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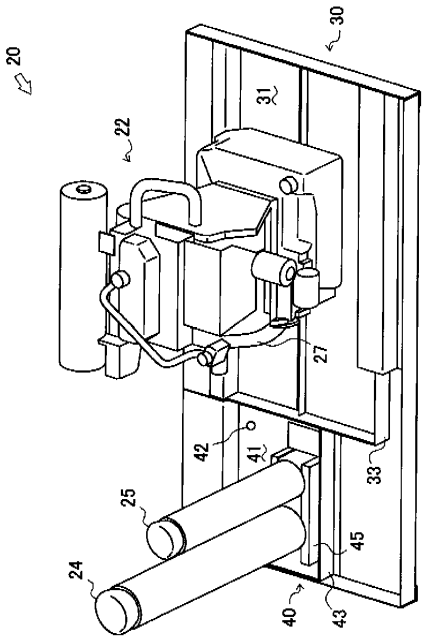
(54) ENGINE-DRIVEN HEAT PUMP

(57) Problems to be solved by the present invention are to provide a construction of a floorboard in an engine-driven heat pump capable of preventing the leaking of an engine oil, of draining away condensate water due to the dropwise condensation in a refrigerating machine and of reducing an engine vibration. In the engine-driven heat pump 1 having an engine 22 for driving a compressor 23 and a receiver 24 for accommodating refrigerant liquid, a floorboard 40 for the refrigerating machine on which the receiver 24 is provided and an engine mounting floorboard 30 on which the engine 22 is provided are comprised as different members. The floorboard 40 for the refrigerating machine is formed so that a drain outlet 42 is provided thereon and a sidewall 43 is provided on the peripheral border thereof, and the engine mounting floorboard 30 is formed so that a sidewall 33 is provided on the peripheral border thereof.

Fig.2



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a construction of a floorboard of an engine-driven heat pump having an engine driving a compressor and a receiver accommodating a refrigerant liquid.

Related Art

[0002] Conventionally, there is well-known an engine-driven heat pump constructed so as to drive a compressor by an engine, as one of an air-conditioning system. There may be occasions when a damage to an oil seal portion in a power transmitting portion (a flywheel or a drive shaft) from an engine to a compressor or the like result in flying an engine oil in all directions, or in leaking the engine oil out of a pipe or the like of the engine. Therefore, various novel ideas has been executed, so as to prevent the engine oil from leaking out of the system and to collect the engine oil at that time, in a construction of a bottom face of an equipment compartment.

[0003] For example, JP 2003-279077 discloses an engine-driven heat pump including a bottom panel having an oil storage chamber formed by press working. If perchance the engine oil is leaked, the engine oil is accommodated in the oil storage chamber.

Disclosure of Invention

Problems to Be Solved By the Invention

[0004] However, the bottom panel of the engine-driven heat pump described in JP 2003-279077 are formed at four corners thereof with creasing chambers which drain away rainwater falling along brace members, and is the portion other than four corners is formed as the oil storage chamber. The oil storage chamber and the creasing chambers are separated due to an oil weir. Therefore, there is a possibility that dropwise condensation generated on a surface of a refrigerating machine disposed at the equipment compartment becomes condensate water so as to be accommodated in the oil storage chamber. For example, the receiver generates the dropwise condensation on the surface thereof, because the refrigerant liquid accommodated inside of it during operation becomes low temperature. The dropwise condensation collected so as to be the condensate water threatens to accumulate on the bottom face of the equipment compartment.

The engine would be associated with a noise due to driving fluctuation. For this reason, when the entire bottom face of the engine-driven heat pump is made up of one bottom panel, the noise having large amplitude may be sometimes generated.

Consequently, problems to be solved by the present invention are to provide a construction of a floor board in an engine-driven heat pump capable of preventing the leaking of the engine oil, of draining away the condensate water due to the dropwise condensation in the refrigeration machine and of reducing the noise due to the engine vibration as a vibratory source, using a simple construction.

SUMMARY OF THE INVENTION

[0005] In an engine-driven heat pump of the present invention, comprising of an engine for driving a compressor and a receiver for accommodating a refrigerant liquid, a floorboard for a refrigerating machine on which the receiver is provided and an engine mounting floorboard on which the engine is provided are comprised as different members.

Accordingly, because only the engine as a vibratory source is installed on the engine mounting floorboard, an amplitude can be restrained and a noise can be reduced, compared to the case when the whole floorboard of the equipment compartment is vibrated by the engine.

Since the floorboard for the refrigerating machine and the engine mounting floorboard are comprised as different members, the collection of the condensate water due to the dropwise condensation and that of the engine oil when it is leaked can be separately performed.

[0006] In the present invention, the floorboard for the refrigerating machine is formed so that a drain outlet is provided thereon and a sidewall is provided on the peripheral border thereof, and the engine mounting floorboard is formed so that a sidewall is provided on the peripheral border thereof.

Accordingly, the condensate water generated in the equipment compartment can be assuredly drained away to the outside of the engine-driven heat pump, while as the engine mounting floorboard is interrupted from the outside thereof without an opening portion, when the engine oil is leaked, the leaked engine oil can be prevented from escaping to the outside of the engine-driven heat pump.

[0007] In the present invention, a plate-like member for introducing the engine oil flied in all directions from the engine on the engine mounting floorboard is provided, adjacent to a power transmitting portion from the engine to the compressor.

Accordingly, for example, even when the engine oil is flied in all directions from the end portion of the engine output shaft, the engine oil can be fallen down to the engine mounting floorboard. Therefore, the engine oil flied in all directions can be prevented from escaping to the outside of the engine-driven heat pump.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

Fig. 1 is an elevational view illustrating a whole construction of an engine-driven heat pump according to an embodiment of the present invention.

Fig. 2 is a perspective view illustrating arrangements of an engine, a receiver and an oil separator in an equipment compartment according to an embodiment of the present invention.

Fig. 3 is a partial sectional view illustrating a cross-section of a flywheel portion of the engine according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0009] An engine-driven heat pump 1 according to the present invention will be briefly described, with reference to Fig. 1. As illustrated in Fig. 1, the engine-driven heat pump 1 comprises two equipment chambers 10, 20 vertically separated. The upper equipment chamber is a heat exchanging chamber 10, and the lower equipment chamber is an equipment compartment 20. The heat exchanging chamber 10 is constructed so as to ventilate an ambient air for the heat exchange in an outdoor heat exchanger 11. The heat exchanging chamber 10 includes outdoor heat exchangers 11, a radiator (not shown), outdoor fans 12 and motors 13 for outdoor fans 12 or the like. The outdoor heat exchanger 11 is disposed on the front and the back sides of the heat exchanging chamber 10. The outdoor fan 12 is constructed so as to inhale the ambient air from the front or the back side thereof, to exchange the heat of it by the outdoor heat exchanger 11 and to ventilate it out of the upper surface thereof. Due to the ventilating construction, the heat of the radiator is also exchanged. In this regard, this ventilating construction is a construction of the form referred to as top-blown type commonly used for a large-size engine-driven heat pump.

[0010] Meanwhile, the equipment compartment 20 is a substantially hermetic type equipment compartment communicating with the exterior portion thereof only through a ventilating hole (not shown), an engine intake pipe (not shown) and an exhaust pipe (not shown). Main equipments in the engine-driven heat pump 1, such as an engine system equipment, a refrigerating machine and an electric machinery box (not shown), are disposed in the equipment compartment 20. An engine 22, peripheral equipments or the like are disposed therein, as the engine system equipment. A compressor 23, an oil separator 25, a receiver 24 or the like are disposed therein, as the refrigerating machine. The equipment compartment 20 is covered around the sides thereof with outer plates 21. Incidentally, a swash plate 50 will be described in greater detail later.

[0011] A construction of a floorboard 40 for the refrigerating machine will be described in detail, with reference to Fig. 2. In this regard, Fig. 2 illustrates only an engine 22, the receiver 24 and the oil separator 25 in the equipment compartment 20, and the outer plates 21 and the swash plates 50 are omitted, so as to explain it simply. As illustrated in Fig. 2, the floorboard 40 for the refrigerating machine is formed so as to be a dish-shaped or a box-shaped configuration, having a sidewall 43 on the periphery thereof. The height of the sidewall 43, which is not especially limited in the present embodiment, is enough at the level of 50 mm to 100 mm. The floorboard 40 for the refrigerating machine is provided on the bottom face thereof with a drain outlet 42. The floorboard 40 for the refrigerating machine is communicated with the outside of the engine-driven heat pump 1 via the drain outlet 42. The floorboard 40 for the refrigerating machine is disposed on the output side of the engine 22 (i.e., on the side of the compressor 23) in the width direction of the engine-driven heat pump 1, and approximately at the middle in the depth direction thereof. The receiver 24 and the oil separator 25 attached to a mounting stage 45 are installed on the floorboard 40 for the refrigerating machine.

[0012] Due to the above-mentioned construction, the following effect can be achieved. Some of the refrigerating machines disposed at the equipment compartment 20 become low-temperature during operation For example, the receiver 24 causes the dropwise condensation on the surface thereof due to moisture in the air, because the refrigerant liquid accommodated therein during operation becomes low-temperature. Therefore, the dropwise condensation is dropped down and collected, so that it is accumulated as the condensate water on the bottom face of the equipment compartment 20. The same type of phenomenon occurs at liquid pipes on the periphery of the receiver 24. The floorboard 40 for the refrigerating machine is constructed so that it can collects these condensate water and assuredly drain away them from the drain outlet 42 to the outside of the engine-driven heat pump 1.

[0013] A construction of an engine mounting floorboard 30 will be also described in detail, with reference to Fig. 2. As illustrated in Fig. 2, the engine mounting floorboard 30 is formed so as to be a dish-shaped or a box-shaped configuration, having a sidewall 33 on the periphery thereof. The height of the sidewall 33, which is not especially limited in the present embodiment, is substantially the same height as the floorboard 40 for the refrigerating machine. A bottom face 31 of the engine mounting floorboard do not have an opening portion, an aperture or the like, so that the engine mounting floorboard 30 is interrupted from the floorboard 40 for the refrigerating machine and the floorboards of the other portions of the equipment compartment 20. The engine mounting floorboard 30 is disposed on the right side from an anterior view in the width direction of the engine-driven heat pump 1 and at the substantially middle portion in the depth direction thereof. The engine 22 attached to an engine mount 51 (see Fig. 3) is installed on the engine mounting floorboard 30.

[0014] Due to the above-described construction, the following effect can be achieved. There may be occasions when a damage or the like to an oil seal portion in

a flywheel 27 of the engine 22 or a drive shaft from the engine 22 to the compressor 23 result in flying the engine oil in all directions, or in leaking the engine oil out of a pipe or the like of the engine 22. Therefore, because the engine mounting floorboard 30 is formed so as to be a dish-shaped or a box-shaped configuration, the engine oil can be collected only by the engine mounting floorboard 30, thereby preventing the engine oil from leaking out of the outside of the engine mounting floorboard 30, if perchance the engine oil is leaked.

[0015] The following effects can be also obtained. That is to say, the floorboard 40 for the refrigerating machine and the engine mounting floorboard 30 are separately comprised, whereby the discharge of the condensate water due to the dropwise condensation, and the collection of the engine oil while it is leaked can be performed respectively. The floorboard 40 for the refrigerating machine and the engine mounting floorboard 30 are easily manufacturable, as they are simply formed so as to be a dish-shaped or a box-shaped configuration.

Because the engine 22 is installed only on the engine mounting floorboard 30, the amplitude of the floorboard due to the vibration of the engine 22 can be restrained, compared to the case when the whole bottom face of the engine-driven heat pump 1 is only comprised of one floorboard. Briefly, the noise by the engine-driven heat pump 1 can be reduced.

[0016] A construction of the swash plate 50 as a plate-like member will be described in detail, with reference to Fig. 3. Incidentally, Fig. 3 illustrates only the engine 22 in the equipment compartment 20, so as to explain it simply. As illustrated in Fig. 3, the swash plate 50 is provided on each of the inner sides of the outer plates 21 at the front and the rear sides in the equipment compartment 20. The swash plate 50 is comprised of an upper straight portion 50a, a sloped portion 50b and a lower straight portion 50c, from a lateral view of the engine-driven heat pump 1. In the swash plate 50 of the present embodiment, the upper straight portion 50a is adjacent to the outer plate 21 at the front or the rear side, and the sloped portion 50b is inclined toward the inner portion of the engine mounting floorboard 30, as well as the lower straight portion 50c is provided so as to be located inwardly from the sidewall 33 of the engine mounting floorboard 30 toward the engine 22. Also, the lower end of the lower straight portion 50c is extended from the upper end of the sidewall 33 to the upper surface of the bottom face 31 in the engine mounting floorboard downward thereof. The height of the swash plate 50 is formed so that it becomes at least that of the engine 22 installed at the equipment compartment 20 or higher. Incidentally, the thickness of the swash plate 50, which is not especially limited, is formed so that it becomes the same thickness as the outer plate 21in the present embodiment. The swash plate 50 is formed so that it has the wide capable of covering the power transmitting portion from the engine 22 to the compressor 23, and it has the wide capable of covering at least the flywheel 27, from a front view of the engine-driven heat pump 1 (see Fig. 1).

[0017] Due to the above-mentioned construction, the following effect can be achieved. Briefly, the engine oil, which flies in all directions due to the damage or the like to the oil seal portion in a flywheel 27 of the engine 22 or the drive shaft from the engine 22 to the compressor 23, can be assuredly received, so that it can be collected in the engine mounting floorboard 30, by the slope of the wash plate 50.

[0018] Thus, if perchance the engine oil is leaked, the collecting performance so as to collect it in the engine mounting floorboard 30 can be improved. Because the swash plate 50 is installed adjacent to a power transmitting portion from the engine 22 to the compressor 23 such as the flywheel 27, the increase in weight of the outer plates 21 involving the swash plates 50 can be minimized, so that the outer plates 21 involving the swash plates 50 can be dismounted easily.

[Industrial applicability]

[0019] The construction of the floorboard in the engine-driven heat pump, in which the floorboard for the refrigerating machine and the engine mounting floorboard are separately formed, is widely applicable in the industrial instruments such as the air-conditioning system having the refrigerating machine and the engine.

Claims

1. An engine-driven heat pump having an engine driving a compressor and a receiver accommodating a refrigerant liquid,
wherein a floorboard for a refrigerating machine on which the receiver is provided and an engine mounting floorboard on which the engine is provided are comprised as different members.

2. The engine-driven heat pump, as set forth in claim 1, wherein the floorboard for the refrigerating machine is formed so that a drain outlet is provided thereon and a sidewall is provided on the peripheral border thereof, and wherein the engine mounting floorboard is formed so that a sidewall is provided on the peripheral border thereof.

3. The engine-driven heat pump, as set forth in claims 1 or 2, wherein a plate-like member for introducing the engine oil flied in all directions from the engine on the engine mounting floorboard is provided, adjacent to a power transmitting portion from the engine to the compressor.

Amended claims under Art. 19.1 PCT

1. An engine-driven heat pump having an engine for

driving a compressor and a receiver for accommodating a refrigerant liquid,
wherein a bottom face of the engine-driven heat pump is divided and is comprised of different members of at least a floorboard for a refrigerating machine on which the receiver is provided and an engine mounting floorboard on which the engine is provided,
wherein the floorboard for the refrigerating machine is formed so as to be a dish-shaped or a box-shaped configuration, on which a drain outlet is provided, and which a sidewall is provided on the periphery thereof, and
wherein the engine mounting floorboard is formed so as to be a dish-shaped or a box-shaped configuration, which a sidewall is provided on the periphery thereof, so that it is interrupted from the floorboard for the refrigerating machine without an opening portion or an aperture.

2. The engine-driven heat pump, as set forth in claim 2, wherein a plate-like member for introducing the engine oil flied in all directions from the engine on the engine mounting floorboard is provided, adjacent to a power transmitting portion from the engine to the compressor.

Amended claims under Art. 19.1 PCT

1. (cancelled)

2. An engine-driven heat pump having an engine for driving a compressor and a receiver for accommodating a refrigerant liquid,
wherein a bottom face of the engine-driven heat pump is comprised of different members of at least a floorboard for a refrigerating machine on which the receiver is provided and an engine mounting floorboard on which the engine is provided,
wherein the floorboard for the refrigerating machine is formed so as to be a dish-shaped or a box-shaped configuration, on which a drain outlet is provided, and which a sidewall is provided on the periphery thereof, and
wherein the engine mounting floorboard is formed so as to be a dish-shaped or a box-shaped configuration, which a sidewall is provided on the periphery thereof, so that it is interrupted from the floorboard for the refrigerating machine without an opening portion or an aperture.

3. The engine-driven heat pump, as set forth in claim 2, wherein a plate-like member for introducing the engine oil flied in all directions from the engine on the engine mounting floorboard is provided, adjacent to a power transmitting portion from the engine to the compressor.

Fig.1

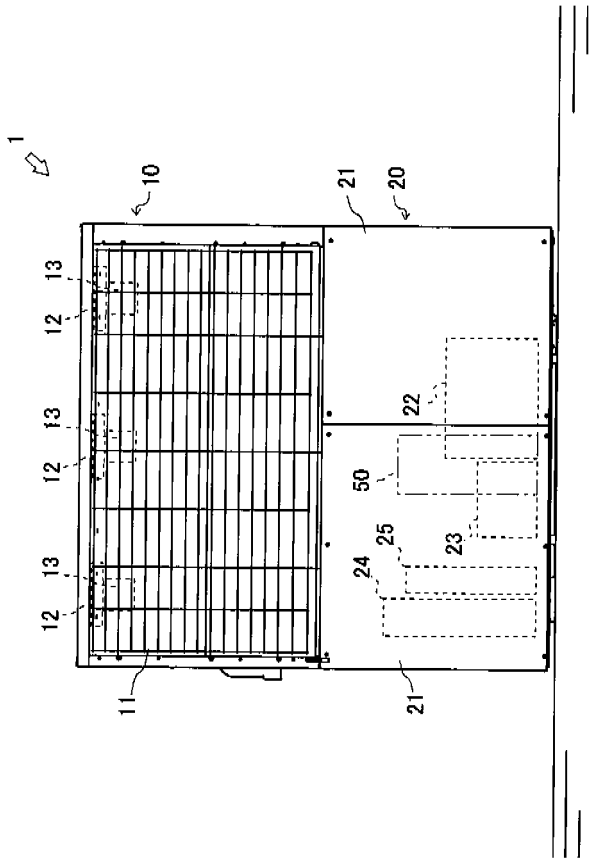


Fig.2

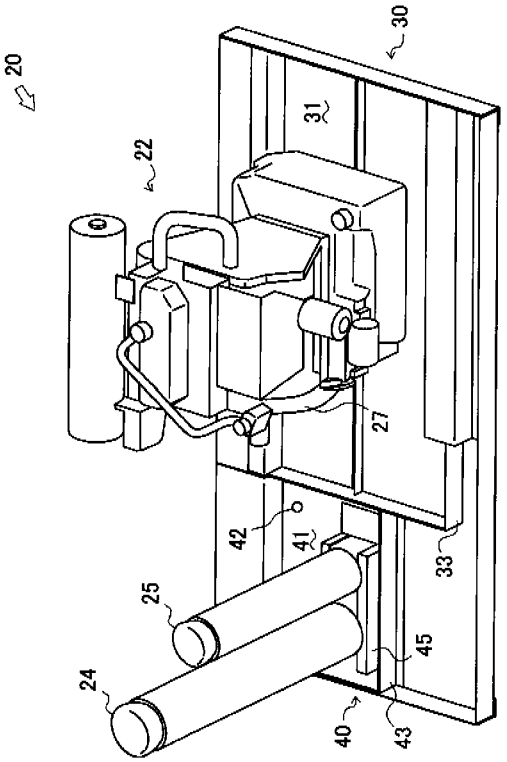
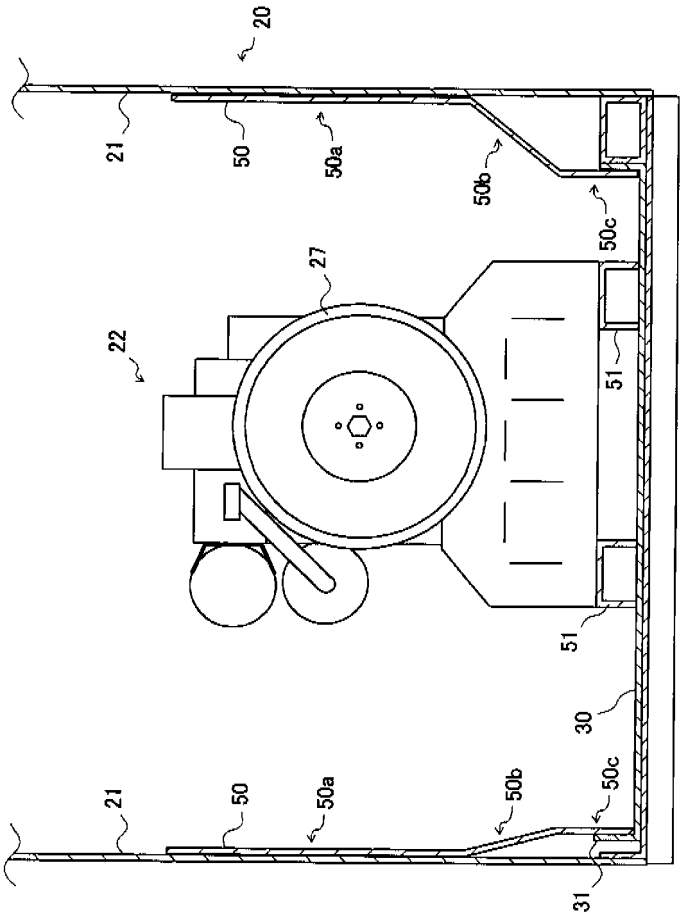


Fig.3



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2008/052836

A. CLASSIFICATION OF SUBJECT MATTER
F25B27/00(2006.01)i, *F24F5/00*(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)
F25B27/00, F24F5/00

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 1996-2008
Kokai Jitsuyo Shinan Koho 1971-2008 Toroku Jitsuyo Shinan Koho 1994-2008

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.
X Y	JP 2006-71196 A (Yanmar Co., Ltd.), 16 March, 2006 (16.03.06), Claims; Par. Nos. [0001] to [0035]; Figs. 1 to 10 (Family: none)	1 2-3
Y	JP 2003-279077 A (Aisin Seiki Co., Ltd.), 02 October, 2003 (02.10.03), Claims; Par. Nos. [0001] to [0036]; Figs. 1 to 8 (Family: none)	2-3
Y	JP 2004-286241 A (Yanmar Co., Ltd.), 14 October, 2004 (14.10.04), Claims; Par. Nos. [0001] to [0070]; Figs. 1 to 6 (Family: none)	2-3

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

* Special categories of cited documents:
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 May, 2008 (15.05.08)	27 May, 2008 (27.05.08)
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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2003279077 A **[0003] [0004]**