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(54) **Hot water supply apparatus**

Vorrichtung zur Abgabe von heißem Wasser

Appareil d'alimentation d'eau chaude

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Description

Technical Field

[0001] The present invention relates to a hot water supply apparatus which stores boiling water in a hot water tank and supplies the boiling water, or utilizes potential heat thereof.

Background Technique

[0002] Fig. 14 shows a conventional hot water supply apparatus of this kind (see patent document 1 for example).

[0003] Fig. 14 shows the conventional hot water supply apparatus described in the patent document 1. As shown in Fig. 14, this hot water supply apparatus includes a hot water tank 1 and a pipe 2 provided in the hot water tank 1 as a heat exchanger. The hot water supply apparatus circulates water in a bathtub 10 toward the pipe 2, and reheats the water in the bathtub 10.

Prior Art Document

[0004] [Patent Document 1] Japanese Patent Application Laid-open No. 2003-214711

[0005] According to the conventional configuration in which the pipe 2 is used as the heat exchanger, however, when water from the bathtub 10 is circulated toward the pipe 2, a temperature of the hot water in the hot water tank around the pipe 2 is lowered and downward stream of water is in Fig. 15, this stream of water is gradually accelerated along the pipe 2 (lengths of arrows show flow velocities), and the accelerated downward stream of water flows downward in the hot water tank 1.

[0006] According to the hot water supply apparatus of this kind, hot water is stored while forming thermal stratification, hot water 3 and water 4 come into contact with each other in the hot water tank 1 in a course of utilization of hot water, and a layer 5 (mixed layer 5, hereinafter) in which their temperatures become a medium temperature, but the downward stream of water reaches the mixed layer 5 and exerts a stirring effect.

[0007] Thereupon, the mixed layer 5 becomes large, the temperature of the stored hot water is lowered more than necessary and therefore, an amount of usable hot water is reduced. At the same time, a temperature water at a lower portion of the mixed layer 5 increases. Hence, when the water is heated next time, water having a higher temperature must be heated. When a heat pump is used as heating means 6, since the heat pump has a characteristic that if a water temperature is high, the operation efficiency is deteriorated, there is a problem that this characteristic obstructs the efficient operation.

[0008] The heat exchanger in which a pipe is disposed in a height direction in the hot water tank 1 like the pipe 2, there is a problem that the amount of usable hot water is reduced due to the increase of the mixed layer 5, and

the efficiency when boiling water by the heat exchanger is deteriorated.

[0009] JP 2003-279150 A discloses a hot water supply apparatus according to the preamble of claim 1 and addresses the problem of being difficult to simultaneously supply high temperature hot water to a plurality of load devices in a hot water supply device using a laminated boiling-up type hot water storage tank. Water is supplied to the hot water storage tank via a water supply port. The supplied water is sent to a heating means by a pump from an inlet water port, and is heated to a constant temperature, and is then supplied from a hot water appearing port of the hot water storage tank via a hot water supply passage. Water circulating passages are arranged in the hot water storage tank for circulating the hot water in the hot water storage tank via the load devices, and the water returning to the hot water storage tank from the respective load devices is exchanged in heat with the high temperature hot water in the hot water storage tank by heat exchangers arranged in an upper part of the hot water storage tank. The respective heat exchangers are arranged in layers inward from the outside in the almost same height position of the upper part of the hot water storage tank.

Disclosure of the Invention

[0010] The present invention is for solving the conventional problem, and it is an object of the invention to provide a hot water supply apparatus having enhanced heating efficiency.

[0011] To solve the conventional problem, a hot water supply apparatus of the present invention is provided as defined in claim 1. It is possible to suppress downward stream of water generated in the hot water tank to a minimum level, and to suppress a stirring effect of a mixing layer.

[0012] According to the present invention, it is possible to provide a hot water supply apparatus having enhanced heating efficiency.

Brief Description of the Drawings

[0013]

Fig. 1 is a block diagram of a hot water supply apparatus according to an example not falling within the wording of claim 1.

Fig. 2 is a plan view of a heat exchanger;

Fig. 3 is a diagram showing a temperature distribution in a hot water tank;

Fig. 4 shows a flow velocity in the vicinity of the heat exchanger;

Figs. 5 are plan views of heat exchangers having different shapes;

Fig. 6 is a plan view of a heat exchanger having another shape;

Fig. 7 is a plan view of a heat exchanger having an-

other shape;

Fig. 8 is a block diagram of a hot water supply apparatus according to an embodiment of the invention;

Fig. 9 is a plan view of a heat exchanger;

Fig. 10 is a diagram showing a temperature distribution in a hot water tank;

Fig. 11 shows a flow velocity in the vicinity of the heat exchanger;

Fig. 12 is a plan view of a heat exchanger having another shape;

Fig. 13 is a plan view of a heat exchanger having another shape;

Fig. 14 is a block diagram of a conventional hot water supply apparatus; and

Fig. 15 is a diagram showing a flow velocity in the vicinity of the heat exchanger.

Mode for Carrying Out the Invention

[0014] According to an example useful for understanding the invention, there is provided a hot water supply apparatus comprising a hot water tank, and a heat exchanger which is formed with a pipe in the hot water tank and exchanges between heat of hot water in the hot water tank and heat of water flowing through the pipe, wherein the pipe is disposed in the hot water tank substantially in a form of a horizontal plane. The downward stream of water generated around the pipe of a heat exchanger provided in the hot water tank is suppressed to a minimum level, a stirring effect in the hot water tank is suppressed, and it is possible to prevent the reduction in the usable hot water amount caused by increase of the mixed layer. Therefore, there is an effect that it is possible to realize excellent usability and high energy saving performance.

[0015] The invention provides a hot water supply apparatus comprising a hot water tank, heating means which heats water in the hot water tank, a first pipe connected to a lower portion of the hot water tank sends the water to the heating means, a second pipe connected to an upper portion of the hot water tank returns the water heated by the heating means to the upper portion of the hot water tank, a hot water supply pipe connected to the upper portion of the hot water tank takes out the hot water from the upper portion of the hot water tank, and a water supply pipe connected to the lower portion of the hot water tank for enabling water to flow into the lower portion of the hot water tank, a heat exchanger which is formed with a pipe for the heat exchanger in the hot water tank increases temperature of the water flowing through the pipe for the heat exchanger by exchanging between heat of hot water in the hot water tank and heat of water flowing through the pipe for the heat exchanger wherein the pipe for the heat exchanger is formed spirally as a single path; wherein an outer end of the pipe for the heat exchanger disposed in the form of a mortar in the heat exchanger is connected to the first connecting tool, and an inner end

of the pipe for the heat exchanger is connected to the second connecting tool, a bathtub, a third pipe for sending water in the bathtub to the heat exchanger, a fourth pipe for returning the hot water after it is heat-exchanged from the heat exchanger to the bathtub, a first connecting tool for connecting the heat exchanger to the third pipe, and a second connecting tool for connecting the heat exchanger to the fourth pipe, wherein the upper portion of the hot water tank is formed substantially in a semicircle spherical shape, a heat pump cycle which is operated with a pressure over a critical pressure is used as the heating means, wherein hot water accumulated in the upper portion of the hot water tank is taken out from the hot water supply pipe and is used as hot water supply, and an amount of water corresponding to the hot water taken out from the hot water supply pipe is filled into the lower portion of the hot water tank from the water supply pipe, the pipe for the heat exchanger is disposed in the upper portion of the hot water tank wherein adjacent lines of the pipe are located such that an inner line is higher than an outer line in the form of a mortar whose opening area is increased downwardly, and wherein water is provided from the bathtub to the heat exchanger through the third pipe and the water is provided from the outer line into the inner line and the water is returned to the bathtub through the fourth pipe. The downward stream of water generated around the pipe of the heat exchanger provided in the hot water tank is suppressed to a minimum level, a stirring effect in the hot water tank is suppressed, and it is possible to prevent the reduction in the usable hot water amount caused by increase of the mixed layer. Therefore, there is an effect that it is possible to realize excellent usability and high energy saving performance.

[0016] The pipe of the heat exchanger is spirally wound. There is an effect that the pipe can easily be accommodated in a cylindrical shape that is a shape of a general hot water tank.

[0017] According to an embodiment of the invention, the pipe of the heat exchanger of the first invention has a plurality of straight portions and a plurality of curved portions. There is an effect that a pipe can freely be formed in accordance with a shape of the hot water tank.

[0018] The pipe of the heat exchanger has a single path. There is an effect that it is possible to realize a simple configuration, and realize high reliability with small leakage.

[0019] According to an example not falling within the scope of the invention, the pipe of the heat exchanger is divided into a plurality of pipes near an inlet of water in the hot water tank, and the pipes are connected to each other near an outlet of water. There is an effect that it is possible to appropriately design a necessary length of the pipe, a pressure loss and a thermal transmission rate.

[0020] According to the invention, the hot water supply apparatus further comprises heating means for heating water in the hot water tank, wherein a heat pump cycle is used as the heating means. Energy utilizing efficiency is enhanced, and it is possible to realize a hot water sup-

ply apparatus having excellent energy saving performance.

[0021] According to the invention, the heat pump cycle is a supercritical refrigerant circuit, and water is heated by a refrigerant whose pressure is increased more than a critical pressure. Since the boiling temperature can be increased, a usable heat amount is increased, and hot water shortage preventing performance can be enhanced.

[0022] Embodiments of the present invention will be described with reference to the drawings. The invention is not limited to the embodiments.

(Example)

[0023] Fig. 1 is a block diagram of a hot water supply apparatus according to an example not falling within the wording of claim 1.

[0024] In Fig. 1, the hot water supply apparatus includes a hot water tank 1, a heat pump unit 6 as heating means which heats water in the hot water tank 1, and a first pipe 7 connected to a lower portion of the hot water tank 1. Water before it is heated is sent to the heat pump unit 6 through the first pipe 7. The hot water supply apparatus also includes a second pipe 8 connected to an upper portion of the hot water tank 1. Water after it is heated is returned to the hot water tank 1 from the heat pump unit 6 through the second pipe 8. The hot water supply apparatus also includes a reheating heat exchanger 9 provided at an upper portion in the hot water tank 1, a bathtub 10, a third pipe 11 for sending water in the bathtub 10 to the heat exchanger 9, and a fourth pipe 12. Hot water after it is heat-exchanged is returned from the heat exchanger 9 to the bathtub 10 through the fourth pipe 12. The hot water supply apparatus also includes a hot water tap 13, a hot water supply pipe 16 connected to an upper portion of the hot water tank 1 for supplying hot water to the hot water tap 13, and a water supply pipe 14 connected to a lower portion of the hot water tank 1. The water supply pipe 14 is connected to the hot water supply pipe 16 through a mixing valve 15.

[0025] A first connecting tool 17 and a second connecting tool 18 are provided in the hot water tank 1 for connecting the heat exchanger 9 to the third pipe 11 and the fourth pipe 12.

[0026] Fig. 2 is a plan view of the heat exchanger 9 in the hot water tank 1. A body of the heat exchanger 9 is formed with a pipe 9a which is a stainless steel pipe. An outer end of the pipe 9a is connected to the third pipe 11 through the first connecting tool 17, and an inner end of the pipe 9a is connected to the fourth pipe 12 through the second connecting tool 18 (shown in Fig. 1) provided on the upper portion of the hot water tank 1.

[0027] Action and effect of the hot water supply apparatus having the above-described configuration will be described below.

[0028] Before water is boiled, the hot water tank 1 is filled with low temperature water. If operation is started,

water in the hot water tank 1 is sent to the heat pump unit 2 through the first pipe 7, heated high temperature hot water is returned to the hot water tank 1 through the second pipe 8. According to this configuration, high temperature hot water is stored in the hot water tank 1.

[0029] When hot water is supplied after it is boiled, high temperature hot water in the hot water tank 1 is sent through the hot water supply pipe 16, this high temperature hot water and water sent through the water supply pipe 14 are mixed by the mixing valve 15, temperature thereof is adjusted to a set temperature, and the hot water is supplied from the hot water tap 13. Water of the amount corresponding to the supplied hot water flows from a lower portion of the hot water tank 1 through the water supply pipe 14.

[0030] When water in the bathtub is to be heated, water in the bathtub 10 is sent to the heat exchanger 9 through the third pipe 11, the water is circulated in the hot water tank 1 through the pipe 9a of the heat exchanger 9, the water is exchanged heat with hot water in the hot water tank 1, water whose temperature increases is returned to the bathtub 10 through the fourth pipe 12.

[0031] According to the above-described action, high temperature hot water 3 stays above low temperature water 4 in the hot water tank 1 while it is used, and a mixed layer 5 having medium temperature exists between the hot water 3 and the water 4 due to heat conductivity and convection.

[0032] Fig. 3 is a diagram for explaining a difference in usable hot water amount caused by size of the mixed layer 5. A lateral axis shows temperature and a vertical axis shows a temperature distribution of hot water in the hot water tank 1 wherein the vertical axis corresponds to a height of the hot water tank 1. A reference number 19 represents a temperature distribution of a state where a mixed layer 5a is small, and a reference number 20 represents a temperature distribution of a state where a mixed layer 5b is large.

[0033] When temperature t_s is a lower limit of a temperature of usable hot water, if a difference in amount of usable heat is expressed schematically, the difference corresponds to a region 21, and as the mixed layer 5 becomes larger, shortage of hot water occurs more frequently, the amount of usable heat is small, and energy saving performance is low.

[0034] If lower portions of the mixed layers 5a and 5b are compared with each other, water temperature of the mixed layer 5b is high in many cases, and this means that water of higher temperature enters the heat pump unit 6 when boiling next time. Efficiency of the heat pump unit 6 becomes worse as the water temperature before boiling is higher, and if the mixed layer 5 is large also at the time of boiling, the energy saving performance is deteriorated.

[0035] Fig. 4 is a sectional view of the heat exchanger 9 in the hot water tank 1. Since lines of the pipe 9a which is a stainless steel pipe constituting the heat exchanger 9 are lined up horizontally, downward stream of water

generated around the pipe 9 is less prone to exert an effect on each other, and the stream of water flows downward in the hot water tank 1 while keeping the low flow velocity. Therefore, the effect exerted on the mixed layer 5 is suppressed to a minimum level.

[0036] By suppressing the downward stream of water generated around the pipe 9a of heat exchanger 9 provided in the hot water tank 1 to the minimum level, a stirring effect in the hot water tank 1 is suppressed, and it is possible to prevent the reduction in the usable hot water amount caused by increase of the mixed layer 5, and reduction in boiling efficiency in the heat pump unit 2 can be prevented. Therefore, it is possible to realize excellent usability and high energy saving performance.

[0037] The heat exchanger 9 is spirally wound substantially in a circle shape. This configuration has a merit that it is easy to secure a length of the pipe when the hot water tank 1 is cylindrical in shape.

[0038] Although water in the heat exchanger 9 flows from the outside toward the inside of the pipe 9a, the same effect can be obtained even if the water flows reversely, i.e., from the inside toward the outside while setting an inlet on the side of the second connecting tool 18 and setting an outlet on the side of the first connecting tool 17.

[0039] In a refrigeration cycle of the heat pump unit 6, it is preferable that carbon dioxide is used as a refrigerant and the heat pump unit 6 is operated under pressure exceeding critical pressure. Since the boiling temperature can be increased by using the carbon dioxide as the refrigerant, it is possible to freely control the hot water temperature in the hot water tank 1.

[0040] Figs. 5 are plan views of the heat exchanger 9 in which the shape of the pipe 9a which is the stainless steel pipe of the heat exchanger 9 has a combination of straight portions and curved portions. According to this configuration, when the shape of the hot water tank 1 is different, the heat exchanger 9 can be disposed while utilizing a space efficiently.

[0041] Fig. 5 (a) is the plan view of the heat exchanger 9 in which the straight portions are lined in parallel to each other, and Fig. 5(b) is the plan view of the heat exchanger 9 in which the curved portions have 180° or greater so that the pipe length can be increased.

[0042] In Fig. 6, the heat exchanger 9 is formed substantially into a rectangular shape. When the hot water tank 1 has a square shape, the space can be utilized efficiently.

[0043] In Fig. 7, a first branch portion 22 is provided in the vicinity of an inlet of water flowing in the heat exchanger 9 in the hot water tank 1, and a second branch portion 23 is provided in the vicinity of an outlet of water. According to this configuration, the pipe 9a of the heat exchanger 9 can be divided into two, and it is possible to appropriately design a relation between a length of the pipe, a pressure loss and a thermal transmission rate.

(Embodiment)

[0044] Fig. 8 is a block diagram showing a configuration of a hot water supply apparatus according to an embodiment of the present invention.

[0045] In Fig. 8, the hot water supply apparatus includes a hot water tank 1, a heat pump unit 6 as heating means which heats water in the hot water tank 1, and a first pipe 7 connected to a lower portion of the hot water tank 1. Water before it is heated is sent to the heat pump unit 6 through the first pipe 7. The hot water supply apparatus also includes a second pipe 8 connected to an upper portion of the hot water tank 1. Water after it is heated is returned to the hot water tank 1 from the heat pump unit 6 through the second pipe 8. The hot water supply apparatus also includes a reheating heat exchanger 9 provided at an upper portion in the hot water tank 1, a bathtub 10, a third pipe 11 for sending water in the bathtub 10 to the heat exchanger 9, and a fourth pipe 12. Hot water after it is heat-exchanged is returned from the heat exchanger 9 to the bathtub 10 through the fourth pipe 12. The hot water supply apparatus also includes a hot water tap 13, a hot water supply pipe 16 connected to an upper portion of the hot water tank 1 for supplying hot water to the hot water tap 13, and a water supply pipe 14 connected to a lower portion of the hot water tank 1. The water supply pipe 14 is connected to the hot water supply pipe 16 through a mixing valve 15.

[0046] A first connecting tool 17 and a second connecting tool 18 are provided in the hot water tank 1 for connecting the heat exchanger 9 to the third pipe 11 and the fourth pipe 12.

[0047] Fig. 9 is a plan view of the heat exchanger 9 in the hot water tank 1. A body of the heat exchanger 9 is formed with a pipe 9a which is a stainless steel pipe. An outer end of the pipe 9a is connected to the third pipe 11 through the first connecting tool 17, and an inner end of the pipe 9a is connected to the fourth pipe 12 through the second connecting tool 18 (shown in Fig. 8) provided on the upper portion of the hot water tank 1.

[0048] A line of the pipe 9a located on the outermost side maintains substantially a constant distance from an inner surface of the hot water tank 1, a line of the pipe 9a located on an inner side is located without a distance along a line of the pipe 9a located on an outer side, adjacent lines of the pipe 9a are located such that an inner line is higher than an outer line, i.e., the pipe 9a is disposed substantially in a form of mortar whose opening area is increased toward a lower portion of the hot water tank 1.

[0049] Action and effect of the hot water supply apparatus having the above-described configuration will be described below.

[0050] Before water is boiled, the hot water tank 1 is filled with low temperature water. If operation is started, water in the hot water tank 1 is sent to the heat pump unit 2 through the first pipe 7, heated high temperature hot water is returned to the hot water tank 1 through the

second pipe 8. According to this configuration, high temperature hot water is stored in the hot water tank 1.

[0051] When hot water is supplied after it is boiled, high temperature hot water in the hot water tank 1 is sent through the hot water supply pipe 16, this high temperature hot water and water send through the water supply pipe 14 are mixed by the mixing valve 15, temperature thereof is adjusted to a set temperature, and the hot water is supplied from the hot water tap 13. Water of the amount corresponding to the supplied hot water flows from a lower portion of the hot water tank 1 through the water supply pipe 14.

[0052] When water in the bathtub is to be heated, water in the bathtub 10 is sent to the heat exchanger 9 through the third pipe 11, the water is circulated in the hot water tank 1 through the pipe 9a of the heat exchanger 9, the water is exchanged heat with hot water in the hot water tank 1, water whose temperature increases is returned to the bathtub 10 through the fourth pipe 12.

[0053] According to the above-described action, high temperature hot water 3 stays above low temperature water 4 in the hot water tank 1 while it is used, and a mixed layer 5 having medium temperature exists between the hot water 3 and the water 4 due to heat conductivity and convection.

[0054] Fig. 10 is a diagram for explaining a difference in usable hot water amount caused by size of the mixed layer 5. A lateral axis shows temperature and a vertical axis shows a temperature distribution of hot water in the hot water tank 1 wherein the vertical axis corresponds to a height of the hot water tank 1. A reference number 19 represents a temperature distribution of a state where a mixed layer 5a is small, and a reference number 20 represents a temperature distribution of a state where a mixed layer 5b is large.

[0055] When temperature t_s is a lower limit of a temperature of usable hot water, if a difference in amount of usable heat is expressed schematically, the difference corresponds to a region 21, and as the mixed layer 5 becomes larger, shortage of hot water occurs more frequently, the amount of usable heat is small, and energy saving performance is low.

[0056] If lower portions of the mixed layers 5a and 5b are compared with each other, water temperature of the mixed layer 5b is high in many cases, and this means that water of higher temperature enters the heat pump unit 6 when boiling next time. Efficiency of the heat pump unit 6 becomes worse as the water temperature before boiling is higher, and if the mixed layer 5 is large also at the time of boiling, the energy saving performance is deteriorated.

[0057] Fig. 11 is a sectional view of the heat exchanger 9 in the hot water tank 1. Since lines of the pipe 9a which is a stainless steel pipe constituting the heat exchanger 9 are arranged such the lines becomes lower toward the outer side in the hot water tank 1, water generated on the upper side of the pipe 9a reaches the inner surface of the hot water tank 1 while gradually accelerating, and

flows downward along the inner surface in this state.

[0058] Since this water flows on the outermost side of the hot water tank 1, a mixing amount with high temperature hot water remaining on the mixed layer 5 is small, and this water reaches the mixed layer 5. Even if the water reaches the mixed layer 5, since the stirring operation occurs around the peripheral edge, an effect for enlarging the mixed layer 5 is relatively small.

[0059] On the other hand, downward stream of water on the lower side of the pipe 9 substantially uniformly flows downward at low flow velocity. This stream of water is less prone to exert an effect on each other, the stream of water flows downward in the hot water tank 1 while keeping the low flow velocity, and an effect exerted on the mixed layer 5 is small.

[0060] By suppressing the downward stream of water generated around the pipe 9a of heat exchanger 9 provided in the hot water tank 1 to the minimum level, a stirring effect in the hot water tank 1 is suppressed, and it is possible to prevent the reduction in the usable hot water amount caused by increase of the mixed layer 5 can be prevented, and reduction in boiling efficiency in the heat pump unit 2 can be prevented. Therefore, it is possible to realize excellent usability and high energy saving performance.

[0061] The heat exchanger 9 is spirally wound substantially in a circle shape. This configuration has a merit that the heat exchanger 9 can easily suit the shape of the hot water tank 1, and it is easy to secure a length of the pipe when the hot water tank 1 is cylindrical in shape.

[0062] Although water in the heat exchanger 9 flows from the outside toward the inside of the pipe 9a, the same effect can be obtained even if the water flows reversely, i.e., from the inside toward the outside while setting an inlet on the side of the second connecting tool 18 and setting an outlet on the side of the first connecting tool 17.

[0063] In a refrigeration cycle of the heat pump unit 6, it is preferable that carbon dioxide is used as a refrigerant and the heat pump unit 6 is operated under pressure exceeding critical pressure. Since the boiling temperature can be increased by using the carbon dioxide as the refrigerant, it is possible to freely control the hot water temperature in the hot water tank 1.

[0064] Fig. 12 shows a substantially rectangular heat exchanger 9 in which the pipe 9a includes straight portions and curved portions, and the heat exchanger 9 of this case can be applied to a rectangular hot water tank 1.

[0065] In Fig. 13, a first branch portion 22 is provided in the vicinity of an inlet of water flowing in the heat exchanger 9 in the hot water tank 1, and a second branch portion 23 is provided in the vicinity of an outlet. According to this configuration, the pipe of the heat exchanger 9 can be divided into two, and it is possible to appropriately design a relation between a length of the pipe, a pressure loss and a thermal transmission rate.

[0066] As described above, according to the hot water supply apparatus of the present invention, the reduction

in the usable hot water amount is suppressed to the minimum level when heat of hot water in the hot water tank is utilized. Therefore, the hot water supply apparatus can be applied to a domestic hot water supply apparatus and also to a large scale use such as commercial use in a system having a heat source and a hot water tank, and it is possible to provide excellent energy saving performance.

Claims

1. A hot water supply apparatus comprising:

a hot water tank (1),
 heating means (6) which heats water in the hot water tank (1),
 a first pipe (7) connected to a lower portion of the hot water tank (1) and arranged to send the water to the heating means (6),
 a second pipe (8) connected to an upper portion of the hot water tank (1) and arranged to return the water heated by the heating means (6) to the upper portion of the hot water tank (1),
 a hot water supply pipe (16) connected to the upper portion of the hot water tank (1) and arranged to take out the hot water from the upper portion of the hot water tank (1), and
 a water supply pipe (14) connected to the lower portion of the hot water tank (1) and arranged for enabling water to flow into the lower portion of the hot water tank (1);
 a heat exchanger (9) which is formed with a pipe (9a) for the heat exchanger (9) in the hot water tank (1) and arranged for increasing the temperature of the water flowing through the pipe (9a) for the heat exchanger (9) by exchanging heat between hot water in the hot water tank (1) and water flowing through the pipe (9a) for the heat exchanger (9) wherein the pipe (9a) for the heat exchanger (9) is formed spirally as a single path; wherein an outer end of the pipe (9a) for the heat exchanger (9) disposed in the form of a mortar in the heat exchanger (9) is connected to a first connecting tool (17), and an inner end of the pipe (9a) for the heat exchanger (9) is connected to a second connecting tool (18),
 a bathtub (10),
 a third pipe (11) arranged for sending water in the bathtub (10) to the heat exchanger (9),
 a fourth pipe (12) arranged for returning the hot water after it is heat-exchanged from the heat exchanger (9) to the bathtub (10),
 the first connecting tool (17) arranged for connecting the heat exchanger (9) to the third pipe (11), and
 the second connecting tool (18) arranged for connecting the heat exchanger (9) to the fourth

pipe (12),

characterized in that

the upper portion of the hot water tank (1) is formed substantially in a semicircle spherical shape,
 a heat pump cycle which is operated with a pressure over a critical pressure is used as the heating means (6), wherein, in use, hot water accumulated in the upper portion of the hot water tank (1) is taken out from the hot water supply pipe (16) and is used as hot water supply, and an amount of water corresponding to the hot water taken out from the hot water supply pipe (16) is filled into the lower portion of the hot water tank (1) from the water supply pipe (14), and the pipe (9a) for the heat exchanger (9) is disposed in the upper portion of the hot water tank (1) wherein adjacent lines of the pipe (9a) are located such that an inner line (9a) is higher than an outer line (9a) in the form of a mortar whose opening area is increased downwardly, and wherein, in use, water is provided from the bathtub (10) to the heat exchanger (9) through the third pipe (11) and the water is provided from the outer line (9a) into the inner line (9a) and the water is returned to the bathtub (10) through the fourth pipe (12).

2. The hot water supply apparatus according to claim 1, wherein the pipe (9a) of the heat exchanger (9) has a plurality of straight portions and a plurality of curved portions.

Patentansprüche

1. Warmwasserversorgungsvorrichtung, umfassend:

einen Warmwasserbehälter (1);
 ein Heizmittel (6), das Wasser in dem Warmwasserbehälter (1) erwärmt;
 eine erste Leitung (7), die mit einem unteren Teil des Warmwasserbehälters (1) verbunden und dazu eingerichtet ist, das Wasser zu dem Heizmittel (6) zu leiten,
 eine zweite Leitung (8), die mit einem oberen Teil des Warmwasserbehälters (1) verbunden und dazu eingerichtet ist, das von dem Heizmittel (6) erwärmte Wasser zu dem oberen Teil des Warmwasserbehälters (1) zurückzuleiten,
 eine Warmwasserversorgungsleitung (16), die mit dem oberen Teil des Warmwasserbehälters (1) verbunden und dazu eingerichtet ist, das Warmwasser aus dem oberen Teil des Warmwasserbehälters (1) zu entnehmen, und
 eine Wasserversorgungsleitung (14), die mit dem unteren Teil des Warmwasserbehälters (1) verbunden und dazu eingerichtet ist, Wasser in

den unteren Teil des Warmwasserbehälters (1) fließen zu lassen;
 einen Wärmetauscher (9), der mit einer Leitung (9a) für den Wärmetauscher (9) in dem Warmwasserbehälter (1) ausgebildet und dazu eingerichtet ist, die Temperatur des durch die Leitung (9a) für den Wärmetauscher (9) fließenden Wassers durch Wärmeaustausch zwischen Warmwasser in dem Warmwasserbehälter (1) und durch die Leitung (9a) für den Wärmetauscher (9) fließendes Wasser zu erhöhen, wobei die Leitung (9a) für den Wärmetauscher (9) spiralförmig als ein einzelner Pfad ausgebildet ist; wobei ein äußeres Ende der Leitung (9a) für den Wärmetauscher (9), das in dem Wärmetauscher (9) in der Form eines Mörsers angeordnet ist, mit einem ersten Verbindungsteil (17) verbunden ist, und ein inneres Ende der Leitung (9a) für den Wärmetauscher (9) mit einem zweiten Verbindungsteil (18) verbunden ist,
 eine Badewanne (10),
 eine dritte Leitung (11), die dazu eingerichtet ist, Wasser in der Badewanne (10) zu dem Wärmetauscher (9) zu leiten,
 eine vierte Leitung (12), die dazu eingerichtet ist, das Warmwasser nach dem Wärmeaustausch vom Wärmetauscher (9) zur Badewanne (10) zurückzuleiten,
 das erste Verbindungsteil (17), das zum Verbinden des Wärmetauschers (9) mit der dritten Leitung (11) ausgestaltet ist, und
 das zweite Verbindungsteil (18), das zum Verbinden des Wärmetauschers (9) mit der vierten Leitung (12) ausgestaltet ist,
dadurch gekennzeichnet, dass
 der obere Teil des Warmwasserbehälters (1) in einer im Wesentlichen halbkreisförmigen Kugelform ausgebildet ist,
 ein Wärmepumpenkreislauf, der mit einem Druck über einem kritischen Druck betrieben wird, als das Heizmittel (6) verwendet wird, wobei, bei Gebrauch, Warmwasser, das in dem oberen Teil des Warmwasserbehälters (1) gespeichert ist, von der Warmwasserversorgungsleitung (16) entnommen und als Warmwasserversorgung verwendet wird und eine Wassermenge, die dem von der Warmwasserversorgungsleitung (16) entnommenen Warmwasser entspricht, von der Wasserversorgungsleitung (14) in den unteren Teil des Warmwasserbehälters (1) gefüllt wird, und
 die Leitung (9a) für den Wärmetauscher (9) in dem oberen Teil des Warmwasserbehälters (1) angeordnet ist, wobei benachbarte Leitungsbahnen der Leitung (9a) derart angeordnet sind, dass eine innere Leitungsbahn (9a) höher als eine äußere Leitungsbahn (9a) in der Form eines Mörsers ist, dessen Öffnungsfläche nach

unten vergrößert ist, und
 wobei, bei Gebrauch, Wasser von der Badewanne (10) durch die dritte Leitung (11) dem Wärmetauscher (9) zugeführt wird und das Wasser von der äußeren Leitungsbahn (9a) in die innere Leitungsbahn (9a) geliefert wird und das Wasser durch die vierte Leitung (12) zur Badewanne (10) zurückgeleitet wird.

2. Warmwasserversorgungsvorrichtung nach Anspruch 1, wobei die Leitung (9a) des Wärmetauschers (9) eine Vielzahl von geraden Abschnitten und eine Vielzahl von gebogenen Abschnitten aufweist.

Revendications

1. Appareil d'alimentation en eau chaude comprenant :

un réservoir d'eau chaude (1),
 un moyen de chauffage (6) qui chauffe l'eau dans le réservoir d'eau chaude (1),
 un premier tuyau (7) relié à une partie inférieure du réservoir d'eau chaude (1) et agencé pour envoyer l'eau vers le moyen de chauffage (6),
 un deuxième tuyau (8) relié à une partie supérieure du réservoir d'eau chaude (1) et agencé pour renvoyer l'eau chauffée par le moyen de chauffage (6) vers la partie supérieure du réservoir d'eau chaude (1),
 un tuyau d'alimentation en eau chaude (16) relié à la partie supérieure du réservoir d'eau chaude (1) et agencé pour soutirer l'eau chaude de la partie supérieure du réservoir d'eau chaude (1) et
 un tuyau d'alimentation en eau (14) relié à la partie inférieure du réservoir d'eau chaude (1) et agencé pour permettre l'écoulement de l'eau dans la partie inférieure du réservoir d'eau chaude (1) ;
 un échangeur de chaleur (9) qui est formé avec un tuyau (9a) pour l'échangeur de chaleur (9) dans le réservoir d'eau chaude (1) et agencé pour augmenter la température de l'eau s'écoulant à travers le tuyau (9a) pour l'échangeur de chaleur (9) par échange de chaleur entre de l'eau chaude dans le réservoir d'eau chaude (1) et de l'eau s'écoulant à travers le tuyau (9a) pour l'échangeur de chaleur (9), dans lequel le tuyau (9a) pour l'échangeur de chaleur (9) est formé en spirale en tant que trajet unique ; dans lequel une extrémité externe du tuyau (9a) pour l'échangeur de chaleur (9) disposée sous la forme d'un mortier dans l'échangeur de chaleur (9) est reliée à un premier outil de raccordement (17) et une extrémité interne du tuyau (9a) pour l'échangeur de chaleur (9) étant reliée à un

deuxième outil de raccordement (18),
 une baignoire (10),
 un troisième tuyau (11) agencé pour envoyer de
 l'eau dans la baignoire (10) vers l'échangeur de
 chaleur (9), 5
 un quatrième tuyau (12) agencé pour renvoyer
 l'eau chaude après son échange thermique à
 partir de l'échangeur de chaleur (9) à la baignoi-
 re (10),
 le premier outil de raccordement (17) étant 10
 agencé pour relier l'échangeur de chaleur (9) au
 troisième tuyau (11) et
 le deuxième outil de raccordement (18) étant
 agencé pour relier l'échangeur de chaleur (9) au
 quatrième tuyau (12), 15
caractérisé en ce que
 la partie supérieure du réservoir d'eau chaude
 (1) est formée sensiblement sous une forme
 sphérique en demi-cercle,
 un cycle de pompe à chaleur qui est actionné à 20
 une pression supérieure à une pression critique
 est utilisé comme moyen de chauffage (6) dans
 lequel, lors de l'utilisation, de l'eau chaude ac-
 cumulée dans la partie supérieure du réservoir
 d'eau chaude (1) est soutirée du tuyau d'alimen- 25
 tation en eau chaude (16) et est utilisée en tant
 qu'alimentation en eau chaude et une quantité
 d'eau correspondant à l'eau chaude soutirée du
 tuyau d'alimentation en eau chaude (16) est in- 30
 troduite dans la partie inférieure du réservoir
 d'eau chaude (1) à partir du tuyau d'alimentation
 en eau (14) et
 le tuyau (9a) pour l'échangeur de chaleur (9) est
 disposé dans la partie supérieure du réservoir
 d'eau chaude (1), dans lequel des lignes adja- 35
 centes du tuyau (9a) sont situées de telle sorte
 qu'une ligne interne (9a) est plus haute qu'une
 ligne externe (9a) sous la forme d'un mortier
 dont la zone d'ouverture augmente vers le bas et
 dans lequel, lors de l'utilisation, de l'eau est four- 40
 nie à partir de la baignoire (10) à l'échangeur de
 chaleur (9) à travers le troisième tuyau (11) et
 l'eau est fournie à partir de la ligne externe (9a)
 à la ligne interne (9a) et l'eau est renvoyée à la
 baignoire (10) à travers le quatrième tuyau (12). 45

2. Appareil d'alimentation en eau chaude selon la re-
 vendication 1, dans lequel le tuyau (9a) de l'échan-
 geur de chaleur (9) possède une pluralité de parties
 droites et une pluralité de parties incurvées. 50

55

Fig.1

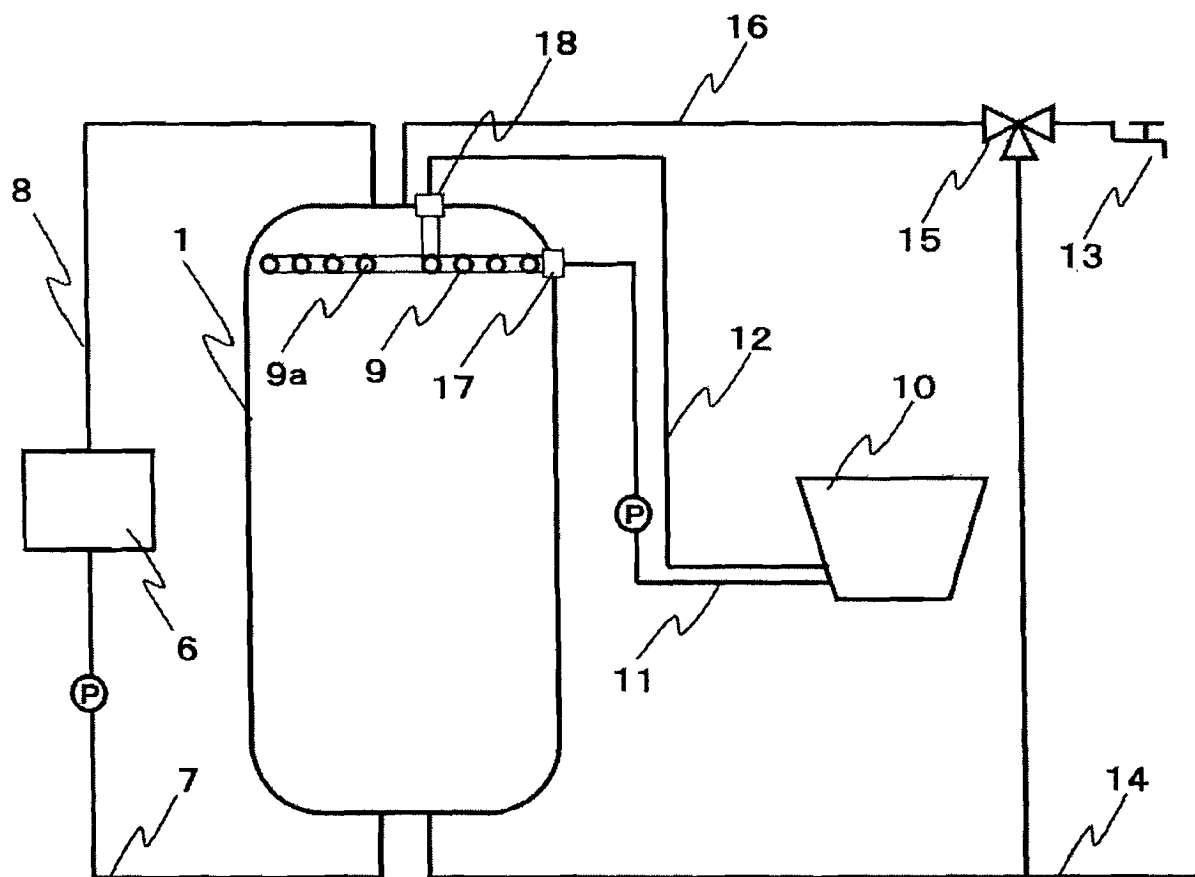


Fig.2

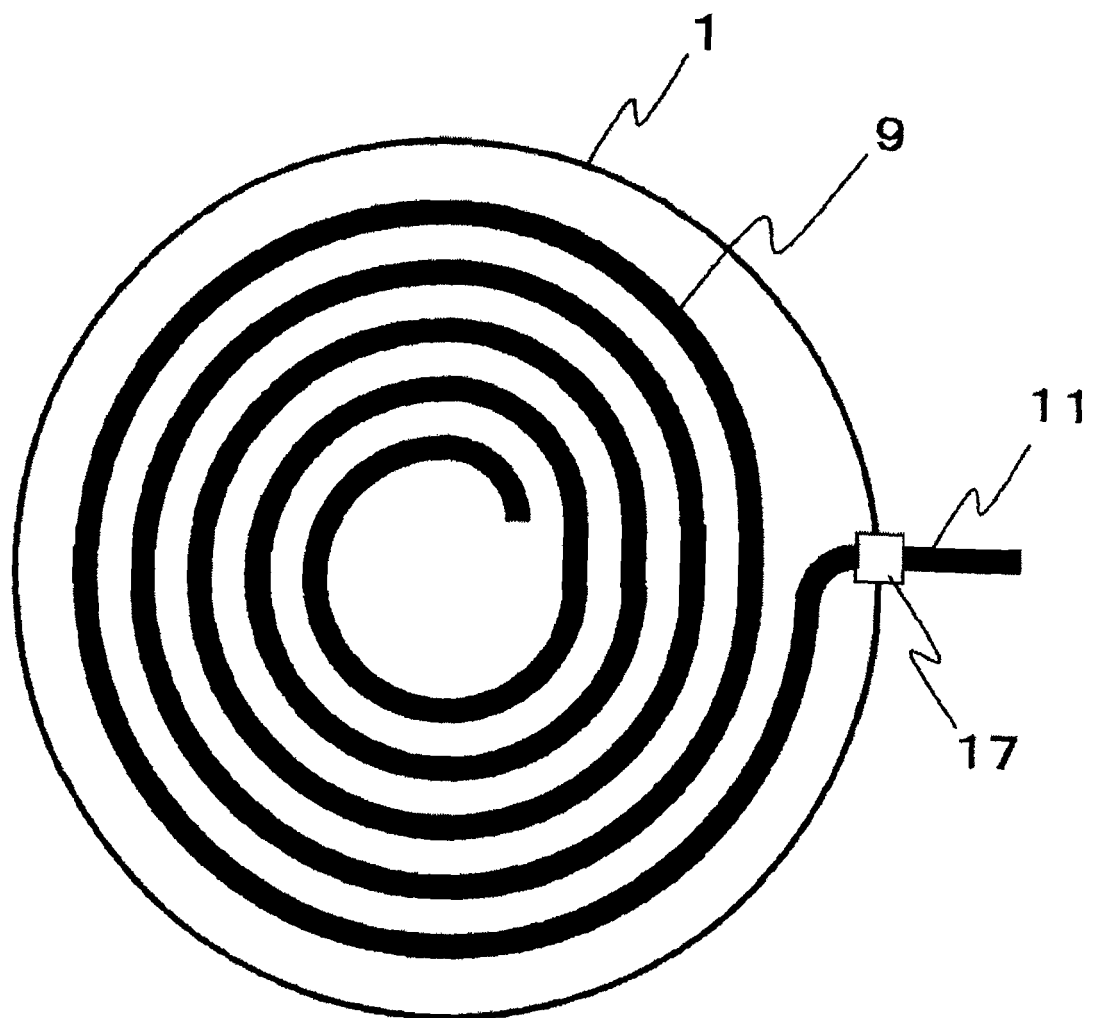


Fig.3

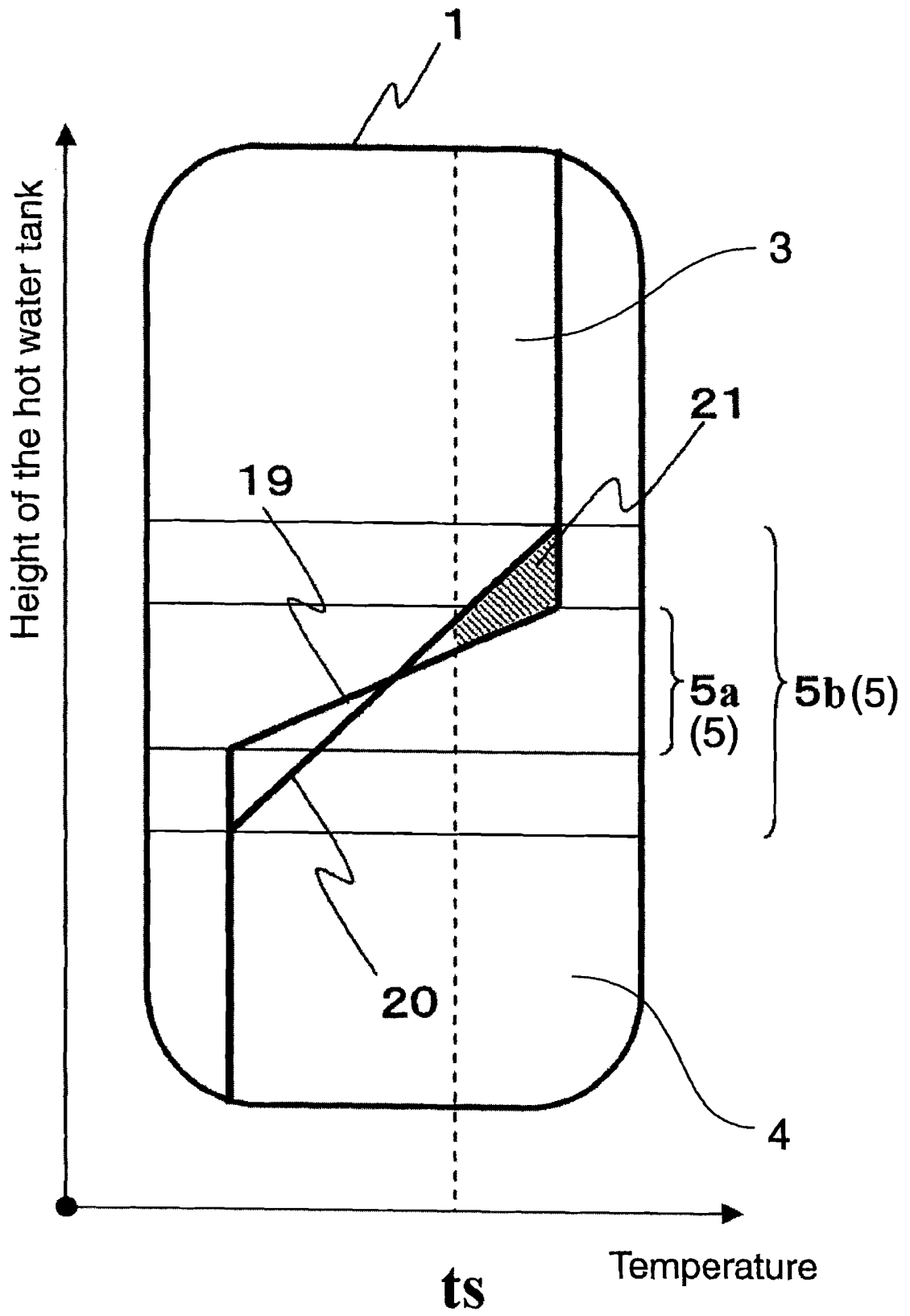


Fig.4

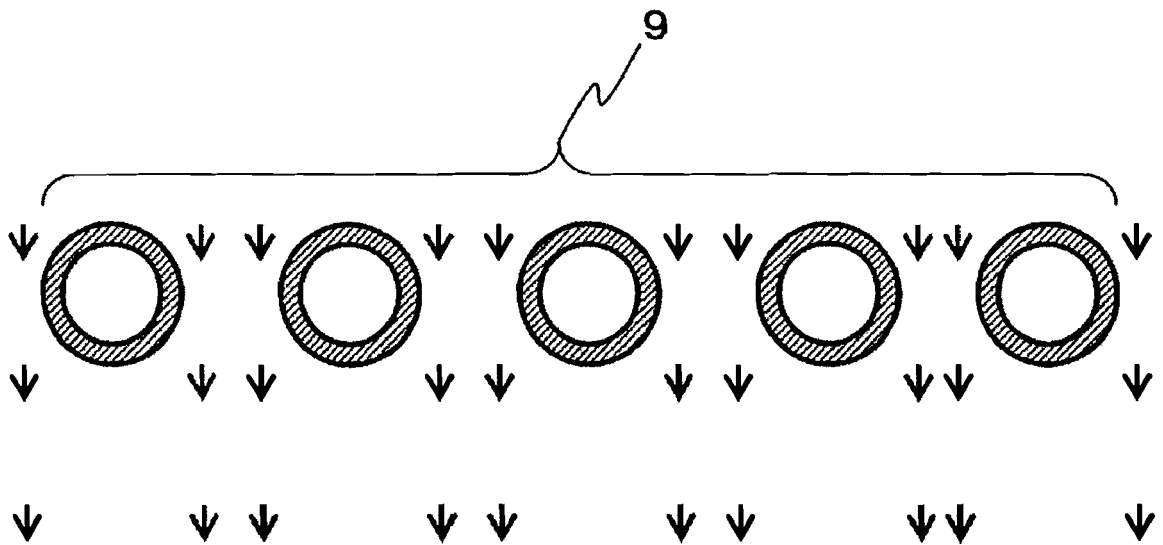


Fig.5

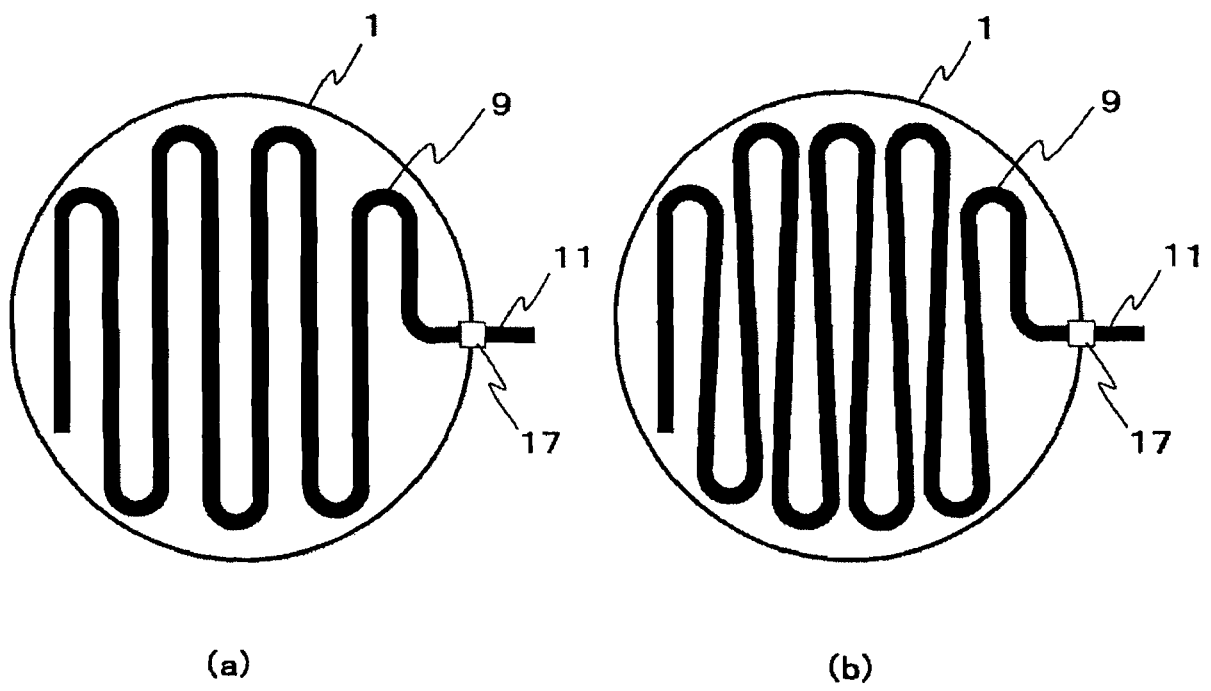


Fig.6

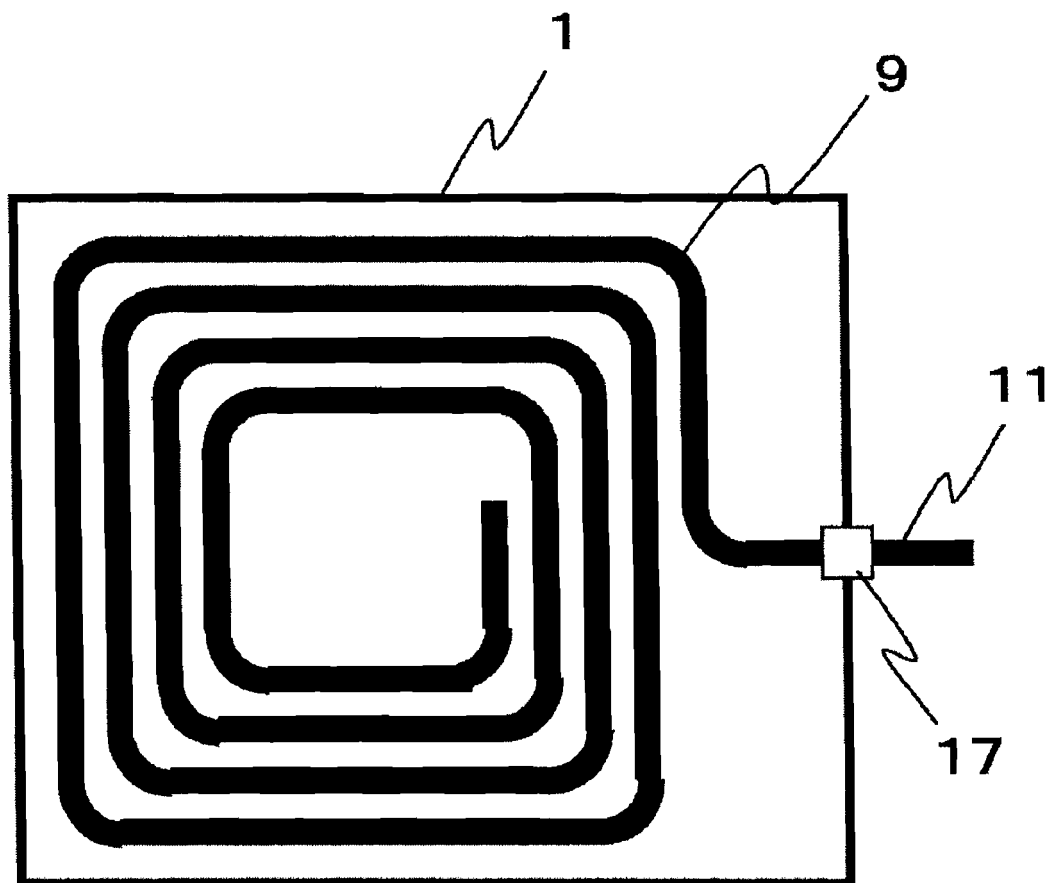


Fig.7

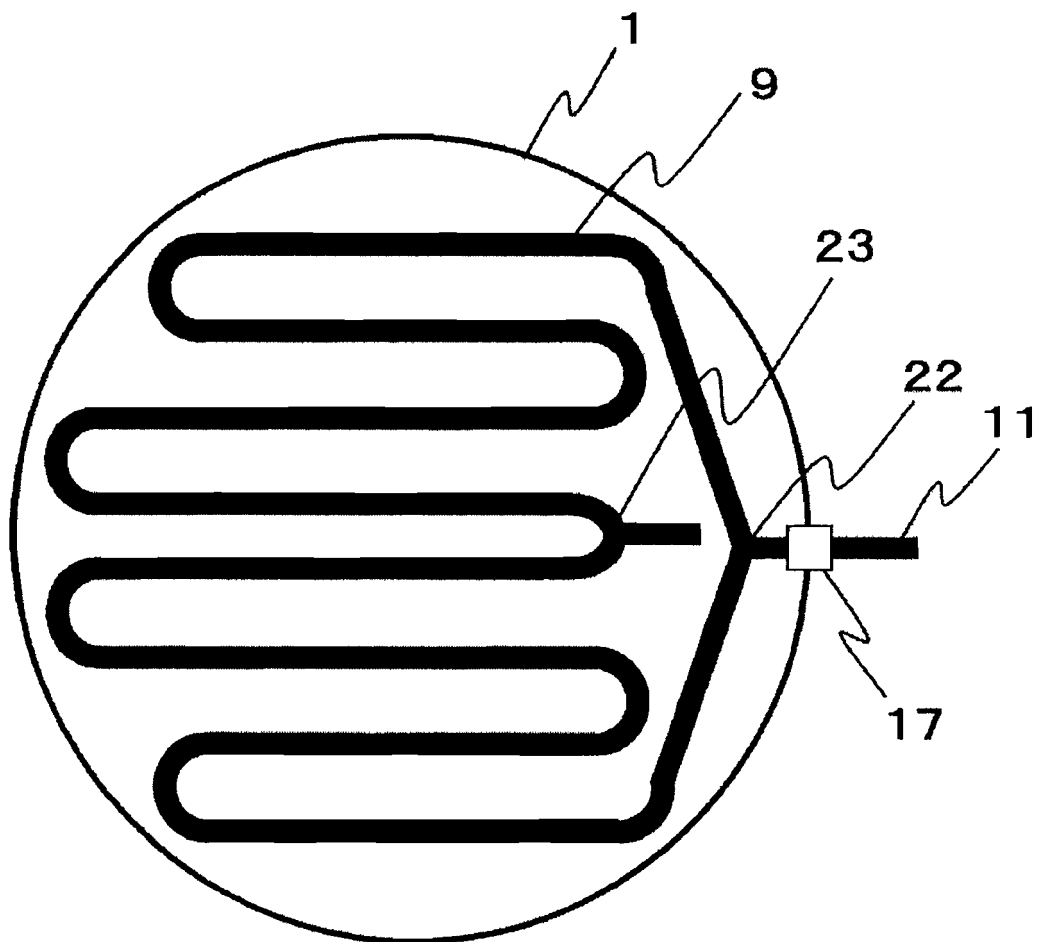


Fig.8

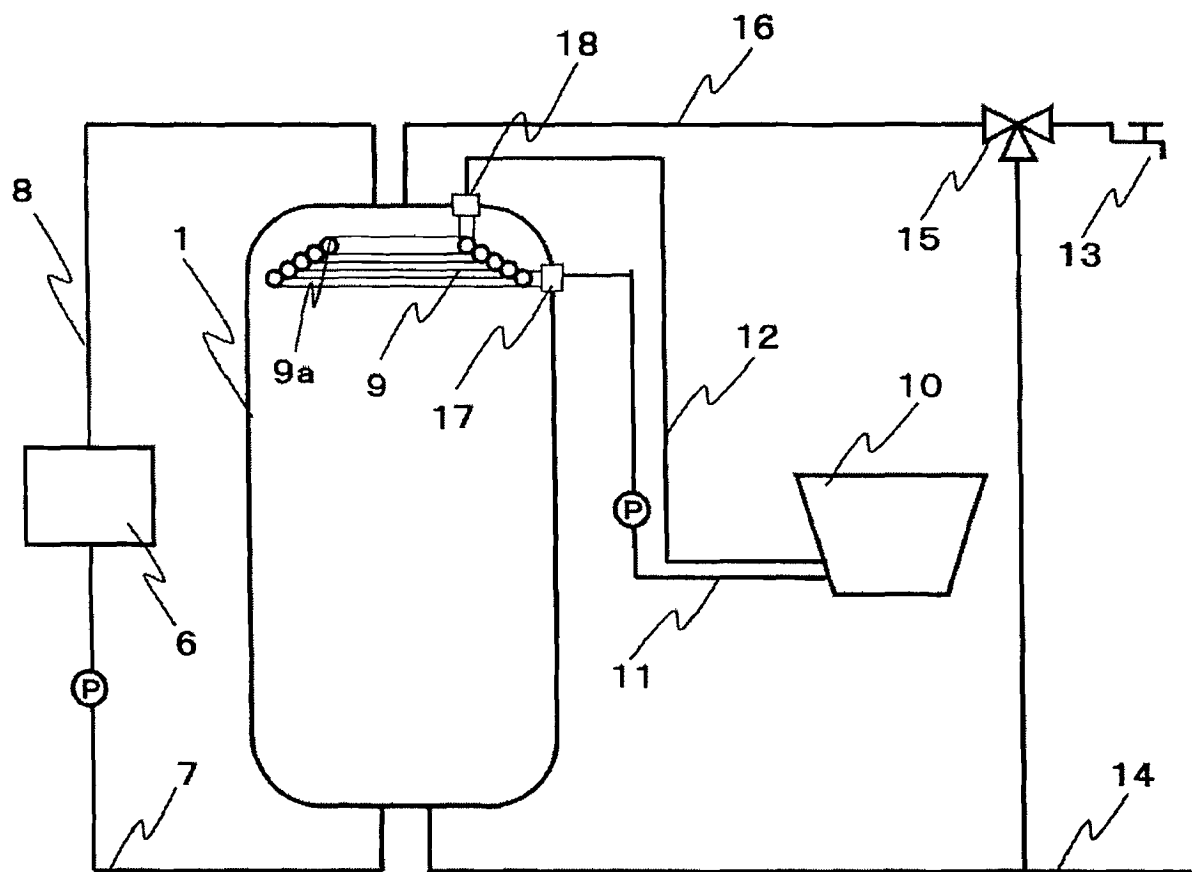


Fig.9

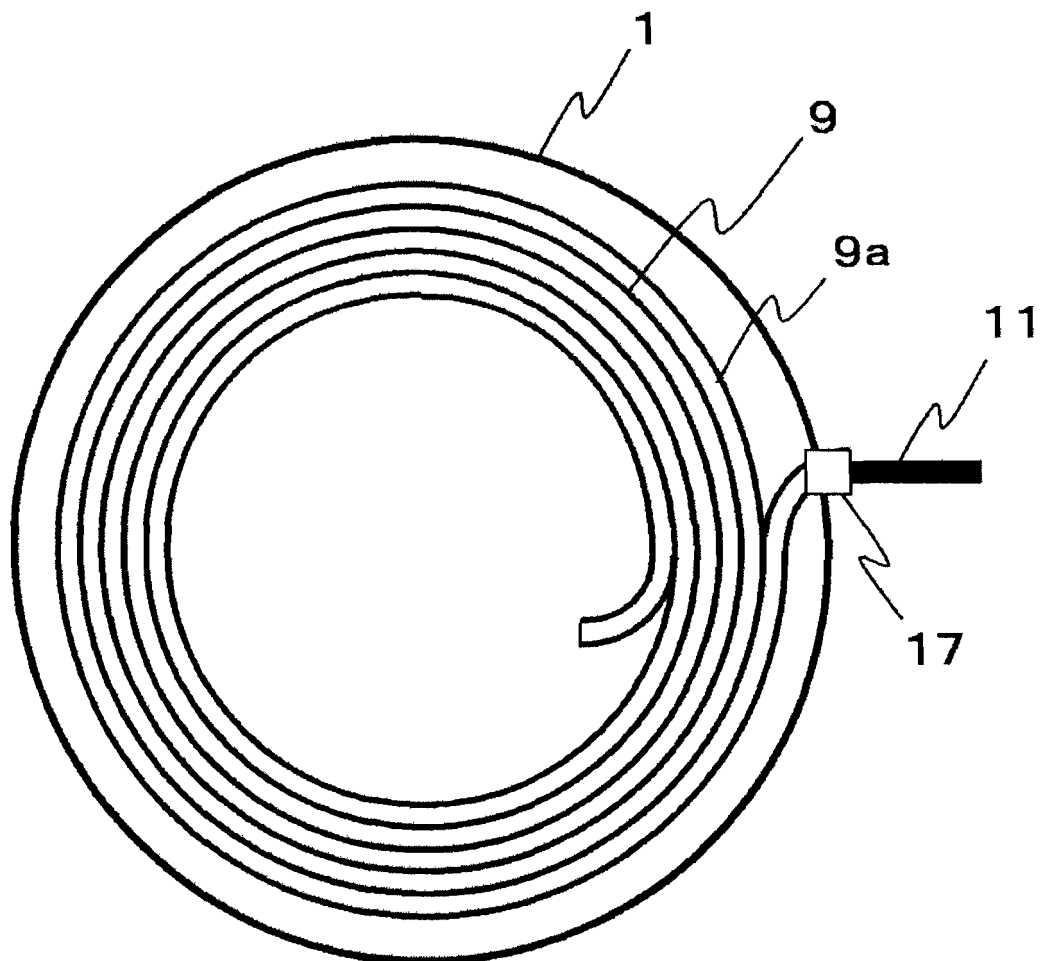


Fig.10

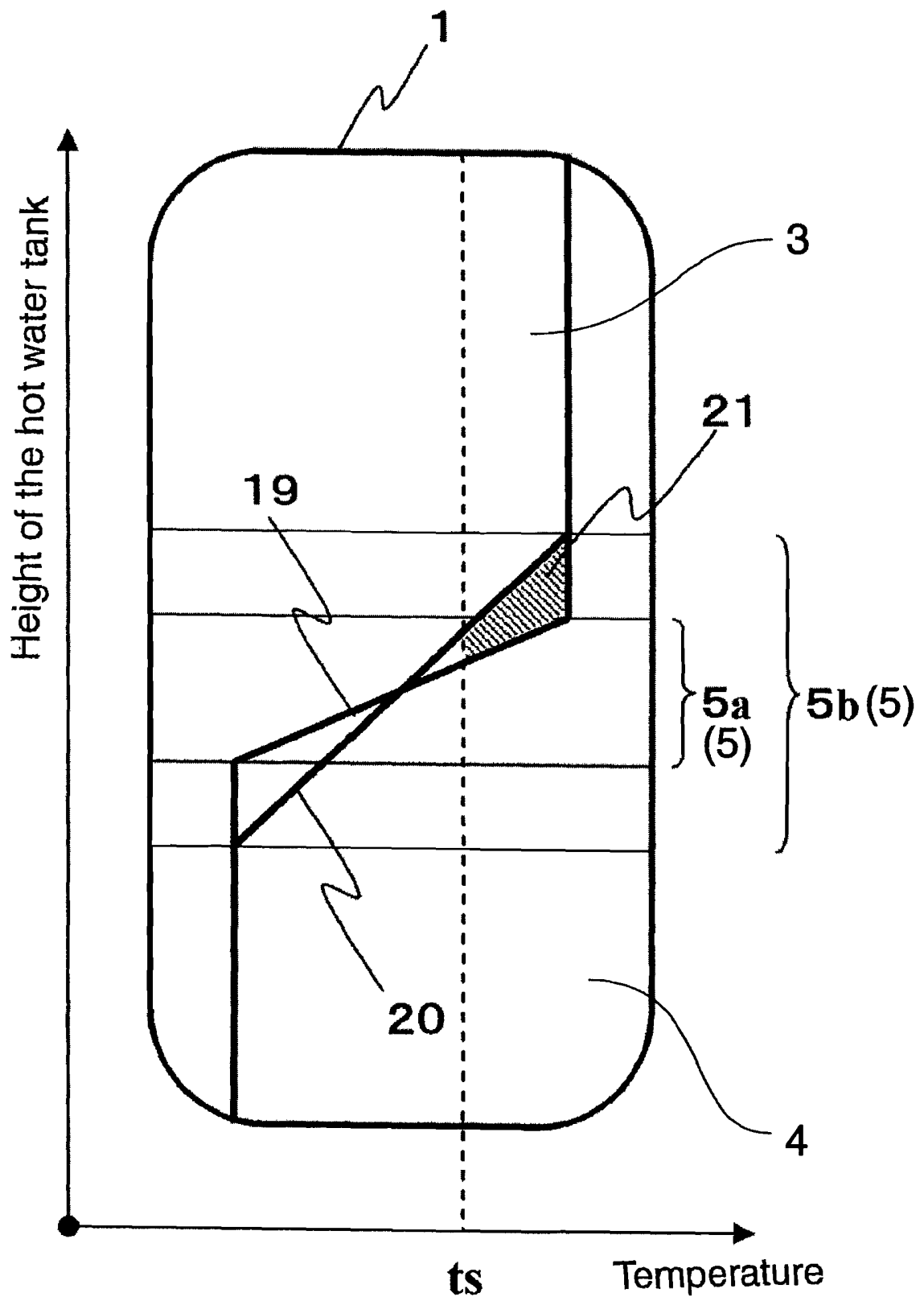


Fig.11

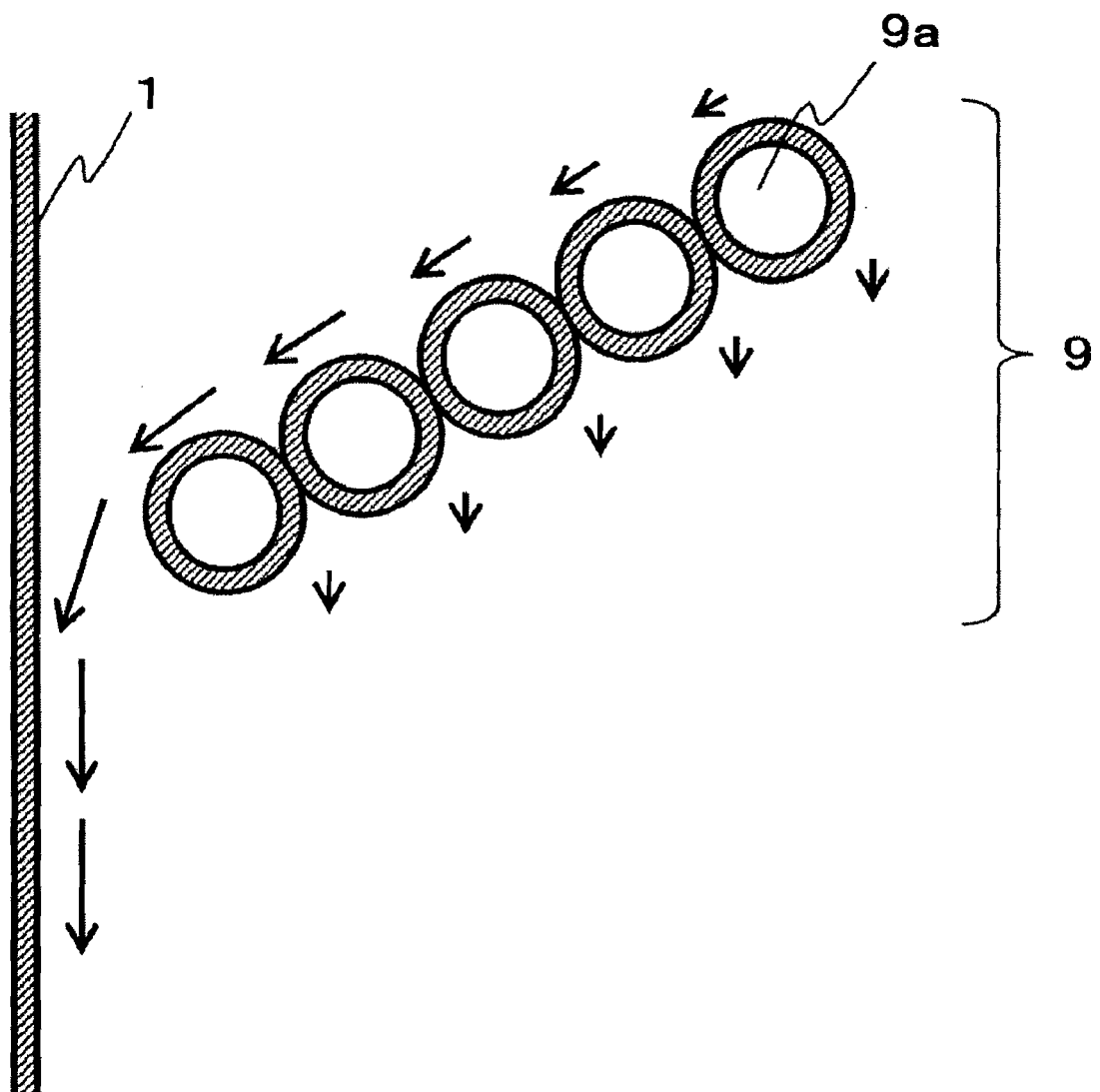


Fig.12

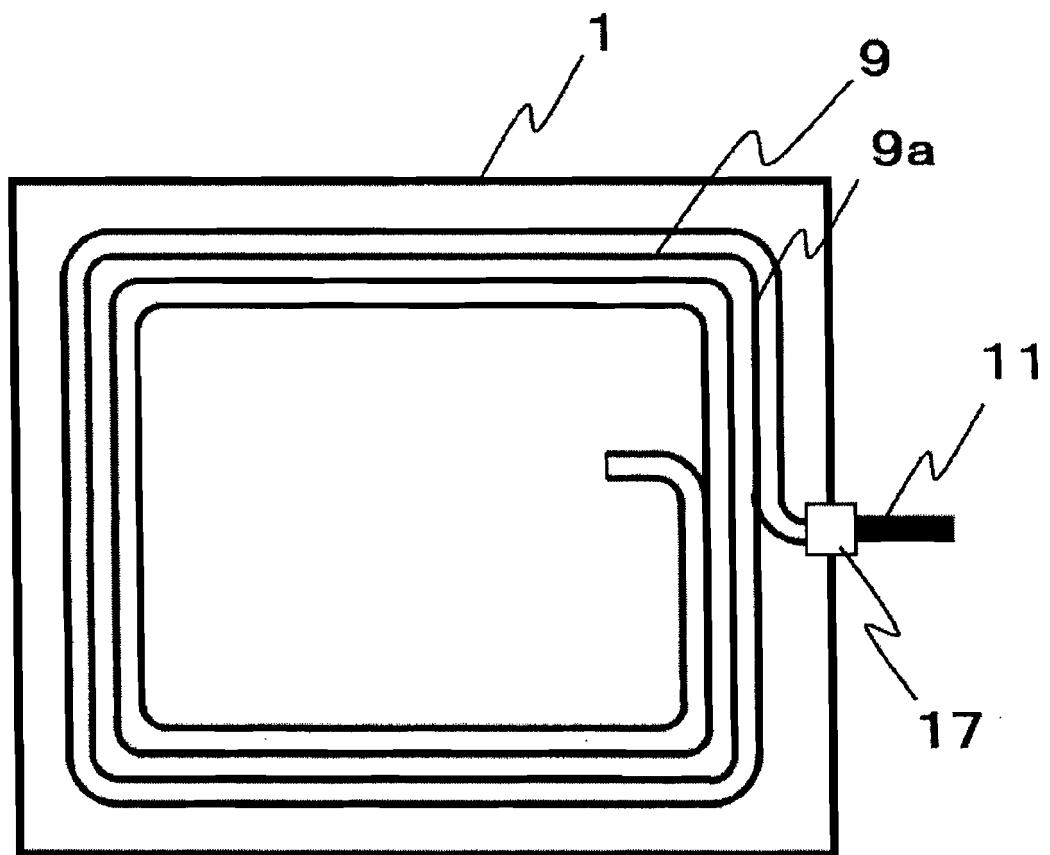


Fig.13

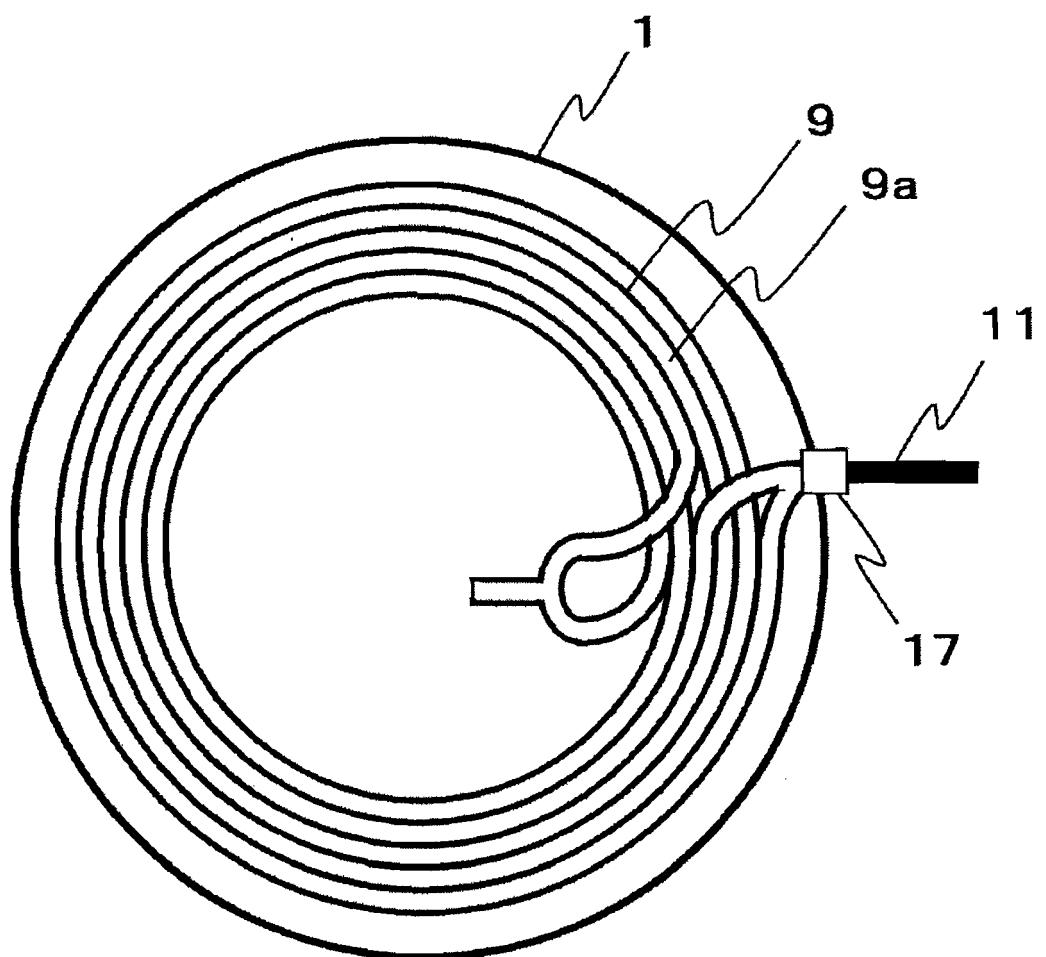


Fig.14

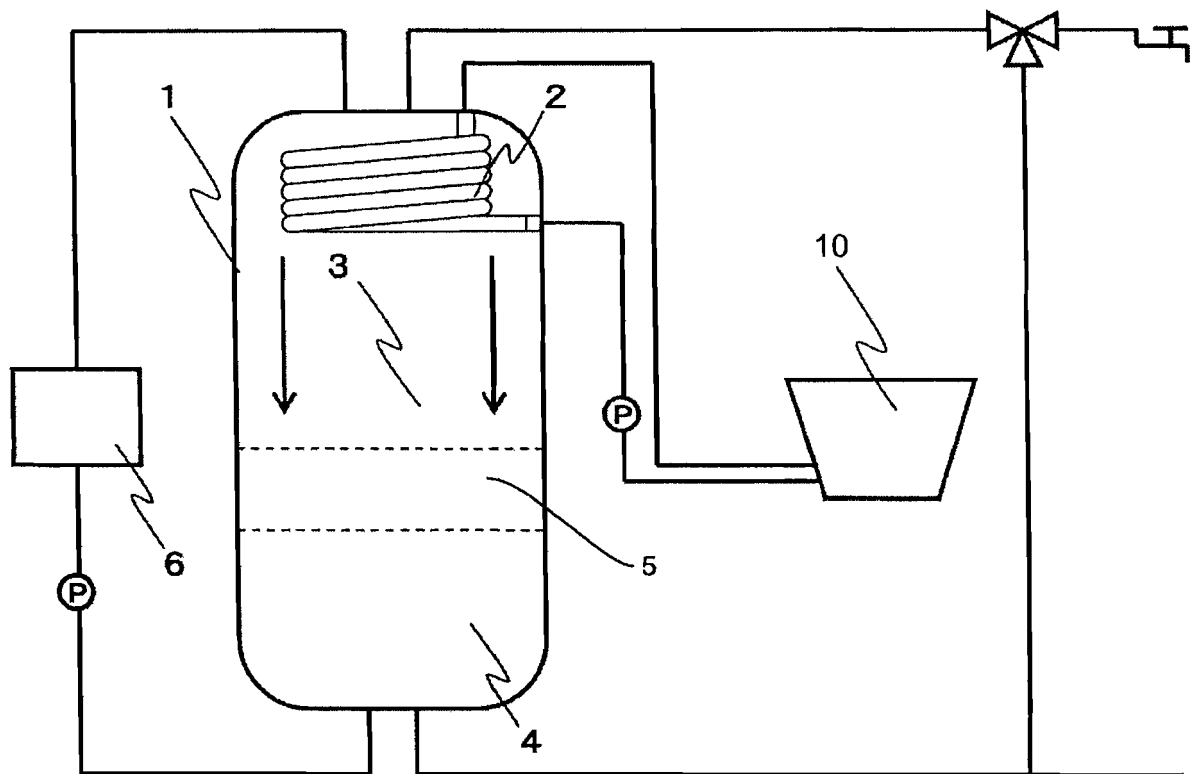
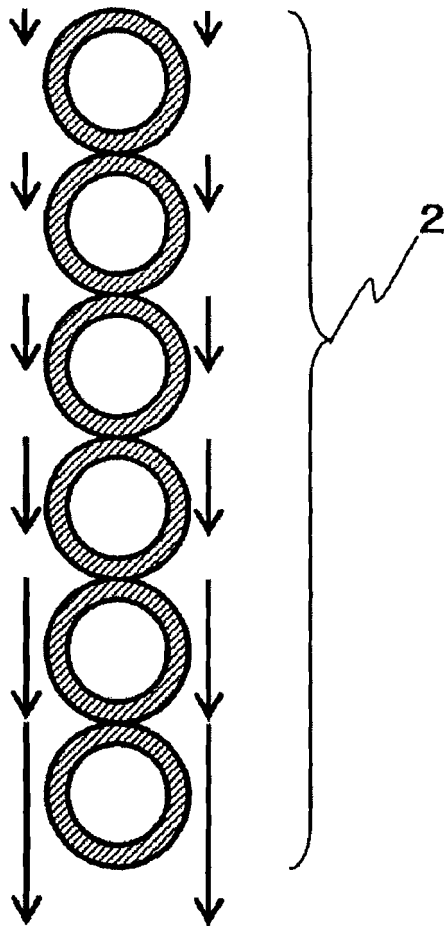


Fig.15



REFERENCES CITED IN THE DESCRIPTION

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