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(54) **PIPE ASSEMBLY, CONDENSATE LINE ASSEMBLY AND REFRIGERATOR INCLUDING THE SAME**

(71) Applicant: **Daewoo Electronics Co., Ltd.**, Gwangju (KR)

(72) Inventor: **Jang Woo LEE**, Gwangju (KR)

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(57) **ABSTRACT**

A pipe assembly, installed in a refrigerator, to function as a condensate line and comprises: a first pipe extending from an evaporator of the refrigerator and inclined downward to drain water; and a second pipe connected to a downstream end of the first pipe to receive the water, the second pipe extending from the first pipe so as to be inclined downward at a steeper slope than the first pipe. The first pipe includes a first connection portion fastened to the second pipe and a water guide portion extending further downward from the first connection portion.

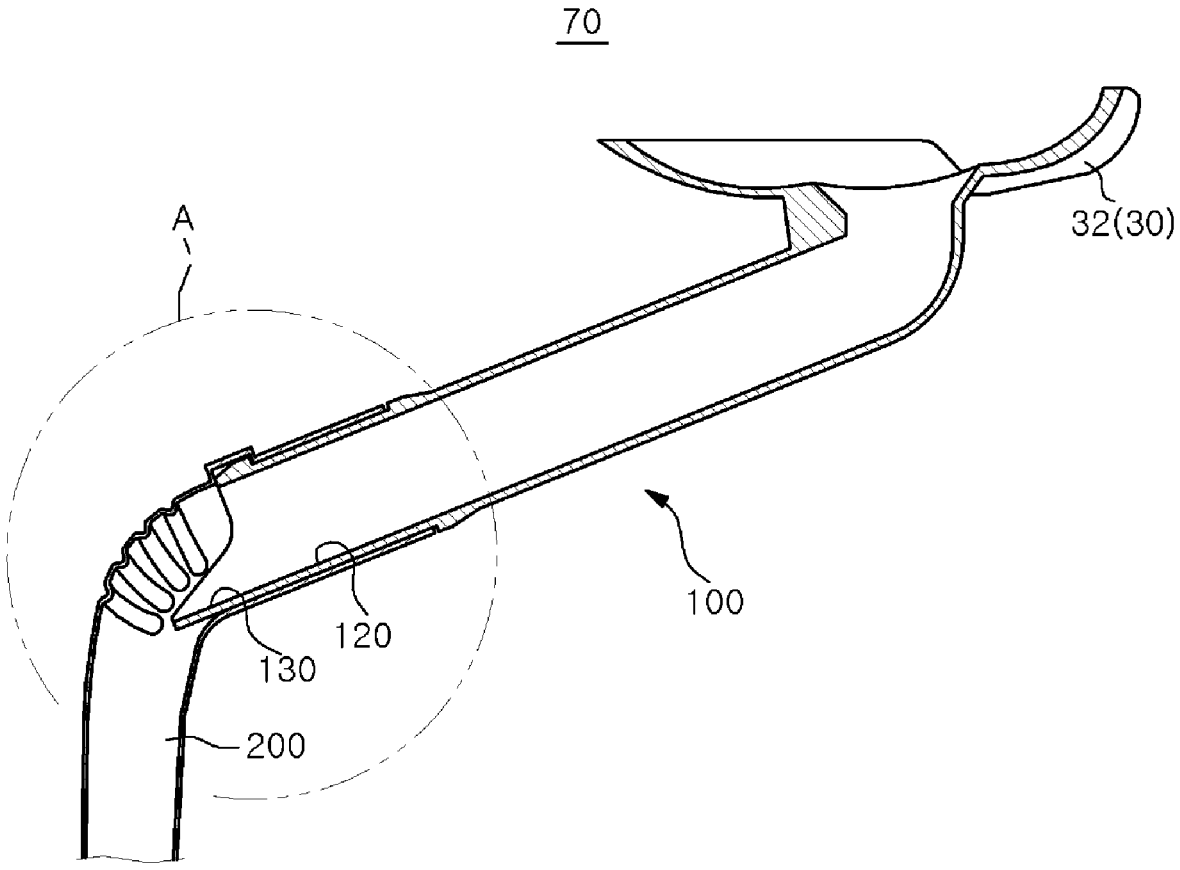


FIG. 1

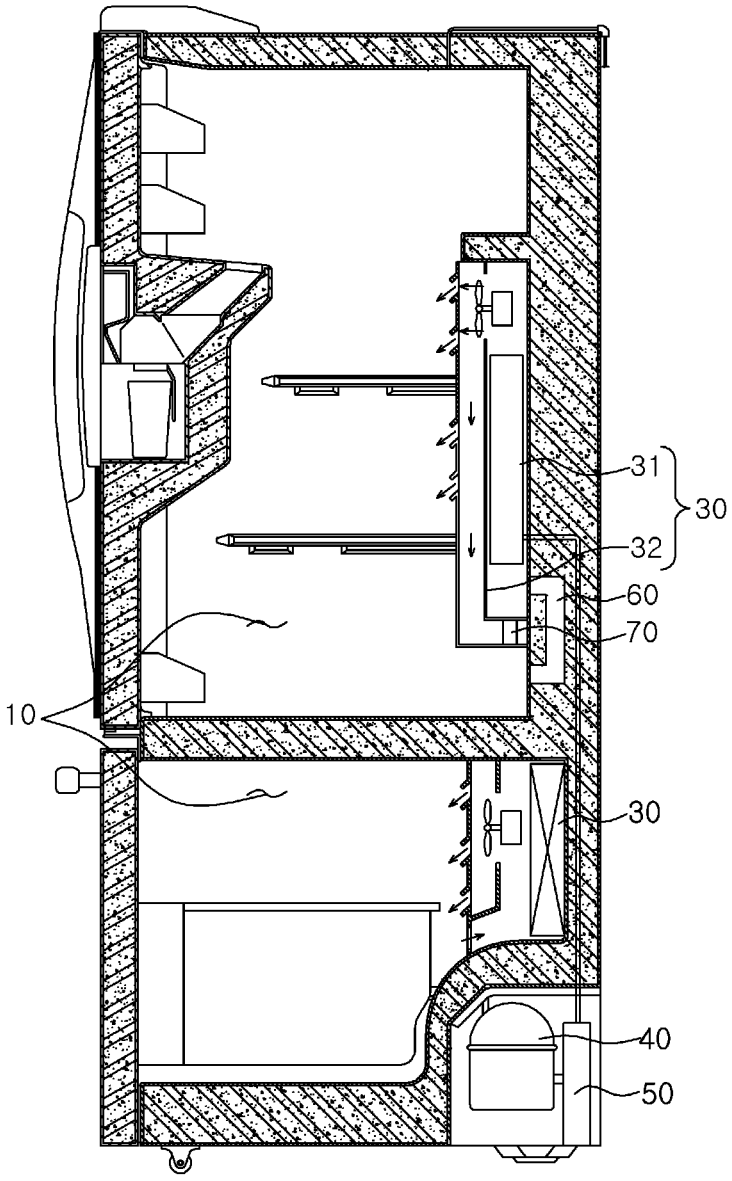


FIG.2

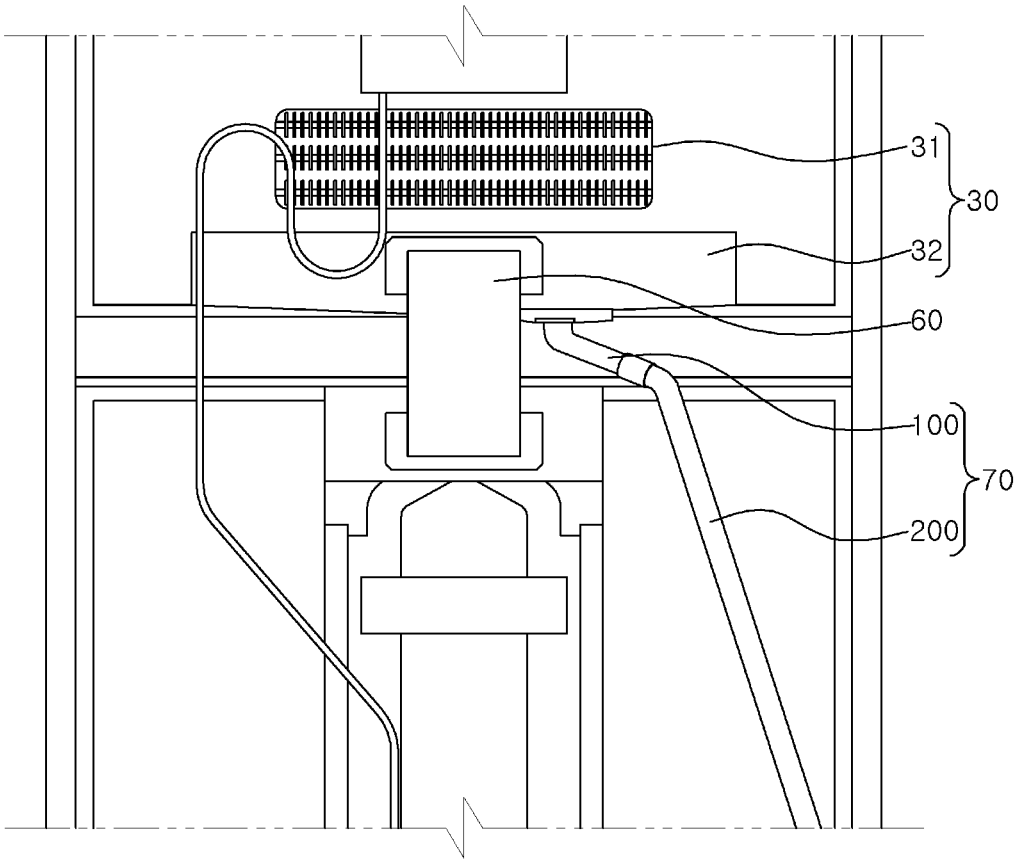


FIG.3

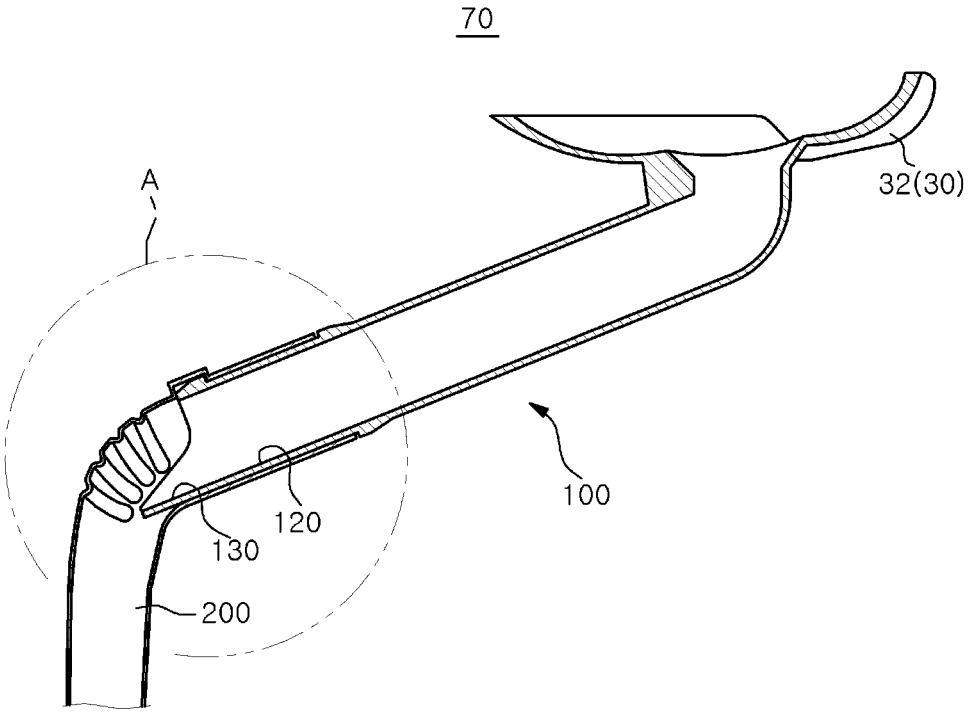
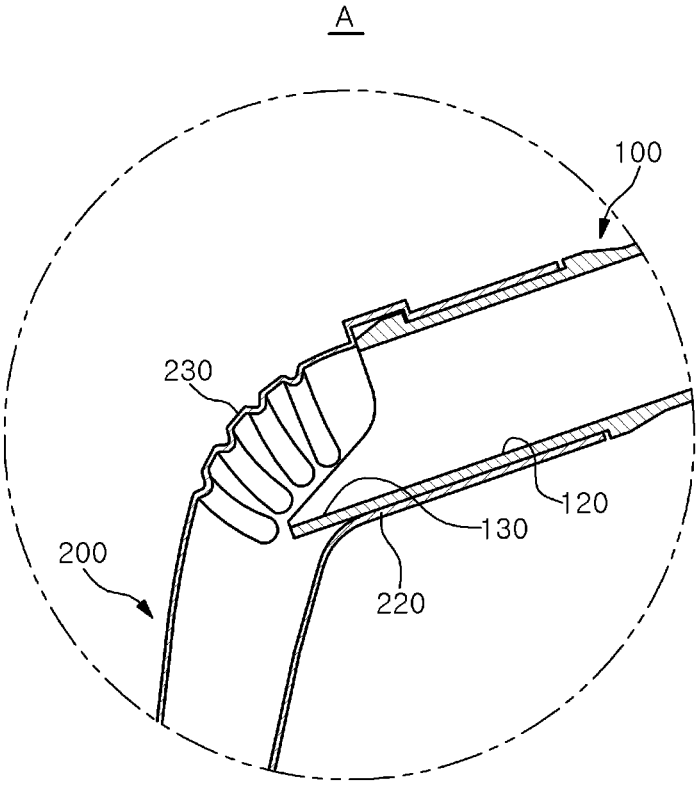


FIG. 4



PIPE ASSEMBLY, CONDENSATE LINE ASSEMBLY AND REFRIGERATOR INCLUDING THE SAME

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is based on and claims priority from Korean Patent Application No. 10-2018-0083604, filed on Jul. 18, 2018, the disclosure of which is incorporated herein in its entirety by reference for all purposes.

TECHNICAL FIELD

[0002] The present disclosure relates to a pipe assembly and a refrigerator including the same.

BACKGROUND

[0003] Generally, a refrigerator is an appliance used for storing items such as food items, beverages and the like for a long period of time. For example, the refrigerator may store items in a frozen state or in a refrigerated state depending on the type of items to be stored.

[0004] Such a refrigerator maintains the temperature in a storage compartment at a predetermined value by supplying cold air generated by a refrigeration cycle into the storage compartment. To this end, the refrigerator includes a compressor, a condenser, an expansion valve and an evaporator. The compressor, the condenser, the expansion valve and the evaporator are accommodated in a machine compartment located on one side of the refrigerator and are configured to supply cold air into the storage compartment.

[0005] For example, a refrigerant is sent to the compressor so that its state is changed into a high-temperature and high-pressure state. The condensation heat is dissipated to the outside while the refrigerant passes through the condenser. The refrigerant is subjected to vaporization which occurs while passing through the expansion valve. The refrigerant takes the latent heat (resultant from evaporation) from the air around a cooling compartment through the evaporator and evaporates to generate cold air. In this cooling process, condensed water is generated in the evaporator. The condensed water is drained to the outside of the evaporator through a pipe assembly.

[0006] However, the condensed water may often seep into, leak into, or stagnate in any minute gap of a pipe-to-pipe connection portion of the pipe assembly. On the other hand, at least a part of such a pipe assembly may be arranged around a return duct or the like having a relatively low temperature. When the condensed water seeps into, leaks into, or stagnates in the minute gap of the connection portion, the condensed water may cool or freeze, thereby potentially causing damage to the connection portion of the pipe assembly.

SUMMARY

[0007] Embodiments of the present disclosure provide a pipe assembly capable of preventing water from seeping into, leaking into, or stagnating in a pipe-to-pipe connection portion which is part of a refrigerator's condensate line, and a refrigerator including the same.

[0008] In accordance with an embodiment, there is provided a pipe assembly, installed in a refrigerator, and comprising: a first pipe extending from an evaporator of the refrigerator and inclined downward to drain water; and a second pipe connected to a downstream end of the first pipe to receive the drain water, the second pipe extending from the first pipe and configured to be inclined downward at a steeper slope than the first pipe, wherein the first pipe includes a first connection portion fastened to the second pipe and a water guide portion extending further downward from the first connection portion.

[0009] In one embodiment, at least a part of the water guide portion may be spaced apart from an inner surface of the second pipe.

[0010] The water guide portion may be further spaced apart from the inner surface of the second pipe as the water guide portion extends toward an end portion.

[0011] The second pipe may include a second connection portion connected to the first connection portion of the first pipe, and where the second connection portion surrounds an outer surface of the first connection portion.

[0012] The second pipe may further include a bent portion extending from the second connection portion in a direction away from the first pipe and bent downward.

[0013] The bent portion may have a lower portion spaced downward from the water guide portion.

[0014] In accordance with another aspect, there is provided a refrigerator comprising: a storage compartment configured to store food and food ingredients; an evaporator configured to cool air by absorbing heat from the air using a vaporizable refrigerant; a return duct configured to bring the storage compartment and the evaporator into communication with each other; and a pipe assembly configured to drain condensed water generated in the evaporator, wherein the pipe assembly includes: a first pipe extending from the evaporator and inclined downward to drain the condensed water from the evaporator; and a second pipe connected to a downstream end of the first pipe to receive the condensed water, the second pipe extending from the first pipe and configured to be inclined downward at a steeper slope than the first pipe, the first pipe including a first connection portion fastened to the second pipe and a water guide portion extending further downward from the first connection portion.

[0015] The first connection portion and the water guide portion may be disposed at positions to which cold energy of a cold air flowing through the return duct is applied.

[0016] The evaporator may include a heat exchanger configured to allow the air and the refrigerant to exchange heat with each other and a condensed water collector configured to collect condensed water generated in the heat exchanger, and where the first pipe of the pipe assembly is connected to the condensed water collector and configured to receive the condensed water generated in the heat exchanger.

[0017] A lower central portion of the condensed water collector may have a downwardly concave shape to collect the condensed water, the first pipe may be connected to the lower central portion of the condensed water collector, and the return duct may be connected to a rear central portion of the condensed water collector in one embodiment.

[0018] The pipe assembly according to the various embodiments of the present disclosure can prevent water from seeping into, leaking into, or stagnating in a pipe-to-pipe connection portion of a condensate line of a refrigerator appliance. In addition, the refrigerator including such a pipe assembly can advantageously prevent condensed water from freezing when the condensed water is drained from an evaporator.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] FIG. **1** is a side sectional view of a refrigerator including a pipe assembly according to an embodiment of the present disclosure.

[0020] FIG. **2** is a rear view of a refrigerator showing a pipe assembly according to an embodiment of the present disclosure and an evaporator.

[0021] FIG. **3** is a side sectional view of a pipe assembly according to an embodiment of the present disclosure.

[0022] FIG. **4** is an enlarged view of a portion indicated by A in FIG. **3**.

DETAILED DESCRIPTION

[0023] Hereinafter, configurations and operations of embodiments will be described in detail with reference to the accompanying drawings. The following description is one of various patentable aspects of the disclosure and may form a part of the detailed description of the disclosure.

[0024] However, in describing the disclosure, detailed descriptions of known configurations or functions that may obscure portions of the disclosure may be omitted.

[0025] The disclosure may be variously modified and may include various embodiments. Specific embodiments will be exemplarily illustrated in the drawings and described in the detailed description of the embodiments. However, it should be understood that they are not intended to limit the disclosure to specific embodiments but rather to cover all modifications, similarities, and alternatives which are included in the spirit and scope of the disclosure.

[0026] The terms used herein, including ordinal numbers such as "first" and "second" may be used to describe, and not to limit, various components. The terms simply distinguish the components from one another.

[0027] When it is said that a component is "connected" or "linked" to another component, it should be understood that the former component may be directly connected or linked to the latter component or a third component may be interposed between the two components.

[0028] Specific terms used in the present application are used simply to describe specific embodiments without limiting the disclosure. An expression used in the singular encompasses the expression of the plural, unless it has a clearly different meaning in the context.

[0029] Hereinafter, a pipe assembly according to an embodiment of the present disclosure and a refrigerator including the same will be described with reference to the drawings. In one embodiment, the pipe assembly is used in the condensate line of a refrigerator appliance.

[0030] Referring to FIG. **1**, a refrigerator **1** according to an embodiment of the present disclosure may include storage compartments **10**, an evaporator **30**, a compressor **40**, a condenser **50**, a return duct **60** and a pipe assembly **70** which functions as a condensate line for the refrigerator appliance to remove excess liquid that condenses as part of the refrigeration cycle of the appliance.

[0031] The storage compartments **10** are spaces for storing items to be cooled including food items and food ingredients. The storage compartments **10** may include a refrigeration compartment in which food and food ingredients can be stored in a refrigerated state and a freezing compartment in which food and food ingredients can be stored in a frozen state.

[0032] The evaporator **30** cools ambient air by allowing the ambient air to exchange heat with a refrigerant in accordance with a heat transfer cycle also called a refrigeration cycle. The evaporator **30** may cool the ambient air to supply a cool air to at least one of the refrigeration compartment and the freezing compartment.

[0033] In accordance with the heat transfer cycle, the compressor **40** may receive a hot refrigerant heated by the evaporator **30** and may compress the refrigerant. The compressor **40** may include a pump or the like.

[0034] The condenser **50** may cool the refrigerant to a low temperature by allowing the refrigerant to exchange heat with the ambient air.

[0035] In accordance with the heat transfer cycle, in the evaporator **30**, the refrigerant may cool the ambient air and may be vaporized. The vaporized hot refrigerant is sent to the compressor **40** and compressed by the compressor **40**. The refrigerant compressed through the compressor **40** is liquefied while dissipating the condensation heat to the outside through the condenser **50**. The liquefied refrigerant passing through the condenser **50** is sent to the evaporator **30**. The liquefied refrigerant that is sent to the evaporator **30** is vaporized by heat exchange with the ambient air, thereby absorbing the ambient heat. The liquefied refrigerant of the evaporator **30** receives heat from the ambient air. In accordance with the heat transfer cycle, the entirety or a part of the liquefied refrigerant of the evaporator **30** is converted into a gaseous refrigerant. Thereafter, the gaseous refrigerant is separated from a liquid refrigerant and is introduced into the compressor **40** again. In the evaporator **30**, the refrigerant absorbs heat from the air existing outside the evaporator **30**. Through this heat exchange, the evaporator **30** cools the air existing in the refrigerator. In this cooling process, the condenser **50** dissipates the heat of the refrigerant to the outside. Hereinafter, the evaporator **30** will be described in more detail with reference to FIG. **2**.

[0036] Referring to FIG. **2**, the evaporator **30** cools the ambient air through heat exchange with the refrigerant. The evaporator **30** may include a heat exchanger **31** for allowing the refrigerant and the ambient air to exchange heat with each other, and a condensed water collector **32**.

[0037] The heat exchanger **31** may include a pipe through which the refrigerant flows. The heat exchanger **31** cools the ambient air through heat exchange between the ambient air and the refrigerant existing inside the pipe. In the pipe of the heat exchanger **31**, a refrigerant having a low temperature flows to cool the ambient air. The air around the pipe may be an uncooled air having a relatively high temperature. Therefore, in the heat exchanger **31**, condensed water may be generated due to the cooling of the ambient air.

[0038] The condensed water collector **32** may collect condensed water generated in the heat exchanger **31**. The condensed water collector **32** may be a container extending widely in the horizontal direction and may be disposed below the heat exchanger **31**. The condensed water generated in the heat exchanger **31** may drop or flow into the condensed water collector **32**, and the condensed water in the condensed water collector **32** may flow toward the pipe assembly **70**. The condensed water collector **32** may be provided as a part of the housing or frame of the evaporator **30**. The lower central portion of the condensed water collector **32** may have a downwardly concave shape to effectively collect the condensed water. On the other hand, the pipe assembly **70** may be connected to the lower central

portion of the condensed water collector **32**, and the return duct **60** may be connected to the rear central portion adjacent to the lower central portion of the condensed water collector **32**.

[0039] The return duct **60** may bring the storage compartments **10** and the evaporator **30** into communication with each other in order to recover the cold air having a relatively high temperature. For example, in the case of a refrigerator in which a freezing compartment is located on the lower side and a refrigeration compartment is located on the upper side, the return duct **60** may be installed between the lower portion of the refrigeration compartment and the upper portion of the freezing compartment. The return duct **60** may be connected to the rear central portion adjacent to the lower central portion of the condensed water collector **32**. The pipe assembly **70** will be described with reference to FIGS. **3** and **4**.

[0040] Referring to FIGS. **3** and **4**, the pipe assembly **70**, or condensate line **70**, may be connected to the condensed water collector **32** of the evaporator **30** to discharge the condensed water from the evaporator **30**. The condensed water discharged through the pipe assembly **70** may arise from condensing air in the process of cooling the air in the evaporator **30**. The pipe assembly **70** may be disposed adjacent to the return duct **60**. For example, the pipe assembly **70** may be arranged so that at least one of a first connection portion **120**, a water guide portion **130** and a second connection portion **220** can be positioned in a zone or region to which the cold energy of the cold air flowing in the return duct **60** can be applied.

[0041] The pipe assembly **70** may include a first pipe **100** and a second pipe **200**.

[0042] The first pipe **100** may have one end connected to the condensed water collector **32** and the other end connected to the second pipe **200**. One end of the first pipe **100** may be provided on the upstream side to serve as an inflow portion for introducing the condensed water from the condensed water collector **32**, and the other end of the first pipe **100** may be provided on the downstream side to serve as a discharge portion for discharging the condensed water from the first pipe **100**. The first pipe **100** may extend from one end to the other end and configured to be inclined downward with respect to the horizontal direction. In other words, the first pipe **100** is formed so as to be inclined downward at a predetermined angle with respect to a horizontal plane. In addition, the first pipe **100** may be formed of a non-flexible material having a rigidity of a certain level or higher. The other end of the first pipe **100** may include a first connection portion **120** for fastening the second pipe **200**, and a water guide portion **130**.

[0043] The first connection portion **120** may be connected to the second connection portion **220** at the end of the second pipe **200**. A groove or protrusion for fastening the second pipe **200** may be provided on the outer circumferential surface of the first connection portion **120**. The first connection portion **120** may provide a space through which the condensed water can flow. The first connection portion **120** may have a circumferential contact surface that makes contact with the second pipe **200**. The contact surface of the first connection portion **120** may be the inner circumferential surface of the first connection portion **120**.

[0044] The water guide portion **130** may be provided at an end of the first connection portion **120** and may be shaped like a protrusion extending downward from an end of the first connection portion **120**. The lower surface of the water guide portion **130** may be spaced apart from the inner surface of the second pipe **200**. The water guide portion **130** may be disposed to be further spaced apart from the inner surface of the second pipe **200** as it extends from the side of the first connection portion **120** toward the end side. The water guide portion **130** may extend linearly without being bent. For example, the water guide portion **130** may extend approximately 15 mm from the end of the first connection portion **120**. The end of the water guide portion **130** may be positioned at the center of the cross section of the second pipe **200**.

[0045] One end of the second pipe **200** may be connected to the first pipe **100**, and the remaining portion of one end of the second pipe **200** may be further downwardly inclined to extend more downward than the first pipe **100**. For example, as shown in FIG. **3**, the second pipe **200** may be formed to have a steeper slope than the first pipe **100** as a whole. The second pipe **200** may be flexibly formed so as to be bent. In order to secure such flexibility, the second pipe **200** may have wrinkles formed to extend in a direction different from the extension direction of the second pipe **200**.

[0046] One end of the second pipe **200** may include a connection portion **220** to be connected to the first pipe **100** and a bent portion **230** bent downward.

[0047] The second connection portion **220** may be connected to the first connection portion **120** at the end of the first pipe **100**. A groove or protrusion for fastening the second pipe **200** may be provided on the inner circumferential surface of the second connection portion **220**. The groove or protrusion of the second connection portion **220** may be formed to engage with the groove or protrusion of the first connection portion **120**. The second connection portion **220** may provide a space through which the condensed water can flow. The second connection portion **220** may have a contact surface formed in the circumferential direction to make contact with the first pipe **100**. The contact surface of the second connection portion **220** may be the inner circumferential surface of the second connection portion **220**.

[0048] The bent portion **230** may extend from the second connection portion **220** so as to be away from the first pipe **100** and may be bent downward. The lower portion of the bent portion **230** may be spaced downward from the water guide portion **130**.

[0049] Advantageously, the pipe assembly **70** according to an embodiment of the present disclosure can prevent the condensed water flowing therethrough from seeping into, leaking into, or stagnating in a pipe-to-pipe connection portion. Therefore, it is possible to prevent the condensed water from freezing in the pipe-to-pipe connection portion. In addition, it is not necessary to provide a heating means such as a heater or the like for preventing the freezing of the condensed water.

[0050] From the foregoing, it will be appreciated that various embodiments of the present disclosure have been described herein for purposes of illustration, and that various modifications may be made without departing from the scope and spirit of the present disclosure. The exemplary embodiments disclosed in the specification of the present disclosure do not limit the present disclosure. The scope of the present disclosure will be interpreted by the claims

below, and it will be construed that all techniques within the scope equivalent thereto belong to the scope of the present disclosure.

What is claimed is:

1. A pipe assembly operable to be installed in a refrigerator, comprising:

a first pipe extending from an evaporator of the refrigerator and inclined downward to drain water; and

a second pipe connected to a downstream end of the first pipe and operable to receive water, the second pipe extending from the first pipe and inclined downward at a steeper slope than a slope of the first pipe,

wherein the first pipe comprises: a first connection portion fastened to the second pipe; and a water guide portion extending further downward from the first connection portion.

2. The pipe assembly of claim **1**, wherein at least a part of the water guide portion is spaced apart from an inner surface of the second pipe.

3. The pipe assembly of claim **2**, wherein the water guide portion is further spaced apart from the inner surface of the second pipe as the water guide portion extends toward an end portion of the water guide portion.

4. The pipe assembly of claim **3**, wherein the second pipe comprises a second connection portion connected to the first connection portion of the first pipe, and wherein the second connection portion surrounds an outer surface of the first connection portion.

5. The pipe assembly of claim **4**, wherein the second pipe further comprises a bent portion extending from the second connection portion in a direction away from the first pipe and bent downward.

6. The pipe assembly of claim **5**, wherein the bent portion has a lower portion spaced downward from the water guide portion.

7. A condensate line assembly operable to be installed in an appliance having an evaporator, the assembly comprising:

a first pipe operable to extend from the evaporator and inclined downward to drain water from the evaporator; and

a second pipe connected to a downstream end of the first pipe and operable to receive water, the second pipe extending from the first pipe and inclined downward at a steeper slope than a slope of the first pipe,

wherein the first pipe comprises: a first connection portion fastened to the second pipe; and a water guide portion extending further downward from the first connection portion.

8. The assembly of claim **7**, wherein at least a part of the water guide portion is spaced apart from an inner surface of the second pipe.

9. The assembly of claim **8**, wherein the water guide portion is further spaced apart from the inner surface of the second pipe as the water guide portion extends toward an end portion.

10. The assembly of claim **9**, wherein the second pipe comprises a second connection portion connected to the first connection portion of the first pipe, and wherein the second connection portion surrounds an outer surface of the first connection portion.

11. The assembly of claim **10**, wherein the second pipe further comprises a bent portion extending from the second connection portion in a direction away from the first pipe and bent downward, and

wherein the bent portion has a lower portion spaced downward from the water guide portion.

12. A refrigerator, comprising:

a storage compartment configured to store items to be cooled;

an evaporator configured to cool air by absorbing heat therefrom using a refrigerant;

a return duct configured to bring the storage compartment and the evaporator into communication with each other; and

a pipe assembly configured to drain condensed water generated in the evaporator,

wherein the pipe assembly comprises:

a first pipe extending from the evaporator and inclined downward to drain condensed water from the evaporator; and

a second pipe coupled to a downstream end of the first pipe to receive the condensed water, the second pipe extending from the first pipe and inclined downward at a steeper slope than a slope of the first pipe, wherein the first pipe comprising: a first connection portion fastened to the second pipe; and a water guide portion extending further downward from the first connection portion.

13. The refrigerator of claim **12**, wherein the first connection portion and the water guide portion are disposed at positions to which cold energy of cold air flowing through the return duct is applied.

14. The refrigerator of claim **12**, wherein the evaporator comprise:

a heat exchanger configured to allow the air and the refrigerant to exchange heat with each other; and

a condensed water collector configured to collect condensed water generated in the heat exchanger, and wherein the first pipe of the pipe assembly is connected to the condensed water collector to receive the condensed water generated in the heat exchanger.

15. The refrigerator of claim **14**, wherein a lower central portion of the condensed water collector has a downwardly concave shape and is configured to collect the condensed water, wherein the first pipe is connected to the lower central portion of the condensed water collector, and the return duct is connected to a rear central portion of the condensed water collector.

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