(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 930 663 B9

(12) CORRECTED EUROPEAN PATENT SPECIFICATION

(15) Correction information:
Corrected version no 1 (W1 B1)
Corrections, see
Description Paragraph(s) 4, 12, 13, 14

(48) Corrigendum issued on:
27.06.2018 Bulletin 2018/26

(45) Date of publication and mention of the grant of the patent:
16.08.2017 Bulletin 2017/33

(21) Application number: **07023472.9**

(22) Date of filing: **04.12.2007**

(51) Int Cl.:
F24F 1/00 *(2011.01)* ***F24F 13/20*** *(2006.01)*
F24F 11/00 *(2018.01)*

(54) Air conditioner

Klimaanlage

Climatiseur

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR

(30) Priority: **08.12.2006 JP 2006332084**

(43) Date of publication of application:
11.06.2008 Bulletin 2008/24

(73) Proprietor: **MITSUBISHI ELECTRIC CORPORATION**
Chiyoda-ku
Tokyo 100-8310 (JP)

(72) Inventors:
- **Saito, Tadashi**
Tokyo 100-8310 (JP)
- **Hirakawa, Seiji**
Tokyo 100-8310 (JP)

(74) Representative: **Pfenning, Meinig & Partner mbB**
Patent- und Rechtsanwälte
Theresienhöhe 11a
80339 München (DE)

(56) References cited:
EP-A1- 1 326 055
EP-A1- 1 632 725
GB-A- 2 360 840
JP-A- 2006 162 132
US-A1- 2002 172 588

Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to an air conditioner, and more specifically to an indoor unit.

Background Art

[0002] There is a conventional air conditioner including an indoor unit with dimensions of 360 mm in height and 150 mm in depth, wherein a cross flow fan is 86 mm in diameter, and the number of stages in an indoor heat exchanger is 14 (For example, refer to the Japanese Examined Patent Publication No. 7-30926 (second paragraph, and Fig. 1).

Description of the Related Art

[0003] These days, energy saving efforts in air conditioners whose power consumption is assumed to be the greatest among which used at home have been made at the social end to decrease global warming. Especially, a component ratio of a separated-type air conditioner used by connecting the indoor unit that is installed by hanging from the wall surface inside a room, and an outdoor unit including a compressor and the outdoor heat exchanger, etc. through a refrigerant pipe is the highest among all the air conditioners, and higher regulation value for energy saving is set for the separated-type air conditioner than the other types of category according to Energy Conservation Law (Law concerning the Rational Use of Energy).

[0004] Thus, as energy saving efforts proceed, heat exchangers or the like have grown in size and in capacity to improve air conditioning efficiency. For this reason, air conditioners have become larger in dimension and weight. Specifically, air conditioners having a configuration in which one wall-hung type indoor unit and one outdoor unit are connected through a refrigerant pipe is a mainstream of the air conditioners for household use, whose regulation value according to Energy Conservation Law (Law concerning the Rational Use of Energy) is high among air conditioners. Air conditioners with high energy-saving performance have a tendency to grow in size, and an outer dimension of the outdoor unit and a horizontal width and a vertical width of the indoor unit have a tendency to increase in size.

[0005] One of the background factors of growing sizes of both the indoor unit and the outdoor unit is that the conventional energy-saving regulation (the standard for fiscal years 2004 and 2007) has been the mean value of COP (cooling/heating average COP, COP stands for Coefficient of Performance) at points under the condition of rated heating and cooling operation. For the cooling/heating average COP, increase in size of both the indoor unit and the outdoor unit has equal energy-saving effect, so that both the indoor unit and the outdoor unit have increased in size. However, from fiscal year 2010 onward, energy-saving regulation is switched to evaluation according to an annual energy consumption efficiency (under APF standard, APF stands for Annual Performance Factor), which is further adapted to actual conditions. Therefore, reconsideration of the configuration of the indoor unit and the outdoor unit more suited to improvement in APF.

[0006] Meanwhile, housing conditions have become diversified in recent years. For example, in a Japanese-style room built according to inter-column module dimension of 3-shaku length (about 90.9 cm, where "shaku" is one of the units in the old Japanese measuring system, or Shaku-Kan system), a 3.5-sun column (a column with a dimension of about 106.75 mm, where "sun" is one of the units in Shaku-Kan system) is often used, so that a horizontal width of a space of the wall surface whereon the indoor unit for air conditioner can be installed is approximately 800 mm. Further, to meet a request for sophisticated interior in a living room for example, there is an increase in cases where windows are enlarged, and a vertical width of a space over the windows to install the indoor unit for air conditioner is approximately 295 mm, so that there is a trend of reduction in size of an installation space provided for the indoor unit for air conditioner. Further, there is a progress in growth of the size of rooms sucht that a living room and a dining room or a kitchen are combined together, and wall surfaces of rooms are reduced, so that installation areas for a wall-hung type air conditioner are reduced.

[0007] As shown above, there is an increase in need for air conditioners with large capacity (improved performance) due to growing size of rooms, and further, there is a progress in growth of the unit size as well as higher energy-saving performance and higher efficiency of air conditioners. Meanwhile, from the aspect of housing conditions, problems have been increased such that it is impossible to install the indoor unit for air conditioner due to restriction in terms of either of the horizontal width or the vertical width, or the both in the unit size.

[0008] US 2002/0172588 A1 discloses an air conditioning apparatus which provides a favorable atmosphere. It is provided with an impeller which is formed by a plurality of vanes and a ring for supporting the plurality of vanes. It includes a nozzle portion formed by a stabilizer and an air outset, a cross-flow fan formed by a guide wall and a heat exchanger. The ratio of the outside diameter of the impeller to the heat of the air conditioning apparatus is 2.2 or above and 3.0 or below.

[0009] GB 2 360 840 A discloses an air conditioner having two front panels forming a front phase of an oblong cabinet having a fan, heat exchanger and detachable air filter arranged inside the cabinet. The front panels are supported pivotably in a horizontal direction and detachably from the outside ends of the cabinet.

[0010] EP 1 326 055 A1 discloses an air conditioner with an indicator panel for indicating its operation status. The indicator panel has a half-mirror film formed on its surface so that only a pattern illuminated by a light source provided inside is made visually recognizable.

[0011] EP 1 632 725 discloses an air conditioner upon which the preamble of appending claim 1 is based.

SUMMARY OF THE INVENTION

[0012] The present invention aims to solve the above-mentioned problems, which intends to define a size of an indoor unit for air conditioner in consideration of an installation space for an air conditioner in houses in recent years, to realize a high energy-saving performance (under APF standard) with size constraints due to a shape and a structure of the indoor unit, and to lighten the burden on the environment by reducing the material usage and promoting recycling.

[0013] An air conditioner according to the present invention is described in claim 1.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] A complete appreciation of the present invention and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

Fig. 1 is a refrigerant circuit diagram of an air conditioner according to a first embodiment of the present invention;
Fig. 2 is a transverse sectional view of an indoor unit for air conditioner according to the first embodiment of the present invention;
Fig. 3 is a front view of the indoor unit for air conditioner according to the first embodiment of the present invention;
Fig. 4 is a graph showing the number of stages in an indoor heat exchanger and the total of material usage of the indoor heat exchanger and an outdoor heat exchanger under a same achievement ratio of standard values according to Energy Conservation Law in the air conditioner according to the first embodiment of the present invention;
Fig. 5 is a graph showing a diameter of a fan and air volume at a same noise level in the air conditioner according to the first embodiment of the present invention;
Fig. 6 is a transverse sectional view of an indoor unit for another air conditioner according to the first embodiment of the present invention; and
Fig. 7 is a right side view of the indoor unit for air conditioner according to the first embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Embodiment 1.

[0015] The first embodiment according to the present invention is enplained below with reference to Fig. 1 through Fig. 7. Fig. 1 is a refrigerant circuit diagram of an air conditioner according to the present invention. In the diagram, a refrigeration cycle is formed by sequentially connecting a compressor 1, a four-way valve 2, an outdoor heat exchanger 3, an expansion mechanism 4 (electronically-controlled expansion valve), and an indoor heat exchanger 5. Further, an outdoor blower 6 (propeller fan) is installed in an air flow path wherein the outdoor heat exchanger 3 is provided. An indoor blower 7 (cross flow fan) is installed in an air flow path wherein the indoor heat exchanger 5 is provided.

[0016] During a cooling operation, a compressed high temperature and pressure refrigerant blows out from the compressor 1 and flows into the outdoor heat exchanger 3 via the four-way valve 2. In the outdoor heat exchanger 3, outdoor air is heat exchanged while the outdoor air is made to pass through between fins and tubes (heat transfer tubes) in the outdoor heat exchanger 3 by the outdoor blower 6 installed in the air flow path of the outdoor heat exchanger 3, while the refrigerant is cooled to a high pressure liquid state, and the outdoor heat exchanger 3 acts as a condenser. Then, the refrigerant passes through the expansion mechanism 4 and is reduced the pressure to a low-pressure two-phase refrigerant, and then flows into the indoor heat exchanger 5. In the indoor heat exchanger 5, indoor air is made to pass through between fins and tubes (heat transfer tubes) in the indoor heat exchanger 5 by driving the indoor blower 7 in the air flow path wherein the indoor heat exchanger 5 is installed, and exchanges heat with the refrigerant. This makes air blown out into an indoor space to be cooled, while the refrigerant to receive heat from air and to evaporate to a gas state (the indoor heat exchanger 5 acts as an evaporator). Then, the refrigerant returns to the compressor 1 and circulates so that the air is conditioned in the indoor space. Further, in a case of heating operation, the four-way valve 2 is reversed, so that the refrigerant flows in an opposite direction to the above in the refrigeration cycle. The indoor heat exchanger 5 acts as a condenser and the outdoor heat exchanger 3 act as an evaporator to warm indoor air.

[0017] Fig. 2 is a transverse sectional view of the indoor unit for air conditioner according to the first embodiment of the present invention. Fig. 3 is a front view of the air conditioner according to the first embodiment of the present invention. In Fig. 2, the indoor heat exchanger 5 housed inside the indoor unit cools and warms air suctioned from a suction opening 17, which is composed of heat transfer tubes penetrating through radiation fins provided in a laminated manner at certain intervals. The indoor heat exchanger 5 composes a part of a refrigeration cycle including the compressor and the expansion valve, and a refrigerant circulating in the refrigeration cycle flows inside the heat transfer tubes and exchanges heat with air to be cooled and warmed. A cross flow fan 7 sends air to a blowout opening 18 through an air flow path 16 from a suction opening 17. A vertical airflow direction vane controls a flow direction of the air blown out from the blowout opening 18 in an up and down direction. A filter 13 captures powder dust included in the air suctioned from the suction opening 17. A filter cleaning mechanism 14 removes the powder dust which adheres to the filter 13. A drain pan 15 includes a nozzle 20, which forms an upper wall of the air flow path adjacent to the blowout opening 18, to retrieve dew condensation created at the indoor heat exchanger 5 at a time of cooling or dehumidification operation. The air flow path 16 leads from the suction opening 17 to the blowout opening 18. A blowout opening 18 releases the air suctioned from the suction opening 17 by the cross flow fan 7 into a room through the air flow path 16. A display unit 12 displays an operating status of the indoor unit. A reception unit 19 receives a remote control signal for remote control.

[0018] Further, installation interval (stage pitch) of centers of the heat transmission tubes, which constitute the indoor heat exchanger 5, in a vertical direction is 15 to 22 mm, and the indoor unit has a size of height H of 295 mm or less. Thus, in the indoor heat exchanger 5, the front side heat exchanger 5a is formed in V-shape folded at an approximately center in a dual-partitioning or integral manner, and mountable quantities (the number of the stages) of the heat transfer tubes in the front side heat exchanger 5a in a vertical direction is around 12, while mountable quantities of the heat transfer tubes in a back side heat exchanger 5b in a vertical direction is around 6. That is, the indoor heat exchanger 5 has a capacity of not less than 16 stages as a whole. Further, auxiliary heat exchangers 5c each constituted of one row placed on an upstream side of airflow in the indoor heat exchanger 5. The auxiliary heat exchangers 5c are provided on air upstream sides of each of lower sides of the back side heat exchanger 5b and the front side heat exchanger 5a.

[0019] Further, a rotational center of the cross flow fan 7 is placed on a lower side with respect to a center of the height H of the indoor unit, but located above one third of the height H from the lower end, so that a space is provided on an upper side of the inside of the indoor unit, whereon the back side heat exchanger 5b can be mounted. Moreover, by a position of the rotational center of the cross flow fan 7 and a shape and a position of the indoor heat exchanger 5, a diameter of the fan of the cross flow fan 6 can be equal to or more than 100 mm, which enables noise reduction and high efficiency.

[0020] In Fig. 2, the suction opening 17 of indoor air into the indoor unit is provided at an upper section of the indoor unit facing the upper side of the front side heat exchanger 5a and the back side heat exchanger 5b, and is covered by a grille 9 through which indoor air passes. Since the suction opening 17 is formed in a manner to occupy most of the upper section of the indoor unit, having sufficient suction area, a design surface on the front side of the indoor unit does not include a suction opening of indoor air.

[0021] Further, the filter 13 is placed at an air flow path between the panel 9 whereto the suction opening 17 is provided and the indoor heat exchanger 5, having a function to capture powder dust flows in along with air from the suction opening 17 before the powder dust enters into the indoor heat exchanger 5. The filter cleaning mechanism 14 is composed of a moving device to move the filter 13, a pressurizing unit 14c to press the filter 13 against a brush 14a, the brush 14a to collect powder dust which adheres to the filter 13, and a dust-collection box 14b to store the collected powder dust. Since the air conditioner periodically removes the powder dust adheres to the filter 13, it is possible to keep the indoor heat exchanger 5 or the cross flow fan 7, etc. provided to the inside of the air flow path in the indoor unit clean, and further to prevent powder dust from accumulating on the filter. Thus, it is possible to prevent reduction of air volume and keep efficiency at an initial period. Since antibacterial and antifungal treatment is applied to the dust-collection box 14b, it is possible to prevent propagation of bacteria and mold on the collected powder dust.

[0022] Further, since the filter cleaning mechanism 14 is located diagonally to the upper front of the front side heat exchanger 5a in V-shape with a prescribed interval, and a space is provided between the filter cleaning mechanism 14 and the front side heat exchanger 5a, air which passes through the filter 13 flows to a lower portion of the front side heat exchanger 5a without being obstructed by the filter cleaning mechanism 14. Thus, heat exchange can be performed efficiently, and a high energy-saving performance can be obtained.

[0023] Moreover, a part or whole the filter cleaning mechanism 14 is not placed between an upper end of the front side heat exchanger 5a and an upper end of the back side heat exchanger 5b, and the suction opening 17, so that the filter cleaning mechanism 14 does not affect a size of the height H of the indoor unit. Further, the indoor heat exchanger 5 can be efficiently installed inside the indoor unit 1 with a restriction on the size of the height. Thus, a high energy-saving performance can be obtained.

[0024] Further, the filter cleaning mechanism 14 is located ahead of the front side heat exchanger 5a, and a part or whole the filter cleaning mechanism 14 is not placed between an end of the indoor heat exchanger 5 in a horizontal direction and a side surface of the indoor unit, so that the filter cleaning mechanism 14 does not affect a size of the width L of the indoor unit to increase, or to be horizontally long. Further, the indoor heat exchanger 5 can be efficiently installed inside the indoor unit 1 with a restriction on the size of the width. Thus, a high energy-saving performance can be obtained.

[0025] Additionally, even when the filter cleaning mechanism 14 is not installed, it is possible to keep the inside of the indoor unit clean and further to prevent powder dust from accumulating on the filter if users clean the filter 13 periodically. Thus, efficiency at an initial period can be maintained. Further, by installing a dust-collection device to collect minute powder dust contained in room air and a deodorizing device to remove or resolve component of order in the room air, it is possible to increase the comfort in the indoor space.

[0026] Further, the grille 10 which is provided at a position facing the front side heat exchanger 5a on a front side of the indoor unit in an openable and closable manner, or a detachable manner, does not include a suction opening on the front side thereof, as shown in Fig. 3, so that it is possible to provide sophisticated interior. Since the suction opening 17 is concentrated in the upper portion of the indoor unit, it is possible to reduce the size of the filter 13, which allows for an inexpensive configuration. Further, since the height of the indoor unit is up to 295 mm in Fig. 2, and the width of the indoor unit is up to 800 mm in Fig. 3, there is also an effect that installable area on the interior wall surfaces is increased without being affected by the above-mentioned installation limitations of the housing conditions, such as the limitation of the installation space with respect to the size of the width due to use of a 3.5-sun column (a column with a dimension of about 106.75 mm, where "sun" is one of the units in the old Japanese measuring system, or Shaku-Kan system) in a Japanese-style room built according to inter-column module dimension of 3-shaku length (about 90.9 cm, where "shaku" is one of the units in Shaku-Kan system), and the size of the height due to increased size of windows.

[0027] Fig. 4 is a graph showing a relation between the number of the stages in the indoor heat exchanger and the total of material usage of the indoor heat exchanger and the outdoor heat exchanger (sum of copper and aluminum) under a same achievement ratio of standard values according to Energy Conservation Law (Law concerning the Rational Use of Energy), wherein the vertical axis shows the material usage (unit: kg), and the horizontal axis shows the number of stages in the indoor heat exchanger. It is calculated as changes in heat exchange capacity according to changes in the number of the stages in the indoor heat exchanger when assuming a unit size (width) of the indoor unit is constant. According to the standard of Energy Conservation Law (Law concerning the Rational Use of Energy) for fiscal years 2004 and 2007, which is a mean value of cooling rated COP and heating rated COP, even when the number of the stages in the indoor heat exchanger changes, the material usage stays approximately constant, as described by a solid line in Fig. 4, since it is possible to obtain the same energy-saving performance by increasing the size of the outdoor heat exchanger for a value decreased in the indoor heat exchanger although the number of the stages in the indoor heat exchanger is decreased. On the other hand, according to the standard of Energy Conservation Law (Law concerning the Rational Use of Energy) from fiscal year 2010 onward, which is APF (Annual Performance Factor, or annual energy consumption efficiency), contribution of efficiency improvement in the indoor heat exchanger to efficiency improvement of APF is large, so that it is necessary to increase the size of the outdoor heat exchanger for equal to or more than the value decreased in the indoor heat exchanger. Thus, the material usage can be reduced more by increasing the number of the stages in the indoor heat exchanger rather than increasing the size of the outdoor heat exchanger, as shown by a dotted line in Fig. 4.

[0028] Further, in an air conditioner using a refrigeration cycle, to improve cooling performance, material usage can be smaller in increasing a size of an outdoor unit rather than in increasing a size of an indoor unit. Meanwhile, to improve heating performance, the material usage can be smaller in increasing the size of the indoor unit rather than in increasing the size of the outdoor unit. In the air conditioner having such characteristics, according to Energy Conservation Law (Law concerning the Rational Use of Energy) for fiscal years 2004 and 2007, contribution ratio of cooling and heating to improvement of cooling/heating average COP stands at 1 to 1, while according to Energy Conservation Law (Law concerning the Rational Use of Energy) from fiscal year 2010 onward, the contribution ratio of cooling and heating to improvement of APF stands at 1 to 3. Thus, according to APF standard, improvement by heating is more efficient, and the material usage can be reduced more when increasing the size of the indoor unit rather than the outdoor unit. Further, the material usage can be reduced further by using alminun or alminun alloy for either one of or both of the fins and the heat transfer tubes in the heat exchanger.

[0029] Fig. 5 shows the diameter of the fan and air volume at a same noise level when the number of the stages in the indoor heat exchanger 5 is 16. The vertical axis shows air volume (unit: m^3/min) to be sent, and the horizontal axis shows a diameter (unit: mm) of a cross flow fan, with values shown in a solid line. The larger the fan diameter is, the more the size and the number of blades can be increased. Thus, it is also possible to increase the air volume, which leads to improvement of heat exchanging ability. Therefore, it is shown that APF is improved as the fan diameter is increased. In this case, as the fan diameter is increased, the air volume to be sent can be increased, which results in improvement of APF. However, if the height of the indoor unit H is limited to 295 mm or less, the distance of the smallest gap of the heat exchanger and the cross flow fan becomes small and an extraordinary noise (rotation noise) occurs, when the fan diameter becomes equal to or larger than 115 mm. Therefore, the appropriate size of the fan diameter is 110 mm to 115 mm.

[0030] For a conventional air conditioner including an indoor unit with a width maximum dimension of which is 800 mm or less, and a height maximum dimension of which is 295 mm or less, such a method is used that an air conditioner with an indoor unit larger in dimension than the above-mentioned indoor unit is applied similarity reduction to have an indoor unit with a cross-section shape of 800 mm or smaller in width and 295 mm or smaller in height, and is configured to include a cross flow fan with a diameter of 99 mm or smaller, and an indoor heat exchanger having the stages 15 or less in number so as to reduce the size of the indoor unit, and a deteriorated energy-saving performance (cooling/heating average COP standard) in the indoor unit is compensated in the outdoor unit side, so that the material usage is not increased. However, since the standard is changed to APF standard according to Energy Conservation Law (Law concerning the Rational Use of Energy) from the fiscal year 2010 onward, by configuring an indoor unit with a width maximum dimension of which is equal to or less than 800 mm, and a height maximum dimension of which is equal to or less than 295 mm to include a cross flow fan of which a diameter is 100 mm or more, and a indoor heat exchanger with stages 16 or more in number, it is possible to reduce the material usage while realizing high-efficiency, and to contribute to reduction of the burden on the environment.

[0031] Fig. 6 is a transverse sectional view of an indoor unit for another air conditioner according to the first embodiment of the present invention. The indoor heat exchanger 5 is configured to be an integrated heat exchanger whereof a front surface on an air inflow side and a back surface on an air outflow side form a continuous surface from the upper end to the lower end, so that it is possible to freely set a shape of the indoor heat exchanger 5 in accordance with a shape of an indoor air flow path. Thus, the heat exchanger can be packed in a more dense state, and downsized with high efficiency. Moreover, it is possible to further reduce the burden on the environment without the need of using extra materials for the indoor air flow path.

[0032] Further, Fig. 7 is a right side view of the air conditioner according to the first embodiment of the present invention. In recent years, due to increase in a recycle quantity of recyclable plastic and further, technology improvement in impurity removal from collected plastic, reprocessed plastic has been applied not only to a cross flow fan which users does not directly see, but also to design parts. For example, as shown in Fig. 7, further reduction of the burden on the environment is sought by using reprocessed plastic for a main body 8 whereto the indoor heat exchanger 5 and a blower device, etc. are fixed and secured, the panel 9 including a lateral face of an outer shell and a suction opening, the grille 10 as a design surface on the front side, which is provided in an openable and closable manner or a detachable manner, a design part forming an outer shell of the vertical airflow direction vane (not shown), and the cross flow fan.

[0033] In Fig. 2 and Fig. 3, the suction opening 17 is explained in a manner to be formed only at the upper surface of the indoor unit. However, it is not limited to this configuration, and the suction opening 17 can be formed only on the front side of the indoor unit. Meanwhile, in a configuration where the suction opening 17 is formed on both the upper surface and the front surface as well, the same effect can be obtained on transmitted from the server.

[0034] The air conditioner according to the present invention, including the indoor unit of the wall-hung type, the air conditioner being formed by connecting the inverter-driven compressor whose rotation rate can be controlled, the four-way valve, the indoor heat exchanger, the decompression device, and the outdoor heat exchanger, and being capable of operating the cooling cycle and the heating cycle by the switching of the four-way valve, includes

the indoor unit includes the case having the suction opening either at the upper surface or the front surface, or at the upper surface and the front surface, and the blowout opening at the lower surface, and the cross flow fan which sends the indoor air suctioned from the suction opening into the case to the blowout opening through the indoor heat exchanger,

the indoor unit has the shape of which the size is up to 800 mm in width, and up to 295 mm in height,

the diameter of the cross flow fan is not less than 100 mm but not more than 115 mm, and

the number of the stage of the indoor heat exchanger is not less than 16.

[0035] Thus, the air conditioner has an effect to realize high energy-saving performance within a size range of the indoor unit in consideration of an installation space of the air conditioner, and to reduce the burden on the environment by reducing material usage.

[0036] Having thus described several particular embodiments of the present invention, various alterations, modifications, and improvements will readily occur to those skilled in the art. Accordingly, the foregoing description is by way of example only, and is not intended to be limiting. The present invention is limited only as defined in the following claims and the equivalents thereto.

Claims

1. An air conditioner including an indoor unit of a wall-hung type, the air conditioner being formed by connecting an inverter-driven compressor (1) whose rotation rate can be controlled, a four-way valve (2), an indoor heat exchanger (5), a decompression device (4), and an outdoor heat exchanger (3), and being capable of operating a cooling cycle and a heating cycle by a switching of the four-way valve (2), wherein

   the indoor unit includes a case having a suction opening (17) only at an upper surface of the indoor unit and having a blowout opening (18) at a lower surface, wherein a design surface on a front side of the indoor unit does not include a suction opening of indoor air, and wherein the indoor unit further includes a cross flow fan (7) which sends an indoor air suctioned from the suction opening (17) into the case to the blowout opening (18) through the indoor heat exchanger (5),

characterized in that:

the indoor unit has a shape of which a size is up to 800 mm in width, and up to 295 mm in height, a diameter of the cross flow fan (7) is not less than 100 mm but not more than 115 mm, and a number of a stage of the indoor heat exchanger (5) is not less than 16.

2. The air conditioner as claimed in claim 1, wherein the indoor heat exchanger includes an auxiliary heat exchanger.

3. The air conditioner as claimed in claim 1, wherein the indoor heat exchanger is an integrated heat exchanger whereof a front surface and a back surface in an inflow direction of air form a continuous surface respectively.

4. The air conditioner as claimed in claim 1, wherein either one or both of a heat transfer tube forming the indoor heat exchanger and a heat transfer tube forming the outdoor heat exchanger are aluminum or aluminum alloy.

5. The air conditioner as claimed in claim 1, wherein a reprocessed plastic is used for a resin part in the indoor unit.

6. The air conditioner as claimed in claims 5, wherein the resin part is a design part.

7. The air conditioner as claimed in claims 5, wherein the resin part is a cross flow fan.

Patentansprüche

1. Eine Klimaeinrichtung umfassend eine Inneneinheit eines wandhängenden Typs, wobei die Klimaeinrichtung ausgebildet ist durch Verbinden eines Inverter-getriebenen Kompressors (1), dessen Rotationsrate gesteuert werden kann, eines Vier-Wege-Ventils (2), eines innenseitigen Wärmetauschers (5), eines Dekompressionsgerätes (4) und eines außenseitigen Wärmetauschers (3), und fähig ist zum Betreiben eines Kühlzyklusses und eines Heizzyklusses durch Schalten des Vier-Wege-Ventils (2),
wobei die Inneneinheit ein Gehäuse umfasst, das eine Saugöffnung (17) lediglich an einer oberen Fläche der Inneneinheit aufweist und das eine Ausblasöffnung (18) an einer unteren Fläche aufweist,
wobei eine Designfläche an einer Frontseite der Innereinheit keine Saugöffnung von innenseitiger Luft umfasst, und
wobei die Inneneinheit darüber hinaus einen Querstromlüfter (7) umfasst, der eine innenseitige Luft, die von der Saugöffnung (17) ins Gehäuse gesaugt wird, zu der Ausblasöffnung (18) durch den innenseitigen Wärmetauscher (5) sendet,
dadurch gekennzeichnet, dass
die Inneneinheit eine Form aufweist, von der eine Größe bis zu 800 mm in der Breite und bis zu 295 mm in der Höhe ist,
dass ein Durchmesser des Querstromlüfters (7) nicht weniger als 100 mm beträgt, aber nicht mehr als 115 mm beträgt, und
dass eine Stufenzahl des innenseitigen Wärmetauschers (5) nicht geringer ist als 16.

2. Die Klimaeinrichtung gemäß Anspruch 1, wobei der innenseitige Wärmetauscher einen Hilfswärmetauscher umfasst.

3. Die Klimaeinrichtung gemäß Anspruch 1,
wobei der innenseitige Wärmetauscher ein integrierter Wärmetauscher ist, wovon eine Frontfläche und eine Rückfläche in einer Einflussrichtung von Luft jeweils eine kontinuierliche Fläche ausbilden.

4. Die Klimaeinrichtung gemäß Anspruch 1,
wobei entweder eine oder beide von einer Wärmeübertragungsleitung ausbildend den innenseitigen Wärmetauscher und einer Wärmeübertragungsleitung ausbildend den außenseitigen Wärmetauscher Aluminium oder eine Aluminiumlegierung ist/sind.

5. Die Klimaeinrichtung gemäß Anspruch 1, wobei ein wiederaufbereitetes Plastik verwendet ist für ein Harzteil in der Inneneinheit.

6. Die Klimaeinrichtung gemäß Anspruch 5, wobei das Harzteil ein Designteil ist.

7. Die Klimaeinrichtung gemäß Anspruch 5, wobei das Harzteil ein Querstromlüfter ist.

Revendications

1. Climatiseur comprenant une unité intérieure de type mural, le climatiseur étant formé en raccordant un compresseur entraîné par un onduleur (1) dont la vitesse de rotation peut être contrôlée, une valve à quatre voies (2), un échangeur de chaleur intérieur (5), un dispositif de décompression (4) et un échangeur de chaleur extérieur (3), et pouvant actionner un cycle de refroidissement et un cycle de chauffage en commutant la valve à quatre voies (2), dans lequel :

l'unité intérieure comprend un boîtier ayant une

ouverture d'aspiration (17) uniquement au niveau d'une surface supérieure de l'unité intérieure et ayant une ouverture de soufflage (18) au niveau d'une surface inférieure, dans lequel une surface de conception sur un côté avant de l'unité intérieure ne comprend pas d'ouverture d'aspiration d'air intérieur, et dans lequel l'unité intérieure comprend en outre un ventilateur à écoulement transversal (7) qui envoie une air intérieur aspiré par l'ouverture d'aspiration (17) dans le boîtier à l'ouverture de soufflage (18) via l'échangeur de chaleur intérieur (5),
caractérisé en ce que :

l'unité intérieure a une forme dont la taille va jusqu'à 800 mm de largeur, et jusqu'à 295 mm de hauteur,
un diamètre du ventilateur à écoulement transversal (7) n'est pas inférieur à 100 mm, mais pas supérieur à 115 mm, et
le nombre d'étages de l'échangeur de chaleur intérieur (5) n'est pas inférieur à 16.

2. Climatiseur selon la revendication 1, dans lequel l'échangeur de chaleur intérieur comprend un échangeur de chaleur auxiliaire.

3. Climatiseur selon la revendication 1, dans lequel:

l'échangeur de chaleur intérieur est un échangeur intégré dont une surface avant et une surface arrière dans une direction d'entrée d'air forment respectivement une surface continue.

4. Climatiseur selon la revendication 1, dans lequel :

l'un ou les deux parmi un tube de transfert de chaleur formant l'échangeur de chaleur intérieur et un tube de transfert de chaleur formant l'échangeur de chaleur extérieur sont en aluminium ou en alliage d'aluminium.

5. Climatiseur selon la revendication 1, dans lequel un plastique retraité est utilisé pour une partie en résine de l'unité intérieure.

6. Climatiseur selon la revendication 5, dans lequel la partie en résine est une partie de conception.

7. Climatiseur selon la revendication 5, dans lequel la partie en résine est un ventilateur à écoulement transversal.

Fig. 1

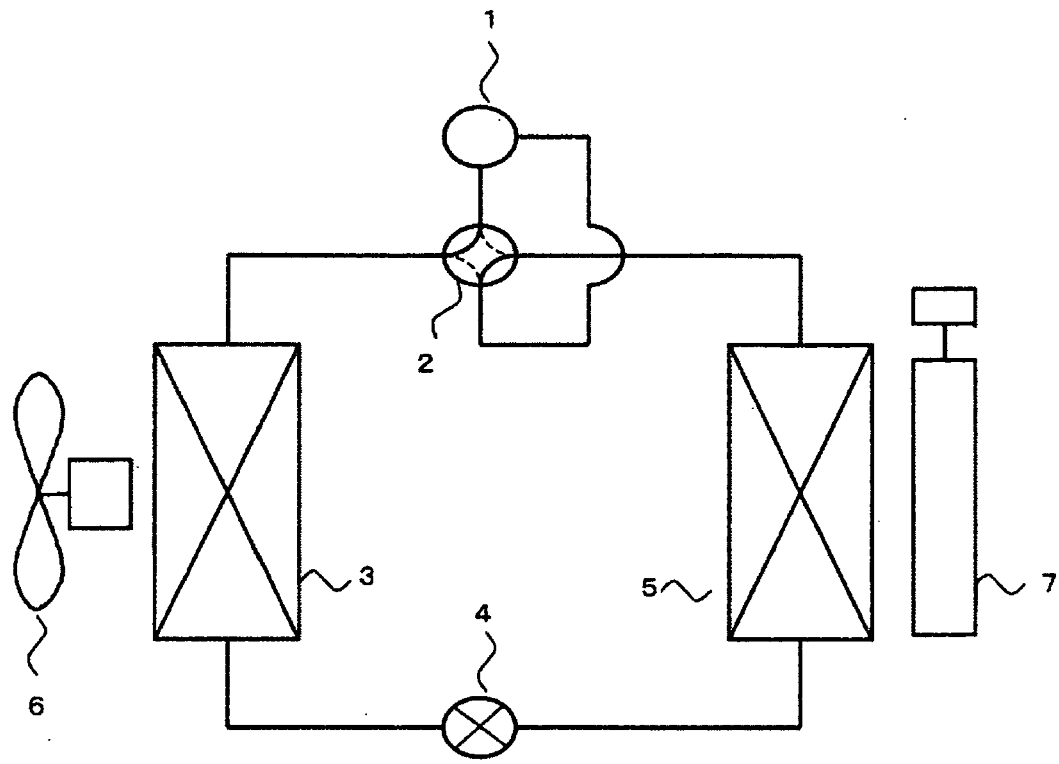


Fig. 2

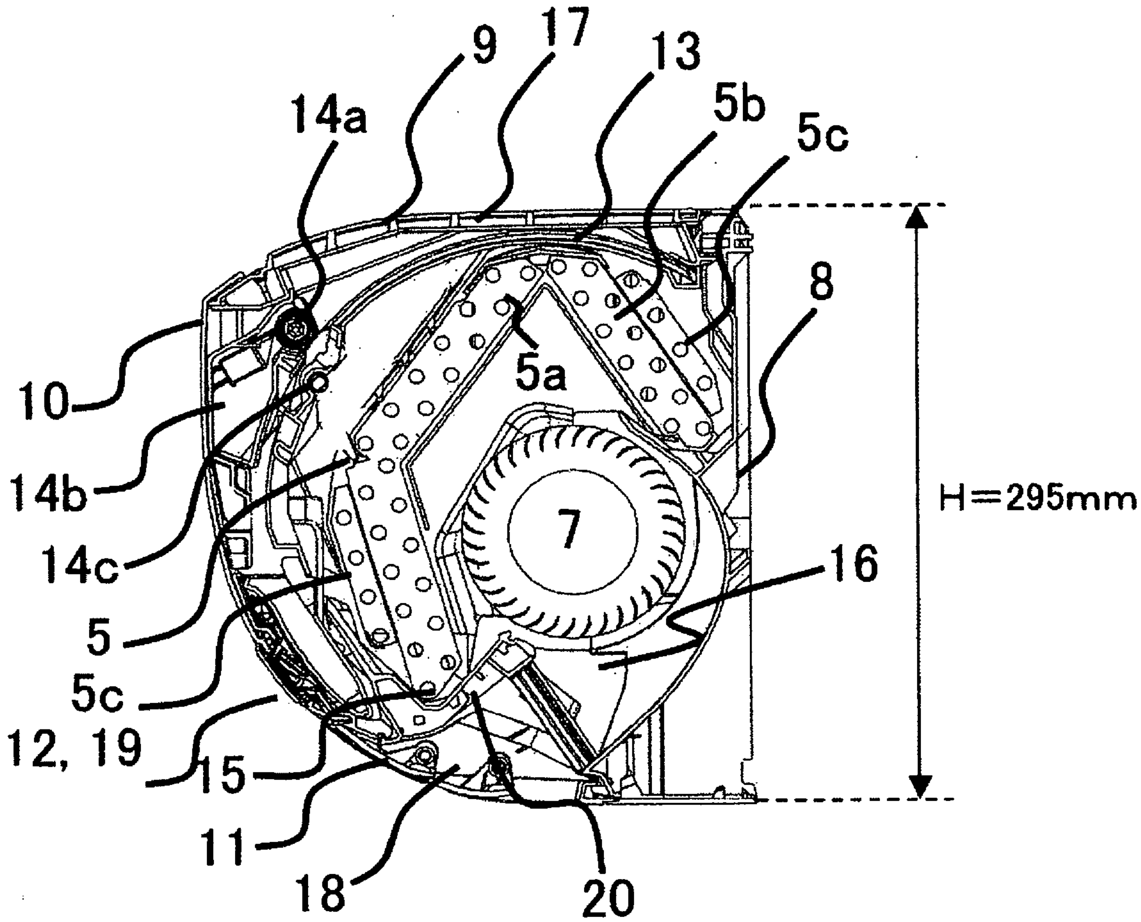


Fig. 3

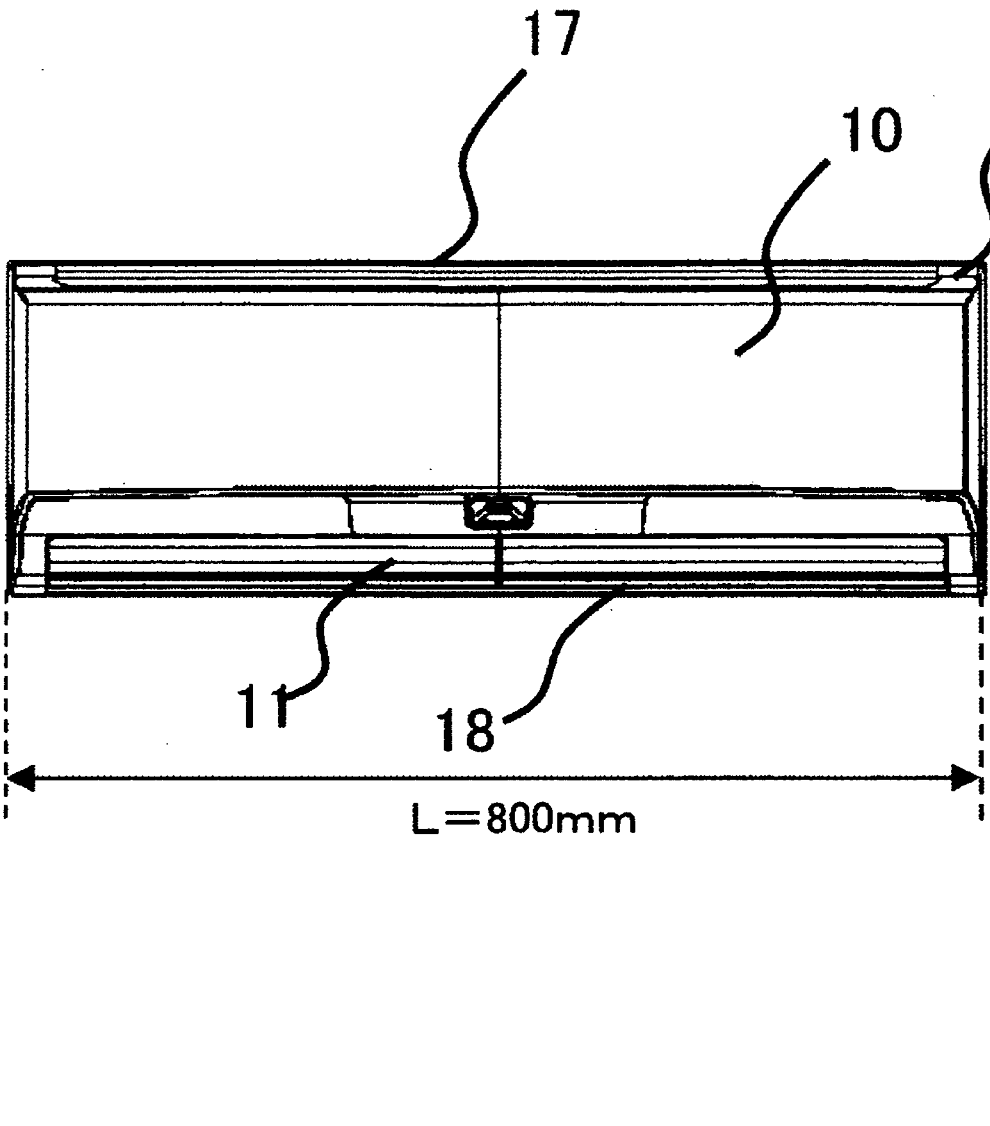


Fig. 4

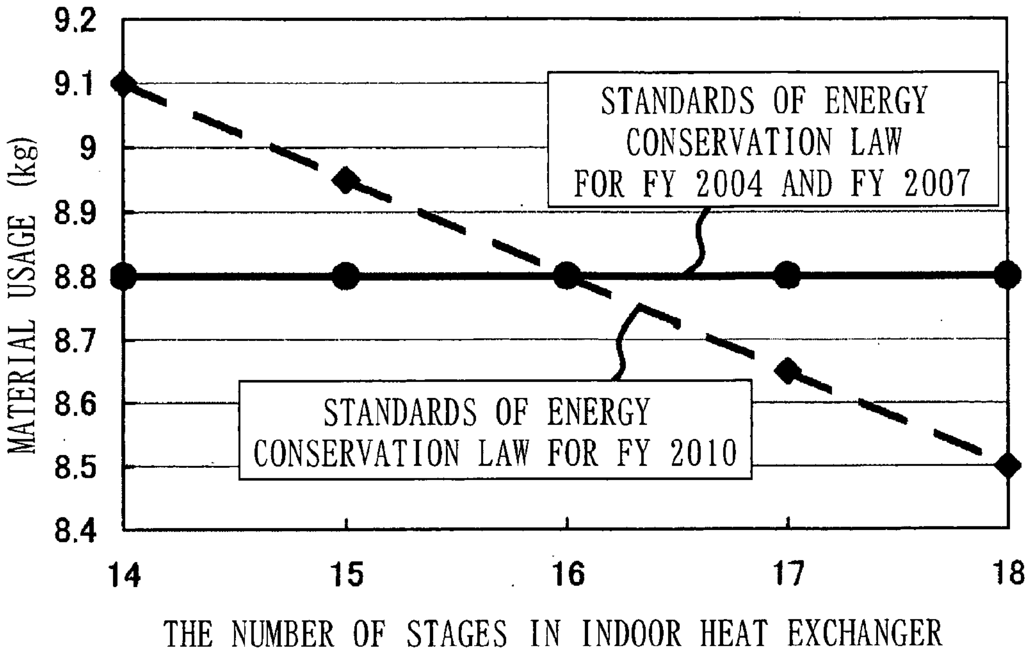

9.2
9.1
9
8.9
8.8
8.7
8.6
8.5
8.4
MATERIAL USAGE (kg)
STANDARDS OF ENERGY CONSERVATION LAW FOR FY 2004 AND FY 2007
STANDARDS OF ENERGY CONSERVATION LAW FOR FY 2010
14
15
16
17
18
THE NUMBER OF STAGES IN INDOOR HEAT EXCHANGER

Fig. 5

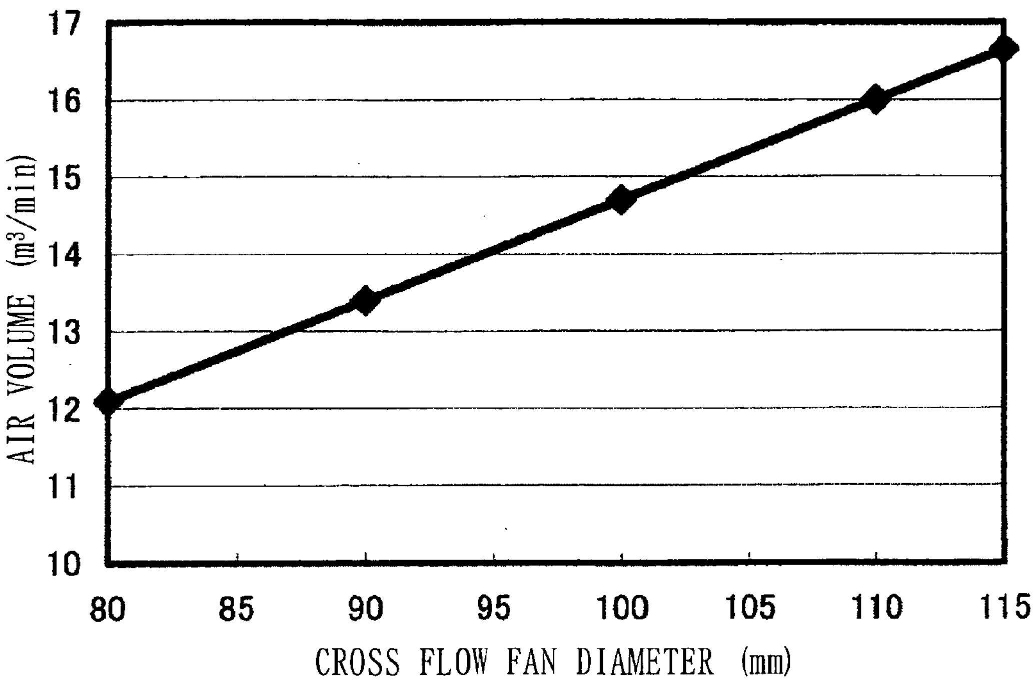

17
16
15
14
13
12
11
10
AIR VOLUME (m³/min)
80
85
90
95
100
105
110
115
CROSS FLOW FAN DIAMETER (mm)

Fig. 6

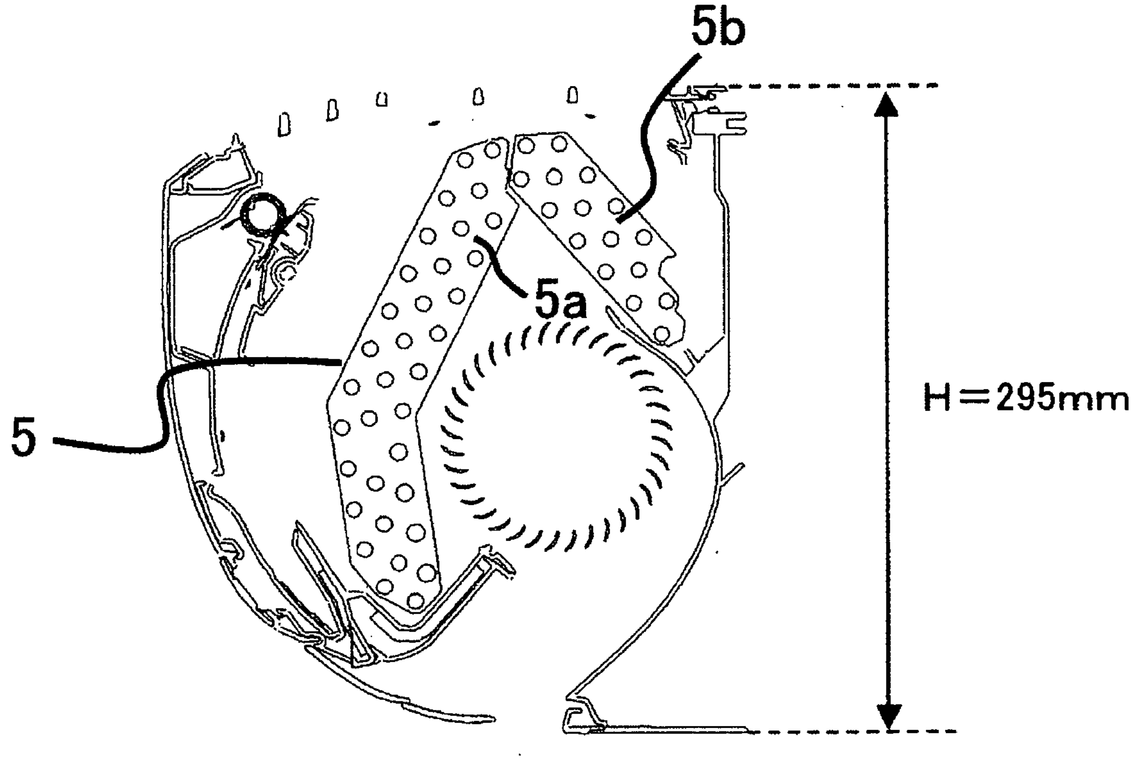
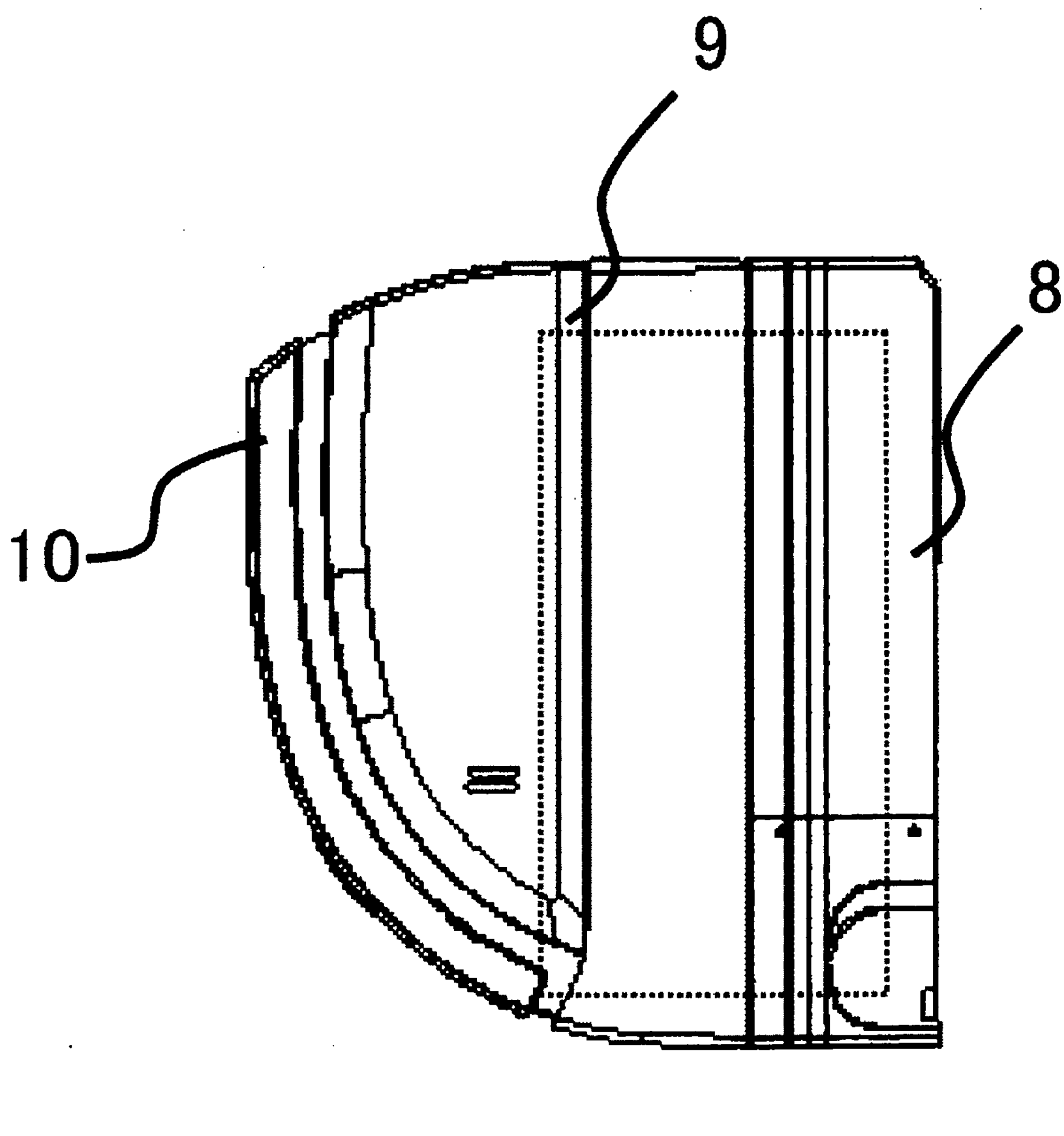


Fig. 7



REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

- JP 7030926 A **[0002]**
- US 20020172588 A1 **[0008]**
- GB 2360840 A **[0009]**
- EP 1326055 A1 **[0010]**
- EP 1632725 A **[0011]**