BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

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

D E C I S I O N
of 19 January 2006

Case Number: T 0828/04 - 3.2.03

Application Number: 97945878.3

Publication Number: 0981715

IPC: F28F 9/02

Language of the proceedings: EN

Title of invention:
Heat exchanger

Patentee:
NORSK HYDRO ASA

Opponent:
Behr GmbH & Co.

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
-

Decisions cited:
-

Catchword:
-

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0828/04 - 3.2.03

D E C I S I O N
of the Technical Board of Appeal 3.2.03
of 19 January 2006

Appellant: (Opponent)	Behr GmbH & Co. Mauserstrasse 3 D-70469 Stuttgart (DE)
Representative:	-
Respondent: (Proprietor of the patent)	NORSK HYDRO ASA Bygdoy Alle 2 NO-0240 Oslo (NO)
Representative:	Bleukx, Lucas Lodewijk M. Bleukx Consultancy BVBA Rijksweg 237 BE-3650 Dilsen-Stokkem (BE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted 24 May 2004 rejecting the opposition filed against European patent No. 0981715 pursuant to Article 102(2) EPC.**

Composition of the Board:

Chairman: U. Krause
Members: G. Ashley
K. Garnett

Summary of Facts and Submissions

I. European patent No. 0 981 715 concerns heat exchangers of the type in which a pair of headers is connected to the ends of flat tubes through which a fluid flows. This appeal lies from the decision of the opposition division, posted on 24 May 2004, to reject an opposition to the grant of the patent. The appeal was filed by the appellant (opponent) on 5 July 2004 and the appeal fee was paid at the same time; the grounds of appeal were filed with a letter dated 14 August 2004.

II. The appellant had opposed the patent in its entirety on the grounds that the invention is not disclosed in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art (Article 100(b) EPC), and that the patent lacks an inventive step (Article 100(a) together with Articles 52(1) and 56 EPC). The opposition was based *inter alia* on the following documents:

D1: EP-A-0 608 439

D2: US-A-5 172 761

III. Claim 1 of the granted patent reads as follows:

"1. A heat exchanger comprising a plurality of flat tubes for heat exchange between a first fluid inside said tubes and a second fluid flowing outside of said tubes, a pair of hollow headers connected to the ends of the flat tubes, an inlet and an outlet being provided in the headers for introducing the first fluid into the tubes and discharging it therefrom, each

header being composed of at least two parallel tubes with circular cross sections two adjacent tubes having common wall portions and all tubes at each header constituting a substantially flat array of tubes, characterised in that, a number of holes each with a dimension corresponding to the cross-section of the flat tube is made in the flat surface of each header, and in that the ends of the flat tubes are only inserted in so far into the circular tubes, that a communication passages (*sic*) is left between the parallel tubes constituting the header."

Dependent claims 2 and 3 defined preferred embodiments of the heat exchanger of claim 1.

IV. Submissions of the Parties

During the appeal procedure, the appellant did not develop the objection under Article 100(b) EPC, but submitted that the heat exchanger of claim 1 lacks an inventive step in light of D1 and D2.

In summary, he argued that D1 discloses all the features of the preamble of claim 1. D1 also shows flattened tubes 40 connected to the header tubes 30. The conventional way of obtaining sound joints between such tubes is to make holes in the header into which the flat tubes are inserted and then brazed. Thus, D1 implicitly discloses that a number of holes each with a dimension corresponding to the cross-section of the flat tube are made in the flat surface of the header. However, D1 does not disclose the feature that the ends of the flat tubes are only inserted in so far into the

circular tubes, that a communication passage is left between the parallel tubes constituting the header.

D1 is mentioned in the introduction to the disputed patent (see paragraph [0005]), where it is said that the pressure drops and flow patterns in the flow paths in the header tubes of D1 are different, and that this has an adverse effect on the heat exchange properties; the presence of a communication channel, as defined in claim 1 of the disputed patent solves this problem. However, D1 describes an embodiment (see Figures 9 and 10) in which a tube 80 having holes 82 is inserted across the header tubes 30. Fluid can flow between the various header tubes 30 via tube 80 and holes 82, with the inevitable effect that pressure differences within the header tubes are equalised. Hence the problem set out in the introduction to the disputed patent is solved by the heat exchanger shown in the embodiment of Figures 9 and 10 of D1. The appellant redefines the objective problem starting from D1 as being how to equalise pressure differences in a simpler way, without using tube 80.

Like the disputed patent, document D2 also concerns heat exchangers, and in particular condensers. D2 discloses a channel, indicated 42 in Figures 2 and 4, which connects two chambers in the header. Any differences in pressure in the chambers would be equalised by fluid flowing through the channel. This effect would be immediately recognised by the skilled person, who, wishing to solve the problem of pressure equalization in the header tubes of D1, would realise that the simplest solution would be to provide channels

between the tubes, as in D2, thereby deriving the subject-matter of claim 1.

The appellant also argued that it is possible to argue lack of inventive step, starting from the heat exchanger of D2 as the closest prior art. In this case, the heat exchanger defined in claim 1 differs from D2 in that each header is composed of at least two parallel tubes with circular cross-sections, two adjacent tubes having common wall portions and all tubes in each header constituting a substantially flat array of tubes.

Starting from D2, the problem to be solved is how to strengthen the heat exchanger, in order that higher pressures can be used, as set out in paragraph [0003] of the introduction to the disputed patent. The solution is provided at column 3, lines 16 to 20 of D1, where it is said that tubes of circular cross-section are used in the headers because of their greater resistance to higher pressures. Thus, for the skilled person, it would be obvious that the problem is solved by replacing the chambers shown in the headers of D2 by tubes, whilst maintaining the channels 42 between the chambers or tubes.

The respondent argued that, when compared with the invention, tube 80 in D1 provides a completely different solution to the problem of how to equalise the pressure in the header tubes. According to the invention, tube 80 can be avoided by adjusting the position of the ends of the flat tubes in the holes in the header, and there is no suggestion of this solution in the prior art.

In particular, the solution is not rendered obvious by D2 because firstly, D2 concerns a different type of heat exchanger, in which the header is formed not from tubes, but from two profiled plates joined together, and secondly, the problem of pressure equalisation is not addressed in D2. The function of channel 42 is not to equalise pressure, but simply to allow fluid flow to flat tube 11. The skilled person would therefore not be motivated to consult D2, and even on reading D2, there is no indication of the solution to the problem.

Since D2 concerns a completely different type of heat exchanger, it cannot be considered as the closest prior art and the respondent disagreed that inventive step could be challenged by starting from the disclosure of D2.

V. Requests

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

The respondent requested that the appeal be dismissed and the patent be maintained as granted.

Reasons for the Decision

1. The appeal is admissible.

Article 100(b) EPC

2. The appellant made no further reference in his appeal to this ground, and the Board agrees with the finding of the opposition division that an objection under Article 100(b) is not justified (see page 2, paragraph 1 of the disputed decision).

Inventive Step

3. It is apparent that none of the documents cited in the procedure discloses the combination of features defined in claim 1. The claimed subject-matter is novel and main issue to be addressed is that of inventive step.

The disputed patent relates to heat exchangers, and in particular heat exchangers operating at relatively high pressures, for example using CO_2 at 80 to 170 bar (see paragraph [0003] of the description). In order to withstand these pressures, either the wall thickness of the header has to be increased or the header is made of a series of parallel tubes, as in D1. The patent is concerned with the latter type of header, and has identified a problem in that when a header is constructed of multiple tubes, pressure differences can exist in the different flow paths, which reduce the effectiveness of the heat exchange process. The patent itself thus starts from the heat exchanger disclosed in D1, and sets out to solve the above mentioned problem (see paragraphs [0004] to [0006]). D1 must therefore be considered as the most relevant disclosure from which inventive step is to be assessed. Consequently, the Board does not concur with the arguments of the

appellant concerning inventive step starting from D2 as the closest prior art.

The heat exchanger of claim 1 differs from that of D1 principally in that the ends of the flat tubes are only inserted in so far into the parallel tubes of the header, that a communication passage is left between these header tubes. The appellant drew attention to an apparent discrepancy between claim 1 and paragraph [0019] of the description of the disputed patent, where it is said that only one of the headers need have tubes partially inserted in order to produce communication passages, whilst the other can have the tubes fully inserted. However, the discrepancy has little bearing on the following appraisal of inventive step, since it applies to either header.

The effect of the communication passage is that fluid can flow between the various header tubes and equalise any pressure differences therein.

According to the embodiment shown in Figures 9 and 10 of D1, a tube 80 is inserted through header tubes 30. Tube 80 is provided with holes 82, with the result that fluid can flow between the header tubes 30 via tube 80. D1 states (see column 8, lines 23 to 26) that tube 80 can be used as an inlet or outlet, or with appropriate plugging can be used to provide multiple passes for the fluid. The use of tube 80 to remove pressure differences between the header tubes is not explicitly mentioned in D1, but it is apparent that this effect would nevertheless be immediately recognised by the skilled person.

Starting from D1 the objective problem can be seen as how to provide a simpler means for equalising the pressure. The appellant formulates the problem as how to equalise pressure differences in a simpler way, without using tube 80. However, this formulation seems to hint at the solution, being tantamount to saying, remove tube 80 and find a feature having the equivalent technical effect.

The solution suggested in the disputed patent is to provide communication channels between the tubes forming the header, in the manner as defined in claim 1. The appellant submits that this solution is rendered obvious by D2.

D2 relates to heat exchangers, in which the headers are not formed from a flat array of tubes, but from two shaped plates that are joined together. The plates have indentations and projections, which when mated together form chambers and strengthening ribs (see column 1, lines 41 to 56 and, for example, Figures 2, 6 and 8). The header disclosed in D2 is therefore of a different type from that of D1 and the disputed patent. In particular, the heat exchanger of D2 is not suitable for the high pressures contemplated by D1 and the disputed patent.

The appellant holds the view that the skilled person has knowledge of heat exchangers in general, and would consult D2 because both documents concern this topic, especially as both D1 and D2 refer to heat exchangers used as condensers. However, the Board is not convinced that the skilled person would consult D2 in expectation of finding a solution to the posed problem, since the

disputed patent and D1 concern high pressure heat exchangers in which the header is made of a series of tubes, and the problem of unequal pressures, which underlies the invention, especially relates to such headers.

Even if the skilled person were to read D2, it is not apparent that he would discover the solution to the problem. The appellant argues that D2 discloses a channel 42, which in Figure 4 is shown to link chambers 30. The chambers 30 are considered by the appellant to be equivalent to the tubes of D1, and since channel 42 provides a fluid communication between the chambers it would equalise any pressure differences; this effect would be immediately appreciated by the skilled person, and no inventive activity would be required in applying it to the header of D1.

However, the features that might be interpreted as separate chambers in Figure 4, are not comparable with the header tubes of D1 or the disputed patent. Figure 4 is a cross-section through a joint where a flat tube is connected to the header (as indicated in Figure 2) and shows that there is a cavity either side of the joint itself. Figure 3 is a cross-section taken above the joint depicted in Figure 4 (this is also indicated in Figure 2), and shows that a cavity extends across the joint and across the whole width of the header. Since the chamber in effect completely surrounds the joint, it does not have a shape comparable with a tube. More to the point, fluid in the cavities above and below the joints is free to flow across the width of the header, thereby equalising any pressure differences. Feature 42 in D2 is actually a tube stop, which prevents flat tube

11 from fully abutting against the rear tank plate 22, and thereby forms a channel through the joint; this channel has a relatively small cross-section and is not there for the purpose of pressure equalisation. The flat tube 11 of D2 is of the "multiport" type, i.e. it is made up of a series of channels or ports; the purpose of the channel through the joint is to allow the central ports of the flat tube to remain open (see column 3, lines 27 to 30). D2 makes no mention of the problem of pressure equalisation, principally because, given the relatively large cavities above and below the joints, this problem does not exist for the header of D2. The skilled person is give no indication in D2 of the solution to the posed problem.

The heat exchanger of claim 1 and dependent claims 2 and 3 is therefore considered as having an inventive step in light of D1 and D2.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

A. Vottner U. Krause