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(54) **HEAT EXCHANGER AND HOT-WATER SUPPLY DEVICE USING SAME**

WÄRMETAUSCHER UND DIESEN VERWENDENDE HEISSWASSERVERSORGUNGSVORRICHTUNG

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Description

Technical field

[0001] The present invention relates to a heat exchanger for use as a water heat exchanger of, for example, a heat pump hot water supply system; and a hot water supply system using the same.

Background art

[0002] A known heat pump hot water supply system, includes a heating unit which heats hot water supply water by a heat pump circuit; and a tank unit which stores hot water generated by the heating unit; and supplies the hot water from the tank unit to a bath and a kitchen (for example, see Japanese Patent Laid-Open Publication No. 2006-46877).

[0003] The heating unit of the hot water supply system includes a refrigerant circuit having a compressor, an evaporator, a water heat exchanger (gas cooler), and the like; and is configured to heat hot water supply water by the water heat exchanger and supply the hot water to the tank unit through a hot water pipe. Moreover, the water heat exchanger of the hot water supply system includes an inner tube which circulates a high temperature refrigerant of the heat pump circuit; and an outer tube in which the inner tube is arranged; and is configured to circulate hot water supply water between the inner tube and the outer tube and thereby exchange heat between the refrigerant and the hot water supply water through the inner tube.

[0004] Meanwhile, the inner tube and the outer tube have a problem in that a so-called scale consisting primarily of calcium and magnesium contained in hot water supply water (e.g., calcium carbonate) is easily adhered thereto; and when a refrigerant and hot water supply water are in countercurrent flow, particularly a scale is strongly adhered to and deposited on the downstream side (high temperature side) of the hot water supply water and impedes water circulation. In light of this, conventionally, all of the outer tubes or only the downstream side thereof is formed by large-diameter tubes so as to sufficiently secure the circulation cross-sectional area between the inner tube and the outer tube so that scale deposit does not impede water circulation.

[0005] This is shown in the European patent application EP 0418534 A, which corresponds to the preamble of claim 1.

Disclosure of the invention

Problems to be solved by the invention

[0006] However, there is a problem that when all of the outer tubes or only the downstream side thereof is formed by large-diameter tubes, the kinds and costs of tubes used for making the outer tubes are increased and the productivity is reduced.

[0007] In view of the above problem, the present invention has been made, and an object of the present invention is to provide a heat exchanger which can effectively prevent circulation blockage due to scale deposits without forming all of the outer tubes or only the downstream side thereof by large-diameter tubes; and a hot water supply system using the same.

Means for solving the problems

[0008] In order to achieve the above object, the present invention provides a heat exchanger comprising: a heat conductive inner tube which circulates a first heat medium; and an outer tube in which the inner tube is arranged, the heat exchanger circulating a second heat medium between the inner tube and the outer tube and thereby exchanging heat between the first heat medium and the second heat medium through the inner tube, wherein the number of inner tubes on a downstream side of the second heat medium is smaller than the number of inner tubes on an upstream side of the second heat medium, characterised in that; the diameter of outer tubes on an upstream side, in use, of the second heat medium is equal to the diameter of outer tubes on a downstream side, in use, of the second heat medium,

[0009] More specifically, the number of inner tubes on the downstream side of the second heat medium is smaller than the number of inner tubes on the upstream side thereof. Therefore, the circulation cross-sectional area can be secured such that the circulation cross-sectional area between the outer tube and the inner tube on the downstream side of the second heat medium is larger than the circulation cross-sectional area between the outer tube and the inner tube on the upstream side thereof. Thus, for example, any scale deposited on the downstream side of the hot water supply water as the second heat medium does not impede circulation of the second heat medium. Moreover, the number of inner tubes on the upstream side of the second heat medium is larger than the number of inner tubes on the downstream side thereof, and thus the second heat medium is sufficiently heated by the inner tubes on the upstream side.

Advantages of the invention

[0010] According to the present invention, the circulation cross-sectional area can be secured such that the circulation cross-sectional area between the outer tube and the inner tube on the downstream side of the second heat medium is larger than the circulation cross-sectional area between the outer tube and the inner tube on the upstream side thereof, and thus the circulation blockage in the outer tube on the downstream side due to scale deposits can be effectively prevented without forming all of the outer tubes or only the downstream side thereof by large-diameter tubes. Therefore, the kinds and costs of tubes used for making the outer tubes are not in-

creased and thus the productivity can be improved. In this case, the second heat medium can be sufficiently heated by the inner tubes on the upstream side of the second heat medium, and thus there is an advantage that the entire heat transfer efficiency is not lowered.

Brief description of the drawings

[0011]

Figure 1 is a schematic block diagram of a heat pump hot water supply system illustrating an embodiment of the present invention;
Figure 2 is a schematic side view of a first water heat exchanger;
Figure 3 is a plan view of the first water heat exchanger;
Figure 4 is a side view of the first water heat exchanger;
Figure 5 is a cross-sectional view along line X-X in Figure 3;
Figure 6 is a plan view of the first water heat exchanger illustrating another embodiment of the present invention;
Figure 7 is a side view of the first water heat exchanger;
and
Figure 8 is a cross-sectional view along line Y-Y in Figure 6.

Best mode for carrying out the invention

[0012] Figures 1 to 5 illustrate an embodiment of the present invention: Figure 1 is a schematic block diagram of a heat pump hot water supply system; Figure 2 is a schematic block diagram of a first water heat exchanger; Figure 3 is a plan view thereof; Figure 4 is a side view thereof; and Figure 5 is a cross-sectional view along line X-X in Figure 3.

[0013] The heat pump hot water supply system illustrated in the same figure includes a refrigerant circuit 10 which circulates a refrigerant; a first hot water supply circuit 20 which circulates hot water supply water; a second hot water supply circuit 30 which circulates hot water supply water; a bath circuit 40 which circulates bath water; a first water heat exchanger 50 which exchanges heat between the refrigerant of the refrigerant circuit 10 and the hot water supply water of the first hot water supply circuit 20; and a second water heat exchanger 60 which exchanges heat between the hot water supply water of the second hot water supply circuit 30 and the bath water of the bath circuit 40, wherein the first water heat exchanger 50 constitutes the heat exchanger of the present invention.

[0014] The refrigerant circuit 10 is formed by connecting a compressor 11, an expansion valve 12, an air heat exchanger 13, and a first water heat exchanger 50; and is configured to circulate a refrigerant in the order of the compressor 11 → the first water heat exchanger 50 → the expansion valve 12 → the air heat exchanger 13 → the compressor 11. Note that the refrigerant used in the refrigerant circuit 10 is, for example, a natural refrigerant such as carbon dioxide.

[0015] The first hot water supply circuit 20 is formed by connecting a hot water storage tank 21, a first pump 22, and the first water heat exchanger 50; and is configured to circulate hot water supply water in the order of the hot water storage tank 21 → the first pump 22 → the first water heat exchanger 50 → the hot water storage tank 21. The hot water storage tank 21 is connected to a water supply pipe 23 and the second hot water supply circuit 30; and the hot water supply water supplied from the water supply pipe 23 is configured to circulate through the first hot water supply circuit 20 via the hot water storage tank 21. The hot water storage tank 21 is connected to a bath 41 through a flow path 25 in which a second pump 24 is provided so that the hot water supply water in the hot water storage tank 21 is supplied to the bath 41 by the second pump 24.

[0016] The second hot water supply circuit 30 is formed by connecting the hot water storage tank 21, a third pump 31, and a second water heat exchanger 60; and is configured to circulate hot water supply water in the order of the hot water storage tank 21 → the second water heat exchanger 60 → the third pump 31 → the hot water storage tank 21.

[0017] The bath circuit 40 is formed by connecting the bath 41, a fourth pump 42, and the second water heat exchanger 60; and is configured to circulate bath water in the order of the bath 41 → the fourth pump 42 → the second water heat exchanger 60 → the bath 41.

[0018] The first water heat exchanger 50 is connected to the refrigerant circuit 10 and the first hot water supply circuit 20; and is configured to exchange heat between a refrigerant as the first heat medium which circulates through the refrigerant circuit 10 and hot water supply water as the second heat medium which circulates through the first hot water supply circuit 20. The first water heat exchanger 50 includes heat conductive first and second inner tubes 51 and 52 each of which circulates a refrigerant; first and second outer tubes 53 and 54 in which the first and second inner tubes 51 and 52 are arranged respectively; a pair of first end headers 55 to which one end of the first and second inner tubes 51 and 52 is connected respectively; a pair of second end headers 56 to which one end of the first and second outer tubes 53 and 54 is connected respectively; a first intermediate header 57 to which the other end of the first and second inner tubes 51 and 52 is connected respectively; and a second intermediate header 58 to which the other end of the first and second outer tubes 53 and 54 is connected respectively, wherein each of the inner tubes 51 and 52 and each of the outer tubes 53 and 54 are spirally wound. In this case, two first inner tubes 51 are arranged in the first outer tube 53 and four second inner tubes 52 are arranged in the second outer tube 54.

[0019] Each first end header 55 is connected to the refrigerant circuit 10 and is connected to a refrigerant inflow pipe 55a and a refrigerant outflow pipe 55b. In this case, the first end header 55 on the inflow side is connected to each first inner tube 51 mutually in parallel; and the first end header 55 on the outflow side is connected to each second inner tube 52 mutually in parallel. Each second end header 56 is connected to the first hot water supply circuit 20 and is connected to a hot water supply water inflow pipe 56a and a hot water supply water outflow pipe 55b. In this case, each second inner tube 52 passes through the second end header 56 on the inflow side; and each first inner tube 51 passes through the second end header 56 on the outflow side.

[0020] The first intermediate header 57 includes a pair of header portions 57a; and a communication pipe 57b which allows each header portion 57a to be mutually communicated with each other. Each first inner tube 51 is connected mutually in parallel to one header portion 57a; and each second inner tube 52 is connected mutually in parallel to the other header portion 57a. In this case, the first and second inner tubes 51 and 52 are connected to the first intermediate header 57 in the same direction. The first and second outer tubes 53 and 54 are connected to the second intermediate header 58 in the same direction; and the first and second inner tubes 51 and 52 pass therethrough respectively.

[0021] Moreover, the first inner tube 51 and the first outer tube 53 are formed such that a spirally wound portion A1 which is spirally wound from outside to inside and a spirally wound portion A2 which is spirally wound from inside to outside are arranged mutually in two upper and lower stages; and the pipe conduit of each of the spirally wound portions A1 and A2 continues to each other by shifting the pipe conduit in up and down directions inside each of the spirally wound portions A1 and A2. The second inner tube 52 and the second outer tube 54 are formed such that the spirally wound portion A2 which is spirally wound from inside to outside and the spirally wound portion A1 which is spirally wound from outside to inside are arranged mutually in two upper and lower stages; and the pipe conduit of each of the spirally wound portions A1 and A2 continues to each other by shifting the pipe conduit in up and down directions inside each of the spirally wound portions A1 and A2. The spirally wound portions A1 and A2 of the first inner tube 51 and the first outer tube 53 are arranged above the spirally wound portions A1 and A2 of the second inner tube 52 and the second outer tube 54; and each of the spirally wound portions A1 and A2 are arranged in four upper and lower stages.

[0022] The second water heat exchanger 60 is connected to the second hot water supply circuit 30 and the bath circuit 40 and is configured to exchange heat between the hot water supply water of the second hot water supply circuit 30 and the bath water of the bath circuit 40.

[0023] Moreover, the hot water supply system includes a heating unit 70 having the refrigerant circuit 10 and the first water heat exchanger 50; and a tank unit 80 having the hot water storage tank 21, the first pump 22, the second pump 24, the second hot water supply circuit 30, the fourth pump 42, and the second water heat exchanger 60, wherein the heating unit 70 is connected to the tank unit 80 through the first hot water supply circuit 20.

[0024] In the above configured hot water supply system, the first water heat exchanger 50 exchanges heat between a high temperature refrigerant of the refrigerant circuit 10 and a hot water supply water of the first hot water supply circuit 20 and the hot water supply water is heated. In the first water heat exchanger 50, as illustrated by a dashed line arrow in Figure 2, the refrigerant of the refrigerant circuit 10 flows into each first inner tube 51 through one first end header 55. After circulation in each first inner tube 51, the refrigerant flows into each second inner tube 52 through the first intermediate header 57. After circulation in each second inner tube 52, the refrigerant flows outside through the other first end header 55. In addition, as illustrated by a solid line arrow in Figure 2, the hot water supply water of the hot water supply circuit 20 flows into the second outer tube 54 through one second end header 56. After circulation between the second outer tube 54 and each second inner tube 52, the hot water supply water flows into the first outer tube 53 through the second intermediate header 58. After circulation between the first outer tube 53 and each first inner tube 51, the hot water supply water flows outside through the other second end header 56. That is, in the first water heat exchanger 50, the refrigerant and the hot water supply water circulate in a mutually opposite direction. Note that the number of first inner tubes 51 on the downstream side of the hot water supply water is smaller than the number of second inner tubes 52 on the upstream side of the hot water supply water. Therefore, the circulation cross-sectional area is secured such that the circulation cross-sectional area between the first outer tube 53 and each first inner tube 51 is larger than the circulation cross-sectional area between the second outer tube 54 and each second inner tube 52. Thus, any scale deposited on the downstream side of the hot water supply water does not impede circulation of the hot water supply water. In addition, the number of second inner tubes 52 on the upstream side of the hot water supply water is larger than the number of first inner tubes 51 on the downstream side thereof and thus the hot water supply water is sufficiently heated by each second inner tube 52.

[0025] As described above, according to the present embodiment, the number of first inner tubes 51 on the downstream side of the hot water supply water is made smaller than the number of second inner tubes 52 on the upstream side thereof. Therefore, the circulation cross-sectional area can be secured such that the circulation cross-sectional area between the first outer tube 53 and each first inner tube 51 is larger than the circulation cross-sectional area between the second outer tube 54 and each second inner tube 52. Thus, the circulation blockage in the outer tube 53 on the downstream side due to

scale deposits can be effectively prevented without forming all of the outer tubes 53 and 54 or the only outer tube 53 on the downstream side by large-diameter tubes. Therefore, the kinds and costs of tubes used for making the outer tubles 53 and 54 are not increased and the productivity can be improved. In this case, the number of second inner tubes 52 on the upstream side of the hot water supply water is larger than the number of first inner tubes 51 on the downstream side thereof and the hot water supply water can be sufficiently heated by each second inner tube 52. Thus, there is an advantage that the entire heat transfer efficiency is not lowered.

[0026] Moreover, the first and second intermediate headers 57 and 58 are provided between the upstream side and the downstream side of the hot water supply water, to which the first inner tube 51 and the first outer tube 53; and the second inner tube 52 and the second outer tube 54 are connected in the same direction so that the pipe conduit is fold back at each of the intermediate headers 57 and 58. Therefore, each of the inner tubes 51 and 52 and each of the outer tubes 53 and 54 are not too lengthy and the entire first water heat exchanger 50 can be compact.

[0027] Further, each of the inner tubes 51 and 52 and each of the outer tubes 53 and 54 are spirally wound and are formed such that the spirally wound portion A1 which is spirally wound from outside to inside and the spirally wound portion A2 which is spirally wound from inside to outside are arranged mutually in up and down directions; and the pipe conduit of each of the spirally wound portions A1 and A2 continues to each other by shifting the pipe conduit in up and down directions inside each of the adjacent spirally wound portions A1 and A2. Thus, each of the inner tubes 51 and 52 and each of the outer tubes 53 and 54 with a large length can be effectively spirally wound and very advantageous to miniaturization.

[0028] Note that in the above described embodiment, the pipe conduit is shifted inside the adjacent spirally wound portions A1 and A2, but the pipe conduit may be shifted outside the spirally wound portions A1 and A2.

[0029] Further, in the above described embodiment, the heat exchanger of the present invention is used as the first water heat exchanger 50 of the heat pump hot water supply system, but the present invention can be applied to other heat exchangers for another application as long as the heat exchanger can exchange heat between the first heat medium and the second heat medium.

[0030] Figures 6 to 8 illustrate another embodiment of the present invention: Figure 6 is a plan view of a first water heat exchanger; Figure 7 is a side view thereof; and Figure 8 is a cross-sectional view along line Y-Y in Figure 6. Note that the same reference numerals or characters are assigned to the components which are the same as or similar to those of the above described embodiment.

[0031] In the present embodiment, of each of the spirally wound portions A1 and A2 arranged in four upper and lower stages, the spirally wound portions A1 and A2 up to the two stages from the bottom are formed so as to extend by a predetermined length L in one side direction (in a direction orthogonal to the direction in which each of the spirally wound portions A1 and A2 is arranged) than the other spirally wound portions A1 and A2. The extension portion 54a is arranged below the evaporator 13 in the heating unit 70. More specifically, the extension portion 54a can be arranged in a space below the evaporator 13 which is dead space if the extension portion 54a is not provided. Thus, the length of the second outer tube 54 can be increased by the length of the extension portion 54a, which can increase the capacity and thus can improve the capability of the first water heat exchanger 50. Note that in the above-described embodiment, the extension portion 54a of the first water heat exchanger 50 is arranged below the evaporator 13, but the extension portion 54a may be arranged below a device other than the evaporator 13.

Description of symbols

[0032]

50	First water heat exchanger
51, 52	Inner tube
53, 54	Outer tube
54a	Extension portion
57	First intermediate header
58	Second intermediate header
A1, A2	Spirally wound portion

Claims

1. A heat exchanger comprising: a heat conductive inner tube (51, 52) which circulates a first heat medium; and an outer tube (53, 54) in which the inner tube (51, 52) is arranged, the heat exchanger circulating a second heat medium between the inner tube (51, 52) and the outer tube (53, 54) and thereby exchanging heat between the first heat medium and the second heat medium through the inner tube (51, 52), wherein the number of inner tubes (51) on a downstream side of the second heat medium is smaller than the number of inner tubes (52) on an upstream side of the second heat medium, **characterised in that**;
the diameter of outer tubes (54) on an upstream side, in use, of the
the diameter of outer tubes (54) on an upstream side, in use, of the second heat medium is equal to the diameter of outer tubes (53) on a downstream side, in use, of the second heat medium,

2. The heat exchanger according to claim 1, further comprising:

a first intermediate header (57) which is provided between the inner tube (52) on the upstream side of the second heat medium and the inner tube (51) on the downstream side thereof, and to which the inner tube (52) on the upstream side and the inner tube (51) on the downstream side are connected in the same direction; and
a second intermediate header (58) which is provided between the outer tube (54) on the upstream side of the second heat medium and the outer tube (53) on the downstream side thereof, and to which the outer tube (54) on the upstream side and the outer tube (53) on the downstream side are connected in the same direction.

3. The heat exchanger according to claim 1, wherein the inner tube (51, 52) and the outer tube (53, 54) are spirally wound and are formed such that a spirally wound portion (A1) which is (A2) which is spirally wound from inside to outside are alternately arranged; and a pipe conduit continues between each of the spirally wound portions (A1, A2) by shifting the pipe conduit inside or outside the adjacent spirally wound portions (A1, A2) in a direction in which the spirally wound portions (A1, A2) are arranged.

4. The heat exchanger according to claim 3, wherein some of the spirally wound portions (A1, A2) of the each of the spirally wound portions (A1, A2) are formed so as to extend in a direction orthogonal to the direction in which each of the spirally wound portions (A1, A2) is arranged than the other spirally wound portions (A1, A2).

5. A hot water supply system having the heat exchanger according to any one of claims 1 to 4, which circulates hot water supply water as the second heat medium into the outer tube (53, 54) and circulates the first heat medium which heats hot water supply water into the inner tube (51, 52) of the heat exchanger.

Patentansprüche

1. Wärmetauscher, umfassend: eine Wärme leitende Innenröhre (51, 52), die ein erstes Wärmemedium umwälzt; und eine Außenröhre (53, 54), in der die Innenröhre (51, 52) angeordnet ist, wobei der Wärmetauscher ein zweites Wärmemedium zwischen der Innenröhre (51, 52) und der Außenröhre (53, 54) umwälzt und dadurch durch die Innenröhre (51, 52) Wärme zwischen dem ersten Wärmemedium und dem zweiten Wärmemedium austauscht,
wobei die Anzahl der Innenröhren (51) auf einer nachgeschalteten Seite des zweiten Wärmemediums kleiner ist als die Anzahl der Innenröhren (52) auf einer vorgeschalteten Seite des zweiten Wärmemediums, **dadurch gekennzeichnet, dass**
der Durchmesser der Außenröhren (54) auf einer vorgeschalteten Seite des zweiten Wärmemediums im Betrieb gleich dem Durchmesser der Außenröhren (53) auf einer nachgeschalteten Seite des zweiten Wärmemediums im Betrieb ist.

2. Wärmetauscher nach Anspruch 1, weiter umfassend:

einen ersten Zwischenverteiler (57), der zwischen der Innenröhre (52) auf der vorgeschalteten Seite des zweiten Wärmemediums und der Innenröhre (51) auf dessen nachgeschalteter Seite angeordnet ist und an den die Innenröhre (52) auf der vorgeschalteten Seite und die Innenröhre (51) auf der nachgeschalteten Seite in der gleichen Richtung angeschlossen sind; und
einen zweiten Zwischenverteiler (58), der zwischen der Außenröhre (54) auf der vorgeschalteten Seite des zweiten Wärmemediums und der Außenröhre (53) auf dessen nachgeschalteter Seite angeordnet ist und an den die Außenröhre (54) auf der vorgeschalteten Seite und die Außenröhre (53) auf der nachgeschalteten Seite in der gleichen Richtung angeschlossen sind.

3. Wärmetauscher nach Anspruch 1, wobei die Innenröhre (51, 52) und die Außenröhre (53, 54) spiralgewickelt und so ausgebildet sind, dass eine spiralgewickelte Partie (A1) und eine spiralgewickelte Partie (A2), die von innen nach außen spiralgewickelt sind, abwechselnd angeordnet sind; und wobei eine Rohrleitung zwischen den spiralgewickelten Partien (A1, A2) erhalten bleibt, indem die Rohrleitung innerhalb oder außerhalb der benachbarten spiralgewickelten Partien (A1, A2) in einer Richtung verschoben wird, in der die spiralgewickelten Partien (A1, A2) angeordnet sind.

4. Wärmetauscher nach Anspruch 3, wobei einige der spiralgewickelten Partien (A1, A2) der jeweiligen spiralgewickelten Partien (A1, A2) so ausgebildet sind, dass sie sich in einer Richtung orthogonal zu der Richtung erstrecken, in der die jeweiligen spiralgewickelten Partien (A1, A2) zum Unterschied von den anderen spiralgewickelten Partien (A1, A2) angeordnet sind.

5. Heißwasserversorgungssystem mit dem Wärmetauscher nach einem der Ansprüche 1 bis 4, das heißes Versorgungswasser als zweites Wärmemedium in der Außenröhre (53, 54) umwälzt und das erste Wärmemedium, das das heiße Versorgungswasser erwärmt, in der Innenröhre (51, 52) des Wärmetauschers umwälzt.

Revendications

1. Echangeur de chaleur comportant: un tube intérieur (51, 52) conducteur de chaleur dans lequel circule un premier moyen de transmission de chaleur; et un tube extérieur (53, 54) à l'intérieur duquel se trouve disposé le tube intérieur (51, 52), l'échangeur de chaleur faisant circuler un deuxième moyen de transmission de chaleur entre le tube intérieur (51, 52) et le tube extérieur (53, 54) assurant ainsi l'échange de chaleur entre le premier moyen de transmission de chaleur et le deuxième moyen de transmission de chaleur au moyen du tube intérieur (51, 52), **caractérisé en ce que** le nombre de tubes intérieurs (51) côté aval du deuxième moyen de transmission de chaleur est inférieur au nombre de tubes intérieurs (52) côté amont du deuxième moyen de transmission de chaleur, **caractérisé en ce que**:

   le diamètre des tubes extérieurs (54) côté amont en service du deuxième moyen de transmission de chaleur est égal au diamètre des tubes extérieurs (53) côté aval en service du deuxième moyen de transmission de chaleur.

2. Echangeur de chaleur selon la revendication 1, comportant par ailleurs:

   un premier collecteur intermédiaire (57) situé entre le tube intérieur (52) côté amont du deuxième moyen de transmission de chaleur et le tube intérieur (51) côté aval de ce deuxième moyen de transmission de chaleur, et auquel sont raccordés dans la même direction le tube intérieur (52) côté amont et le tube intérieur (51) côté aval; et
   un deuxième collecteur intermédiaire (58) situé entre le tube extérieur (54) côté amont du deuxième moyen de transmission de chaleur et le tube extérieur (53) côté aval de ce deuxième moyen de transmission de chaleur, et auquel sont raccordés dans la même direction le tube extérieur (54) côté amont et le tube extérieur (53) côté aval.

3. Echangeur de chaleur selon la revendication 1, **caractérisé en ce que** le tube intérieur (51, 52) et le tube extérieur (53, 54) sont enroulés en spirale et sont formés de telle manière qu'une partie enroulée en spirale (A1) qui est (A2) qui est enroulée en spirale de l'intérieur à l'extérieur sont alternées; et de manière aussi qu'une tuyauterie se prolonge entre chacun des parties enroulées en spirale (A1, A2) par déplacement de la tuyauterie à l'intérieur ou à l'extérieur des parties adjacentes enroulées en spirale (A1, A2) dans la même direction que celle où sont disposées les parties enroulées en spirale (A1, A2).

4. Echangeur de chaleur selon la revendication 3, **caractérisé en ce que** certaines portions des parties enroulées en spirale (A1, A2) de chacune des parties enroulées en spirale (A1, A2) sont formées de manière à s'étendre dans une direction qui est orthogonale par rapport à la direction dans laquelle chacune des parties enroulées en spirale (A1, A2) se trouve disposée que les autres parties enroulées en spirale (A1, A2).

5. Système d'approvisionnement en eau chaude comportant l'échangeur de chaleur selon l'une quelconque des revendications 1 à 4, qui fait circuler l'eau chaude approvisionnée en tant que deuxième moyen de transmission de chaleur dans le tube extérieur (53, 54) et qui fait circuler, dans le tube intérieur (51, 52) de l'échangeur de chaleur, le premier moyen de transmission de chaleur servant à chauffer l'eau chaude approvisionnée.

Fig. 1

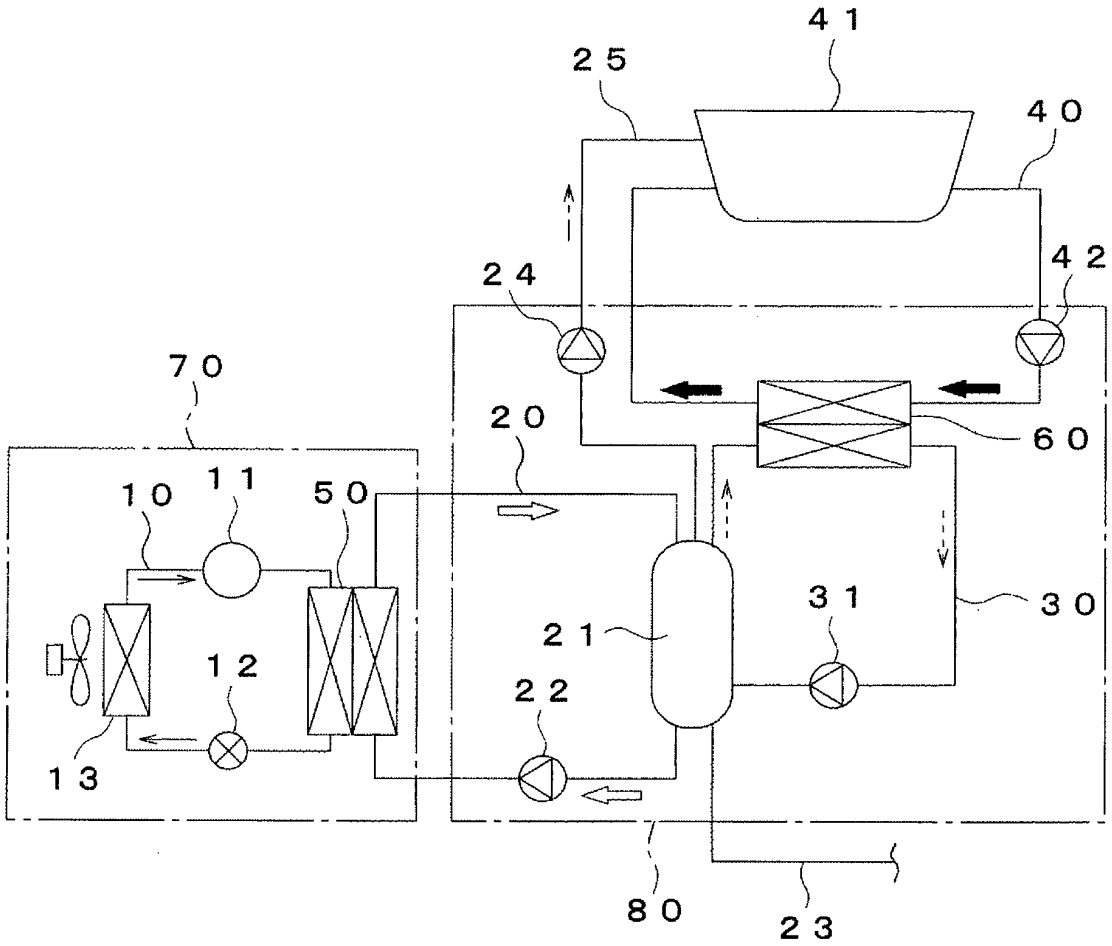


Fig. 2

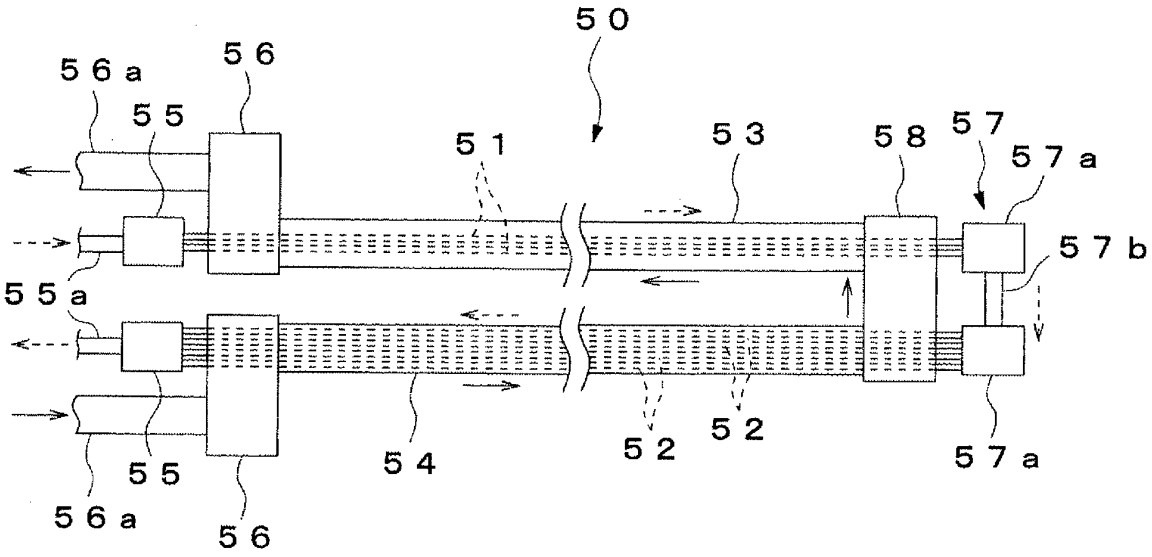

50
56a
56
55
51
53
58
57
57a
57b
55a
54
52
52
55
56a
56
57a

Fig. 3

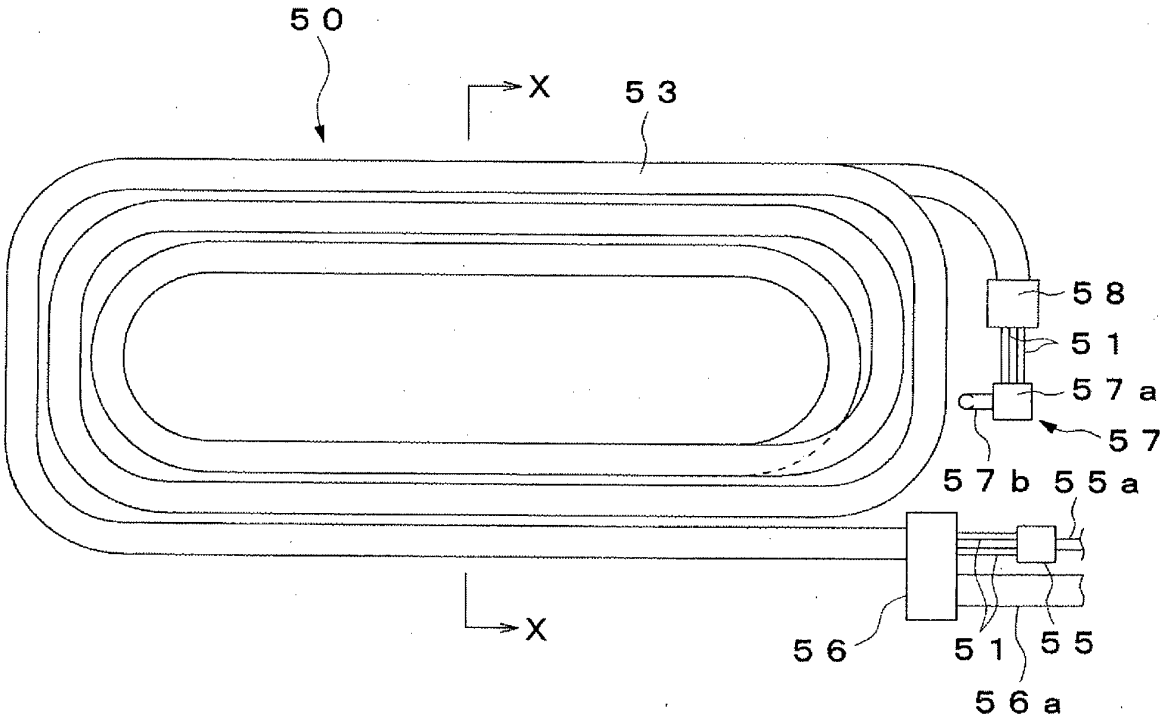

50
X
53
58
51
57a
57
57b
55a
X
56
51
55
56a

Fig. 4

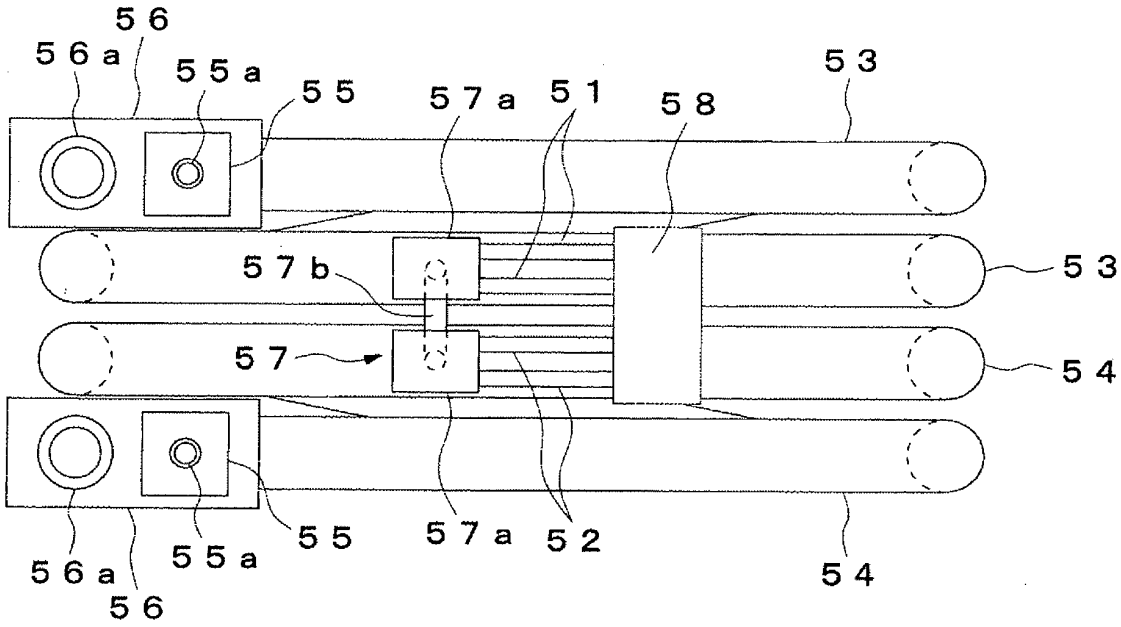

56
56a
55a
55
57a
51
58
53
57b
53
57
54
56a
55a
55
57a
52
54
56

Fig. 5

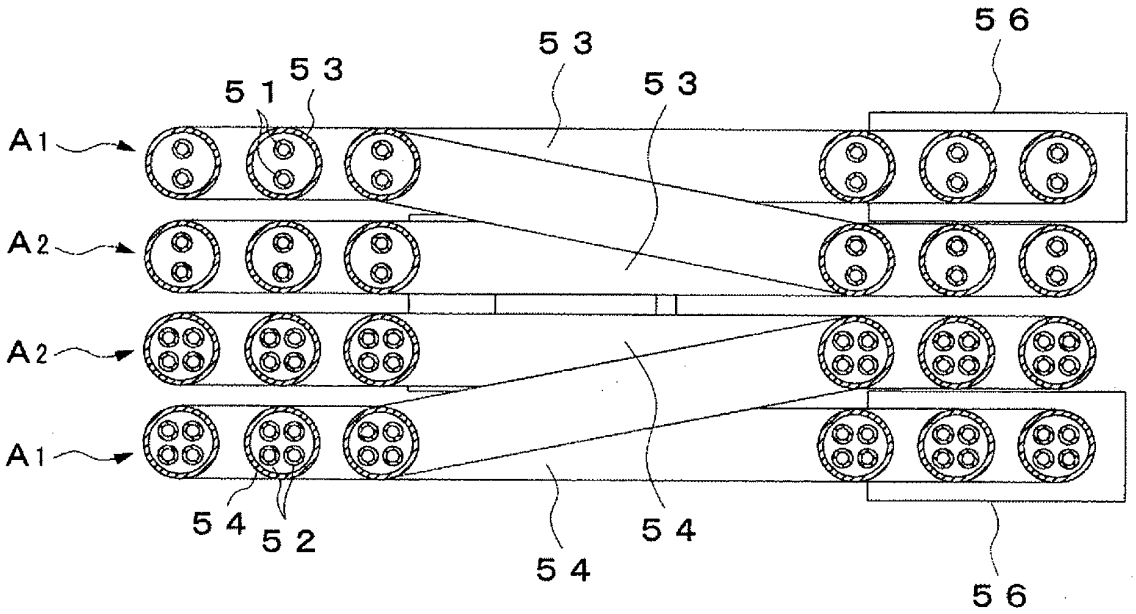

56
53
53
51
53
A1
A2
A2
A1
54
52
54
54
56

Fig. 6

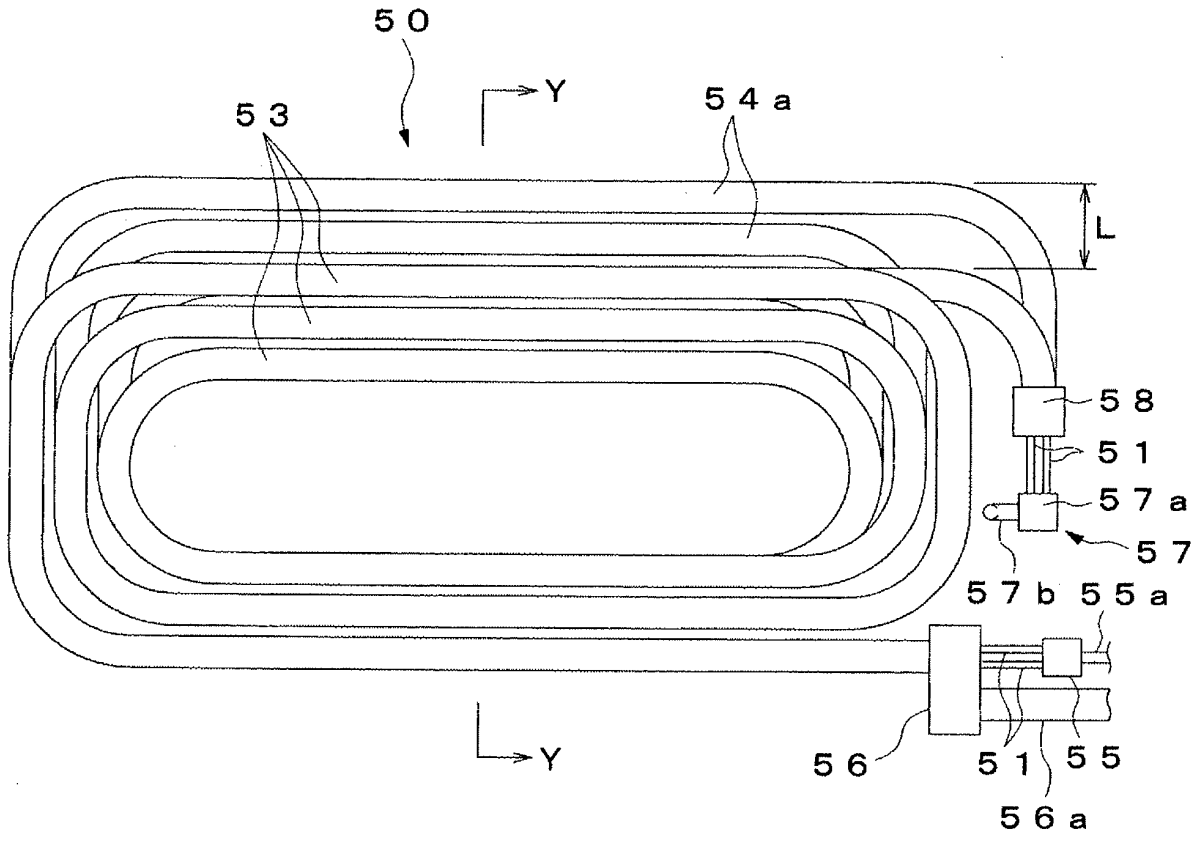


Fig. 7

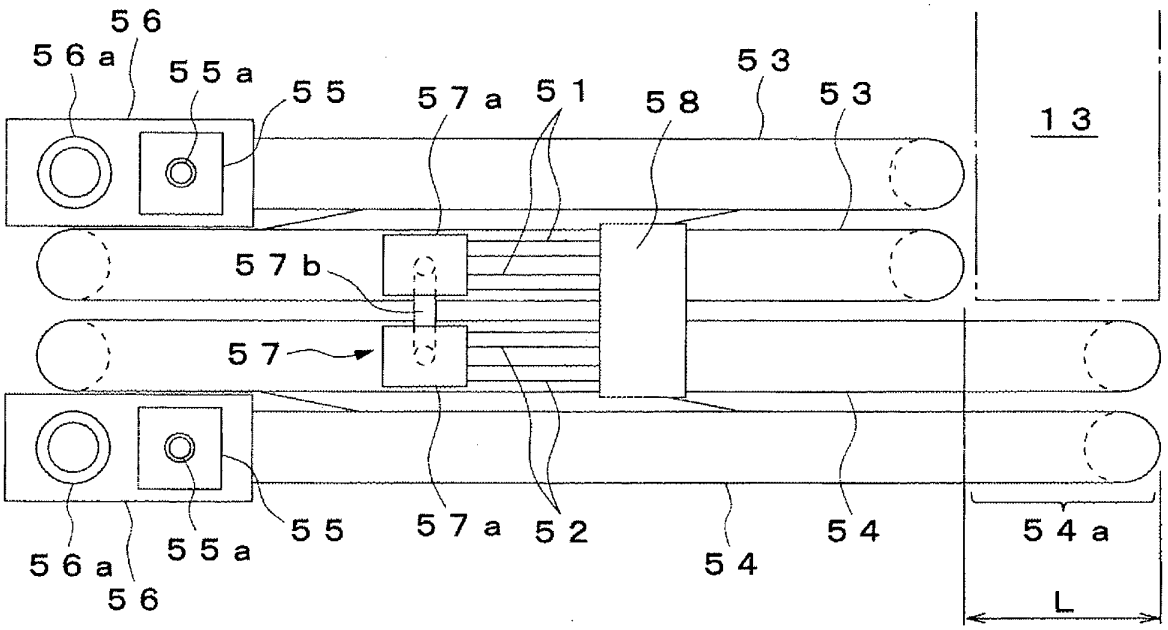
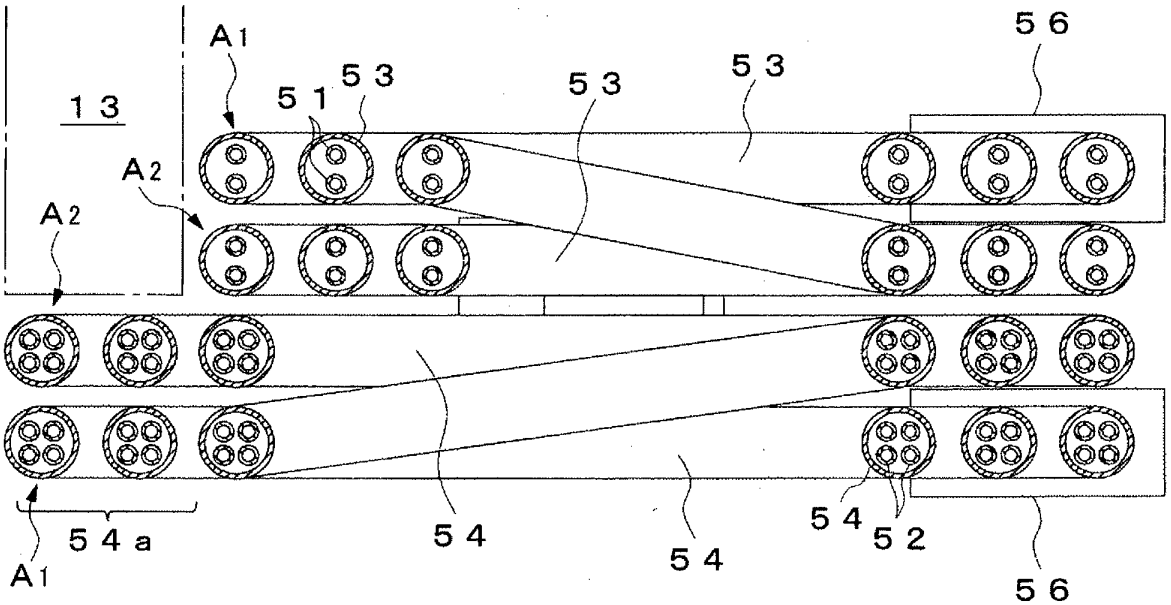

56
56a
55a
55
57a
51
58
53
53
13
57b
57
56a
55a
55
57a
52
54
54
54a
56
L

Fig. 8


A1
13
51
53
53
53
56
A2
A2
54a
A1
54
54
54
52
56

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2006046877 A **[0002]**
- EP 0418534 A **[0005]**