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Description

[TECHNICAL FIELD]

[0001] The present invention relates to a hot water generator for heating water using a refrigeration cycle.

[BACKGROUND TECHNIQUE]

[0002] As conventional hot water generators of this kind, there is one integrally provided with a heat pump apparatus, a water heat exchanger and a pump (see patent document 1 for example). In the heat pump apparatus, a compressor, a water heat exchanger (radiator) which exchanges heat between refrigerant and water to produce hot water, an expansion valve, and an air heat exchanger which exchanges heat between refrigerant and air are annularly connected to one another through a refrigerant pipe. The pump circulates hot water between a heater terminal and a hot water supplying terminal.

[0003] According to the hot water generator described in patent document 1, a hot water unit is placed above a heat pump unit. A compressor, an expansion valve, an air heat exchanger and constituent elements of other refrigerant circuit are accommodated in the heat pump unit. Constituent elements of a water circuit such as a water heat exchanger and a pump are accommodated in a hot water unit. Hot water produced by the heat pump apparatus is supplied to a heater terminal and a hot water supplying terminal through a water pipe connecting portion provided in the hot water unit.

[0004] Patent Document 2, forming the closest prior art, discloses all features of the preamble of claim 1 of the present invention.

[PRIOR ART DOCUMENT]

[PATENT DOCUMENT]

[0005]

[Patent Document 1] Japanese Patent Application Laid-open No.2010-144986

[Patent Document 2] European Patent Application Laid-open No. 2 530 938

[SUMMARY OF THE INVENTION]

[PROBLEM TO BE SOLVED BY THE INVENTION]

[0006] However, the conventional configuration has the following problems. Since the heat pump unit and the hot water unit are separately provided, the hot water generator which is integrally formed together with them becomes large in size. Further, since the hot water unit is provided above the heat pump unit, if a draining operation of a water pipe is carried out, it is necessary to carefully carry out the operation to keep water away from the heat pump unit. Moreover, air stays in the water pipe depending upon a positional relation between the pump, the water heat exchanger and the water pipe connecting portion, and an air-removing operation becomes complicated.

[0007] The present invention has been accomplished to solve the conventional problems, and it is an object of the invention to provide a small hot water generator having excellent maintenance operability.

[MEANS FOR SOLVING THE PROBLEM]

[0008] To solve the conventional problems, the present invention provides a hot water generator including: a refrigerant circuit formed by annularly connecting, to one another through a refrigerant pipe, a compressor, a first heat exchanger which exchanges heat between refrigerant and water, an expansion valve, and a second heat exchanger which exchanges heat between refrigerant and air; a water circuit formed by connecting, to each other through a water pipe, the first heat exchanger and a pump which sends water to the first heat exchanger under pressure; a fan which blows air into the second heat exchanger; a blowing chamber in which at least the fan is placed; a machine chamber in which at least the compressor is placed; an outer covering body which covers the blowing chamber and the machine chamber; a first connection port through which water flows into the water circuit; and a second connection port through which water flowing through the water circuit flows out, wherein the second connection port is placed at a location higher than the first connection port in a vertical direction, the first heat exchanger is placed at a location lower than the first connection port in the vertical direction, and a suction port and a discharge port of the pump are placed at height which is equal to or higher than the first connection port and which is equal to or lower than the second connection port in the vertical direction, wherein the water pipe connects the discharge port of the pump and the first heat exchanger to each other , reaches the highest position of the water circuit.

[0009] According to this, the refrigerant circuit and the water circuit can be accommodated in the outer covering body, and the hot water generator can be made small in size. A draining operation and an air-removing operation can easily be carried out, and maintenance operability can be enhanced.

[EFFECT OF THE INVENTION]

[0010] According to the present invention, it is possible to provide a small hot water generator having excellent maintenance operability.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[0011]

Fig. 1 is a perspective view of an outward appearance of a hot water generator according to an embodiment of the present invention;
Fig. 2(a) is a top view showing an internal structure of the hot water generator, and Fig. 2(b) is a front view showing the internal structure of the hot water generator;
Fig. 3 is a sectional view taken along a line B-B in Fig. 1;
Fig. 4 is a side view of Fig. 1 showing the internal structure as viewed from a direction A; and
Fig. 5 is an enlarged view of essential portions of Fig. 2(b).

[MODE FOR CARRYING OUT THE INVENTION]

[0012] A first aspect of the present invention provides a hot water generator including: a refrigerant circuit formed by annularly connecting, to one another through a refrigerant pipe, a compressor, a first heat exchanger which exchanges heat between refrigerant and water, an expansion valve, and a second heat exchanger which exchanges heat between refrigerant and air; a water circuit formed by connecting, to each other through a water pipe, the first heat exchanger and a pump which sends water to the first heat exchanger under pressure; a fan which blows air into the second heat exchanger; a blowing chamber in which at least the fan is placed; a machine chamber in which at least the compressor is placed; an outer covering body which covers the blowing chamber and the machine chamber; a first connection port through which water flows into the water circuit; and a second connection port through which water flowing through the water circuit flows out, wherein the second connection port is placed at a location higher than the first connection port in a vertical direction, the first heat exchanger is placed at a location lower than the first connection port in the vertical direction, and a suction port and a discharge port of the pump are placed at height which is equal to or higher than the first connection port and which is equal to or lower than the second connection port in the vertical direction.

[0013] According to this, it is possi to efficiently lay out the refrigerant circuit and the water circuit in the outer covering body, and it is possible to downsize the hot water generator.

[0014] When a user starts using the hot water generator, water is poured into the water circuit and the air-removing operation is carried out. During a maintenance operation carried out by the air-removing operation, if water is poured from the first connection port in a state where the second connection port is opened into atmosphere, water which was poured into the water circuit is pushed up to a height of the second connection port. Here, the second connection port is provided at a location higher than the first heat exchanger and at the same height as the pump or at a location higher than the pump. Air generated by pouring water into the water circuit moves to a location higher than the pump and the first heat exchanger and is discharged out from the second connection port. Hence, air does not stay in the water circuit, maintenance operability is enhanced, a circulation flow rate of liquid when the pump is driven is stabilized, and heat exchanging efficiency in the first heat exchanger can be maintained at a high level. The first connection port is provided at the same height as the pump or at a location higher than the pump. Hence, in the draining operation in the water circuit, water staying in the pump is discharged from the first connection port only by opening the first connection port. Therefore, maintenance operability is further enhanced.

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[0015] When a user starts using the hot water generator, an air-removing operation is carried out. In this case, if water is poured from the first connection port in a state where the second connection port is opened into atmosphere, water which was poured into the water circuit is pushed up to a height of the second connection port. At this time, if an amount of air remaining in the water circuit is high, air can not be moved even by momentum of water which is sent by the pump under pressure and especially, air adversely remains in the pump in some cases.

[0016] Here, if a portion of the water pipe (discharge pipe) which connects the discharge port and the first heat exchanger to each other is placed at a location higher than the second connection port, air naturally moves from the pump toward the discharge pipe. Hence, even when the amount of air remaining in the water circuit is high, air does not remain especially in the pump, maintenance becomes easy, and the circulation flow rate of water which is circulated by the pump can be stabilized. Therefore, the circulation flow rate is stabilized, and efficiency of the first heat exchanger can be enhanced. Air does not remain in the pump, turbulence of water flow when the pump is driven is suppressed, it is possible to restrain flowing sound from generating, and noise can be reduced. Since the efficiency of the first heat exchanger is enhanced, capacities of the first heat exchanger and the second heat exchanger are reduced, and it is possible to reduce the hot water generator in size and in weight. Hence, it is possible to reduce the production cost of the hot water generator.

[0017] If air remaining in the water circuit flows through the first heat exchanger which is heated to high temperature, this may rot the water pipe. According to the present invention, even if air flows into the water circuit, it is possible to make air stay in a portion of the discharge pipe on the upstream side from the first heat exchanger which is heated to high temperature. Hence, it is possible to restrain air from flowing into the first heat exchanger

and to enhance durability of the hot water generator.

[0018] According to a second aspect of the invention, in the first aspect, the discharge port is placed such that it is oriented in a horizontal direction or oriented upward from the horizontal direction.

[0019] According to this, air which flows into the pump is smoothly discharged from the discharge port which is placed such that it is oriented in the horizontal direction or oriented upward from the horizontal direction, and it is possible to restrain air from remaining in the pump. Further, water flow generated by driving the pump is formed upward from the horizontal direction. By driving the pump, air which flows into the pump can smoothly be discharged.

[0020] When the hot water generator is not used for a long term, the draining operation for discharging water in the water circuit is carried out. In the maintenance carried out by the draining operation, if the first connection port and the second connection port are opened, water in the pump and water in the discharge pipe are discharged from the first connection port. At this time, since the discharge port of the pump is placed such that it is oriented upward from the horizontal direction, it is possible to smoothly flow water from the discharge port toward the suction port, and to discharge water from the pump. Hence, it is possible to restrain water from remaining in the pump, and to avoid a case where volume of water is increased by freezing and the pump is damaged by water.

[0021] Further, when the hot water generator is used again in a state where water remaining in the pump freezes, if water is poured from the first connection port and the second connection port into the water circuit, water flows from the discharge port of the pump toward the suction port. Hence, water which froze in the pump can be melted quickly.

[0022] According to a third aspect of the invention, in any one of first or second aspect, the hot water generator further including a drainage port provided in a tip end of a drainpipe which branches off from the water pipe, the drainpipe is placed at a position lower than a water flowpath of the first heat exchanger, and a difference in height between the suction port and the drainage port in the vertical direction is greater than a difference in height between the suction port and the first connection port.

[0023] According to this, when the draining operation in the water circuit is carried out, if the first connection port, the second connection port and the drainage port are opened, air flows into the water circuit, and water in the water circuit can be discharged out from the drainage port. Entire water in the water circuit is not completely discharged by the draining operation. However, since air flows into the water circuit, even if water remaining in the water circuit freezes and its volume is expanded, it is possible to prevent the water pipe from being damaged.

[0024] If a difference in height between the suction port and the drainpipe in the vertical direction is made greater than a difference in height between the suction port and the first connection port, it is possible to increase a pressure difference applied in the pump. Hence, it is possible to reliably discharge water staying in the pump.

[0025] An embodiment of the present invention will be described with reference to the drawings. The invention is not limited to the embodiment.

[0026] Fig. 1 is a perspective view of an outward appearance of a hot water generator according to an embodiment, Fig. 2 (a) is a top view showing an internal structure of the hot water generator, Fig. 2(b) is a front view showing the internal structure of the hot water generator, Fig. 3 is a sectional view taken along a line B-B in Fig. 1, Fig. 4 is a side view of Fig. 1 showing the internal structure as viewed from a direction A, and Fig. 5 is an enlarged front view of essential portions of Fig. 2(b).

[0027] To make the explanation easy, Fig. 2(a) does not show a portion of an upper plate 1e, and Fig. 2 (b) does not show portions of a fan 33, a water heat exchanger (first heat exchanger) 22 and a heat insulator 41. To make the explanation easy, Fig. 4 shows a water circuit 50, an air heat exchanger (second heat exchanger) 24, the upper plate 1e and a bottom plate 1d.

[0028] As shown in Fig. 1, the hot water generator in the embodiment includes an outer covering body 1. As shown in Figs. 1 to 4, the outer covering body 1 is composed of a front plate 1a, a right side plate 1b, a left side plate 1c, the bottom plate 1d and the upper plate 1e. The right side plate 1b includes a first connection port 51 and a second connection port 52 which project from the outer covering body 1. There is also provided a cover 1f which covers the first connection port 51 and the second connection port 52. The first connection port 51 supplies water to the hot water generator, and the second connection port 52 flows out hot water produced by the hot water generator.

[0029] As shown in Fig. 3, the front plate 1a includes a bell mouth-shaped orifice 31. According to this, an air outlet 32 from which air flows out from an interior of the hot water generator is formed.

[0030] A surface (back surface) of the hot water generator which is opposite from the front plate 1a of the hot water generator is covered with an air heat exchanger 24 placed on the bottom plate 1d. For example, when the air heat exchanger 24 is disposed up to a left side surface of the hot water generator so that the upper plate 1e can be fixed, the left side plate 1c may be omitted.

[0031] The hot water generator includes a refrigerant circuit 20 which configures a refrigeration cycle. The refrigerant circuit 20 is configured by annularly connecting the following members to one another through a refrigerant pipe; i.e., a compressor 21 which compresses refrigerant, a water heat exchanger 22 which exchanges heat between refrigerant and water, an expansion valve (decompressor) 23 which expands refrigerant, and an air heat exchanger 24 which exchanges heat between refrigerant and air. At the time of heating operation for producing hot water, the compressor 21 is driven, and an opening degree of the expansion valve 23 is controlled, thereby making high temperature and high pressure gas

refrigerant flow into the water heat exchanger 22. The high temperature and high pressure gas refrigerant dissipates heat in the water heat exchanger 22 and hot water is produced.

[0032] As shown in Fig. 3, the water heat exchanger 22 is a double pipe type heat exchanger in which a refrigerant pipe through which refrigerant flows is accommodated in a water pipe through which water flows. This double pipe is wound into a coiled shape and is formed into a substantially rectangular parallelepiped shape. A periphery of the water heat exchanger 22 is covered with the heat insulator 41. Heat radiation loss from the water heat exchanger 22 is reduced by the heat insulator 41. The heat insulator 41 is made of foamed resin material. Of a periphery of the heat insulator 41, its upper surface and a side surface are covered with a casing 42 which is made of erosion-resistant metal. The casing 42 suppresses deterioration of the heat insulator 41 caused by heat, ultraviolet, rain and ozone, and the casing 42 prevents heat exchanging performance when hot water is produced from deteriorating. The upper surface of the heat insulator 41 is a surface on the side of the upper plate 1e of the heat insulator 41, and the side surface of the heat insulator 41 is surfaces of the heat insulator 41 other than a surface on the side of the upper plate 1e and a surface on the side of the bottom plate 1d.

[0033] As shown in Fig. 2, the hot water generator includes the water circuit 50. As shown in Figs. 2 and 4, the water circuit 50 is configured by connecting the following members to one another through a water pipe; i.e., the first connection port 51 through which water flows from outside into the water circuit 50, a pump 54, a water flow-path (water inlet 22a) of the water heat exchanger 22, and the second connection port 52 through which water flowing through the water circuit 50 flows to outside. Here, the first connection port 51 and a suction port 54a of the pump 54 are connected to each other through a water inlet pipe (suction pipe) 53, a discharge port 54b and the water heat exchanger 22 are connected to each other through a discharge pipe 55, and the water heat exchanger 22 and the second connection port 52 are connected to each other through a hot water outlet pipe 57. The discharge pipe 55 is provided with an entering-water sensor 16 which detects temperature of water flowing through the interior, and the hot water outlet pipe 57 is provided with an outgoing-water sensor 17.

[0034] A drainpipe 56 is connected to the water circuit 50. The drainpipe 56 is formed such that it branches off from any one of water pipes which form the water circuit 50, and a tip end of the drainpipe 56 is provided with a drainage port 56a which can open and close. The drainage port 56a is exposed from the outer covering body 1. According to this, a later-described draining operation becomes easy, and maintenance operability is enhanced. In this embodiment, the drainage port 56a is provided below the right side plate 1b.

[0035] It is preferable that the drainpipe 56 is formed at a lowest location in the water circuit 50. According to this, the later-described draining operation becomes easy. In this embodiment, the drainpipe 56 branches off from a lowest location of the discharge pipe 55 and extends downward toward the drainage port 56a as shown in Fig. 4. According to this, the drainpipe 56 is placed below the water flow-path (water inlet 22a) of the water heat exchanger 22.

[0036] The pump 54 includes a centrifugal impeller which sends water into its interior under pressure. The suction port 54a is provided in a rotation shaft direction of the centrifugal impeller, and an end of a case in which the centrifugal impeller is accommodated is provided with the discharge port 54b from which water flows out. The discharge port 54b is provided above the suction port 54a, and the discharge port 54b is oriented upward from the horizontal direction.

[0037] As shown in Fig. 2, an interior of the hot water generator is separated into a blowing chamber 91 and a machine chamber 92 by a partition plate 90. The outer covering body 1 covers at least upper surfaces, bottom surfaces, front surfaces and right side surfaces of peripheries of the blowing chamber 91 and the machine chamber 92.

[0038] The water heat exchanger 22 covered with the heat insulator 41, the air heat exchanger 24, the fan 33 for blowing air on the air heat exchanger 24, a fan motor 34 for rotating the fan 33, and a column 35 for supporting and fixing the fan motor 34 are placed in the blowing chamber 91. The water heat exchanger 22 covered with the heat insulator 41 is placed on the bottom plate 1d.

[0039] As described above, the upper surface and the side surface of the heat insulator 41 are covered with the casing 42. Hence, the heat insulator 41 is covered with the casing 42 and the bottom plate 1d. According to this, it is possible to restrain the heat insulator 41 from being exposed to heat, ultraviolet, rain and ozone, and to restrain the heat insulator 41 from deteriorating.

[0040] The water heat exchanger 22 is placed on the downwind side with respect to a direction of air flowing through the blowing chamber 91 as compared with the air heat exchanger 24. During operation of the hot water generator, temperature around the air heat exchanger 24 is lower than outside air temperature by about 5 to 8K. During operation of the hot water generator, temperature of the water heat exchanger 22 becomes high up to about 90°C. That is, in winter when outside air temperature is low and very hot water is produced, a temperature difference between the periphery of the air heat exchanger 24 and the water heat exchanger 22 becomes high up to about 100K.

[0041] Hence, when a periphery of the heat insulator 41 is covered with the casing 42, it is preferable that a space is provided between the casing 42 and the heat insulator 41 on the upwind side of the heat insulator 41. This space forms a heat-insulating layer, and high heat-retaining performance of the water heat exchanger 22 can be maintained. Further, it is possible to prevent rain which enters the blowing chamber 91 from coming into

contact with the heat insulator 41, and to prevent aged deterioration of the heat insulator 41.

[0042] Since the water heat exchanger 22 is covered with the heat insulator 41 and the casing 42, it is possible to place the water heat exchanger 22 adjacent to the air heat exchanger 24. That is, the water heat exchanger 22 can be placed in the blowing chamber 91, and the hot water generator can be downsized.

[0043] Of the refrigerant circuit 20, a refrigerant pipe configuring the compressor 21, the expansion valve 23 and the refrigerant circuit 20 is placed in the machine chamber 92. The air heat exchanger 24 is placed on the side of a surface (back surface) opposite from the front plate 1a such that it straddles the blowing chamber 91 and the machine chamber 92. It is only necessary that the air heat exchanger 24 is placed at least in the blowing chamber 91, and the air heat exchanger 24 need not extend from the blowing chamber 91 to the machine chamber 92.

[0044] Of the water circuit 50, the water inlet pipe 53, the pump 54, the discharge pipe 55 and the hot water outlet pipe 57 are placed in the machine chamber 92. The water inlet pipe 53 and the hot water outlet pipe 57 are placed closer to the front plate 1a and the right side plate 1b than the compressor 21. According to this, when maintenance of the water heat exchanger 22 becomes necessary, since the water heat exchanger 22 and the water pipe connected to the water heat exchanger 22 are exposed only by detaching the front plate 1a, maintenance operability is enhanced.

[0045] Next, action of water flowing in the water circuit 50 during a heating operation for producing hot water by the hot water generator, and a positional relation of constituent elements of the water circuit 50 will be described based on Figs. 2 and 5.

[0046] In the heating operation, the compressor 21, the expansion valve 23 and the pump 54 are controlled by a controller 25. Based on detection values of the entering-water sensor 16 and the outgoing-water sensor 17, the controller 25 controls the compressor 21, the expansion valve 23 and the pump 54 such that the detection value of the outgoing-water sensor 17 becomes equal to predetermined temperature.

[0047] Water which flows from outside into the water circuit 50 through the first connection port 51 flows from the first connection port 51 into the water inlet pipe 53 which extends in the horizontal direction. Water which flows through the water inlet pipe 53 flows from the suction port 54a of the pump 54 into the pump 54. Here, as shown in Fig. 5, the first connection port 51, the water inlet pipe 53 and the suction port 54a are placed such that their heights become the same in the vertical direction. According to this, the draining operation becomes simple as will be described later. It is only necessary that a height of the suction port 54a is equal to or higher than the first connection port 51. It is only necessary that the water inlet pipe 53 is formed such that its position becomes higher from the first connection port 51 toward the suction port 54a. According to this, the draining operation becomes simple and the maintenance operability can be enhanced as will be described later.

[0048] The pump 54 is placed such that the discharge port 54b is located higher than the suction port 54a. The suction port 54a is formed in the horizontal direction or upward from the horizontal direction. According to this, air is restrained from remaining in the pump 54. Hence, maintenance operability which is carried out when a user starts using the hot water generator is enhanced, and durability of the pump 54 is also enhanced.

[0049] Water which flows from the suction port 54a into the pump 54 flows out from the discharge port 54b and flows through the discharge pipe 55. The discharge pipe 55 extends upward from a connecting portion between the discharge pipe 55 and the discharge port 54b and reaches a highest position of the water circuit 50. According to this, since air which flows into the pump 54 flows toward the discharge pipe 55 which extends upward from the pump 54, this configuration restrains air from remaining in the pump 54. This configuration prevents the pump 54 from being driven in a state where air remains in the pump 54. Hence, the air-removing operation which is carried out when a user starts using the hot water generator becomes simple, and maintenance operability is enhanced. Durability of the pump 54 is also enhanced. A portion (uppermost portion) of the discharge pipe 55 is located at a highest position of the water circuit. Hence, if a water surface in the water circuit 50 is pushed up to a position of the second connection port 52, air which flows into the water circuit 50 is pushed up to the highest position of the discharge pipe 55. Therefore, air does not flow toward the other constituent elements of the water circuit 50.

[0050] As shown in Fig. 5, the discharge pipe 55 reaches the highest position of the water circuit 50, and a portion of the discharge pipe 55 located downstream (on the side of water heat exchanger 22) of the highest position extends to a lowest position of the water circuit 50 except the drainpipe 56. The lowest position of the water circuit 50 except the drainpipe 56 is a lowest position of the water flow-path (water inlet 22a) which forms the water heat exchanger 22 or a position lower than the lowest position. The discharge pipe 55 is connected to the water flow-path (water inlet 22a) of the water heat exchanger 22 at the lowest position of the water circuit 50 except the drainpipe 56.

[0051] Water which flowed into the water heat exchanger 22 exchanges heat with high temperature and high pressure gas refrigerant and becomes hot water. The produced hot water flows out from the water heat exchanger 22 into the hot water outlet pipe 57 through a water outlet 22b which is formed at a location higher than the water inlet 22a. The hot water outlet pipe 57 connects the water outlet 22b and the second connection port 52 to each other. The second connection port 52 is placed at a location higher than the first connection port 51 in the vertical direction. Hot water which flows through the

hot water outlet pipe 57 flows from the second connection port 52 to outside of the water circuit 50. It is only necessary that the second connection port 52 is placed at a location higher than the discharge port 54b of the pump 54 and lower than a portion (uppermost portion) of the discharge pipe 55 which is placed at a highest position of the water circuit 50. According to this, in the air-removing operation, water which was poured into the water circuit 50 is pushed up to a height of the second connection port 52 as will be described later. Hence, it is possible to prevent air from remaining in the pump 54, and the maintenance operability is enhanced. A circulation flow rate of water when the pump 54 is driven is stabilized, and it is possible to maintain high heat exchanging efficiency in the water heat exchanger 22.

[0052] Next, a draining operation which is carried out when the hot water generator is not used for a long term for example will be described.

[0053] When the hot water generator is not used for a long term, water staying in the water circuit 50 freezes in some cases. If water staying in the water circuit 50 freezes, since its volume expands, constituent elements of the water circuit 50 are broken. Hence, when the hot water generator is not used for a long term, the draining operation (maintenance) is required.

[0054] The draining operation is carried out by opening (releasing) the first connection port 51, the second connection port 52 and the drainage port 56a into atmosphere. If the first connection port 51, the second connection port 52 and the drainage port 56a are opened (released), water staying in the water circuit 50 is discharged out from the first connection port 51 and the drainage port 56a.

[0055] That is, water staying between the uppermost portion of the discharge pipe 55 and the second connection port 52 is discharged out from the drainage port 56a through the drainpipe 56 which branches off from the discharge pipe 55. Water staying between the first connection port 51 and the uppermost portion of the discharge pipe 55 is discharged out from the first connection port 51.

[0056] Here, the drainpipe 56 is placed at a lowest location of the water circuit 50. Hence, during the draining operation, most of water staying between the uppermost portion of the discharge pipe 55 and the second connection port 52 can reliably be discharged out.

[0057] The suction port 54a is placed at a height equal to or higher than the first connection port 51, and the water inlet pipe 53 is placed such that it is oriented in the horizontal direction or such that the suction port 54a becomes higher than the first connection port 51. The pump 54 is placed such that the discharge port 54b becomes higher than the suction port 54a. Hence, in the draining operation, most of water staying between the first connection port 51 and the uppermost portion of the discharge pipe 55 can reliably be discharged out from the first connection port 51.

[0058] Further, a difference in height between the suction port 54a of the pump 54 and the drainage port 56a is greater than a difference in height between the suction port 54a and the first connection port 51. According to this, a pressure difference generated between the drainage port 56a and the pump 54 is increased. Generally, if the pump 54 is at a stop, since the centrifugal impeller in the pump 54 is fixed, it becomes difficult to discharge water staying in the pump 54. On the other hand, if the difference in height between the suction port 54a and the drainage port 56a is increased, a pressure difference generated between the drainage port 56a and the pump 54 can be increased. Hence, especially even during the draining operation which is carried out in a state where the pump 54 is stopped, most of water in the water circuit 50 can reliably be discharged out. Hence, it is possible to reduce water remaining in the water circuit 50 and to avoid damage which may be caused by freezing of water.

[0059] Next, the air-removing operation which is carried out when a user starts using the hot water generator or when the hot water generator is again used after the draining operation of the hot water generator is carried out will be described.

[0060] The air-removing operation is carried out by closing the drainage port 56a, opening the second connection port 52 and pouring water from the first connection port 51. If water is poured from the first connection port 51 in a state where the second connection port 52 is opened, a water surface in the water circuit 50 is pushed up to a height of the second connection port 52. Since the second connection port 52 is provided at a location higher than the water heat exchanger 22 and the pump 54, air existing in the water circuit 50 moves to a location higher than the pump 54 and the water heat exchanger 22. Hence, it is possible to restrain air from remaining in the pump 54 and the water heat exchanger 22. If the pump 54 is driven in a state where the second connection port 52 is opened (released) into atmosphere, it is possible to almost completely discharge air remaining in the water circuit 50 by water which flows and moves in the water circuit 50.

[0061] According to this, it is possible to prevent air from remaining in the pump 54 and to enhance as durability of the pump 54. Further, since the circulation flow rate of water which is made to flow and move by the pump 54 is stabilized, it is possible to enhance the heat exchanging efficiency in the water heat exchanger 22. Since the discharge port 54b is located higher than the suction port 54a and the discharge port 54b is formed such that it is oriented upward from the horizontal direction, air which flows into the pump 54 is easily discharged out from the discharge port 54b.

[0062] A portion (uppermost portion) of the discharge pipe 55 extends to a location higher than the second connection port 52. Hence, even if a large amount of air flows into the pump 54, a space into which air flowing in the pump 54 can be released is formed. Therefore, it is possible to prevent air from remaining in the pump 54. Air remaining in the water circuit 50 includes oxygen. If tem-

perature of this air becomes high, the air can be a factor which rots the water pipe and the water flow-path (water inlet 22a) of the water heat exchanger 22. In this embodiment, a portion of the discharge pipe 55 located on the upstream side from the water heat exchanger 22 is placed at a highest location in the water circuit 50, and the space into which air is released is formed. Hence, air does not flow into the water heat exchanger 22 and durability of the hot water generator can be enhanced.

[0063] As described above, the hot water generator of the present invention can be downsized while accommodating the water heat exchanger 22 and the pump 54 in the outer covering body 1. The suction port 54a and the discharge port 54b of the pump 54 are placed within a height range L which is equal to or higher than the first connection port 51 and which is equal to or lower than the second connection port 52. Therefore, maintenance such as the draining operation and the air-removing operation can be simplified. The height which is equal to or higher than the first connection port 51 is a height which is equal to or higher than a lowermost portion of the first connection port 51, and the height which is equal to or lower than the second connection port 52 is a height which is equal to or lower than the uppermost portion of the second connection port 52.

[INDUSTRIAL APPLICABILITY]

[0064] As described above, according to the hot water generator of the present invention, the heat exchanger and the pump are placed in the outer covering body, the hot water generator is downsized and the maintenance operability is excellent. Therefore, the hot water generator of the invention is suitable as domestic and professional-use hot water generators.

[EXPLANATION OF SYMBOLS]

[0065]

1	outer covering body
20	refrigerant circuit
21	compressor
22	water heat exchanger (first heat exchanger)
23	decompressor (expansion valve)
24	air heat exchanger (second heat exchanger)
33	fan
35	column
41	heat insulator
42	casing
50	water circuit
51	first connection port
52	second connection port
54	pump
54a	suction port
54b	discharge port
55	discharge pipe
56	drainpipe
56a	drainage port
91	blowing chamber
92	machine chamber

Claims

1. A hot water generator, comprising:

a refrigerant circuit (20) formed by annularly connecting, to one another through a refrigerant pipe, a compressor (21), a first heat exchanger (22) which exchanges heat between refrigerant and water, an expansion valve (23), and a second heat exchanger (24) which exchanges heat between refrigerant and air;
a water circuit (50) formed by connecting, to each other through a water pipe, the first heat exchanger (22) and a pump (54) which sends water to the first heat exchanger (22) under pressure;
a fan (33) which blows air into the second heat exchanger (24);
a blowing chamber (91) in which at least the fan (33) is placed;
a machine chamber (92) in which at least the compressor (21) is placed;
an outer covering body (1) which covers the blowing chamber (91) and the machine chamber (92);
a first connection port (51) through which water flows into the water circuit (50); and
a second connection port (52) through which water flowing through the water circuit (50) flows out, wherein

the second connection port (52) is placed at a location higher than the first connection port (51) in a vertical direction,
the first heat exchanger (22) is placed at a location lower than the first connection port (51) in the vertical direction, and
a suction port (54a) and a discharge port (54b) of the pump (54) are placed at height which is equal to or higher than the first connection port (51) and which is equal to or lower than the second connection port (52) in the vertical direction,
characterized in that a discharge pipe (55) which connects the discharge port (54b) of the pump (54) and the first heat exchanger (22) to each other, reaches the highest position of the water circuit (50).

2. The hot water generator according to claim 1, wherein the discharge port (54b) is placed such that it is oriented in a horizontal direction or oriented upward from the horizontal direction.

3. The hot water generator according to claim 1 or 2,

further comprising a drainage port (56a) provided in a tip end of a drainpipe (56) which branches off from the water pipe, wherein
the drainpipe (56) is placed at a position lower than a water flow-path (22a) of the first heat exchanger (22), and
a difference in height between the suction port (54a) and the drainage port (56a) in the vertical direction is greater than a difference in height between the suction port (54a) and the first connection port (51).

Patentansprüche

1. Heißwassererzeuger umfassend:

einen Kältemittelkreislauf (20), gebildet durch das ringförmige Miteinanderverbinden eines Kompressors (21), eines ersten Wärmetauschers (22), der Wärme zwischen dem Kühlmittel und Wasser austauscht, eines Expansionsventil (23) und eines zweiten Wärmetauscher (24), der Wärme zwischen dem Kältemittel und Luft austauscht, mittels einer Kühlmittelleitung;
einen Wasserkreislauf (50), gebildet durch das Miteinanderverbinden des ersten Wärmeaustauscher (22) und einer Pumpe (54), die unter Druck Wasser zu dem ersten Wärmetauscher (22) sendet, mittels einer Wasserleitung,
ein Gebläse (33), das Luft in den zweiten Wärmetauscher (24) bläst;
eine Blaskammer (91), in der zumindest das Gebläse (33) angeordnet ist;
eine Maschinenkammer (92), in der zumindest der Kompressor (21) angeordnet ist;
einen äußeren Abdeckungskörper (1), der die Blaskammer (91) und die Maschinenkammer (92) abdeckt;
einen ersten Verbindungsanschluss (51), durch den Wasser in den Wasserkreislauf (50) fließt; und
einen zweiten Verbindungsanschluss (52), durch den Wasser, das durch den Wasserkreislauf (50) fließt, herausfließt, wobei

der zweite Verbindungsanschluss (52) an einer Position platziert ist, die in vertikaler Richtung höher ist als der erste Verbindungsanschluss (51),
der erste Wärmetauscher (22) an einer Position platziert ist, die in vertikaler Richtung tiefer ist als der erste Verbindungsanschluss (51), und
ein Ansauganschluss (54a) und ein Auslassanschluss (54b) der Pumpe (54) in einer Höhe angeordnet sind, die in vertikaler Richtung gleich oder höher als der erste Verbindungsanschluss (51) ist und die gleich oder tiefer als der zweite Verbindungsanschluss (52) ist,
dadurch gekennzeichnet, dass eine Auslassleitung (55), die den Auslassanschluss (54b) der Pumpe (54) und den ersten Wärmetauscher (22) miteinander verbindet, die höchste Position des Wasserkreislaufs (50) erreicht.

2. Heißwassererzeuger nach Anspruch 1, wobei der Auslassanschluss (54b) so platziert ist, dass er in horizontaler Richtung oder von der horizontalen Richtung nach oben orientiert ist.

3. Heißwassererzeuger nach Anspruch 1 oder 2, ferner umfassend einen Ablassanschluss (56a), der an einem Ende einer Ablassleitung (56), die von der Wasserleitung abzweigt, bereitgestellt wird, wobei
die Ablassleitung (56) an einer Position angeordnet ist, die niedriger als ein Wasserströmungspfad (22a) des ersten Wärmetauschers (22) ist, und
eine Höhendifferenz zwischen dem Ansauganschluss (54a) und dem Ablassanschluss (56a) in vertikaler Richtung größer ist als eine Höhendifferenz zwischen dem Ansauganschluss (54a) und dem ersten Verbindungsanschluss (51).

Revendications

1. Générateur d'eau chaude comprenant:

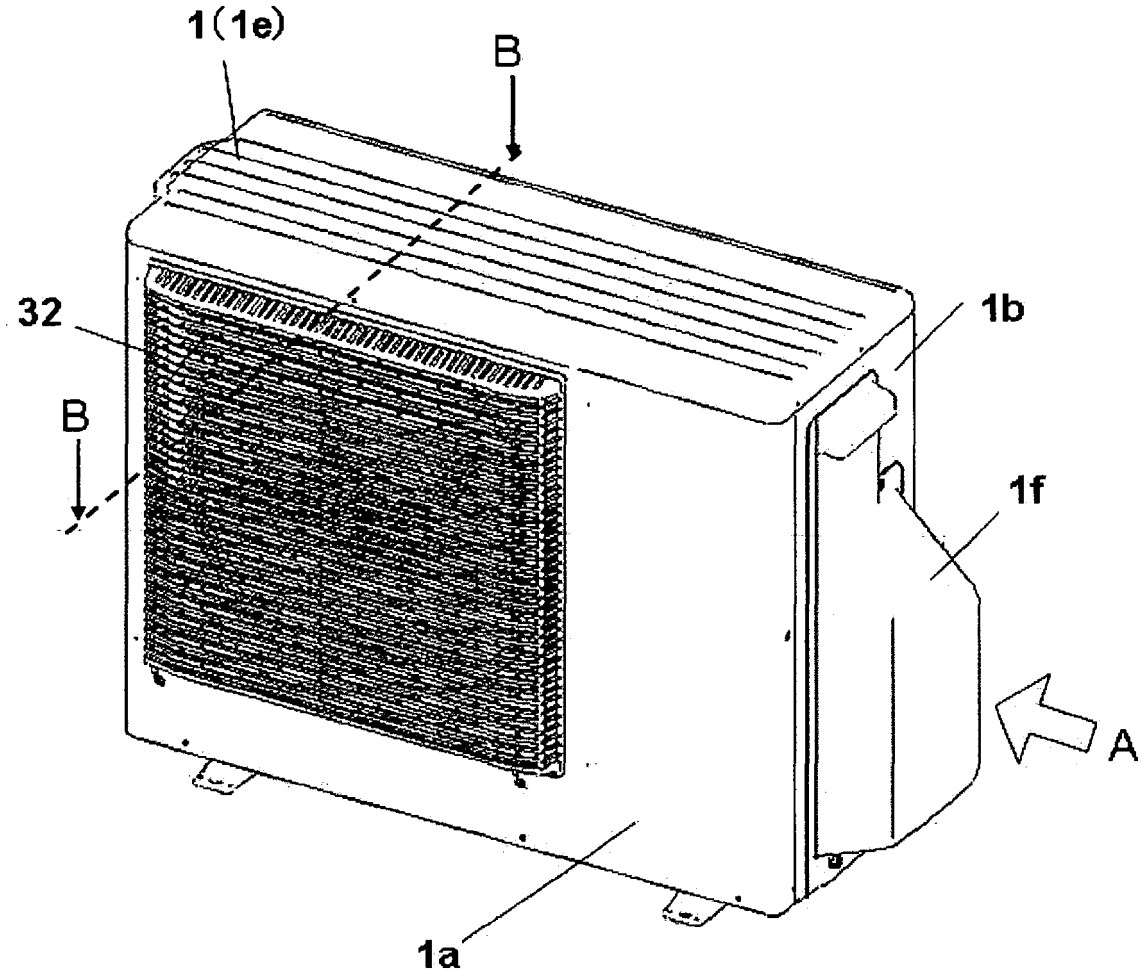
un circuit de réfrigérant (20) formé en reliant en anneau les uns aux autres, par l'intermédiaire d'une conduite de réfrigérant, un compresseur (21), un premier échangeur de chaleur (22) qui échange de la chaleur entre le réfrigérant et de l'eau, une valve d'expansion (23) et un deuxième échangeur de chaleur (24) qui échange de la chaleur entre le réfrigérant et de l'air;
un circuit d'eau (50) formé en reliant l'un à l'autre, par l'intermédiaire d'une conduite d'eau, ledit premier échangeur de chaleur (22) et une pompe (54) qui envoie de l'eau, sous pression, audit premier échangeur de chaleur (22);
un ventilateur (33) qui souffle de l'air dans le deuxième échangeur de chaleur (24);
une chambre de soufflage (91) à l'intérieur de laquelle est disposé au moins le ventilateur (33);
une chambre de machine (92) à l'intérieur de laquelle est disposé au moins le compresseur (21);
un corps extérieur de recouvrement (1) qui recouvre la chambre de soufflage (91) et la chambre de machine (92);
un premier raccord de jonction (51) à travers lequel de l'eau s'écoule dans ledit circuit d'eau (50); et
un deuxième raccord de jonction (52) à travers lequel sort de l'eau qui circule à travers le circuit d'eau (50), dans lequel

le deuxième raccord de jonction (52) est placé sur une position plus haute que celle du premier raccord de jonction (51) dans la direction verticale,
le premier échangeur de chaleur (22) est placé sur une position plus basse que celle du premier raccord de jonction (51) dans la direction verticale, et
un raccord d'aspiration (54a) et un raccord de refoulement (54b) de la pompe (54) sont disposés à une hauteur qui est égale ou supérieure, dans la direction verticale, à celle du premier raccord de jonction (51) et qui est égale ou inférieure à celle du deuxième raccord de jonction (52),
caractérisé par le fait que la conduite une décharge (55) qui relie l'un à l'autre le raccord de refoulement (54b) de la pompe (54) et le premier échangeur de chaleur (22) atteint la position la plus haute du circuit d'eau (50).

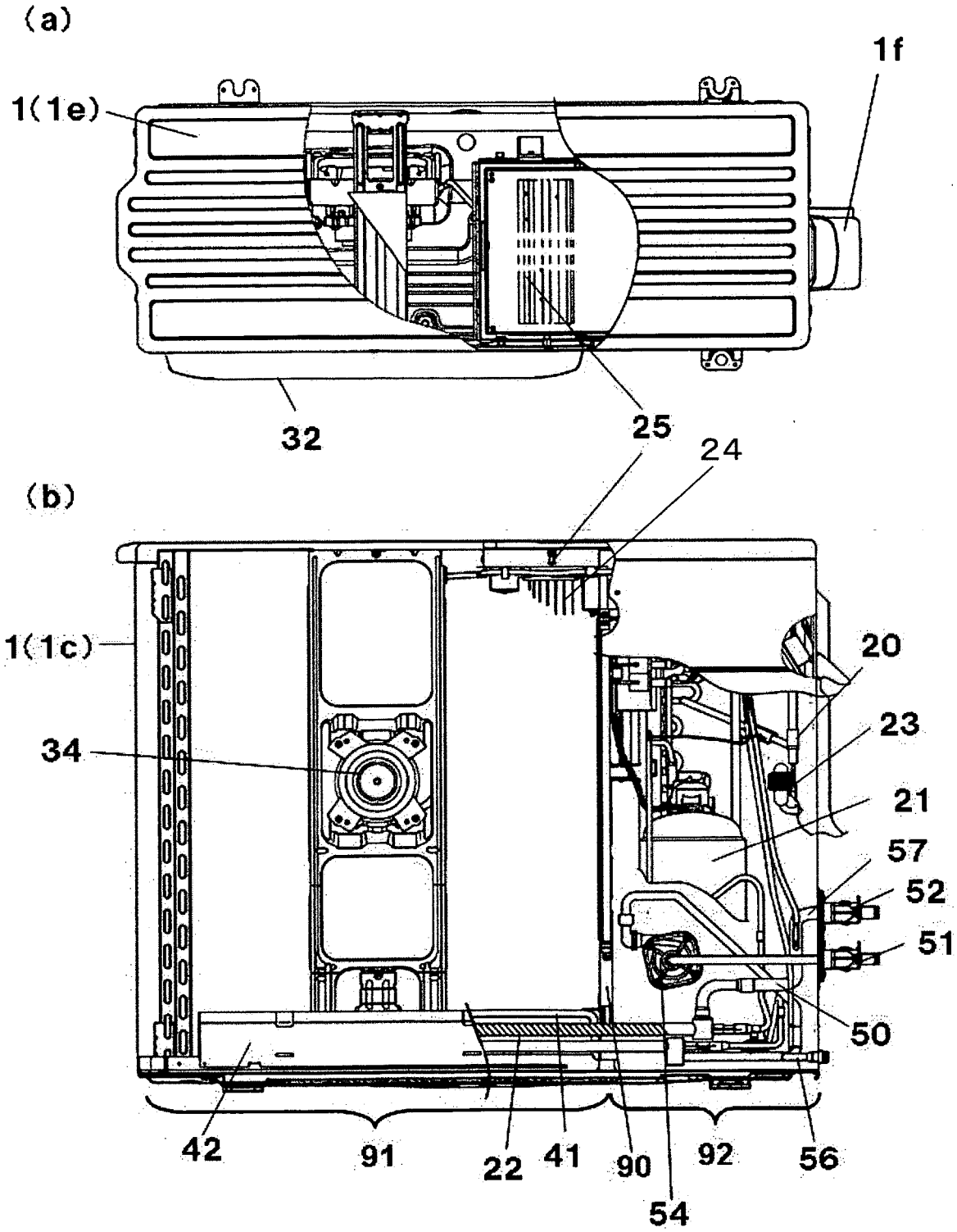
2. Générateur d'eau chaude selon la revendication 1, dans lequel le raccord de refoulement (54b) est placé de telle manière qu'il est orienté dans une direction horizontale ou orienté vers le haut depuis la direction horizontale.

3. Générateur d'eau chaude selon la revendication 1 ou 2, comprenant en outre un raccord d'évacuation (56a) qui est prévu à une extrémité d'une conduite d'évacuation (56) dérivée de la conduite d'eau, dans lequel
ladite conduite d'évacuation (56) est disposée sur une position inférieure à celle d'un chemin d'écoulement d'eau (22a) du premier échangeur de chaleur (22), et
une différence en hauteur entre le raccord d'aspiration (54a) et le raccord d'évacuation (56a) dans la direction verticale est supérieure à une différence en hauteur entre le raccord d'aspiration (54a) et le premier raccord de jonction (51).

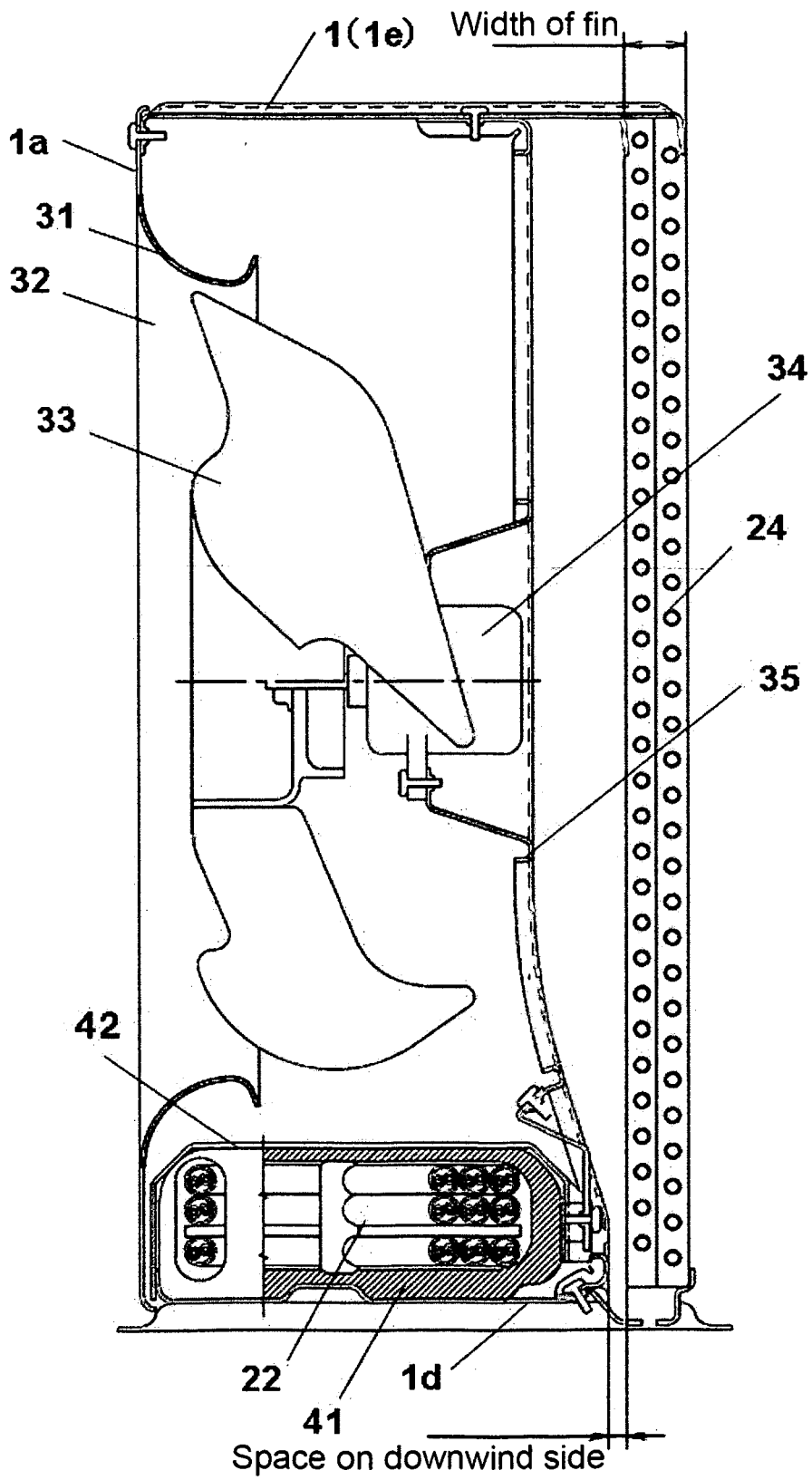
[Fig. 1]



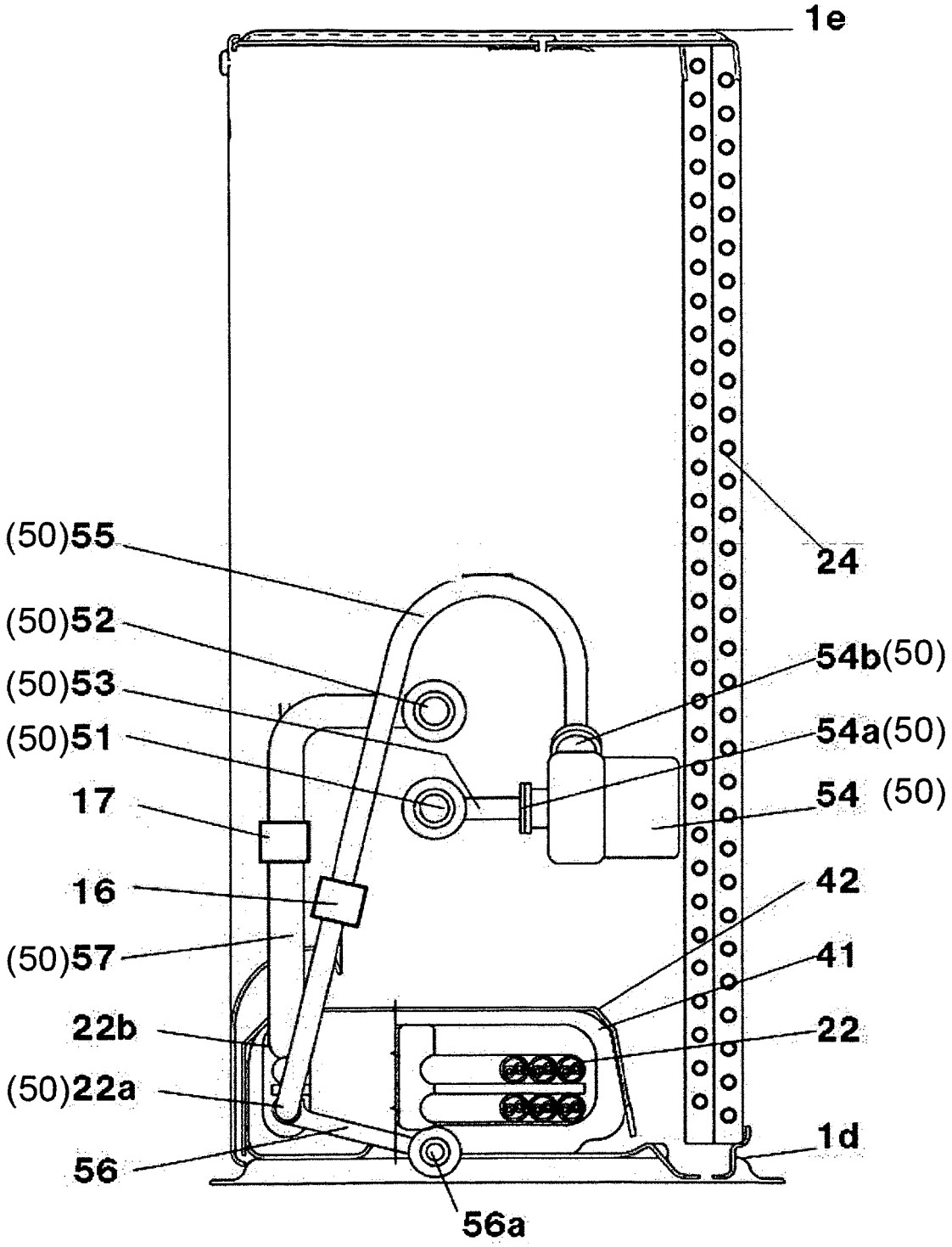
[Fig. 2]



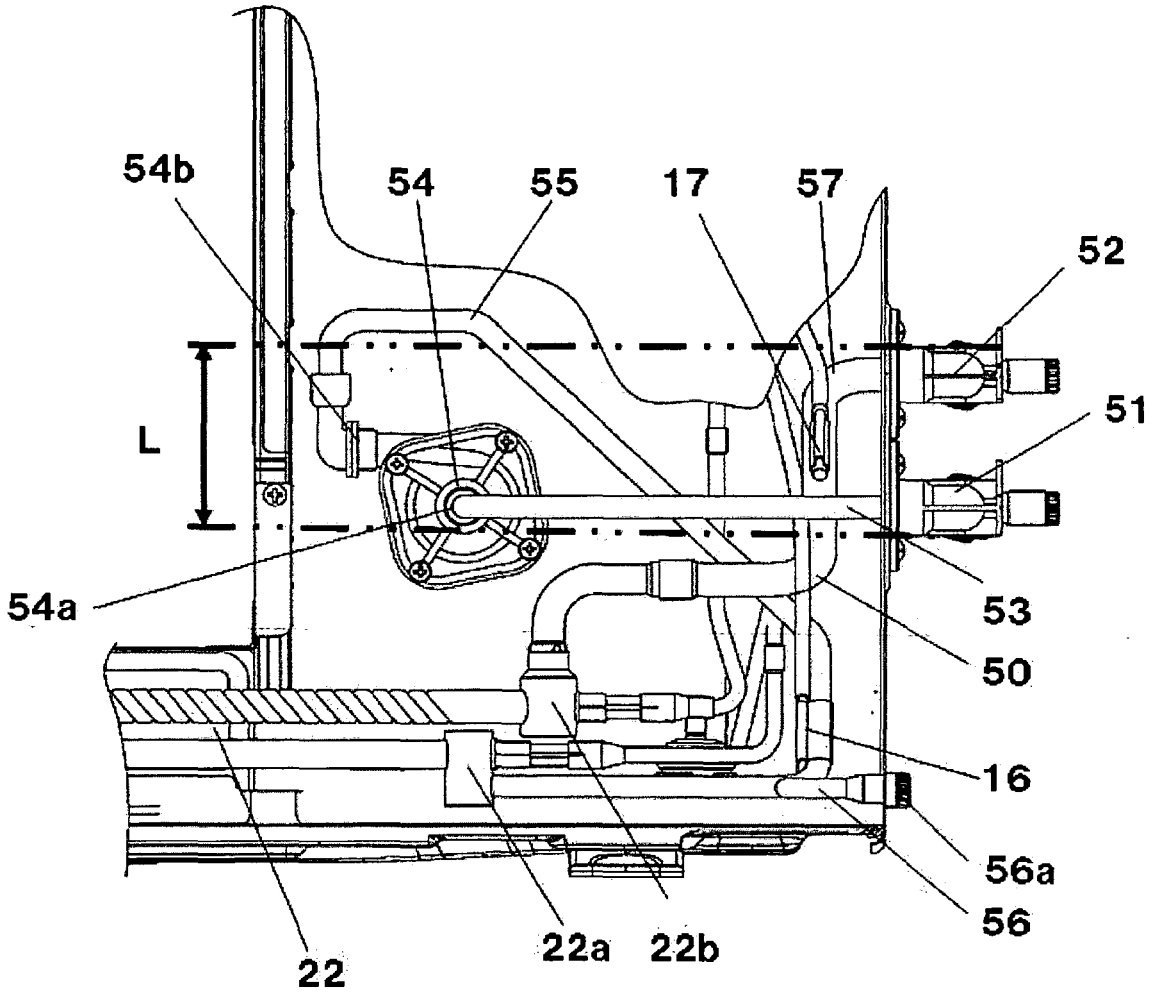
[Fig. 3]


1(1e)
Width of fin
1a
31
32
33
34
24
35
42
22
41
1d
Space on downwind side

[Fig. 4]


1e
24
(50)55
(50)52
(50)53
(50)51
17
16
(50)57
22b
(50)22a
56
56a
54b(50)
54a(50)
54 (50)
42
41
22
1d

[Fig. 5]



REFERENCES CITED IN THE DESCRIPTION

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