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(54) **FULL FRONT BLOWING TYPE AIR CONDITIONER**

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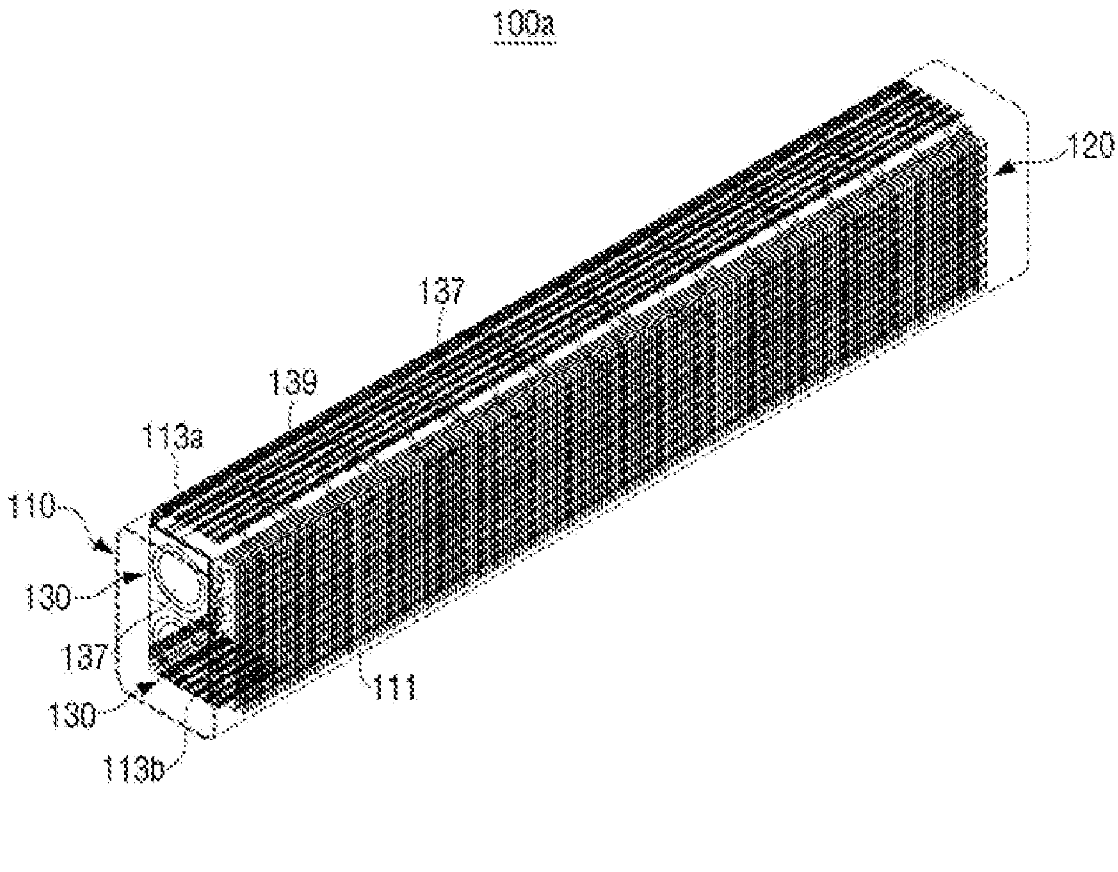
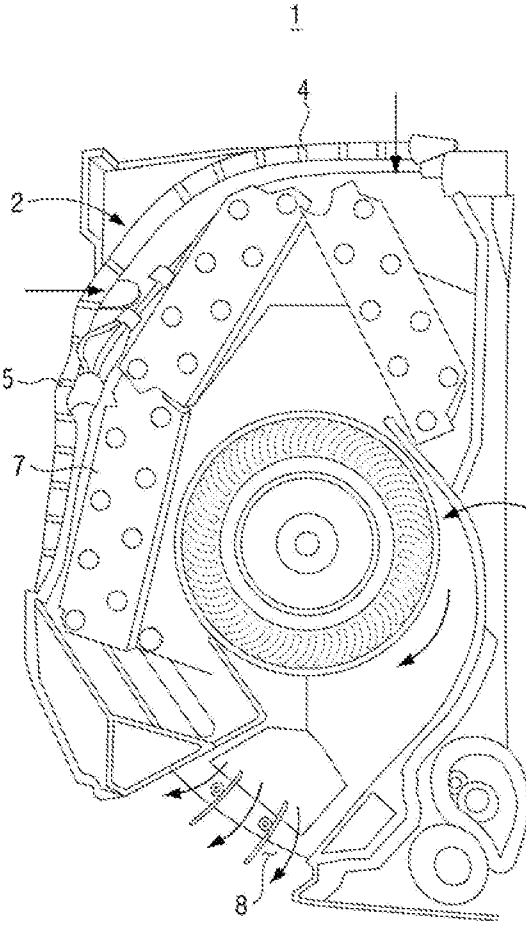
(57) **ABSTRACT**

A full front blowing type air conditioner is disclosed. The disclosed full front blowing type air conditioner includes a case of which a heat exchanger is disposed in an inner side; and a blower module disposed in rear of the heat exchanger in the case, and configured to discharge a pulse jet for blowing through a front face of the case. The blowing module changes air pressure of a cavity formed between at least one pair of piezoelectric diaphragms and discharges the pulse jet to a side of the heat exchanger according to periodic deformation of the pair of piezoelectric diaphragms to opposite phases to each other.



【Figure 1】



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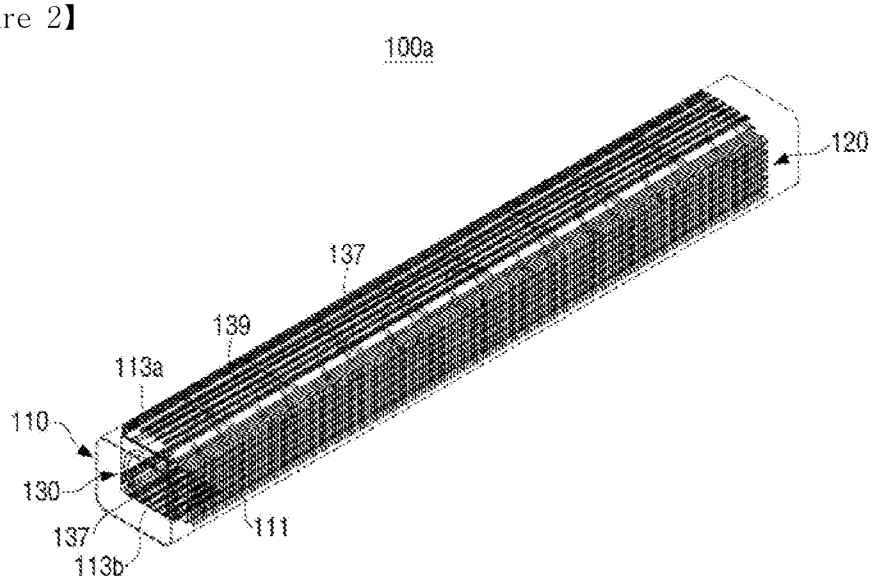

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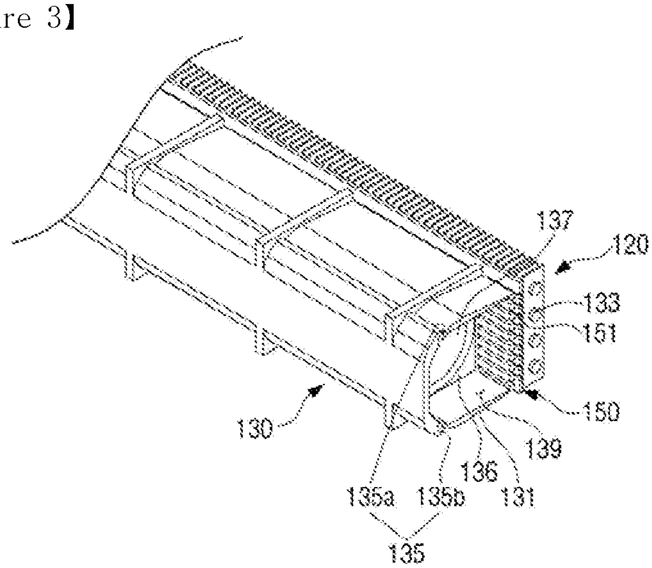

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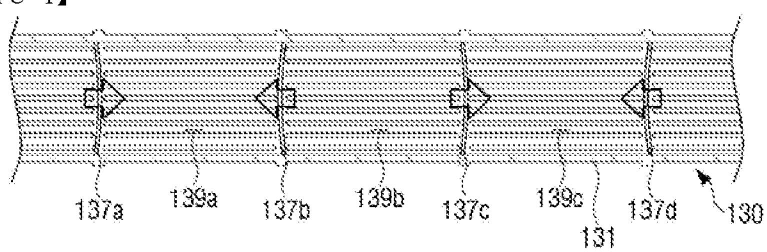

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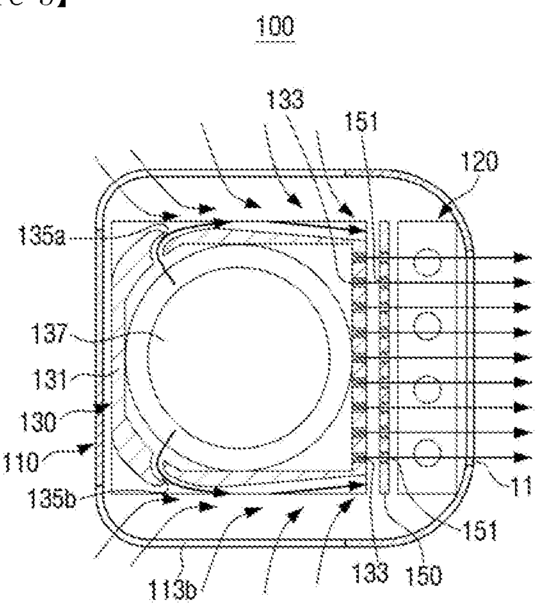

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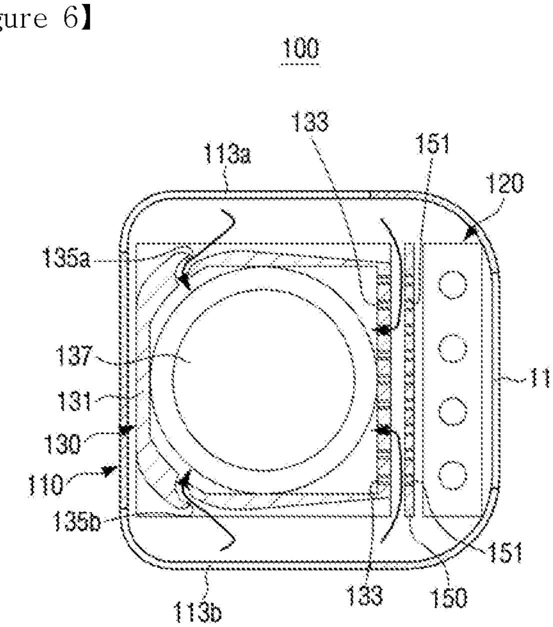

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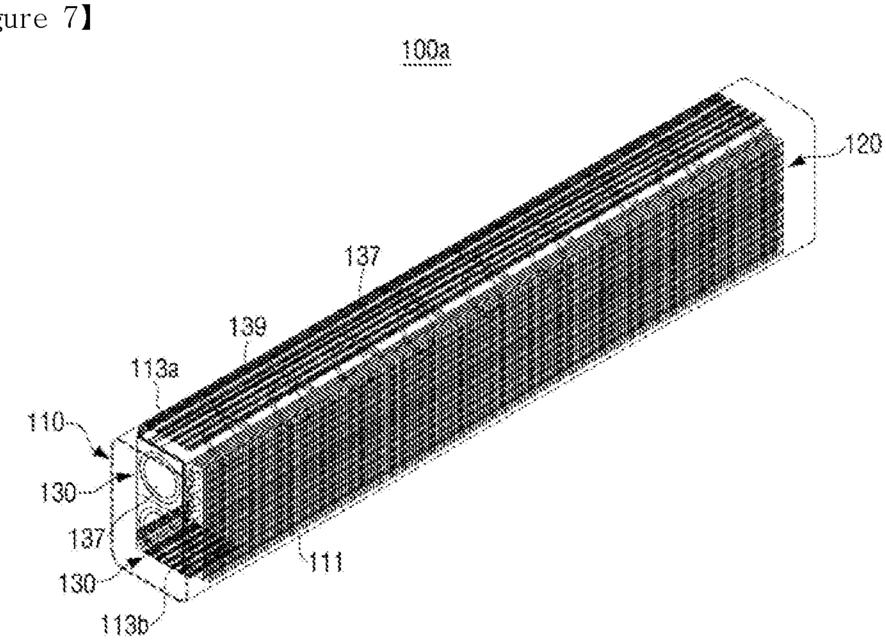

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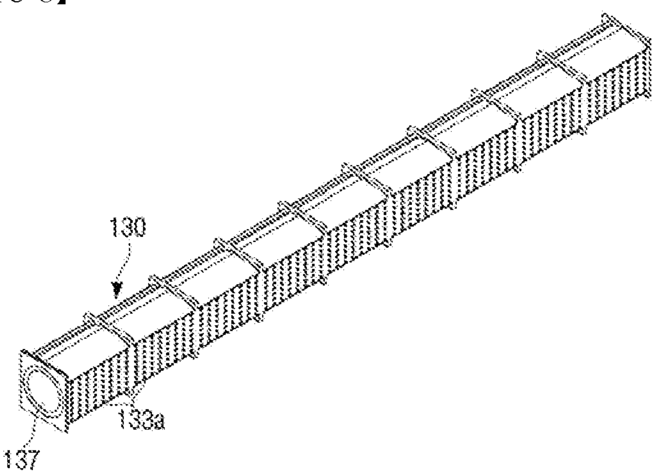

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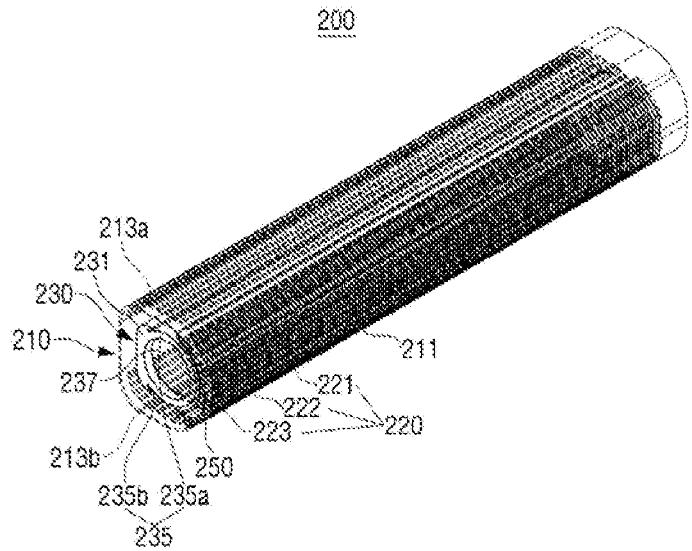

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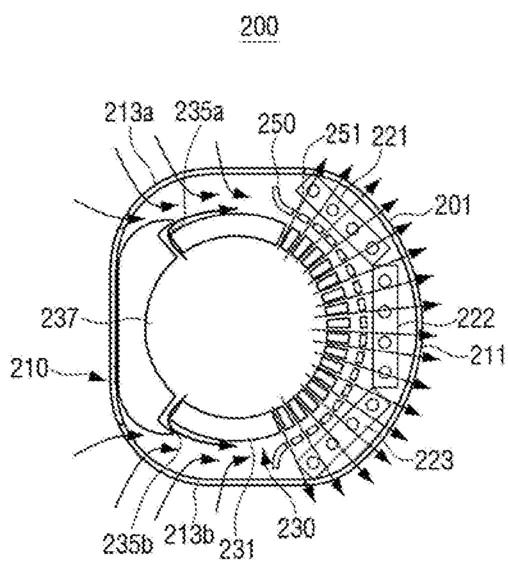

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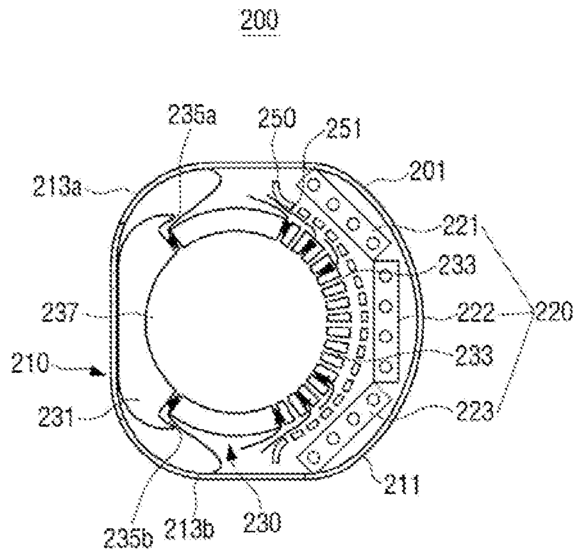

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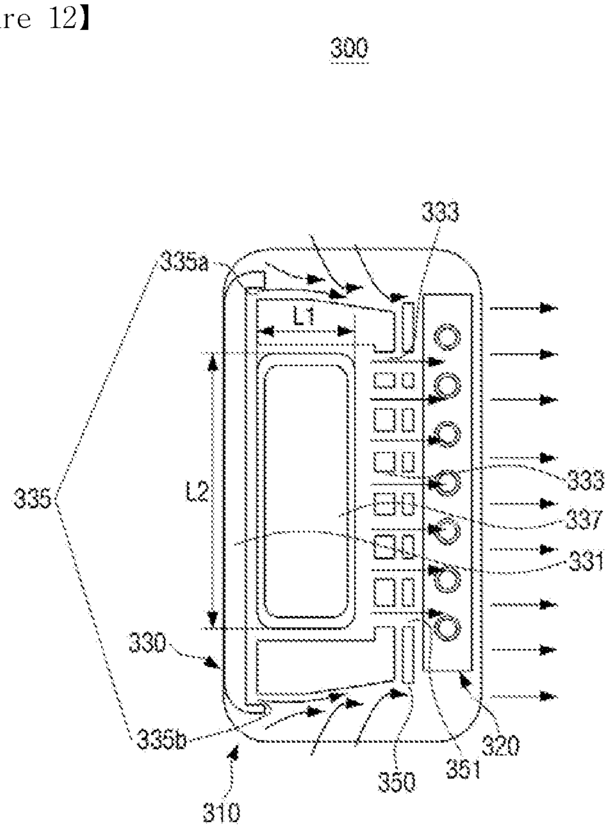

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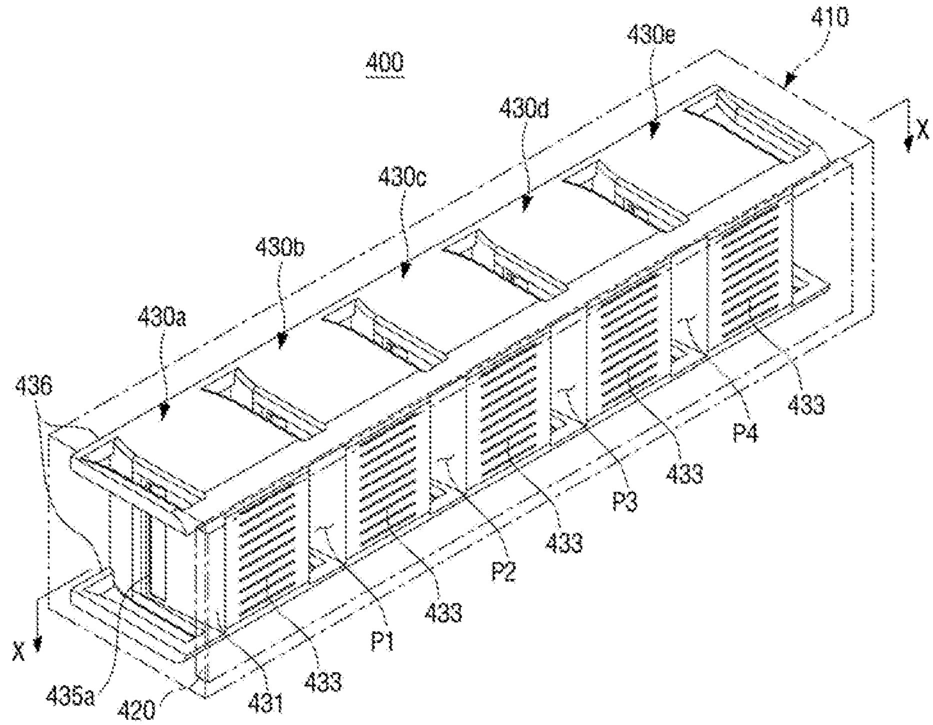

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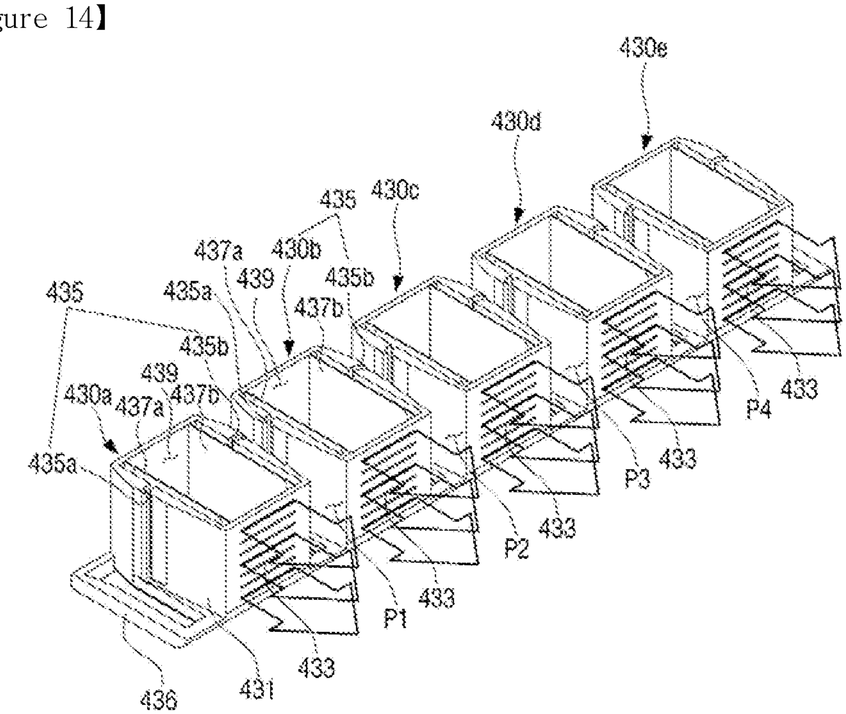

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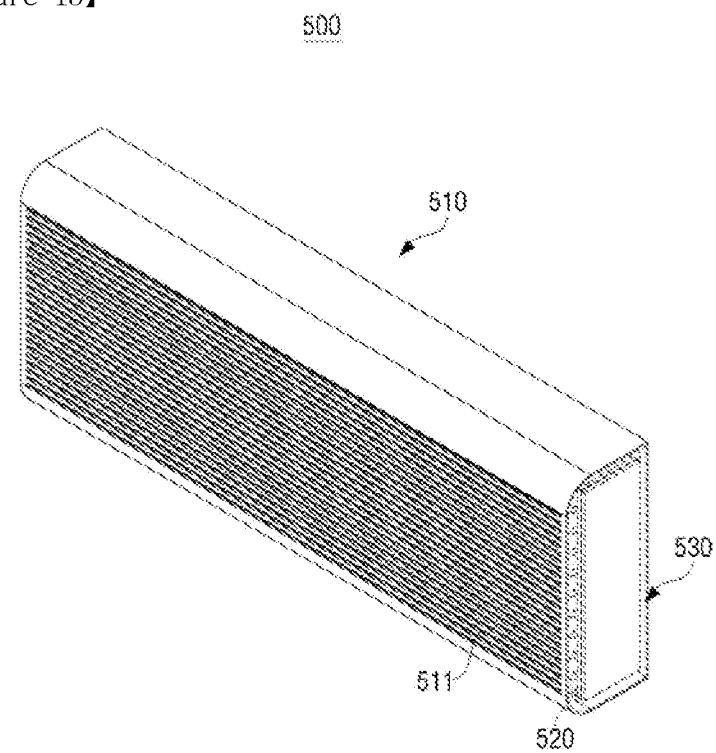

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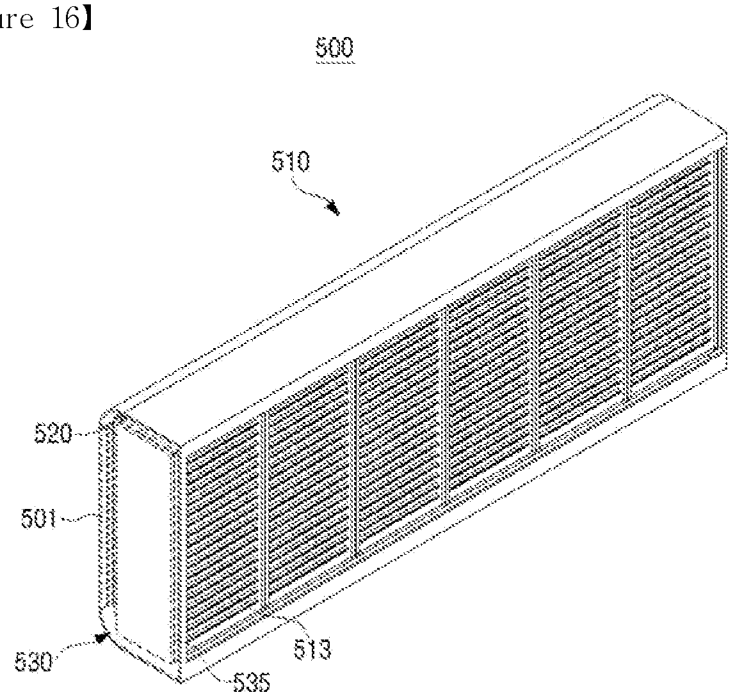

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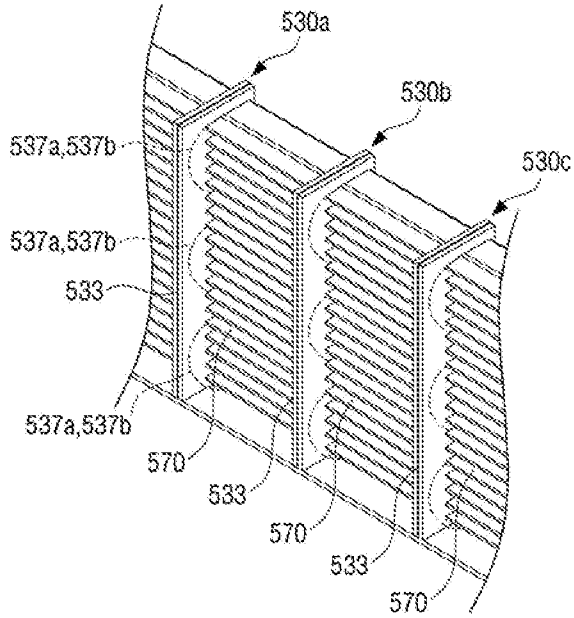

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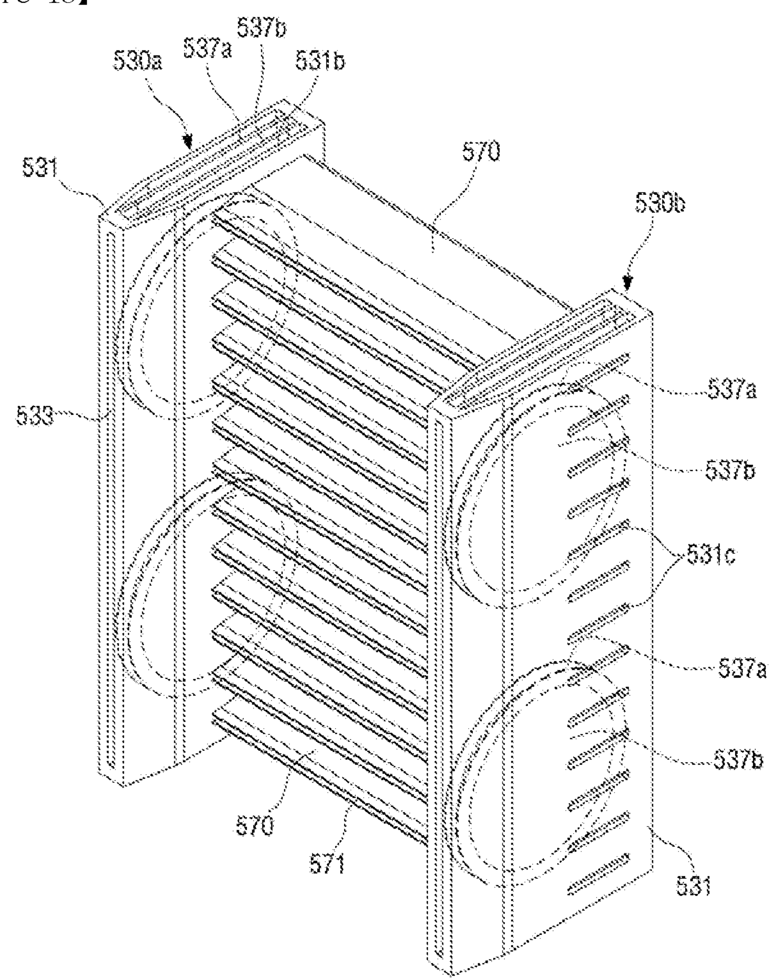

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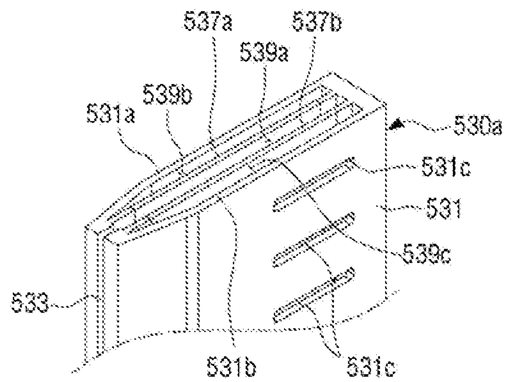

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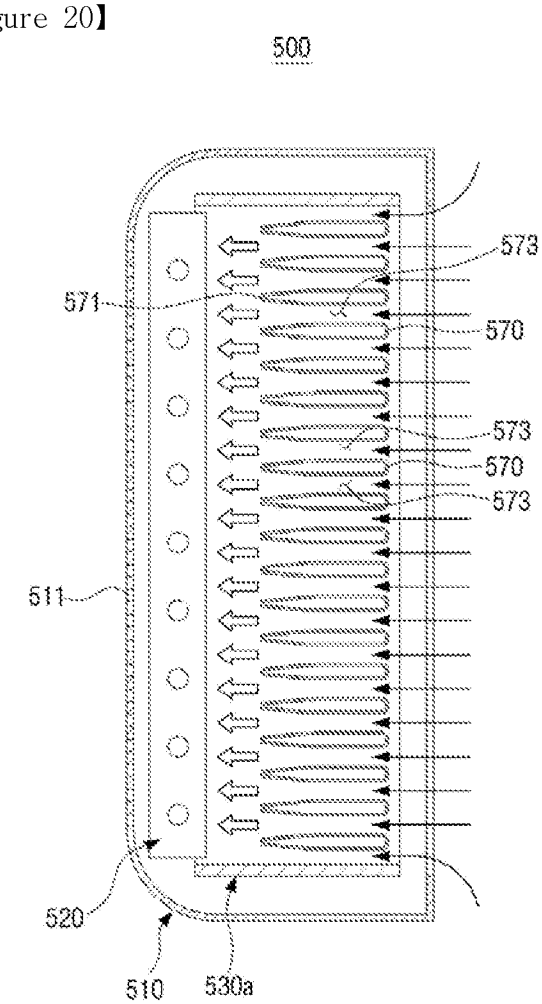

FULL FRONT BLOWING TYPE AIR CONDITIONER

TECHNICAL FIELD

[0001] The present invention relates to a wall-mounted air conditioner, and more particularly, to an indoor unit of an air conditioner capable of blowing a pulse jet from a portion corresponding to an entire area of a front face of the air conditioner.

BACKGROUND ART

[0002] In general, air conditioners are an apparatus for heating or cooling an indoor using a cooling cycle of a refrigerant formed of a compressor, a condenser, an expander, and a heat exchanger. The air conditioners are divided into a system type, a stand type, a window-mounted type, and a wall-mounted type according to an installation type thereof.

[0003] An indoor unit **1** of a wall-mounted air conditioner in the related art uses a conventional cross flow fan **3** as a blowing unit as illustrated in FIG. **1**. When a heat exchanger **7** is arranged in an entire face of a case **2** according to air flow property and an arrangement structure of the cross flow fan **3**, and in response to front blowing being performed, efficiency is lowered due to heat exchange deviation, and thus cooling performance is degraded.

[0004] Therefore, a wall-mounted air conditioner in the related art has a structure in which an air outlet **8** is limited to a lower portion of a front face since inlet grills **4** and **5** of the case **2**, which suck the external air, are arranged in front and top faces so as to increase efficiency of the heat exchanger. The air exhausted from the air outlet **8** in the lower portion of the front face is discharged in a fast flow rate due to a small discharge area. In this case, there are problems that in response to the cooling air being in direct contact with a user's skin, the cooling air may cause an unpleasant feeling in the user.

DISCLOSURE

Technical Problem

[0005] The present invention has been made in view of the above problems, and an object of the present invention is to provide a full front blowing type air conditioner capable of maintaining cooling performance and simultaneously providing a comfortable feeling to a user through increase in a blowing area and blowing in a low flow rate.

Technical Solution

[0006] To obtain the above-described object, the present invention is to provide an air conditioner including: a case of which a heat exchanger is disposed in an inner side; and a blower module disposed in rear of the heat exchanger in the case, and configured to discharge a pulse jet for blowing through a front face of the case. The blowing module changes air pressure of a cavity formed between at least one pair of piezoelectric diaphragms and discharges the pulse jet to a side of the heat exchanger according to periodic deformation of the pair of piezoelectric diaphragms to opposite phases to each other.

[0007] The blower module may include a housing in which a first air flow unit is formed in one side corresponding to the heat exchanger, and a second air flow unit is formed in the other side. The at least one pair of piezoelectric diaphragms may be disposed to be spaced in parallel in the inner side of the housing, and the blower module may discharge the pulse jet to the side of the heat exchanger through the first and second air flow units.

[0008] The first air flow unit may include a plurality of slits or a plurality of holes which allow the air to flow into the cavity and flow out from the cavity.

[0009] The second air flow unit may include an upper slit and a lower slit which allow the air to flow into the cavity and flow out from the cavity, and are formed in an upper rear and a lower rear of the housing, respectively. The upper slit and the lower slit may face a front of the housing.

[0010] The heat exchanger may have an area corresponding to an entire area of the front face of the case.

[0011] A face of the housing, which faces the heat exchanger, has a shape corresponding to a shape of the heat exchanger.

[0012] A face of the housing, which faces the heat exchanger, is formed in a plane or a curved surface convexly protruding toward the outer side of the housing.

[0013] The air conditioner of the present invention may further include a partition plate which forms a plurality of slits and is disposed between the heat exchanger and the housing.

[0014] The plurality of slits of the partition plate may be arranged in locations corresponding to the plurality of slits formed in the first air flow unit.

[0015] The blower module may include a plurality of blower modules, and the plurality of blower modules may be arranged at least in a row. The blower module may include a plurality of blower modules, and the plurality browser modules may be arranged to be spaced at a preset distance from each other.

[0016] The second air flow unit may include a left slit and a right slit which allow the air to flow into the cavity and flow out from the cavity, and are formed in a left rear and a right rear of the housing, respectively. The left and the right slit may face a front of the housing.

[0017] An air exhaust passage configured to discharge the pulse jet from the left slit and the right slit may be provided between the blower modules.

[0018] At least one manifold configured to communicate with adjacent blower modules may be disposed between the adjacent blower modules.

[0019] A plurality of manifolds configured to communicate with adjacent blower modules may be disposed to be spaced from each other to a longitudinal direction between the adjacent blower modules.

[0020] Piezoelectric diaphragms mat be arranged to be spaced to a longitudinal direction in pairs in each of the plurality of blower modules.

[0021] The blower module may include a plurality of blower modules, and the plurality of blower modules may be arranged in a matrix form.

[0022] The one pair of piezoelectric diaphragms may have outer shapes corresponding to an inner surface shape of the housing.

[0023] The one pair of piezoelectric diaphragms may have any one shape among a circular shape, an elliptic shape, and a tetragonal shape.

[0024] The housing may have an aspect ratio that a height size is larger than a width size.

[0025] The at least one pair of piezoelectric diaphragms may be disposed to be perpendicular to a face corresponding to the heat exchanger.

[0026] Further, to obtain the above-described object, the present invention is to provide an air conditioner including: a case of which a heat exchanger is disposed in an inner side; and a blower module disposed in the case, and configured to discharge a pulse jet for blowing through a front face of the case. The blowing module may include a housing in which a plurality of air flow units are formed, and a plurality of piezoelectric diaphragms disposed to be spaced in parallel to each other in a row so as to form a plurality of cavities in an inner side of the housing. The plurality of piezoelectric diaphragms change air pressure in the plurality of cavities and discharge the pulse jet to a side of the heat exchanger through the plurality of air flow units according to periodic deformation of the plurality of piezoelectric diaphragms to opposite phases to piezoelectric diaphragms adjacent thereto.

[0027] Further, to obtain the above-described object, the present invention is to provide an air conditioner including: a case of which a heat exchanger is disposed in an inner side; and a blower module including a cavity partitioned with the heat exchanger in rear of the heat exchanger, and at least one pair of piezoelectric diaphragms configured to change a volume of the cavity. The one pair of piezoelectric diaphragms discharge the pulse jet to a side of the heat exchanger from an inside of the cavity according to periodic deformation of the pair of piezoelectric diaphragms to opposite phases.

DESCRIPTION OF DRAWINGS

[0028] FIG. **1** is a cross-sectional view illustrating an indoor unit of a wall-mounted air conditioner in the related art.

[0029] FIG. **2** is a perspective view illustrating a full front blowing type air conditioner according to a first embodiment of the present invention.

[0030] FIG. **3** is a perspective view illustrating an inner structure of a full front blowing type air conditioner according to a first embodiment of the present invention.

[0031] FIG. **4** is a schematic perspective view explaining an operation of a plurality of piezoelectric diaphragms disposed in an inside of a blower module of a full front blowing type air conditioner according to a first embodiment of the present invention.

[0032] FIG. **5** is a cross-sectional view illustrating a state in which a pulse jet is discharged from a blower module of a full front blowing type air conditioner according to a first embodiment of the present invention.

[0033] FIG. **6** is a cross-sectional illustrating a state in which the surrounding air flows into a blower module of a full front blowing type air conditioner according to a first embodiment of the present invention.

[0034] FIG. **7** is a perspective view illustrating a state in which blower modules are arranged in two rows as a modification example of a full front blowing type air conditioner according to a first embodiment of the present invention.

[0035] FIG. **8** is a perspective view illustrating an example that a plurality of holes of a blower module are formed in front of a housing other than a plurality of slits.

[0036] FIG. **9** is a perspective view illustrating a full front blowing type air conditioner according to a second embodiment of the present invention.

[0037] FIG. **10** is a cross-sectional view illustrating a state in which a pulse jet is discharged from a blower module of a full front blowing type air conditioner according to a second embodiment of the present invention.

[0038] FIG. **11** is a cross-sectional view illustrating a state in which the surrounding air flows into a blower module of a full front blowing type air conditioner according to a second embodiment of the present invention.

[0039] FIG. **12** is a cross-sectional view illustrating a full front blowing type air conditioner according to a third embodiment of the present invention.

[0040] FIG. **13** is a perspective view illustrating a full front blowing type air conditioner according to a fourth embodiment of the present invention.

[0041] FIG. **14** is a perspective view illustrating the full front blowing type air conditioner taken along line X-X of FIG. **13**.

[0042] FIGS. **15** and **16** are perspective views when viewed in a front and a rear of a full front blowing type air conditioner according to a fifth embodiment of the present invention.

[0043] FIG. **17** a perspective view illustrating a plurality of blower modules disposed in an inside of a full front blowing type air conditioner and a plurality of manifolds arranged to a longitudinal direction between the blower modules according to a fifth embodiment of the present invention.

[0044] FIG. **18** is a perspective view illustrating a portion of the plurality of blower modules and the plurality of manifolds illustrated in FIG. **17**.

[0045] FIG. **19** is an enlarged perspective view illustrating the blower module illustrated in FIG. **18**.

[0046] FIG. **20** is a cross-sectional view illustrating a state in which a pulse jet is discharged from a manifold of a full front blowing type air conditioner according to a fifth embodiment of the present invention.

MODE FOR INVENTION

[0047] The present invention will be more apparent through detailed description of preferred embodiments of the present invention with reference to the accompanying drawings. Further, for understanding of the present invention, the accompanying drawings may be illustrated not in an actual scale but sizes in portions of configuration components are exaggeratedly illustrated.

[0048] An air conditioner of the present invention relates to an indoor unit of a full front blowing type air conditioner, and may be an air conditioner for cooling only, an air conditioner for heating only, or an air conditioner for both heating and cooling.

[0049] Further, the present invention may dispose a heat exchanger to correspond to approximately an entire area of a front face of a case and dispose a blower module configured to discharge a pulse jet with respect to an entire surface of the heat exchanger in rear of the heat exchanger, so that blowing from the entire area of the front face of the case is obtained. Therefore, the present invention may discharge a cooling air or a heating air from a wide blowing area as compared with a wall-mounted type air conditioner in the related art, and provide a comfortable feeling to a user due to blowing in a low flow rate as compared with the related art.

[0050] Hereinafter, full front blowing type air conditioners according to various embodiments of the present invention will be described with reference to the accompanying drawings.

[0051] FIGS. **2** and **3** are perspective views illustrating an outside and an inside of a full front blowing type air conditioner according to a first embodiment of the present invention, respectively, FIG. **4** is a schematic perspective view explaining an operation of a plurality of piezoelectric diaphragms disposed in an inside of a blower module of a full front blowing type air conditioner according to a first embodiment of the present invention, FIGS. **5** and **6** are cross-sectional views illustrating a state in which a pulse jet is discharged from a blower module and a state in which the surrounding air flows into the blower module in a full front blowing type air conditioner according to a first embodiment of the present invention, FIG. **7** is a perspective view illustrating a state in which blower modules are arranged in two rows as a modification example of a full front blowing type air conditioner according to a first embodiment of the present invention, and FIG. **8** is a perspective view illustrating an example that a plurality of holes of a blower module are formed in front of a housing other than a plurality of slits.

[0052] Referring to FIGS. **2** and **3**, a full front blowing type air conditioner **100** according to a first embodiment of the present invention includes a case **110**, a heat exchanger **120**, a blower module **130**, and a partition plate **150**.

[0053] The case **110** forms an outer appearance of an indoor unit of the full front blowing type air conditioner **100**, and the heat exchanger **120**, the blower module **130**, and the partition plate **150** are disposed in an inner side of the case. Further, the case **110** includes a plurality of air outlets **111** and pluralities of first and second air inlets **113***a* and **113***b*.

[0054] The plurality of air outlets **111** guide the air, which passes through the heat exchanger **120** and temperature thereof is changed, to be discharged to the outside of the front face of the case **110**.

[0055] The plurality of air outlets **111** are arranged to be spaced in the whole front face so as to occupy most of the front face of the case **110** so that the main air current may be blown through the entire area of the front face. In this case, the plurality of air outlets **111** have shapes of slits arranged to be spaced as illustrated in FIG. **2**. Further, the plurality of air outlets **111** may have circular holes other than the slit shapes.

[0056] The plurality of first air inlets **113***a* are formed over portions of top and rear faces of the case **110**, and the plurality of second air inlets **113***b* are formed over portions of bottom and rear faces of the case.

[0057] The pluralities of first and second air inlets **113***a* and **113***b* serve as passages which allow the external air to flow in the inside of the case **100**. Thus, in order for a significant amount of air to flow in the inside of the case **110**, the pluralities of first and second air inlets **113***a* and **113***b* are formed at intervals to a longitudinal direction of the case **110** from one side to the other side of the case **110**.

[0058] On the other hand, the shape of the case **110** may be determined according to a shape or arrangement of the blower module **130** disposed in the inside of the case. For example, the case **110** is formed to have a height, in response to the blow modules **130** disposed in the inside of the case **110** being arranged in multi rows, larger than a height in response to the blower modules **130** being arranged in a row to a lateral direction. The case **110** may be formed to correspond to the shape of the blower module **130**, and the longitudinal cross-section of the blower module **130** is formed approximately in a tetragonal shape, a rectangular shape, a circular shape, or a partially rounded shape. The case **110** may be formed to correspond to the shape or arrangement of the heat exchanger **120**.

[0059] The heat exchanger **120** may form a refrigerant cycle, in which a refrigerant is circulated, together with a compressor (not shown) and a condenser (not shown).

[0060] The heat exchanger **120** is disposed adjacent to the plurality of air outlets **111** in the case **110**. In this case, the heat exchanger **120** may have an area corresponding to approximately the entire area of the front face of the case **110**.

[0061] Under the arrangement, the pulse jet discharged to a side of the heat exchanger **120** from the blower module **130** disposed in rear of the heat exchanger **120** passes through the heat exchanger **120** so that the temperature of the pulse jet is changed, and is discharged to the outside of the case **110** through the air inlets **111** of the case **110**.

[0062] Further, since the heat exchanger **120** is formed to have the area corresponding to the entire area of the front face of the case **110**, a blowing area toward the front face of the full front blowing type air conditioner **100** through the pulse jet discharged by the blower module **130** can be maximized.

[0063] The blower module **130** generates the pulse jet and continuously discharges the pulse jet to the side of the heat exchanger **120**. Such a blower module **130** includes a housing **131**, a first air flow unit **133**, a second air flow unit **135**, and a piezoelectric diaphragm **137**.

[0064] The housing **131** is located in rear of the heat exchanger **120**, and a plurality of piezoelectric diaphragms **137** are disposed to be spaced at intervals in an inner side of the housing **131**. In this case, a plurality of cavities **139** formed by the plurality of piezoelectric diaphragms **137** are provided in the inner side of the housing **131**. In this case, the plurality of cavities **139** are provided in the inner side of the housing **131**, and thus the plurality of cavities **139** are partitioned with the heat exchanger **120**.

[0065] Further, the plurality of cavities **139** are configured of n−1 in response to the number of piezoelectric diaphragms **137** being n.

[0066] On the other hand, the housing **131**, of which three piezoelectric diaphragms **137** or more are disposed in the inner side and two cavities **139** or more are formed in the inner side, has been exemplarily described, but this is not limited thereto. The housing **131**, of which a pair of piezoelectric diaphragms **137** are disposed in the inner side and one cavity **139** is formed in the inner side, may be employed.

[0067] A front face of the housing **131**, in which the first air flow unit **133** is formed, has an area corresponding to an area of the heat exchanger **120**.

[0068] Further, the shape of the front face of the housing **131** may be changed according to the arrangement of the heat exchanger **120**. That is, in response to the plate-shaped single heat exchanger **120** being approximately vertically disposed as illustrated in FIG. **2**, the front face of the housing **131** has a plane. Alternatively, in response to a plurality of heat exchangers **220** being continuously disposed to maintain a predetermined angle to each other as illustrated in FIG. **9**, the front face of the housing **131** may be formed to convexly protrude and to be adjacent to the side of the heat exchanger **120**.

[0069] The first air flow unit **133** is formed in the front face of the housing **131**, and is a passage for discharging the pulse jet to the front of the housing **131** from the cavity **139**. The first air flow unit **133** includes a plurality of slits having a predetermined length. At this time, the plurality of slits are formed to a lateral direction, and are distributed to correspond to the plurality of cavities **139**, respectively.

[0070] The second air flow unit **135** includes an upper slit **135***a* formed in the upper rear of the housing **131** to a longitudinal direction of the housing **131**, and a lower slit **135***b* formed in the lower rear of the housing **131** to the longitudinal direction of the housing **131**. The upper slit **135***a* and the lower slit **135***b* are disposed to face the front of the housing **131** so as to discharge the pulse jet to the side of the heat exchanger **120**.

[0071] In response to a phase of the piezoelectric diaphragm **137** being periodically changed, the pulse jet are discharged from the cavity **139** through the first and second air flow units **133** and **135** according to reduction in a volume of the cavity **139**, and on the contrary, the surrounding air of the housing **131** flows into the cavity **139** through the first and second air flow units **133** and **135** according to expansion of the volume of the cavity **139**.

[0072] Referring to FIG. **4**, a plurality of piezoelectric diaphragms **137***a* to **137***d* are disposed at intervals, and cavities **139***a*, **139***b*, and **139***c* are formed between adjacent piezoelectric diaphragms **137***a* to **137***d*.

[0073] Each of the piezoelectric diaphragms **137***a* to **137***d* includes a ferroelectric thin film (for example, piezoelectric translator (PZT)). In this time, the phase of each of the piezoelectric diaphragms **137***a* to **137***d* is periodically changed to an opposite phase (180 degrees) according to an externally applied voltage, and thus the shapes of the piezoelectric diaphragms **137***a* to **137***d* are deformed so that one portion of the piezoelectric diaphragms **137***a* to **137***d* convexly protrudes toward one side and the other portion of the piezoelectric diaphragms **137***a* to **137***d* convexly protrude the other side opposite to the one side.

[0074] That is, as illustrated in FIG. **4**, phases of adjacent first and second piezoelectric diaphragms **137***a* and **137***b* and phases of adjacent third and fourth piezoelectric diaphragms **137***c* and **137***d* disposed in the left thereof are simultaneously changed to opposite phases to each other so as to reduce the volumes of first and third cavities **139***a* and **139***c*. Thus, pressures of the first and third cavities **139***a* and **139***c* are increased, and the air existing in the first and third cavities **139***a* and **139***c* are discharged to the side of the heat exchanger **120** through the first and second air flow units **133** and **135** of the housing **131** at a fast flow rate. At this time, the stream discharged through the first and second air flow units **133** and **135** is called the above-mentioned 'pulse jet'. Such a pulse jet may provide a comfortable feeling to the user due to a slow flow rate.

[0075] On the other hand, in response to the phases of the first and second piezoelectric diaphragms **137***a* and **137***b* and the third and fourth piezoelectric diaphragms **137***c* and **137***d* being changed to the opposite phases to each other again, the volumes of the first and third cavities **139***a* and **139***c* disposed between the piezoelectric diaphragms **137***a* and **137***b*, and **137***c* and **137***d* are increased. Thus, the pressures of the first and third cavities **139***a* and **139***c* are lowered, and the surrounding air of the first and third cavities **139***a* and **139***c*, which are under atmosphere pressure relatively higher than pressures of the first and third cavities **139***a* and **139***c*, flow into the first and third cavities **139***a* and **139***c* through the first and second air flow units **133** and **135**. At this time, a volume of a second cavity **139***b* formed between the second and third piezoelectric diaphragms **137***b* and **137***c* is reduced according to change in the phases of the second and third piezoelectric diaphragms **137***b* and **137***c*, and the air of the second cavity **139***b* is discharged towards the heat exchanger **120** through the first and second air flow units **133** and **135** (see FIG. **5**).

[0076] Thus, the first to fourth piezoelectric diaphragms **137***a* to **137***d* change the volumes and pressures of the first to third cavities **139***a* to **139***c* through the periodic phase change, and continuously discharge the pulse jet to the side of the heat exchanger **120**.

[0077] Referring to FIG. **5**, the partition plate **150** is disposed between the heat exchanger **120** and the blower module **130**, and a plurality of slits **151** are formed in the partition plate **150** so as to allow the pulse jet discharged from the front face of the housing **131** to be passed through. The plurality of slits **151** are formed in locations corresponding to the plurality of slits in the first air flow unit **133**, respectively, and thus interference by the partition plate **150** is minimized in response to the pulse jet discharged from the first air flow unit **133** being moved to the heat exchanger **120**.

[0078] Referring to FIG. **6**, in response to the surrounding air of the housing **131** being introduced to the first air flow unit **133** while the volume of the cavity **139** is increased, the partition plate **150** prevents a portion of the pulse jet of which temperature is changed through the heat exchanger **120** from flowing into the first air flow unit **133** again through the plurality of slits **151** of the partition plate **150**. Thus, reflow-in of the air (cooling air or heating air), of which the temperature is already changed through the heat exchanger **120**, to the first air flow unit **133** may be prevented, and degradation in cooling or heating efficiency of the full front blowing type air conditioner **100** may be minimized.

[0079] The above-described full front blowing type air conditioner **100** according to the first embodiment of the present invention that the single blower module **130** is disposed in the case **110** is exemplified, but this is not limited thereto, and it is possible to dispose blower modules **130** in two rows as illustrated in FIG. **7**. Further, it is possible to dispose blower modules **130** in three rows or more, and in this case, the size of the case **110** may be determined by considering the number of disposed blower modules **130**.

[0080] The above-described housing **131** that the first air flow unit **133** includes a plurality of slits is exemplified, but this is not limited thereto, and the first air flow unit **133** may include a plurality of circular holes as illustrated in FIG. **8**. In this case, although not shown in drawings, the partition plate **150** may include a plurality of circular holes like the above-described first air flow unit **133** other than the plurality of slits. In this case, the circular holes of the partition plate **150** may be formed in locations corresponding to the plurality of circular holes of the first air flow unit **133**.

[0081] FIG. **9** is a perspective view illustrating a full front blowing type air conditioner according to a second embodiment of the present invention, and FIGS. **10** and **11** are cross-sectional views illustrating a state in which a pulse jet is discharged from a blower module and a state in which a surrounding air flows into a blower module in a full front blowing type air conditioner according to a second embodiment of the present invention.

[0082] A full front blowing type air conditioner **200** according to a second embodiment of the present invention will be described with reference to FIGS. **9** to **11**.

[0083] Most of configuration in the full front blowing type air conditioner **200** according to the second embodiment is the same as that of the full front blowing type air conditioner **100** according to the first embodiment, and merely, an arrangement of a heat exchanger **220** and shapes of a portion of a housing **231** of a blower module **230** and a partition plate **250** according to the arrangement of the heat exchanger **220** are changed. Therefore, hereinafter, description for the same configuration of the air conditioner in the second embodiment as that of the air conditioner in the first embodiment will be omitted, and focused description on the different configuration will be made.

[0084] The heat exchanger **220** includes first to third portions **221**, **222**, and **220** which are disposed an upper side, a middle side, and a lower side, respectively. In this case, referring to FIG. **9**, the second portion **222** is substantially vertically disposed, and the first and third portions **221** and **223** are disposed in the upper side and the lower side of the second portion **222** and disposed to have a predetermined angle with respect to the second portion **222** so that the heat exchanger **220** maintains the shape approximately protruding forward.

[0085] Referring to FIG. **10**, a front face of the housing **231** of the blower module **230** is formed to protrude toward a rear of the heat exchanger **220** according to an arrangement of the first to third portions **221**, **222**, and **223** constituting the heat exchanger **220**. In this case, the front face of the housing **231** is curvedly formed to have a predetermined curvature. However, the shape of the front face of the housing **231** is not limited to the curved shape, and the front face of the housing **231** may have three planes corresponding to the first to third portions **221**, **222**, and **223**.

[0086] A plurality of slits constituting a first air flow unit **233** formed in the front face of the housing **231** are uniformly distributed with respect to the front face of the housing **231**, and thus the pulse jet from cavities formed between a plurality of piezoelectric diaphragms **237** may be discharged over all the first to third portions **221**, **222**, and **223**.

[0087] A partition plate **250** may be disposed between the blower module **230** and the heat exchanger **220**, and may be curvedly formed to have a predetermined shape corresponding to shapes of the heat exchanger and the front face of the housing **231**, for example, to have a predetermined curvature as illustrated in FIG. **10**.

[0088] A plurality of slits formed in the partition plate **250** are formed in locations corresponding to the plurality of slit constituting the first air flow unit **233**, and thus the pulse jet sprayed from the cavity is discharged to the side of the heat exchanger **220** with the state in which the interference by the partition plate is minimized.

[0089] In the blower module **230**, according to the periodic change of the phases of the plurality of piezoelectric diaphragms **237**, the pulse jet is discharged from cavity through the first air flow unit **233** and second air flow units **235***a* and **235***b* formed in the housing **230**, and on the contrary, the surrounding air of the housing **230** flows into the inside of the cavity through the first air flow unit **233** and the second air flow units **235***a* and **235***b*.

[0090] Referring to FIG. **11**, the air being introduced into the cavity, the partition plate **250** prevents the air of which temperature is changed through the side of the heat exchanger **220** from flowing into the cavity of the housing **231** again, and thus the cooling or heating efficiency may be improved.

[0091] On the other hand, in FIGS. **9** to **11**, the reference numeral **211** denotes an air outlet of the case **210**, and the reference numerals **213***a* and **213***b* denote air inlets of the case **210**.

[0092] FIG. **12** is a cross-sectional view illustrating a full front blowing type air conditioner according to a third embodiment of the present invention.

[0093] A full front blowing type air conditioner **300** according to a third embodiment of the present invention will be described with reference to FIG. **12**.

[0094] Most of configuration in the full front blowing type air conditioner **300** according to the third embodiment is the same as that of the full front blowing type air conditioner **100** according to the first embodiment, and merely, a shape of a blower module **330**, that is, shapes of a plurality of piezoelectric diaphragms **337** and a longitudinal cross-sectional shape of a housing **331** in which the plurality of piezoelectric diaphragms **337** are built in are different from those in the first embodiment.

[0095] The plurality of piezoelectric diaphragms **337** have a rectangular shape in which a longitudinal length L**2** is approximately larger than a lateral length L**1**, and the longitudinal cross-sectional shape of the housing **331** also has a rectangular shape to correspond to shapes of the plurality of piezoelectric diaphragms **337**. In this case, the heat exchanger **320** may also have an area approximately corresponding to an area of a front face of the housing **331**.

[0096] Like this, in response to the plurality of piezoelectric diaphragms **337** and the housing **331** being formed so that the lateral lengths are smaller than the longitudinal lengths, a front blowing area of the full front blowing type air conditioner **300** may be increased in a vertical direction as compared with the housing fabricated in a circular shape or a square shape. Further, a size of the full front blowing type air conditioner **300** may be entirely slimly maintained.

[0097] In FIG. **12**, the reference numeral **310** denotes a case, the reference numeral **333** denotes a first air flow unit formed in the housing **331**, and reference numerals **335***a* and **335***b* denote second air flow units formed in the housing **331**.

[0098] FIG. **13** is a perspective view illustrating a full front blowing type air conditioner according to a fourth embodiment of the present invention, and FIG. **14** is a perspective view illustrating the full front blowing type air conditioner taken along line X-X of FIG. **13**.

[0099] Referring to FIG. **13**, a full front blowing type air conditioner **400** according to a fourth embodiment includes a case **410**, a heat exchanger **420** disposed in an inner side of the case **410**, and a plurality of blower modules **430***a* to **430***e* in rear of the heat exchanger **420**.

[0100] Like the case **110** of the above-described full front blowing type air conditioner **100** according to the first embodiment, an air outlet and an air inlet are provided in the case **410**. However, for clarity of an arrangement of the plurality blower modules **430***a* to **430***e* in the case **410**, the air outlet and the air inlet formed in the case **410** will be omitted in FIG. **13**.

[0101] The plurality of blower modules **430***a* to **430***e* are integrally formed by a frame **436**, and are disposed at intervals to a lateral direction. In this case, air exhaust passages P**1** to P**4** are formed between the blower modules **430***a* to **430***e* adjacent to each other. In this case, the air exhaust passages P**1** to P**4** may be formed to have a width smaller than that of a cavity **439** disposed in the inner side of the housing **431** in each of the blower modules **430***a* to **430***e*.

[0102] Referring to FIG. **14**, each of the blower modules **430***a* to **430***e* includes the housing **431** independently maintained, a pair of piezoelectric diaphragms **437***a* and **437***b* disposed at intervals in the housing **431**, and the cavity **439** formed between the pair of piezoelectric diaphragms **437***a* and **437***b*.

[0103] A first air flow unit **433** facing the heat exchanger **420** is formed in a front face of the housing **431** of each of the blower modules **430***a* to **430***e*, and the first air flow unit **433** includes a plurality of slits approximately formed to a lateral direction and arranged to a longitudinal direction.

[0104] A second air flow unit **435** includes a left slit **435***a* longitudinally formed in a left rear of each blower module **430***a* to **430***e*, and a right slit **435***b* longitudinally formed in a right rear of each blower module **430***a* to **430***e*.

[0105] The air exhaust passages P**1** to P**4** formed between the blower modules **430***a* to **430***e* are surrounded with piezoelectric diaphragms facing to each other with the air exhaust passages P**1** to P**4** being interposed therebetween among pairs of piezoelectric diaphragms **437***a* and **437***b* provided adjacent blower modules **430***a* to **430***e*. Thus, the pulse jets discharged from the left and right slits **435***a* and **435***b* are discharged to the side of the heat exchanger **420** through the air exhaust passages P**1** to P**4**.

[0106] In the fourth embodiment, while phases of the pair of piezoelectric diaphragms **437***a* and **437***b* provided in each of blower modules **430***a* to **430***e* are periodically changed to opposite phases to each other, the pulse jet is discharged from the cavity **439** through the first and second air flow units **433** and **435** according to volume change of the cavity **439**. At this time, the pressures of the air exhaust passages P**1** to P**4** are lowered, and thus the air in the case **410** in rear of the air exhaust passages P**1** to P**4** flow into the air exhaust passages P**1** to P**4**. Thus, a sufficient amount of air may be supplied to the side of the heat exchanger **420**.

[0107] On the other hand, in the fourth embodiment, the plurality of blower modules which are arranged to be spaced in a row to the lateral direction are exemplarily described, but the arrangement of the blower modules is not limited thereto. The plurality of blower modules may be arranged in two rows, or in a matrix form in which N×M blower modules are disposed in the lateral and longitudinal directions.

[0108] FIGS. **15** and **16** are perspective views when viewed in a front and a rear of a full front blowing type air conditioner according to a fifth embodiment of the present invention, FIG. **17** a perspective view illustrating a plurality of blower modules and a plurality of manifolds arranged between the blower modules to a longitudinal direction, FIG. **18** is a perspective view illustrating a portion of the plurality of blower modules and the plurality of manifolds, FIG. **19** is an enlarged perspective view illustrating the blower module, and FIG. **20** is a cross-sectional view illustrating a state in which a pulse jet is discharged from the manifold.

[0109] Referring to FIGS. **15** and **16**, a full front blowing type air conditioner **500** according to a fifth embodiment includes a case **510**, a heat exchanger **520** disposed in the case **510**, and a blower module **530** disposed in rear of the heat exchanger **520** in the case **510**.

[0110] The case **510** forms a plurality of air outlets **511** so as to allow the pulse jet to be discharged to the outside of the case **510** through the heat exchanger **520** as illustrated in FIG. **15**. The plurality of air outlets **511** include slits formed to the lateral direction and arranged to the longitudinal direction. The plurality of air outlets are arranged by considering an arrangement of a plurality of manifolds **570** located between the plurality of blower modules **530***a* to **530***c*, which is to be described later. The arrangement of the plurality of manifolds **570** will be described later.

[0111] Further, the case **510** forms a plurality of air inlet **513** in a rear face of the case **510** as illustrated in FIG. **16**. The plurality of air inlets **513** include slits formed to a lateral direction and arranged to a longitudinal direction like the plurality of air outlets **511**. In this case, in response to the case **510** being installed to a wall, so as to allow the air to smoothly flow into the plurality of air inlets **513**, the case **510** may be installed so that the rear of the case **510** is spaced from the wall at intervals.

[0112] Referring to FIG. **17**, each of the plurality of blower modules **530***a* to **530***c* includes the housing **531** having a thin thickness and formed to be elongated along the longitudinal direction, and a plurality of piezoelectric diaphragms **537***a* and **537***b* disposed to be spaced in the inner side of the housing **531** in pair and arranged to be spaced in multiple rows to a longitudinal direction.

[0113] An air flow unit **533** including a single slit is formed along a front face of the housing **531** to the longitudinal direction. In this case, in each of the above-described housings **131**, **231**, **331**, and **431** of the full front blowing type air conditioners **100**, **200**, **300**, and **400** according to the first to fourth embodiments, the first air flow unit is formed in the front face and the second air flow units are provided in the upper rear and lower rear of the housing or the left rear and right rear of the housing. However, in the housing **531** of the fifth embodiment, the air flow unit **533** is formed only in the front of the housing **531**.

[0114] Referring to FIG. **18**, a plurality of communication holes **531***c* which communicate with both ends of the plurality of manifolds **570** are formed in the left and right of the housing **531**.

[0115] The plurality of manifolds **570** are approximately arranged to the lateral direction with respect to the plurality of blower modules **530***a* to **530***c* disposed to the longitudinal direction. In this case, the plurality of manifolds **570** are disposed to be spaced from each other at intervals.

[0116] Further, a slit **571** configured to discharge the pulse jet is formed along a front face of each of the plurality of manifolds **570** to the lateral direction. Both sides of the plurality of manifolds **570** formed in the plurality of blower modules **530***a* to **530***c* guide the pulse jet discharged from the blower modules **530***a* to **530***c*, and discharge the pulse jet to the slits **571**.

[0117] Referring to FIG. **19**, according to periodic change in the phases of the pair of piezoelectric diaphragms **537***a* and **537***b* to opposite directions, that is, to the direction facing each other or the direction away from each other, the pulse jet is alternately discharged to the air flow unit **533** formed on the front face and the plurality of manifold **570**.

[0118] In response to the phases of the pair of piezoelectric diaphragms **537***a* and **537***b* being changed to the direction facing each other, a volume of a first cavity **539***a* formed between the pair of piezoelectric diaphragms **537***a* and **537***b* is reduced, and thus the air existing in the inside of the first cavity **539***a* is discharged through the air flow unit **533**. At this time, volumes of second and third cavities **539***b* and **539***c* formed between the pair of piezoelectric diaphragms **537***a* and **537***b* and both sidewalls of the housing **531** are increased, and the air flows into the insides of the plurality of manifolds **570** and the second and third cavities **539***b* and **539***c* through the slits **571** of the plurality of manifolds **570**.

[0119] On the contrary, in response to the phases of the pair of piezoelectric diaphragms **537***a* and **537***b* being changed to the direction away from each other, volumes of the second and third cavities **539***b* and **539***c* are reduced, and thus the air existing in the insides of the second and third cavities **539***b* and **539***c* and the plurality of manifolds **570** are discharged through the slits **571**. In this case, the volume of the first cavity **539***a* is increased, and the surrounding air flows into the first cavity **539***a* through the air flow unit **533**.

[0120] FIG. **20** illustrates a state in which the pulse jet is discharged through the slits **571** of the plurality of manifolds **570**. In this case, the pulse jet is discharged from the slits **571** of the plurality of manifolds **570** at a fast flow rate, and thus air pressure in the periphery of the slits **571** is lowered. Thus, after the air flows into the air inlet **513** of the case **510**, the air is sucked into the air exhaust passage **573** formed between the plurality of manifolds **570**, and then the air is discharged to the side of the heat exchanger **520** together with the pulse jet. Therefore, the full front blowing type air conditioner **500** in the fifth embodiment may also supply a sufficient flow of air to the heat exchanger **520**.

[0121] While the phases of the pair of piezoelectric diaphragms **537***a* and **537***b* are periodically changed to the opposite phases to each other, the pulse jet is discharged to the air flow unit **533** of the housing **531** and the slit **571** of the plurality of manifolds **570**.

[0122] As described above, the full front blowing type air conditioners **100**, **200**, **300**, **400**, and **500** according to the first to fifth embodiments may maximize a blowing area to considerably improve the cooling or heating efficiency, and may continuously discharge the air at a low flow rate to implement comfortable blowing without an unpleasant feeling of the use.

[0123] The foregoing exemplary embodiments and advantages are merely exemplary and are not to be construed as limiting the present inventive concept. The description of the exemplary embodiments is intended to be illustrative, and not to limit the scope of the claims, and many alternatives, modifications, and variations will be apparent to those skilled in the art.

[0124] The present invention relates to an indoor unit of an air conditioner capable of blowing a pulse jet from a portion corresponding to an entire area of a front face of the air conditioner.

INDUSTRIAL APPLICABILITY

[0125] The present invention will be more apparent through detailed description of preferred embodiments of the present invention with reference to the accompanying drawings. Further, for understanding of the present invention, the accompanying drawings may be illustrated not in an actual scale but sizes in portions of configuration components are exaggeratedly illustrated.

[0126] An air conditioner of the present invention relates to an indoor unit of a full front blowing type air conditioner, and may be an air conditioner for cooling only, an air conditioner for heating only, or an air conditioner for both heating and cooling.

[0127] Further, the present invention may dispose a heat exchanger to correspond to approximately an entire area of a front face of a case and dispose a blower module configured to discharge a pulse jet with respect to an entire surface of the heat exchanger in rear of the heat exchanger, so that blowing from the entire area of the front face of the case is obtained. Therefore, the present invention may discharge a cooling air or a heating air from a wide blowing area as compared with a wall-mounted type air conditioner in the related art, and provide a comfortable feeling to a user due to blowing in a low flow rate as compared with the related art.

[0128] Hereinafter, full front blowing type air conditioners according to various embodiments of the present invention will be described with reference to the accompanying drawings.

[0129] FIGS. **2** and **3** are perspective views illustrating an outside and an inside of a full front blowing type air conditioner according to a first embodiment of the present invention, respectively, FIG. **4** is a schematic perspective view explaining an operation of a plurality of piezoelectric diaphragms disposed in an inside of a blower module of a full front blowing type air conditioner according to a first embodiment of the present invention, FIGS. **5** and **6** are cross-sectional views illustrating a state in which a pulse jet is discharged from a blower module and a state in which the surrounding air flows into the blower module in a full front blowing type air conditioner according to a first embodiment of the present invention, FIG. **7** is a perspective view illustrating a state in which blower modules are arranged in two rows as a modification example of a full front blowing type air conditioner according to a first embodiment of the present invention, and FIG. **8** is a perspective view illustrating an example that a plurality of holes of a blower module are formed in front of a housing other than a plurality of slits.

[0130] Referring to FIGS. **2** and **3**, a full front blowing type air conditioner **100** according to a first embodiment of the present invention includes a case **110**, a heat exchanger **120**, a blower module **130**, and a partition plate **150**.

[0131] The case **110** forms an outer appearance of an indoor unit of the full front blowing type air conditioner **100**, and the heat exchanger **120**, the blower module **130**, and the partition plate **150** are disposed in an inner side of the case. Further, the case **110** includes a plurality of air outlets **111** and pluralities of first and second air inlets **113***a* and **113***b*.

[0132] The plurality of air outlets **111** guide the air, which passes through the heat exchanger **120** and temperature thereof is changed, to be discharged to the outside of the front face of the case **110**.

[0133] The plurality of air outlets **111** are arranged to be spaced in the whole front face so as to occupy most of the front face of the case **110** so that the main air current may be blown through the entire area of the front face. In this case, the plurality of air outlets **111** have shapes of slits arranged to be spaced as illustrated in FIG. **2**. Further, the plurality of air outlets **111** may have circular holes other than the slit shapes.

[0134] The plurality of first air inlets **113***a* are formed over portions of top and rear faces of the case **110**, and the plurality of second air inlets **113***b* are formed over portions of bottom and rear faces of the case.

[0135] The pluralities of first and second air inlets **113***a* and **113***b* serve as passages which allow the external air to flow in the inside of the case **100**. Thus, in order for a significant amount of air to flow in the inside of the case **110**, the pluralities of first and second air inlets **113***a* and **113***b* are formed at intervals to a longitudinal direction of the case **110** from one side to the other side of the case **110**.

[0136] On the other hand, the shape of the case **110** may be determined according to a shape or arrangement of the blower module **130** disposed in the inside of the case. For example, the case **110** is formed to have a height, in response to the blow modules **130** disposed in the inside of the case **110** being arranged in multi rows, larger than a height in response to the blower modules **130** being arranged in a row to a lateral direction. The case **110** may be formed to correspond to the shape of the blower module **130**, and the longitudinal cross-section of the blower module **130** is formed approximately in a tetragonal shape, a rectangular shape, a circular shape, or a partially rounded shape. The case **110** may be formed to correspond to the shape or arrangement of the heat exchanger **120**.

[0137] The heat exchanger **120** may form a refrigerant cycle, in which a refrigerant is circulated, together with a compressor (not shown) and a condenser (not shown).

[0138] The heat exchanger **120** is disposed adjacent to the plurality of air outlets **111** in the case **110**. In this case, the heat exchanger **120** may have an area corresponding to approximately the entire area of the front face of the case **110**.

[0139] Under the arrangement, the pulse jet discharged to a side of the heat exchanger **120** from the blower module **130** disposed in rear of the heat exchanger **120** passes through the heat exchanger **120** so that the temperature of the pulse jet is changed, and is discharged to the outside of the case **110** through the air inlets **111** of the case **110**.

[0140] Further, since the heat exchanger **120** is formed to have the area corresponding to the entire area of the front face of the case **110**, a blowing area toward the front face of the full front blowing type air conditioner **100** through the pulse jet discharged by the blower module **130** can be maximized.

[0141] The blower module **130** generates the pulse jet and continuously discharges the pulse jet to the side of the heat exchanger **120**. Such a blower module **130** includes a housing **131**, a first air flow unit **133**, a second air flow unit **135**, and a piezoelectric diaphragm **137**.

[0142] The housing **131** is located in rear of the heat exchanger **120**, and a plurality of piezoelectric diaphragms **137** are disposed to be spaced at intervals in an inner side of the housing **131**. In this case, a plurality of cavities **139** formed by the plurality of piezoelectric diaphragms **137** are provided in the inner side of the housing **131**. In this case, the plurality of cavities **139** are provided in the inner side of the housing **131**, and thus the plurality of cavities **139** are partitioned with the heat exchanger **120**.

[0143] Further, the plurality of cavities **139** are configured of n−1 in response to the number of piezoelectric diaphragms **137** being n.

[0144] On the other hand, the housing **131**, of which three piezoelectric diaphragms **137** or more are disposed in the inner side and two cavities **139** or more are formed in the inner side, has been exemplarily described, but this is not limited thereto. The housing **131**, of which a pair of piezoelectric diaphragms **137** are disposed in the inner side and one cavity **139** is formed in the inner side, may be employed.

[0145] A front face of the housing **131**, in which the first air flow unit **133** is formed, has an area corresponding to an area of the heat exchanger **120**.

[0146] Further, the shape of the front face of the housing **131** may be changed according to the arrangement of the heat exchanger **120**. That is, in response to the plate-shaped single heat exchanger **120** being approximately vertically disposed as illustrated in FIG. **2**, the front face of the housing **131** has a plane. Alternatively, in response to a plurality of heat exchangers **220** being continuously disposed to maintain a predetermined angle to each other as illustrated in FIG. **9**, the front face of the housing **131** may be formed to convexly protrude and to be adjacent to the side of the heat exchanger **120**.

[0147] The first air flow unit **133** is formed in the front face of the housing **131**, and is a passage for discharging the pulse jet to the front of the housing **131** from the cavity **139**. The first air flow unit **133** includes a plurality of slits having a predetermined length. At this time, the plurality of slits are formed to a lateral direction, and are distributed to correspond to the plurality of cavities **139**, respectively.

[0148] The second air flow unit **135** includes an upper slit **135***a* formed in the upper rear of the housing **131** to a longitudinal direction of the housing **131**, and a lower slit **135***b* formed in the lower rear of the housing **131** to the longitudinal direction of the housing **131**. The upper slit **135***a* and the lower slit **135***b* are disposed to face the front of the housing **131** so as to discharge the pulse jet to the side of the heat exchanger **120**.

[0149] In response to a phase of the piezoelectric diaphragm **137** being periodically changed, the pulse jet are discharged from the cavity **139** through the first and second air flow units **133** and **135** according to reduction in a volume of the cavity **139**, and on the contrary, the surrounding air of the housing **131** flows into the cavity **139** through the first and second air flow units **133** and **135** according to expansion of the volume of the cavity **139**.

[0150] Referring to FIG. **4**, a plurality of piezoelectric diaphragms **137***a* to **137***d* are disposed at intervals, and cavities **139***a*, **139***b*, and **139***c* are formed between adjacent piezoelectric diaphragms **137***a* to **137***d*.

[0151] Each of the piezoelectric diaphragms **137***a* to **137***d* includes a ferroelectric thin film (for example, piezoelectric translator (PZT)). In this time, the phase of each of the piezoelectric diaphragms **137***a* to **137***d* is periodically changed to an opposite phase (180 degrees) according to an externally applied voltage, and thus the shapes of the piezoelectric diaphragms **137***a* to **137***d* are deformed so that one portion of the piezoelectric diaphragms **137***a* to **137***d* convexly protrudes toward one side and the other portion of the piezoelectric diaphragms **137***a* to **137***d* convexly protrude the other side opposite to the one side.

[0152] That is, as illustrated in FIG. **4**, phases of adjacent first and second piezoelectric diaphragms **137***a* and **137***b* and phases of adjacent third and fourth piezoelectric diaphragms **137***c* and **137***d* disposed in the left thereof are simultaneously changed to opposite phases to each other so as to reduce the volumes of first and third cavities **139***a* and **139***c*. Thus, pressures of the first and third cavities **139***a* and **139***c* are increased, and the air existing in the first and third cavities **139***a* and **139***c* are discharged to the side of the heat exchanger **120** through the first and second air flow units **133** and **135** of the housing **131** at a fast flow rate. At this time, the stream discharged through the first and second air flow units **133** and **135** is called the above-mentioned 'pulse jet'. Such a pulse jet may provide a comfortable feeling to the user due to a slow flow rate.

[0153] On the other hand, in response to the phases of the first and second piezoelectric diaphragms **137***a* and **137***b* and the third and fourth piezoelectric diaphragms **137***c* and **137***d* being changed to the opposite phases to each other again, the volumes of the first and third cavities **139***a* and **139***c* disposed between the piezoelectric diaphragms **137***a* and **137***b*, and **137***c* and **137***d* are increased. Thus, the pressures of the first and third cavities **139***a* and **139***c* are lowered, and the surrounding air of the first and third cavities **139***a* and **139***c*, which are under atmosphere pressure relatively higher than pressures of the first and third cavities **139***a* and **139***c*, flow into the first and third cavities **139***a* and **139***c* through the first and second air flow units **133** and **135**. At this time, a volume of a second cavity **139***b* formed between the second and third piezoelectric diaphragms **137***b* and **137***c* is reduced according to change in the phases of the second and third piezoelectric diaphragms **137***b* and **137***c*, and the air of the second cavity **139***b* is discharged towards the heat exchanger **120** through the first and second air flow units **133** and **135** (see FIG. **5**).

[0154] Thus, the first to fourth piezoelectric diaphragms **137***a* to **137***d* change the volumes and pressures of the first to third cavities **139***a* to **139***c* through the periodic phase change, and continuously discharge the pulse jet to the side of the heat exchanger **120**.

[0155] Referring to FIG. **5**, the partition plate **150** is disposed between the heat exchanger **120** and the blower module **130**, and a plurality of slits **151** are formed in the partition plate **150** so as to allow the pulse jet discharged from the front face of the housing **131** to be passed through. The plurality of slits **151** are formed in locations corresponding to the plurality of slits in the first air flow unit **133**, respectively, and thus interference by the partition plate **150** is minimized in response to the pulse jet discharged from the first air flow unit **133** being moved to the heat exchanger **120**.

[0156] Referring to FIG. **6**, in response to the surrounding air of the housing **131** being introduced to the first air flow unit **133** while the volume of the cavity **139** is increased, the partition plate **150** prevents a portion of the pulse jet of which temperature is changed through the heat exchanger **120** from flowing into the first air flow unit **133** again through the plurality of slits **151** of the partition plate **150**. Thus, reflow-in of the air (cooling air or heating air), of which the temperature is already changed through the heat exchanger **120**, to the first air flow unit **133** may be prevented, and degradation in cooling or heating efficiency of the full front blowing type air conditioner **100** may be minimized.

[0157] The above-described full front blowing type air conditioner **100** according to the first embodiment of the present invention that the single blower module **130** is disposed in the case **110** is exemplified, but this is not limited thereto, and it is possible to dispose blower modules **130** in two rows as illustrated in FIG. **7**. Further, it is possible to dispose blower modules **130** in three rows or more, and in this case, the size of the case **110** may be determined by considering the number of disposed blower modules **130**.

[0158] The above-described housing **131** that the first air flow unit **133** includes a plurality of slits is exemplified, but this is not limited thereto, and the first air flow unit **133** may include a plurality of circular holes as illustrated in FIG. **8**. In this case, although not shown in drawings, the partition plate **150** may include a plurality of circular holes like the above-described first air flow unit **133** other than the plurality of slits. In this case, the circular holes of the partition plate **150** may be formed in locations corresponding to the plurality of circular holes of the first air flow unit **133**.

[0159] FIG. **9** is a perspective view illustrating a full front blowing type air conditioner according to a second embodiment of the present invention, and FIGS. **10** and **11** are cross-sectional views illustrating a state in which a pulse jet is discharged from a blower module and a state in which a surrounding air flows into a blower module in a full front blowing type air conditioner according to a second embodiment of the present invention.

[0160] A full front blowing type air conditioner **200** according to a second embodiment of the present invention will be described with reference to FIGS. **9** to **11**.

[0161] Most of configuration in the full front blowing type air conditioner **200** according to the second embodiment is the same as that of the full front blowing type air conditioner **100** according to the first embodiment, and merely, an arrangement of a heat exchanger **220** and shapes of a portion of a housing **231** of a blower module **230** and a partition plate **250** according to the arrangement of the heat exchanger **220** are changed. Therefore, hereinafter, description for the same configuration of the air conditioner in the second embodiment as that of the air conditioner in the first embodiment will be omitted, and focused description on the different configuration will be made.

[0162] The heat exchanger **220** includes first to third portions **221**, **222**, and **220** which are disposed an upper side, a middle side, and a lower side, respectively. In this case, referring to FIG. **9**, the second portion **222** is substantially vertically disposed, and the first and third portions **221** and **223** are disposed in the upper side and the lower side of the second portion **222** and disposed to have a predetermined angle with respect to the second portion **222** so that the heat exchanger **220** maintains the shape approximately protruding forward.

[0163] Referring to FIG. **10**, a front face of the housing **231** of the blower module **230** is formed to protrude toward a rear of the heat exchanger **220** according to an arrangement of the first to third portions **221**, **222**, and **223** constituting the heat exchanger **220**. In this case, the front face of the housing **231** is curvedly formed to have a predetermined curvature. However, the shape of the front face of the housing **231** is not limited to the curved shape, and the front face of the housing **231** may have three planes corresponding to the first to third portions **221**, **222**, and **223**.

[0164] A plurality of slits constituting a first air flow unit **233** formed in the front face of the housing **231** are uniformly distributed with respect to the front face of the housing **231**, and thus the pulse jet from cavities formed between a plurality of piezoelectric diaphragms **237** may be discharged over all the first to third portions **221**, **222**, and **223**.

[0165] A partition plate **250** may be disposed between the blower module **230** and the heat exchanger **220**, and may be curvedly formed to have a predetermined shape corresponding to shapes of the heat exchanger and the front face of the housing **231**, for example, to have a predetermined curvature as illustrated in FIG. **10**.

[0166] A plurality of slits formed in the partition plate **250** are formed in locations corresponding to the plurality of slit constituting the first air flow unit **233**, and thus the pulse jet sprayed from the cavity is discharged to the side of the heat exchanger **220** with the state in which the interference by the partition plate is minimized.

[0167] In the blower module **230**, according to the periodic change of the phases of the plurality of piezoelectric diaphragms **237**, the pulse jet is discharged from cavity through the first air flow unit **233** and second air flow units **235***a* and **235***b* formed in the housing **230**, and on the contrary, the surrounding air of the housing **230** flows into the inside of the cavity through the first air flow unit **233** and the second air flow units **235***a* and **235***b*.

[0168] Referring to FIG. **11**, the air being introduced into the cavity, the partition plate **250** prevents the air of which temperature is changed through the side of the heat exchanger **220** from flowing into the cavity of the housing **231** again, and thus the cooling or heating efficiency may be improved.

[0169] On the other hand, in FIGS. **9** to **11**, the reference numeral **211** denotes an air outlet of the case **210**, and the reference numerals **213***a* and **213***b* denote air inlets of the case **210**.

[0170] FIG. **12** is a cross-sectional view illustrating a full front blowing type air conditioner according to a third embodiment of the present invention.

[0171] A full front blowing type air conditioner **300** according to a third embodiment of the present invention will be described with reference to FIG. **12**.

[0172] Most of configuration in the full front blowing type air conditioner **300** according to the third embodiment is the same as that of the full front blowing type air conditioner **100** according to the first embodiment, and merely, a shape of a blower module **330**, that is, shapes of a plurality of piezoelectric diaphragms **337** and a longitudinal cross-sectional shape of a housing **331** in which the plurality of piezoelectric diaphragms **337** are built in are different from those in the first embodiment.

[0173] The plurality of piezoelectric diaphragms **337** have a rectangular shape in which a longitudinal length L2 is approximately larger than a lateral length L1, and the longitudinal cross-sectional shape of the housing **331** also has a rectangular shape to correspond to shapes of the plurality of piezoelectric diaphragms **337**. In this case, the heat exchanger **320** may also have an area approximately corresponding to an area of a front face of the housing **331**.

[0174] Like this, in response to the plurality of piezoelectric diaphragms **337** and the housing **331** being formed so that the lateral lengths are smaller than the longitudinal lengths, a front blowing area of the full front blowing type air conditioner **300** may be increased in a vertical direction as compared with the housing fabricated in a circular shape or a square shape. Further, a size of the full front blowing type air conditioner **300** may be entirely slimly maintained.

[0175] In FIG. **12**, the reference numeral **310** denotes a case, the reference numeral **333** denotes a first air flow unit formed in the housing **331**, and reference numerals **335***a* and **335***b* denote second air flow units formed in the housing **331**.

[0176] FIG. **13** is a perspective view illustrating a full front blowing type air conditioner according to a fourth embodiment of the present invention, and FIG. **14** is a perspective view illustrating the full front blowing type air conditioner taken along line X-X of FIG. **13**.

[0177] Referring to FIG. **13**, a full front blowing type air conditioner **400** according to a fourth embodiment includes a case **410**, a heat exchanger **420** disposed in an inner side of the case **410**, and a plurality of blower modules **430***a* to **430***e* in rear of the heat exchanger **420**.

[0178] Like the case **110** of the above-described full front blowing type air conditioner **100** according to the first embodiment, an air outlet and an air inlet are provided in the case **410**. However, for clarity of an arrangement of the plurality blower modules **430***a* to **430***e* in the case **410**, the air outlet and the air inlet formed in the case **410** will be omitted in FIG. **13**.

[0179] The plurality of blower modules **430***a* to **430***e* are integrally formed by a frame **436**, and are disposed at intervals to a lateral direction. In this case, air exhaust passages P1 to P4 are formed between the blower modules **430***a* to **430***e* adjacent to each other. In this case, the air exhaust passages P1 to P4 may be formed to have a width smaller than that of a cavity **439** disposed in the inner side of the housing **431** in each of the blower modules **430***a* to **430***e*.

[0180] Referring to FIG. **14**, each of the blower modules **430***a* to **430***e* includes the housing **431** independently maintained, a pair of piezoelectric diaphragms **437***a* and **437***b* disposed at intervals in the housing **431**, and the cavity **439** formed between the pair of piezoelectric diaphragms **437***a* and **437***b*.

[0181] A first air flow unit **433** facing the heat exchanger **420** is formed in a front face of the housing **431** of each of the blower modules **430***a* to **430***e*, and the first air flow unit **433** includes a plurality of slits approximately formed to a lateral direction and arranged to a longitudinal direction.

[0182] A second air flow unit **435** includes a left slit **435***a* longitudinally formed in a left rear of each blower module **430***a* to **430***e*, and a right slit **435***b* longitudinally formed in a right rear of each blower module **430***a* to **430***e*.

[0183] The air exhaust passages P1 to P4 formed between the blower modules **430***a* to **430***e* are surrounded with piezoelectric diaphragms facing to each other with the air exhaust passages P1 to P4 being interposed therebetween among pairs of piezoelectric diaphragms **437***a* and **437***b* provided adjacent blower modules **430***a* to **430***e*. Thus, the pulse jets discharged from the left and right slits **435***a* and **435***b* are discharged to the side of the heat exchanger **420** through the air exhaust passages P1 to P4.

[0184] In the fourth embodiment, while phases of the pair of piezoelectric diaphragms **437***a* and **437***b* provided in each of blower modules **430***a* to **430***e* are periodically changed to opposite phases to each other, the pulse jet is discharged from the cavity **439** through the first and second air flow units **433** and **435** according to volume change of the cavity **439**. At this time, the pressures of the air exhaust passages P1 to P4 are lowered, and thus the air in the case **410** in rear of the air exhaust passages P1 to P4 flow into the air exhaust passages P1 to P4. Thus, a sufficient amount of air may be supplied to the side of the heat exchanger **420**.

[0185] On the other hand, in the fourth embodiment, the plurality of blower modules which are arranged to be spaced in a row to the lateral direction are exemplarily described, but the arrangement of the blower modules is not limited thereto. The plurality of blower modules may be arranged in two rows, or in a matrix form in which N×M blower modules are disposed in the lateral and longitudinal directions.

[0186] FIGS. **15** and **16** are perspective views when viewed in a front and a rear of a full front blowing type air conditioner according to a fifth embodiment of the present invention, FIG. **17** a perspective view illustrating a plurality of blower modules and a plurality of manifolds arranged between the blower modules to a longitudinal direction, FIG. **18** is a perspective view illustrating a portion of the plurality of blower modules and the plurality of manifolds, FIG. **19** is an enlarged perspective view illustrating the blower module, and FIG. **20** is a cross-sectional view illustrating a state in which a pulse jet is discharged from the manifold.

[0187] Referring to FIGS. **15** and **16**, a full front blowing type air conditioner **500** according to a fifth embodiment includes a case **510**, a heat exchanger **520** disposed in the case **510**, and a blower module **530** disposed in rear of the heat exchanger **520** in the case **510**.

[0188] The case **510** forms a plurality of air outlets **511** so as to allow the pulse jet to be discharged to the outside of the case **510** through the heat exchanger **520** as illustrated in FIG. **15**. The plurality of air outlets **511** include slits formed to the lateral direction and arranged to the longitudinal direction. The plurality of air outlets are arranged by considering an arrangement of a plurality of manifolds **570** located between the plurality of blower modules **530***a* to **530***c*, which is to be described later. The arrangement of the plurality of manifolds **570** will be described later.

[0189] Further, the case **510** forms a plurality of air inlet **513** in a rear face of the case **510** as illustrated in FIG. **16**. The plurality of air inlets **513** include slits formed to a lateral direction and arranged to a longitudinal direction like the plurality of air outlets **511**. In this case, in response to the case **510** being installed to a wall, so as to allow the air to smoothly flow into the plurality of air inlets **513**, the case **510** may be installed so that the rear of the case **510** is spaced from the wall at intervals.

[0190] Referring to FIG. **17**, each of the plurality of blower modules **530***a* to **530***c* includes the housing **531** having a thin thickness and formed to be elongated along the longitudinal direction, and a plurality of piezoelectric diaphragms **537***a* and **537***b* disposed to be spaced in the inner side of the housing **531** in pair and arranged to be spaced in multiple rows to a longitudinal direction.

[0191] An air flow unit **533** including a single slit is formed along a front face of the housing **531** to the longitudinal direction. In this case, in each of the above-described housings **131**, **231**, **331**, and **431** of the full front blowing type air conditioners **100**, **200**, **300**, and **400** according to the first to fourth embodiments, the first air flow unit is formed in the front face and the second air flow units are provided in the upper rear and lower rear of the housing or the left rear and right rear of the housing. However, in the housing **531** of the fifth embodiment, the air flow unit **533** is formed only in the front of the housing **531**.

[0192] Referring to FIG. **18**, a plurality of communication holes **531***c* which communicate with both ends of the plurality of manifolds **570** are formed in the left and right of the housing **531**.

[0193] The plurality of manifolds **570** are approximately arranged to the lateral direction with respect to the plurality of blower modules **530***a* to **530***c* disposed to the longitudinal direction. In this case, the plurality of manifolds **570** are disposed to be spaced from each other at intervals.

[0194] Further, a slit **571** configured to discharge the pulse jet is formed along a front face of each of the plurality of manifolds **570** to the lateral direction. Both sides of the plurality of manifolds **570** formed in the plurality of blower modules **530***a* to **530***c* guide the pulse jet discharged from the blower modules **530***a* to **530***c*, and discharge the pulse jet to the slits **571**.

[0195] Referring to FIG. **19**, according to periodic change in the phases of the pair of piezoelectric diaphragms **537***a* and **537***b* to opposite directions, that is, to the direction facing each other or the direction away from each other, the pulse jet is alternately discharged to the air flow unit **533** formed on the front face and the plurality of manifold **570**.

[0196] In response to the phases of the pair of piezoelectric diaphragms **537***a* and **537***b* being changed to the direction facing each other, a volume of a first cavity **539***a* formed between the pair of piezoelectric diaphragms **537***a* and **537***b* is reduced, and thus the air existing in the inside of the first cavity **539***a* is discharged through the air flow unit **533**. At this time, volumes of second and third cavities **539***b* and **539***c* formed between the pair of piezoelectric diaphragms **537***a* and **537***b* and both sidewalls of the housing **531** are increased, and the air flows into the insides of the plurality of manifolds **570** and the second and third cavities **539***b* and **539***c* through the slits **571** of the plurality of manifolds **570**.

[0197] On the contrary, in response to the phases of the pair of piezoelectric diaphragms **537***a* and **537***b* being changed to the direction away from each other, volumes of the second and third cavities **539***b* and **539***c* are reduced, and thus the air existing in the insides of the second and third cavities **539***b* and **539***c* and the plurality of manifolds **570** are discharged through the slits **571**. In this case, the volume of the first cavity **539***a* is increased, and the surrounding air flows into the first cavity **539***a* through the air flow unit **533**.

[0198] FIG. **20** illustrates a state in which the pulse jet is discharged through the slits **571** of the plurality of manifolds **570**. In this case, the pulse jet is discharged from the slits **571** of the plurality of manifolds **570** at a fast flow rate, and thus air pressure in the periphery of the slits **571** is lowered. Thus, after the air flows into the air inlet **513** of the case **510**, the air is sucked into the air exhaust passage **573** formed between the plurality of manifolds **570**, and then the air is discharged to the side of the heat exchanger **520** together with the pulse jet. Therefore, the full front blowing type air conditioner **500** in the fifth embodiment may also supply a sufficient flow of air to the heat exchanger **520**.

[0199] While the phases of the pair of piezoelectric diaphragms **537***a* and **537***b* are periodically changed to the opposite phases to each other, the pulse jet is discharged to the air flow unit **533** of the housing **531** and the slit **571** of the plurality of manifolds **570**.

[0200] As described above, the full front blowing type air conditioners **100**, **200**, **300**, **400**, and **500** according to the first to fifth embodiments may maximize a blowing area to considerably improve the cooling or heating efficiency, and may continuously discharge the air at a low flow rate to implement comfortable blowing without an unpleasant feeling of the use.

[0201] The foregoing exemplary embodiments and advantages are merely exemplary and are not to be construed as limiting the present inventive concept. The description of the exemplary embodiments is intended to be illustrative, and not to limit the scope of the claims, and many alternatives, modifications, and variations will be apparent to those skilled in the art.

INDUSTRIAL APPLICABILITY

[0202] The present invention relates to an indoor unit of an air conditioner capable of blowing a pulse jet from a portion corresponding to an entire area of a front face of the air conditioner.

1. An air conditioner comprising:

a case of which a heat exchanger is disposed in an inner side; and

a blower module disposed in rear of the heat exchanger in the case, and configured to discharge a pulse jet for blowing through a front face of the case,

wherein the blowing module changes air pressure of a cavity formed between at least one pair of piezoelectric diaphragms and discharges the pulse jet to a side of the heat exchanger according to periodic deformation of the pair of piezoelectric diaphragms to opposite phases to each other.

2. The air conditioner according to claim **1**, wherein the blower module includes a housing in which a first air flow unit is formed in one side corresponding to the heat exchanger, and a second air flow unit is formed in the other side, and

the at least one pair of piezoelectric diaphragms are disposed to be spaced in parallel in the inner side of the housing, and the blower module discharges the pulse jet to the side of the heat exchanger through the first and second air flow units.

3. The air conditioner according to claim **2**, wherein the first air flow unit includes a plurality of slits or a plurality of holes which allow the air to flow into the cavity and flow out from the cavity.

4. The air conditioner according to claim **2**, wherein the second air flow unit includes an upper slit and a lower slit which allow the air to flow into the cavity and flow out from the cavity, and are formed in an upper rear and a lower rear of the housing, respectively, and

the upper slit and the lower slit face a front of the housing.

5. The air conditioner according to claim **1**, wherein the heat exchanger has an area corresponding to an entire area of the front face of the case.

6. The air conditioner according to claim **2**, wherein a face of the housing, which faces the heat exchanger, has a shape corresponding to a shape of the heat exchanger.

7. The air conditioner according to claim **6**, further comprising a partition plate which forms a plurality of slits and is disposed between the heat exchanger and the housing.

8. The air conditioner according to claim **7**, wherein the plurality of slits of the partition plate are arranged in locations corresponding to the plurality of slits formed in the first air flow unit.

9. The air conditioner according to claim **2**, wherein the blower module includes a plurality of blower modules, and the plurality of blower modules are arranged at least in a row.

10. The air conditioner according to claim **9**, wherein the blower module includes a plurality of blower modules, and the plurality browser modules are arranged to be spaced at a preset distance from each other.

11. The air conditioner according to claim **10**, wherein the second air flow unit includes a left slit and a right slit which allow the air to flow into the cavity and flow out from the cavity, and are formed in a left rear and a right rear of the housing, respectively, and

the left and the right slit face a front of the housing.

12. The air conditioner according to claim **11**, wherein an air exhaust passage configured to discharge the pulse jet from the left slit and the right slit is provided between the blower modules.

13. The air conditioner according to claim **11**, wherein at least one manifold configured to communicate with adjacent blower modules are disposed between the adjacent blower modules.

14. The air conditioner according to claim **11**, wherein a plurality of manifolds configured to communicate with adjacent blower modules are disposed to be spaced from each other to a longitudinal direction between the adjacent blower modules.

15. The air conditioner according to claim **2**, wherein the blower module includes a plurality of blower modules, and the plurality of blower modules are arranged in a matrix form.

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