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D E C I S I O N
of 28 October 1999

Case Number: T 0544/97 - 3.2.3

Application Number: 90308921.7

Publication Number: 0414433

IPC: F28D 1/04, F28D 1/053, F28F 9/00

Language of the proceedings: EN

Title of invention:
Duplex heat exchanger

Patentee:
Showa Aluminum Kabushiki Kaisha

Opponent:
Behr GmbH & Co.

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (yes)"

Decisions cited:
T 0024/81, T 0002/83, T 0939/92

Catchword:
-



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Boards of Appeal

Chambres de recours

Case Number: T 0544/97 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 28 October 1999

Appellant:
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 19 March 1997
rejecting the opposition filed against European
patent No. 0 414 433 pursuant to Article 102(2)
EPC.

Composition of the Board:

Chairman: C. T. Wilson
Members: H. Andra
J. P. B. Seitz

Summary of Facts and Submissions

- I. European patent application No. 90 308 921.7, filed on 14 August 1990 and published on 27 February 1991 under publication No. 0 414 433, was granted on 24 May 1995.

Independent claims 1 and 7 as granted read as follows:

"1. A condenser comprising unit heat exchangers (A and B) which respectively comprise a plurality of flat tubes (1, 21) arranged parallel with each other and fins (2, 22) each interposed between adjacent tubes with opposite ends of each tube being connected to a pair of headers (3, 4 and 23, 24) in fluid connection therewith, the unit heat exchangers (A, B) being closely juxtaposed to each other fore and aft in a direction of air flow so that coolant circuits of the unit heat exchangers are connected in series, each unit heat exchanger comprising partitioning means (9, 29) fixed inside at least one of the headers so as to divide an internal space thereof into at least two sections in a manner such that the coolant paths in the unit heat exchangers are meanders which make zigzag turns caused by the partitioning means, the coolant flowing from one unit heat exchanger lying on the leeward side, into the other unit heat exchanger standing to the windward side of the air flow, the sections including an inlet section formed in the unit heat exchanger lying on the leeward side and an outlet section formed in one of the other unit heat exchangers standing to the windward side, a coolant inlet pipe being connected to the inlet section, whilst a coolant outlet pipe is connected to the outlet section, the total cross sectional area of the coolant paths formed through the tubes connected to the outlet section being

smaller than that formed through the other tubes connected to the inlet section, wherein heat exchange capacity of the leeward unit heat exchanger is greater than that of the windward unit heat exchanger. "

"7. A condenser comprising two unit heat exchangers which respectively comprise a plurality of flat tubes arranged parallel with each other and fins each interposed between one of such tubes and the next, with opposite ends of each tube being respectively connected to a pair of hollow headers in fluid connection therewith, the unit heat exchangers being closely juxtaposed to each other fore and aft in the direction of air flow wherein coolant circuits of the unit heat exchangers are connected in parallel with each other so that the coolant flows simultaneously through the unit heat exchangers and the coolant circuit of each heat exchanger is formed in a meandering pattern to make U-turns, by means of at least one partition means secured in at least one header and wherein the number of U-turns of the coolant within the leeward unit heat exchanger is greater than that within the windward unit heat exchanger, so that a total length of the flow paths in the former is greater than that in the latter."

II. The patent was opposed by the Appellant who requested the revocation of the patent in accordance with Article 100(a) EPC on the ground that the granted claims do not define new and inventive subject-matter.

The opposition was supported *inter alia* by the following document:

(E2) DE-B-1 072 257

III. By decision dated 19 March 1997 the Opposition Division rejected the opposition.

The Opposition Division held that the subject-matter of independent Claims 1 and 7 cannot be derived in an obvious manner from the cited prior art documents and accordingly involves an inventive step.

IV. On 22 May 1997 the Appellant lodged an appeal against the decision paying the appeal fee and submitting the Statement of Grounds of Appeal on the same day.

In the Statement of Grounds of Appeal the Appellant cited for the first time the document

(E5) EP-A-0 255 313

The Appellant submitted that the subject-matter of the contested patent results in an obvious manner from a combination of (E2) and (E5).

V. Following the communication pursuant to Article 11(2) RPBA dated 17 November 1998 in which the Board expressed its provisional opinion oral proceedings were conducted on 28 October 1999.

VI. The Appellant requested that the decision under appeal be set aside and that the patent be revoked. The Appellant's arguments were essentially as follows:

The answer to the question what a skilled person would have done in the light of the state of the art depends on the technical result he intends to achieve. This is confirmed by the decisions T 2/83 and T 939/92 of the Boards of Appeal. According to the further decision T 24/81 objectivity in the assessment of inventive step

is achieved by starting out from the objectively ruling prior art in the light of which the technical problem is determined whereupon the issue of inventive step is answered.

Having regard to the relevant prior art disclosed by (E2) the features remaining in Claim 1 relate to the flat configuration of the tubes and to the arrangement of partitioning means in the headers.

Owing to the pointer in (E2) to the provision of the tubes with lamellae or ribs it is cogent for the skilled person to combine the heat exchangers known from (E2) and (E5).

The skilled person will arrange the duplex heat exchanger known from (E2) such that its condenser unit is arranged in one plane. He will split up the heat exchanger described by (E5) into two parts connected in series as shown by (E2).

The above-cited pointer in (E2) induces the skilled person also to make use of flat tubes. Thus, by combining (E2) and (E5) Claim 1 will be arrived at in an obvious manner.

The feature according to Claim 7 that the unit heat exchangers are connected in parallel with each other is no more than a trivial solution since the connection of unit heat exchangers can be effected only in parallel or in series arrangement. Furthermore, the proposal that the number of U-turns within the leeward unit heat exchanger is greater than within the windward unit heat exchanger results from the smaller temperature difference of the fluids within the former unit.

VII. The Respondent (Patentee) requested that the appeal be dismissed and that the patent be maintained as granted (main request) or according to the auxiliary request filed with Fax dated 17 September 1999. The Respondent's arguments were essentially as follows:

The inherent technical problem of the invention is indicated in column 1, lines 42 to 45 of the patent. Starting out from (E2) it cannot be seen for what reason the skilled person should go to (E5) since there is no cross-reference between (E2) and (E5). If he did so nevertheless, it would be only with the benefit of hindsight and such combination would anyway not result in the claimed invention.

The statement in column 4, first sentence, of (E2) also does not give any motivation to go to (E5) since this passage emphasises that it is irrelevant whether the tubes are provided with lamellae and ribs, respectively, or not.

No combination of (E2) and (E5) would lead to Claim 1 or Claim 7 as (E5) does not relate to duplex condensers as required by the teaching of Claim 1 and Claim 7, respectively. This applies the more to Claim 7 as nothing in the prior art discussed relates to a connection of the unit heat exchangers in parallel. Modifying (E2) such that it corresponds with the features of Claim 1 and Claim 7, respectively, would presuppose an unreasonable mosaicing of prior art documents for which there is no incentive.

Reasons for the Decision

1. The appeal is admissible.
2. *Main request*
- 2.1 Novelty

In the judgement of the Board the closest prior art with regard to Claim 1 is described by (E2).

Claim 1 differs from this prior art by the following features:

- (a) the tubes are flat
- (b) each unit heat exchanger comprises partitioning means fixed inside at least one of the headers so as to divide an internal space thereof into at least two sections in a manner such that the coolant paths in the unit heat exchangers are meanders which make zigzag turns caused by the partitioning means.

Claim 7 differs additionally by the following feature:

- (c) the coolant circuits of the unit heat exchangers are connected in parallel with each other for simultaneous flow of the coolant through the unit heat exchangers.

It derives from the foregoing that the subject-matter of Claim 1 as well as that of Claim 7 is novel. Since novelty was not disputed by the Appellant in the appeal proceedings, this issue requires no further argument.

2.2 Inventive step

2.2.1 In the condenser described by (E2), the leeward heat exchanger comprises two headers (2, 4) positioned side by side and connected by a number of parallel round tubes arranged in a meandering pattern to make U-turns in a plane rectangular to the longitudinal axes of the headers. As can be seen from the single figure of (E2) the known condenser requires a large dimension in the direction of the air stream. Furthermore, due to the tubes of the heat exchangers having a circular cross-section, the efficiency of heat exchange is low.

The problem to be solved is therefore seen in providing a condenser which is adapted to increase the heat transfer capacity thereof without necessitating an excessively wide space.

It is undisputed that Claim 1 solves the underlying problem whereby in particular the flat configuration of the tubes increases the heat transfer capacity and the arrangement of the tubes in the form of meanders which make zigzag turns caused by the partitioning means in the headers leads to a small extension of the condenser in the direction of the air stream.

The choice of (E2) as the starting point in view of the relevant prior art and the definition of the technical problem effectively solved by Claim 1 are in accordance with the case law of the Boards of Appeal and in particular with the decisions T 2/83, T 939/92 and T 24/81 cited by the Appellant. Since no objection was raised by the Appellant in this respect, this issue necessitates no further argument.

2.2.2 The skilled person faced with the underlying problem as outlined above appears to be motivated to decrease the distance between the headers (2) and (4) of (E2) in order to reduce the extension of the condenser in the direction of the airstream. However, due to the space occupied by the U-turns of the tubes (3) this solution would have only a limited effect with regard to space saving and would not at all improve the heat transfer capacity. As an alternative, the replacement of the leeward heat exchanger unit (2, 3, 4) by a heat exchanger unit identical basically with the windward heat exchanger unit (6, 7a, 7, 8, 9, 9a, 10) would in fact reduce the bulkiness of the condenser, but would also not solve the aspect of increasing the heat transfer capacity. Both of the cited solutions would not lead to Claim 1 since the above-cited features (a) and (b) (see section 2.1) would be missing.

2.2.3 (E5) was cited after expiry of the period allowed for filing an opposition. Since the disclosure of (E5) corresponds substantially with JP-A-63-34466 which was cited in the European Search Report and has been discussed in the introductory part of the description of the patent, (E5) is regarded as having been introduced into the proceedings in time.

(E5) describes a condenser comprising a single unit heat exchanger which has a plurality of flat tubes arranged parallel with each other and fins each interposed between adjacent tubes with opposite ends of each tube being connected to a pair of headers in fluid connection therewith, the heat exchanger comprising partitioning means fixed inside at least one of the headers so as to divide an internal space thereof into at least two sections in a manner such that the coolant paths in the heat exchanger are meanders which make zigzag turns caused by the partitioning means.

The skilled person faced with the problem of improving a condenser consisting of a number of unit heat exchangers being closely juxtaposed to each other fore and aft in a direction of air flow with regard to compactness will look for possible solutions to this problem in the field of condensers comprising each a plurality of unit heat exchangers. For solving the cited problem the totality of the heat exchanger units of the condenser has to be taken into account since each unit heat exchanger unit contributes to the volume occupied by the condenser. It is, therefore, doubtful whether the skilled person will take into closer consideration the disclosure of (E5) which relates only to a single heat exchanger unit.

When considering nevertheless a combination of (E5) with (E2) the question arises which part of (E2) should be replaced by the heat exchanger disclosed in (E5).

Having regard to the process occurring in the condenser known from (E2) the leeward unit (2, 3, 4) serves mainly the purpose of condensing the fluid whereas in the windward unit (6, 7, 9, 10) besides condensing the remaining gaseous fluid, supercooling of the condensed fluid is mainly effected (see column 3, lines 9 to 28).

In the condenser disclosed by (E5), sections (A), (B) and (C) are provided in which section (A) is a condensing section, section (B) is a zone in which gas and liquid are present and section (C) is a supercooling section where the coolant is in its liquid state (see Figures 1 and 8 with pertinent description, in particular column 2, line 50, to column 3, line 4, and column 4, line 49, to column 5, line 13).

It follows from the above that the single-unit condenser known from (E5) corresponds in functional respect to the two-unit condenser according to (E2). It would, therefore, seem to be reasonable for the skilled person, if he should intend to make any substitution at all, to substitute the condenser known from (E5) for the whole of the condenser known from (E2). By such substitution, the subject-matter of Claim 1 which requires a condenser comprising at least two unit heat exchangers would, however, not be arrived at.

- 2.2.4 In column 4, first sentence, of (E2) the information is given that it does not matter with regard to the invention whether the tubes are provided with lamellae, respectively ribs, or not. The opinion of the Appellant that this information leads the skilled person to envisage a combination of (E2) and (E5), in particular to make use of flat tubes, cannot be followed. Since the cited passage teaches that it is of no relevance whether the tubes are provided with lamellae, respectively ribs, or not, the skilled person is informed rather to direct his attention away from providing the tubes with such particular means for transferring heat from the tubes to the air stream as this issue is completely irrelevant for the invention disclosed by (E2).

The Appellant argues further that in combining the teachings of (E2) and (E5) the skilled person will modify the condenser known from (E5) such that it comprises two units arranged in series. This argument appears to the Board to be artificially construed as there is no pointer in (E5) that separation of the condenser into at least two units may be advantageous. Moreover, splitting-up of the single unit condenser

into two units arranged one behind the other in the direction of the air stream would counteract the problem of avoiding a wide space for accommodating the condenser. This argument is therefore based on an impermissible *ex post facto* analysis.

- 2.2.5 If follows from the above considerations that the condensers described by (E2) on the one hand and by (E5) on the other hand relate to fundamentally different concepts according to which the subsequent process steps of condensing and supercooling are effected in a two-unit condenser (E2) and in a single unit condenser (E5), respectively. These different concepts are incompatible with each other in the sense that it is unreasonable to transfer particular elements between these condensers without making at the same time further substantial amendments for which the citations provide no motivation.

It is observed in this context that it is irrelevant with regard to the result obtained whether one starts from (E2) or, as advocated by the Respondent, from (E5) as the relevant prior art since the question of the correct starting point has no bearing in the present case on the fact that the condensers known from (E2) and from (E5) are based on different operational concepts.

The teaching of Claim 1 is not, therefore, obvious from a combination of (E2) and (E5).

The above considerations apply basically also to the subject-matter of Claim 7 which comprises substantially all the features of Claim 1 except for the arrangement of the unit heat exchangers in series. Claim 7 includes the additional feature (c) that the coolant circuits of the unit heat exchangers are connected in parallel with

each other for simultaneous flow of the coolant through the unit heat exchangers. Neither of the citations (E2) and (E5) discussed by the Appellant discloses the arrangement of unit heat exchangers in parallel so that also for this reason Claim 7 is not arrived at in an obvious manner by these citations.

The remaining documents (E1), (E3) and (E4) discussed in the opposition proceedings were no longer taken up by the parties in the oral proceedings. The Board is satisfied that these documents can also not jeopardize the validity of the patent.

- 2.2.6 Summarising, the Board comes to the conclusion that the subject-matter of Claim 1 and of Claim 7, respectively, according to the main request involves an inventive step (Article 56 EPC).

Dependent Claim 2 to 6 relating to particular embodiments of the invention in accordance with Rule 29(3) EPC are likewise to be maintained.

3. Auxiliary request

Since the main request of the Respondent is allowed consideration of the auxiliary request is without object.

Order

For these reasons it is decided that:

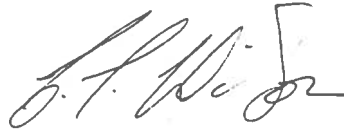
The appeal is dismissed.

The Registrar:



N. Maslin

The Chairman:



C. T. Wilson

in MS

