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D E C I S I O N
of 15 September 1995

Case Number: T 0272/93 - 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

Applicant:
SHOWA ALUMINUM KABUSHIKI KAISHA

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (yes)"

Decisions cited:
-

Catchword:
-

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Case Number: T 0272/93 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 15 September 1995

Appellant: SHOWA ALUMINUM KABUSHIKI KAISHA
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Decision under appeal: **Decision of the Examining Division of the European Patent Office dated 17 November 1992 refusing European patent application No. 89 305 294.4 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: C. T. Wilson
Members: H. Andrä
L. C. Mancini

Summary of Facts and Submissions

I. European patent application No. 89 305 294.4 was refused by a decision of the Examining Division dated 17 November 1992.

II. The decision was based on Claims 1 to 8 received on 8 May 1990 with the letter dated 2 May 1990. The reason given for the refusal was that the subject-matter of Claim 1 did not involve an inventive step in view of the disclosure of EP-A-0 255 313 and the common technical knowledge of the skilled person.

III. The Appellant (Applicant) lodged an appeal against this decision on 12 December 1992 and paid the appeal fee on 19 December 1992.

The Statement of Grounds of Appeal was filed on 15 March 1993.

IV. As a result of objections raised by the Board in a communication pursuant to Article 110(2) EPC dated 10 March 1995 and by telephone, the Appellant submitted, by letter dated 19 June 1995, received on 22 June 1995, a new Claim 1.

The Appellant requests that the impugned decision be set aside and that a patent be granted on the basis of the following documents:

Claims: 1 to 4, 5 (partially), received on 22 June 1995;
5 (partially), 6 to 8, received by Telefax dated 31 July 1995.

Description: pages 1, 5, 6 and 8 to 14 as originally filed, received on 25 May 1989;

pages 2 and 3, received on 29 May 1995;
page 4 received on 11 May 1995;
page 7, received on 22 June 1995.

Drawings: sheets 1/5 to 5/5 as originally filed, received on 25 May 1989.

In support of his request, the Appellant argues essentially that, in contrast with the teaching of EP-A-0 255 313, the invention was made not only to reduce the pressure drop of coolant, but also to improve the heat exchange efficiency at the same time. Further according to the Appellant, the citation is quite reticent about a higher heat exchange efficiency which cannot be enhanced if the relationship between the inlet side and outlet side groups of coolant paths would not be optimized as to their cross-sectional areas. An inventive step should be seen in the concept of the inventors that the relationship in cross-sectional area between the inlet side paths and the outlet side paths is a key factor in realizing the higher efficiency.

V. 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 (7) 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) characterized in that the cross-sectional area of the outlet side group of paths (C) is 30% to 60% of that of the inlet side group of paths (A)."

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

Claim 1 is supported by the original Claim 1. The incorporation of the term "the cross-sectional area of the outlet..." in present Claim 1 which is missing in the original Claim 1 has to be regarded as an obvious correction in the sense of Rule 88 EPC based upon the "Summary of the invention" on page 4 of the original description.

The substitution of the term "corrugated fins sandwiched between the flat tubes for releasing heat" in present Claim 1 for the term "corrugated fins sandwiched between the flat tubes" according to the original Claim 1 constitutes a permissible clarification which is supported by the original description, cf. the passage bridging pages 8 and 9.

Claims 2 to 8 are supported by the respective originally filed claims.

Claims 1 to 8 are therefore in compliance with Article 123(2) EPC.

3. *Novelty*

Having examined the citations revealed by the search report, the Board considers that none of these discloses a condenser comprising all the features according to Claim 1. Since novelty of the subject-matter of Claim 1 has never been in dispute, there is no reason for detailed substantiation of this issue. Therefore, the subject-matter as set forth in Claim 1 is novel in the sense of Article 54 EPC.

4. *Inventive Step*

4.1 In agreement with the opinion expressed in the contested decision, the Board regards EP-A-0 255 313 as reflecting the nearest prior art.

This citation discloses a condenser (10) particularly for use in automobile air conditioning systems, comprising a plurality of flat tubes (11) and corrugated fins (12) sandwiched between the flat tubes for releasing heat, a pair of hollow headers (13, 113; 14) connected to the end of the flat tubes, an inlet (16) and an outlet (18) being provided in the headers for introducing a cooling medium into the flat tubes and discharging a used cooling medium therefrom, wherein the inner spaces of the headers are divided by partitions (20,21) so as to form a cooling medium flow path in a zigzag pattern including an inlet side group of paths (A) and an outlet side group of paths (C). Furthermore, the cross-sectional area of the outlet side group of paths is smaller than that of the inlet side group of paths (cf. column 4, lines 27 to 48 and Fig. 1 of the citation).

The condenser according to Claim 1 differs therefrom in that the cross-sectional area of the outlet side group of paths (C) is 30% to 60% of that of the inlet side group of paths (A).

Having regard to the reference in EP-A-0 255 313, column 4, lines 34 to 48, to Figure 8 thereof, with respect to the cross-sectional area of the flow paths, it may be allowable to conclude from this Figure, although having a schematic character, the effective ratio of the cross-sectional areas of the outlet side group of paths (C) to the inlet side group of paths (A). This consideration yields a value of C/A = 5/8 (62.5%) which is clearly above the value of 30% < C/A < 60% claimed in present Claim 1.

4.2 In accordance with page 3, penultimate paragraph of the original description of the present application (column 2, lines 16 to 22 of the published application), the object of the invention is to provide a condenser having cooling medium paths divided into an inlet side section and an outlet side section in an optimum proportion, thereby increasing the efficiency of heat exchange and reducing the pressure loss of a cooling medium.

Pursuant to this problem, the optimum proportion of the inlet and outlet side sections is selected in a range in which the efficiency of heat exchange is maximised and the pressure loss of the cooling medium is minimised. The test results depicted in Figures 7 and 8 of the drawings show that satisfactory values of the rate of heat exchange as well as of the pressure loss of the cooling medium are obtained in the range of the cross-sectional area ratio outlet side/inlet side of the headers of approximately 30% to 60%. It can be seen from the graphs that in this range of the area ratio the rate

of heat transfer is near the maximum value and the pressure loss of the cooling fluid is near the minimum value.

The Board cannot see any reason why the test results shown in Figures 7 and 8 and discussed on page 8, second paragraph of the original description should be questioned. They appear, therefore, to be credible. The problem as indicated above is therefore solved by the subject-matter of Claim 1.

4.3 The first instance argued in the contested decision (cf. page 3, last paragraph to page 4, paragraph 1) as follows:

The inlet side section of the headers has an optimum area for accommodating the cooling medium in a gaseous state and the outlet side section has an optimum area for accommodating that in a liquid state. The ultimate choice of the area of the two side groups of paths may be done after a rational procedure of optimisation, involving theoretical calculations or practical tests. Therefore, these features represent merely dimensional alterations, resp. an optimisation of the proportions of the inlet and outlet side sections of the known condenser which comes within the scope of the customary practice followed by persons skilled in the art.

To this argument, the Board would observe the following:

The object underlying EP-A-0 255 313 (cf. column 2, paragraph 2) is to provide a condenser having a relatively small core which nevertheless includes a large effective cross-sectional area for coolant passageways, thereby reducing a possible resistance to the flow of coolant.

This problem is different from that basic to the present application according to which an optimisation of the proportion of the flow areas of the header outlet side section and the header inlet side section in view of both the efficiency of heat exchange and the pressure loss of the cooling medium is strived for.

Due to this difference in the inherent problems, it may not be argued convincingly that the distinguishing feature of Claim 1 represents merely dimensional alterations, respectively, an optimisation of the preparations of the inlet - and outlet side sections of the known condenser. In particular, the criterion of arriving at a condenser having a relatively small core aimed at with the known condenser does not direct to and is not compatible with the demand for both a high efficiency of heat exchange and a low pressure loss. A small condenser core requires necessarily cooling medium ducts of small dimensions, hence raised flow velocities and an increased pressure loss, in addition to short duct lengths which do not contribute to a high efficiency of heat transfer.

Furthermore, EP-A-0 255 313 does not suggest in any way the distinguishing feature of Claim 1 that the cross-sectional area of the outlet side group of paths is 30% to 60% of the inlet side group of paths. Thus, the argument that the establishment of this range of values comes within the scope of the customary practice followed by persons skilled in the art cannot be accepted by the Board since it does not originate from the effective teaching of the prior art.

4.4 The Board considers, therefore, that the subject-matter of Claim 1 is non-obvious with regard to the teaching of EP-A-0 255 313.

4.5 The remaining citations of the search report are:

FR-A-2 478 807
US-A-1 958 226.

FR-A-2 478 808 describes a heat exchanger comprising three connecting ducts. Depending on the particular use and arrangement of the heat exchanger, different connecting ducts may be used. The problem solved consists in providing a standard heat exchanger which is suitable for different configurations and junctions to the outside duct installation. There is no clue to a condenser and no suggestion of the cross-sectional area of the outlet side group of flow paths being of a predetermined proportion of that of the inlet side group of paths.

US-A-1 958 226 describes a condenser for a refrigerating apparatus comprising a plurality of flattened tubes arranged in superimposed parallel rows. At each lateral end of the rows, a header is provided for fluid communication with the tubes, a continuous serpentine passage thus being formed from the input pipe to the output pipe.

No suggestion is made of a predetermined proportion of the cross-sectional areas of the outlet and the inlet side group of flow paths.

Thus, the further documents cited in the search report are all more remote from the claimed condenser and the Board is satisfied that none of these citations contains an indication to adapt the condenser described in EP-A-0 255 313 such as to include all the features of Claim 1.

4.6 It follows from the foregoing that the subject-matter of Claim 1 is regarded as involving an inventive step (Article 56 EPC). Claim 1 is therefore allowable under Article 52(1) EPC. The same applies to dependent Claims 2 to 8 which concern particular embodiments of the invention according to Claim 1.

5. The description and drawings comply with the requirements of the EPC, in particular with Rule 27(1)(a) to (e), and are therefore suitable for the grant of the patent.

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 grant the patent on the basis of the claims, the description and the drawings as set out under Section IV above.

The Registrar: The Chairman:

N. Maslin C. T. Wilson