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Datasheet for the decision of 2 March 2021

Case Number: T 0917/18 - 3.2.03

Application Number: 08741887.7

Publication Number: 2257757

IPC: F28D9/00, F28F3/02, F28F3/08

Language of the proceedings: EN

Title of invention:
A PLATE HEAT EXCHANGER

Patent Proprietor:
Alfa Laval Corporate AB

Opponent:
MAHLE International GmbH

Headword:

Relevant legal provisions:
EPC Art. 56
RPBA 2020 Art. 13(2)

Keyword:
Inventive step - combination invention (yes)
Late-filed document - justification for late filing (no)
Oral proceedings - postponement (no)

Decisions cited:

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

Boards of Appeal

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Case Number: T 0917/18 - 3.2.03

D E C I S I O N
of Technical Board of Appeal 3.2.03
of 2 March 2021

Appellant: (Opponent)	MAHLE International GmbH Pragstrasse 26-46 70376 Stuttgart (DE)
Representative:	BRP Renaud & Partner mbB Rechtsanwälte Patentanwälte Steuerberater Königstraße 28 70173 Stuttgart (DE)
Respondent: (Patent Proprietor)	Alfa Laval Corporate AB P.B. Box 73 221 00 Lund (SE)
Representative:	Grünecker Patent- und Rechtsanwälte PartG mbB Leopoldstraße 4 80802 München (DE)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 12 February 2018 concerning maintenance of the European Patent No. 2257757 in amended form.**

Composition of the Board:

Chairman	C. Herberhold
Members:	B. Goers
	E. Kossonakou

Summary of Facts and Submissions

I. With the interlocutory decision posted on 12 February 2018 the opposition division decided that European patent No. 2 257 757 in amended form in accordance with the then auxiliary request 1 complied with the requirements of the EPC.

II. This decision was appealed by the opponent (hereafter: appellant).

III. The patent proprietor (respondent) stated by letter dated 8 February 2021 that it did not consent to oral proceedings by videoconference, while the appellant requested by letter dated 19 February 2021 that the oral proceedings be postponed and, in the alternative, that they be held as a videoconference.

IV. The parties were informed by a communication dated 25 February 2021, that the requests for postponement of oral proceedings and the auxiliary request for a videoconference had been refused.

V. Oral proceedings before the Board were held on 2 March 2021 on the premises of the EPO.

At the end of the oral proceedings, the requests were as follows:

The appellant requested that the decision under appeal be set aside and that the patent be revoked in its entirety.

The respondent requested that the appeal be dismissed, or alternatively that the patent be maintained on the

basis of one of the sets of claims filed as auxiliary requests 1 to 5 with the reply to the statement of the grounds of appeal.

VI. Evidence

The following prior art documents submitted with the notice of opposition are relevant to the decision:

- D1: DE 10 2004 003 790 A1
- D2: FR 2 850 740 A1
- D3: DE 10 2004 036 951 A1
- D4: US 2005/178536 A1
- D5: JP 2002 107074 A and PAJ abstract
- D6: US 5,988,269 A1
- D7: DE 10 2005 010478 A1
- D8: GB 2 379 730 A
- D9: DE 11 2004 002 637 T
- D10: WO 2005/012820 A1

The following document was submitted by the appellant for the first time during oral proceedings before the Board:

- D5': English machine translation of D5

VII. Claim 1 in accordance with the main request (corresponding to the set of claims maintained by the interlocutory decision) reads as follows (feature numbering added in "[]"):

"[1.1] *A plate heat exchanger comprising a plurality of heat exchanger plates (1),*
[1.2] *which are made through forming of a metal sheet and are provided beside each other and permanently joined to each other by means of a braze material to*

form a plate package having first plate interspaces (4) for a first medium and second plate interspaces (5) for a second medium,

[1.3] *wherein at least one of the first medium and the second medium is carbon dioxide,*

[1.4] *wherein each heat exchanger plate (1) has a pattern forming a heat transfer area (20), a plurality of porthole areas (21-24), each porthole area (21-24) surrounding a respective porthole defined by a porthole edge (25),*

wherein each heat exchanger plate (1) extends along a

[1.5] *main extension plane (p),*

[1.6] *wherein said areas (20-24), on one side of the heat exchanger plate (1), extend between a primary level (p') at a distance from the main extension plane (p) and a secondary level (p") at a distance from and on an opposite side of the main extension plane (p),*

[1.7] *wherein each heat exchanger plate (1) has a depth (d) defined by the distance between the primary level (p') and the secondary level (p"),*

[1.8] *the depth (d) being equal to or less than 1,0 mm,*

[1.9] *wherein each heat exchanger plate (1) defines a longitudinal centre line (x) and wherein the heat transfer area (20) comprises ridges (27) and valleys (27') arranged in such a manner that the ridges (27) of one of the heat exchanger plates (1) abut the valleys (27') of an adjoining one of the heat exchanger plates (1) to form a plurality of joining areas (28),*

[1.10] *wherein the ridges (27) and valleys (27') extend along at least one extension line (e) forming an angle α of inclination with the centre line,*

characterised in

[1.11] *that each heat exchanger plate (1), before the forming, has a metal sheet thickness t, which lies in the range 0,2 ≤ t ≤ 0,4 mm,*

[1.12] *that the extension line (e) of each ridge (27)*

and valley (27') forms a positive angle α of inclination at one side of the centre line (x) and a corresponding negative angle α of inclination at the other side of the centre line (x),
[1.13] *that the angle α of inclination lies in the range 20° ≤ α ≤ 70°,*
[1.14] *that the ridges (27) and valleys (27') form joining areas (29) at the centre line (x),*
[1.15] *that the ridges (27) are disposed at a distance (r) from and extend in parallel with each other, and*
[1.16] *that the distance (r) between adjacent ridges (27) on the heat transfer area (20) is less than 4 mm,*
[1.17] *that the braze material has a braze volume with respect to the heat transfer area (20) of the plate heat exchanger, and the first interspaces (4) and the second interspaces (5) have an interspace volume with respect to the heat transfer area (20) of the plate heat exchanger, and*
[1.18] *that the proportion of the braze volume to the interspace volume is at least 0,05.*"

VIII. The appellant's arguments relevant to the present decision may be summarised as follows:

(a) Postponement and/or format of oral proceedings

In view of the general Covid-19 pandemic situation, it was not appropriate to hold the oral proceedings in the physical presence of the parties.

(b) Admission of D5'

The translation of D5 was highly relevant to the discussion of inventive step. Its late submission was occasioned by surprising comments in the annex to the summons, specifically point 8.2.6. When filing the

grounds of appeal, there was no reason to assume that a specific focus would be placed on D5, since in the appealed decision the respective feature group 1.12 to 1.14 was found not to contribute to inventive step. Furthermore, the translation of D5 had not been available on the EPO website for long.

(c) Inventive step

The appealed decision was correct in that features 1.11 to 1.14 and 1.16 constituted an aggregation without functional reciprocity. Furthermore, D2 implicitly disclosed a plate thickness in the range of feature 1.11. This was derivable from the disclosed distance between the plates as well as from the drawings. The additional features 1.17/1.18 could not justify inventive step since the skilled person would adjust the amount of braze by balancing the strength requirements with the costs of the brazing material in an obvious manner. Further, when using plates coated with braze material as suggested by the respondent, there was not even the possibility of adjusting that amount. In view of D8, page 5, lines 14 to 16 and D9, paragraph 41 the skilled person would further consider feature 1.11 a usual choice to save costs and to improve heat transfer. Features 1.12/1.13 constituted well-known design options in the art of brazed heat exchangers, as apparent from any of documents D1, D3 to D6 and D10. Feature 1.14 was made obvious by the teaching of D5 and also by D4, since the wording "*at the centre line*" also encompassed braze portions close to the centre line. Even if the claim were interpreted narrowly so as to require braze portions exactly on the centre line, no technical effect would be linked to exactly locating the braze points on the centre line. Lastly, the distance between the ridges according to

feature 1.16 was in the range commonly known in the prior art such as in D7, paragraph [0015] or D9, paragraph [0041].

Consequently, the subject-matter of claim 1 did not involve an inventive step.

IX. The respondent's arguments relevant to the present decision may be summarised as follows:

(a) Postponement and/or format of oral proceedings

Due to its complexity, the case would not be suitable for a videoconference hearing. The proceedings should thus be held in person.

(b) Admission of D5'

There were neither cogent reasons nor exceptional circumstances for not filing the translation of D5 until the oral proceedings. The submission was not occasioned by a new, surprising development. Indeed, it was generally known that the information provided in an abstract might not be sufficient in an inventive step attack. In any event, the translation should have been filed in reaction to the reply to the statement of grounds of appeal or at the latest in response to the Article 15(1) RPBA 2020 communication. The relevance of the document was not a valid criterion according to Article 13(2) RPBA 2020. Consequently, this extremely late-filed document, for which the respondent had not been able to prepare, should not be admitted into the appeal proceedings.

(c) Inventive step

It was true that D2 disclosed features 1.1 to 1.10 and 1.15.

However, feature 1.11 was not disclosed in D2. The metal sheet thickness before the forming was derivable neither from the distance between the plates nor from the schematic drawings. Moreover, it did not contribute to an increase but rather to a decrease in strength of the plate heat exchanger, while reducing material costs and improving heat transfer. The objective technical problem was thus to achieve an improved heat transfer capability while still providing sufficient strength to comply with the high-pressure requirements of carbon dioxide fluid applications. In view of this problem there was indeed functional reciprocity between feature 1.11 on the one hand and features 1.12 to 1.14 and 1.16 to 1.18 on the other hand. Even if all the distinguishing features were mentioned individually in the different documents, the skilled person starting from D2 would not consider them in combination in order to solve the objective technical problem. The abstract of D5 further contained no pointer to discarding the orthogonal arrangement of the ridges in favour of a V-shape arranged along the centre line. Nor did it provide any pointer that V-shaped ridges were beneficial compared with orthogonally-arranged ridges as used in D2. Such a motivation was also not provided by any of documents D1, D3, D6, D7 and D10 either: these documents related to conventional oil heat exchangers which were not suitable for high-pressure applications using CO_2 as the heat transfer medium. Features 1.12 to 1.14 and 1.16 to 1.18 all interacted to provide a high density of equally-distributed and sufficiently solid brazed connection points between the

plates, which was required to provide sufficient strength for the very thin sheet thickness. This sheet thickness was considerably thinner than that disclosed in prior art documents D8 or D9. Although D7 disclosed inter alia feature 1.16, it related to an oil heat exchanger and exhibited a design not in accordance with features 1.12 and 1.13.

Thus the combination of all these features coacting and interacting with each other to solve the problem posed involved an inventive step.

Reasons for the Decision

1. Procedural issues

1.1 Request that oral proceedings be postponed

In support of its request for postponement the appellant did not give any specific reason apart a general reference to the Covid-19 pandemic situation. Since, however, no restrictions regarding legal proceedings and business travel were in place in Germany at the time of the oral proceedings as scheduled, there were no apparent reasons justifying the postponement of oral proceedings under Article 15(2) RPBA 2020. Such reasons were not apparent from the Boards of Appeal communication dated 19 October 2020, to which the appellant made reference, either.

1.2 Auxiliary request that oral proceedings be held as a videoconference

In view of the respondent's explicit disagreement in its letter dated 8 February 2021 with holding the

proceedings as a videoconference, the Board exercised its discretion to conduct the oral proceedings in the physical presence of the parties in accordance with the relevant strict hygiene and social distancing measures in force (see communication from the President of the Boards of Appeal dated 15 December 2020).

2. Non-admission of D5' under Article 13(2) RPBA 2020

According to Article 13(2) RPBA 2020, any amendment to a party's appeal case made after notification of the summons to oral proceedings shall not be taken into account unless there are exceptional circumstances, which have been justified with cogent reasons by the party concerned. However, none of the arguments for the late submission of D5' set out by the appellant during oral proceedings (see point VIII.(b) above) establish such exceptional circumstances nor can they be perceived as cogent reasons.

Firstly, the alleged prima facie relevance of the full (machine) translation of D5 cannot establish exceptional circumstances. Document D5 and its JPO-furnished English abstract had already been considered in the discussion of inventive step concerning the question of obviousness of features 1.12 to 1.14 as reflected in the impugned decision. Although these features were found not to contribute to inventive step, the appellant ought to have been aware that in the course of a reassessment of the ground under Article 56 EPC the Board would consider anew all distinguishing features and the prior art held against them. The potential relevance of the entire content of D5 became apparent at the latest from the respondent's reply to the grounds of appeal (page 7, second paragraph and page 11, third paragraph), in which it

was argued that the abstract of D5 alone did not contain a "*clear statement*" suitable as a pointer. A similar statement had been made by the Board in its communication under Article 15(1) RPBA 2007 (item 8.2.6).

Secondly, the alleged non-availability of the electronic translation on the EPO website is not a valid reason for not providing such a translation earlier in the appeal proceedings. The responsibility for providing a needed translation in time lies with the party which wishes to rely on it. There is no legal or other hindrance in providing a translation from other sources, e.g. from the JPO or from conventional translators.

Thirdly, the appellant's interest in introducing the document into the proceedings must be balanced with the procedural difficulty for the respondent and the Board of reacting to the new information in the document without adequate preparation on the very day of the oral proceedings.

In view of the above considerations the appellant could and should have provided the document earlier.

For these reasons, the Board decided to exercise its discretion under Article 13(2) RPBA not to admit D5' into the appeal proceedings.

3. Inventive step

3.1 Closest prior art and distinguishing features

It is undisputed that D2 is the closest prior art. D2 discloses a plate heat exchanger made of corrugated

aluminium or steel sheets which are connected by brazing to form a stack for high-pressure applications including those in which high-pressure carbon dioxide is used as a fluid. It is further undisputed that D2 discloses all the features 1.1 to 1.10 and 1.15.

Unlike the appellant, the Board regards feature 1.11 as not disclosed in D2. The dimension of 0.3 to 0.9 mm for the distance between the heat exchanger plates (page 3, lines 9/10 and claim 4: "*l'écartement/ l'espacement entre deux plaques*") does not allow any conclusions to be drawn about the thickness of the plates, before or after the forming. Moreover, the figures are only schematic and cannot be used to derive the thickness of the plates therefrom; let alone the thickness before forming.

Therefore the subject-matter of claim 1 differs from the disclosure of D2 in the following distinguishing features:

- feature 1.11 (metal sheet thickness before forming of 0.2 to 0.4 mm);
- feature group 1.12 to 1.13 (ridges and valleys at an angle of 20-70° with respect to the longitudinal centre line);
- feature 1.14 (joining areas at centre line);
- feature 1.16 (distance of ridges less than 4 mm);
- feature group 1.17 and 1.18 (proportion of braze material volume to interspace volume).

3.2 Problem to be solved

According to the appealed decision, the distinguishing features 1.11 to 1.14, 1.16 and 1.17/1.18 all address the problem of improving the strength of the heat

exchanger. However this is not the case for feature 1.11. This is not disputed by any of the parties.

Both parties agreed that decreasing the thickness of the heat exchanger plates (or their respective precursor metal sheet thickness according to feature 1.11) contributed to improved heat transfer properties and reduced material costs while, however, reducing the strength of the heat exchanger.

Accordingly, the objective technical problem with respect to features 1.11 to 1.14 and 1.16 as defined in paragraph [0005] of the patent has to be reformulated and is to provide a heat exchanger with improved heat transfer properties and sufficient strength for high-pressure applications.

3.3 Functional reciprocity of the distinguishing features

The Board sees in the combination of features 1.11 with 1.12 to 1.14 and 1.16 to 1.18 a combinative effect which goes beyond the sum of the individual effects.

The claimed range of the metal sheet thickness of 0.2 to 0.4 mm can be considered a narrow selection at the low end of thicknesses considered in the art. In the prior art, thickness values are only disclosed in D8 and D9 (with respect to their alleged disclosure in D2 see point 2.1 above), both also being directed to high-pressure carbon dioxide applications. D8 discloses solely a generic thickness range of 0.2 to 5 mm in the context of a large number of different embodiments including plates formed by pressing, milling or etching techniques and connected by various methods such as brazing, welding or soldering (page 5, lines 8 to 18). D9 discloses only a specific value of 0.71 mm (0.028

inches) in a specific embodiment of brazed aluminium heat exchanger plates ("*Platten*"), which lies outside the claimed range. It is noted that D8 and D9 disclose the thickness after forming and that the thickness of the respective plates before forming (the parameter claimed) may have been even greater, depending on the forming method. It is further noted that the valleys and ridges in the heat exchangers disclosed in D8 and D9 also show a pattern considerably different from the one claimed.

The respondent's argument that features 1.12 to 1.14 and 1.16, together with the small depth of the plates according to feature 1.9 and the relatively large volume of braze material with respect to the interspace volume, provide for a defined high-density of equally distributed relatively solid brazing points in the heat exchanger is persuasive. These features do indeed result in a particularly rigid structure allowing for heat exchanger plates formed of relatively thin metal sheets in accordance with feature 1.11. In particular features 1.13 and 1.16 further develop the concept of features 1.12 and 1.14 which is disclosed in the abstract of D5 in the context of increasing the rigidity of the plate connection of V-shaped ridges (prevention of "peeling"). By defining a maximum distance of the brazing points according to feature 1.16 in combination with an equal distribution in both the x and the y dimensions of the plates by restricting the angle of inclination according to feature 1.13, the brazing points are numerous and equally distributed, thus further improving the prevention of "peeling".

With respect to features 1.17 and 1.18, it is true that the claim defines an unusual parameter for which none of the prior art documents provides suitable values.

However, at this stage of the proceedings it is the appellant who bears the burden of proof of at least casting doubts that the statement in paragraph [0010] of the patent, according to which the claimed value represents a relatively large volume of braze material, is correct. Without any indication to the contrary, the Board sees no reason to doubt that a relatively high amount of braze material in relation to the interspace volume is required by the parameter range in the claim and that this feature contributes to enhancing the strength of the joint between the plates. A relation in the claimed parameter range is also achievable by decreasing solely the interspace volume, i.e. if the absolute amount of braze material used between two plates is not changed (e.g. by using braze plates or fully braze material-coated plates as suggested by the respondent). Thus the contribution of the feature to the combinative effect in the solution of the technical problem is acknowledged.

3.4 Non-obviousness of the solution

Starting from D2 as closest prior art, the combination of features 1.11 to 1.14 and 1.16 to 1.18 is not made obvious by the prior art.

3.4.1 D2 discloses heat exchanger plates for high-pressure applications including carbon dioxide as a working fluid, each with ridges and valleys ("*ondulations*") extending in parallel. The plates are superposed in an alternating manner such that the ridges extend at an angle of 90° ("*sensiblement perpendiculaire*"), thereby creating a number of contact points for brazing (page 4, lines 10 to 26). According to the figures, the ridges and valleys seem to extend in parallel or perpendicular to the longitudinal center line. D2 is

already suitable for withstanding pressures above 100 bar (page 1, last paragraph).

In the further documents, no pointer can be found which might motivate the skilled person to change the design according to D2 to a pattern of ridges and valleys with angles towards the centre line in accordance with features 1.12 and 1.13 in order to solve the technical problem.

3.4.2 Among the cited documents, D5 is the most relevant. While D5 does indeed also disclose a heat exchanger having sufficient strength to prevent "*peeling*", i.e. to withstand the pressure used in the application of carbon dioxide, and further encompasses at least features 1.12 and 1.14, the abstract is silent about the thickness of the plates and the distance between the ridges. It is not discussed that the density and arrangement of brazing points is decisive for improving the heat transfer properties of the heat exchanger.

It is therefore not apparent from the abstract that the design according to D5 provides any improvement over the design of D2. D5 discloses an alternative design but does not provide any pointer towards the further distinguishing features 1.11 or 1.16 to 1.18.

3.4.3 D4 does not disclose feature 1.14, and in paragraph [0002] teaches increasing the thickness of the plates in order to increase the strength. In this respect the appellant's argument, that the provision of braze points "*close to the centre line*" in D4 has the same effect as providing them directly on the centre line, is not relevant.

3.4.4 D6 does not provide any details about dimensions (features 1.11 and 1.16) or applicable pressure ranges.

3.4.5 While D8 and D9 are also directed to high-pressure heat exchangers, they disclose heat exchanger plates with a completely different design concept. Further, even though D9 in paragraph [0041] suggests a distance between the ridges in line with feature 1.16, this is only in connection with a plate thickness considerably larger than that required by feature 1.11.

3.4.6 Finally, none of the documents discloses the proportion of the braze volume to the interspace volume as being at least 0.05.

3.4.7 The respondent is correct that a skilled person starting from the high-pressure heat exchanger in D2 would not consider the teaching of documents D1, D3, D7 and D10 to improve the design of a heat exchanger according to D2 since these documents deal with conventional oil coolers designed for considerably lower pressures (see also the related statement in D9, paragraph [0002]).

3.4.8 The person skilled in the art thus had no reason to combine the isolated pieces of information from a multitude of individual documents into a single embodiment in order to solve the objective problem posed. The appellant's allegations to the contrary are based on hindsight.

3.5 To conclude, the subject-matter of claim 1 of the main request involves an inventive step.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

C. Spira C. Herberhold

Decision electronically authenticated