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# Datasheet for the decision of 15 June 2007

**Case Number:** T 0747/05 - 3.3.03

**Application Number:** 98911871.6

**Publication Number:** 0968243

**IPC:** C08G 63/88

**Language of the proceedings:** EN

**Title of invention:**
Apparatus and method for molding polyester articles having low acetaldehyde content directly from the melt formation using flash tank devolatilization

**Patentee:**
EASTMAN CHEMICAL COMPANY

**Opponent:**
INVENTA-FISCHER GmbH & Co. KG
ZIMMER A.G.

**Headword:**
-

**Relevant legal provisions:**
EPC Art. 56

**Keyword:**
"Inventive step - non-obvious combination of known features"

**Decisions cited:**
-

**Catchword:**
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**Case Number:** T 0747/05 - 3.3.03

# D E C I S I O N
**of the Technical Board of Appeal 3.3.03**
**of 15 June 2007**

**Appellant:** (Patent Proprietor)
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**Decision under appeal:** **Decision of the Opposition Division of the European Patent Office dated 2 March 2005 and posted 12 April 2005 revoking European patent No. 0968243 pursuant to Article 102(1) EPC.**

**Composition of the Board:**

**Chairman:** R. Young
**Members:** W. Sieber
E. Dufrasne

## Summary of Facts and Submissions

I. The mention of the grant of European patent No. 0 968 243, in respect of European patent application no. 98 911 871.6, based on International application PCT/US98/05479, in the name of Eastman Chemical Company, filed on 19 March 1998 and claiming US priorities of 20 March 1997 (US 60/041056) and 24 October 1997 (US 08/957522), was published on 3 July 2002 (Bulletin 2002/27). The granted patent contained 20 claims, whereby Claims 1 and 7 read as follows:

"1. An apparatus for producing molded thermoplastic articles comprising:

a) means for reacting polyester precursors and forming a molten polyester homopolymer or copolymer;
b) means for flowing the molten polyester into a mixer, without intermediate solidification of the molten polyester; means for injecting an acetaldehyde stripping agent into the mixer; said mixer being capable of forming a mixture of the molten polyester and the acetaldehyde stripping agent under superatmospheric pressure;
c) means for flowing the mixture through one or more dies into an upper portion of a flash tank maintained under vacuum conditions therein, said dies being capable of imparting a back pressure to the mixer; means for removing vented gases, vapors and acetaldehyde from the flash tank; and
d) means for removing collected devolatilized polyester from the flash tank and injecting the devolatilized polyester into a molding apparatus.

7. A method for producing molded polyester articles comprising:

a) reacting polyester precursors and forming a molten polyester homopolymer or copolymer;
b) continuously flowing the molten polyester from step (a) into a mixer, without intermediate solidification of the molten polyester, and forming a mixture of the polyester and an acetaldehyde stripping agent by injecting the acetaldehyde stripping agent into the mixer and mixing the stripping agent with the molten resin under superatmospheric pressure;
c) flowing the mixture, through one or more dies, into an upper portion of a flash tank maintained under vacuum conditions therein, which dies impart a back pressure to the mixer, while removing vented gases, vapors and acetaldehyde from the tank; and
d) removing collected devolatilized polyester from the tank and injecting the devolatilized polyester into a molding apparatus."

Claims 2-6 and 8-20 were dependent claims directed to preferred embodiments of the apparatus of Claim 1 and the method of Claim 7, respectively.

II. Notices of opposition were filed on 2 April 2003 by Inventa-Fischer GmbH & Co. KG (opponent 01), and by Zimmer AG (opponent 02). Opponent 01 opposed the patent on the grounds that its subject-matter was not patentable within the terms of Articles 54 and 56 EPC (Article 100(a) EPC). Opponent 02 opposed the patent on

the grounds that its subject-matter was not patentable within the terms of Articles 56 EPC (Article 100(a) EPC).

Among the documents cited by the opponents were

E1/D1: DE-A1-195 03 053;

E2: DE-C1-195 05 680; and

D3: *Verein Deutscher Ingenieure VDI-Gesellschaft Kunststofftechnik (Herausgeber)*, "Entgasen beim Herstellen und Aufarbeiten von Kunststoffen", chapter "Statische Entgasungsapparate", VDI-Verlag 1992, 77-109.

III. In a decision which was announced orally on 2 March 2005 and issued in writing on 12 April 2005, the opposition division revoked the patent.

The decision was based on a main and an auxiliary request whereby the claims according to the main request were those of the patent as granted (Claims 1-20). Claims 1 and 7 of the auxiliary request differed from Claims 1 and 7 as granted in that the back pressure in step (c) had been further specified ("*wherein the back pressure from the dies is from 6.9 kPa to 20.7 kPa (1000 to 3000 psi*").

According to the decision, the subject-matter of the main request was new over the cited prior art. However, the subject-matter of Claims 1 and 7 as granted was obvious in the light of E1/D1 alone or in combination with D3. The specification of the back pressure in

Claims 1 and 7 of the auxiliary request could not render the subject-matter of these claims inventive, in particular because the added feature did not contribute to a technical effect.

IV. On 8 June 2005, the appellant (proprietor) filed a notice of appeal against the above decision with simultaneous payment of the prescribed fee.

The arguments of the appellant submitted with the statement of grounds of appeal (22 August 2005) and a letter dated 13 July 2006, may be summarized as follows:

The appellant believed that the opposition division had erred in its analysis of inventive step, in particular in its finding that the skilled person would combine the teaching of E1/D1 with D3 to arrive at the claimed invention. The opposition division had failed to take due regard of the content and context of the disclosure of flash evaporation apparatuses in D3 and the prejudice of the skilled person against flash tank devolatisation for high viscosity polyesters.

It was accepted that E1/D1 represented the closest prior art and that the technical problem had to be seen in the provision of an alternative means for removing, to a very low concentration, polyester polycondensation by-products, namely acetaldehyde.

E1/D1's clear teaching was to use mechanical agitation with vacuum degassing. E1/D1 did not suggest or teach the skilled person that it would be appropriate to employ any other degassing method without mechanical

agitation, or to abandon considerations of established known suitability of particular methods.

D3 was part of a handbook reference which had several chapters although the text of only one chapter had been supplied during the opposition proceedings, namely the chapter on static degassing apparatuses filed as D3. However, faced with the technical problem, the skilled person would primarily consider the chapter on "Devolatisation in polycondensation" of that handbook (filed as D3b including an English translation thereof). D3b concerned degassing during polycondensation and exemplified polyester. D3b consistently taught the combination of mechanical agitation and vacuum degassing.

D3b: *Verein Deutscher Ingenieure VDI-Gesellschaft Kunststofftechnik (Herausgeber)*, "Entgasen beim Herstellen und Aufarbeiten von Kunststoffen", chapter "Entgasen bei der Polykondensation ", VDI-Verlag 1992, 187-197.

Even if the skilled person did look at D3 he/she would be prejudiced against adopting a flash tank devolatiser as the mechanical agitation required in E1/D1 was absent. D3 explicitly taught against the use of static devolatisation in polymer systems in which sticking or encrusting of machinery was a problem. And polyesters were known to stick and encrust the reactor vessel as could be seen, for example, from E2. Thus, the skilled person would not combine E1/D1 with D3.

V. The submissions of respondent 01 (opponent 01) presented in a letter dated 13 February 2006 may be summarized as follows:

E1/D1 was considered to represent the closest prior art. The technical problem had to be seen in the provision of an alternative degassing method in the process of E1/D1. E1/D1 already taught on page 5, line 1 that the degassing apparatus consisted in its simplest form of an enlargement in the melt line connected to a vacuum pump and that other known types of equipment were suitable. Thus, E1/D1 itself contained a hint to look for alternative degassing methods. A person skilled in the art would automatically arrive at D3 disclosing a flash tank as an example of a static degassing apparatus. Furthermore, a flash tank was based on the same principle as the simplest form of vacuum degassing mentioned in E1/D1. Since the use of a flash tank was not associated with any additional technical effect, the claimed subject-matter was obvious over E1/D1 in combination with D3.

VI. Respondent 02 (opponent 02) presented its submissions in the letters dated 2 November 2005 and 8 May 2007. Also respondent 02 considered E1/D1 to represent the closest prior art and saw the technical problem to be solved in the provision of an alternative degassing method for the process of the closest prior art. The solution to this problem was obvious over E1/D1 alone or in combination with D3. E1/D1 already disclosed static degassing on page 3. Static degassing was in fact the underlying principle of a flash tank. Starting from E1/D1, the skilled person seeking an alternative degassing method would consider D3 and not D3b. D3b was

directed to degassing during the polycondensation which was not relevant in the claimed process. D3, on the other hand, concerned degassing further downstream. Thus, the skilled person would consult D3 when seeking alternative devolatisation methods. Furthermore, the skilled reader would learn from D3 that static degassing apparatuses were also suitable for highly viscous materials and that by the use of stripping agents low concentrations of contaminants could be achieved. As regards the appellant's argument to a prejudice against flash tank devolatisation for high viscosity polyesters, the existence of such a prejudice had not been established.

VII. On 15 June 2007, oral proceedings were held before the board. The parties basically elaborated on their written submissions.

VIII. The appellant requested that the decision under appeal be set aside and that the patent be maintained unamended.

Respondent 01 and respondent 02 requested that the appeal be dismissed.

## Reasons for the Decision

1. The appeal complies with Articles 106 and 108 EPC and Rule 64 EPC and is therefore admissible.

2. In the decision under appeal, the opposition division acknowledged the novelty of the claimed subject-matter. This finding on novelty has not been disputed so that

the sole issue in these opposition appeal proceedings is inventive step.

3. *Problem and solution*

3.1 The patent in suit is directed in general terms to an apparatus (Claim 1) and a method (Claim 7) for moulding polyester articles having low acetaldehyde content. In practice, molten polyester is prepared by continuously reacting polyester precursors and injecting an acetaldehyde stripping agent into the melt under pressure. The polyester is then devolatilized in a flash tank under vacuum and moulded directly from the melt into shaped articles. This procedure reduces the amount of acetaldehyde to a level of less than 10 ppm (paragraph [0012] of the patent specification).

3.2 It is common ground that E1/D1 represents the closest prior art. This document describes a process for the direct production of shaped packaging material made of thermoplastic polyesters having low acetaldehyde content. Following a melt-phase polycondensation, the molten polyester is introduced into the moulding apparatus without any intermediate conversion of the polyester to the solid form (chips). Before entering the shaping apparatus, the acetaldehyde content of the polyester melt is reduced to a level of less than 5 ppm (page 5, lines 2-4) by the introduction of an inert gas, ie a stripping agent, an acetaldehyde reducing agent and subsequent degassing. Preferably, static mixing elements are installed in the melt line immediately after the gas feed point in order to achieve a homogenous distribution of the gas in the melt. Use of other suitable equipment such as extruders is possible

but not necessary (page 4, lines 33-35). As regards the degassing apparatus, it consists in the simplest case of an enlargement in the melt line that is equipped with a spiral stirrer and is connected to a vacuum pump. However, known types of equipment such as extruders and kneaders with a degassing zone can also be used (page 4, line 68 to page 5, line 2).

3.3 Basically, the claimed subject-matter differs from the disclosure of E1/D1 in that a flash tank is used for degassing the polyester melt before the moulding step. Since the technical effect achieved by the claimed subject-matter is already achieved by the process of the closest prior art, namely a low content of acetaldehyde in the polyester melt and the resulting moulded articles, the objective technical problem can only be seen in achieving such a low level of acetaldehyde in an alternative way.

In view of the detailed description provided in the patent specification, the board is satisfied that this technical problem is solved by the features required in granted Claims 1 and 7, respectively. This was also not disputed by the respondents.

4. *Inventive step*

4.1 It remains to be decided whether the proposed solution, ie flowing the molten polyester through one or more dies into the upper portion of a flash tank whereby the dies are capable of imparting a back pressure to the mixer, is obvious from the prior art.

4.2 Contrary to the opinions expressed by the respondents, E1/D1 itself does not teach the skilled person that a static degassing apparatus or even a specific type of a static degassing apparatus, namely a flash tank, may be employed in the process of E1/D1.

4.2.1 What is described at page 4, line 68 to page 5, line 2 are particular methods of degassing:

*In the simplest case the degassing consists of an enlargement in the melt line that is equipped with a spiral stirrer and is connected to a vacuum pump. However, known types of equipment such as extruders and kneaders with a degassing zone can also be used.*

First of all, this passage clearly describes mechanical mixing. As regards the "*known types of equipment*", it is unmistakably implicit in this description, that the "*known types of equipment*" must be those that are known for degassing polyester melts. This passage does not suggest or teach the skilled person that it would be appropriate to employ **any** other degassing method, or to abandon considerations of established known suitability of particular methods. Since there is no evidence on file that static degassing apparatuses are used for molten polyester, the rather general statement in E1/D1 to "*known types of equipment*" cannot be interpreted as to provide a hint to static degassing and to a flash tank in particular.

4.2.2 As regards the argument of respondent 02 that the passage on page 3, lines 42-46 of E1/D1 hints to static degassing of the molten polyester is not convincing. This passage generally describes two different steps of

the process of E1/D1, namely (1) the introduction of the inert gas into the polyester melt aided by some static mixing elements and (2) the degassing of the polyester melt further downstream. It is important to note that the static mixing elements are not mentioned in connection with the degassing step. The association of static mixing elements with static degassing is therefore not justified. Also the fact that the description of step (2) does not refer to mechanical agitation is not an indication that this statement implies static degassing because this statement has to be read in the light of the remaining disclosure of E1/D1 and in particular with the passage bridging pages 4 and 5 where step (2) is described in further detail. As explained in point 4.2.1, above, this passage describes mechanical mixing in the degassing step and the general statement to "*known types of equipment*" cannot be interpreted as to provide a hint to static degassing and to a flash tank in particular. Respondent 02 unwarrantably isolated a selected passage of D1 from the overall teaching of D1, thereby taking this passage out of context and leading to a misinterpretation of its significance for a person skilled in the art.

4.2.3 Summing up, E1/D1 contains no suggestion to use a static degassing apparatus and in particular no hint to a flash tank with at least one die capable of imparting a back pressure to the mixer. Reading static degassing into E1/D1 appears to be based on an *ex post facto* analysis.

4.3 D3 is a handbook reference relating to static degassing. Figure 2 shows six static degassing apparatuses whereby

the simplest is a batch tank (Figure 2a) which is simply a vent from a chamber to a vacuum. More complex are flash and strand devolatisation chambers whereby the apparatus of Figure 2d and possibly Figure 2f appear to meet the requirements of a flash tank as used in the patent in suit. D3 describes the use of static degassing apparatuses as widespread in the production of styrene-containing, olefinic and acrylic-containing polymers (page 79) which typically requires the removal of a large quantity of monomer and/or solvent. Indeed, D3 mentions the use of a series of flash-type tanks in order to deal with the high vapour volume flows that may arise (sentence bridging pages 79 and 80). There is no disclosure anywhere in D3 of the use or the suitability of a flash tank for degassing polyester melts.

4.3.1 As pointed out by the respondents, D3 does mention in the 1st paragraph of page 81 that *in contrast to a widely held opinion static devolatisation may be used for liquids with extremely high viscosities (above 20,000 Pa s)*. This includes prima facie polyesters as used in the patent in suit. However, this statement is qualified by noting that mechanical transportation aids (screws, obliquely mounted vanes, scrapers or kneading elements) are unavoidable for liquids which have a pronounced flow limit, stick, cross-link or become encrusted. Such mechanical transportation aids are not present in a static degassing apparatus (page 81, 1st paragraph, penultimate and last sentence).

4.3.2 However, as pointed out by the appellant, moulding grade polyesters as used in the patent in suit are known to stick and may encrust the polymer vessel. This

statement of the appellant was not contested by the respondents and is supported by, for example, E2, a document relating to a process for producing bottle preforms from a polyester melt. E2 notes at page 4, lines 15-17 that screw shafts in an extruder devolatiser are in close engagement to ensure self-cleaning - in other words they prevent build-up (sticking) of polyester melt to the extruder walls.

Thus, the skilled person seeking an alternative way of removing acetaldehyde from a polyester melt may look at D3 but would not be prompted by D3 to use the described static degassing apparatuses described in the process of E1/D1 because the skilled reader would learn from D3 that mechanical agitation is required with sticky polymers, such as polyesters. This teaching in D3 may not amount to a prejudice against adopting static degassing for polyester melts as submitted by the appellant. Nevertheless, the board accepts that D3 teaches away from using static degassing, and in particular a flash tank, in polymer systems in which sticking or encrusting of machinery is a problem. Moreover, in view of the statement in D3, the successful use of a flash tank for removing acetaldehyde from a sticky, high-viscosity polyester melt without mechanical agitation appears to be surprising.

4.3.3 Furthermore, a skilled person is not simply looking at D3 for any alternative degassing method. He/she is looking for a method which is likely to be as successful as the method of the closest prior art with respect to the removal of acetaldehyde. In the closest prior art and in the patent in suit, the acetaldehyde

is reduced with the aid of a stripping agent to a level of below 10 ppm. D3, on the other hand, discloses that the degassing of polystyrene with water as stripping agent yields under its best circumstances a styrene level of less than 50 ppm (page 103). This is, as pointed out by the appellant, higher than what is achieved in the closest prior art and in the patent in suit. Thus, D3 is also counterintuitive in this respect.

4.4 Summing up, neither E1/D1 alone nor the combination with D3 would lead the skilled person to consider the use of a flash tank devolatisation in thermoplastic polyester continuous moulding process to remove acetaldehyde by-product. As regards the combination of E1/D1 with D3, it appears that without the patent in mind, the skilled person had no reason to ignore the teaching concerning sticky polymers in D3 and to focus on an individual embodiment of static degassing disclosed in D3 (flash tank) and to use it in the process of the closest prior art. Therefore, a combination of D3 with E1/D1 is based on hindsight and cannot succeed. Consequently, the claimed subject-matter is based on an inventive step (Article 56 EPC).

4.5 In view of the above, any discussion as to whether or not the skilled person seeking alternative devolatisation methods would look rather at D3b than at D3 is superfluous.

## Order

## For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is maintained unamended.

The Registrar: The Chairman:

E. Görgmaier R. Young