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**Datasheet for the decision
of 8 May 2018**

Case Number: T 2149/14 - 3.2.03

Application Number: 09741040.1

Publication Number: 2342521

IPC: F28D9/00, B23K1/00

Language of the proceedings: EN

Title of invention:

HEAT EXCHANGER

Applicant:

Alfa Laval Corporate AB

Headword:

Relevant legal provisions:

EPC Art. 56

Keyword:

Inventive step - (yes)

Decisions cited:

Catchword:



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Case Number: T 2149/14 - 3.2.03

D E C I S I O N
of Technical Board of Appeal 3.2.03
of 8 May 2018

Appellant: Alfa Laval Corporate AB
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Representative: Alfa Laval Attorneys
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Decision under appeal: **Decision of the Examining Division of the
European Patent Office posted on 4 March 2014
refusing European patent application No.
09741040.1 pursuant to Article 97(2) 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 examining division to refuse European application no. 09741040.1

In its decision the examining division held that the subject-matter of claim 1 according to the main request then on file lacked an inventive step taking WO 01/87529 (D1) as the nearest prior art in combination with WO 2005/071342 (D2).

The applicant (hereinafter: the "appellant") lodged an appeal against this decision.

- II. 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.

- III. Oral proceedings were held on 8 May 2018 as requested by the appellant. At the end of the debate the appellant confirmed its request
- that the decision under appeal be set aside and
 - that a patent be granted on the basis of either the main request filed during the oral proceedings, or the first auxiliary request filed with the grounds of appeal.

- IV. Independent apparatus claim 1 according to the main request reads:

"Heat exchanger, comprising a plurality of heat exchanger plates (2) having a corrugated pattern, a front cover plate (3) and a rear cover plate (4), where the heat exchanger plates are fixedly attached by brazing to each other and to the front cover plate and the rear cover plate, and where the front and/or rear

cover plate comprises a plurality of connection ports (5,6,7,8), which comprise an outwardly extending collar (9,10) shaped from the same material as the cover plate, wherein the heat exchanger further comprises a connection tubing (11) fixedly attached to one of the collars (9,10), characterized in that the connection tubing is brazed to the collar using a brazing material having a lower melting point than the brazing material for the heat exchanger plates."

Independent method claim 4 according to the main request reads:

"Method for the assembly of a brazed heat exchanger having tubular connections, wherein at least one of the heat exchanger's cover plates (3,4) comprises a plurality of connection ports (5,6,7,8) which comprise an outwardly extending collar (9,10) shaped from the same material as the cover plate, comprising the steps of:

- heating the heat exchanger in an oven so that the brazing material applied to the heat exchanger plates and the cover plates brazes the heat exchanger together,
- cooling the heat exchanger,

characterised in the step of:

brazing a tubular connection to one of the collars on the cover plate using an induction brazing method with a brazing material having a lower melting point than the melting point of the brazing material for the heat exchanger plates."

Reasons for the Decision

1. Amendments, Articles 84 and 123(2) EPC

Amended claim 1 is based on claim 1 as originally filed with a minor amendment to specify in the preamble that the heat exchanger plates are brazed to each other, this being a fundamental feature of the invention. Thus, the requirements of Articles 123(2) and 84 EPC are met.

2. Inventive step, Article 56 EPC

2.1 D1 relates to a micro heat-exchanger of the cross-flow type suitable for use in cooling electronic equipment (see page 1, paragraph 3). The flow channels are etched in the plates in a groove-like manner as opposed to being formed between the corrugated pattern of the plates as specified in claim 1. The plates in D1 are stacked such that the channels run perpendicular to each other (see figure 4b) and are joined to each other by diffusion brazing in an oven. Further, the device does not comprise front and rear cover plates having connection ports; indeed, from figure 4a it can be deduced that the cooling fluid and the fluid to be cooled must be fed into the channels through some kind of manifold which is not described in any detail.

2.2 In conclusion, D1 relates to a completely different type of heat exchanger to that of the application. Therefore, the board agrees with the appellant that the skilled person would consider that D2 is the more realistic starting point for the invention.

2.3 D2 can be seen to disclose a:

heat exchanger, comprising a plurality of heat exchanger plates (2) having a corrugated pattern, a front cover plate (see figure 1a) and a rear cover plate (3), where the heat exchanger plates are brazed to each other and to the front cover plate and the rear cover plate, and where the front cover plate comprises a plurality of connection ports (see figure 2), which comprise an outwardly extending collar (see figure 1a) shaped from the same material as the cover plate, wherein the heat exchanger further comprises a connection tubing (see figure 1a) fixedly attached to one of the collars.

2.4 The board accepts the appellant's argument that D2 does not detail how the connection tubing is fixedly attached to the cover plate, but that the connection geometry depicted in figures 1a, 1b, 4a and 4b indicates that the joint is formed by clamping.

2.5 The subject-matter of claim 1 differs therefrom in that the connection tubing is brazed to the collar using a brazing material having a lower melting point than the brazing material for the heat exchanger plates.

2.6 The technical effect of this feature is to reduce the risk that the brazing contact points of the heat-exchanger plates (see the application, page 3, lines 22 to 24) re-melt during a second brazing operation to fit the connection tubing. By carrying out the brazing operation in two stages it is moreover possible to reduce the size of the oven necessary for brazing the plate stacks.

2.7 Therefore, the objective technical problem to be solved can be seen as one of providing a heat-exchanger which can be more economically produced.

2.8 The skilled person seeking a solution to this problem would not have taken D1 into consideration without the benefit of hindsight since, as detailed above, it relates to a completely different type of heat exchanger to that disclosed in D2 and the application. In particular, D1 relies on a diffusion brazing process which differs in several important aspects to the classic brazing process which would have been used to manufacture the heat exchanger of D2. In a diffusion brazing process only a microscopic film of brazing material is applied to the surfaces to be joined by electrolysis (see page 4, paragraph 4) and the process is carried out in a vacuum or under inert gas (see page 3, line 6). During the brazing process the brazing material completely diffuses into the parts to be joined as opposed to remaining visible in the joint area. Thus, the skilled person would recognise that the teachings of D1 cannot be directly applied to the heat exchanger of D2 and cannot provide a solution to the problem.

2.9 The examining division referred in its decision to the following passage in D1 at page 4, lines 12 to 17:

"In order to avoid that a previously brazed/soldered stack of plates is negatively affected by a following brazing/soldering operation to directly fit connectors, for example, it is suggested that the subsequent brazing/soldering operation is carried out at a lower temperature than the first brazing/soldering process."

However, as the appellant explained during the oral proceedings, brazing materials are intended to be used over a range of temperatures and not just at exactly their melting point. When brazing the plate stacks in large ovens it is essential to ensure that all of the plates are correctly brazed, wherever they are placed in the oven which may exhibit an uneven temperature distribution. Hence, the operation is generally carried out at the top end of the recommended temperature range. However, when brazing the connectors, the lower end of the temperature range can be used since only a localised area is under consideration and the process temperature is easier to control. Thus, even if the skilled person did consider D1, this passage would not provide a direct and unambiguous instruction to use a brazing material of a lower melting point.

- 2.10 None of the other available prior art documents disclose or suggest such a feature.
- 2.11 Therefore, starting out from the heat-exchanger known from D2, the skilled person would have to first decide that the connection tubing should be joined to the cover plate by brazing, instead of clamping, and then decide that this joint should not be made using the same brazing material as that for the corrugated plates, but rather that the joint should be made using a brazing material with a lower melting point.
- 2.12 Similar considerations apply to the independent method claim 4, which additionally specifies that the tubular connection to one of the collars on the cover plate is made by induction brazing.
- 2.13 The board considers that the execution of these steps would require the skilled person to exercise an

inventive activity. Therefore, the subject-matter of claims 1 and 4 according to the main request meets the requirements of Article 56 EPC.

2.14 Dependent claims 2, 3 and 5 specify further variants of the heat exchanger and method specified in claims 1 and 4 respectively and therefore also meet the requirements of Article 56 EPC.

2.15 Since the appellant's main request meets the requirements of the EPC, there is no need to discuss the auxiliary request.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the examining division with the order to grant a patent on the basis of the following documents:
 - claims 1 to 5 of the main request filed during the oral proceedings before the Board,
 - description pages 1 and 3 to 11 of the published application and page 2 filed during the oral proceedings before the Board and
 - figures 1 to 4 and 5a to 5c of the published application.

The Registrar:

The Chairman:



C. Spira

G. Ashley

Decision electronically authenticated