Internal distribution code:

(A) [-] Publication in OJ
(B) [-] To Chairmen and Members
(C) [-] To Chairmen
(D) [X] No distribution

Datasheet for the decision of 13 July 2017

Case Number: T 1845/13 - 3.2.03

Application Number: 00204029.3

Publication Number: 1111318

IPC: F25D21/14, F25B39/02, F28F1/12, F28D1/03

Language of the proceedings: EN

Title of invention:
Evaporator with enhanced condensate drainage

Patent Proprietor:
Delphi Technologies, Inc.

Opponent:
MAHLE Behr GmbH & Co. KG

Headword:

Relevant legal provisions:
EPC Art. 56
RPBA Art. 13

Keyword:
Inventive step - (yes)
Late-filed request - justification for late filing (no)

Decisions cited:

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern
Boards of Appeal
Chambres de recours

European Patent Office
D-80298 MUNICH
GERMANY
Tel. +49 (0) 89 2399-0
Fax +49 (0) 89 2399-4465

Case Number: T 1845/13 - 3.2.03

D E C I S I O N
of Technical Board of Appeal 3.2.03
of 13 July 2017

Appellant: (Patent Proprietor)	Delphi Technologies, Inc. PO Box 5052 Troy, MI 48007 (US)
Representative:	BRP Renaud & Partner mbB Rechtsanwälte Patentanwälte Steuerberater Königstraße 28 70173 Stuttgart (DE)
Respondent: (Opponent)	MAHLE Behr GmbH & Co. KG Mauserstr. 3 70469 Stuttgart (DE)
Representative:	Grauel, Andreas Grauel IP Patentanwaltskanzlei Wartbergstrasse 14 70191 Stuttgart (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 27 June 2013 revoking European patent No. 1111318 pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman	G. Ashley
Members:	C. Donnelly
	E. Kossonakou

Summary of Facts and Submissions

I. The appeal lies from the decision of the opposition division to revoke European Patent No. EP 1 111 318 following the earlier decision T1373/09 to remit the case to the opposition division for further prosecution.

II. The patent proprietor (hereinafter: the "appellant") lodged an appeal against this decision in due form and time.

By letter of 9 July 2014, the opponent filed counter-arguments. However, by letter of 15 December 2015 it withdrew its opposition.

III. In its decision the opposition division relied on the following evidence and documents:

ES1 to ES13: Supporting evidence for two public prior uses concerning the "OKV-condenser" and a Mercedes vehicle containing such a condenser;

O5: DE 36 06 253 A;
O9: US-A 5 669 438;
O11: DE 195 23 285 A.

In support of its case the appellant referred to:

D12: US-A 5 289 698.

It also made reference to a comparison table of the properties of automobile air-conditioning unit evaporators and condensers, initially filed with letter of 11 February 2009.

IV. In a communication pursuant to Article 15(1) RPBA, annexed to the summons to oral proceedings, the Board informed the appellant of its provisional opinion. Oral proceedings were duly held on 13 July 2017. At the end of the debate the appellant requested that:

- the decision under appeal be set aside and the patent maintained on the basis of either the main request submitted during the oral proceedings, namely the claims as granted, or the request submitted on 21 July 2009 as the main request in opposition proceedings.

V. Claim 1 according to the main request of 21 July 2009 reads:

"An automotive air conditioning system evaporator (10) having substantially parallel, substantially vertically oriented refrigerant flow tubes (12), said tubes having opposed pair of surfaces (14) spaced apart by a distance c, between which tube surfaces (14) corrugated air fins (16) are located, said fin corrugations comprised of adjacent pairs of fin walls (18) joined at integral crests having an interior radius r and a fin pitch p, said fin walls (18) also comprising louvers (22) having a length 1, whereby the integral crests have a V-shape; characterized in that

said tube surface spacing c, crest interior radius r, fin pitch p, and fin louver length l have the following relationships:

$0 \leq r/c \leq 0.057$

and

$0.89 \leq 1/c \leq 1.01$

and

$0.29 \leq p/c \leq 0.43$."

VI. The appellant's case can be summarised as follows:

Admissibility of new main request.

This request should be admitted into the proceedings since it is only a minor amendment, which should not present any undue burden for the board, even at this late stage.

Main request of 21 July 2009, inventive step

The opposition division's argument that the skilled person would have come to the same fin design without considering the problem of condensate drainage and would also have adapted the OKV-condenser for use as an evaporator is incorrect.

The relative magnitudes of the latent and sensible loads in stationary and mobile applications are different. The latent load in stationary applications is about 5%, whereas in mobile applications it is around 40%. In other words the amount of moisture to be removed from the air in stationary applications is negligible, whereas in mobile applications it is significant. This is because in mobile applications only 10 to 15% of the conditioned air is recirculated with 85 to 90% moisture-laden outside air being drawn in as make-up air.

None of the documents ES1 to ES13, relating to the OKV condenser, mention its possible use as an evaporator. If it had been the intention that the OKV-condenser was also to be used as an evaporator, it would have been described as a "heat-exchanger".

Documents ES1 to ES13 also fail to disclose what kind of system the OKV-condenser was used in and, in particular, whether the refrigerant flow in that system could be reversed. It is normal in automotive air-conditioning systems to only have uni-directional flow. In common automotive air-conditioning systems, the evaporator and the condenser are intended to perform different functions and are constructed differently in order to ensure balanced operation. From the comparison table submitted on 11 February 2009 it is evident that the evaporator and condenser of an automobile air-conditioning system are not interchangeable. Thus, the skilled person would know that an automobile air-conditioning unit condenser cannot normally simply be swapped for an evaporator.

The system in O11 is an isolated, specific example of a non-conventional heat-pump arrangement using two condensers which cannot be taken to represent the skilled person's general knowledge. The only other instance of the use in a motor vehicle of a heat-pump system with interchangeable condenser and evaporator was by General Motors in the EV1 range. Experience with this system showed that the evaporator could not provide the necessary heating performance in winter when operated as the condenser. This is borne out by D12 where it is stated at column 4, lines 26 to 32 that "The evaporator 26 and the condenser 22 act according to their respective functions at all times. etc."

O9 is completely silent on the problem of water condensate formation which is typical for evaporators, but does not occur on condensers. O9 is mainly concerned with an improved louver design and does not teach that the refrigerant flow tubes are oriented vertically - in fact the figures suggest they are horizontal. O9 does not mention the tube surface spacing as a design parameter, since it only cites the proportion of an end to end louver length compared to total fin width W, which has nothing to do with and cannot render obvious relating the louver length to the tube surface spacing. In particular, it does not render obvious the values of r/c, l/c and p/c as specified in claim 1.

O5 is the only document relied on by the opposition division in its decision which explicitly deals with the problem of condensate drainage in automobile air-conditioner evaporators. However, in fact O5 recommends that the heat-exchange tubes of the evaporator should preferably be arranged horizontally since a higher relative efficiency is obtained through the larger effective surface area (see Abstract, claim 1, page 3, paragraph 1, page 4, paragraph 2, page 5, paragraph 2, figure 1).

Therefore, the skilled person would not see O9 as a promising starting point, and a combination of O9 with O5 would not in any case lead to the subject-matter of claim 1 since O5 teaches that the tubes should be stacked horizontally.

Also taking the OKV condenser as the nearest prior art and combining it with either O5 or the skilled person's general knowledge would not lead to the subject-matter

of claim 1 in an obvious manner, since O5 specifies horizontal tubes. Also, O5 indicates in its discussion of the state of the art, that the skilled person would know that such an arrangement has a higher heat-transfer efficiency, which then teaches away from having a vertical arrangement of tubes.

Thus, the subject-matter of claim 1 meets the requirements of Article 56 EPC since it involves an inventive step.

Reasons for the Decision

1. *Admissibility of new main request for the patent to be maintained as granted.*

The Board decided not to admit this request into the proceedings since it is extremely late filed, represents more than a minor amendment since, as argued by the appellant itself, heat transfer conditions in an evaporator used in mobile applications are completely different to those of stationary applications. Furthermore the amendment was not the subject of the appealed decision (Article 106(1) EPC; Article 13(1), (3) RPBA).

2. Main request of 21 July 2009, inventive step

2.1 In its decision the opposition division held that the subject-matter of claim 1 did not involve an inventive step in view of:

(i) US-A-5 669 438 (O9) in combination with DE 3 606 253 A (O5) or general technical knowledge.

(ii) the prior use OKV-Condenser in combination with DE 195 23 285 A (O11) or general technical knowledge;

2.2 Essentially, the opposition division considered that "the skilled person could have come to the same fin design without considering the problem of drainage of condensate", since the skilled person facing the problem of heat transfer and air flow optimisation would arrive at values falling within the claimed ranges. Also, when starting out from the OKV-condenser, it was of the view that, in the field of automotive air conditioning, reversible cycles exist where heat exchangers are used as condensers or evaporators depending on the flow direction (see O11). Thus, in its view, the exchangeability of condensers and evaporators even in the field of automotive air conditioning was well known in the state of the art,.

2.3 (i) O9 in combination with O5 or common general knowledge

2.3.1 O9 discloses the fin design of heat exchangers in general (see column 1, lines 5 to 7). O9 is particularly concerned with an improved louver design and does not discuss the problem of water condensate formation, retention and removal from evaporators, which are only mentioned once as an aside at column 2, lines 10 to 12, where it is stated that "Technically, of course, air is a fluid as well, and the heat flow may in fact be in the opposite direction, as in an evaporator". Further, O9 does not mention the tube surface spacing "c" as a design parameter. The only numerical ratio explicitly specified is that of the proportion of an end to end louver length l compared to total fin width W. Also, O9 does not give any

indication as to whether the flow pipes of the heat-exchanger are oriented vertically or horizontally.

2.3.2 O5 deals with the same problem as that of the contested patent, namely condensate drainage in automobile air-conditioner evaporators. However, although mentioning that evaporator tubes may be aligned vertically, the overall teaching of O5 is that they should be arranged horizontally, since a higher relative efficiency is obtained through the larger effective surface area (see Abstract, claim 1, page 3, paragraph 1, page 4, paragraph 2, page 5, paragraph 2, figure 1).

2.3.3 O5 also indicates that the fin design has a significant effect on the removal of condensate. However, the pitch between fin crests ("Rippenabstand fp" - corresponding to "p" in the patent) is specified as being between 3.2 and 4.0 mm and the fin height (i.e. distance between the flat tubes "c" in the patent), as being from 14 to 20mm (see claim 1, figure 3 and page 8, lines 18 to 22). Therefore, the preferred value p/c recommended by O5 lies between 0.16 and 0.28, which is entirely outside of the range 0.29 to 0.43 recommended in the patent.

2.3.4 Therefore, starting out from O9, the skilled person would not obtain the subject-matter of claim 1 without the benefit of hindsight, since O5 not only recommends that the fluid flow tubes are positioned horizontally if efficiency is to be optimised, but also, in order to improve condensate drainage, that the pitch (p) and fin-height c are chosen such that the ratio p/c falls outside of the claimed range.

2.3.5 In its decision, the opposition division argued that the technical problem to be solved could be regarded

as that of the optimisation of the parameters r, l, c and p of a heat-exchanger with regard to heat transfer rate and air flow. However, such a definition already comprises a suggestion to the claimed solution. Therefore, a broader formulation leaving out the specific parameters (particularly since O9 does not mention tube spacing "c") would have been more appropriate. Further, an extrapolation from a ratio l/W of louver length l to fin length W to one of louver length l to tube spacing c does not inevitably lead to the claimed range of l/c, since for small c and high angle corrugations with large W (and hence large l according to O9) the resulting ratio l/c will fall outside the range. Therefore, the skilled person would not be able to derive the claimed relationships from O9 by using general knowledge alone.

2.4 ii) the prior use OKV-condenser in combination with O11 or general technical knowledge;

2.4.1 The validity of the public prior use of the OKV-condenser is not contested. As decided in the earlier decision T1373/09, the subject-matter of claim 1 only differs from this known heat-exchanger in that it relates to an evaporator instead of a condenser and that, when installed, the flow tubes are substantially vertically oriented. The technical effect of these distinguishing characteristics is that (a) condensate is produced and (b) by arranging the flat tubes to be vertical the condensate drainage is improved.

2.4.2 Normally, a specific embodiment in a single patent document cannot be construed as being general knowledge unless there are specific indications to this effect. Therefore, O11 cited by the opposition division cannot be considered to represent conventional general

knowledge, since it relates to an isolated specific example of a non-conventional heat-pump arrangement using two condensers.

2.4.3 As laid out by the appellant in the comparison table, filed with letter of 11 February 2009, it is generally known that in optimised automobile air-conditioning units there are considerable differences between condensers and evaporators, since the heat transfer conditions (temperature, pressure, phase changes) of each heat-exchanger differ greatly and different designs are required. Consequently, the skilled person would know that it is not possible simply to swap one for the other without compromising the efficiency of the refrigeration cycle.

2.4.4 Further, it is generally known that condensate formation and removal from evaporators in automotive air-conditioning systems is a considerable problem since, due to the motion of the automobile, new, moisture-laden air is always entering the system. Consequently, as explained in the patent itself in the section "Background of the invention" and also O5 (see page 3, final paragraph to page 5, paragraph 4), fin design in the case of an evaporator is a compromise between condensate drainage/removal, heat transfer and manufacturing constraints.

2.4.5 However, for a condenser, condensate drainage is not a factor in the fin design or arrangement of the tubes. Therefore, the board agrees with the appellant that in common automotive air-conditioning systems, the evaporator and the condenser are intended to perform different functions and are constructed differently in order to meet their respective requirements and ensure balanced operation.

2.4.6 Consequently, the skilled person would not simply use the OKV-condenser as an evaporator without the benefit of hindsight since he would be aware that the fin design and tube arrangement of the condenser would not have taken account of condensate drainage and that design changes would be necessary.

2.4.7 Moreover, even if the skilled person were to decide that the OKV-condenser could be used as an evaporator, it would not be an obvious measure to arrange the tubes vertically, since this would lead to a loss of efficiency and therefore go against the skilled person's general knowledge as well as against the specific teaching of O5 (see in particular page 4, paragraph 2, page 5, paragraphs 2 to 4).

2.5 Thus, the subject-matter of claim 1 involves an inventive step and meets the requirements of Article 56 EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the opposition division with the order to maintain the patent in amended form on the basis of:
- the claim of the main request originally filed on 21 July 2009,
- description: pages 2 and 3 as filed in the oral proceedings before the Board and pages 4 to 6 and page 7, lines 1 to 26 of the patent specification; and
- figures of the patent specification.

The Registrar: The Chairman:

K. Götz-Wein G. Ashley

Decision electronically authenticated