plurality of lateral pipe sets to the longitudinal pipes. Accordingly, if the cooling unit grows in size, connection spots of each pipe (refrigerant piping) through which the refrigerant flows increase, and the pressure loss of refrigerant vapor in a connection part also increases. As a result, there has been a problem that a cooling capacity decreases in a large-size cooling unit when employing the pipe aggregation (piping structure) in the related cooling unit.

[0011]

In a cooling system employing the related cooling unit and the heat exchanger described in Patent Literature 1, it is assumed to drive a pump to circulate the refrigerant forcibly. However, in this case, there has been a problem that the power consumption of the cooling system increases.

[0012]

Thus, there has been a problem that it is difficult to avoid a decrease in cooling capacity without causing an increase in power consumption if a cooling device including a piping structure grows in size as in the case of using it attached to the rear door of a rack for an electronic device.

[0013]

Embodiments of the present invention provide a piping structure, a cooling device including the piping structure, and a method for transporting refrigerant vapor that solve the problem that it is difficult to avoid a decrease in cooling capacity without causing an increase in power consumption if a cooling device including a piping structure grows in size.

[Solution to Problem]

[0014]

According to a first aspect of the present disclosure, there is provided a piping structure including a tubular part including a first flow passage through which a refrigerant flows and a shell region surrounding the first flow

passage; an introduction part composing a part of the shell region and including a second flow passage connected to the first flow passage; and a connection located at an end, between ends of the introduction part, on the side opposite to an end on a side where the second flow passage being connected to the first flow passage, wherein the second flow passage is included within the shell region.

[0014a]

According to a second aspect of the present disclosure, there is provided a cooling device including the above piping structure; and a plurality of evaporation units connected to the connection, wherein the refrigerant vaporizes by drawing heat in the evaporation unit.

[0015]

According to a third aspect of the present invention, there is provided a method for transporting refrigerant vapor including making a first refrigerant flow through a cylindrical pipe in a first direction, the cylindrical pipe having a single axis; making a second refrigerant flow in a second direction different from the first direction; and making the first refrigerant and the second refrigerant join so that an angle on the same plane, between the first direction and the second direction may be an acute angle.

[Advantageous Effects of Invention]

[0016]

According to the piping structure, the cooling device including the piping structure, and the method for transporting refrigerant vapor of embodiments of the present invention, it is possible to avoid a decrease in cooling capacity without causing an increase in power consumption even when a cooling device grows in size.

[Brief Description of Drawings]

[0017]

[FIG. 1]

FIG. 1 is a cross-sectional view illustrating a configuration of a piping structure in accordance with a first exemplary embodiment of the present invention.

[FIG. 2]

FIG. 2 is a schematic view illustrating a configuration of a server module including a cooling device including a piping structure in accordance with

[CLAIMS]

1. A piping structure, comprising:

a tubular part including a first flow passage through which a refrigerant flows and a shell region surrounding the first flow passage;

an introduction part composing a part of the shell region and including a second flow passage connected to the first flow passage; and

a connection located at an end, between ends of the introduction part, on the side opposite to an end on a side where the second flow passage being connected to the first flow passage, wherein the second flow passage is included within the shell region.

2. The piping structure according to claim 1,

wherein an outer surface of the connection is a plane.

3. The piping structure according to claim 1 or 2,

wherein the connection includes a seal structure.

4. The piping structure according to any one of claims 1, 2, and 3,

wherein the connection includes an opening through which the refrigerant flows, and

a cross-sectional area of the first flow passage is larger than a cross-sectional area of the opening.

5. The piping structure according to any one of claims 1, 2, 3, and 4,

wherein a drawing direction of the second flow passage does not intersect with a central axis of the first flow passage.

6. The piping structure according to any one of claims 1, 2, 3, 4, and 5,

wherein an angle on the same plane, between a drawing direction of the first flow passage and a drawing direction of the second flow passage, is an acute angle.

7. The piping structure according to any one of claims 1, 2, 3, 4, 5, and 6,

wherein a saturated vapor pressure of the refrigerant is equal to or lower than an atmospheric pressure at zero degree Celsius.

8. A cooling device including a piping structure, comprising:

the piping structure according to any one of claims 1, 2, 3, 4, 5, 6, and 7; and

a plurality of evaporation units connected to the connection,

wherein the refrigerant vaporizes by drawing heat in the evaporation unit.

9. The cooling device including the piping structure according to claim 8, further comprising a heat radiator connected to the tubular part and a distribution structure connected to the heat radiator,

wherein the heat radiator makes the refrigerant vaporized in the evaporation unit radiate heat and liquefy,

the distribution structure distributes the refrigerant liquefied in the heat radiator to at least one of the plurality of evaporation units.

10. A method for transporting refrigerant vapor, comprising:

making a first refrigerant flow through a pipe in a first direction, the pipe including a first flow passage and a shell region surrounding the first flow passage;

making a second refrigerant flow through the shell region in a second direction different from the first direction; and

making the first refrigerant and the second refrigerant join so that