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D E C I S I O N
of 30 April 2002

Case Number: T 0669/00 - 3.2.3

Application Number: 96100773.9

Publication Number: 0723124

IPC: F25B 39/00

Language of the proceedings: EN

Title of invention:
Heat exchanger

Patentee:
Sanden Corporation

Opponent:
Bosch-Siemens Hausgeräte GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (yes)"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0669/00 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 30 April 2002

Appellant: (Opponent)
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D-81669 München (DE)

Representative:
-

Respondent: (Proprietor of the patent)
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Decision under appeal:
Interlocutory decision of the Opposition Division of the European Patent Office posted 11 May 2000 concerning maintenance of European patent No. 0 723 124 in amended form.

Composition of the Board:

Chairman: C. T. Wilson
Members: J. du Pouget de Nadaillac
M. K. S. Aúz Castro

Summary of Facts and Submissions

I. The appeal is directed against the interlocutory decision dated 11 May 2000 of an opposition division of the European patent office, which maintained in an amended form the European patent EP-B-0 723 124.

Claim 1, as amended, reads as follows:

"1. A heat exchanger forming part of a refrigeration circuit into which a first fluid is charged, said heat exchanger comprising:

conducting means (151) for conducting said first fluid therethrough so that a flow path of said first fluid is defined;

exposed area increasing means (152, 152a) for increasing a substantially exposed area of said conducting means (151) to a second fluid which flows along an exterior surface of said heat exchanger, said exposed area increasing means (152, 152a) having an area which is in contact with said second fluid; and a heat exchange region (153) which is formed by said conducting means (151) and said exposed area increasing means (152, 152a);

said conducting means (151) including a first port (151c) through which said first fluid flows thereinto, and a second port (151d) through which said first fluid flow out therefrom, characterized by

said heat exchange region (153) of said heat

exchanger comprising a first section (153a) which includes a first portion of said flow path of said first fluid continuing from said first port (151c) to an interim location along said flow path of said first fluid, and a second section (153b) which includes a second portion of said flow path of said first fluid continuing from said interim location to said second port (151d), said second section (153b) of said heat exchange having a greater substantially exposed area than said first section (153a) of said heat exchanger with respect to the unit length of said flow path of said first fluid,

wherein said conducting means includes a pipe member (151) through which said first fluid flows,

said pipe member (151) has a plurality of straight portions (151a) and a plurality of curved portions (151b) connecting one end of adjacent straight portions (151a) and an another end of adjacent straight portions (151b) alternately, and said second fluid flows perpendicularly to a plane through said plurality of straight portions (515a) and said plurality of curved portions (151b) of said pipe member 151."

The other claims, namely claims 2 to 15, are dependent claims, that is to say they concern preferred embodiments of the heat exchanger defined in claim 1.

II. In its decision, the opposition division held that, contrary to the opponent's opinion, the subject-matter of this claim was new, in particular vis-a-vis D2 (US-A-3 267 692) which was considered by the opponent

to represent the prior art closest to the present invention, and implied an inventive step having regard to the disclosures of:

D1: US-A-3 084 914

D3: US-A-4 672 817

D4: DE-A-1 601 018

D7: US-A-4 438 808

III. The appellant, opponent, filed the notice of appeal on 13 June 2000, paying the appeal fee at the same time. In the statement of grounds of appeal, which was received on 11 September 2000, it essentially based its appeal on a lack of inventive step, having regard to D4, now taken as the closest prior art, and combining it with the disclosure of D2.

In a communication joined to the summons to oral proceedings dated 2 October 2001, the board of appeal expressed its provisional opinion that the choice of D4 as prior art nearest to the invention as claimed, preferably to D2 or D7, did not seem to be realistic and that a combination of D4 with D2 seemed to be illogical.

IV. By a phone call on 4 April 2002 and a fax dated 17 April 2002 respectively, the respondent, proprietor of the patent, and the appellant indicated that they would not attend the oral proceedings.

These proceedings took place nevertheless on 30 April 2002 without the parties, pursuant to

Rule 71(2) EPC.

V. The appellant requested in writing that the decision under appeal be set aside and that the European patent No. 0 723 124 be revoked.

The respondent has not made any request.

Reasons for the Decision

1. The appeal is admissible.

2. In the statement of grounds of appeal the appellant has indicated that a heat exchanger is known from D4 which comprises conducting means in the form of pipes having a plurality of curved and straight portion tubes for conducting a first fluid, namely a refrigerant, and exposed area increasing means in the form of fins for increasing a substantially exposed area of said conducting means to a second fluid, namely air, which flows along an exterior surface of said heat exchanger. The heat exchange region of the heat exchanger is formed by said conducting means and said exposed area increasing means, namely the tubes and the fins, as is well known in the art, for example in the car industry. The conducting means for the refrigerant includes a first port through which said first fluid flows thereinto and a second port through which said first fluid flows out therefrom. Hence, all the features of the preamble of claim 1 of the patent in suit can be found in this prior art and the board agrees with this opinion of the appellant.

Then the appellant continued by asserting that, in

accordance with a conclusion of the decision under appeal, the second fluid (the air) flows perpendicularly to a plane through said plurality of straight portions and said plurality of curved portions of the pipe conducting means (the last feature of claim 1). The board cannot agree with this last assessment: in the decision under appeal, it is only indicated that, in the evaporator according to D4, the air flow is perpendicular to the finned tubes, and **not to the plane** in which the curved and straight portions of the pipe conducting means lie. Figure 1 of D4 clearly shows that the air rather flows parallel to said plane, although flowing simultaneously perpendicular to the pipes.

3. Therefore, this prior art D4 does not, contrary to the appellant's conclusion, provide a disclosure which goes beyond that of the other mentioned prior art documents D1, D2 and D7, as long as only the constructional features of claim 1 of the patent in suit are considered. Thus, the choice of D4 for representing the nearest prior art is at least not justified on this sole basis.

Regarding moreover the whole solution disclosed by this prior art which aims at reducing the frequency of the melting of the ice which has built up on the heat exchanger surfaces, this solution consists in a heat exchanger comprising a first set of rows of finned tubes disposed before a fan in order to collect the maximum of ice and to dry the air and a second set located after the fan to fulfill the main heat exchanger function. Such an arrangement does not correspond to a heat exchanger according to the present invention, which comprises conducting means defining,

according to claim 1, **a** flow path in the form of a pipe member for the first fluid, and not several flow paths or even several heat exchanger sections, each comprising several flow paths or pipe members, as is disclosed by D4. Also for this reason, the choice of D4 for representing the undoubted nearest prior art is wrong. In this respect, prior art document D2 is more appropriate, since it concerns a heat exchanger comprising a single serpentine pipe member for the first fluid.

4. The combination of document D4 with D2, which is finally presented by the appellant in its statement of grounds of appeal in order to deny any inventive step, is illogical: Both documents have the same main object, namely to reduce the disadvantages due to the ice formation, but they solve it by quite different means which are based on contradictory ideas: D2 designs the main exchanger means, namely a serpentine pipe member, so that it accumulates a frost built-up substantially greater than was the case in the prior art at that time, whereas D4, as seen above, uses several pipe members, which do not form a single serpentine flow path, and solves the problem by separate ice accumulating and air drying means, which are located upstream of the main heat exchanger means. The appellant has not explained the reasons, which would lead the person skilled in the art to combine these two documents, following the "problem-solution" approach.

5. Moreover , in neither of these documents, is the above mentioned last feature of claim 1 disclosed, so that, even assuming that a person skilled in the art would pick up and combine together different features of the heat exchangers known from D2 and D4, he would not

arrive at the subject-matter of claim 1 of the patent in suit.

6. In fact, in the prior art documents D1, D2 , D4 and D7, regarding only the structural arrangement of a heat exchanger independently of the objects underlying these documents, one could say that the same teaching is provided by all of them, namely to provide a heat exchanger comprising different sections of the flow path of the first fluid from the first fluid inlet towards its outlet, the sections differing from each other by the exposed area that they have in contact with the air, that is to say with the second fluid. The exposed area can be varied by modifying either the distance between the serpentine portions of the pipe member (tube pitch) or the lengths and pitches of the fins. This is also a part of the solution according to claim 1 of the patent in suit.

However, in the above mentioned prior art documents D1, D2 and D4, the direction of the second fluid is the same, namely parallel to the plane containing the pipe member and the section with the reduced exposed area is the section in which the air first enters, namely the section near the first fluid inlet. For D2 and D4, as seen above, the object is the same, namely to have a first section, that is to say the section subjected to the most moist air flow, with the least number of fins or tube portions on which the ice can accumulate, whereas in D1 the problem is substantially different, since it concerns a condenser for recovering sublimable material from the vapor which flows externally through pipe members which cool the vapor and what is looked for is uniform recovery of the sublimable material upon the whole heat exchanger surface and not only mostly in

the first section as was the case in the prior art.

In the heat exchanger according to D7, the air flow is perpendicular to the serpentine pipe member, as is the case with the present invention, and the heat exchanger also comprises sections with different exposed areas. However, these sections are determined in relation with the winding action of the fan associated to the heat exchanger, that is to say the rather circular central part of the heat exchanger which is directly under the action of the fan when viewed in the air flow direction is provided with the greater exposed area. This solution does not correspond to that claimed by the present invention.

7. In the present invention, as indicated by claim 1, the solution resides in the combination of the claimed variation of sectional exposed areas of the heat exchanger, known *per se* from D1, D2 or D4, with the direction of the air or first fluid flow, which is perpendicular to the plane of the pipe member. This combination of features, as will be hereinafter explained, is not disclosed in any one of the cited prior art documents, which in fact do not concern the particular kind of heat exchangers concerned by the present invention, namely heat exchangers in which the first fluid is a non-azeotropic mixture, for example the so called R407A refrigerant. As indicated in the description of the patent in suit, the components of such a refrigerant, which flows through an evaporator in operation, vary with the result that the temperature differential between the refrigerant and the air outside the evaporator becomes gradually smaller toward the outlet port side of the refrigerant in the evaporator (this phenomen occurs in the opposite

direction in a condenser). Hence, the amount of heat absorbed from the air moving along the exterior surface of the evaporator, perpendicularly to the serpentine pipe member plane, is lower in the last portion, namely the section near the outlet of the refrigerant. In order to have an efficient evaporation process along the whole evaporator with such an air flow direction, it is therefore necessary to make the second or last section of the evaporator more efficient than the first section in the heat exchanging process, which according to claim 1 is obtained by having the second section with the greatest exposed area.

8. This idea of taking into account the phenomenas occurring inside the refrigerant, the consequences on the heat exchanging process, and the solution which follows according to claim 1 are not disclosed in any of the cited prior art documents. Therefore, the subject-matter of claim 1 involves an inventive step in the meaning of Article 56 EPC.

Order

For these reasons it is decided that:

The appeal is dismissed

The Registrar: The Chairman:

A.Counillon C.T.Wilson