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D E C I S I O N
of 21 June 2000

Case Number: T 0842/96 - 3.2.6

Application Number: 87300767.8

Publication Number: 0237164

IPC: B23P 15/26

Language of the proceedings: EN

Title of invention:
Method of making a heat exchanger

Patentee:
Modine Manufacturing Company

Opponent:
Behr GmbH & Co.

Headword:
-

Relevant legal provisions:
EPC Art. 84

Keyword:
"Clarity and incorporation of all essential features of the invention (no)"

Decisions cited:
T 0409/91

Catchword:
-



Case Number: T 0842/96 - 3.2.6

D E C I S I O N
of the Technical Board of Appeal 3.2.6
of 21 June 2000

Appellant: Modine Manufacturing Company
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 16 July 1996
maintaining European patent No. 0 237 164 in
amended form.

Composition of the Board:

Chairman: P. Alting van Geusau
Members: M. Bidet
J. C. De Preter

Summary of Facts and Submissions

- I. The appellants are proprietor of European patent No. 0 237 164.
- II. Claims 1, 2 and 5 of the patent were opposed on the grounds that their subject-matter was not novel and lacked an inventive step (Article 100(a) EPC), essentially in view of the prior art disclosed in the documents:

D1: JP-A-59-52 196

D2: US-A-3 951 328

D3: GB-A-2 133 525

D4: Article published in the "Keikinzoku Digest",
17 April 1989

D5: Article "Process control criteria for brazing
aluminum under vacuum" in Welding Journal, October
1984, pages 33-39, by W.L. Winterbottom

D6: Article "Fluxless brazing of aluminum" in Welding
journal, October 1973, by W. Schultze and H.
Schoer, pages 644-651.

During the opposition proceedings the appellants relied on the affidavits A1 to A5.

- III. In the decision under appeal issued on 16 July 1996 the Opposition Division took the view that the subject-matter of amended claim 1 (main request) directed to the combination of the subject-matter of claims 1 and 5

of the patent as granted, did not define a specific flux loading level considered to be an essential feature for performance of the invention. Therefore, this claim did not meet the requirements of Article 84 in combination with Rules 29(1) and (3) EPC.

Also claim 1 of the first auxiliary request was not found acceptable since there was no disclosure of the feature concerning a flux loading of substantially less than 175 g/m² in the originally filed application. Therefore, the subject-matter of this claim 1 extended beyond the content of the application as filed and consequently did not meet the requirements of Article 123(2) EPC.

Claim 1 of a second auxiliary request was directed to the combination of the subject-matter of granted claims 1 and 3 and since the opposition had not been directed against claim 3 and the opponent expressly stated that he had no objection against maintenance of the patent on the basis of claim 1 of the second auxiliary request, the Opposition division decided to maintain the patent in this amended form.

- IV. Against this decision, the appellants lodged an appeal on 16 September 1996. The appeal fee was paid on 17 September 1996. Together with the statement of grounds which was received on 26 November 1996, the appellants filed new claims 1 in accordance with a main and a first auxiliary request, respectively.
- V. In a communication issued with the summons to attend oral proceedings, the Board, in its provisional opinion, considered, inter alia, that the additional feature of the flux loading in claim 1 of the first

auxiliary request was disclosed solely in relation to the preferred embodiment of the method of making a heat exchanger disclosed in the patent which was brazed in accordance with the so-called "Nocolok" brazing process. Since the latter process appeared to imply a specific aluminium brazing process, claim 1 of the auxiliary request, which did not include the resulting limitations, appeared to infringe the requirements of Article 123(2) EPC.

Moreover, as was already pointed out by the Opposition division in the decision under appeal, in accordance with the case law of the Boards of appeal all features which were necessary for solving the technical problem underlying the patent were to be regarded as essential features. Consequently, it was proposed to discuss during the oral proceedings whether these requirements were met by the independent claims 1 in accordance with the main and auxiliary requests filed with the grounds of appeal.

VI. On 9 May 2000 a third party filed observations under Article 115 EPC, citing

D13: "On the Nocolok brazing process", described in the technical journal "Light Metal Welding", Vol. 23, No. 11, 16 November 1985 (with English translation thereof) and

D14: JP-A-49-114 145.

It was submitted that practically all the features of claim 1, except for the descriptions about the use of the brazing flux and the hydraulic diameter, were known from D1. Since these additional features were known

from D13 and D14 in relation to the purpose of the claimed method, this method lacked an inventive step.

VII. Oral proceedings took place on 21 June 2000 during which the appellants filed a new main request and three auxiliary requests.

Claim 1 of main request reads as follows:

" A method of making a heat exchanger for an air-conditioner or a refrigeration system having a plurality of hydraulically parallel tubes each of which has a plurality of side-by-side fluid passages (48-58), the passages having a hydraulic diameter of about 1.778mm (0.07 inches) or less, the method comprising the steps of:

- (a) providing a flattened tube (20) having an interior defined by a wall (42);
- (b) forming an elongate insert (40) of slightly lesser size than the interior of said tube, said insert having a plurality of oppositely directed crests (41) separated by oppositely opening valleys (43) sufficiently proximate to each other that, when the insert is placed in the tube, each valley (43) and the adjacent interior wall (42) of the tube will define an elongate passage (48-58) in the tube;
- (c) adhering a non-corrosive brazing flux and a brazing alloy to at least one of the interior of said tube (20) and said crests (41);
- (d) inserting said insert (40) into said tube (20)

without disturbing said flux;

- (e) bringing said interior wall (42) into contact with said crests (41);
- (f) heating the assembled tube (20) and insert (40) to a temperature above the melting point of the brazing alloy to braze the crests to said interior wall; and
- (g) thereafter cooling the assembled tube and insert."

Claim 1 according to first auxiliary request comprises all features of claim 1 of main request with the additional features that the flattened tube (20) in feature (a), the elongate insert (40) in feature (b), the non-corrosive brazing flux and the brazing alloy (c), all relate to **aluminium**.

Claim 1 of the second auxiliary request contains all features of claim 1 of the main request with the additional feature in feature (c) that the **flux loading is in an amount of the order of 5 g/m²**.

According to the third auxiliary request, claim 1 is based on claim 1 of the first auxiliary request in which the amount to the flux loading is in the order of 5 g/m².

VIII. The appellants requested that the decision under appeal be set aside and that the patent be maintained on the basis of the main request as submitted at the oral proceedings or on the basis of one of the three auxiliary requests as submitted at the oral proceedings or on the basis of the patent as maintained by the

Opposition Division (fourth auxiliary request).

The appellants requested also an adjournment to consider filing a further auxiliary request in the form of the third auxiliary request but limited to a flux range of 2 to 5 g/m².

IX. The arguments developed in support of these requests can be summarised as follows:

The Opposition Division could be followed in that there was a prejudice against the use of flux brazing techniques in relation to the manufacture of heat exchanger tubes having a hydraulic diameter of 1.778 mm or less. In view of the prejudice, as further substantiated by the Affidavits A1 to A4 filed by the appellants, it would not be obvious in the light of the disclosure of D2 to use a flux brazing process to produce a heat exchange tube to a small hydraulic diameter using the method of D1. Once this conclusion had been reached, D2 was of no further relevance to the proceedings and it was certainly not proper to conclude that D2 necessitated a numerical restriction to be placed on the flux loading of the method of claim 1. The new document D13, cited by the third party, related to exterior brazing and in view of the prejudice not to apply flux for brazing small hydraulic diameter tubes and the readily available alternative of fluxless brazing it would not be considered by the skilled person for solving the underlying problem of the patent in suit.

Considering the requirements of Article 84 EPC, the competent addressee of the specification would immediately recognise that the flux loading should be

significantly less than the minimum flux loading of 175 g/m² disclosed in D2 and therefore the Opposition Division incorrectly applied Article 84 EPC to require a specific flux loading to be specified in the claim.

- X. The respondents (opponents) requested that the appeal be dismissed and essentially relied on the following submissions:

The method disclosed in the patent in suit lacked an inventive step when taking account of the teachings of D1, to be taken as the closest prior art, when combined with the disclosures of the Nocolok brazing method disclosed in D13. Furthermore it was apparent to the skilled person and specifically described in D3 and D14, that small hydraulic diameters were advantageous when used in heat exchangers of the claimed type.

Furthermore the amended claims did not comply with Article 84 EPC because essential features for performing the invention were missing in the claims and the use of ranges of parameter by undefined terms such as "about" or "in the order of " introduced ambiguity as to the exact technical content of the claims.

Reasons for the Decision

1. The appeal is admissible
2. *Amendments*
 - 2.1 Claim 1 of the main request results from the combination of all features of claims 1 and 5 of the patent as granted and the additional features according

to which the heat exchanger obtained by the method of claim 1 is for an **air-conditioner or a refrigeration system** having a plurality of hydraulically parallel tubes.

In the description, column 1, lines 8 to 10 of the patent in suit, as well as in the application as filed page 1 lines 7 to 9, it is described that many heat exchangers in the state of the art were employed in air conditioning or refrigeration systems. The drawbacks and resulting problems of these known heat exchangers were set out in the introductory part of the patent in suit. It is therefore implicit to the skilled person, seeking to improve the method of making heat exchangers, that any improvement in heat exchangers, such as in claim 1, would also be employed in air-conditioning or refrigeration systems. In so far no objections under Article 123(2) EPC arise against the introduction in claim 1 of the feature relating to making a heat exchanger for an air-conditioner or a refrigerating system.

The fluid passages having a hydraulic diameter of **about** 1.778 mm (0.07 inches) or less is a feature of claims 1, 2, 4 of the application as originally filed and therefore also this feature is supported by the originally filed application documents.

According to feature (c) the brazing flux is non-corrosive. This feature is disclosed in the application as filed, page 10, lines 17 to 19, as well as in the patent in suit, column 6, lines 45 to 50.

- 2.2 In view of these assessments no objection arises from the amendments made to claim 1 of main request with

respect to the requirements according to Article 123(2) EPC and since the subject-matter claimed is further limited by the introduction of additional features, the requirements of Article 123(3) EPC is also fulfilled.

3. *Sufficiency in respect of the requirements of Article 84 EPC*

3.1 According to the established case law of the Boards of appeal, Article 84 has to be interpreted as meaning not only that a claim has to be comprehensible from a technical point of view, but also that it has to define clearly the object of the invention, which means that it should comprise all the essential features thereof. All features which are necessary for solving the technical problem underlying the patent are to be regarded as essential features (see for example T 409/91, OJ 1994, 653, reasons 3.3). When amended claims are filed during the opposition proceedings such claims should meet the requirements of the EPC also with respect to Article 84 EPC.

3.2 Considering this condition following from the interpretation of Article 84 EPC, the Board supports the view expressed by the opposition division that the features defined in the claim are not complete for solving the problem underlying its subject-matter. In particular when flow passages having a very small hydraulic diameter of about 1.778 mm or less are concerned, as is now specified in the claims, it is clear for the skilled person that in addition to the use of a non-corrosive brazing flux (see page 10, lines 16 to 25 of the originally filed application documents and column 6, lines 51 to 58 of the patent) also the brazing flux loading is of essential

importance.

In particular when having recourse to the affidavit A5 filed by the appellants (discussed on page 9 of the decision under appeal) it is immediately apparent that the flux loading should be very low, well below the known range of 175 g/m² to 350 g/m² (see D2, column 11, lines 1 to 3), otherwise no satisfactory functioning heat exchangers are obtained.

- 3.3 Having now regard to the original disclosure, it is to be noted that in the single complete embodiment of the invention disclosed in the originally filed application documents (the embodiment disclosed in relation to Figures 3A and 3B) this embodiment is related to the so-called Nocolok (Registered Trade Mark) brazing process being used for brazing an aluminium heat exchanger with a specific flux loading "in an amount equal to 5 g/m²" (steps 94,96 in Figure 3A or step 110 in Figure 3B, see page 11, lines 13 to 16 and page 12, lines 17 to 20 of the originally filed application).
- 3.4 Although this embodiment is indicated as the "preferred embodiment" no additional information is derivable from the application as originally filed that when brazing materials other than aluminium or other flux compositions or loadings than those disclosed in the originally filed application documents, a heat exchanger having passages with a very small hydraulic diameter of about 1.778 mm or less can be manufactured avoiding the difficulties explained in the affidavits A1 to A5 submitted by the appellants.
- 3.5 The appellants argued that it was immediately apparent that the disclosed flux loading in an amount equal to

5 g/m² of insert surface was not an absolute value and could be varied within certain limits with no perceivable effect on the brazing results.

However, the Board considers that broadening of a specific teaching is possible only if it is immediately apparent to the skilled person that a broader range was envisaged and how far such new range extended. In so far the Board does not see a basis in the original application documents concerning the method of manufacturing heat exchangers having a hydraulic diameter of each fluid passage less than 1.778 mm which allows broadening in the manner as claimed in the main request - and also as claimed in the auxiliary requests 1 to 3 - even when taking account of the common knowledge of the skilled person.

In this respect it is be noted that the originally filed application documents lack any information about a flux loading value to be applied when materials other than aluminium are used for manufacturing the small hydraulic diameter heat exchangers of claim 1. Furthermore because only one single fixed flux loading value of 5 g/m² is mentioned in relation to a preferred embodiment, the application documents also lack any disclosure or suggestion of a possible range of deviation from this specifically disclosed flux loading value.

Moreover, in view of the fact that the flux loading value of 5 g/m² is considerably less than the conventional values of 175 to 350 g/m² as mentioned in D2 (see also the Affidavit 5), the Board is of the opinion that the determination of such low flux loading is at odds with the teachings of the relevant prior art

and therefore the skilled person needs more information than that provided by claim 1 of the main request, which in fact neither specifies aluminium nor flux loading, for manufacturing satisfactorily functioning heat exchangers.

Therefore, since the disclosure of the specific low flux loading is directly related to the Nocolok brazing process, which concerns a very specific known aluminium brazing process, it is not considered acceptable to extend such specific disclosure of the flux loading mentioned in the originally filed application documents related to such known process in a direction not clearly suggested in these documents and thus also not immediately apparent to the skilled person when reading the application documents.

- 3.6 Therefore, the Board is of the opinion that a sufficiently complete disclosure of a method of making a heat exchanger having passages with a hydraulic diameter of about 1.778 mm or less is limited to the combination of method steps in accordance with the single detailed disclosure of making a heat exchanger involving the Nocolok process and the specific flux loading disclosed in relation thereto.

Consequently, any claim lacking the essential features of the embodiment described in relation to the Nocolok process cannot be considered complete within the meaning of Article 84 EPC as explained above.

- 3.7 When considering the method claim 1 in accordance with the main request it is to be noted that this claim does not specify the use of aluminium and the specific amount of flux loading.

Furthermore, also considering the respective claims 1 of the auxiliary requests, claims 1 of the first and third auxiliary request do not specify the flux loading and claim 1 of the second auxiliary request does not specify the use of aluminium.

4. Therefore, none of these claims comprises all the necessary features for the definition of the invention and consequently none of these claims is acceptable as regards Article 84 EPC.

5. Following arguments submitted by the appellants relating to an envisaged further specification of the unsupported and vague amount of flux in "the order of 5g/m²" to a specific amount of flux of 2 to 5 g/m², the appellants requested at the end of the oral proceedings an adjournment to consider filing a further auxiliary request in the form of the third auxiliary request, but limited to a flux range of 2 to 5 g/m².

It is to be noted that not only can the Board not find a basis in the originally filed application documents for the range now claimed but also that the reason for the request for an adjournment of the proceedings to provide an opportunity to file a further auxiliary request in fact concerns the issue of flux loading already raised in the Board's communication. The Board therefore considers that the appellants have had sufficient opportunity to decide before and during the oral proceedings what should be included in the requests and that there is no reason to allow a further delay, in particular since the suggested claim 1 also raises doubt as to its acceptability (see Case Law of the Boards of appeal, 3rd edition 1998, VII-D, point 14).

6. Since the fourth auxiliary request of the appellants was to maintain the patent with the documents on which the decision under appeal was based, which was not appealed by the respondents, the Opposition Division's decision remains as it stands.

Order

For these reasons it is decided that:

The appeal is dismissed

The Registrar:

The Chairman:

M. Patin

P. Alting van Geusau