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Datasheet for the decision of 17 July 2008

Case Number: T 1145/06 - 3.2.03

Application Number: 98941869.4

Publication Number: 1030155

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Language of the proceedings: EN

Title of invention:
Tube for heat exchangers and method of manufacturing the same

Patentee:
Zexel Valeo Climate Control Corporation

Opponent:
Behr GmbH & Co. KG

Headword:
-

Relevant legal provisions:
EPC Art. 123(2), 83, 54, 56

Relevant legal provisions (EPC 1973):
-

Keyword:
"Novelty main request (no)"
"Inventive step 3rd Auxiliary request (yes)"

Decisions cited:
-

Catchword:
-

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Case Number: T 1145/06 - 3.2.03

D E C I S I O N
of the Technical Board of Appeal 3.2.03
of 17 July 2008

Appellant: (Opponent)	Behr GmbH & Co. KG Mauserstr. 3 D-70469 Stuttgart (DE)
Representative:	Bendel, Christian Haifastrasse 20 D-40227 Düsseldorf (DE)
Respondent: (Patent Proprietor)	Zexel Valeo Climate Control Corporation 39 Aza-Higashihara Oaza Sendai, Kohnan-machi Ohsato-gun Saitama (JP)
Representative:	HOFFMANN EITLE Patent- und Rechtsanwälte Arabellastrasse 4 D-81925 München (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted 22 May 2006 rejecting the opposition filed against European patent No. 1030155 pursuant to Article 102(2) EPC.**

Composition of the Board:

Chairman: U. Krause
Members: C. Donnelly
K. Garnett

Summary of Facts and Submissions

I. The appeal lies from the decision of the opposition division, posted on 22 May 2006, to reject the opposition against European Patent EP-B-1030155.

II. The opponent (hereinafter "the appellant") filed a notice of appeal on 24 July 2006 and paid the fee the same day. In the grounds of appeal filed on 22 September 2006, the appellant requested that the impugned decision to be set aside and the patent revoked under Article 100(a), (b) and (c) EPC.

In support of this request, the appellant cited the following documents from the opposition proceedings:

D8: DE-A-19548244;
D9: US-A-5271151;
D10: DE-A-19548495;

and cited a further document:
D14: "Dubbel- Taschenbuch für den Maschinenbau", 1986, page 303.

III. In its reply filed on 16 February 2007, the patent proprietor (hereinafter "the respondent") requested that the appeal be dismissed or alternatively, the patent be maintained in amended form on the basis of auxiliary requests 1 or 2 filed with the same letter.

Both parties made auxiliary requests for oral proceedings to be held.

IV. In a communication dated 18 March 2008 pursuant to Article 15(1) RPBA annexed to the summons to oral proceedings, the board informed the parties of its provisional opinion. In particular, the board indicated that the inclusion by the respondent of three independent claims in the first auxiliary request and of three new dependent claims in the second auxiliary request did not appear to be occasioned by any of the grounds of opposition and, thus, these requests would not be admitted into the proceedings (Rule 57a EPC 1973).

With its letter of 17 June 2008 the respondent filed auxiliary requests 1 to 8 to replace auxiliary requests 1 and 2 of 16 February 2007.

With its letter of 17 June 2008 the appellant filed document US-A-2573161 (D15) which, it was said, had only recently come to the appellant's notice through its appearance in another case, and requested that it be admitted into the proceedings since it was considered novelty destroying for claim 1 as granted.

V. Oral proceedings were held on 17 July 2008. During these proceedings the respondent filed an amended third auxiliary request.

VI. Claim 1 as granted reads:

"A method for manufacturing a tube (2) for a heat exchanger (1) by forming beads (21) on a brazing sheet (B) for configuring the tube (2), folding the brazing sheet (B) so as to form a tube part (20), and brazing the tops of the beads (21) with opposed portions within

said tube part (20), wherein the tube (2) is determined to have a predetermined thickness (t) when the tops of the beads have been brazed to the opposed portions within the tube part (20),
characterised in that
the tube part (20) prior to brazing is determined to have a thickness (t') larger than said predetermined thickness (t), and the tube part (20) is compressed to the predetermined thickness (t) in a direction of its thickness when it is brazed."

In Claim 1 of the first auxiliary request of 17 June 2008 the opening lines of the main request are amended to read:

"A method for manufacturing a tube (2) for a heat exchanger (1) by forming beads (21) on a brazing sheet (B) for configuring the tube (2), *and also joint sections (22) at both ends of the brazing sheet (B) in its breadth direction,* folding the brazing sheet (B) *along a folding portion (23) to contact the joint sections mutually and also tops (21a) of the beads (21) with opposed portions within the tube (2),* so as to form a tube part (20)....."

Claim 1 of the second auxiliary request of 17 June 2008 is further amended by the addition of the expression "at the centre" as follows:

"A method for manufacturing a tube (2) for a heat exchanger (1) by forming beads (21) on a brazing sheet (B) for configuring the tube (2), and also joint sections (22) at both ends of the brazing sheet (B) in its breadth direction, folding the brazing sheet (B)

along a folding portion (23) *at the centre* to contact the joint sections (22) mutually and also tops (21a) of the beads (21) with opposed portions within the tube (2), so as to form a tube part (20).....".

Claim 1 according to the third auxiliary request filed during the oral proceedings reads:

"A method for manufacturing a heat exchanger (1) having a plurality of tubes (2) each formed from a brazing sheet (B), which tubes are stacked with fins (5) interposed between them, connected to communicate with header pipes (3,4) which are disposed at both ends of the tubes, by

forming beads (21) on each brazing sheet (B) for configuring each tube (2),

folding the brazing sheets (B) so as to form tube parts (20),

assembling the tube parts (20), fins (5), and header pipes (3,4) into one body by means of a jig, and

brazing the tops of the beads (21) with opposed portions within said tube parts (20), wherein each tube (2) is determined to have a predetermined thickness (t) when the tops of the beads are brazed with opposed portions within the tube part (20),

characterised in that

when assembling the tube parts (20), fins (5), and header pipes (3,4) into one body prior to brazing, each tube part (20) is determined to have a thickness (t') larger than said predetermined thickness (t), and elasticity serving to compress the tube parts (20) in a direction of their thickness is accumulated in the fins (5), and

at the time of brazing, each tube part (20) is compressed to the predetermined thickness (t) in a direction of its thickness wherein a pressing force for compressing the tube parts (20) is obtained by the elasticity accumulated in the fins (5)."

VII. The arguments of the parties can be summarised as follows:

(a) Main Request

(i) Article 100(c), 123(2) EPC

Appellant

The subject-matter of claim 1 contravenes Article 123(2) EPC since it specifies "folding the brazing sheet so as to form a tube part" whereas in the originally filed application there is only mention of the sheet being "folded along a folding portion 23 at the centre to contact the joint sections 22 mutually and also tops 21a of the beads 21 with the opposed portions within the tubes so as to form a tube part 20" (see page 8, lines 7 to 10 of the application as filed). Hence, claim 1 comprises folding positions other than around the centre and as such is an unallowable intermediate generalisation.

Respondent

The skilled person understands directly and unambiguously from the application as a whole that it is only essential to form the brazing sheet into the shape of a tube, irrespective of whether the sheet is

folded along a folding line which is provided at the centre thereof. It is technically irrelevant for the invention how the tube is folded since it is concerned with improving brazing quality by providing a compressive force during brazing.

Furthermore, the passage at page 1, paragraph 3 states that the tube used for a conventional heat exchanger is "produced by forming a brazing sheet into the shape of a tube" and that "The brazing sheet is formed by rolling, pressing or the like". When employing fabrication techniques such as rolling and pressing to form a tube from a sheet there is little alternative other than to do this by folding. Thus, in the context of the contested patent the words "forming" and "folding" are synonymous. Consequently, since in the passage covering the final two lines of page 7 of the description as originally filed it is stated that "The tube 2 of this embodiment is formed by forming a brazing sheet B" the disputed phrase "folding the brazing sheet so as to form a tube part" used in claim 1 as granted is fully supported.

(ii) Interpretation of claim 1

Appellant

Although clarity is not a ground for opposition it is important for the parties to know what kind of method is under consideration. The expression "when it is brazed" used in claim 1 is ambiguous since it is not clear whether "when it is being brazed" or "when it has been brazed" or both is meant. Thus, the claim could also cover compressing the tube part to a smaller

thickness before brazing and maintaining this thickness during brazing, for example by compressing a folded and slightly bulging tube part to reduce a gap between the beads (thickness t') to bring the beads into mutual contact for and during the brazing (thickness t).

Respondent

This expression is clear and it would be the normal interpretation to understand that only compression at the time of brazing is meant. If the skilled person needed any confirmation to this effect it can be found in the description of the contested patent at paragraph [0034] where the expression "at the time of brazing" is used explicitly.

(iii) Article 100(b), 83 EPC

This objection arises in connection with the ambiguous nature of claim 1 previously discussed. Claim 2 requires that the "tops of the beads are crushed". There is no indication in the patent as to how this can be achieved since the elastic force of the fins is obviously insufficient. It would also not be obvious to the skilled person how or at what stage to carry out this crushing. Thus, the main request does not comply with Article 83 EPC.

Respondent

The predetermined thickness is the thickness after brazing and this thickness is obtained during the brazing process. The compressing force being provided, for example, by the elasticity of the fins interposed

between the tubes. The crushing of the bead tops mentioned by the appellant is specified in claim 2 and is therefore not part of the invention according to claim 1. However, as explained in paragraph [0044] of the patent, the bead tops are crushed against the opposite portion within the tube part when the brazing sheet is folded to form the tube i.e. before brazing. It would be a routine task for the skilled person to come up with a way of providing the necessary force to cause crushing within the context of a rolling and pressing operation used for folding the tube.

(iv) Admission of document D15

Appellant

This document should be admitted into the proceedings since it is prima facie novelty destroying not only for claim 1 as granted, but is also extremely relevant to the subject-matter of all the auxiliary requests.

Respondent

This document should not be admitted into the proceedings since it was filed at a very late stage and is not prima facie relevant to the claims of any requests since the manner in which pressure is applied during brazing excludes any compression force capable of reducing tube thickness being brought to bear on the flat tubes of the assembly.

(v) Novelty, Article 100(a)

Appellant

The subject-matter of claim 1 is not new with respect to D15. This document describes:

a method for manufacturing a tube (22) for a heat exchanger by forming beads (26) on a brazing sheet for configuring the tube (22), folding the brazing sheet so as to form a tube part and brazing the tops of the beads (26) with opposed portions within said tube part (22), wherein the tube (22) is determined to have a predetermined thickness when the tops of the beads have been brazed to the opposed portions within the tube part (22),

As regards the feature of the characterising portion, whereby:

"the tube part prior to brazing is determined to have a thickness larger than said predetermined thickness, and the tube part is compressed to the predetermined thickness in a direction of its thickness when it is brazed."

this is implicit from the passage at column 3, lines 43 to 48 which states that "Pressure is then applied to the top and bottom of the stack so that the peaks of the longitudinal corrugations of the fins are deformed slightly into good contact with the tubes".

As a consequence, the side-walls of the tubes 22 are subjected to a compression force before being introduced into the brazing oven. As soon as the brazing material between the top of the corrugation 26 and the inside of the tube melts this compression force

will inevitably urge the side wall into the top of the corrugation 26 resulting in a reduction in thickness. The assembly will then be cooled in and, thus, fixed in this position. Inevitably therefore, the thickness of the flat tube after brazing is less than that before brazing as required by claim 1 as granted.

Respondent

It is not disputed that D15 shows the features of the preamble of claim 1. However, a deeper analysis of the manufacturing method disclosed therein reveals fundamental differences in comparison to that of the patent in suit. The passage at column 3, lines 43 to 48 cited by the appellant goes on to say that "and the flanges of the channels are pressed against each other for welding". Thus, at the moment of being put into the brazing oven there is no compressive force brought to bear on the flat tubes. This can be deduced from the fact that, on the one hand, the peaks of the longitudinal corrugations are plastically deformed as clearly suggested by figure 1 which shows the free end of the fin structure 32 maintains a rectangular shape even in the final assembly where no pressure is brought to bear and, on the other hand, that once the channels have been brought together no amount of pressure will result in any compression of the flat tubes. Thus, since whatever is providing the compressive force to deform the fins cannot act upon the flat tubes because of the limit imposed by the channels, and seeing as the fins have been plastically, rather than elastically, deformed and are therefore incapable of exerting any force, there can be no compression acting on the flat tubes during brazing.

(b) Auxiliary requests 1 and 2

(i) Article 123(2) EPC

Appellant

The same objection raised in connection with the main request applies to the first auxiliary request since the expression "at the centre" is still missing. There is no objection to the second auxiliary request as far as this Article is concerned.

Respondent

The same observations as for the main request apply. The skilled person would clearly recognise that the requirement for the folding portion to be "at the centre" is not technically relevant to the invention.

(ii) Novelty, Inventive step

Appellant

In connection with the objection under Article 123(2) EPC, the respondent argued that the position of the folds is not technically relevant to the invention and that the skilled person would anyway understand the implications of the different folding positions. Thus, either the second auxiliary is not allowable in view or Article 123(2) EPC or the additional feature, if deemed by the board not to be shown in D15, is by the respondent's own admission not sufficient to justify recognition of an inventive step.

Respondent

The particular folding methods specified in these requests are not disclosed in D15 and affect how the tube behaves when compressed since there is no thicker overlapping portion as is the case in D15.

(c) Auxiliary request 3

The appellant stated that there were no objections under Articles 123(2) and (3) or Article 83 EPC.

(i) Novelty

Novelty was not disputed by the appellant.

(ii) Inventive step

Appellant

D15 discloses all of the features of claim 1 with the exception that the headers of D15 are not header pipes but a series of channels 14 which are brazed together and then closed with a tank 10.

This difference is merely a minor constructional alteration. The skilled person, faced with the problem of simplifying the fabrication or increasing the pressure rating of the heat exchanger, would not require any inventive skill in order to implement it since reducing the number of components to be joined is always a fundamental consideration and one which goes hand in hand with reducing the number of brazed joints

which are known to be potential weak points at high pressure. Header pipes are shown for example in document D9 which discloses a high pressure condenser.

Respondent

The method specified in claim 1 is fundamentally different to that disclosed in D15 since it is now explicitly specified that the pressing force for compressing the tube parts is obtained by the elasticity accumulated in the fins whereas in D15, as already explained in relation to the main request, the fins are plastically deformed and incapable of providing a pressing force for compressing the tube parts.

Further, D15 only states that "pressure is applied to the top and bottom of the stack", there is no disclosure as to how this pressure is applied. Hence, the feature of claim 1 specifying "assembling the tube parts (20), fins (5), and header pipes (3,4) into one body by means of a jig" is not disclosed since D15 does not disclose a jig.

Additionally, the difference in the header construction admitted by the appellant cannot be waved aside as a minor constructional adaptation. The header construction of D15 uses a series of channels (14) which are brazed together to form one side of the top and bottom tanks (10,12). Once the channels have been brought together the intermediate gap between the flat tubes accommodating the fins is fixed. Consequently, the fins cannot be used to accumulate elastic energy to

provide a compression force to reduce the thickness of the tubes at the time of brazing.

D15 gives no information as to where any energy to provide a compressing force is stored elastically and accordingly does not give any hint or suggestion towards the method of claim 1.

Reasons for the Decision

1. ***Main Request***

1.1 *Article 123(2) EPC*

The board finds convincing the respondent's argument that the only way of forming a flat tube from a sheet through rolling and pressing operations is by folding. Hence, in the context of the contested patent the term "forming" is seen to be synonymous with "folding" such that the disclosure at the last two lines of page 7 of the application as filed is a sufficient basis for the expression "folding the brazing sheet so as to form a tube part" used in claim 1 as granted.

Thus, the requirements of Article 123(2) EPC are met.

1.2 *Article 83 EPC, Interpretation of claim 1.*

The board concurs with the respondent and accepts that the method according to claim 1 is restricted to a process whereby the tube thickness is reduced by compression at the time of brazing. This interpretation would be the normal understanding of the expression

"when it is brazed", and is the one supported by the description of the contested patent at paragraph [0034].

The board is of the view that the patent describes how a compressive force capable of causing the reduction in thickness during the brazing process can be achieved by the interposed fins. Further, the board considers that the skilled person would anyway not have any difficulty in providing a way of compressing the tube during brazing by other means. Nor would any inventive skill be required of the skilled person to find a way of crushing the bead tops when folding the brazing sheet to form the tubes since only an increase in the final pressing force would be required.

Thus, the requirements of Article 83 EPC are met.

1.3 *Admission of document D15*

The board considers this document should be admitted into the procedure since it is the only document, besides D10, which explicitly mentions a pressure being applied to a heat-exchanger assembly comprising flat tubes during brazing (see in particular column 3, lines 43 to 48).

1.4 *Novelty, Article 54 EPC*

D15 describes:

a method for manufacturing a tube (22) for a heat exchanger ("radiator" see column 1, line 40) by forming beads (26) on a brazing sheet for configuring the tube

(22), folding the brazing sheet so as to form a tube part (see column 2, lines 1-2 and figure 4), and brazing the tops of the beads (26) with opposed portions within said tube part (22- see column 2, line 5 and figure 2), wherein the tube (22) is determined to have a predetermined thickness when the tops of the beads have been brazed to the opposed portions within the tube part (22).

As regards the characterising portion of the claim, the parties have put forward differing interpretations as to the teaching of D15. The board considers that the skilled person would learn from the passage at column 3, lines 43 to 48 that pressure is applied to the stack with the aim of ensuring good contact between the fins 30 and the tubes 22. The skilled person would also understand that in the context of a heat-exchanger this good contact is necessary to ensure efficient heat transfer from the tube to the fin. There is no doubt that the pressure is applied at the time of welding since otherwise it would mean interpreting the expression "pressed against each other for welding" as "pressed against each other *and released* for welding" which would have little technical sense. Further, pressure is applied to the extent that the "peaks of the longitudinal corrugations are deformed slightly". The appellant is of the view that this deformation must be elastic whereas the respondent maintains that it is entirely plastic such that the fins exert no pressure on the tube after deformation.

The board considers that, as far as the main request is concerned, there is no need to address the issue of whether there is plastic or elastic deformation of the

fins. D15 fundamentally teaches that there is an application of pressure at the time of brazing which is sufficient to cause deformation of the fin peaks. In order for this deformation to occur an equal and opposite force must be provided. From figure 2 it is apparent that this counterbalancing force can only be provided by the corrugations 26 which, as stated at column 2, lines 4 to 6 "are deep enough so that the material of the two sides may be in contact for welding". Hence, as argued by the appellant, when the compressed fin/flat-tube stack of D15 is heated for brazing according to the method given at column 3, lines 49 to 57 there is inevitably a reduction in tube thickness when the brazing material layer melts and is squeezed along the corrugations by the compression produced on the one side by the force transmitted through the fins to produce the deformation of the peaks and, on the other, by the reaction force provided through the corrugations.

The subject-matter of claim 1 of the main request is therefore not new with respect D15 and does not meet the requirements of Article 54 EPC.

2. ***Auxiliary requests 1 and 2***

2.1 *Novelty, Inventive step.*

As argued by the respondent when defending the main request with respect to the objection under Article 123(2) EPC, the skilled person is aware of the various merits and problems associated with different tube fold positions and would make a selection according to

circumstances without the need to exercise any inventive skill.

Thus, the subject-matter of claim 1 according to both auxiliary requests 1 and 2 does not meet the requirements of Article 56 EPC.

3. ***Auxiliary request 3***

3.1 *Inventive step*

The board concurs with the respondent that D15 is silent as regards the technique used for pressing the heat exchanger assembly together. An indication that "pressure is applied to the top and bottom of the stack" does not inevitably mean that a jig is used since there are other obvious alternatives available, such as simply placing a weight on the top of the stack.

Indeed, the header construction of D15 which employs a series of channels means that a jig would in fact be otiose since the channels themselves act to position and maintain the flat tubes in position.

Therefore, the method of D15 is fundamentally different to that of the contested patent in that the connection between the header and the tube is made before compression as opposed to afterwards. The need for a jig is therefore related to the use of header pipes, the conventional construction of which is understood in the art and given in the contested patent at paragraph [0027]). Such header pipes have tube holes formed at predetermined intervals which are not capable of

accommodating any longitudinal displacement of the tube ends such as would occur when the fin/tube stack is compressed. This problem does not arise in the method according to D15.

Hence, the feature of claim 1 specifying "assembling the tube parts, fins, and header pipes into one body by means of a jig" is not disclosed.

The respondent is correct to argue that D15 does not explicitly state whether the fins of D15 are elastically or plastically deformed. Indeed, in the respondent's view there is no information in D15 as to where any elastic energy is stored.

When considering the system of D15 there are several candidates for where energy could be stored elastically, namely:
(i) the device used to provide the pressure on the stack;
(ii)) the channels;
(iii) the flat tubes themselves;
(iv) the fins.

The device used to provide pressure on the stack need not store any elastic energy since this could simply be a weight placed on top of the stack.

The channels and the flat tubes are both made of metal and accordingly both are potential sites for elastic energy storage. It is highly improbable that any pressing force would take them beyond their respective elastic limits since they both have a constructional

function to fulfil and would be dimensioned accordingly.

The situation regarding the fins is not clear cut. The fins will be made of metal to allow brazing and ensure good heat transfer which prima facie suggests that they are capable of storing energy elastically in the manner of a spring. However, since their primary function is to promote heat transfer they need serve no particular structural function. Thus, the fins can be made of a thin material (D15 itself for example, column 2, lines 35 to 36, states "preferably about six thousandths of an inch", i.e. approximately the same thickness as a sheet of copier paper), indeed, from a weight saving point of view this would be advantageous. Nevertheless, the fins must be stiff enough to transmit the pressure applied to the top and bottom of the stack in order to ensure "slight deformation into good contact with the tubes" which may be by plastic or elastic deformation.

D15 does not state whether the pressure is applied to the channels or to the tube/fins or to both. However, it is stated that the pressure is applied to ensure "good contact" between the fins and the tubes, accordingly there must be some pressure applied to the fin/tube area such that the deformation of the fin peaks is assured up to the limit set by the channels coming into contact. By so doing, the tubes of D15 are compressed to reduce their thickness at the time of brazing since the necessary force is transmitted from the pressure applying means through the fins. However the fins may be plastically or elastically deformed, thus, it is not inevitable that there is accumulation of elastic energy in the fins themselves. Since the

thickness change under consideration is minimal (i.e. the thickness of the brazing material layer which is of the order of 0.04mm - see contested patent column 5, lines 43 to 47) the overall dimensional changes are limited such that they can be accommodated by the overall elasticity of channel/tube assembly.

In conclusion, it is not directly and unambiguously derivable from D15 that there is a force exerted by the elastic energy accumulated in the fins tending to reduce the tube thickness.

Thus, D15 does not disclose the following features of claim 1.

(i) - that the tubes are connected to communicate with header pipes which are disposed at both ends of the tubes,
(ii) - assembling the tube parts, fins, and header pipes into one body by means of a jig, and
(iii) - when assembling the tube parts, elasticity serving to compress the tube parts in a direction of their thickness is accumulated in the fins, and
(iv) -at the time of brazing a pressing force for compressing the tube parts is obtained from the elasticity accumulated in the fins.

The technical effect of using a header pipe, as opposed to a segmented header bottom and tank part, as far as the manufacturing method is concerned is to reduce the number of components requiring brazing. A header pipe without a brazed tank part potentially permits higher operating pressures since the number of brazed joints, often a source of leaks under pressure, are minimised.

The technical effect of using a jig to assemble the components is that of allowing the fins and tubes to be held in position and compressed such that the header pipes may then be added to form one body. This is in effect a complication compared the segmented header system which does not require a jig. By using the elastic energy accumulated in the fins by the compression it is ensured that pressure is evenly distributed along the tubes such that the quality of the brazing between all the bead tops and the flat tube interior as well as between the fins and tube exterior is improved. Further, the need for providing further pressure applying means capable of working at the time of brazing is avoided.

Thus, the objective technical problem to be solved can be taken to be one of how to provide a method of manufacturing a heat exchanger with an increased pressure rating in the simplest manner.

Faced with this problem there does not appear to be any incentive in the prior art which would lead the skilled person to incorporate all the distinguishing features specified above into the method of D15.

The appellant has argued that a header pipe is a standard configuration in the field of heat-exchangers particularly when a high pressure rating is needed such as would be the case for condensers. The board agrees with this viewpoint which is supported for example by the heat-exchanger shown in D9 which discloses a high-pressure condenser comprising a header pipes 23. However, D9 is silent on how the tubes, fins and headers are assembled and brazed together, merely

stating that it is carried out (see column 3, lines 32 to 37 and column 4, lines 5 to 10).

Further, the stack construction method of D15 does not lend itself to a combination with header pipes known from D9. The slight deformation of each row of fins in D15 adds up to a considerable compression of the whole stack. In D15, this is taken up by the corresponding movement of the flanges of the channels before coming into contact. No such mobility is available when using the header pipe of D9 since the tube insertion holes are at fixed distances apart. Thus, the skilled person would not consider modifying D15 by replacing the segmented header construction with a header pipe.

As regards the pertinence of the other documents mentioned during the proceedings, the board would comment as follows.

D8 does not explicitly mention any reduction in tube thickness during the brazing process nor that any force is applied to the tube during the brazing process to effect such a reduction. There are no details given for a method of manufacturing a heat exchanger comprising fins, tubes and header pipes.

In D10 (see in particular column 7, line 24 to column 8, line 6) the thickness of the tube is fixed because of the presence of the separating web (4) which is indicated as being a stiff support (starre Stütze - see column 7, line 10).

The passage of D10 at column 7, lines 38 to 49 does not mean that the beads are forced together so that the

thickness is reduced during the brazing process since the spring element ("federndes Element") is the bulging section of the tube and the thickness of the tube is limited by the separating web ("Trennwand" 4). Thus, D10 teaches away from the invention in that it deliberately prevents reduction in tube thickness by compression at the time of brazing.

In conclusion, although the appellant has argued that the claimed method is merely a way in which heat exchangers have always been assembled, no prior art which describes or suggests such a method has been produced to back up this assertion nor has it been demonstrated that such a method would be obvious in view of the skilled person's general knowledge.

Thus, the subject-matter of claim 1 according to the third auxiliary request is therefore also inventive and meets the requirements of Articles 54 and 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 on the basis of claims 1 to 5 of the third auxiliary request filed during the oral proceedings after adaptation of the description and drawings.

Registrar: Chairman:

A. Counillon U.Krause