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D E C I S I O N
of 13 March 2001

Case Number: T 0925/98 - 3.2.3

Application Number: 89305294.4

Publication Number: 0359358

IPC: F28F 9/02, F25B 39/04

Language of the proceedings: EN

Title of invention:
A condenser

Patentee:
SHOWA ALUMINUM KABUSHIKI KAISHA

Opponents:
BEHR GmbH & Co.
VALEO THERMIQUE MOTEUR

Headword:
-

Relevant legal provisions:
EPC Art. 53, 54, 56, 123

Keyword:
"No added subject-matter (combination of range ends)"
"Inventive step (yes)"

Decisions cited:
T 0002/81, T 0201/83, T 0053/82, T 0571/89, T 0656/92, T 0522/96, T 0947/96, T 0229/85, T 0099/85

Catchword:
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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0925/98 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 13 March 2001

Appellant: (Proprietor of the patent)
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 15 July 1998 revoking European patent No. 0 359 358 pursuant to Article 102(1) EPC.**

Composition of the Board:

Chairman: C. T. Wilson
Members: J. du Pouget de Nadaillac
M. K. S. Aúz Castro

Summary of Facts and Submissions

I. The appeal is directed against the decision dated 15 July 1998 of an opposition division of the European Patent Office, which revoked European Patent EP-B1-0 359 358 for the reason that the subject-matter of its amended Claim 1 did not involve an inventive step in view of the documents referenced D1 and D4 among the following documents of the prior art, which were cited in the opposition proceedings:

D1: EP-B-0 255 313

D2: US-A-2 004 390

D4: JP-A-61-114 094 (translation)

D9: EP-A-0 138 435

II. The amended claim 1 reads as follows.

"A condenser particularly for use in automobile air conditioning systems, comprising a plurality of flat tubes (1) and corrugated fins (2) sandwiched between the flat tubes for releasing heat, a pair of hollow headers (3,4) connected to the end of the flat tubes (1), an inlet (6) and an outlet (8) being provided in the headers (3,4) for introducing a cooling medium into the flat tubes and discharging a used cooling medium therefrom, the inner spaces of the headers (3,4) being divided by partitions (10 and 11 respectively) so as to form a cooling medium flow path (12) in a zigzag pattern including an inlet side group of paths (A) and an outlet side group of paths (C), the number of groups of paths being 2 to 5, and each of the flat tubes being

made of extruded aluminium and having a plurality of bores (12) extending along the length therof, characterised in that the cross-sectional area of the outlet side group of paths (C) is 30% to 50% of that of the inlet side group of paths (A)."

III. The proprietor of the European patent, hereinafter the appellant, filed the appeal and paid the corresponding fee on 10 September 1998. The statement of grounds of appeal was received on 12 November 1998.

The three opponents replied by writing to this statement of grounds. However, respondent 01 with a letter received on 22 September 2000 withdrew his opposition, so that only opponents 02 and 03 remain as respondents.

IV. In a communication dated 12 October 2000 accompanying the summons to oral proceedings, the board of appeal expressed its provisional opinion that a combination of D1 with D4 did not seem to be obvious.

With a letter received on 8 February 2001, respondent 02 filed a new document referenced D11 (US-A-4 141 409) and raised an objection under Article 123, paragraph 2, EPC against the range 30%-50% given in Claim 1.

V. Oral proceedings took place on 13 March 2001. A new description was filed in these proceedings.

VI. The appellant argued as follows:

The technology of the condenser according to D4 is different from that of the condenser disclosed in D1. A

layered-type heat exchanger with spacer elements is disclosed and a person skilled in the art would not have considered such a particular heat exchanger for improving the heat exchanger according to D1. Moreover, Figure 7 of this document was selected with hindsight. In this document as well as in both others which were cited, namely D9 and D11, it may be that embodiments with a C/A ratio falling within the claimed range are disclosed, but they are not presented as being optimum configurations.

VII. The respondents challenged the relevance of these arguments as follows:

In the originally filed documents of the patent in suit it was the range 30% to 60% with a preference for the range 35% to 50%, which was disclosed. By now claiming 30% to 50%, the appellant infringes Article 123(2) EPC.

The problem underlying the present invention is to optimise the heat exchanger according to D1. It is not convincing to argue that already the identification of this problem is inventive, since it is the permanent task of the skilled person to improve a device. In the description of the patent in suit, page 2, line 26, it was recognised that the improper proportion between the inlet (A) and outlet (C) side groups of paths in the condenser according to D1 was affecting the efficiency of the heat exchange. Thus, the problem was well identified and for the skilled addressee, who has it in mind, it is obvious to conduct experiments for finding the optimum proportions. The passages in column 2, lines 30 to 40, and column 4, lines 34 to 49, of D1 lead him to first have path (C) greater than path (A) and then to see by means of tests which proportions of

the inlet to the outlet section reach the best compromises for simultaneously increasing the efficiency of the heat exchange, while reducing the pressure loss of the cooling medium.

Moreover, several prior art documents prompt the person skilled in the art to do so:

Important in the disclosure of D4 is not the particular construction of its condenser, but the inducement provided on page 3 of this prior art to set the most suitable flow quantity of the cooling medium having regard to the balance between pressure loss and heat tranfer rate with, immediately after in the same paragraph, both the advice to choose section (C) greater than (A) and the configuration of Figure 7, in which the C/A ratio egals 50%. The same problem is mentioned, together with an example of the solution. Figure 5 of this document and line 3 of its page 3 indicate to the skilled person that the layered arrangement disclosed therein, although being different from the construction of D1, also creates flow paths, so that the same problem of volume or effective cross-sectional areas exists. Thus, a hint to combine D1 with D4 is given.

D11, see column 1, lines 41 to 52, and column 3, line 62, to column 4, line 6, deals with the same problem and this with a "multi-flow" type condenser with two hollow headers internally divided by partitions and into which the cooling medium in a gaseous state is introduced, flows in zigzag patterns through tube groups and is discharged in a liquid state. In this known heat exchanger, means are provided to by-pass the liquid, but Claim 1 of the patent in

suit leaves open whether the medium of the heat exchanger according to the invention, once transformed into a liquid state, flows as a whole through the inlet and outlet tube sections or not. As a solution for optimizing the flow rate through the whole condenser, it is disclosed in the main claim of this document that the inlet section comprises a greater number of tubes than the outlet section and the disclosed configuration gives a C/A ratio of 50%.

The multi-flow type condenser according to D9, which is made of U-shaped tubes interconnecting two internally subdivided hollow headers arranged side by side, is equivalent to that of D1, once the tubes are unbent. The object of this prior art is to reduce the pressure drop of the cooling medium by means of a specific pass pattern of the tubes, thereby improving the heat transfer rate. Thus, the same problem as in the present invention is dealt with and it is indicated - see page 11 and the table of Figure 7- that one multi-pass configuration, namely that according to Figure 6, is of particular interest as to the heat transfer. This embodiment shows a C/A ratio of 40%.

The person skilled in the art, receiving the teaching from D1 that the C/A ratio is important for the heat exchange efficiency, will recognize in view of D4, D11 or D9 that a ratio range between 40 and 50% is preferable to that shown in D1 and then he will conduct experiments in order to determine the optimum ratio range. The solution according to Claim 1 of the patent in suit is therefore obvious.

VIII. The appellant requested that the decison under appeal be set aside and that the patent be maintained on the

basis of the claims 1 to 7 submitted on 12 November 1998, an adapted description filed in the oral proceedings and Figures 1 to 15 according to the patent specification.

The respondents requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.

2. Admissibility of the newly submitted documents of the patent in suit.

According to Respondent 03, the range 30% to 50% given in Claim 1 infringes Article 123(2) EPC, since such a range was not disclosed in the originally filed documents of the patent in suit, which only disclose a general range of 30% to 60% and a preferred range of 35% to 50%.

However, according to the established jurisprudence of the boards of appeal, in the case of such a disclosure of both a general and a preferred range a combination of the preferred disclosed narrower range and one of the part-ranges lying within the disclosed overall range on either side of the narrower range is unequivocally derivable from the original disclosure of the patent in suit and thus supported by it (see T 2/81, OJ EPA 1982, 394, point 3; T 201/83, OJ EPA 1984, 481; and also T 53/82, T 571/89, T 656/92, T 522/96 and T 947/96, not published, but which all refer to T 2/81). In the present case, further, the

graphs of Figures 7 and 8 indicate that the claimed range is in fact the most efficient one.

All the other features of Claim 1 and those of claims 2 to 7, which are dependent on Claim 1, were originally disclosed. Since, moreover, the subject-matter of Claim 1 compared to that of the granted Claim 1 is restricted by the contested range and by the last feature of the preamble of this claim, the claims as a whole fulfil the requirements of Article 123(2) and (3) EPC. The description of the patent in suit has been adapted to these claims. Thus, having regard to Article 123 EPC, the newly filed documents are admissible.

3. It was not disputed that the subject-matter of Claim 1 is novel and after consideration of the cited prior art the board also considers this subject-matter to be new (Article 52 and 54 EPC).

4. It was also undisputed that prior art document D1 represents the closest prior art. It discloses a condenser comprising all the features of the preamble of Claim 1 and is considered as a "multi-flow" type condenser, which in the present case comprises groups of paths for the cooling medium which are each made of a plurality of tubes arranged in parallel. Intermediate groups of cooling medium paths can be provided between the inlet and outlet groups. Because the cooling medium is in a gaseous state when flowing through the inlet side and in a liquid state at the outlet side, it is known to provide a relatively large effective cross-sectional area for the cooling medium at the inlet side group, whereas a smaller cross-sectional area is sufficient for the outlet side group of the condenser.

The heat exchange efficiency is thereby improved, if simultaneously an increased pressure drop of the cooling medium is avoided. D1 teaches that, in order to obtain this result, it is possible either to decrease progressively the number of tubes from the inlet group to the outlet group or to have the same number of tubes in each group, but with progressively reduced cross-sectional sections of the tubes. Figure 8 of D1 shows one example, in which the inlet group comprises eight tubes and the outlet group five tubes.

In order to improve the heat exchange efficiency, other parameters are also considered in D1, namely the relationship between the tubes and the fins of the condenser or the inside height of its flat tubes.

5. The subject-matter of Claim 1 differs from the disclosure of this prior art in that a ratio range is given between the inlet and outlet side groups.

According to the description of the patent in suit, this feature solves the problem underlying the present invention, namely to provide a condenser having cooling medium paths divided in an inlet side section and an outlet side section in an optimum proportion, thereby increasing the heat exchange efficiency and reducing the pressure loss of a cooling medium.

However, this formulation of the problem to be solved is not correct, since the closest prior art D1, as seen above, suggests several possible directions for improving the condenser described in this prior art. As a consequence, the above defined problem by referring to one specific direction, namely to the proportion between the inlet and outlet side sections, contains a

pointer to the solution, which according to the jurisprudence of the boards of appeal is not admissible (T 229/85, OJ EPA 1987,237 and T 99/85, OJ EPA 1987, 413). Starting from D1, the problem to be solved is only to be seen in the provision of a condenser according to D1, which is optimised.

6. The board agrees with the respondents that, in general, the optimisation of a known device belongs to the permanent task of the person skilled in the art, so that the present case does not concern a "problem" type of invention. Nevertheless, starting from D1, the first step towards the solution is to make a choice between the at least three directions of improvement, which are suggested in D1.

The second step, however, seems to be the most important: D1, by indicating that the inlet side group of the condenser should have a greater cross-sectional area than the outlet side group, indeed gives the idea of a proportion or ratio between these two groups, but nothing more. In particular, it does not suggest that it could be interesting to determine the proportions which provide an optimised heat exchange and subsequently to locate the optimum range of proportions. The only ratio disclosed in D1 is outside of the claimed range. Therefore, the Board cannot follow the respondents when they argue that, on the sole basis of the teaching of D1, the claimed solution is obvious.

7. Having regard to the other prior art documents mentioned by the respondents, the board comes to the same conclusion. In fact, these documents do not teach much more than D1 and, moreover, a combination of D1

with at least two of them is not obvious:

7.1 D4, for example, starts from a known condenser which corresponds to the type disclosed in D1 and indicates that problems occur with respect to the bent fins which are sandwiched between the tubes. Therefore, this prior art moves aside from this kind of condenser and aims at improving a different kind of heat-exchanger, namely a layered-type one which is made of plates used as fins, which are sandwiched between spacer elements. Longitudinal holes in the plates and corresponding holes in the spacer elements are so arranged that a flow path with groups of rows is provided for the cooling medium. Because of the large number of rows, the heat transfer performance of this kind of heat exchanger is not good and D4 aims at providing a solution which overcomes this problem. A skilled person, who looks for an improvement of the condenser according to D1, has no reason to consider individual features of this prior art in view of this aim and of the kind of heat-exchanger which deliberately moves away from the condenser of D1.

Moreover, on the second page of this document, nearly the same teaching as in D1 is found, that is to say that it is possible to set the most suitable flow quantity of the cooling medium through the heat-exchanger based on the balance between pressure loss and heat tranfer rate by creating a flow path structure comprising different passes between the inlet section and the outlet section. One example is given with the embodiment according to Figure 7 which gives a C/A ratio of 50%, thus at one limit of the claimed range according to the present invention. However, there is no indication that this example could be an optimum

one, nor that an optimum range of ratios could exist.

7.2 A combination of the teaching of D11 with D1 is also not logical, since D11 describes a condenser which indeed is of the multi-flow type of D1, however is so constructed that an alternative flow path, namely a kind of bypass path, is provided for the cooling medium as soon as it becomes a liquid. The main aim of this prior art is to avoid that the cooling medium when being in a liquid state affects the overall efficiency of the condenser. The working conditions of such a condenser are thus quite different from those of a condenser according to D1 and one aim of D1, which is to provide a large effective cross-sectional area for the paths of the **whole** cooling medium, cannot be achieved.

The only configuration shown in this prior art, namely that of its Figure 1, gives also a C/A ratio of 50%, but this is clearly proposed in combination with the bypass. Moreover, there is no incitation in this prior art to look for other configurations, or even a clear suggestion that other proportions of the inlet side section to the outlet side section may bring an optimum efficiency of the heat exchange.

7.3 D9 relates to a condenser for automotive air conditioning systems of the type described in D1, the main difference being the round and U-shaped tubes, instead of flat and straight tubes. Due to this particular shape of the tubes, both hollow headers are located besides one another. An inventive idea of this prior art, which is three years older than D1, is to divide the inner spaces of the headers by means of partitions so as to provide several path groups for the

cooling medium, each group comprising several tubes. This technical feature is also disclosed in D1. Then, D9 describes several embodiments, which essentially differ from one another by the path patterns, for example from the inlet to the outlet 5-5-4-4-4-4-4-4-4-4 or 5-5-5-5-5-4-4-2-2 and so on, each number indicating a group and the number itself the number of tubes in this group. It can be seen that the above last configuration 5 to 2 gives a C/A ratio of 40%, thus inside the range given in Claim 1 of the patent in suit. One respondent has pointed out that, in the last lines of D9, this last configuration was shown as being particularly interesting. This is true, but in respect of the resulting weight reduction of the heat exchanger, and not with the heat transfer performance. In fact, the data table of page 10 of this document shows that, depending on the vehicle speed, the first above pattern, which is outside of the claimed range, can be more interesting having regard to the heat transfer performance. Thus, the person skilled in the art reading this document is at least not directed towards the claimed range. More important is the fact that he does not receive a clear indication that a particular range of proportions could be optimum to increase the efficiency of the heat exchange and reduce the pressure loss of the cooling medium. It is also observed that, in this prior art, the number of path groups lies between 10 and 14, thus well outside that given in Claim 1 of the patent in suit.

7.4 In a written submission one respondent has also mentionned D2. This prior art indeed concerns a multi-flow condenser, however with dam plates arranged inside the headers so as to create an accumulation of the cooling medium - when in a liquid state- at the end of

each path group. The operation of such a condenser is quite different from that of the condenser according to D1, so that the skilled person would not have combined D2 with D1.

The respondent has referred to the last embodiment of this prior art, that of Figure 7, which does not use dam elements. However, in the headers of this embodiment, not only partitions are present for providing several paths groups, but also inside some groups, in particular in the outlet section, return bonnets are arranged, providing sub-groups. In Figure 7, such a sub-group can be seen within the outlet path group, so that, contrary to the view of the respondent, it is not clear whether this outlet group is to be considered as comprising one or two tubes. A clear C/A ratio, as defined in Claim 1 of the patent in suit, is therefore not disclosed.

8. Therefore, the board concludes that the subject-matter of Claim 1 of the patent in suit is not obvious to a person skilled in the art and thus involves the inventive step required by Article 56 EPC. Dependent claims 2 to 7 concern particular embodiments of the condenser according to Claim 1, so that their patentability is supported by that of this claim.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to maintain the patent in amended form on the basis of Claims 1 to 7 submitted on 12 November 1998, the adapted description filed in oral proceedings and Figures 1 to 15 according to the patent specification.

The Registrar: The Chairman:

A. Counillon C. T. Wilson