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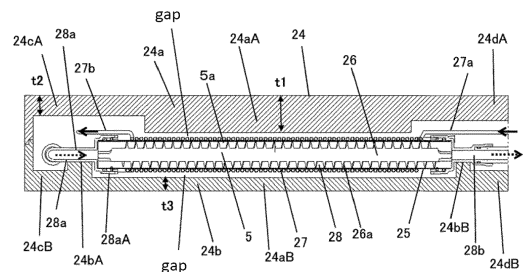
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(54) **HEAT PUMP HEAT SOURCE MACHINE**

(57) A heat pump heat source machine includes: a refrigerant circuit 8 formed by annularly connecting a compressor 4, a refrigerant flow path of a water-refrigerant heat exchanger 5, a decompressor 6 and an evaporator 7 to one another through a pipe 3, refrigerant being circulated in the pipe 3; a blast device 9 for generating air which passes through the evaporator 7; and a bottom plate 11 on which the evaporator 7 is placed, wherein the water-refrigerant heat exchanger 5 is covered with a heat insulating material 24, the water-refrigerant heat exchanger 5 includes a water inlet portion 28a, a water outlet portion 28b, and a heat exchanging section 5a which exchanges heat between water and the refrigerant, the water inlet portion 28a and the water outlet portion 28b of the water-refrigerant heat exchanger 5 are supported by a supporting portion (24bA, 24bB) of the heat insulating material 24, and a gap is provided between the heat exchanging section 5a and an inner surface of the heat insulating material 24. According to this, there is provided the heat pump heat source machine 1 including the water-refrigerant heat exchanger 5 having enhanced durability performance of the heat insulating material 24 which covers the water-refrigerant heat exchanger 5.

[Fig. 2]



- 5 Water-refrigerant heat exchanger
- 5a Heat exchanging section
- 24 Heat insulating material
- 24a Upper side heat insulating material
- 24b Lower side heat insulating material
- 24aA Heat exchanging section upper heat insulating material
- 24aB Heat exchanging section lower heat insulating material
- 24bA Heat insulating material first supporting portion
- 24bB Heat insulating material second supporting portion
- 24cA Refrigerant outlet side upper heat insulating material
- 24cB Water inlet side lower heat insulating material
- 24dA Refrigerant inlet side upper heat insulating material
- 24dB Water inlet/outlet side lower heat insulating material
- 25 Inner pipe
- 26 Insertion body
- 26a Spiral projection
- 27 Refrigerant flow path
- 27a Refrigerant inlet connection pipe
- 27b Refrigerant outlet connection pipe
- 28 Water-flow path
- 28a Water inlet connection pipe
- 28b Water outlet connection pipe

Description**[TECHNICAL FIELD]**

[0001] The present invention relates to a heat pump heat source machine.

[BACKGROUND TECHNIQUE]

[0002] In a conventional heat pump heat source machine, an air-heat exchanger disposed on a back surface side of a water-heat exchanger and a blast fan are placed.

[0003] The water-heat exchanger placed in an air blowing path of the blast fan is covered with and heat-insulated by a foamed heat insulating container, and is covered with and protected by a protection cover (see patent document 1 for example).

[PRIOR ART DOCUMENT]**[PATENT DOCUMENT]**

[0004] [Patent Document 1]
Japanese Patent Application Laid-open
No.2005-147619

[SUMMARY OF THE INVENTION]**[PROBLEM TO BE SOLVED BY THE INVENTION]**

[0005] According to the conventional configuration, however, there is a problem that the water-heat exchanger and the foamed heat insulating container are adhered to each other substantially tightly, and durability performance of the foamed heat insulating container is deteriorated by temperature rise of the water-heat exchanger.

[0006] The present invention has been accomplished to solve the conventional problem, and it is an object of the invention to provide a heat pump heat source machine having a water-refrigerant heat exchanger which enhances durability performance of a heat insulating material which covers the water-refrigerant heat exchanger.

[MEANS FOR SOLVING THE PROBLEM]

[0007] To solve the conventional problem, the present invention provides a heat pump heat source machine including: a refrigerant circuit formed by annularly connecting a compressor, a refrigerant flow path of a water-refrigerant heat exchanger, a decompressor and an evaporator to one another through a pipe, refrigerant being circulated in the pipe; a blast device for generating air which passes through the evaporator; and a bottom plate on which the evaporator is placed, wherein the water-refrigerant heat exchanger is covered with a heat insulating material, the water-refrigerant heat exchanger includes a water inlet portion, a water outlet portion, and a heat exchanging section which exchanges heat between

water and the refrigerant, the water inlet portion and the water outlet portion of the water-refrigerant heat exchanger are supported by a supporting portion of the heat insulating material, and a gap is provided between the heat exchanging section and an inner surface of the heat insulating material.

[0008] According to this, the water inlet portion and the water outlet portion of the water-refrigerant heat exchanger are supported by the inner surface of the heat insulating material, and a gap is provided between the heat exchanging section which exchanges heat between water and refrigerant of the water-refrigerant heat exchanger and the inner surface of the heat insulating material which covers the water-refrigerant heat exchanger. Since the refrigerant flow path through which high temperature refrigerant flows does not come into contact with the inner surface of the heat insulating material, it is possible to provide a heat pump heat source machine including the water-refrigerant heat exchanger having enhanced durability performance of the heat insulating material which covers the water-refrigerant heat exchanger.

[EFFECT OF THE INVENTION]

[0009] According to the present invention, it is possible to provide a heat pump heat source machine including a water-refrigerant heat exchanger having enhanced durability performance of the heat insulating material which covers the water-refrigerant heat exchanger.

[BRIEF DESCRIPTION OF THE DRAWINGS]**[0010]**

Fig. 1(a) is a plan view of an internal appearance of a heat pump heat source machine in an embodiment of the present invention, and Fig. 1(b) is a front view of the internal appearance of the heat pump heat source machine;

Fig. 2 is a side sectional view of essential portions of a water-refrigerant heat exchanger of the heat pump heat source machine in the embodiment of the invention;

Fig. 3 is an upper sectional view of essential portions of another water-refrigerant heat exchanger of the heat pump heat source machine;

Fig. 4 is a fluid circuit diagram of a hot water supplying system using the heat pump heat source machine;

Fig. 5 is a side sectional view of essential portions of another water-refrigerant heat exchanger of the heat pump heat source machine; and

Fig. 6 is a side sectional view of essential portions of another water-refrigerant heat exchanger of the heat pump heat source machine.

[MODE FOR CARRYING OUT THE INVENTION]

[0011] A first aspect of the present invention provides

a heat pump heat source machine including: a refrigerant circuit formed by annularly connecting a compressor, a refrigerant flow path of a water-refrigerant heat exchanger, a decompressor and an evaporator to one another through a pipe, refrigerant being circulated in the pipe; a blast device for generating air which passes through the evaporator; and a bottom plate on which the evaporator is placed, wherein the water-refrigerant heat exchanger is covered with a heat insulating material, the water-refrigerant heat exchanger includes a water inlet portion, a water outlet portion, and a heat exchanging section which exchanges heat between water and the refrigerant, the water inlet portion and the water outlet portion of the water-refrigerant heat exchanger are supported by a supporting portion of the heat insulating material, and a gap is provided between the heat exchanging section and an inner surface of the heat insulating material.

[0012] According to this, the water inlet portion and the water outlet portion of the water-refrigerant heat exchanger are supported by the inner surface of the heat insulating material, and a gap is provided between the heat exchanging section which exchanges heat between water and refrigerant of the water-refrigerant heat exchanger and the inner surface of the heat insulating material which covers the water-refrigerant heat exchanger. Since the refrigerant flow path through which high temperature refrigerant flows does not come into contact with the inner surface of the heat insulating material, it is possible to provide a heat pump heat source machine including the water-refrigerant heat exchanger having enhanced durability performance of the heat insulating material which covers the water-refrigerant heat exchanger.

[0013] According to a second aspect of the invention, especially in the first aspect, the water-refrigerant heat exchanger is placed on the bottom plate in a state where the water-refrigerant heat exchanger is covered with the heat insulating material.

[0014] According to this, even if a weight of the water-refrigerant heat exchanger covered with the heat insulating material is slightly heavy, the water-refrigerant heat exchanger can stably be fixed.

[0015] According to a third aspect of the invention, especially in the first or second aspect, a most thick portion of the heat insulating material located on an upper side of the water-refrigerant heat exchanger is formed at a position opposed to the heat exchanging section.

[0016] According to this, a thickness of a portion of the water-refrigerant heat exchanger opposed to the high temperature heat exchanging section is thicker than a thickness of the heat insulating material located on upper sides of the low temperature water inlet portion and the refrigerant outlet portion after heat radiation of the water-refrigerant heat exchanger. Therefore, it is possible to provide a heat pump heat source machine including a water-refrigerant heat exchanger which efficiently suppresses heat radiation loss from the high temperature heat exchanging section.

[0017] According to a fourth aspect of the invention,

especially in the second aspect, a maximum thickness of a portion of the heat insulating material opposed to an upper side of the heat exchanging section is thicker than a maximum thickness of a portion of the heat insulating material opposed to a lower side of the heat exchanging section.

[0018] According to this, the water-refrigerant heat exchanger covered with the heat insulating material is placed on the bottom plate. Therefore, even if the upper side heat insulating material of the water-refrigerant heat exchanger is cooled by air after it is generated by the blast device and after it passes through the evaporator, since the maximum thickness of the heat insulating material opposed to the upper side of the heat exchanging section of the water-refrigerant heat exchanger is thicker than the maximum thickness of the heat insulating material opposed to the lower side of the heat exchanging section of the water-refrigerant heat exchanger, the heat exchanging section of the water-refrigerant heat exchanger is not easily cooled. As a result, even if the heat exchanging section of the water-refrigerant heat exchanger is placed on the downstream side of the air flow of the evaporator, it is possible to provide a heat pump heat source machine including a water-refrigerant heat exchanger having suppressed heat radiation loss.

[0019] According to a fifth aspect of the invention, especially in the second aspect, the heat insulating material is divided at least in a vertical direction, and density of the heat insulating material on an upper side thereof is larger than density of the heat insulating material on a lower side thereof.

[0020] According to this, the water-refrigerant heat exchanger covered with the heat insulating material is placed on the bottom plate. Therefore, even if the upper side heat insulating material of the water-refrigerant heat exchanger is cooled by air after it is generated by the blast device and it passes through the evaporator, the heat insulating material which covers the water-refrigerant heat exchanger is divided at least in the vertical direction, and density of the upper side heat insulating material is larger than that of the lower side heat insulating material. Hence, the water-refrigerant heat exchanger is not easily cooled. As a result, even if the water-refrigerant heat exchanger is placed on the downstream side of the air flow of the evaporator, it is possible to provide a heat pump heat source machine including a water-refrigerant heat exchanger having suppressed heat radiation loss.

[0021] According to a sixth aspect of the invention, especially in any one of the first to fifth aspects, a vacuum heat insulating material is used on an outer surface of the heat insulating material at least opposed to the heat exchanging section.

[0022] According to this, since the vacuum heat insulating material having about 1/10 heat conductivity of a foamed heat insulating material is used on the outer surface of the heat insulating material opposed to the heat exchanging section of the water-refrigerant heat exchanger, even if the thickness of the heat insulating ma-

terial located around the heat exchanging section which exchanges heat between water and refrigerant of the water-refrigerant heat exchanger is reduced as much as possible, and even if the water-refrigerant heat exchanger is placed on the downstream side of the air flow of the evaporator, it is possible to provide a heat pump heat source machine including a water-refrigerant heat exchanger having suppressed heat radiation loss.

[0023] An embodiment of the present invention will be described below with reference to the drawings. The invention is not limited to the embodiment.

(Embodiment)

[0024] Fig. 1(a) is a plan view of an internal appearance of a heat pump heat source machine in an embodiment of the present invention, and Fig. 1(b) is a front view of the internal appearance of the heat pump heat source machine of the embodiment of the invention.

[0025] Fig. 4 is a circuit diagram of a hot water supplying system using the heat pump heat source machine of the embodiment of the invention.

[0026] First, a fluid circuit diagram of the hot water supplying system will be described below using Fig. 4. The heat pump heat source machine 1 heats tap water. The water is heated by the heat pump heat source machine 1, and high temperature water conveyed through a pipe 3 is stored in a tank unit 2, the stored high temperature water and tap water are mixed, and warm water having predetermined temperature is supplied.

[0027] In the heat pump heat source machine 1, there are placed a compressor 4 for compressing refrigerant into a high temperature and high pressure state, a water-refrigerant heat exchanger 5 for radiating heat of refrigerant to water, a decompressor 6 which is an expansion valve, and an evaporator 7 which is an air-refrigerant heat exchanger for absorbing heat from air. A blast device 9 is a blast fan for generating air which passes through the evaporator 7.

[0028] The compressor 4, the water-refrigerant heat exchanger 5, the decompressor 6 and the evaporator 7 are sequentially and annularly connected to one another through a pipe to form a refrigerant circuit 8 which is a closed circuit. The refrigerant circuit 8 is a heat pump through which refrigerant is circulated while changing refrigerant between a high temperature and high pressure state and a low temperature and low pressure state. In the water-refrigerant heat exchanger 5, water flowing through the water-refrigerant heat exchanger 5 is heated by high pressure side refrigerant which circulates through the refrigerant circuit 8, thereby producing high temperature water.

[0029] A hot water-supply cycle 10 formed in the tank unit 2 is composed of a hot water-storing tank 12 for storing high temperature water produced by the water-refrigerant heat exchanger 5, a water entering pipe 13 for introducing tap water into the hot water-storing tank 12, a hot water-supply pipe 15 for supplying high temperature

water from the hot water-storing tank 12 to a hot water-supply terminal 14 such as a faucet and a shower, and a circulation pump 16 which conveys low temperature water in the hot water-storing tank 12 to the water-refrigerant heat exchanger 5 for heating low temperature water in the hot water-storing tank 12 and producing high temperature water.

[0030] Figs. 1(a) and 1(b) show a placement configuration of component parts shown in the circuit diagram of the hot water supplying system of Fig. 4.

[0031] Next, the placement configuration of the component parts will be described in more detail using Figs. 1(a) and 1(b).

[0032] A bottom plate 11, a right plate 20 forming a right side, a left plate 21 forming a left side, a top plate 22 forming an upper side, and a front plate 23 forming a front side are exterior bodies forming an external outline of the heat pump heat source machine 1. An outlet port 23a is formed in the front plate 23 which is one of the exterior bodies. The outlet port 23a is concentric with the blast device 9.

[0033] An interior of the exterior bodies of the heat pump heat source machine 1 is partitioned by a partition plate 17 into right and left sides as viewed from front. The compressor 4 and the decompressor 6 are placed in a right space of the partition plate 17 as viewed from front, i.e., in one of side spaces of the partition plate 17.

[0034] The evaporator 7 is placed in a left space of the partition plate 17 as viewed from front, i.e., in the other space of the partition plate 17. The evaporator 7 is placed behind the other side space and on a leftmost side of the other side space. The blast device 9 is placed on the front side of the evaporator 7. A portion of the blast device 9 is supported by the evaporator 7. The blast device 9 generates air which passes through the evaporator 7 to make heat of the air to be absorbed by refrigerant flowing through the evaporator 7.

[0035] The water-refrigerant heat exchanger 5 covered with the heat insulating material 24 is placed on the bottom plate 11 located on the lower side of the blast device 9. The heat insulating material 24 is divided at least in a vertical direction, and has an upper side heat insulating material 24a and a lower side heat insulating material 24b. Therefore, the lower side heat insulating material 24b is placed on the bottom plate 11.

[0036] When air generated by the blast device 9 passes through the evaporator 7, heat of the air is absorbed by refrigerant flowing through the evaporator 7. The air collides against the heat insulating material 24 which covers the water-refrigerant heat exchanger 5, and the air is discharged out from the outlet port 23a formed in the front plate 23.

[0037] At that time, the air generated by the blast device 9 collides against the heat insulating material 24 which covers the water-refrigerant heat exchanger 5, but since the lower side heat insulating material 24b is placed on the bottom plate 11, more air collides against the upper side heat insulating material 24a than against the lower

side heat insulating material 24b.

[0038] Next, the water-refrigerant heat exchanger of the heat pump heat source machine and the heat insulating material covering the water-refrigerant heat exchanger in the embodiment of the present invention will be described using Fig. 2. Fig. 2 is a side sectional view of essential portions of the water-refrigerant heat exchanger of the heat pump heat source machine in the embodiment of the invention.

[0039] First, the water-refrigerant heat exchanger 5 will be described. First fluid such as water flows through an inner pipe 25. An insertion body 26 is inserted into the inner pipe 25. A spiral projection 26a is formed on the insertion body 26, and the spiral projection 26a and an inner surface of the inner pipe 25 abut against each other.

[0040] Hence, the first fluid such as water flows through a spiral water-flow path 28 formed by the inner surface of the inner pipe 25, an outer surface of the insertion body 26 and an inclined surface of the spiral projection 26a. A refrigerant flow path 27 which is a refrigerant pipe is spirally wound around an outer periphery of the inner pipe 25. Second fluid such as refrigerant flow through the refrigerant flow path 27.

[0041] The first fluid such as water flowing through the water-flow path 28 and second fluid such as refrigerant flowing through the refrigerant flow path 27 flow such that they are opposed to each other as shown in Fig. 2. The second fluid such as high temperature refrigerant flowing through the refrigerant flow path 27 heats the first fluid such as low temperature water flowing through the water-flow path 28, and high temperature water is produced. It is preferable that carbon dioxide gas is used as the second fluid. If carbon dioxide gas is used, high temperature water can be produced.

[0042] Hence, a water inlet connection pipe 28a is connected to one end of the water-flow path 28 as shown in Fig. 2. The water inlet connection pipe 28a is a water inlet portion which is in communication with the water-flow path 28. A refrigerant outlet connection pipe 27b is placed above the water inlet connection pipe 28a. The refrigerant outlet connection pipe 27b is a refrigerant outlet portion connected to the refrigerant flow path 27.

[0043] A water outlet connection pipe 28b is connected to the other end of the water-flow path 28. The water outlet connection pipe 28b is a water outlet portion which is in communication with the water-flow path 28. A refrigerant inlet connection pipe 27a is placed above the water outlet connection pipe 28b. The refrigerant inlet connection pipe 27a is a refrigerant inlet portion connected to the refrigerant flow path 27.

[0044] A heat exchanging section 5a is provided between the refrigerant inlet connection pipe 27a and the water outlet connection pipe 28b. In the heat exchanging section 5a, the second fluid such as refrigerant heats the first fluid such as water.

[0045] That is, in the heat exchanging section 5a, the first fluid such as water flowing through the spiral water-flow path 28 formed by the inner surface of the inner pipe

25, the outer surface of the insertion body 26 and the inclined surface of the spiral projection 26a and the second fluid such as refrigerant flowing through the refrigerant flow path 27 which is the spiral refrigerant pipe wound around the outer periphery of the inner pipe 25 exchange heat with each other, and the first fluid such as water is heated by the second fluid such as refrigerant.

[0046] Since the temperature of the refrigerant inlet connection pipe 27a is discharge temperature of the compressor 4, the temperature of the refrigerant inlet connection pipe 27a may exceed 100°C in some cases. On the other hand, since water as the first fluid which exchanges heat with refrigerant flows through the water inlet connection pipe 28a and the water outlet connection pipe 28b, temperature of the water inlet connection pipe 28a and temperature of the water outlet connection pipe 28b are lower than that of refrigerant.

[0047] Hence, the refrigerant outlet connection pipe 27b is placed such that it is separated upward away from the water inlet connection pipe 28a, and the refrigerant inlet connection pipe 27a is placed such that it is separated upward away from the water outlet connection pipe 28b.

[0048] In Figs. 2, 3, 5 and 6, solid lines show flowing directions of the second fluid such as refrigerant and broken lines show flowing directions of the first fluid such as water.

[0049] Next, the heat insulating material will be described. The heat insulating material 24 is divided at least in the vertical direction, the heat insulating material 24 includes an upper side heat insulating material 24a and a lower side heat insulating material 24b, and they sandwich the water-refrigerant heat exchanger 5 in the vertical direction and covers the same. Therefore, the lower side heat insulating material 24b is placed on the bottom plate 11.

[0050] The upper side heat insulating material 24a includes a refrigerant outlet side upper heat insulating material 24cA located on an upper side of the refrigerant outlet connection pipe 27b provided on one end side, a refrigerant inlet side upper heat insulating material 24dA located on an upper side of the refrigerant inlet connection pipe 27a located on the other end side, and a heat exchanging section upper heat insulating material 24aA located on an upper side of a heat insulating material second supporting portion 24bB between the refrigerant outlet side upper heat insulating material 24cA and the refrigerant inlet side upper heat insulating material 24dA.

[0051] The lower side heat insulating material 24b includes a water inlet side lower heat insulating material 24cB located on a lower side of the water inlet connection pipe 28a provided on one end side, a water inlet/outlet side lower heat insulating material 24dB located on a lower side of the water outlet connection pipe 28b provided on the other end side, and a heat exchanging section lower heat insulating material 24aB located on a lower side of the heat exchanging section 5a between the water inlet side lower heat insulating material 24cB and

the water inlet/outlet side lower heat insulating material 24dB.

[0052] In a longitudinal direction (lateral direction) of the lower side heat insulating material 24b which is the flowing direction of the first fluid such as water, a heat insulating material first supporting portion 24bA is provided between the water inlet side lower heat insulating material 24cB and the heat exchanging section lower heat insulating material 24aB. In the longitudinal direction (lateral direction) of the lower side heat insulating material 24b which is the flowing direction of the first fluid such as water, the heat insulating material second supporting portion 24bB is provided between the heat exchanging section lower heat insulating material 24aB and the water inlet/outlet side lower heat insulating material 24dB.

[0053] The water inlet connection pipe 28a of the water-refrigerant heat exchanger 5 is supported from a lower side by the heat insulating material first supporting portion 24bA, and the water outlet connection pipe 28b of the water-refrigerant heat exchanger 5 is supported from the lower side by the heat insulating material second supporting portion 24bB. Gaps are provided between the heat exchanging section 5a and the inner surface of the upper side heat insulating material 24a and between the heat exchanging section 5a and the lower side heat insulating material 24b. That is, the gap is provided between the heat exchanging section 5a and the inner surface of the peripheral heat insulating material 24.

[0054] According to this, the heat exchanging section 5a having the refrigerant flow path 27 through which high temperature refrigerant flows does not come into contact with the inner surface of the upper side heat insulating material 24a and the inner surface of the lower side heat insulating material 24b, i.e., does not come into contact with the heat exchanging section 5a and the inner surface of the peripheral heat insulating material 24. Therefore, it is possible to prevent the inner surface of the upper side heat insulating material 24a and the lower side heat insulating material 24b from being deformed. Hence, the heat insulating material 24 can stably maintain the arranged position of the water-refrigerant heat exchanger 5 for a long term.

[0055] Foamed polystyrene is mainly used as the upper side heat insulating material 24a and the lower side heat insulating material 24b, but heatproof temperature of general foamed polystyrene is about 70°C to 80°C, and if the heat insulating materials are heated higher than the heatproof temperature, there is a possibility that the foamed polystyrene is softened or melted. Heat-resisting foamed polystyrene in which heatproof temperature is enhanced by changing raw material depending on the intended use, but its heatproof temperature is still about 90°C.

[0056] Here, since temperature of the refrigerant inlet connection pipe 27a is the discharge temperature of the compressor 4, the temperature of the refrigerant inlet connection pipe 27a may exceed 100°C in some cases. Hence, a gap is provided also between the high temper-

ature refrigerant inlet connection pipe 27a and the inner surface of the upper side heat insulating material 24a as shown in Fig. 2. Since the refrigerant inlet connection pipe 27a does not come into contact with the upper side heat insulating material 24a, durability performance of the upper side heat insulating material 24a can be enhanced.

[0057] In the upper side heat insulating material 24a, a most thick portion thereof is located at a position opposed to the heat exchanging section 5a as shown in Fig. 2.

[0058] More specifically, a thickness (t1) of the heat exchanging section upper heat insulating material 24aA opposed to the high temperature heat exchanging section 5a is thicker than a thickness (t2) of the refrigerant outlet side upper heat insulating material 24cA located on the upper sides of the low temperature water inlet connection pipe 28a and the refrigerant outlet connection pipe 27b after heat radiation. Therefore, it is possible to efficiently suppress the heat radiation loss from the high temperature heat exchanging section 5a.

[0059] Due to a relation of counter flow (opposed flow), the low temperature water inlet connection pipe 28a and the refrigerant outlet connection pipe 27b after heat radiation are connected to the same side of the water-refrigerant heat exchanger 5.

[0060] Further, the water-refrigerant heat exchanger 5 covered with the heat insulating material 24 is placed on the bottom plate 11. Therefore, even if the upper side heat insulating material 24a of the water-refrigerant heat exchanger 5 is cooled by air after it is generated by the blast device 9 and it passes through the evaporator 7, it is possible to efficiently suppress the heat radiation loss from the high temperature heat exchanging section 5a. As a result, even if the water-refrigerant heat exchanger 5 is placed on the downstream side of air flow of the evaporator 7, it is possible to provide the heat pump heat source machine 1 including the water-refrigerant heat exchanger 5 having the suppressed heat radiation loss.

[0061] Further, as shown in Fig. 2, the maximum thickness (t1) of the upper side heat insulating material 24a opposed to the upper side of the heat exchanging section 5a of the heat insulating material 24 is thicker than a maximum thickness (t3) of the lower side heat insulating material 24b opposed to the lower side of the heat exchanging section 5a of the heat insulating material 24.

[0062] According to this, the water-refrigerant heat exchanger 5 covered with the heat insulating material 24 is placed on the bottom plate 11. Therefore, even if the upper side heat insulating material 24a of the water-refrigerant heat exchanger 5 is cooled by air after it is generated by the blast device 9 and it passes through the evaporator 7, since the maximum thickness of the upper side heat insulating material 24a opposed to the upper side of the heat exchanging section 5a of the water-refrigerant heat exchanger 5 is thicker than the maximum thickness of the lower side heat insulating material 24b opposed to the lower side of the heat exchanging section

5a of the water-refrigerant heat exchanger 5, the heat exchanging section 5a of the water-refrigerant heat exchanger 5 is not easily cooled. As a result, even if the water-refrigerant heat exchanger 5 is placed on the downstream side of the air flow of the evaporator 7, it is possible to provide the heat pump heat source machine 1 including the water-refrigerant heat exchanger 5 having the suppressed heat radiation loss.

[0063] Fig. 3 is an upper sectional view of essential portions of another water-refrigerant heat exchanger of the heat pump heat source machine of the embodiment of the present invention. In Fig. 3, only portions which are different from those shown in Fig. 2 will be described.

[0064] In Fig. 3, water which is the first fluid and refrigerant which is the second fluid flow through a plurality of (two in this embodiment) water-refrigerant heat exchangers 5 in series.

[0065] More specifically, one ends of the plurality of water-refrigerant heat exchangers 5 are provided with a refrigerant returning connection pipe 27c and a water returning connection pipe 28c to bring the refrigerant flow path 27 and the water-flow path 28 into communication with each other so that water which is the first fluid and refrigerant which is the second fluid can flow into second one of the plurality of water-refrigerant heat exchangers 5 after the water and the refrigerant pass through first one of the water-refrigerant heat exchangers 5.

[0066] A pair of water inlet connection pipe 28a and refrigerant outlet connection pipe 27b, and a pair of water outlet connection pipe 28b and refrigerant inlet connection pipe 27a are connected to the other ends of the plurality of water-refrigerant heat exchangers 5.

[0067] In this case, the water inlet connection pipe 28a and the water outlet connection pipe 28b of the water-refrigerant heat exchanger 5 are supported by the heat insulating material second supporting portion 24bB from below.

[0068] For the plurality of water-refrigerant heat exchangers 5, a water returning connection pipe 28c which corresponds to a water inlet portion and a water outlet portion is supported by a heat insulating material first supporting portion 24bA from below.

[0069] Fig. 5 is a side sectional view of essential portions of another water-refrigerant heat exchanger of the heat pump heat source machine of the embodiment of the invention. In Fig. 5, only different portions from those shown in Fig. 2 will be described.

[0070] In Fig. 5, density of the upper side heat insulating material 24a is larger than that of the lower side heat insulating material 24b. If the density of the upper side heat insulating material 24a is set great, heat insulating performance is enhanced.

[0071] According to this, the water-refrigerant heat exchanger 5 covered with the heat insulating material 24 is placed on the bottom plate 11. Therefore, even if the upper side heat insulating material 24a of the water-refrigerant heat exchanger 5 is cooled by air after it is generated by the blast device 9 and after it passes through

the evaporator 7, the heat insulating material 24 which covers the water-refrigerant heat exchanger 5 is divided at least in the vertical direction, and the density of the upper side heat insulating material 24a is larger than that of the lower side heat insulating material 24b. Hence, the water-refrigerant heat exchanger 5 is not easily cooled. As a result, even if the water-refrigerant heat exchanger 5 is placed on the downstream side of the air flow of the evaporator 7, it is possible to provide a heat pump heat source machine 1 including the water-refrigerant heat exchanger 5 having the suppressed heat radiation loss.

[0072] Fig. 6 is a side sectional view of essential portions of another water-refrigerant heat exchanger of the heat pump heat source machine of the embodiment of the invention. In Fig. 6, only different portions from those shown in Fig. 2 will be described.

[0073] A vacuum heat insulating material 29 is used on an outer surface of a heat insulating material of the upper side heat insulating material 24a opposed at least to the heat exchanging section 5a.

[0074] Since the vacuum heat insulating material 29 having about 1/10 heat conductivity of the foamed heat insulating material is used on the outer surface of the upper side heat insulating material 24a opposed to the heat exchanging section 5a of the water-refrigerant heat exchanger 5, even if a thickness of the heat insulating material around the heat exchanging section 5a which exchanges heat between water and refrigerant of the water-refrigerant heat exchanger 5 is reduced as much as possible, and even if the water-refrigerant heat exchanger 5 is placed on the downstream side of the air flow of the evaporator 7, it is possible to provide a heat pump heat source machine 1 including the water-refrigerant heat exchanger 5 having the suppressed heat radiation loss.

[INDUSTRIAL APPLICABILITY]

[0075] As described above, according to the heat pump heat source machine of the present invention, even if the water-refrigerant heat exchanger is placed on the downstream side of the air flow of the evaporator, since the heat pump heat source machine includes of the water-refrigerant heat exchanger having the suppressed heat radiation loss, the heat pump heat source machine can be applied to a hot water supplying system and a heat pump heater such as a warm water heater.

[EXPLANATION OF SYMBOLS]

[0076]

- 1 heat pump heat source machine
- 2 tank unit
- 3 pipe
- 4 compressor
- 5 water-refrigerant heat exchanger
- 5a heat exchanging section

6 decompressor
 7 evaporator
 8 refrigerant circuit
 9 blast device
 10 hot water-supply cycle
 11 bottom plate
 12 hot water-storing tank
 13 water entering pipe
 14 hot water-supply terminal
 15 hot water-supply pipe
 16 circulation pump
 17 partition plate
 20 right plate
 21 left plate
 22 top plate
 23 front plate
 23a outlet port
 24 heat insulating material
 24a upper side heat insulating material
 24b lower side heat insulating material
 24aA heat exchanging section upper heat insulating material
 24aB heat exchanging section lower heat insulating material
 24bA heat insulating material first supporting portion
 24bB heat insulating material second supporting portion
 24cA refrigerant outlet side upper heat insulating material
 24cB water inlet side lower heat insulating material
 24dA refrigerant inlet side upper heat insulating material
 24dB water inlet/outlet side lower heat insulating material
 25 inner pipe
 26 insertion body
 26a spiral projection
 27 refrigerant flow path
 27a refrigerant inlet connection pipe (refrigerant inlet portion)
 27b refrigerant outlet connection pipe (refrigerant outlet portion)
 27c refrigerant returning connection pipe
 28 water-flow path
 28a water inlet connection pipe (water inlet portion)
 28b water outlet connection pipe (water outlet portion)
 28c water returning connection pipe
 29 vacuum heat insulating material

compressor (6) and an evaporator (7) to one another through a pipe (3), refrigerant being circulated in the pipe (3);
 a blast device (9) for generating air which passes through the evaporator (7); and
 a bottom plate (11) on which the evaporator (7) is placed, wherein
 the water-refrigerant heat exchanger (5) is covered with a heat insulating material (24),
 the water-refrigerant heat exchanger (5) includes a water inlet portion (28a), a water outlet portion (28b), and a heat exchanging section (5a) which exchanges heat between water and the refrigerant,
 the water inlet portion (28a) and the water outlet portion (28b) of the water-refrigerant heat exchanger (5) are supported by a supporting portion (24bA, 24bB) of the heat insulating material (24), and
 a gap is provided between the heat exchanging section (5a) and an inner surface of the heat insulating material (24) .

2. The heat pump heat source machine according to claim 1, wherein the water-refrigerant heat exchanger (5) is placed on the bottom plate (11) in a state where the water-refrigerant heat exchanger (5) is covered with the heat insulating material (24) .

3. The heat pump heat source machine according to claim 1 or 2, wherein a most thick portion of the heat insulating material (24) located on an upper side of the water-refrigerant heat exchanger (5) is formed at a position opposed to the heat exchanging section (5a).

4. The heat pump heat source machine according to claim 2, wherein a maximum thickness of a portion of the heat insulating material (24) opposed to an upper side of the heat exchanging section (5a) is thicker than a maximum thickness of a portion of the heat insulating material (24) opposed to a lower side of the heat exchanging section (5a).

5. The heat pump heat source machine according to claim 2, wherein the heat insulating material (24) is divided at least in a vertical direction, and density of the heat insulating material (24) on an upper side thereof is larger than density of the heat insulating material (24) on a lower side thereof.

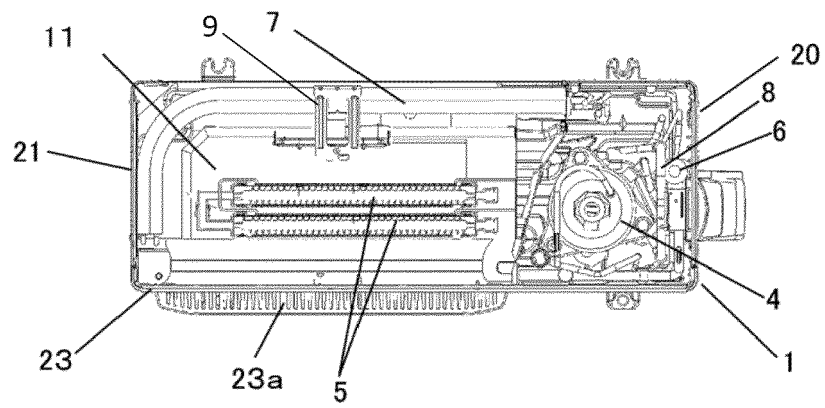
6. The heat pump heat source machine according to any one of claims 1 to 5, wherein a vacuum heat insulating material is used on an outer surface of the heat insulating material (24) at least opposed to the heat exchanging section (5a).

Claims

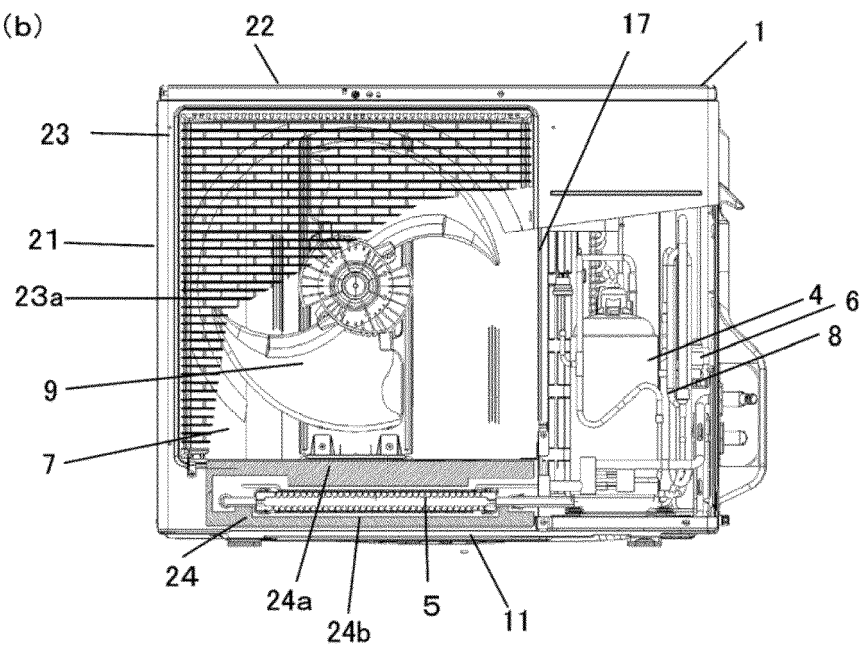
1. A heat pump heat source machine comprising:
 a refrigerant circuit (8) formed by annularly connecting a compressor (4), a refrigerant flow path of a water-refrigerant heat exchanger (5), a de-

[Fig. 1]

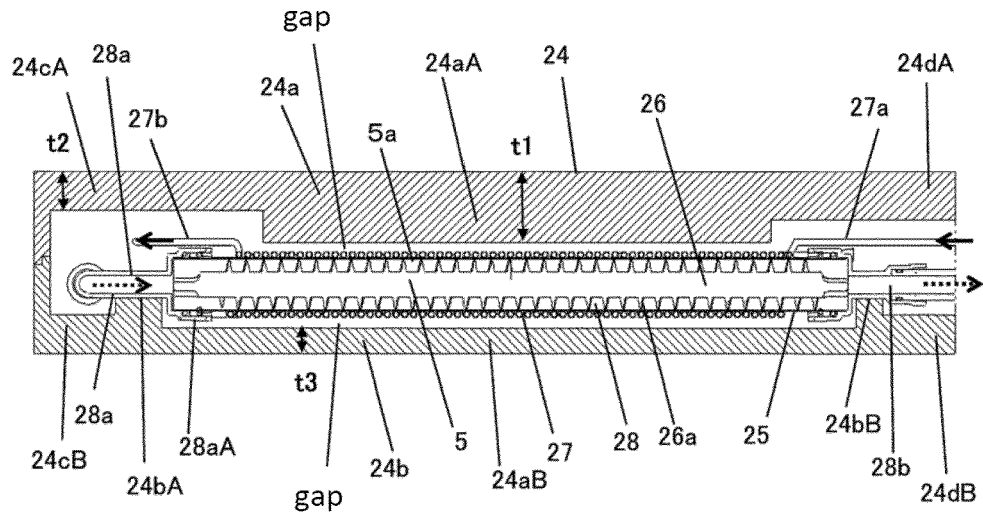
(a)



(b)

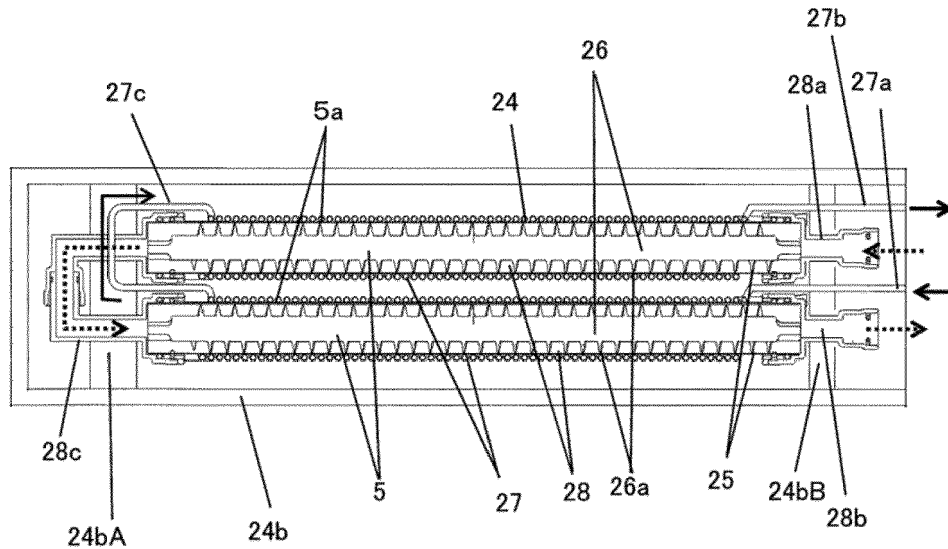


[Fig. 2]



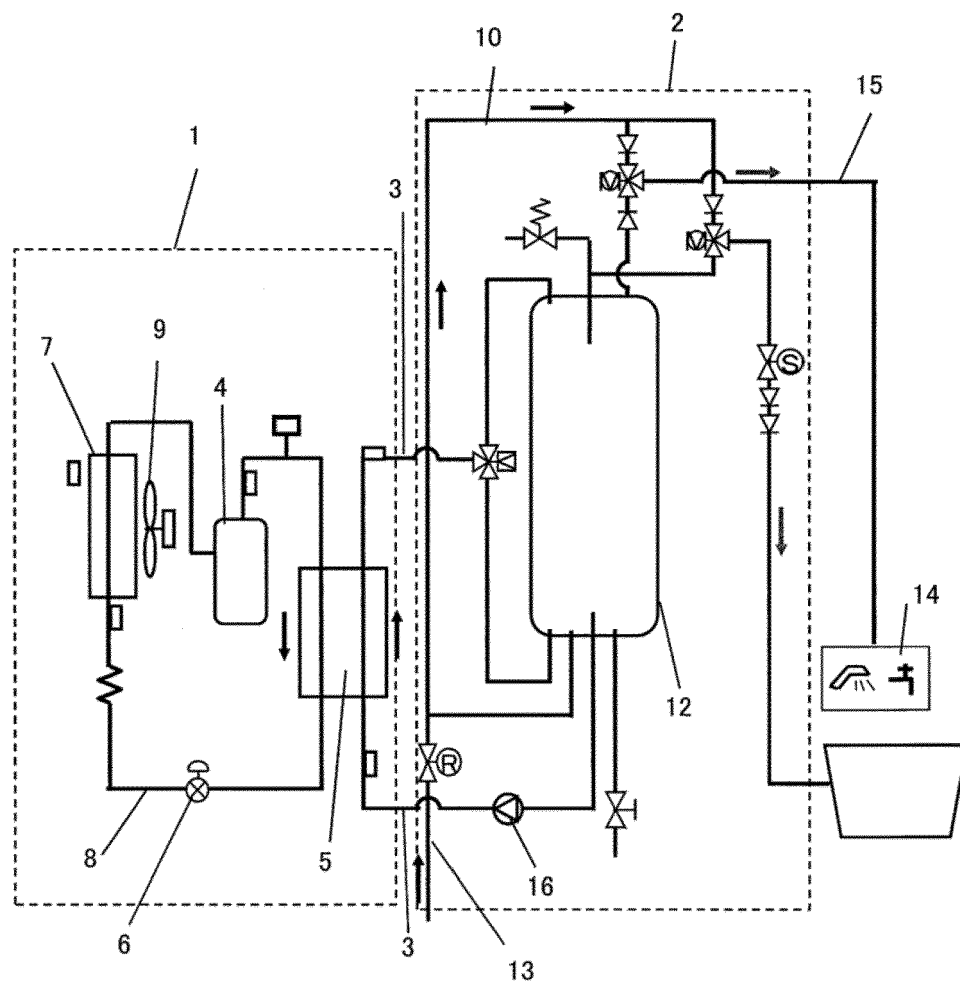
- 5 Water-refrigerant heat exchanger
- 5a Heat exchanging section
- 24 Heat insulating material
- 24a Upper side heat insulating material
- 24b Lower side heat insulating material
- 24aA Heat exchanging section upper heat insulating material
- 24aB Heat exchanging section lower heat insulating material
- 24bA Heat insulating material first supporting portion
- 24bB Heat insulating material second supporting portion
- 24cA Refrigerant outlet side upper heat insulating material
- 24cB Water inlet side lower heat insulating material
- 24dA Refrigerant inlet side upper heat insulating material
- 24dB Water inlet/outlet side lower heat insulating material
- 25 Inner pipe
- 26 Insertion body
- 26a Spiral projection
- 27 Refrigerant flow path
- 27a Refrigerant inlet connection pipe
- 27b Refrigerant outlet connection pipe
- 28 Water-flow path
- 28a Water inlet connection pipe
- 28b Water outlet connection pipe

[Fig. 3]

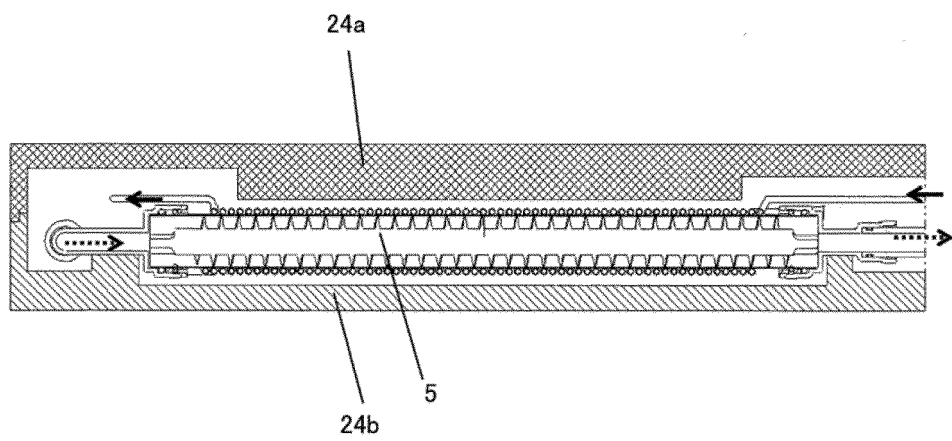


- 5 Water-refrigerant heat exchanger
- 5a Heat exchanging section
- 24 Heat insulating material
- 24b Lower side heat insulating material
- 24bA Heat insulating material first supporting portion
- 24bB Heat insulating material second supporting portion
- 25 Inner pipe
- 26 Insertion body
- 26a Spiral projection
- 27 Refrigerant flow path
- 27a Refrigerant inlet connection pipe
- 27b Refrigerant outlet connection pipe
- 27c Refrigerant returning connection pipe
- 28 Water-flow path
- 28a Water inlet connection pipe
- 28b Water outlet connection pipe
- 28c Water returning connection pipe

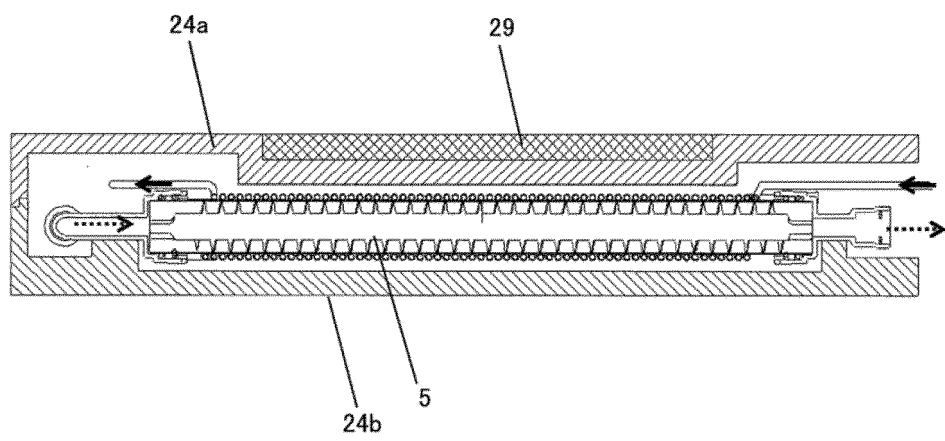
[Fig. 4]



[Fig. 5]



[Fig. 6]





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			F25B F24F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 9 July 2020	Examiner Amous, Moez
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