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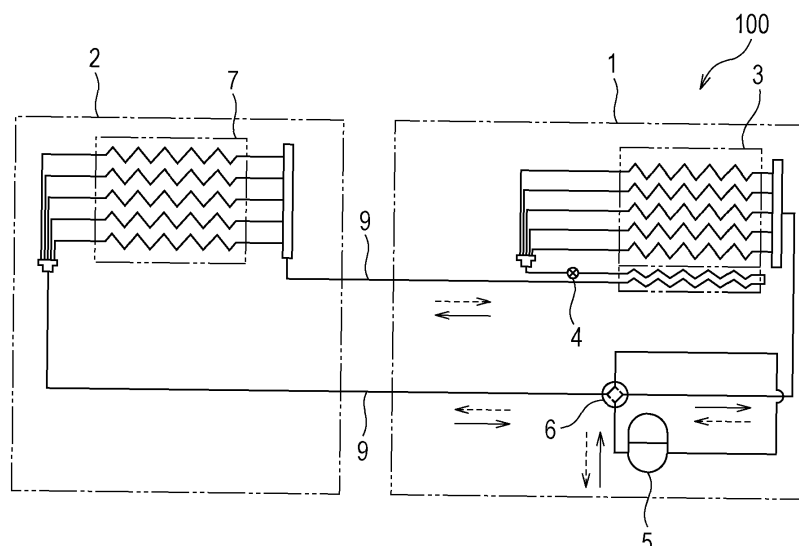
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(54) **AIR-CONDITIONER**

(57) Provided is an air-conditioner which includes an aluminum refrigerant pipe made of aluminum or metal containing aluminum, a copper refrigerant pipe made of copper or metal containing copper, and a connection portion connecting the aluminum refrigerant pipe and the copper refrigerant pipe. One end portion of the aluminum refrigerant pipe is located lower than one end portion of the copper refrigerant pipe. The connection portion is located such that an angle between a center

axis of the connection portion and an up-down direction is within 45 degrees. The aluminum refrigerant pipe includes an inclined portion extending in a direction inclined upward with respect to the center axis of the connection portion, and a bottom portion of the inclined portion is located lower than the connection portion. The air-conditioner includes a cover that covers at least a portion from the connection portion to the bottom portion of the inclined portion.

FIG. 1



Description

BACKGROUND

1. Technical Field

[0001] The present disclosure relates to an air-conditioner.

2. Related Art

[0002] Generally, a refrigerant pipe provided in an air-conditioner is made of copper or metal containing copper. However, in recent years, part of the refrigerant pipe is made of aluminum or metal containing aluminum in terms of weight reduction and cost reduction. It has been known that aluminum is easily corroded due to contact with other metals, i.e., so-called bimetallic corrosion is easily caused. For this reason, corrosion is easily caused at a connection portion between an aluminum refrigerant pipe made of aluminum or metal containing aluminum and a copper refrigerant pipe made of copper or metal containing copper. When corrosion is caused, the aluminum refrigerant pipe may be perforated. In this case, refrigerant may leak through a hole.

[0003] In an air-conditioner disclosed in JP-A-2014-159953, an aluminum refrigerant pipe has an inverted U-shaped portion or a U-shaped portion in the vicinity of the above-described connection portion. The inverted U-shaped portion has an upwardly-raised inverted U-shape. On the other hand, the U-shaped portion has a downwardly-raised U-shape. This configuration reduces a water droplet on a copper refrigerant pipe from flowing down to the aluminum refrigerant pipe. As a result, corrosion of the aluminum refrigerant pipe is avoided.

[0004] However, a problem that the above-described U-shaped or inverted U-shaped portion occupies an internal space (unit internal space) of an indoor unit or an outdoor unit is caused with reduction in the size of the air-conditioner. Moreover, in order to prevent the water droplet on, e.g., the copper refrigerant pipe from adhering to the aluminum refrigerant pipe, the copper refrigerant pipe is generally located lower than the aluminum refrigerant pipe. However, for example, in a case where the refrigerant pipe is drawn upward, the aluminum refrigerant pipe folded back after drawn upward once needs to be connected to the copper refrigerant pipe. Thus, the entire length of the refrigerant pipe increases. As a result, the unit internal space may be occupied.

SUMMARY

[0005] An air-conditioner according to the present embodiment includes an aluminum refrigerant pipe made of aluminum or metal containing aluminum, a copper refrigerant pipe made of copper or metal containing copper, and a connection portion connecting the aluminum re-

frigerant pipe and the copper refrigerant pipe. One end portion of the aluminum refrigerant pipe is located lower than one end portion of the copper refrigerant pipe. The connection portion is located such that an angle between a center axis of the connection portion and an up-down direction is within 45 degrees. The aluminum refrigerant pipe includes an inclined portion extending in a direction inclined upward with respect to the center axis of the connection portion, and a bottom portion of the inclined portion is located lower than the connection portion. The air-conditioner includes a cover that covers at least a portion from the connection portion to the bottom portion of the inclined portion.

15 BRIEF DESCRIPTION OF DRAWINGS

[0006]

Fig. 1 is a configuration diagram showing a refrigeration cycle of an air-conditioner according to the present embodiment;

Fig. 2 is a perspective view showing an outdoor heat exchanger used in the present embodiment; and

Fig. 3 is an enlarged view of a refrigerant pipe shown in Fig. 2.

DETAILED DESCRIPTION

[0007] In the following detailed description, for purpose of explanation, numerous specific details are set forth in order to provide a thorough understanding of the disclosed embodiments. It will be apparent, however, that one or more embodiments may be practiced without these specific details. In other instances, well-known structures and devices are schematically shown in order to simplify the drawing.

[0008] An object of the present disclosure is to provide an air-conditioner configured so that corrosion of an aluminum refrigerant pipe can be reduced and a sufficient unit internal space can be ensured.

[0009] An air-conditioner according to the present disclosure includes an aluminum refrigerant pipe made of aluminum or metal containing aluminum, a copper refrigerant pipe made of copper or metal containing copper, and a connection portion connecting the aluminum refrigerant pipe and the copper refrigerant pipe. One end portion of the aluminum refrigerant pipe is located lower than one end portion of the copper refrigerant pipe. The connection portion is located such that an angle between a center axis of the connection portion and an up-down direction is within 45 degrees. The aluminum refrigerant pipe includes an inclined portion extending in a direction inclined upward with respect to the center axis of the connection portion, and a bottom portion of the inclined portion is located lower than the connection portion. The air-conditioner includes a cover that covers at least a portion from the connection portion to the bottom portion of the inclined portion.

[0010] According to such a configuration, a water droplet on the copper refrigerant pipe flows down along the cover. The inclined portion can reduce such a water droplet from reaching a portion of the aluminum refrigerant pipe not covered with the cover. Moreover, the inclined portion does not occupy an internal space (unit internal space) of an outdoor unit or an indoor unit as compared to a conventional U-shaped portion or inverted U-shaped portion. Thus, the unit internal space can be ensured. Consequently, corrosion of the aluminum refrigerant pipe can be reduced. In addition, the unit internal space can be ensured.

[0011] One example of an air-conditioner 100 according to the present embodiment will be described with reference to Fig. 1. Fig. 1 is a configuration diagram showing a refrigeration cycle of the air-conditioner 100. Note that in Fig. 1 (the same also applies to Figs. 2 and 3), a dimensional ratio in the drawing and an actual dimensional ratio are not necessarily coincident with each other. Similarly, the dimensional ratio is not necessarily coincident between the drawings. Examples of the air-conditioner 100 include a room air-conditioner, a packaged air-conditioner, and a building multi air-conditioner.

[0012] As shown in Fig. 1, the air-conditioner 100 includes an outdoor unit 1, an indoor unit 2, and a refrigerant pipe 9 connecting these units. In the example of Fig. 1, one indoor unit 2 is connected to one outdoor unit 1. Note that the present embodiment is not limited to this example. For example, a plurality of outdoor units may be connected to one indoor unit. Alternatively, a plurality of indoor units may be connected to one outdoor unit. In Fig. 1, solid arrows indicate the flow of refrigerant in a cooling operation. Dashed arrows indicate the flow of refrigerant in a heating operation.

[0013] The outdoor unit 1 includes, for example, an outdoor heat exchanger 3, an expansion valve 4, a compressor 5, a four-way valve 6, an outdoor fan (not shown). The compressor 5, the four-way valve 6, the outdoor heat exchanger 3, and the expansion valve 4 are connected through the refrigerant pipe 9. The outdoor fan sucks outdoor air from the back side of the outdoor unit 1. The sucked outdoor air passes through the outdoor heat exchanger 3, and is discharged from the front side of the outdoor unit 1. Thus, the outdoor fan is disposed adjacent to the outdoor heat exchanger 3.

[0014] The indoor unit 2 includes an indoor heat exchanger 7 and an indoor fan (not shown). The expansion valve 4 and the indoor heat exchanger 7 are connected through the refrigerant pipe 9. The indoor fan sucks indoor air. The sucked indoor air passes through the indoor heat exchanger 7, and is discharged to the outside of the indoor unit 2, i.e., sent into a room. Thus, the indoor fan is disposed adjacent to the indoor heat exchanger 7.

[0015] The air-conditioner 100 having the above-described configuration operates as follows, thereby performing the heating operation and the cooling operation.

[0016] In the case of the heating operation (dashed arrows), refrigerant is compressed in the compressor 5.

The compressed refrigerant in the form of gas passes through the four-way valve 6, and flows into the indoor heat exchanger 7. Then, by an airflow generated by the indoor fan, heat is exchanged between indoor air and the refrigerant in the indoor heat exchanger 7. At this time, heat is dissipated from the refrigerant in the form of gas to the indoor air. Then, the refrigerant in the form of gas is condensed and changes into the form of liquid. The refrigerant in the form of liquid passes through the expansion valve 4, and flows into the outdoor heat exchanger 3. In the outdoor heat exchanger 3, the refrigerant in the form of liquid exchanges heat with outdoor air by an airflow generated by the outdoor fan. At this time, heat is absorbed from the outdoor air by the refrigerant in the form of liquid. Then, the refrigerant in the form of liquid is evaporated and changes into the form of gas. The refrigerant in the form of gas passes through the four-way valve 6, and flows into the compressor 5 again.

[0017] In the case of the cooling operation (solid arrows), the four-way valve 6 is switched. In this manner, the direction of the flow of refrigerant is reversed from that in the heating operation. That is, refrigerant compressed into the form of gas in the compressor 5 passes through the four-way valve 6, and flows into the outdoor heat exchanger 3. Then, by an airflow generated by the outdoor fan, heat is exchanged between outdoor air and the refrigerant in the outdoor heat exchanger 3. At this time, heat is dissipated from the refrigerant in the form of gas to the outdoor air. Then, the refrigerant in the form of gas is condensed and changes into the form of liquid. The refrigerant in the form of liquid flows into the indoor heat exchanger 7 through the expansion valve 4 and the refrigerant pipe 9. In the indoor heat exchanger 7, the refrigerant in the form of liquid exchanges heat with indoor air by an airflow generated by the indoor fan. At this time, heat is absorbed from the indoor air by the refrigerant in the form of liquid. Then, the refrigerant in the form of liquid is evaporated and changes into the form of gas. The refrigerant in the form of gas passes through the four-way valve 6, and flows into the compressor 5 again. The air cooled in the indoor heat exchanger 7 is released into the room by the indoor fan.

[0018] Fig. 2 is a perspective view showing the outdoor heat exchanger 3. Fig. 3 is an enlarged view of the refrigerant pipe 9 shown in Fig. 2. As shown in Figs. 2 and 3, the air-conditioner 100 includes an aluminum refrigerant pipe 91 and a copper refrigerant pipe 92. The aluminum refrigerant pipe 91 is made of aluminum or metal (aluminum alloy) containing aluminum. The copper refrigerant pipe 92 is made of copper or metal (copper alloy) containing copper. In the present embodiment, the configuration of the refrigerant pipe 9 includes the aluminum refrigerant pipe 91 and the copper refrigerant pipe 92. In the example shown in the figure, the aluminum refrigerant pipe 91 has a greater thickness than that of the copper refrigerant pipe 92.

[0019] The air-conditioner 100 includes a connection portion 93 which connects the aluminum refrigerant pipe

91 (one end portion 911 thereof) and the copper refrigerant pipe 92 (one end portion 921 thereof). The aluminum refrigerant pipe 91 and the copper refrigerant pipe 92 are connected (joined), for example, by brazing, welding, or eutectic bonding. A connection portion between the aluminum refrigerant pipe 91 and the copper refrigerant pipe 92 is the connection portion 93. In the present embodiment, the one end portion 911 of the aluminum refrigerant pipe 91 is increased in diameter (see Fig. 3). The one end portion 921 of the copper refrigerant pipe 92 is fitted in the one end portion 911 of the aluminum refrigerant pipe 91. In this state, the one end portions 911, 921 are connected to each other by brazing. Since the one end portion 911 of the aluminum refrigerant pipe 91 is increased in diameter, the one end portion 911 avoids a brazing material from dripping from the connection portion 93. The aluminum refrigerant pipe 91 (except for the one end portion 911) has, before and after the connection portion 93, the substantially same outer diameter as that of the copper refrigerant pipe 92.

[0020] The one end portion 911 of the aluminum refrigerant pipe 91 is located lower than the one end portion 921 of the copper refrigerant pipe 92. The aluminum refrigerant pipe 91 extends such that the one end portion 911 thereof faces up. The copper refrigerant pipe 92 extends such that the one end portion 921 thereof faces down. The one end portion 911 of the aluminum refrigerant pipe 91 and the one end portion 921 of the copper refrigerant pipe 92 extend in an up-down direction.

[0021] The connection portion 93 is located such that an angle between the center axis CL of the connection portion 93 and the up-down direction (vertical direction) is within 45 degrees. That is, the connection portion 93 is located so as to extend in the up-down direction. As described above, in the present embodiment, the center axis CL of the connection portion 93 is located coincident with the up-down direction. Note that the connection portion 93 may be located such that the center axis CL thereof is inclined with respect to the up-down direction. In the example shown in the figure, the center axis CL of the connection portion 93 is substantially coincident with the center axis of the one end portion 911 of the aluminum refrigerant pipe 91 and the center axis of the one end portion 921 of the copper refrigerant pipe 92.

[0022] The aluminum refrigerant pipe 91 includes an inclined portion 913. The inclined portion 913 extends in a direction inclined upward with respect to the center axis CL of the connection portion 93 (see Fig. 2). A bottom portion 913b of the inclined portion 913 is located lower than the connection portion 93. Note that one aluminum refrigerant pipe 91 may include a plurality of portions extending in the direction inclined upward with respect to the center axis CL of the connection portion 93. In this case, one of these portions having the shortest distance to the connection portion 93 along the aluminum refrigerant pipe 91 is the inclined portion 913.

[0023] The air-conditioner 100 includes a cover 94 that covers the entire circumference of at least a portion of the

refrigerant pipe 9 from the connection portion 93 to the bottom portion 913b of the inclined portion 913. According to such a configuration, a water droplet on the copper refrigerant pipe 92 flows down along the cover 94. The inclined portion 913 reduces the water droplet from reaching a portion of the aluminum refrigerant pipe 91 not covered with the cover 94. Moreover, the inclined portion 913 does not occupy an internal space (unit internal space) of the outdoor unit 1 or the indoor unit 2 as compared to a conventional U-shaped or inverted U-shaped portion. Thus, the unit internal space can be ensured. Consequently, corrosion of the aluminum refrigerant pipe 91 is reduced. In addition, the unit internal space can be ensured.

[0024] As shown in Fig. 3, an angle $\theta 1$ between the direction of extension of the inclined portion 913 (a later-described linear portion 913a thereof) and the horizontal plane is preferably 10 degrees or more. This configuration can reduce the inclined portion 913 from facing horizontally or down even in a case where a floor on which the outdoor unit 1 (or the indoor unit 2) provided with the aluminum refrigerant pipe 91 is placed is inclined. The angle $\theta 1$ may be 15 degrees or more, 20 degrees or more, or 25 degrees or more.

[0025] The angle $\theta 1$ is preferably 45 degrees or less. This configuration can reduce occupation of the unit internal space due to the inclined portion 913. More preferably, the angle $\theta 1$ is 35 degrees or less.

[0026] The aluminum refrigerant pipe 91 includes a first curved portion 916 curved in a downwardly-raised shape and a second curved portion 917 curved in an upwardly-raised shape. The inclined portion 913 includes the linear portion 913a between the first curved portion 916 and the second curved portion 917. Of the first curved portion 916 and the second curved portion 917, portions extending in the direction inclined upward with respect to the center axis CL of the connection portion 93 are included in the inclined portion 913. In the present embodiment, the inclined portion 913 includes the linear portion 913a, a bottom portion 916a of the first curved portion 916, and a top portion 917a of the second curved portion 917. That is, at least part of the inclined portion 913 is shared by the first curved portion 916 or the second curved portion 917. Note that the inclined portion 913 does not necessarily include the linear portion 913a, and may include the bottom portion 916a and the top portion 917a.

[0027] The first curved portion 916 is located at a position lower than the second curved portion 917. The first curved portion 916 is located on the side closer to the one end portion 911 of the aluminum refrigerant pipe 91. The second curved portion 917 is located on the side closer to the other end portion 912 of the aluminum refrigerant pipe 91. The bottom portion 913b of the inclined portion 913 is the bottom portion 916a of the first curved portion 916. A top portion 913c of the inclined portion 913 is the top portion 917a of the second curved portion 917.

[0028] The aluminum refrigerant pipe 91 includes one end linear portion 914 including the one end portion 911. The one end linear portion 914 extends linearly in the up-down direction, and is connected to the first curved portion 916. An angle θ_2 between the direction of extension of the one end linear portion 914 and the direction of extension of the inclined portion 913 (the linear portion 913a thereof) is, for example, less than 90 degrees. The length of the linear portion 913a is less than the length of the one end linear portion 914 or the length of a later-described standing portion 915. The length of the linear portion 913a is set as necessary, for example, according to the outer diameter of the aluminum refrigerant pipe 91. In the present embodiment, the one end linear portion 914 is located substantially coincident with the up-down direction. The one end linear portion 914 may be located inclined with respect to the up-down direction.

[0029] In the example of the embodiment above, the entirety of the inclined portion 913 is located lower than the connection portion 93. Note that the present embodiment is not limited to this example. Part of the top portion 913c or linear portion 913a of the inclined portion 913 may be located higher than the connection portion 93.

[0030] The cover 94 is made of a material having waterproof properties and capable of covering the refrigerant pipe 9 with no gap. Preferably, the cover 94 is a heat-shrinkable tube curable after contracted by heating. The heat-shrinkable tube is made of, for example, polyolefin, fluorine-based polymer, or thermoplastic elastomer. Note that a coating film formed by painting the refrigerant pipe 9 may be used as a cover.

[0031] The cover 94 covers at least the bottom portion 913b of the inclined portion 913. Preferably, the cover 94 covers the linear portion 913a. This configuration can further reduce the water droplet flowing down from the copper refrigerant pipe 92 from reaching the portion of the aluminum refrigerant pipe 91 not covered with the cover 94. The cover 94 may cover the top portion 913c of the inclined portion 913.

[0032] The cover 94 preferably covers at least a portion from the one end portion 921 of the copper refrigerant pipe 92 to the bottom portion 913b of the inclined portion 913. This configuration can reduce the water droplet on the copper refrigerant pipe 92 from penetrating a gap between the cover 94 and the connection portion 93. As a result, corrosion of a portion of the aluminum refrigerant pipe 91 covered with the cover 94 can be reduced.

[0033] As shown in Fig. 2, the aluminum refrigerant pipe 91, the copper refrigerant pipe 92, and the connection portion 93 are located in the outdoor unit 1. The other end portion (not shown) of the copper refrigerant pipe 92 is connected to a refrigerant outlet/inlet (not shown) of the outdoor unit 1. The other end portion 912 of the aluminum refrigerant pipe 91 is connected to a refrigerant inlet 31 of the outdoor heat exchanger 3 serving as an evaporator. The refrigerant outlet/inlet of the outdoor unit 1 is preferably located higher than the refrigerant inlet 31 of the outdoor heat exchanger 3 serving as the evaporator.

According to such a configuration, an increase in the total length of a liquid pipe, in which a two-phase flow is generated, of the refrigerant pipe 9 can be suppressed. The other end portion of the copper refrigerant pipe 92 is connected to the refrigerant outlet/inlet of the outdoor unit 1 through the expansion valve 4 (see Fig. 1). Alternatively, the other end portion 912 of the aluminum refrigerant pipe 91 is connected to the outdoor heat exchanger 3 through the expansion valve 4. Note that the aluminum refrigerant pipe 91, the copper refrigerant pipe 92, and the connection portion 93 may be located in the indoor unit 2.

[0034] The aluminum refrigerant pipe 91 preferably includes the standing portion 915 standing upward between the other end portion 912 and the second curved portion 917. According to such a configuration, a space can be provided in a lower portion in the outdoor unit 1 (or the indoor unit). Thus, for example, a pipe can pass through such a space. The standing portion 915 extends in the up-down direction.

[0035] In the present embodiment, the standing portion 915 extends linearly in the up-down direction, and is connected to the second curved portion 917. The standing portion 915 is located substantially parallel with the one end linear portion 914. Thus, the aluminum refrigerant pipe 91 has a substantially Z-shape defined by the one end linear portion 914, the inclined portion 913, and the standing portion 915. In the example of the embodiment above, the standing portion 915 is located such that the direction of extension thereof is substantially coincident with the up-down direction. Note that the standing portion 915 is not limited to this example. For example, the standing portion 915 may extend in a curved shape. Alternatively, the standing portion 915 may be located inclined with respect to the up-down direction.

(Modifications)

[0036] A stainless-steel refrigerant pipe made of stainless steel may be provided at the connection portion 93. That is, the aluminum refrigerant pipe 91 and the copper refrigerant pipe 92 may be connected to each other through the stainless-steel refrigerant pipe. According to such a configuration, the aluminum refrigerant pipe 91 and the copper refrigerant pipe 92 can be connected through the stainless-steel refrigerant pipe. Thus, corrosion of the aluminum refrigerant pipe 91 can be further reduced.

(1) As described above, the air-conditioner 100 according to the present embodiment includes the aluminum refrigerant pipe 91 made of aluminum or metal containing aluminum, the copper refrigerant pipe 92 made of copper or metal containing copper, and the connection portion 93 connecting the aluminum refrigerant pipe 91 and the copper refrigerant pipe 92 such that the one end portion 911 of the aluminum refrigerant pipe 91 is located lower than

the one end portion 921 of the copper refrigerant pipe 92. The connection portion 93 is located such that the angle between the center axis CL of the connection portion 93 and the up-down direction is within 45 degrees. The aluminum refrigerant pipe 91 includes the inclined portion 913 extending in the direction inclined upward with respect to the center axis CL of the connection portion 93. The bottom portion 913b of the inclined portion 913 is located lower than the connection portion 93. The air-conditioner 100 includes the cover 94 that covers at least the portion from the connection portion 93 to the bottom portion 913b of the inclined portion 913.

According to such a configuration, the water droplet on the copper refrigerant pipe 92 flows down along the cover 94. The inclined portion 913 can reduce such a water droplet from reaching the portion of the aluminum refrigerant pipe 91 not covered with the cover 94. Moreover, the inclined portion 913 does not occupy the internal space (unit internal space) of the outdoor unit 1 or the indoor unit 2 as compared to the conventional U-shaped portion or inverted U-shaped portion. Thus, the unit internal space can be ensured. Consequently, corrosion of the aluminum refrigerant pipe 91 can be reduced, and the unit internal space can be ensured.

(2) In a preferable configuration of the air-conditioner 100 according to (1), the aluminum refrigerant pipe 91 includes the first curved portion 916 curved in the downwardly-raised shape and the second curved portion 917 curved in the upwardly-raised shape. That is, at least part of the inclined portion 913 is formed by the first curved portion 916 or the second curved portion 917.

(3) In another preferable configuration of the air-conditioner 100 according to (1) or (2), the air-conditioner 100 further includes the outdoor unit 1 having the outdoor heat exchanger 3. The aluminum refrigerant pipe 91, the copper refrigerant pipe 92, and the connection portion 93 are located in the outdoor unit 1. The other end portion of the copper refrigerant pipe 92 is connected to the refrigerant outlet/inlet of the outdoor unit 1. The other end portion 912 of the aluminum refrigerant pipe 91 is connected to the refrigerant inlet 31 of the outdoor heat exchanger 3 serving as the evaporator. The refrigerant outlet/inlet of the outdoor unit 1 is located higher than the refrigerant inlet 31 of the outdoor heat exchanger 3 serving as the evaporator.

According to such a configuration, the increase in the total length of the liquid pipe, in which the two-phase flow is generated, of the refrigerant pipe 9 can be suppressed.

(4) In still another preferable configuration of the air-conditioner 100 according to any one of (1) to (3), the aluminum refrigerant pipe 91 includes the standing portion 915 standing upward between the other end portion 912 and the second curved portion 917.

[0037] According to such a configuration, the space can be provided in the lower portion in the outdoor unit 1 (or the indoor unit 2). Thus, for example, the pipe can pass through such a space.

[0038] Note that the configuration of the air-conditioner 100 is not limited to the configuration of the embodiment above. The features and effects thereof are not limited to those described above. Needless to say, changes can be made to the air-conditioner 100 without departing from the gist of the present embodiment. For example, one or more configurations or methods arbitrarily selected from the configurations or methods of the air-conditioners according to the embodiments described above as the modifications may be applied to the configuration or method of the air-conditioner according to the embodiment above, needless to say.

Claims

1. An air-conditioner including an aluminum refrigerant pipe made of aluminum or metal containing aluminum, a copper refrigerant pipe made of copper or metal containing copper, and a connection portion connecting the aluminum refrigerant pipe and the copper refrigerant pipe,

one end portion of the aluminum refrigerant pipe being located lower than one end portion of the copper refrigerant pipe,
the connection portion being located such that an angle between a center axis of the connection portion and an up-down direction is within 45 degrees,
the aluminum refrigerant pipe including an inclined portion extending in a direction inclined upward with respect to the center axis of the connection portion, and
a bottom portion of the inclined portion being located lower than the connection portion, the air-conditioner comprising:
a cover that covers at least a portion from the connection portion to the bottom portion of the inclined portion.

2. The air-conditioner according to claim 1, wherein

the aluminum refrigerant pipe includes a first curved portion curved in a downwardly-raised shape and a second curved portion curved in an upwardly-raised shape, and
at least part of the inclined portion is formed by the first curved portion and the second curved portion.

3. The air-conditioner according to claim 1 or 2, further comprising:

an outdoor unit having an outdoor heat exchanger,
wherein the aluminum refrigerant pipe, the copper refrigerant pipe, and the connection portion are located in the outdoor unit, 5
the other end portion of the copper refrigerant pipe is connected to a refrigerant outlet/inlet of the outdoor unit,
the other end portion of the aluminum refrigerant pipe is connected to a refrigerant inlet of the outdoor heat exchanger serving as an evaporator, and 10
the refrigerant outlet/inlet of the outdoor unit is located higher than the refrigerant inlet of the outdoor heat exchanger serving as the evaporator. 15

4. The air-conditioner according to claim 2, wherein the aluminum refrigerant pipe includes a standing portion standing upward between the other end portion of the aluminum refrigerant pipe and the second curved portion. 20

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FIG. 1

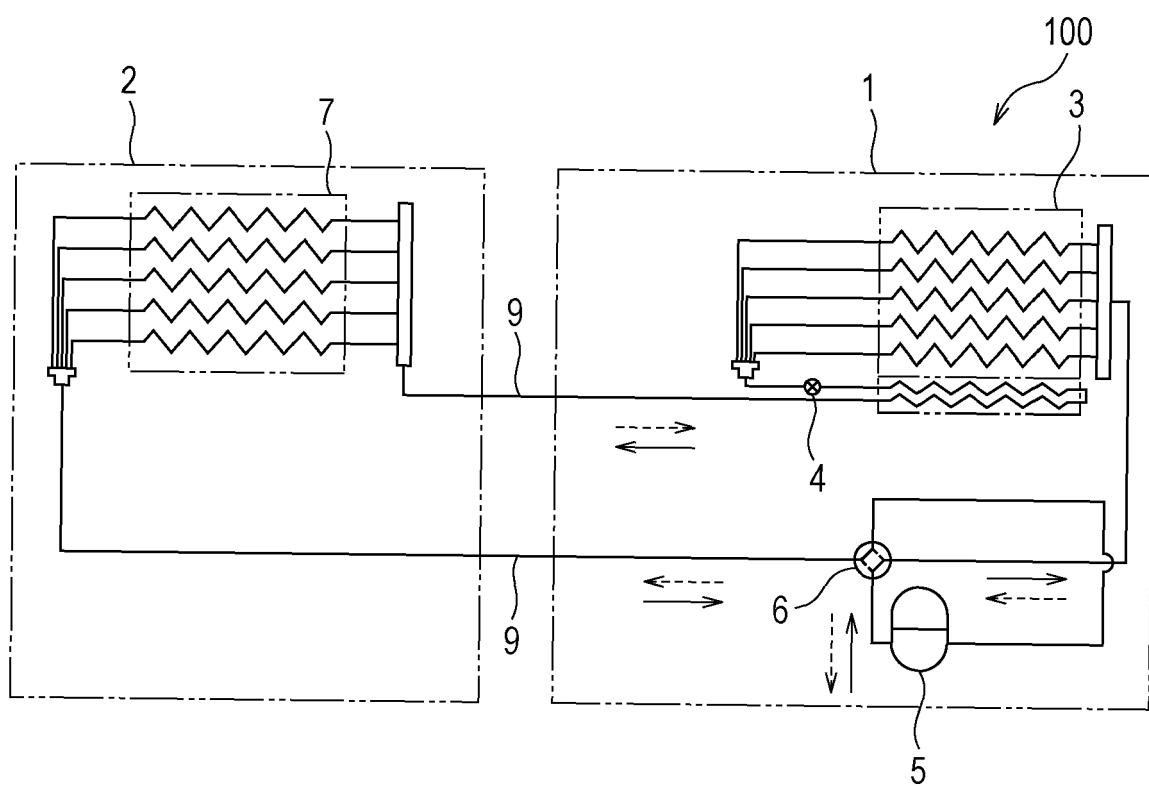


FIG. 2

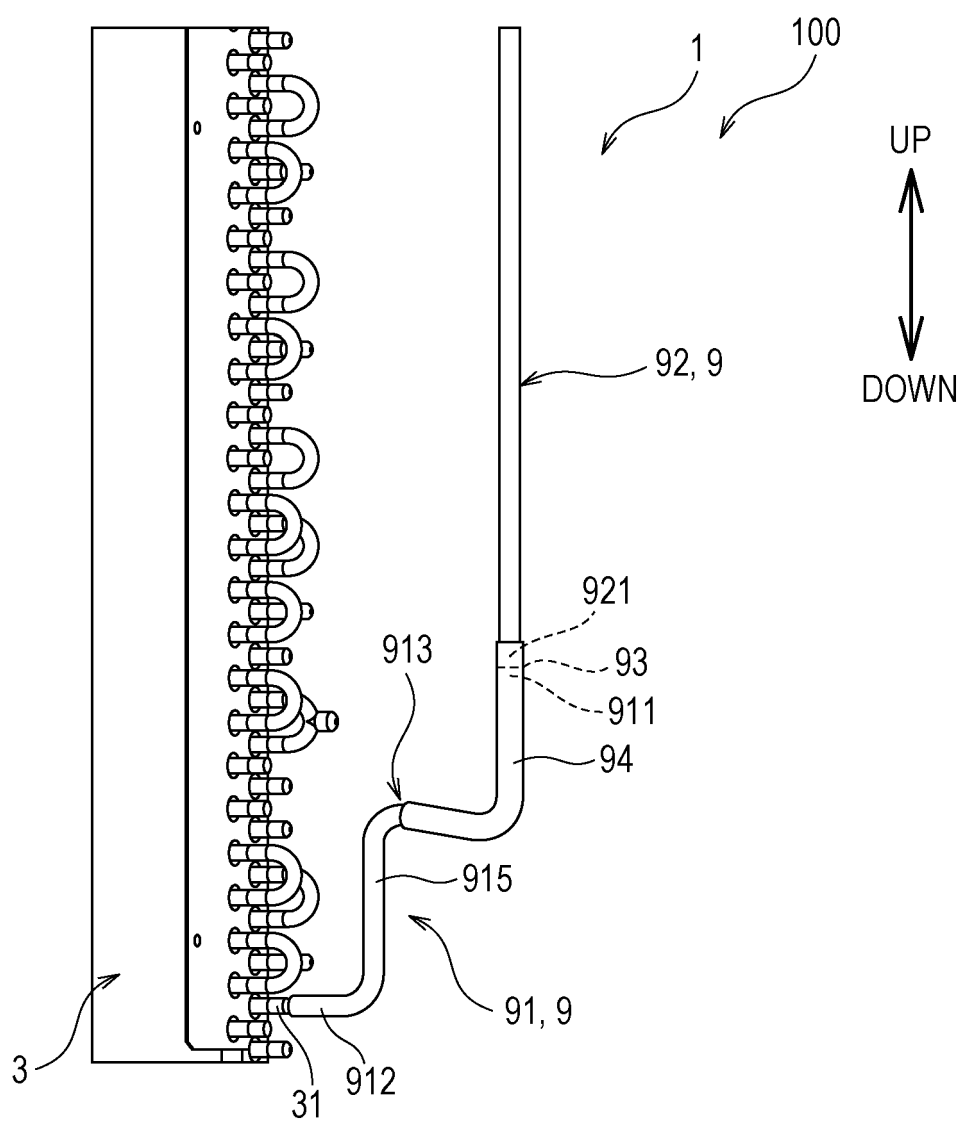
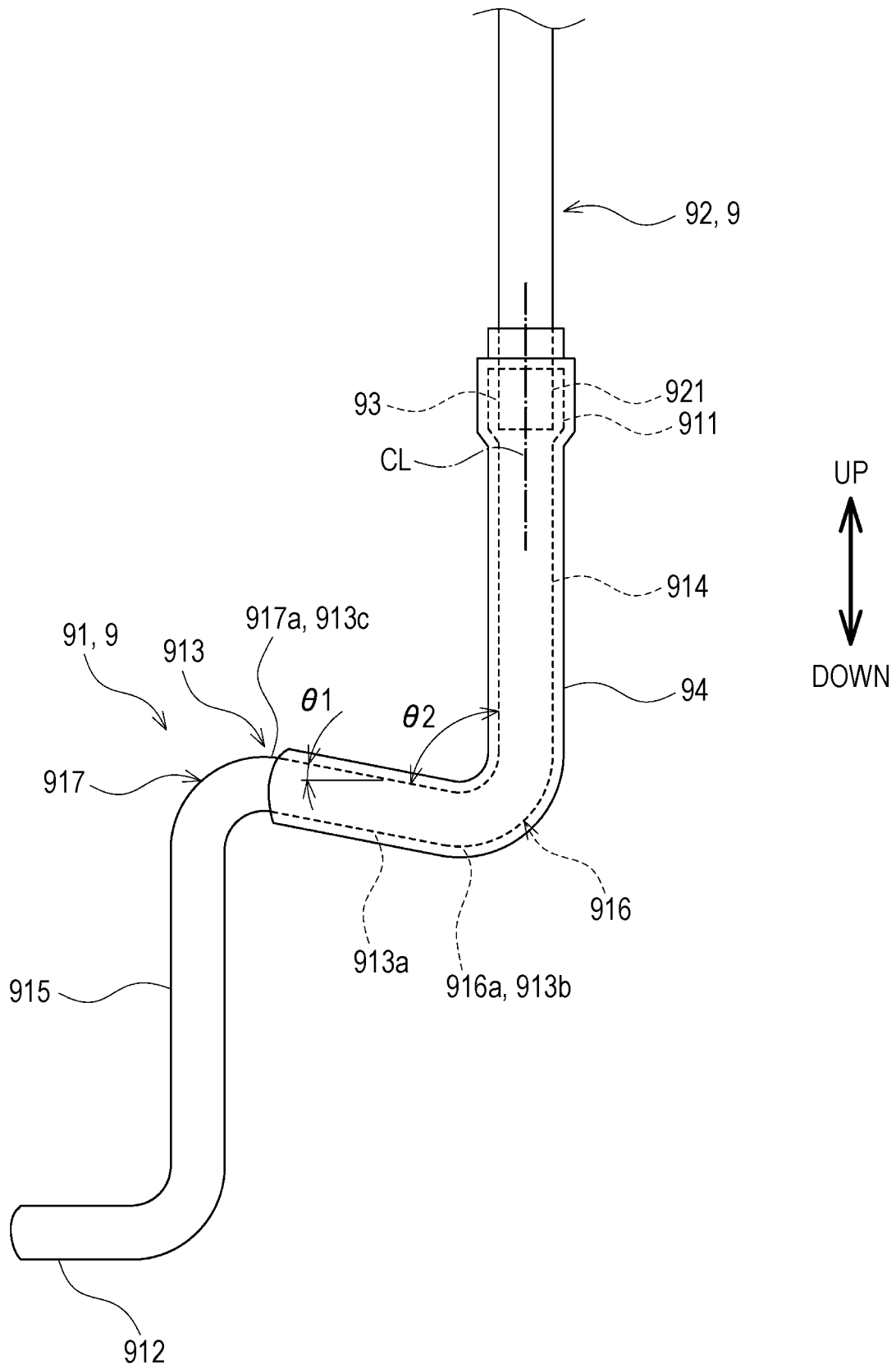


FIG. 3





EUROPEAN SEARCH REPORT

Application Number

EP 24 21 3777

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		1 April 2025	Szilagyi, Barnabas
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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