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File Number: T 515/91 - 3.2.3

Application No.: 88 303 098.3

Publication No.: 0 286 399

Title of invention: Heat exchanger fabricated from polymer compositions

Classification: F28F 21/06, F28D 1/03

D E C I S I O N
of 23 April 1993

Applicant: Du Pont Canada Inc., et al

Headword:

EPC Articles 52(1) and 56

Keyword: "Inventive step (yes) - prejudice in the art arising from the standard literature - corroboration of problem - solution approach"



Case Number : T 515/91 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 23 April 1993

Appellant : Du Pont Canada Inc.
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Representative : Ellis, Edward Lovell et al.
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Decision under appeal : Decision of the Examining Division 2.3.01.074 of
the European Patent Office dated 5 December 1990,
issued in writing on 14 February 1991 refusing
European patent application No. 88 303 098.3
pursuant to Article 97(1) EPC.

Composition of the Board :

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

Summary of Facts and Submissions

- I. European patent application No. 88 303 098.3 filed on 7 April 1988 and published on 12 October 1988 under No. 0 286 399 was refused by a decision of the Examining Division taken at the oral proceedings on 5 December 1990 with written reasons posted on 14 February 1991.

- II. The decision was based on Claim 1 filed with the letter of 21 August 1990 and Claims 2 to 8 as published.

The reason given for the refusal was that the subject-matter of Claim 1 did not involve an inventive step having regard to the prior art disclosed in DE-U-8 420 082 and in DE-A-1 952 785.

- III. On 23 April 1991, the Appellant (Applicant) filed by telefax, confirmed by letter of 23 April 1991, received on 29 April 1991, a notice of appeal against that decision, paying the appeal fee in due time. The Statement of Grounds of Appeal was filed by telefax on 21 June 1991 and confirmed by letter of 21 June 1991, received on 24 June 1991 together with a new Claim 1 according to the main request. Amended sets of Claims 1 to 9 according to a first and a second auxiliary request were filed with the letter of 26 June 1991, received on 1 July 1991.

- IV. In a communication pursuant to Article 110(2) EPC dated 12 March 1993, following a consultation between the Rapporteur and the representative, the Board gave its provisional opinion that Claim 1 according to the main request filed with the Statement of Grounds of Appeal seemed to be basically acceptable but appeared not to have been delimited properly vis à vis the relevant prior art reflected by the document DE-U-8 420 082.

V. With the letter of 23 March 1993, the Appellant filed a new Claim 1 and new pages 3a and 6 of the description. After a further discussion by telephone between the Rapporteur and the representative, revised pages 1, 3a, 4, 9, 11 and 14 were submitted with the letter of 31 March 1993.

VI. The effective Claim 1 reads as follows:

"1. A liquid to gas panel heat exchanger comprising a generally planar panel having a pair of unitary outer walls formed from sheets of a polymeric material, these outer walls being circumferentially bonded together and further bonded together to define inlet and outlet header areas and a labyrinth of fluid passages between these inlet and outlet header areas, characterised in that the outer walls are formed from sheets of a composition of an aliphatic polyamide coated with an inner layer of a material that promotes bonding together of the sheets, the sheets having a thickness in the range of 0.12 to 0.5 mm."

VII. The Appellant requests to set aside the contested decision and to grant a patent on the basis of the following document:

Claims: Claim 1 filed with letter of 23 March 1993, received on 25 March 1993;
Claims 2 to 8 as originally filed.

Description: Pages 1, 3a, 4, 9, 11 and 14 filed with letter of 31 March 1993, received on 1 April 1993;

Pages 2, 5 and 7 as originally filed;
Pages 3, 8, 12 and 13 filed with letter of
3 April 1990, received on 6 April 1990;
Page 10 filed with letter of 21 August 1990,
received on 23 August 1990;
Page 6 filed with letter of 23 March 1993,
received on 25 March 1993.

Drawings: Sheet 1/1 as originally filed.

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC; it is admissible.
2. Amendments (Article 123(2) EPC)
- 2.1 Claim 1 is supported essentially by original Claim 1.

The term "liquid to gas panel heat exchanger" in Claim 1 derives from page 1, lines 3 to 5 in combination with page 3, lines 25 to 32 of the original description.

The feature according to Claim 1 that the outer walls are formed from sheets of a composition of an aliphatic polyamide coated with an inner layer of a material that promotes bonding together of the sheets, derives from page 8, line 33 to page 9, line 5 in combination with page 5, paragraph 4, page 6, paragraph 2 and page 10, lines 16 to 19 of the original description.

The further feature according to Claim 1 that the sheets have a thickness in the range of 0.12 to 0.5 mm is disclosed in the passage bridging pages 10 and 11 of the original description.

The fact that the term "thermoplastic polymer" in original Claim 1 has been replaced by the term "polymeric material" in present Claim 1 does not contravene Article 123(2) EPC since the particular polymeric material claimed, namely polyamide, constitutes a thermoplastic material.

The feature according to original Claim 1 that the fluid passages between the outer walls of the heat exchanger panel occupy a substantial proportion of the area of the panel has been omitted from present Claim 1. This omission does not lead, in the Board's view, to the application being amended in such a way that it contains subject-matter which extends beyond the content of the application as filed. The panel according to Claim 1 serves the purpose of heat exchange and will therefore utilise, as is usual with heat exchange panels, a substantial proportion of its area for this purpose.

2.2 As a result of the preceding considerations, Claim 1 is not objectionable under Article 123(2) EPC.

3. Novelty

Having examined the prior art documents indicated in the European Search Report as to their relevance, the Board is satisfied that none of them discloses a liquid to gas panel heat exchanger including all the features stated in Claim 1. Since this has not been disputed in the proceedings before the first instance, there is no need for detailed substantiation of this matter.

4. Closest prior art, problem and solution

Considering the subject-matter of independent Claim 1, the nearest prior art, in the view of the Board, is described

by DE-U-8 420 082 (D1). This citation discloses all the features according to the precharacterising portion of Claim 1 including the feature that the outer walls of the heat exchanger are bonded together to define a labyrinth of fluid passages between inlet and outlet header areas. This feature is disclosed in the embodiment according to Figures 7 and 8 of D1 which shows cylindrically shaped elevations (28) connecting the pair of unitary outer walls (26,30). It is clear that the elevations (28) arranged in the channel (32) and formed between the outer walls cause the fluid particles to follow a flow path within the channel between the inlet and outlet header areas which avoids the obstacles formed by the elevations so that the channel constitutes a labyrinth of fluid passages in the general meaning of the term "labyrinth".

Claim 1 is thus correctly delimited over D1 (Rule 29(1)(a) and (b) EPC).

In D1, it is stated on page 8, paragraph 3 that high-pressure cross-linked polyethylene has been found to be particularly suitable for the panels and connecting pipes used in the heat exchanger.

In the Statement of Grounds of Appeal, the Appellant observed that polyethylene has a melting point in the range of about 100 to 130°C which restricts the use of the known heat exchanger to a relatively low temperature range.

The inherent problem the Appellant has set himself is to be seen in providing a liquid to gas panel heat exchanger made of sheets of a polymeric material of the type described by D1 which is intended for use at elevated temperatures and affords an increased effectiveness of

exchange of heat (cf. also page 1, paragraph 2 and the passage bridging pages 7 and 8 of the original description).

The features according to Claim 1 that the outer walls are formed from sheets of a composition of an aliphatic polyamide coated with an inner layer of a material that promotes bonding together of the sheets, the sheets having a thickness in the range of 0.12 to 0.5 mm, allow for use of the heat exchanger at significantly elevated temperatures. As arises from the standard literature, see e.g. "ABC Naturwissenschaft und Technik", Verlag Harri Deutsch, Leipzig, 1980, Catchwords "Polyamide" and "Polyethylene" on page 923, the melting point of 6,6 - polyamide is at 250°C which is substantially above the melting point of polyethylene in the range of 125-130°C.

Furthermore, there is no reason to doubt the statement of the Appellant that within the panel thickness range indicated in Claim 1, the transmission of heat through the wall tends to become substantially independent of wall thickness, and thus wall thickness may become a minor or insignificant factor in the operating effectiveness of the heat exchanger (see page 11, lines 1 to 6 and the passage bridging pages 13 and 14 of the original description).

In the Board's view, the above-cited problem is solved by the subject-matter of Claim 1.

5. Inventive step

- 5.1 The first instance based their negative attitude in respect of an inventive step primarily on the disclosure of the document DE-A-1 952 785 (D2).

D2 discloses a generally planar panel comprising a pair of unitary outer walls formed from sheets, the outer walls being circumferentially bonded together and further bonded together to define areas and passages for fluid. The outer walls may be formed from sheets of synthetic thermoplastic material, inter alia, of polyamide.

The citation discloses further that when forming the walls from metal webs or metal sheets, heat exchange panels, e.g. flexible heating or cooling panels, with a heat transfer fluid flowing through the chambers or in channels may be produced. Radiators or other heat transfer devices of planar shape may be manufactured by means of two metal plates with an intervening layer of a flexible plastic.

There is, however, no passage in the citation which suggests the use of sheets of polyamide per se in panel heat exchangers, let alone of sheets of polyamide having a thickness in the range of 0.12 to 0.5 mm.

5.2 Starting out from the closest prior art reflected by D1 the skilled person may come across the prior art described in D2 in the search for a solution to his problem. He might have the idea of replacing the unitary outer walls formed from sheets of high pressure polyethylene of the heat exchanger according to D1 by the corresponding outer walls formed by a construction of two metal plates with a flexible layer of synthetic plastic material between the plates as disclosed by D2. He would thereby arrive at a heat exchanger having outer walls consisting of a multi-layered structure of metal and flexible synthetic material. Due to the fact that each of these layers would, for reasons of sufficient mechanical strength, be required to have a minimum thickness at least of the value indicated in present Claim 1 for the polyamide sheet, the outer walls thus formed would be of a substantial

thickness and would therefore not be appropriate for solving the underlying problem in respect of an effective heat transfer.

- 5.3 The first instance argued in the contested decision that although in D2 the use of the known article for a panel heat exchanger is only suggested in connection with metal support plates for the polymer sheets, no indication can be found in the publication that the polyamide walls without the metal support are not suitable for a panel heat exchanger. It was further argued that the skilled person would be aware of the fact that the physical properties of polyamide which are important for heat transfer applications are comparable to the properties of polyethylene; it would therefore be obvious to replace polyethylene by a polyamide which is also widely used in almost all technical fields.

This line of argument cannot be followed by the Board.

The statement in the contested decision relating to the comparability of polyamide with polyethylene is not pertinent as far as the use of these materials for heat exchange purposes is concerned since the melting temperatures of these materials, which constitute a decisive factor to be taken account of in heat exchange applications in the case of use intended at elevated temperatures, differ fundamentally (see section 4 above).

Furthermore, the statement of the contested decision "no indication can be found in the publication that the polyamide walls are not suitable for a panel heat exchanger ..." with the subsequent conclusion of obviousness of the use of polyamide sheets as such for heat exchange panels is not in line with the jurisprudence of the Boards relating to inventivity. It is set out, for

example, in the decision T 2/83 published in OJ EPO 1984, 265 that, for a correct assessment of the issue of inventive step, the proper question to be asked is not whether the skilled person could have taken a certain measure but whether he would have done so in expectation of some improvement or advantage. In the present case, D2 teaches, however, the concept of a heat exchanger panel of two metal plates with a flexible layer of synthetic plastic material between the plates rather than a heat exchanger panel having outer walls formed from sheets of polyamide per se of a thickness as defined in Claim 1.

- 5.4 The Appellant put forward that skilled persons at the time of the invention would have regarded polyamides as being insulators rather than effective transmitters of heat for the end-use envisaged for the heat exchangers of the invention. This would have been apparent to the patentees of D2 who teach a construction of two metal plates with a flexible layer of synthetic plastic material between the metal plates. The Appellant further maintained that polyamides though being known for over 50 years, have not been used in the construction of panel heat exchangers in the manner defined in Claim 1 and that there existed a prejudice in the art against such use.

In fact, the standard literature, see e.g. "ABC Naturwissenschaft und Technik", quoted in above section 4, Catchwords "Plastics" on page 913 and "Polyamide" on page 923, discloses that polyamides have good insulating properties in general, including good thermal insulating properties. Considering that this disclosure originates from a general technical encyclopedia and in the absence of evidence to the contrary, the Board is of the opinion that the existence of a prejudice in the art against the use of sheets of polyamide per se as the walls of a heat exchanger panel may be acknowledged. Such a factor is not

to be regarded as a substitute for the technically skilled assessment of the invention vis à vis the prior art, in particular according to the problem-solution approach as applied in the above section of the "Reasons for the Decision", but constitutes an indication corroborating further the fact that inventive step is involved (see also Decision T 24/81 of 13 October 1982, published in OJ EPO 1983, 133).

- 5.5 As outlined above, even if D2 were combined with D1, neither the object of the invention would be achieved nor the solution thereof as indicated in the characterising portion of Claim 1 would be arrived at.

The further documents cited in the search report all lie further away from the subject-matter of Claim 1 and the Board is satisfied that none of them suggests to adapt the heat exchanger disclosed in D1 to include all the features of Claim 1.

- 5.6 For the foregoing reasons it must be concluded that Claim 1 is based on an inventive step within the meaning of Article 56 EPC and the claim can be allowed having regard to Article 52(1) EPC.

6. Dependent Claims 2 to 8 concern particular embodiments of the heat exchanger according to Claim 1 and are thus also allowable.

7. The description now on file is in agreement with the actual wording and scope of the claims. These documents may therefore form the basis for the grant of a 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 a patent on the basis of the documents set out under above section VII.

The Registrar:



N. Maslin

The Chairman:



C.T. Wilson

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C.T. Wilson
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