

Title (en)  
HEAT EXCHANGER AND AIR CONDITIONER

Title (de)  
WÄRMETAUSCHER UND KLIMAAANLAGE

Title (fr)  
ÉCHANGEUR DE CHALEUR ET CLIMATISEUR

Publication  
**EP 4155625 A1 20230329 (EN)**

Application  
**EP 20937009 A 20200522**

Priority  
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Abstract (en)

A heat exchanger includes a main heat exchanger and a sub-heat exchanger connected to the main heat exchanger. The main heat exchanger includes a plurality of main heat transfer tubes extending in an up-down direction, each of the plurality of main heat transfer tubes having a flow passage inside which refrigerant flows, a first main header into which one end portion of each of the main heat transfer tubes is inserted, main fins provided to the main heat transfer tubes and helping heat exchange between air and refrigerant flowing inside the main heat transfer tubes, and a second main header into which the other end portion of each of the main heat transfer tubes is inserted, the second main header being opposite to the first main header. The sub-heat exchanger includes a plurality of sub-heat transfer tubes extending in an up-down direction, each of the plurality of sub-heat transfer tubes having a flow passage inside which refrigerant flows, sub-fins provided to the sub-heat transfer tubes and helping heat exchange between air and refrigerant flowing inside the sub-heat transfer tubes, a first sub-header into which one end portion of each of the sub-heat transfer tubes is inserted, and a second sub-header into which the other end portion of each of the sub-heat transfer tubes is inserted, the second sub-header being opposite to the first sub-header. The heat exchanger satisfies Expression (1) below, where the number of the main heat transfer tubes is represented as  $N_{\text{sub}1}$ , and the number of the sub-heat transfer tubes is represented as  $N_{\text{sub}2}$ . The heat exchanger satisfies Expressions (2) and (3) below, where a cross-sectional area of the flow passage of each of the main heat transfer tubes is represented as  $Ta_{\text{sub}1}$ , a cross-sectional area of the flow passage of each of the sub-heat transfer tubes is represented as  $Ta_{\text{sub}2}$ , a cross-sectional area of the first main header per each of the main heat transfer tubes is represented as  $Ha_{\text{sub}1}$ , and a cross-sectional area of the first sub-header per each of the sub-heat transfer tubes is represented as  $Ha_{\text{sub}2}$ . The heat exchanger satisfies Expressions (4) and (5) below, where a sum total of cross-sectional areas of the flow passages of the main heat transfer tubes is represented as  $AT_{\text{sub}1}$ , a sum total of cross-sectional areas of the flow passages of the sub-heat transfer tubes is represented as  $AT_{\text{sub}2}$ , a flow rate [kg/h] of all refrigerant flowing through the main heat exchanger is represented as  $Gr_{\text{sub}1}$ , a flow rate [kg/h] of all refrigerant flowing through the sub-heat exchanger is represented as  $Gr_{\text{sub}2}$ , a gravitational acceleration [m/s<sup>2</sup>] is represented as G, an equivalent diameter [m] of a cross-section of the flow passage of each of the main heat transfer tubes is represented as  $D_{\text{sub}1}$ , an equivalent diameter [m] of a cross-section of the flow passage of each of the sub-heat transfer tubes is represented as  $D_{\text{sub}2}$ , a density [kg/m<sup>3</sup>] of liquid refrigerant flowing in the main heat transfer tubes is represented as  $\rho L_{\text{sub}1}$ , a density [kg/m<sup>3</sup>] of liquid refrigerant flowing in the sub-heat transfer tubes is represented as  $\rho L_{\text{sub}2}$ , a density [kg/m<sup>3</sup>] of gas refrigerant flowing in the main heat transfer tubes is represented as  $\rho G_{\text{sub}1}$ , a density [kg/m<sup>3</sup>] of gas refrigerant flowing in the sub-heat transfer tubes is represented as  $\rho G_{\text{sub}2}$ , a quality [-] of refrigerant flowing in the main heat exchanger is represented as  $X_{\text{sub}1}$ , and a quality [-] of refrigerant flowing in the sub-heat exchanger is represented as  $X_{\text{sub}2}$ .  $0.03 < Ta_1/Ha_1 < 0.30$ ,  $0.03 < Ta_2/Ha_2 < 0.30$ ,  $1 < N_1/N_2 < 0.4$ ,  $1 < Gr_1/G \times D_1 \rho L_1 - \rho G_1^{1/2} \times X_1^{1/2} \times pG_1 - 1/4 + 1 - X_1^{1/2} \times pL_1 - 1/4 \times AT_2 < Gr_2/G \times D_2 \rho L_2 - \rho G_2^{1/2} \times X_2^{1/2} \times pG_2 - 1/4 + 1 - X_2^{1/2} \times pL_2 - 1/4$

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