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

(11) **EP 1 837 608 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 158(3) EPC

(43) Date of publication:
26.09.2007 Bulletin 2007/39

(21) Application number: **05819666.8**

(22) Date of filing: **22.12.2005**

(51) Int Cl.:
F24F 5/00 *(2006.01)* ***F28F 1/32*** *(2006.01)*

(86) International application number:
PCT/JP2005/023573

(87) International publication number:
WO 2006/068210 (29.06.2006 Gazette 2006/26)

(84) Designated Contracting States:
ES FR GB IT

(30) Priority: **24.12.2004 JP 2004373762**

(71) Applicants:
- **Toshiba Carrier Corporation**
  Tokyo 105-0023 (JP)
- **Advanced Air-Conditioning Research and Development**
  Center Co., Ltd.
  Fuji-shi, Shizuoka 416-8521 (JP)

(72) Inventors:
- **SATO, Takehiko**
  Fuji Operation Center Toshiba Carrier Corporation
  Shizuoka-Ken (JP)
- **KAWAI, Nobuo**
  Adv. Air-Cond. Res. and Dev. Center co, LTD
  Shizuoka-Ken (JP)
- **TERASAKI, Akira**
  Adv. Air-Cond. Res. and Dev. Center co, LTD
  Shizuoka-Ken (JP)

(74) Representative: **Kramer - Barske - Schmidtchen**
Radeckestrasse 43
81245 München (DE)

(54) OUTDOOR UNIT FOR AIR CONDITIONER

(57) An outdoor unit for an air conditioner is provided with an outdoor unit housing accommodating a compressor, an outdoor heat exchanger, and a blower. The outdoor heat exchanger includes a plurality of rows of heat exchangers bent into L-shapes in a plan view toward the blower and disposed in an air circulating direction, and a downstream side heat exchanger on a downstream side in the air circulating direction has an obtuse bending angle.

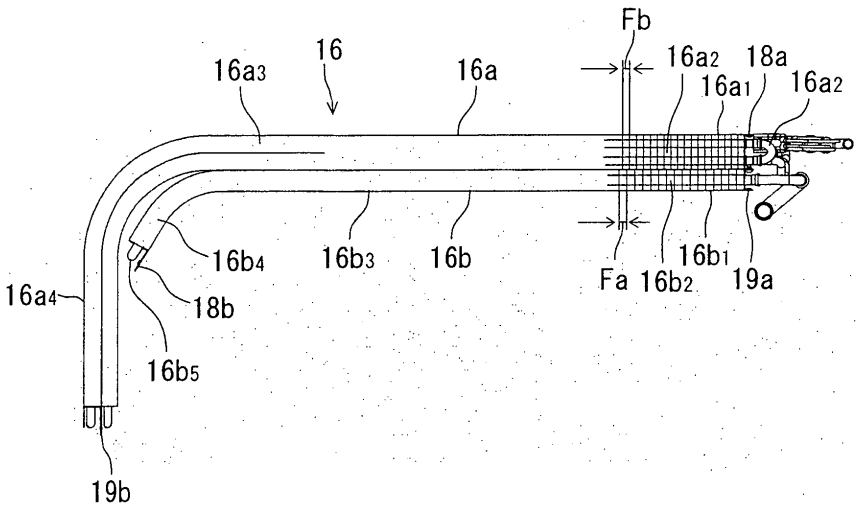

FIG. 3

EP 1 837 608 A1

Description

Technical Field

[0001] The present invention relates to an outdoor unit for an air conditioner, and particularly, to an outdoor unit for an air conditioner in which a structure of an outdoor heat exchanger is improved.

Background Art

[0002] In recent years, a space-saving outdoor unit for an air conditioner is desired in view of an installation space and installation operation with an operating performance being maintained. In order to satisfy this desire, there is provided a method of disposing a large-capacity outdoor heat exchanger and increasing a blowing rate by locating an outdoor blower fan.

[0003] For example, there is proposed a unit including a plurality of rows of heat exchangers bent in L-shapes and arranged in an air circulating direction in Patent Document 1 (Japanese Patent Application Laid-open No. 8-247499).

[0004] However, in the unit disclosed in the Patent Document 1, if the number of rows of the heat exchangers is increased so as to increase a heat exchanging capacity, a ventilating resistance increases in the downstream side heat exchanger to reduce heat exchanging efficiency. If the blower is increased in size to increase the blowing rate, a short-side portion of an L-shape of the downstream side heat exchanger comes in contact with the blower fan or becomes close to the blower fan to thereby increase noise.

Disclosure of The Invention

[0005] The present invention has been made in consideration of the above-described circumstances, and it is an object of the invention to provide a space-saving outdoor unit for an air conditioner having an increased heat exchanging capacity and performance.

[0006] To achieve the above object, according to the present invention, there is provided an outdoor unit for an air conditioner, including:

> an outdoor unit housing an inside of which is partitioned by a partition plate into two sections;
> a machine chamber provided on one side partitioned by the partition plate; and
> a heat exchange chamber provided on the other side partitioned by the partition plate,

wherein the machine chamber includes a compressor provided on a bottom plate of the outdoor unit housing, the heat exchanger chamber houses an outdoor heat exchanger and a blower, the outdoor heat exchanger includes at least two rows of heat exchangers bent into L-shapes in a plan view toward the blower and disposed so as to be overlapped in an air circulating direction, and a downstream side heat exchanger on a downstream side in the air circulating direction has an obtuse bending angle.

[0007] An interval of fins of the downstream side heat exchanger is preferably greater than an interval of fins of an upstream heat exchanger disposed on the upstream side from the downstream side heat exchanger.

[0008] An interval of refrigerant pipes of the downstream side heat exchanger is preferably different from an interval of refrigerant pipes of an upstream side heat exchanger.

[0009] An end portion of a short side of the L-shape of the downstream side heat exchanger may be positioned on the upstream side from a blower fan of the blower in a direction of a blower rotation axis.

[0010] Moreover, according to the invention, there is provided an outdoor unit for an air conditioner, including:

> an outdoor unit housing an inside of which is partitioned by a partition plate into two sections;
> a machine chamber provided on one side partitioned by the partition plate; and
> a heat exchange chamber provided on the other side partitioned by the partition plate,

wherein the machine chamber includes a compressor provided on a bottom plate of the outdoor unit housing, 'the heat exchanger chamber houses an outdoor heat exchanger and a blower, the outdoor heat exchanger includes at least two rows of heat exchangers bent into L-shapes in a plan view toward the blower and disposed so as to be overlapped in an air circulating direction, and a downstream side heat exchanger disposed on a downstream side in the air circulating direction has a length greater in a height direction than an upstream side heat exchanger disposed on the upstream side in the air circulating direction.

[0011] With the outdoor unit for the air conditioner according to the present invention, it is possible to provide the space-saving outdoor unit for the air conditioner having the increased heat exchanging capacity.

[0012] In the outdoor unit for the air conditioner of the present invention having the above structure, the bending angle of the downstream side heat exchanger is the obtuse angle (e.g., 120°). As a result, the interval of the fins is extended as compared with the case where the bending angle is 90°, and the air circulation amount increases to thereby enhance the heat exchanging efficiency. Moreover, because the end portion of the short-side portion of the L-shape of the downstream heat exchanger is positioned on the upstream side from the blower fan in the air circulating direction, it is possible to maintain a distance between the blower fan and the downstream side heat exchanger to thereby suppress noise. In addition, the radial and axial lengths of the blower fan can be elongated, and the blowing rate can be increased. Furthermore, since the downstream side heat exchanger

has a length longer than the length in the height direction of the upstream side heat exchanger, the heat exchanging capacity can be increased.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

Fig. 1 is a perspective view of an outdoor unit for an air conditioner according to the present invention.

Fig. 2 is a perspective view of the outdoor unit for the air conditioner according to the present invention in a state in which a housing is removed.

Fig. 3 is a plan view of a heat exchanger used for the outdoor unit for the air conditioner according to the present invention.

Fig. 4 is a side view of the heat exchanger used for the outdoor unit for the air conditioner according to the present invention.

Fig. 5 is a sectional view taken along a line V-V in Fig. 4.

Fig. 6 is a vertical sectional enlarged view of a part of the heat exchanger used for the outdoor unit for the air conditioner according to the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

[0014] An embodiment of an outdoor unit for an air conditioner according to the present invention will be described hereunder with reference to the accompanying drawings. In the following description, expressions indicating directions such as upper, lower, left, and right are used based on states shown in the drawings or a state of an actually installed outdoor unit.

[0015] Fig. 1 is a perspective view of an outdoor unit for an air conditioner according to the present invention and Fig. 2 is a perspective view of the same in a state in which an outdoor unit housing is removed.

[0016] As shown in Fig. 1, the outdoor unit 1 for the air conditioner of the present embodiment includes an outdoor unit housing 2. The outdoor unit housing 2 includes a bottom plate 3 having fixing legs 3a, a front plate 4 provided so as to stand up from the bottom plate 3, formed with an air outlet 4a, and having a service plate 4b which is separated and detached, a wire guard 5 connected to the front plate 4 and serving as an intake side, a machine chamber plate 6 connected to the wire guard 5, a column 7 facing the machine chamber plate 6 and provided so as to stand up from a rear side corner portion of the bottom plate 3, and a top plate 6 placed to cover an upper opening defined by the front plate 4, the wire guard 5, the machine chamber plate 6, and the column 7. The top plate 6 has a ceiling portion 6a and a fixing portion 6b formed at a peripheral end portion of the ceiling portion 6a and fixed to the front plate 4, the machine chamber plate 6, and the column 7.

[0017] As shown in Fig. 2, an inside of the outdoor unit housing 2 is partitioned by a partition plate 9 into a machine chamber 10 and a heat exchanger chamber 1 1.

[0018] In the machine chamber 10, a compressor 12, an accumulator 13, a piping connecting valve 14 at the site, refrigerant piping, an outdoor controller, not shown, for controlling the compressor 12 and a blower 15, and the like are housed while placed on the bottom plate 3.

[0019] In the heat exchanger chamber 11, the blower 15 having a blower fan 15a and a motor 15b and a heat exchanger 16 are housed while placed on the bottom plate 3.

[0020] The motor 15b of the blower 15 is fixedly mounted to a motor base 17, which has a lower portion fixed to the bottom plate 3, an upper portion having one end fixed to a rear side of the top plate 8, and the other end fixed to the front plate 4. Furthermore, the motor base 17 has a lower fixing portion 17a to be fixed to the bottom plate 3, a fan motor fixing portion 17b for fixing the fan motor 15b, and an upper fixing portion 17c shown in Fig. 6.

[0021] As shown in Figs. 3 to 6, the heat exchanger 16 includes an upstream side heat exchanger 16a formed in an L-shape in a plan view so as to surround the blower 15 and to face a rear side and one side-surface side of the outdoor unit housing 2 and a downstream side heat exchanger 16b disposed on the downstream side of the upstream side heat exchanger 16a in an air circulating direction.

[0022] In the upstream side heat exchanger 16a, two rows of refrigerant pipes (heat transfer pipes) $16a_2$ penetrate a plurality of aluminum fins $16a_1$ in the air circulating direction and in a staggered arrangement. On the rear side of the outdoor unit housing 2, an L-shape long-side portion $16a_3$ is disposed. On the one side-surface side of the outdoor unit housing 2, an L-shape short-side portion $16a_4$ is disposed. A rear side end plate 18a and a front side end plate 18b are provided to the respective end portions. The rear side end plate 18a is fixed to an end portion of the partition plate 9 on a rear side of the outdoor unit housing 2 and the front side end plate 18b is fixed to the bottom plate 3 and the front plate 4.

[0023] In the downstream side heat exchanger 16b, a row of refrigerant pipes $16b_2$ penetrate a plurality of aluminum fins $16b_1$. Similarly to the upstream side heat exchanger 16a, an L-shape long-side portion $16b_3$ is disposed on the rear side of the outdoor unit housing 2 and an L-shape short-side portion $16b_4$ is disposed on the one side-surface side. By providing the L-shape short-side portion $16b_4$ also to the downstream side heat exchanger 16b, it is possible to increase the heat exchange capacity. A rear side end plate 19a and a front side end plate 19b are provided at the end portions of the downstream side heat exchanger 16b. The rear side end plate 19a is fixed to the partition plate 9 and a lower portion of the front side end plate 19b is fixed to the bottom plate 3 through a fixture 20.

[0024] The upstream side heat exchanger 16a and the downstream side heat exchanger 16b are connected by means of the refrigerant piping and a U-shaped pipe 21

at end portions on the rear side of the outdoor unit housing 2.

[0025] A fin interval Fb of the downstream side heat exchanger 16b is greater than a fin interval Fa of the upstream side heat exchanger 16a. As a result, air can easily circulates toward the downstream side heat exchanger 16b to enhance the heat exchanging efficiency.

[0026] An interval Pb of the refrigerant pipes $16b_1$ of the downstream side heat exchanger 16b is different from an interval Pa of the refrigerant pipes $16a_1$ of the upstream side heat exchanger 16a. For example, the vertical interval Pa of the refrigerant pipes $16a_2$ and the vertical interval Pb of the refrigerant pipes $16b_2$ of the downstream side heat exchanger 16b is different from each other such as Pb>Pa in this embodiment. As a result, the upstream side pipes $16a_2$ and the downstream side pipes $16b_2$ are less overlapped in the air circulating direction to make the downstream refrigerant pipes $16b_2$ more exposed to air to thereby enhance the heat exchanging efficiency.

[0027] A bending angle α which the L-shape long-side portion $16b_3$ and the L-shape short-side portion $16b_4$ of the downstream side heat exchanger 16b is set to form an obtuse angle and preferably 120°, for example. An end portion $16b_5$ of the L-shape short-side portion $16b_4$ is provided to be positioned on the upstream side from the blower fan 15a in a direction of a blower rotation axis. Because the bending angle α is the obtuse angle, the interval of the fins at the bent portion is extended as compared with a case where the bending angle is 90°, and an air circulating amount increases to thereby enhance the heat exchanging efficiency.

[0028] Furthermore, because the end portion $16b_5$ of the L-shape short-side portion $16b_4$ of the downstream side heat exchanger 16b is provided so as to be positioned on the upstream side from the blower fan 15a in the direction of the blower rotation axis, it is possible to maintain a distance between the blower fan 15a and the downstream side heat exchanger 16b to thereby suppress noise. Moreover, it is possible to increase radial and axial lengths of the blower fan 15a so as to increase an air blowing rate.

[0029] Furthermore, a length Hb in a height direction of the downstream side heat exchanger 16b is greater than a length Ha in the height direction of the upstream side heat exchanger 16a.

[0030] The upper end portion of the upstream side heat exchanger 16a cannot be made high due to interference with a bent portion formed between the ceiling portion 6a and the fixing chip 6b of the top plate 6, screws for fixing the top plate 6, and the like. Even if the upper end portion of the upstream side heat exchanger 16a is provided to be as high as the ceiling portion 6a, the top plate fixing chip 6b is positioned near to obstruct circulation of the air, so that the heat exchanging is hardly carried out. However, since the upper end portion of the downstream side heat exchanger 16b is apart from the fixing chip 6b of top plate 6, the upper end portion can be provided so as to have a position as high as the ceiling portion 6a. Further, since the air circulation is not obstructed by the fixing portion 6b of the top plate 6, the heat exchanging can be carried out. In the present invention, because the downstream side heat exchanger 16a has a length longer than the length in the height direction of the upstream side heat exchanger 16a, a space on a back side of the top plate 6 can be effectively utilized, and the heat exchanging amount can be increased.

[0031] Furthermore, by pinching the high upper end portion of the downstream side heat exchanger 16b in a pinching portion 17d provided to the upper fixing portion 17c of the motor base 17 and fixing one side end portion 17e of the upper fixing portion 17c to the top plate 6, the long-side portion $16b_3$ of the downstream side heat exchanger 16b and the long-side portion $16a_3$ of the upstream side heat exchanger 16a come in close contact with each other. As a result of this close contact, the ventilating resistance is reduced to thereby enhance the heat exchanging efficiency.

[0032] In the outdoor unit for the air conditioner of the embodiment having the above structure, the bending angle α of the downstream side heat exchanger is the obtuse angle, and accordingly, the interval of the fins can be extended as compared with the case where the bending angle is 90°, and the circulation amount of air increases to enhance the heat exchanging efficiency. Moreover, because the end portion $17b_4$ of the L-shape short-side portion $16b_3$ is positioned on the upstream side from the blower fan 15a in the air circulating direction, it is possible to maintain a distance between the blower fan 15a and the downstream side heat exchanger 16b to suppress noise. In addition, the radial and axial lengths of the blower fan 15a can be elongated, and the blowing rate can be increased. Furthermore, since the downstream side heat exchanger 16b has the length longer than the length in the height direction of the upstream side heat exchanger 16a, the heat exchanging capacity and performance can be increased.

[0033] According the outdoor unit for the air conditioner of the present embodiment, the space-saving outdoor unit for the air conditioner having the increased heat exchanging capacity can be provided.

Claims

1. An outdoor unit for an air conditioner, comprising:

an outdoor unit housing an inside of which is partitioned by a partition plate into two sections;
a machine chamber provided on one side partitioned by the partition plate; and
a heat exchanger chamber provided on another side partitioned by the partition plate,

wherein the machine chamber includes a compressor provided on a bottom plate of the outdoor unit

housing, the heat exchanger chamber houses an outdoor heat exchanger and a blower, the outdoor heat exchanger including at least two rows of heat exchangers bent into L-shapes in a plan view toward the blower and disposed to be overlapped in an air circulating direction, and a downstream side heat exchanger on a downstream side in the air circulating direction has an obtuse bending angle.

2. The outdoor unit for an air conditioner according to claim 1, wherein an interval of fins of the downstream side heat exchanger is greater than an interval of fins of an upstream side heat exchanger disposed on the upstream side from the downstream side heat exchanger.

3. The outdoor unit for an air conditioner according to claim 1, wherein an interval of refrigerant pipes of the downstream side heat exchanger is different from an interval of refrigerant pipes of an upstream side heat exchanger.

4. The outdoor unit for an air conditioner according to claim 1, wherein an end portion of a short side of the L-shape of the downstream side heat exchanger is positioned on the upstream side from a blower fan of the blower in a direction of a blower rotation axis.

5. The outdoor unit for an air conditioner according to claim 1, the downstream side heat exchanger on the downstream side in the air circulating direction has an obtuse bending angle of about 120°.

6. An outdoor unit for an air conditioner, comprising:

an outdoor unit housing an inside of which is partitioned by a partition plate into two sections;
a machine chamber provided on one side partitioned by the partition plate; and
a heat exchange chamber provided on the other side partitioned by the partition plate,

wherein the machine chamber includes a compressor provided on a bottom plate of the outdoor unit housing, the heat exchanger chamber houses an outdoor heat exchanger and a blower, the outdoor heat exchanger including at least two rows of heat exchangers bent into L-shapes in a plan view toward the blower and disposed to be overlapped in an air circulating direction, and a downstream side heat exchanger disposed on a downstream side in the air circulating direction has a length greater in a height direction than an upstream side heat exchanger disposed on the upstream side in the air circulating direction.

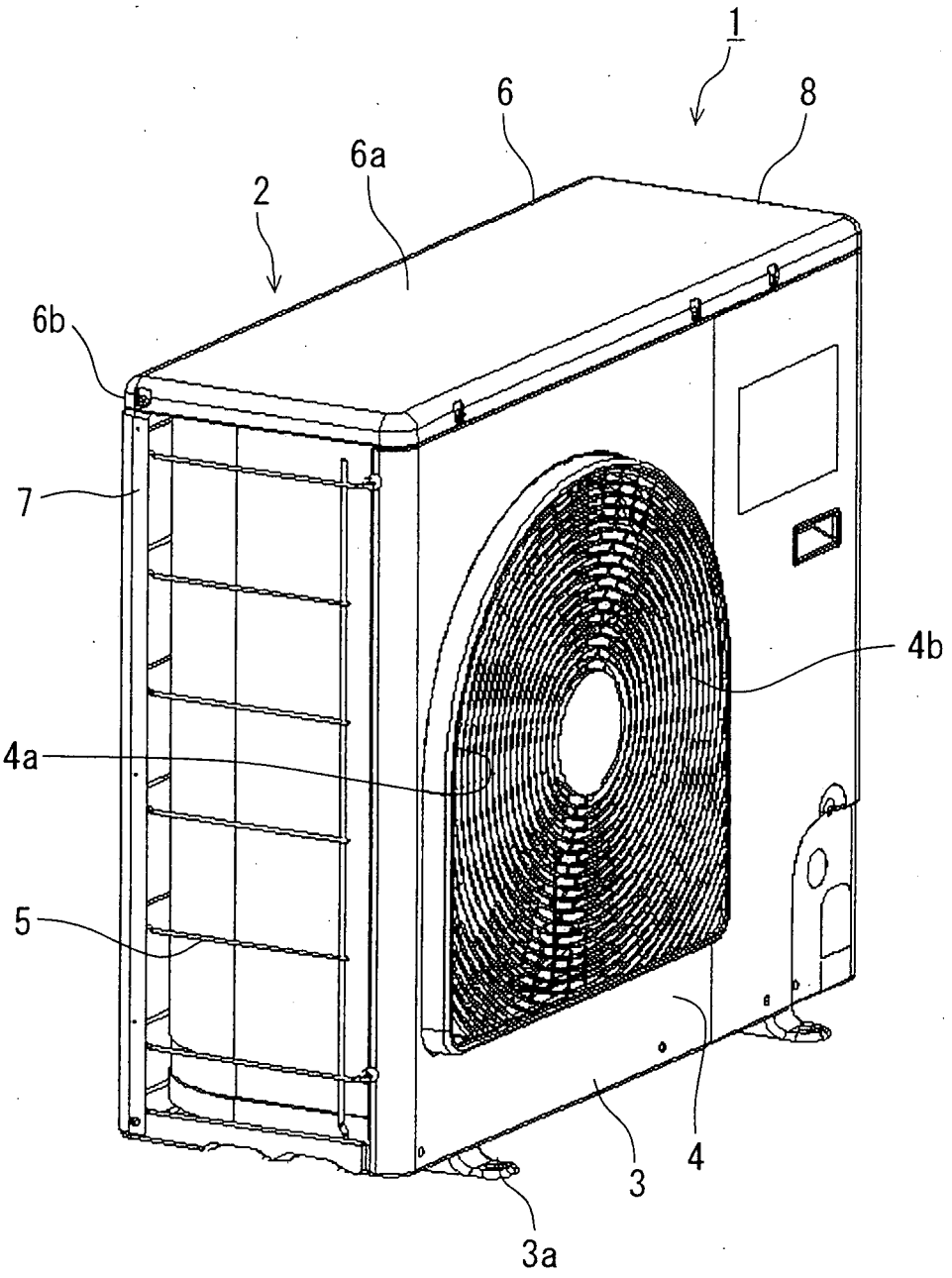

FIG. 1

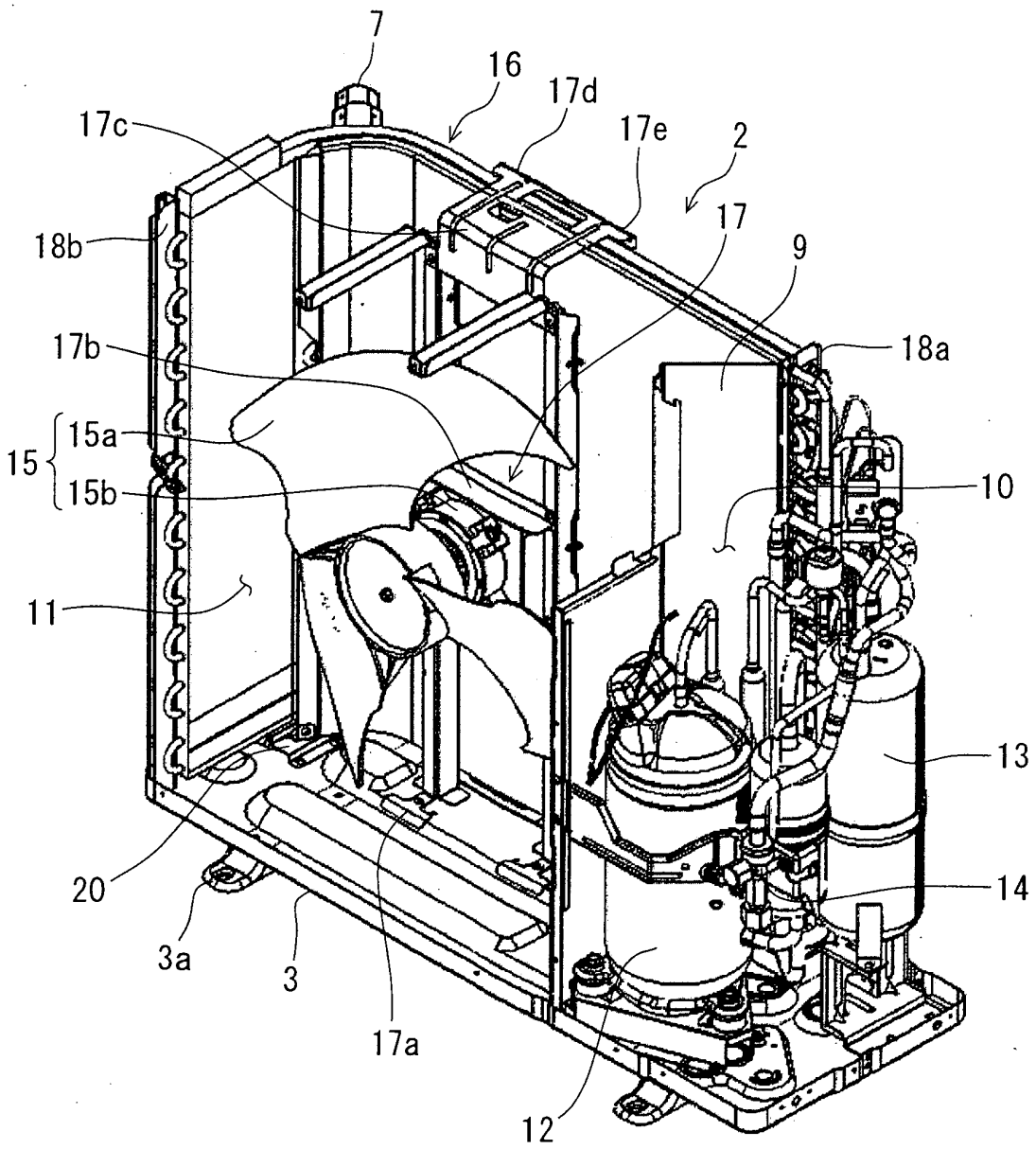
7
16
17d
17c
17e
2
17
18b
9
17b
18a
15
15a
15b
10
11
13
20
14
3a
3
17a
12

FIG. 2

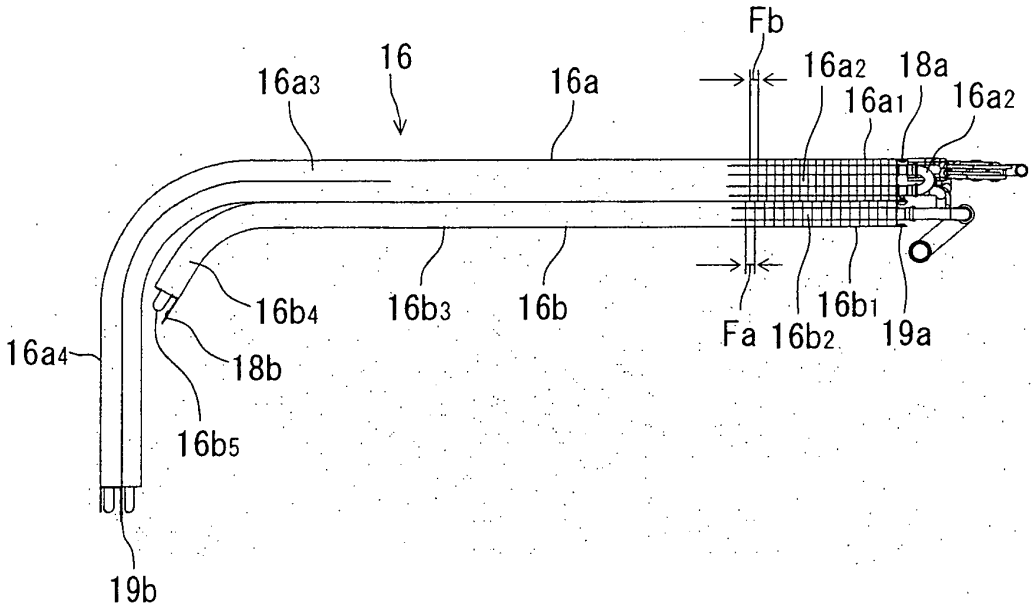
Fb
16
16a3
16a
16a2
18a
16a1
16a2
16b4
16b3
16b
16b1
Fa
16b2
19a
16a4
18b
16b5
19b

FIG. 3

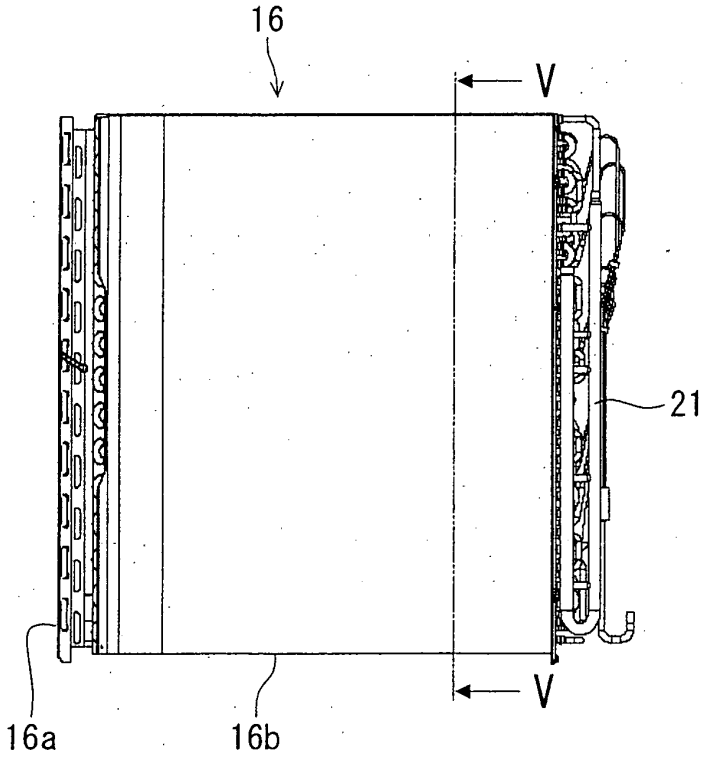
16
V
21
V
16a
16b

FIG. 4

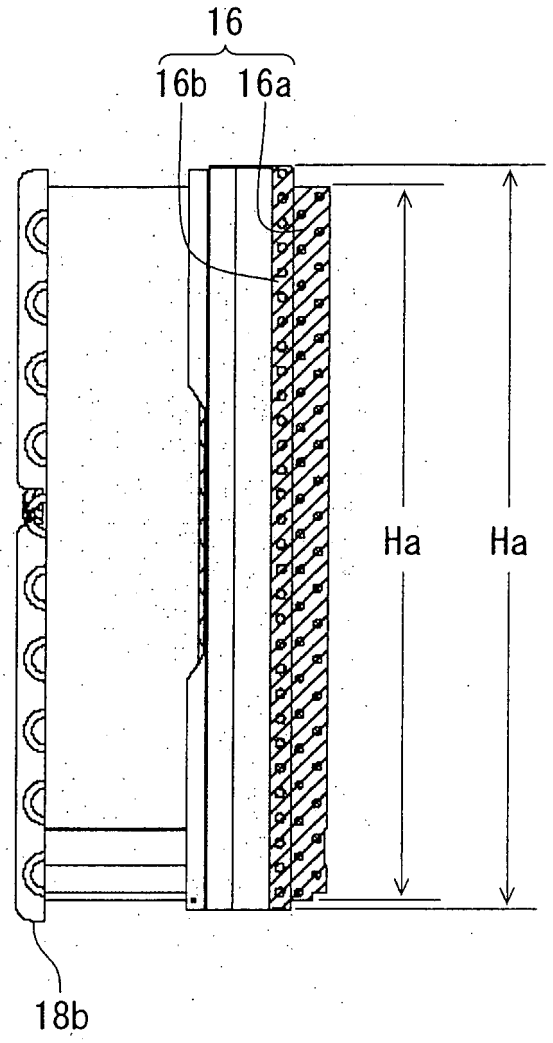

FIG. 5

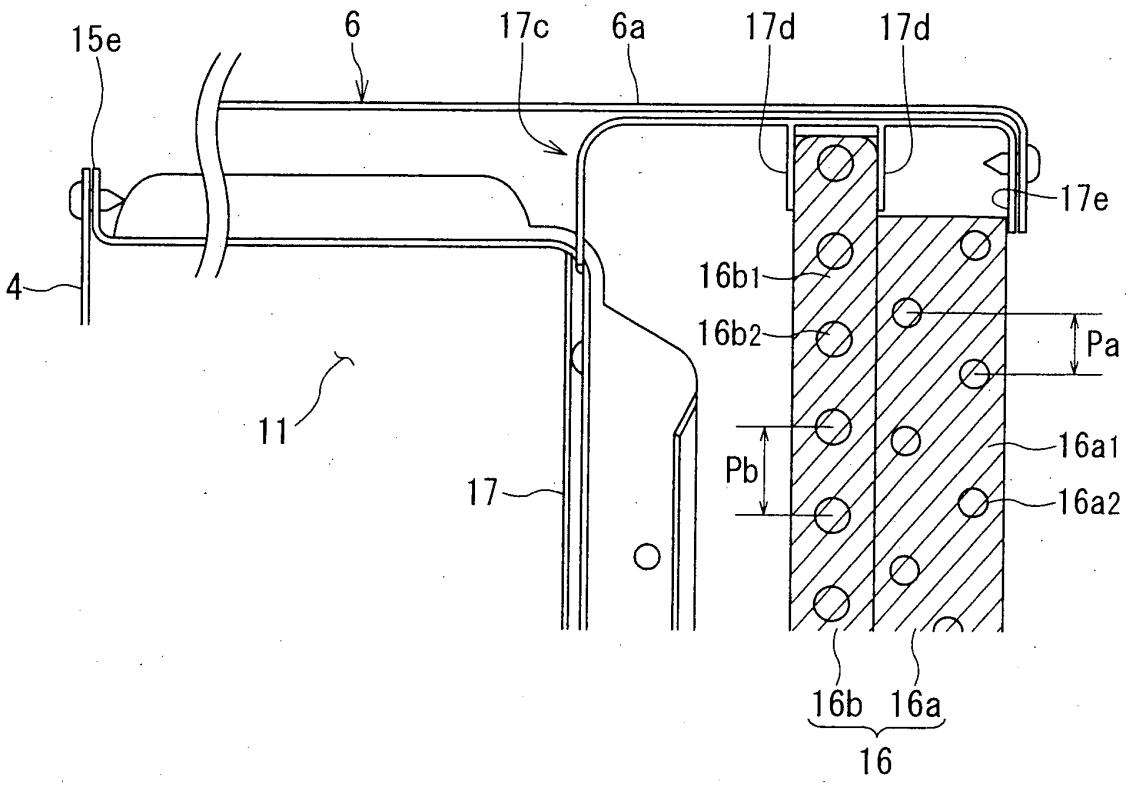
15e
6
17c
6a
17d
17d
17e
4
16b1
16b2
Pa
11
17
Pb
16a1
16a2
16b
16a
16

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2005/023573

A. CLASSIFICATION OF SUBJECT MATTER
F24F5/00(2006.01), ***F28F1/32***(2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F24F5/00(2006.01), ***F28F1/32***(2006.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2006
Kokai Jitsuyo Shinan Koho 1971-2006 Toroku Jitsuyo Shinan Koho 1994-2006

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 8-270985 A (Toshiba Corp.), 18 October, 1996 (18.10.96), Par. Nos. [0013], [0060], [0068], [0070]; Figs. 4, 6, 8, 9 & GB 2299656 A & CN 1149117 A & KR 189000 B	1-5
Y	JP 8-29085 A (Hitachi, Ltd.), 02 February, 1996 (02.02.96), Par. Nos. [0012] to [0014]; Figs. 1, 2 (Family: none)	1-5
Y	JP 11-30494 A (Hitachi, Ltd.), 02 February, 1999 (02.02.99), Par. No. [0016]; Fig. 3 (Family: none)	2

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
03 March, 2006 (03.03.06)	14 March, 2006 (14.03.06)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2005/023573

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 7-27370 A (Mitsubishi Heavy Industries, Ltd.), 27 January, 1995 (27.01.95), Par. No. [0005]; Fig. 2 (Family: none)	6

Form PCT/ISA/210 (continuation of second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2005/023573

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

The invention of claims 1-5 relates to the bending shape of a heat exchanger.
The invention of claim 6 relates to the length in the height direction of a heat exchanger.
They are not one invention nor a group of inventions that are related so as to form a single general inventive concept.

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

the

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, payment of a protest fee..

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (2)) (April 2005)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 8247499 A **[0003]**