Claims

[Claim 1]

An evaporator comprising:

a housing provided with a refrigerant outlet discharging an evaporated refrigerant to an outside and forming an outer shell;

a liquid film-type heat transfer pipe group accommodated in the housing and having a plurality of liquid film heat transfer pipes in which a medium to be cooled circulates;

a refrigerant supply unit accommodated in the housing and supplying a liquid-phase refrigerant from above to the liquid film-type heat transfer pipe group;

a side plate portion covering the liquid film-type heat transfer pipe group from a side and being apart from the refrigerant supply unit; and

an upper plate portion disposed above the refrigerant supply unit and covering the liquid film-type heat transfer pipe group from above,

wherein the refrigerant evaporated in the liquid film-type heat transfer pipe group passes through a gap is formed between the side plate portion and the upper plate portion.

[Claim 2]

The evaporator according to Claim 1, further comprising a flooded-type heat transfer pipe group accommodated in the housing, immersed in a liquid-phase refrigerant stored in a lower portion of the housing, and having a plurality of flooding heat transfer pipes in which a medium to be cooled circulates,

wherein the liquid film-type heat transfer pipe group is provided above a liquid surface of the liquid-phase refrigerant stored in the lower portion of the housing.

[Claim 3]

The evaporator according to Claim 1 or 2, wherein the refrigerant outlet is provided above a lower end of the side plate portion.

[Claim 4]

The evaporator according to any one of Claims 1 to 3, wherein

the refrigerant supply unit is provided above the liquid film-type heat transfer pipe group, and

the side plate portion covers an upper portion of the liquid film-type heat transfer pipe group from a side.

[Claim 5]

An evaporator comprising:

a housing having a refrigerant outlet discharging an evaporated refrigerant to an outside and forming an outer shell;

a flooded-type heat transfer pipe group accommodated in the housing, immersed in a liquid-phase refrigerant stored in a storage portion provided in a lower portion of the housing, and having a plurality of flooding heat transfer pipes in which a medium to be cooled circulates;
a liquid film-type heat transfer pipe group accommodated in the housing, provided above a liquid surface of the liquid-phase refrigerant stored in the storage portion, and having a plurality of liquid film heat transfer pipes in which a medium to be cooled circulates;

a refrigerant supply unit accommodated in the housing and supplying a liquid-phase refrigerant from above to the liquid film-type heat transfer pipe group; and
a lower plate portion provided between the liquid film-type heat transfer pipe group and the liquid surface, and

a refrigerant discharge pipe guiding the refrigerant on an upper surface of the lower plate portion to the storage portion.

[Claim 6]

The evaporator according to Claim 5, wherein

the refrigerant discharge pipe has an upper end connected to the lower plate portion and a lower end disposed below the flooded-type heat transfer pipe group, and

the lower plate portion is provided below the liquid film-type heat transfer pipe group.

[Claim 7]

The evaporator according to Claim 5 or 6, wherein the lower plate portion has a hole penetrating the lower plate portion from an upper surface to a lower surface.

[Claim 8]

An evaporator comprising:

a housing provided with a refrigerant outlet discharging an evaporated refrigerant to an outside and forming an outer shell;

a flooded-type heat transfer pipe group accommodated in the housing, immersed in a liquid-phase refrigerant stored in a lower portion of the housing, and having a plurality of flooding heat transfer pipes in which a medium to be cooled circulates;

a liquid film-type heat transfer pipe group accommodated in the housing, provided above a liquid surface of the liquid-phase refrigerant stored in the lower portion

of the housing, and having a plurality of liquid film heat transfer pipes in which a medium to be cooled circulates;

a refrigerant supply unit accommodated in the housing and supplying a liquid-phase refrigerant from above to the liquid film-type heat transfer pipe group; and

a pressure loss increasing portion disposed only on a side of a lower end portion of the liquid film-type heat transfer pipe group and increasing a pressure loss in a region where the lower end portion of the liquid film-type heat transfer pipe group is disposed, wherein

the pressure loss increasing portion has a pair of lower end side plate portions disposed to sandwich the liquid film-type heat transfer pipe group and covering the liquid film-type heat transfer pipe group from a side, and

the lower end side plate portions are disposed along the liquid film-type heat transfer pipe group such that distances apart from the liquid film-type heat transfer pipe group are the same at upper end portions and lower end portions.

[Claim 9]

An evaporator comprising:

a housing provided with a refrigerant outlet discharging an evaporated refrigerant to an outside and forming an outer shell;

a flooded-type heat transfer pipe group accommodated in the housing, immersed in a liquid-phase refrigerant stored in a lower portion of the housing, and having a plurality of flooding heat transfer pipes in which a medium to be cooled circulates;

a liquid film-type heat transfer pipe group accommodated in the housing, provided above a liquid surface of the liquid-phase refrigerant stored in the lower portion of the housing, and having a plurality of liquid film heat transfer pipes in which a medium to be cooled circulates;

a refrigerant supply unit accommodated in the housing and supplying a liquid-phase refrigerant from above to the liquid film-type heat transfer pipe group; and

a pressure loss increasing portion disposed on a side of a lower end portion of the liquid film-type heat transfer pipe group and increasing a pressure loss in a region where the lower end portion of the liquid film-type heat transfer pipe group is disposed, wherein

the pressure loss increasing portion includes a plurality of pipes provided on both sides of the liquid film-type heat transfer pipe group, and

the plurality of pipes are disposed such that a distance between adjacent pipes is shorter than a distance between adjacent liquid film heat transfer pipes.

[Claim 10]

An evaporator comprising:

a housing provided with a refrigerant outlet discharging an evaporated refrigerant to an outside and forming an outer shell;

a flooded-type heat transfer pipe group accommodated in the housing, immersed in a liquid-phase refrigerant stored in a lower portion of the housing, and having a plurality of flooding heat transfer pipes in which a medium to be cooled circulates;

a liquid film-type heat transfer pipe group accommodated in the housing, provided above a liquid surface of the liquid-phase refrigerant stored in the lower portion of the housing, and having a plurality of liquid film heat transfer pipes in which a medium to be cooled circulates;

a refrigerant supply unit accommodated in the housing and supplying a liquid-phase refrigerant from above to the liquid film-type heat transfer pipe group; and

a rectification portion disposed to sandwich a lower portion which is below a central portion of the liquid film-type heat transfer pipe group in an up-down direction

and guiding a refrigerant evaporated in the flooded-type heat transfer pipe group to the refrigerant outlet,

wherein the rectification portion is disposed such that a lower end of the rectification portion is above a lower end of the liquid film-type heat transfer pipe group.

[Claim 11]

The evaporator according to Claim 10, wherein the rectification portion has a pair of lower side plate portions covering the liquid film-type heat transfer pipe group from both sides.

[Claim 12]

The evaporator according to any one of Claims 1 to 11, wherein

the housing extends in a predetermined direction,

a plurality of cross plate portions disposed to intersect the predetermined direction are provided on the side of the liquid film-type heat transfer pipe group, and

the predetermined direction is a longitudinal direction of the housing.

[Claim 13]

An evaporator comprising:

a housing having a refrigerant outlet discharging an evaporated refrigerant to an outside and forming an outer shell;

a flooded-type heat transfer pipe group accommodated in the housing, immersed in a liquid-phase refrigerant stored in a lower portion of the housing, and having a plurality of flooding heat transfer pipes in which a medium to be cooled circulates;

a liquid film-type heat transfer pipe group accommodated in the housing, provided above a liquid surface of the liquid-phase refrigerant stored in the lower portion of the housing, and having a plurality of liquid film heat transfer pipes in which a medium to be cooled circulates;

a refrigerant supply unit accommodated in the housing and supplying a liquid-phase refrigerant from above to the liquid film-type heat transfer pipe group;

a lower plate portion provided between the liquid film-type heat transfer pipe group and the liquid surface; and

a refrigerant discharge pipe with an upper end connected to the lower plate portion and a lower end disposed below the flooded-type heat transfer pipe group,

wherein the lower plate portion is provided below the liquid film-type heat transfer pipe group.