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**Datasheet for the decision
of 3 July 2008**

Case Number: T 0732/06 - 3.2.03

Application Number: 97946087.0

Publication Number: 0881450

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F28D 1/053

Language of the proceedings: EN

Title of invention:
Heat Exchanger

Patentee:
Zexel Valeo Climate Control Corporation

Opponent:
Behr GmbH & Co. KG

Headword:
-

Relevant legal provisions:
EPC Art. 56

Relevant legal provisions (EPC 1973):
-

Keyword:
"Inventive step (no)"

Decisions cited:
-

Catchword:
-



Case Number: T 0732/06 - 3.2.03

D E C I S I O N
of the Technical Board of Appeal 3.2.03
of 3 July 2008

Appellant: Zexel Valeo Climate Control Corporation
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Respondent: Behr GmbH & Co. KG
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Representative: Mr Mantel

Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 10 March 2006
revoking European patent No. 0881450 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: U. Krause
Members: C. Donnelly
K. Garnett

Summary of Facts and Submissions

- I. The appeal lies from the decision of the opposition division, posted on 10 March 2006, to revoke European Patent no. EP-B-881450. In its decision the opposition division held that the subject-matter of claim 1 as granted was new with respect to EP-A-0431917 (D5), JP-A-8170888 (D9) and US-A-5000257 (D13), but was rendered obvious by a combination of D5 with the general knowledge of the skilled person.
- II. The patentee (hereinafter "the appellant") filed a notice of appeal on 10 May 2006 and paid the fee on the same day. In the grounds of appeal filed on 20 July 2006 the appellant made a main request for the impugned decision to be set aside and the opposition rejected. Alternatively, as auxiliary requests it was requested that the impugned decision be set aside and the patent maintained in amended form on the basis of claims 1 to 3 of the first auxiliary request or the amended claims of the second auxiliary request.
- III. By letter of 7 February 2007 the respondent (opponent) requested that the appeal be dismissed.

Both parties requested oral proceedings.

- IV. The board informed the parties of its provisional opinion in a communication pursuant to Article 15(1) RPBA dated 22 February 2008 annexed to the summons to the oral proceedings. In particular, the board expressed its view that the subject-matter of claim 1 appeared new with respect to the nearest prior art described in D5. However, as a result of this

preliminary examination, it had become apparent that it was doubtful whether the embodiments depicted in figures 15 to 26 of the contested patent fell within the scope of claim 1. The board also drew the parties attention to documents D1, D3, D12, D17 and D18 from the opposition proceedings which it considered might be of particular relevance when assessing the question of inventive step.

In letter of 3 June 2008, the appellant filed further auxiliary requests 3 to 5. The appellant also essentially agreed with the board's provisional assessment of the embodiments falling within the scope of claim 1 and filed amended description sections for each request which took this into account by deletion of figures 14 to 26. The appellant also filed two graphs ("Air Velocity Impact (1) and (2)") showing the results of tests carried out to demonstrate the effect of air velocity and louver angle on the performance of a combined heat-exchanger.

V. Oral proceedings were held on 3 July 2008.

Following the board's decision not to allow its main request, the appellant filed third and fourth auxiliary requests to replace those already on file.

VI. *State of the art*

The following documents were referred to during the appeal procedure:

D1: Patent Abstracts of Japan vol. 018, no. 594(M-1703), 14 November 1994 (1994-11-14) - & JP 06221787 A (Nippondenso Co Ltd), 12 August 1994 (1994-08-12);
D1a: English translation of D1;
D3: US-A-5311935;
D5: EP-A-0431917;
D9: JP-A-8170888;
D12: FR-A-2576094;
D13: US-A-5000257;
D15: US-A-4958681;
D16: DE-A-4142019;
D17: US-A-4621687;
D18: FR-A-1521499.

During the oral proceedings the respondent requested that document JP-U-214582 (D10), cited in the opposition proceedings, be admitted into the proceedings.

VII. Claim 1 as granted reads:

"A combined heat exchanger (1) comprising a first heat exchanger (A) having first tubes (4) connecting a pair of first tanks (2) and disposed downstream with respect to a direction of air flow, and including fins (6) disposed between adjacent first tubes (4); and a second heat exchanger (B) having second tubes (5) connecting a pair of second tanks (3) and disposed upstream with respect to the direction of air flow, and including fins (6) disposed between adjacent second tubes (5);

wherein the fins (6) disposed between adjacent first tubes and the fins (6) disposed between adjacent second tubes (5) are integrally formed, the fins (6) have louvers (7A,7B) which are formed into a first group of first louvers (7A) on the fins (6) of the first heat exchanger (A) and into a second group of second louvers (7B) on the fins (6) of the second heat exchanger (B); characterised in that the shape of the first louvers (7A) is different from the shape of the second louvers (7B) in respect of at least one of a louver angle, a slit length, a louver width, and the number of louver members; and the first louvers (7A) and the second louvers (7B) have different opening directions."

VIII. The arguments of the parties with respect to the issues relevant to the final decision can be summarised as follows:

(a) *Main request*

Appellant

D5 represents the nearest prior art. It is not disputed that the louvers open in opposite directions, hence, the subject-matter of claim 1 differs from the device disclosed in D5 by the remaining feature of the characterising portion, i.e. in that:

-the shape of the first louvers is different from the shape of the second louvers in respect of at least one of a louver angle, a slit length, a louver width, and the number of louver members.

In agreement with the interpretation made by the board in the provisional opinion this feature is to be understood as:

-the shape of the first louver group is different from the shape of the second louver group in respect of at least one of a louver angle, a slit length, a louver width, and the number of louver members.

Claim 1, as well as paragraphs [0007] and [0008] of the contested patent make it clear that the invention is concerned with combined heat exchangers. Thus, it is unjustified simply to concentrate on the aspect of improving overall heat exchange performance whilst ignoring the particular constructional constraints imposed by combined heat-exchangers.

The present invention maintains the advantages of an integral fin in terms of ease of assembly, structural stiffness and compactness whilst accepting the increase in difficulty associated with manufacturing such a fin with louver groups of a dedicated design for each exchanger. The solutions of the prior art do not make such a compromise. Either the idea of a common fin is abandoned and separate fins for each exchanger are adopted (e.g. figure 5 of D1) or a common fin with the same louver shape (as in D5) or a repeating louver pattern wherein each louver group is not attributed to any particular exchanger (e.g. see D9 figure 4) is used.

D5 is primarily concerned with optimising the shape of the central cut-out placed in the integral fin to

reduce heat transfer between the two exchangers. It gives no hints as to how the performance of each exchanger may be adapted to its particular function, let alone how this may be done within the constraints of a combined heat exchanger. D5 is completely silent on the question of louver shape and its influence on heat transfer and accordingly cannot give the skilled person any incentive to alter this particular parameter among the many available. Any suggestion that the skilled person would do so merely on the basis of his own general knowledge is a pure assertion.

D12 relates exclusively to single heat-exchangers and, thus, can provide no hint to the skilled person to provide an integral fin in a combined exchanger. Further, the skilled person would not simply transfer features from a document relating purely to single heat-exchangers since he is well aware that a combined heat-exchanger is fundamentally different. The same reasoning applies to D17 and D18 which also relate exclusively to single heat-exchangers.

D3 also concerns a single heat-exchanger (see column 1, line 61). Further, this document only teaches that within a specific range of fin height there are no fixed rules governing heat transfer. An analysis of the examples shows that the results are not predictable. In particular, it is pointed out that fin-pitch and fin-height do not have to be the same for both exchangers since a common fin can be formed by welding together two sheets with different geometries.

D13 just says that the width (i.e. the core depth) of the flat tubes is "not always the same" (see column 3,

line 15, which indicates that normally the widths are the same. At column 2, lines 55 to 65, this document confirms that the heat exchange situation in a combined heat-exchanger is more complicated than in a single heat exchanger and proposes several solutions as to how the direct heat exchange between the cores may be reduced, none of which involve dedicating specific forms of louvers to each exchanger.

In conclusion, the opposition division has wrongly identified the objective technical problem to be solved and relied on the benefit of hindsight to come to the conclusion that the skilled person would choose to dedicate a particular design of the louver groups to each heat-exchanger.

Respondent

The subject-matter of claim 1 is not inventive in view of D5 and the skilled person's general knowledge.

D5 shows all the features of claim 1 except for that wherein:

-the shape of the first louvers is different from the shape of the second louvers in respect of at least one of a louver angle, a slit length, a louver width, and the number of louver members.

Since D5 already shows an integral fin, the problem of facilitating manufacture has already been solved. Consequently, the only problem facing the skilled person is that of how to adapt each heat-exchanger to its particular function. It is part of the skilled

person's general knowledge that although a large number of parameters influence heat transfer these can be split into two major groups, namely:

- (a) those relating to the tube characteristics i.e. its length, width, depth and thickness; and
- (b) those relating to the fin characteristics i.e. fin-pitch, fin-height, width, louver shape

In the case of an integral fin arrangement only the tube depth (i.e. in the direction of the air-flow) from the parameters of the first group can easily be altered and adapted to each exchanger's requirements. In the second group, the skilled person would not seriously contemplate using different fin-height and pitches. Thus, the skilled person is left with little alternative but to adjust the tube depth and adapt the number of louvers accordingly for each exchanger. Consequently, the skilled person would place more louvers on the tube side with the greater core depth and the number of louvers would be different for each exchanger as specified in claim 1.

Contrary to the assertion of the appellant, D3 does not disclose a myriad of parameters susceptible to influence the heat transfer characteristics of the exchanger. In fact, at column 3, final paragraph only four parameters are listed namely: height H_f of the fin, the depth D of the core, the pitch P_f of the fin, and the thickness B of the tube. Since a common single fin is under consideration it would be impractical for the skilled person to elect to alter either the height or pitch of the fin, for the same reason the tube thickness would not be altered. Hence, the only parameter that can be adjusted in practice is that of

the core depth D. Thus, D3 confirms what the skilled person would have deduced from general knowledge.

D13 at column 3, lines 15 to 18 makes it clear that the width of the flat tubes or the core depth is dependent on heat exchange requirements of each exchanger. This passage is a direct indication to the skilled person that in a combined heat-exchanger the core depth of each exchanger is a fundamental parameter which can be adjusted depending on the heat transfer requirements of each exchanger.

(b) *Admission of auxiliary requests filed during oral proceedings.*

The appellant argued that the requests should be admitted since they introduced no new subject-matter and the Respondent must therefore be prepared to deal with them.

The respondent was of the view that the requests should not be admitted since they were not clearly allowable. Further, he was not prepared to deal with them since it was impossible to anticipate all the combinations of parameters open to the Appellant to pursue by virtue of the use of the expression "at least one of" in claim 1.

Reasons for the Decision

1. Request to admit D10

The board considers that this document is prima facie no more relevant than those already cited previously in

the appeal procedure. Further, the fact that a document has been cited in the opposition procedure does not mean that a party can suddenly refer to it in the oral proceedings at the appeal stage in order to support a previously unannounced line of argument (Article 12(2), Article 13(1),(3) RPBA).

2. *Main request*

The only issue at stake is that of inventive step.

The board considers D5 to be the most relevant prior art since it relates to a combined heat-exchanger of the type claimed comprising a single fin. It is common ground between the parties that this document describes:

a combined heat exchanger comprising:

a first heat exchanger (10) having first tubes (13) connecting a pair of first tanks (11,12) and disposed downstream with respect to a direction of air flow, and including fins (14) disposed between adjacent first tubes (13); and

a second heat exchanger (20) having second tubes (23) connecting a pair of second tanks (21,22) and disposed upstream with respect to the direction of air flow, and including fins (24) disposed between adjacent second tubes (23);

wherein the fins (14) disposed between adjacent first tubes and the fins (24) disposed between adjacent second tubes (23) are integrally formed, the fins (14,24) have louvers (4) which are formed into a first group of first louvers on the fins (14) of the first heat exchanger (10) and into a second group of

second louvers on the fins (24) of the second heat exchanger (20); and wherein the first louvers and the second louvers have different opening directions (see figure 3).

The board also agrees with this analysis. Hence, the subject-matter of claim 1 is distinguished from the known apparatus in that:

-the shape of the first louvers is different from the shape of the second louvers in respect of at least one of a louver angle, a slit length, a louver width, and the number of louver members.

Although this feature is slightly ambiguous in that the number of louver members is clearly not a parameter of the shape of a single louver member, but of the louver arrangement as a whole, the parties have not contested the board's interpretation of this feature as:

-the shape of the first louver group is different from the shape of the second louver group in respect of at least one of a louver angle, a slit length, a louver width, and the number of louver members.

There is no doubt that this feature has the immediate technical effect of making the heat-transfer characteristics of the each portion of the fin different from one another.

The board therefore sees the objective technical problem to be solved as one of how to adapt the heat-transfer characteristics of each of the heat-exchangers of a combined heat-exchanger to its specific function.

The appellant has argued that the above technical effect cannot be divorced from the fact that a combined heat-exchanger with an integral fin is under consideration.

The board agrees with the appellant that when dealing with a combined heat-exchanger, the skilled person is faced with more onerous challenges in terms of construction and heat-transfer performance than those encountered with single heat-exchangers since the interaction between the two exchangers must always be considered. However, this does not mean that the skilled person should not apply basic heat transfer theory to combined heat-exchangers simply because it also applies to single heat-exchangers.

As the appellant points out there are numerous ways in which the heat transfer characteristics of a heat-exchanger can be influenced in order to adapt it to a particular function. However, the board is of the view that the skilled person would know that perhaps the most basic amongst these is the surface area available for heat transfer. This is borne out, for example, by figures 9 and 10 of D3 which show that generally a flat tube with a larger core depth "D" will always dissipate more heat than a tube of a lesser core depth, other parameters being equal.

It is acknowledged that the surface area available for heat dissipation is also influenced by the fin arrangement, however, in the device under consideration the fins are integrally formed and common to both the heat-exchangers. The board accepts the view of the

respondent that, given the technical complication of manufacturing two sheets with different corrugation forms and welding them together, the skilled person would consider it impractical to produce a common fin with a different fin-pitch and fin-height for each exchanger. For similar reasons the skilled person would also keep the tube thicknesses the same so as to be able to maintain a uniform fin geometry.

Thus, the board is of the view that the skilled person applying general knowledge of heat transfer to the problem of adapting each of the exchangers of the combined heat-exchanger of D5 to its particular function (i.e. in the case of D5 a radiator and a condenser) would come to the conclusion that the obvious parameter to adjust is the core depth. This view is further reinforced by D13 which also describes a combined radiator/condenser heat-exchanger unit. This document states at column 3, lines 15 to 18 that "the width of the flat tubes 110 is not always the same as the width of the flat tubes 111. Each width depends on the effective coefficient for heat exchange of the heat exchanger". The term "width" in this passage corresponding to "core depth" used above and in D3.

Once the skilled person has made this decision, it would then be normal design procedure to keep the number of louvers per unit length of the core depth constant. Indeed, it would prima facie be odd if the skilled person departed from this practice. As a consequence, the number of first louvers on the fins of the first heat exchanger would end up being different from the number of second louvers on the fins of the second heat-exchanger.

The appellant has argued that the skilled person would rather take up other solutions suggested in the prior art, such as using separate fins for each exchanger as shown in figure 5 of D1, or adopting a common fin with no particular attribution of louvers to one or other of the exchangers as shown in D9. The board does not accept this reasoning since D5 already shows a common fin with a cut-out clearly delimiting the two regions attributable to each exchanger. In the board's view there is no reason why the skilled person would abandon the advantages associated with the integral fin construction and adopt separate fins when the cut-out feature is expressly intended to minimise heat transfer between the exchangers and, hence, mimic the use of separate fins. Similarly, since the skilled person recognises that the cut-out is an essential feature of the integral fin in the apparatus of D5 there is no reason to use a fin with a uniform louver pattern which would anyway have to be interrupted by the cut-out.

In conclusion, the subject-matter of claim 1 as granted does not involve an inventive step.

3. *Auxiliary requests*

The parameter of the number of louvers is present as one of the options in all of the auxiliary requests, consequently none of these requests is allowable either.

4. *Admission of third and fourth auxiliary requests filed during the oral proceedings.*

In the board's opinion, the respondent's line of attack against the number of louvers was made clear in the reply to the grounds of appeal. The appellant should have filed any new requests, at the latest, within a reasonable time of receiving this reply. The respondent is also correct to point out that the requests are not clearly allowable. The board also accepts that the respondent was not in a position to deal properly with such a late filed request: an opponent cannot be expected to hold himself ready to deal with all responses which a proprietor may make to a long-standing objection. In conclusion the third and fourth auxiliary requests filed during the oral proceedings are not admitted (Article 13(3) RPBA).

Order

For these reasons it is decided that:

The appeal is dismissed.

Registrar

Chairman

A. Counillon

U. Krause