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Datasheet for the decision of 17 May 2010

Case Number: T 2029/07 - 3.3.09

Application Number: 98964150.1

Publication Number: 1040158

IPC: C08J 9/00

Language of the proceedings: EN

Title of invention:
Microcellular foam extrusion/blow molding process and article made thereby

Patentee:
Trexel, Inc.

Opponent:
CLARIANT INTERNATIONAL LTD.

Headword:
-

Relevant legal provisions:
EPC Art. 123(2)

Relevant legal provisions (EPC 1973):
EPC Art. 84, 54, 56

Keyword:
"Amendments - added subject-matter (no)"
"Clarity (yes)"
"Novelty (yes)"
"Inventive step (yes)"

Decisions cited:
T 0246/91

Catchword:
–

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 2029/07 **-** 3.3.09

D E C I S I O N
of the Technical Board of Appeal 3.3.09
of 17 May 2010

Appellant: (Opponent)
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Decision under appeal:
Decision of the Opposition Division of the European Patent Office announced orally on 20 November 2007 and issued in writing on 10 December 2007 rejecting the opposition filed against European patent No. 1040158 pursuant to Article 102(2) EPC 1973.

Composition of the Board:

Chairman: W. Sieber
Members: M. O. Müller
W. Sekretaruk

Summary of Facts and Submissions

I. European patent No. 1 040 158 was granted in respect of European patent application No. 98964150.1, which was filed in the name of TREXEL, INC. as international patent application PCT/US1998/027118 on 18 December 1998, claiming priority from US 68173 P (19 December 1997) and US 107754 P (10 November 1998). The mention of grant was published on 2 March 2005 in Bulletin 2005/09. The granted patent contained 49 claims of which the two independent Claims 1 and 34 read as follows:

"1. An article comprising:
a blow molded, foam, microcellular, polymeric article, wherein the article has an average cell size of less than 100 µm."

"34. A method comprising:
providing a polymeric microcellular foam parison; and blow molding the parison to form a blow molded, foam, microcellular polymeric article having an average cell size of less than 100 µm."

II. A notice of opposition was filed on 2 December 2005 by Clariant International Ltd. requesting revocation of the patent in its entirety on the grounds that the claimed subject-matter was neither novel nor inventive (Article 100(a) EPC 1973) and that the patent did not disclose the invention in a manner sufficiently clear and complete for it to be carried out by the person skilled in the art (Article 100(b) EPC 1973).

III. The documents cited during opposition proceedings included:

D4: US 3,225,127 A;

D6a: Cellular and Microcellular Materials, MD volume 53, ASME 1994, pages 109 - 124;

D9: WO 97/16476 A;

D12: Cellular and Microcellular Materials, MD volume 53, ASME 1994, pages 125, 127 and 139;

D13: Cellular and Microcellular Materials, MD volume 76, ASME 1996, pages 1, 2, 27, 47 and 48;

D13a: Cellular and Microcellular Materials, MD volume 76, ASME 1996, pages 33 - 36 and 71 - 74;

D16: US 4,874,649 A; and

D18: P. W. Atkins, "Physikalische Chemie", 1st edition, VCH, 1987, pages 158 and 159.

IV. In a decision announced orally on 20 November 2007 and issued in writing on 10 December 2007, the opposition division rejected the opposition.

The opposition division held ***inter alia*** that novelty of the opposed patent was to be acknowledged in view of D9 as this document did not disclose a blow molded article with an average cell size as cited in Claims 1 and 34. Furthermore, according to the opposition division, the subject-matter of the opposed patent was inventive. In

particular, D4, rather than D9, constituted the closest prior art and starting from D4, an average cell size as cited in independent Claims 1 and 34 was not obvious.

V. On 17 December 2007, the appellant (opponent) filed a notice of appeal against the above decision and paid the prescribed fee on the same day. A statement setting out the grounds of appeal was filed on 11 April 2008.

The following documents were submitted with the statement of grounds of appeal and subsequent letter of 14 July 2008:

D17: J. F. Stevenson (ed.), "Innovation in Polymer Processing Molding", Carl Hanser Verlag Munich, Vienna, New York, 1996, chapter 3, pages 94 - 149;

D20: D. F. Baldwin, "Microcellular Polymer Processing and the Design of a Continuous Sheet Processing System", PhD Thesis, Massachusetts Institute of Technology, Cambridge, MA 1994;

D21: Kunststoff-Taschenbuch, 17th edition, Carl Hanser Verlag München, 1967, pages 119 - 123; and

D22: Confirmation of MIT Libraries about public availability of D20.

VI. By letter of 4 January 2008, the respondent (proprietor) requested, as its main request, that the appeal be dismissed, ie that the opposed patent be maintained as granted. With letter of 19 April 2010, the respondent filed six sets of claims as auxiliary requests 1 - 6.

VII. On 17 May 2010, oral proceedings were held before the board. The respondent withdrew the main request and all auxiliary requests and submitted Claims 1 - 15 as its new and sole request. Claim 1 of this request reads as follows:

"1. A method comprising:
providing a polymeric microcellular foam parison by extrusion from a single phase solution of supercritical blowing agent in an amount of less than 3 % by weight blowing agent based on the weight of the polymeric stream and the blowing agent, and polymeric material and
blow molding the parison to form a blow molded foam, microcellular polymeric article comprising a polymeric semi-crystalline material and a nucleating agent in an amount of from 2,5% to 7% by weight, by weight of the polymeric material, and having an average cell size of less than 100 µm."

The remaining claims are dependent claims directed to elaborations of the subject-matter of Claim 1.

VIII. The appellant's position in the written and oral proceedings, in as far as relevant to the present decision, was as follows:

D4 was directed to the same technical area as the opposed patent, namely the blow molding of foam bottles. Therefore, D4 constituted the closest prior art.

Example I of D4 disclosed a process wherein a foamed polyethylene parison was prepared and the foamed

parison was inflated with air and formed into a foamed polyethylene bottle.

In column 3, lines 21 - 25, D4 disclosed that solid blowing agents, which according to D9 represented nucleating agents, were preferred and would be used in an amount of 0.01 to 5 weight %. Hence, D4 disclosed the use of nucleating agents in an amount overlapping with that cited in Claim 1. Irrespective of this, it was already known from the third paragraph of page 17 of D9 to use nucleating agents in an amount of 0.1 to 10 wt%. Finally, it followed from Example 4 of the opposed patent that even without any nucleating agent, foams with desired properties were obtained. Consequently, the opposed patent did not provide any proof of an unexpected advantageous effect linked to the use of a nucleating agent. For all these reasons, said use of a nucleating agent could not support inventive step.

D4 was silent about the further features of Claim 1, namely the cell size, the use of a supercritical blowing agent as well as the amount thereof. However, these features could not contribute to inventive step either.

As to the cell size of the foam, the foam of Example 10 of the opposed patent had a cell size above the upper limit of the range cited in Claim 1. Nevertheless there was no indication in this example that the obtained foam was inferior to those having a cell size according to Claim 1. The objective problem solved by the cell size required by Claim 1 was thus the provision of an alternative foam. The claimed alternative was already

known from Table 7 of D9, where foam strands with cell sizes within the range cited in Claim 1 were disclosed. The alternative furthermore formed part of common general knowledge as represented by D12, D13, D13a, D17, and D18, optionally further combined with D20. Finally, even if one were to assume that the objective technical problem was the provision of foamed articles with better physical properties, the solution to this problem would already have been known on the basis of the last paragraph of the chapter "Introduction" on page 2 of D13.

As to the use of a supercritical blowing agent, it was already known from page 123 of D6a that microcellular foams could be produced with supercritical blowing agents. The same followed from page 111 of D17. The use of supercritical blowing agents thus could not contribute to inventive step.

Finally, as to the amount of supercritical blowing agent, it could be deduced from Table 7 of D9 that in order to obtain small cell sizes, one had to apply less blowing agent. Furthermore, any proof of an unexpected surprising effect linked to an amount of blowing agent as cited in Claim 1 was absent in the opposed patent. The use of blowing agent amounts as required by Claim 1 thus did not provide any inventive contribution.

With regard to the respondent's argument that D16 proved that it was not possible to produce a blow molded microcellular article with the process of D4, the appellant noted that D16, as a single patent document, could not provide sufficient proof for the respondent's allegation. On the contrary, it followed

from page 252 of D20 that microcellular foam technology could be extended to blow molding.

On the basis of the above, the appellant concluded that the subject-matter of Claim 1 lacked inventive step.

During the written proceedings, the appellant further held that the melt flow cited in the opposed patent lacked clarity as no temperature was given at which the melt flow was to be measured. This objection was not pursued during the oral proceedings of 17 May 2010.

IX. The respondent's position in the written and oral proceedings, in as far as relevant to the present decision, was as follows:

In the same way as the opposed patent, D4 was directed to a blow molding process. D4 thus constituted the closest prior art.

The blowing agents disclosed in D4 could not be considered as nucleating agents on the basis of D9 as this document referred to a specific context different from that of D4. Consequently, no disclosure of nucleating agents was present in this document. Irrespective thereof, the preferred amount of blowing agent in D4 was 0.1 to 1 wt%. Hence, even if one were to consider the blowing agents of D4 to be nucleating agents, this would not prejudice inventive step as the amounts applied in D4 were below the lower limit of the range cited in Claim 1.

As set out in paragraph [0033] of the opposed patent, low amounts of blowing agent resulted in foams with

improved surface quality. As confirmed by Examples 4, 5, 10 and 16 of the opposed patent, microcellular blow molded articles could be obtained with low amounts of supercritical blowing agents only if a nucleating agent was applied during the foaming process. This was particularly surprising as it followed from a comparison of Examples 4 and 5 of the opposed patent that in the absence of nucleating agents, higher blowing agent amounts led to smaller cells. Hence, the skilled person aiming at small cell sizes would have applied high blowing agent amounts, contrary to what is required by Claim 1. The prior art did not give any indication as to this effect. Hence, the application of nucleating agent amounts in combination with supercritical blowing agent amounts as required by Claim 1 was inventive.

Furthermore, D4 was silent about the cell size of the blow molded foam. As confirmed by D16, one would have expected that when blow molding a microcellular article, the microcellular structure of the article would be destroyed. The skilled person reading D4 would thus not have expected that with the process of D4, blow molded microcellular foams could be obtained. As was set out in paragraph [0058] of the opposed patent, surprisingly, this was possible by means of the claimed process. The cell size as cited in Claim 1 was further not obvious in view of D13 as this document did not deal with the question of whether microcellular materials could be blow molded.

Finally, neither D4 nor D9 disclosed any supercritical blowing agent. Furthermore there was no link between the disclosure of D4 and D6a or D17. Hence, the skilled

person would not have applied the supercritical blowing agent cited in D6a or D17 in D4. Doing so would have been based on hindsight.

For the above reasons, the claimed subject-matter was inventive.

X. The appellant requested that the decision under appeal be set aside and that the European patent No. 1 040 158 be revoked.

XI. The respondent requested that the European patent be maintained on the basis of the request of 17 May 2010.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments - Article 123(2) EPC*

Claim 1 corresponds to granted Claim 34 with the additional features

(a) "by extrusion from a single phase solution of supercritical blowing agent in an amount of less than 3 % by weight blowing agent based on the weight of the polymeric stream and the blowing agent, and polymeric material", and

(b) "comprising a polymeric semi-crystalline material and a nucleating agent in an amount of from 2,5% to 7% by weight, by weight of the polymeric material"

Feature (a) is based on original Claim 117 in conjunction with original Claim 116, which is referred to in original Claim 117. Feature (b) is based on original Claim 6. The application as filed furthermore contains several pointers towards a combination of features (a) and (b). In particular, page 19, lines 25 - 28 of the application as filed discloses blowing agent amounts as cited in Claim 1 for the case where a nucleating agent is used. Additionally, Examples 3, 6 - 9, 11 - 14, 18 and 19 employ a combination of features (a) and (b), ie amounts of supercritical blowing agent in combination with amounts of nucleating agent as required by Claim 1. Consequently, such a combination is clearly and unambiguously derivable from the application as filed.

For the above reasons, Claim 1 meets the requirements of Article 123(2) EPC. This was not contested by the appellant.

Claims 2 - 15 correspond to granted Claims 35, 36 and 38 - 49. They were merely re-numbered with the necessary amendment of the back-references. The appellant did not raise any objections under Article 123(2) EPC against these claims, nor had the corresponding granted claims been objected to under Article 100(c) EPC 1973. The board does not see any reason either to raise an objection of its own in this connection.

3. *Amendments - Article 84 EPC 1973*

In the written proceedings, the appellant raised an objection under Article 84 EPC 1973 against the melt flow, which is now cited in Claim 12. This objection was not pursued by the appellant during oral proceedings.

Claim 12 corresponds to granted Claim 46. Consequently, the alleged unclarity, if it existed at all, was already present in the granted claims and thus cannot give rise to an objection under Article 84 EPC 1973 in opposition proceedings.

No further clarity objections were raised by the appellant. The board does not see any reasons why the amendments effected in the claims submitted during oral proceedings should give rise to any objection under Article 84 EPC 1973.

The claims, in as far as the amendments are concerned, therefore meet the requirements of Article 84 EPC 1973.

4. *Novelty*

4.1 Novelty of the subject-matter of the request filed during oral proceedings on 17 May 2010 was not contested.

4.2 The most relevant document D4 discloses a process for manufacturing blown thermoplastic hollow articles, such as bottles (column 1, lines 13 - 14). The process comprises forming a mixture of a plastic material and a blowing agent selected from the group of inert gases,

volatile liquids or finely divided solids, extruding said mixture through an orifice to form a foamed parison and blow molding said foamed parison (column 1, lines 53 - 63). The amount of blowing agent is generally in the range of 0.01 - 25 wt% of the plastic material. Solid foaming agents are preferred and are applied preferably in an amount of 0.1 to 1.0 wt% based on the plastic material (column 3, lines 17 - 25). In Example I of D4, a high density polyethylene is mixed with the powdered foaming agent azodicarbonamide and extruded to a foamed parison which is subsequently blow molded.

D4 is silent about the cell size of the blow molded foamed articles and furthermore does not disclose any supercritical blowing agent.

Furthermore, D4 does not explicitly disclose the application of any nucleating agent. The appellant argued in this context that the solid blowing agents cited in D4, apart from expanding the plastic material, additionally represented nucleating agents and referred to the third paragraph on page 17 and last paragraph on page 19 of D9. Even if one were to accept this argument, no information is present as to which part of the solid blowing agent in D4 would have to be considered as a blowing agent and which part as a nucleating agent. Hence, even if one assumes in the appellant's favour that nucleating agents are implicitly disclosed in D4, this document does not disclose a combination of the amount of nucleating agent and the amount of blowing agent as required by Claim 1, let alone the combination of nucleating agent and supercritical blowing agent.

Novelty in view of D4 therefore is acknowledged.

4.3 A further relevant document is D9. This document refers to the preparation of foams from cycloolefin copolymers. The blowing agents used in this process are selected from chemical and physical blowing agents (third paragraph of page 18 through the paragraph bridging pages 19 and 20). They are applied in an amount of 0.01 to 20 wt%, preferably 0.1 to 10 wt% (second paragraph on page 17). A nucleating agent may be present in an amount of 0.01 to 20 wt%, preferably 0.1 to 10 wt% (third paragraph of page 17). The nucleating agent may be identical to the blowing agent (last paragraph on page 19). The foams may be formed into blow molded articles (first paragraph on page 21, second paragraph on page 23 and lines 7 - 8 from the bottom of page 24).

D9 nowhere describes the application of a supercritical blowing agent. Furthermore, a foaming process in which an amount of nucleating agent and an amount of blowing agent as required by Claim 1 are applied is not part of the disclosure of D9. Finally, D9 nowhere discloses microcellular blow molded articles.

Therefore, the claimed subject-matter is novel in view of D9.

4.4 In addition, none of the further prior art documents cited by the appellant discloses all features of Claim 1, let alone a combination of said features.

4.5 Consequently, the subject-matter of the request filed during the oral proceedings of 17 May 2010 is novel.

5. *Inventive step*

5.1 Selection of the closest prior art

The opposed patent is directed to the provision of a process for preparing blow molded microcellular polymer articles (paragraphs [0020] and [0021]).

Although not disclosing the cell size of the articles, D4 is directed to the same field of application, ie the manufacture of blow-molded foamed polymer articles (title and column 1, lines 12 - 15). Consequently, as agreed by both parties, D4 can be considered to represent the closest prior art.

5.2 The objective technical problem

5.2.1 According to the opposed patent, the technical problem to be solved by the claimed process resides in the provision of blow molded microcellular foams with improved surface quality at reduced cost (paragraph [0033]). This is achieved by applying low blowing agent percentages in the presence of a nucleating agent (paragraph [0033]).

5.2.2 As discussed in T 246/91 of 14 September 1993 (point 4.4; not published in OJ EPO), "an objective definition of the technical problem to be solved should normally start from the technical problem that is described in the patent in suit. Only if it turns out that an incorrect state of the art was used to define the technical problem or that the technical problem disclosed has in fact not been solved, can an inquiry

be made as to which other technical problem objectively existed".

In the present case, the technical problem presented in the opposed patent (paragraph [0033], see point 5.2.1 above) follows the discussion of the prior art including closest prior art document D4 (paragraph [0011]). Thus, the proper document was used in the opposed patent for defining the technical problem.

Moreover, there is nothing available to the board which could call into question the success of the suggested solution. On the contrary, the board considers it credible that the technical problem has been solved by the features distinguishing the claimed subject-matter from D4. The reasons for this are as follows:

(a) It goes without saying that the less supercritical blowing agent that is applied in the foaming process, the less gaseous blowing agent has to leave the foamed article through its surface and the better the surface quality will be. Furthermore, the lower the amount of material applied in a process, the lower the process cost will be. Hence, it is credible that by applying low amounts of blowing agents, surface quality can be improved while production costs can be reduced.

(b) As confirmed by the examples in the opposed patent, blow molded foams that are microcellular can be produced with low amounts of blowing agents only if a certain amount of nucleating agent is present during the foaming process. In particular, in all examples where an amount of nucleating agent

within the range cited in Claim 1 is applied, ie Examples 3, 6 - 9, 11 - 14, 18 and 19, microcellular blow molded foams are obtained with amounts of blowing agents of at maximum 1.5 wt%. In Examples 4 and 5, however, where no nucleating agent is present, high amounts of blowing agent are needed, namely 4.8 wt% in Example 4 and 4.2 wt% in Example 5, to obtain a microcellular foam. Furthermore, in Example 16, where again no nucleating agent is present, stripping is observed despite an amount of blowing agent as high as 3.4 wt%. Finally, in Example 10, where an amount of nucleating agent below the lower limit cited in Claim 1 is applied (1 wt% as opposed to 2.5 - 7 wt%), no microcellular foam is obtained.

5.2.3 From the above, it follows that there is no need to deviate from the technical problem set out in the opposed patent, namely the obtainment of microcellular blow molded articles with improved surface quality at reduced cost. Therefore, it has to be accepted for the purpose of evaluating inventive step as the objective technical problem.

5.3 Obviousness of the solution

5.3.1 As has been set out above, D4 nowhere discloses the application of an amount of nucleating agent in combination with an amount of blowing agent as required by Claim 1.

Even if one were to assume in the appellant's favour that the blowing agent of D4 can be considered a nucleating agent, D4 would clearly teach away from the

claimed solution. More particularly, D4 would teach the skilled person to apply an amount of nucleating agent (blowing agent in the language of D4) of preferably 0.1 to 1 wt% (column 3, lines 21 - 24), which is below the lower limit of the range cited in Claim 1.

Furthermore, it follows from a comparison of Examples 4 and 5 of the opposed patent, that if blow molded articles are prepared with a supercritical blowing agent in the absence of nucleating agents, the more blowing agent that is applied, the smaller the cell size of the foam will be. Hence, the skilled person starting from D4 and aiming at the obtainment of microcellular foams, ie foams with small cell sizes, would have applied high amounts of supercritical blowing agent, contrary to what is required in Claim 1. In this context, the appellant's reference to Table 7 of D9, in which smaller cell sizes are obtained with smaller amounts of blowing agent, is irrelevant, as there, a solid chemical blowing agent is applied, which is entirely different from the supercritical blowing agent required by Claim 1. Apart from that, the experiments listed in Table 7 of D9 do not exemplify "blow molding". They merely describe the extrusion of foamed material.

Hence, the skilled person trying to prepare microcellular blow molded foams on the basis of D4 would have had no incentive to employ a process as claimed in Claim 1.

In addition, D4 does not address the specific problem of obtaining microcellular blow molded foams with improved surface quality at low cost, let alone suggest

that said problem could be solved by applying a specified amount of nucleating agent in combination with a low amount of blowing agent as required by Claim 1.

For the above reasons, the skilled person confronted with the objective technical problem would not have modified the teaching of D4 in such a way as to arrive at the claimed solution.

5.3.2 D9 discloses the use of nucleating agents in an amount of 0.01 to 20 wt%, preferably 0.1 to 10 wt% (third paragraph of page 17). In this paragraph, it is further stated that nucleating agent and blowing agent can be identical. However, D9 nowhere describes the combination of nucleating and blowing agent as required by Claim 1, let alone that such a combination would improve the surface quality of blow molded microcellular articles.

5.3.3 In the appellant's view, starting from D4, the claimed process was obvious in view of any of D6a, D12, D13, D13a, D17, D18 and D20. However, this argument is not convincing for the following reasons:

D6a and D12 deal with processes for the manufacture of microcellular foams. D13 is a collection of articles dealing with the preparation of microcellular foams from wood/polymer composites, the stress-strain relationship of open-cell foams and the control of cell growth in microcellular processing. D13a represents a collection of articles in which the mechanism for nucleation in microcellular foam formation and the effect of foam thickness and cell density on foam sheet

formation are discussed. Finally, D17 represents a chapter out of a textbook on polymer processing and deals with microcellular plastics. However, none of D6a, D12, D13, D13a and D17 refers to a blow molding process. Furthermore, in none of these documents is any combination of supercritical blowing agent and nucleating agent or amounts thereof disclosed. Finally, any indication is missing that the application of amounts of supercritical blowing agent and nucleating agent as required by Claim 1 would provide microcellular foams with improved surface quality at reduced cost. Therefore, from none of D6a, D12, D13, D13a and D17 would the skilled person have obtained any indication pointing towards the claimed solution.

D18 refers to physical laws applicable to droplets and bubbles. No reference is made to polymeric foams or the application of nucleating or blowing agents for the preparation thereof. Hence, the skilled person confronted with the objective technical problem would not have considered D18 and even if having done so, would not have arrived at the claimed solution.

D20 represents a PhD thesis on microcellular polymer processing. This document states on page 252 that it can provide a knowledge base to extend the microcellular process technologies disclosed therein to eg blow molding. However, no concrete measures are disclosed in D20 in respect of how this should be done. The skilled person would thus be left in the dark by D20 as to how blow molded microcellular foams could be obtained. The skilled person would in particular not find any indication in D20 on how he could obtain blow

molded microcellular foams with improved surface quality at reduced cost.

5.3.4 Finally, neither of the further prior art documents D16 and D21 contains any indication that blow molded microcellular foams with improved surface quality can be obtained at reduced cost by applying a combination of amounts of supercritical blowing agent and nucleating agent as required by Claim 1.

5.4 From the above, it follows that inventive step in view of D4, taken alone or in combination with any of the further prior art documents referred to by the appellant, can be acknowledged. The subject-matter of the request filed during the oral proceedings of 17 May 2010 thus is inventive.

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 European patent on the basis of Claims 1 to 15 of the request filed during the oral proceedings of 17 May 2010, after any necessary consequential amendments of the description and the figures.

The Registrar: The Chairman:

G. Röhn W. Sieber