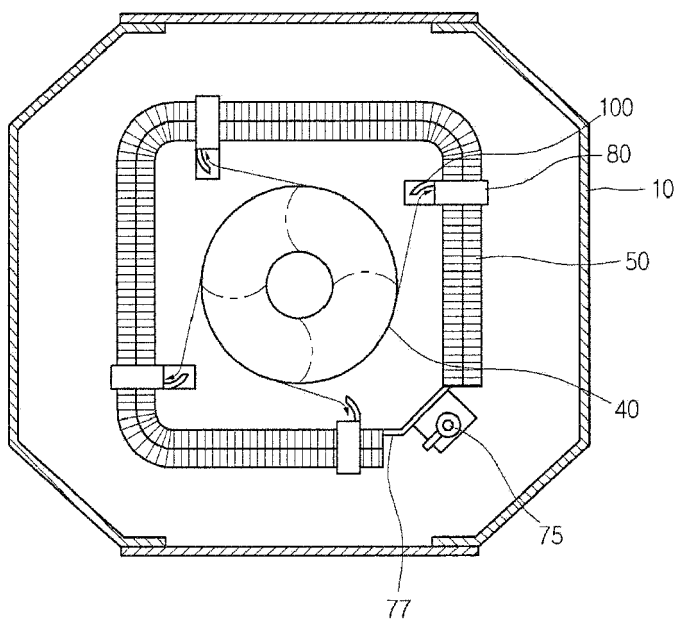


Fig.5

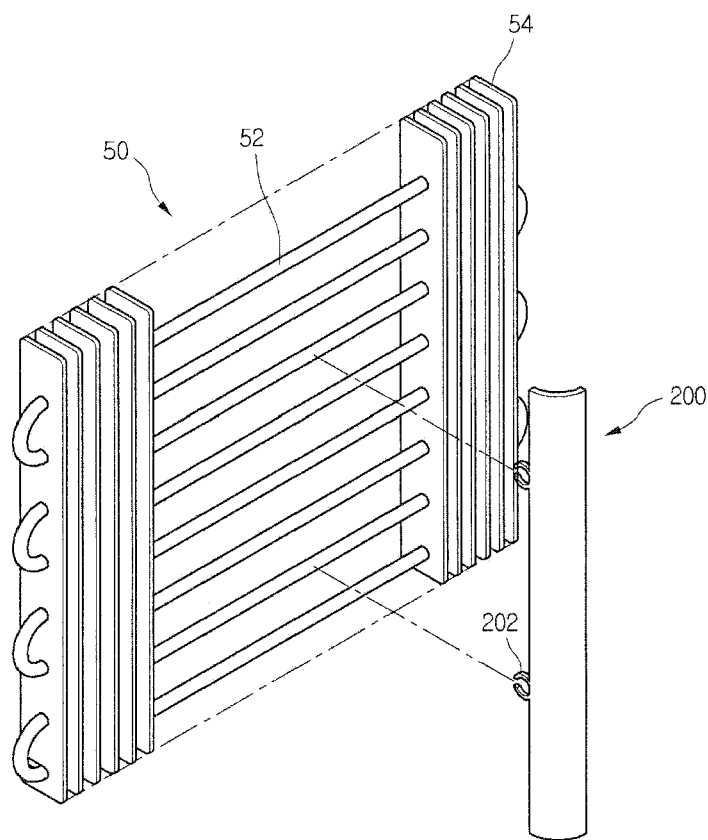
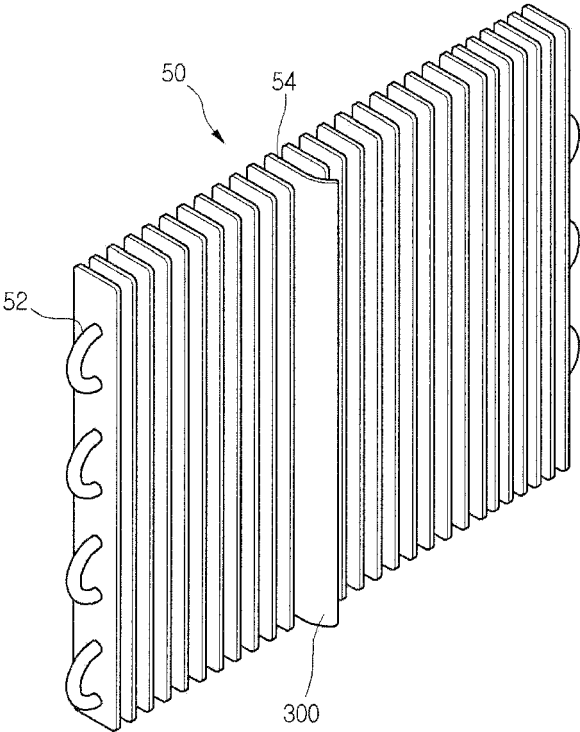


Fig.6





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 07 11 3938

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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