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(54) ELECTRIC COMPRESSOR

(57) The present invention provides an electric compressor having a configuration whereby bearings can be press fitted without damaging an inverter circuit substrate and without increasing the thickness of a wall part after the inverter circuit substrate has been mounted on the wall part of an inverter housing chamber.

This electric compressor is equipped with a compression mechanism, an electric motor that drives the compression mechanism, and an inverter circuit for the purpose of driving the electric motor, and has a housing that defines a compression mechanism housing part which houses the compression mechanism, an electric motor housing part which houses the electric motor, and an inverter circuit housing part which houses the inverter circuit. Bearings which support the rotary shaft of the electric motor in a rotatable manner on the electric motor housing part-side are press-fitted between the electric motor housing part and the inverter circuit housing part, and a wall part, provided with an inverter circuit substrate to which an inverter circuit is wired, is provided on the inverter circuit housing part-side. In addition, the inverter circuit housing part is blocked off by a cover member, and at least one pillar is provided between the aforementioned wall part and the cover member.

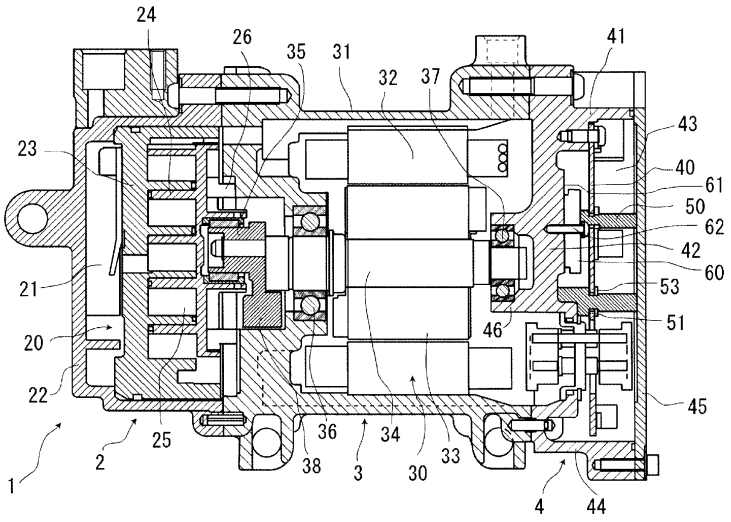

Fig. 1

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Description

[Technical Field]

[0001] The present invention relates to an electric compressor where a compression part and an electric motor which constitutes a drive part are integrally formed.

[Background Art]

[0002] JP-A-2002-174178 discloses an electric compressor for compressing a refrigerant where a compression part and a motor are integrally formed, wherein a motor drive circuit is mounted on an outer surface of a surrounding wall of a refrigerant gas suction passage, and heat radiation fins are mounted on an inner surface of a motor drive circuit mounting portion of the surrounding wall of the refrigerant gas suction passage. The motor drive circuit is configured to be cooled by a refrigerant gas which flows through the surrounding wall of the refrigerant gas suction passage and the heat radiation fins.

[0003] An electric compressor disclosed in JP-A-2008-184947 is configured such that the electric compressor includes a motor chamber arranged in a suction pressure region, the motor chamber and an inverter housing chamber are arranged adjacent to each other with a first housing sandwiched therebetween, a cooling hole which extends toward the inverter housing chamber from the motor chamber is formed in the first housing, the cooling hole is a through hole which penetrates the first housing, and a refrigerant in the motor chamber flows into the cooling hole and comes into contact with a heat transfer plate thus directly cooling the heat transfer plate whereby an electronic part cooling effect can be enhanced.

[0004] An electric compressor disclosed in JP-A-2010-59809 is configured such that the electric compressor includes a motor housing, an inverter housing is joined to a bottom portion of the motor housing which forms a rear-side end portion of the motor housing, an inverter housing chamber is defined in the inside of the inverter housing, and an inverter is housed in the inverter housing chamber in a state where the inverter is fixed to a bottom portion of the inverter housing chamber.

[Citation List]

[Patent Literature]

[0005]

Patent literature 1: JP-A-2002-174178
Patent literature 2: JP-A-2008-184947
Patent literature 3: JP-A-2010-59809

[Summary of Invention]

[Technical Problem]

[0006] As can be understood from the above-mentioned patent JP-A-2002-174178, JP-A-2008-184947 and JP-A-2010-59809, in the conventional electric compressor, a board on which the inverter circuit is wired (inverter circuit board) is arranged and fixed in the inverter housing chamber which is defined in a partitioned manner from a space where the electric motor is housed by a wall portion. Electronic parts such as switching elements mounted in the inverter circuit generate a large amount of heat and hence, for the purpose of enhancing a cooling effect by improving thermal conductivity of the electronic parts, the switching elements and the like are arranged in a state where the switching elements and the like are brought into close contact with the wall portion in general. Further, with respect to the electric compressors disclosed in JP-A-2002-174178, JP-A-2008-184947 and JP-A-2010-59809, a bearing which rotatably supports a rotary shaft of the electric motor is press-fitted into a motor-side wall portion of the inverter housing chamber.

[0007] In the conventional electric compressor, when the bearing is press-fitted into the wall portion of the inverter housing chamber after the inverter circuit board is fixed to the wall portion of the inverter housing chamber, a press-fit load generated at the time of press fitting cannot be supported by a portion of a wall portion of the inverter housing chamber positioned behind a press-fitting portion of the bearing (a center portion of a wall portion of the inverter housing chamber) and hence, there is a fear that the wall portion of the inverter housing chamber is largely deformed. When the wall portion is deformed, there is a possibility that a drawback arises in that a close contact state between an element which requires heat radiation and the wall portion is deteriorated so that an element cooling effect is lowered or a drawback that an element is broken. To prevent the occurrence of such a drawback, it is necessary to press-fit the bearing before the inverter circuit board (the element which requires heat radiation) is mounted or it is necessary to increase a thickness of the wall portion of the inverter housing chamber.

[0008] Further, when the inverter circuit board is mounted after the bearing is press-fitted into the wall portion of the inverter housing chamber, there arises a risk that the bearing is exposed to dust, moisture or oil at the time of shifting step from one step to another step such as the transfer of the inverter circuit board.

[0009] Accordingly, it is an object of the present invention to provide an electric compressor having the structure which enables press-fitting of a bearing into a wall portion of an inverter housing chamber after an inverter circuit board is mounted on the wall portion of the inverter housing chamber while preventing an effect of cooling switching elements and the like mounted on an inverter

circuit from lowering or the switching elements and the like from breaking, and also preventing the increase of a thickness of the wall portion.

[Solution to Problem]

[0010] Accordingly, the present invention provides an electric compressor which includes: a compression mechanism; an electric motor for driving the compression mechanism; an inverter circuit for driving the electric motor; and a housing in which a compression mechanism housing portion for housing the compression mechanism, an electric motor housing portion for housing the electric motor, and an inverter circuit housing portion for housing the inverter circuit are defined, wherein a wall portion is provided between the electric motor housing portion and the inverter circuit housing portion, a bearing which rotatably and pivotally supports a rotary shaft of the electric motor is press-fitted into the wall portion on an electric motor housing portion side of the wall portion, an inverter circuit board on which the inverter circuit is wired is provided on an inverter circuit housing portion side of the wall portion, and the inverter circuit housing portion is closed by a lid member, wherein the improvement is characterized in that at least one pillar is provided between the wall portion and the lid member.

[0011] Due to such a constitution, a load applied to the wall portion at the time of press-fitting the bearing can be received by the pillar and hence, even when the bearing is press-fitted into the wall portion after the inverter circuit board is mounted on the wall portion, a load (press-fitting force) applied to the inverter circuit board can be received by the lid member by way of the pillar whereby it is possible to prevent an inverter circuit cooling effect from lowering and the switching element or the like mounted on the inverter circuit board from breaking.

[0012] It is desirable that the inverter circuit board is mounted on the wall portion by way of the pillar. To realize such a constitution, a seat for holding the inverter circuit board is formed on the pillar, and the inverter circuit board is fixed to the seat.

[0013] The pillar is integrally formed with the wall portion and extends from the wall portion, and a distal end of the pillar is brought into contact with the lid member.

[Advantageous Effects of Invention]

[0014] According to the present invention, the inverter circuit board is fixed to the wall portion between the inverter circuit housing portion and the electric motor housing portion by way of the pillar and hence, a load generated at the time of press-fitting the bearing can be supported by the wall portion and the lid member whereby a bearing press-fitting operation can be performed after mounting the inverter circuit board. Accordingly, the present invention can acquire an advantageous effect that a risk that the bearing is exposed to dust, moisture or oil after mounting the bearing is small. Further, a press-fitting force is not transmitted to an electric element such as a switching element which requires heat radiation at the time of press-fitting the bearing and hence, the present invention can acquire an advantageous effect that a risk that an inverter circuit cooling effect is lowered due to the deterioration of a close contact state between the wall portion and the electric element or the electric element is broken is small. Still further, a press-fitting force generated at the time of press-fitting the bearing is supported by the pillar and hence, it is unnecessary to increase a thickness of the wall portion whereby the present invention can acquire an advantageous effect that a heat radiation effect at the wall portion can be increased. Still further, the inverter circuit board is held at and fixed to the seat formed on the pillar and hence, the present invention can acquire an advantageous effect that the structure for fixing the inverter circuit board can be simplified.

[Brief Description of Drawings]

[0015]

- Fig. 1 is a schematic constitutional view of an electric compressor according to an embodiment of the present invention;
- Fig. 2 is an explanatory view showing an inverter circuit housing portion of the electric compressor according to the embodiment of the present invention;
- Fig. 3 is a schematic constitutional view for explaining the structure of the present invention.

[Description of Embodiments]

[0016] Hereinafter, an embodiment of the present invention is explained in conjunction with drawings.

[Embodiment]

[0017] As shown in Fig. 1, an electric compressor 1 according to the embodiment of the present invention constitutes a part of a refrigerating cycle not shown in the drawing, for example. The electric compressor 1 is provided for compressing a refrigerant and for circulating the refrigerant in the refrigerating cycle. The electric compressor 1 is constituted of a compression mechanism housing portion 2 in which a compression mechanism 20 is housed, an electric motor housing portion 3 in which an electric motor 30 for driving the compression mechanism 20 is housed, and an inverter circuit housing portion 4 in which an inverter circuit board 40 where an inverter circuit for driving the electric motor 30 is wired is housed.

[0018] The compression mechanism housing portion 2 includes a compression mechanism housing block 22 which houses the compression mechanism 20 therein and defines a discharge space 21 therein. In this embodiment, the compression mechanism 20 is a scroll-type compression mechanism which is constituted of a fixed

scroll member 23 which is fixed to the compression mechanism housing block 22 by fitting, and a swing scroll member 24 which is meshed with the fixed scroll member 23 thus defining a compression space 25. However, the compression mechanism 20 is not particularly limited to a scroll-type compression mechanism.

[0019] The electric motor housing portion 3 includes an electric motor housing block 31 which is joined and fixed to the compression mechanism housing block 22 using bolts or the like and houses the electric motor 30 therein. In this embodiment, the electric motor 30 is constituted of a plurality of stators 32 which are fixed to the electric motor housing block 31 and around which coils connected to the inverter circuit wired on the inverter circuit board 40 are wound, and a plurality of magnet-made rotors 33 which are fixed to a rotary shaft 34 and are arranged to face the stators 32 in an opposed manner. Due to such a constitution, the rotor 33 is rotated by a rotating magnetic field generated by the stators 32 with the supply of electric power outputted from the inverter circuit so that the rotary shaft 34 is rotated.

[0020] The rotary shaft 34 is rotatably and pivotally supported by bearings 36, 37. An eccentric shaft 35 is provided to one end of the rotary shaft 34 in an eccentric manner. The swing scroll member 24 is swung due to the cooperative operation of the revolution of the eccentric shaft 35 brought about by the rotation of the rotary shaft 34 and an Oldham's mechanism 26 so that a volume of a compression space 25 is gradually decreased from the outer peripheral direction to the center direction thus compressing a sucked refrigerant. Further, a balance weight 38 for taking a rotary balance of the eccentric shaft 35 is formed on the eccentric shaft 35.

[0021] As shown in Fig. 1 and Fig. 2, the inverter circuit housing portion 4 is constituted of an inverter circuit housing block 41 which is connected and fixed to the electric motor housing portion 3. The inverter circuit housing block 41 is constituted of a wall portion 42 which is positioned between the inverter circuit housing portion 4 and the electric motor housing portion 3, and a peripheral wall portion 44 which defines a housing space 43 in which the inverter circuit board 40 is housed. An end surface of the housing space 43 in the axial direction is closed by a lid member 45. Further, a bearing support portion 46 in which the bearing 37 is press-fitted is formed on the wall portion 42 in an extending manner.

[0022] A drive circuit module 60 which is constituted by forming switching elements of the inverter circuit into a module is arranged on a wall portion 42 side of the inverter circuit board 40. Elements which generate a large amount of heat are integrated on the drive circuit module 60. Accordingly, the drive circuit module 60 is brought into close contact with a flat mounting surface 61 formed on the wall portion 42 by way of a heat conductive material such as silicon grease, is fixed to the mounting surface 61 of the wall portion 42 by bolts 62 so as to hold such a state, and is cooled by a sucked refrigerant which flows in the inside of the electric motor housing block 31 through the wall portion 42.

[0023] According to the present invention, in the electric compressor 1 having the above-mentioned constitution, at least one pillar (three pillars in this embodiment) 50 are integrally formed with the wall portion 42 in a state where the pillars 50 extend toward the above-mentioned lid member 45 side from the wall portion 42 of the inverter circuit housing block 41. As shown in Fig. 3, the pillars 50 extend from the wall portion 42, and a seat 51 for holding the inverter circuit board 40 at predetermined position is formed on the pillar 50. The inverter circuit board 40 is mounted on the seats 51, and is fixed by washers 53. The pillars 50 penetrate the inverter circuit board 40 and extend toward the lid member 45, and end portions 52 of the pillars 50 are brought into contact with the lid member 45.

[0024] Due to such a constitution, at the time of press-fitting the bearing 37 into the bearing support portion 46, a load applied to the wall portion 42 is supported by the lid member 45 by way of the pillars 50 and hence, it is possible to eliminate a possibility that an effect of cooling electronic parts arranged on the inverter circuit board 40, particularly electric elements such as switching elements which require heat radiation is lowered or a possibility that the electronic part is broken. Accordingly, a press-fitting operation of the bearing 37 can be performed after the inverter circuit board 40 is arranged on the inverter circuit housing portion 4 before press-fitting the bearing.

[0025] Further, by adopting the structure where the seat is formed on the respective pillars 50 and the inverter circuit board 40 is held and fixed by the washers, the fixing structure of the inverter circuit board can be simplified.

[Reference Signs List]

[0026]

1:	electric compressor
2:	compression mechanism housing portion
3:	electric motor housing portion
4:	inverter circuit housing portion
20:	compression mechanism
21:	discharge space
22:	compression mechanism housing block
23:	fixed scroll member
24:	swing scroll member
25:	compression space

26: Oldham's mechanism

30: electric motor

31: electric motor housing block

32: stator

33: rotor

34: rotary shaft

35: eccentric shaft

36, 37: bearing

38: balance weight

40: inverter circuit board

41: inverter circuit housing block

42: wall portion

43: housing space

44: peripheral wall portion

45: lid member

46: bearing support portion

50: pillar

51: seat

52: end portion

53: washer

Claims

1. Electric compressor comprising:

- a compression mechanism;
an electric motor for driving the compression mechanism;
an inverter circuit for driving the electric motor; and
a housing in which a compression mechanism housing portion for housing the compression mechanism, an electric motor housing portion for housing the electric motor, and an inverter circuit housing portion for housing the inverter circuit are defined,
wherein a wall portion is provided between the electric motor housing portion and the inverter circuit housing portion, a bearing which rotatably and pivotally supports a rotary shaft of the electric motor is press-fitted into the wall portion on an electric motor housing portion side of the wall portion, an inverter circuit board on which the inverter circuit is wired is provided on an inverter circuit housing portion side of the wall portion, and the inverter circuit housing portion is closed by a lid member, **characterized in that**
at least one pillar is provided between the wall portion and the lid member.

2. Electric compressor according to claim 1, wherein the pillar has a seat for holding the inverter circuit board, and the inverter circuit board is fixed to and held at the seat.

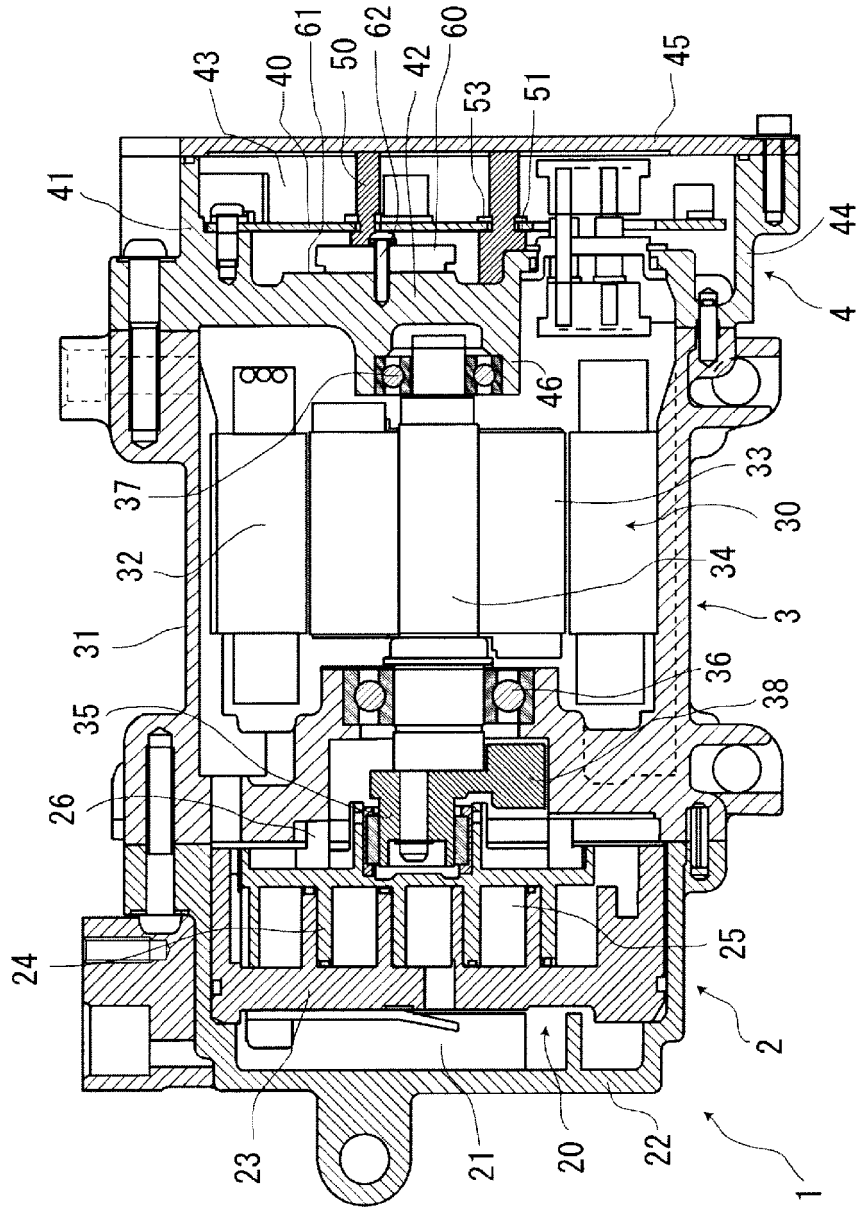
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Fig. 1

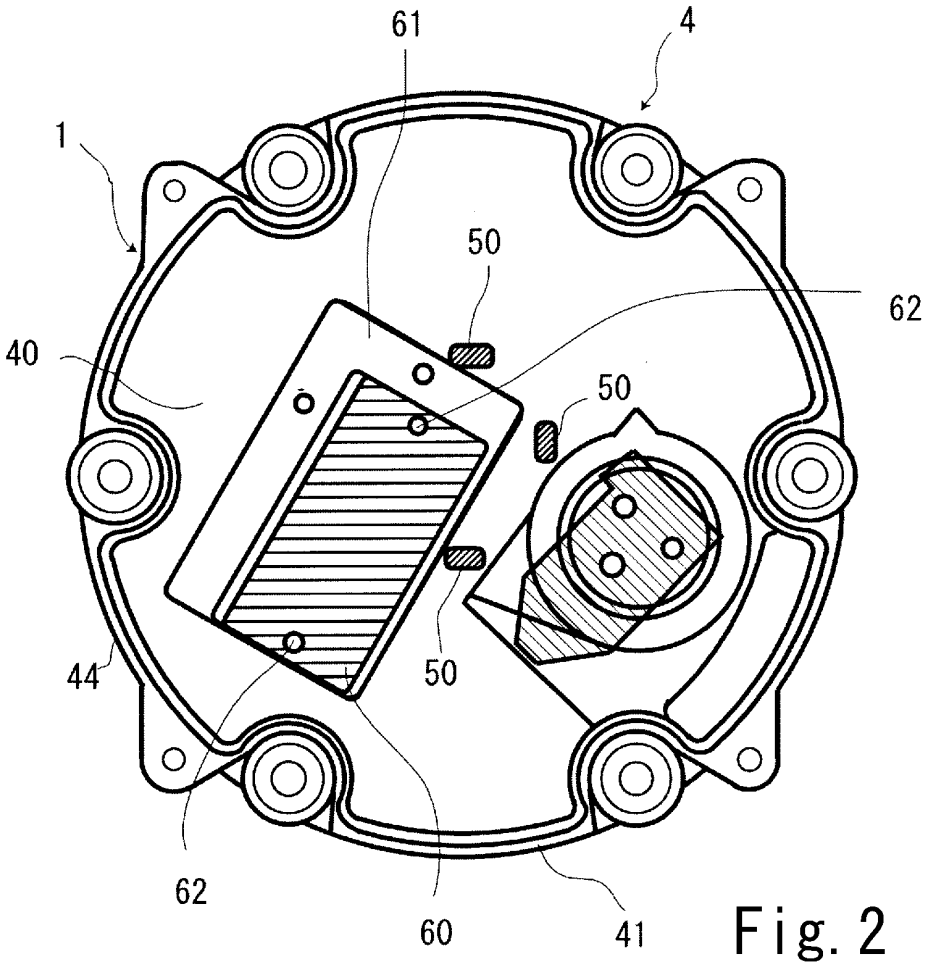

Fig. 2

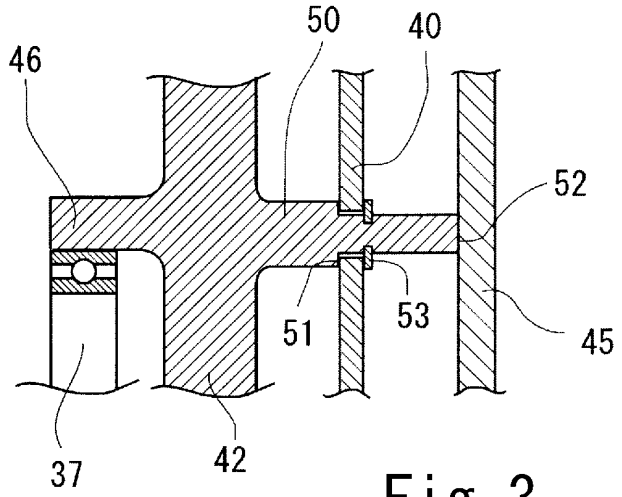

Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2011/007248

A. CLASSIFICATION OF SUBJECT MATTER
F04B39/00(2006.01)i

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)
F04B39/00

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 1996-2012
Kokai Jitsuyo Shinan Koho 1971-2012 Toroku Jitsuyo Shinan Koho 1994-2012

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.
A	JP 2009-264172 A (Toyota Industries Corp.), 12 November 2009 (12.11.2009), entire text; all drawings (Family: none)	1,2
A	WO 2010/131671 A1 (Sanden Corp.), 18 November 2010 (18.11.2010), entire text; all drawings & JP 2010-285980 A	1,2
A	WO 2010/052936 A1 (Sanden Corp.), 14 May 2010 (14.05.2010), entire text; all drawings & JP 2010-112338 A	1,2

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

* Special categories of cited documents:
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"P" document published prior to the international filing date but later than the priority date claimed
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"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
21 March, 2012 (21.03.12)	03 April, 2012 (03.04.12)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2002174178 A **[0002] [0005] [0006]**
- JP 2008184947 A **[0003] [0005] [0006]**
- JP 2010059809 A **[0004] [0005] [0006]**