

Publication in the Official Journal ~~Yes~~ / No

File Number: T 519/89 - 3.3.3

Application No.: 83 630 127.5

Publication No.: 0 104 130

Title of invention: Thermoforming partially crystalline polyester articles

Classification: C08L 67/02

DECISION

of 5 May 1992

Proprietor of the patent: THE GOODYEAR TIRE & RUBBER COMPANY

Opponents:

- 01) Imperial Chemical Industries PLC  
Legal Department Patents
- 02) Hoechst AG, Werk Kalle
- 03) Hoechst AG
- 04) Akzo N.V.

Headword:

EPC Article 56

Keyword: Teaching given in a single patent specification and not a hand book  
does not (absent special circumstances) amount to a prejudice



Case Number : T 519/89 - 3.3.3

**D E C I S I O N**  
of the Technical Board of Appeal 3.3.3  
of 5 May 1992

Appellant :  
(Patentee)

THE GOODYEAR TIRE & RUBBER COMPANY  
1144 East Market Street  
Akron, Ohio 44316-0001 (US)

Representative :

Weinhold, Peter, Dr.  
Patentanwälte Dipl.-Ing. G. Dannenberg,  
Dr. P. Weinhold, Dr. D. Gudel,  
Dipl.-Ing. S. Schubert, Dr. P. Barz,  
Siegfriedstrasse 8  
W - 8000 München 40 (DE)

Respondent :  
(Opponent 01)

Imperial Chemical Industries PLC  
Legal Department: Patents  
PO BOX 6  
Bessemer Road  
Welwyn Garden City  
Hertfordshire AL7 1HD (GB)

Representative :

Corbett, William Michael  
Imperial Chemical Industries PLC  
Legal Department: Patents  
PO BOX 6  
Bessemer Road  
Welwyn Garden City  
Hertfordshire AL7 1HD (GB)

Opponent 02 :

HOECHST AKTIENGESELLSCHAFT, Frankfurt (Main)  
c/o Kalle Niederlassung der HOECHST AG  
Postfach 3540  
W - 6200 Wiesbaden 1 (DE)

Opponent 03 : HOECHST AKTIENGESELLSCHAFT, Frankfurt  
-Ressortgruppe Patente, Marken und Lizenzen-  
W - 6230 Frankfurt am Main 80 (DE)

Opponent 04 : Akzo N.V.  
Velperweg 76  
NL - 6824 BM Arnhem (NL)

Representative : Sieders, René  
AKZO N.V.  
Patent Department (Dept. CO)  
PO BOX 9300  
NL - 6800 SB Arnhem (NL)

Decision under appeal : Decision of Opposition Division of the European  
Patent Office of 11 April 1989, issued on 9 June  
1989 revoking European patent No. 0 104 130  
pursuant to Article 102(1) EPC.

Composition of the Board :

Chairman : F. Antony  
Members : H.H.R. Fessel  
M.K.S. Aúz Castro

## Summary of Facts and Submissions

I. The mention of the grant of European patent No. 0 104 130 in respect of European patent application No. 83 630 127.5 filed on 16 August 1983 and claiming a US priority of 18 August 1982 (US 409 219) was announced on 8 October 1986 (cf. Bulletin 86/41).

II. Notices of opposition were filed

on 15 June 1987 by ICI PLC (hereinafter Respondent I);  
on 4 July 1987 by Hoechst A.G. Werk Kalle and  
on 7 July 1987 by Hoechst A.G. (handled together and  
hereinafter jointly referred to as Respondent II);  
on 2 July 1987 by AKZO N.V. (hereinafter Respondent III).

The Oppositions were supported inter alia by

- (1) US-A-3 960 807
- (2) GB-A-1 298 107
- (8) GB-A-1 091 256
- (26) US-A-3 496 143
- (29) US-A-3 865 302
- (31) JP-A-80 109 616, Derwent Abstract 70649C/40
- (31a) Translation of said JP-A
- (35) Kunststoff - Handbuch (1973), Vol. VIII, pages 698 to 703.

III. By a decision which was given at the end of Oral Proceedings held on 11 April 1989 on the basis of five claims (two independent and three dependent) as amended during said Oral Proceedings, and was issued in writing on 9 June 1989, the Opposition Division revoked the patent since the subject-matter of independent Claims 1 and 5 did not involve any inventive step.

IV. The Opposition Division held that considering (1) or (29) to be the closest prior art, the problem solved by the patent in suit could be seen in obtaining a specific degree of crystallinity (cf. Claim 1). Faced with this problem a man skilled in the art would, however, be able to solve it by carrying out normal routine investigations as to the time sufficient to achieve the desired level of crystallinity.

The argument that the claimed subject-matter excluded the presence of a nucleating agent was rejected, because the wording of the claim did not reflect such absence. However, even if the claimed subject-matter were regarded as excluding any further nucleating agent, the problem underlying the patent in suit would then merely consist in providing an alternative to the process and the articles known from (1) and (29). In view of the teaching given in (35) and (2), the incorporation of polyolefins alone as nucleating agent would be no more than a conventional option for the solution of said problem.

The information given in (1), particularly column 4, line 13 et seq., could not be accorded general validity and inventive step based on overcoming a prejudice could thus not be acknowledged.

When starting from (26) as closest prior art, the problem underlying the patent in suit and plausibly solved with regard to the given examples could be seen in (a) improving crystallisation and (b) improving mechanical properties - impact strength. The solution to said problem - incorporation of small amounts of a polyolefin - was, however, obvious in the light of the teaching given in (35), since it was known therefrom to improve

crystallisation by incorporation of a polyolefin as nucleating agent, and the close relationship of crystallisation and mechanical properties was also known therefrom. Furthermore (1) and (8) also taught to incorporate polyolefins in PET to improve its mechanical properties.

V. On 8 August 1989 an appeal was lodged against said decision, together with payment of the prescribed fee. Attached to his Statement of Grounds, received on 25 September 1989, the Appellant (Patentee) filed a new Claim 1 reading as follows:

"A process for making a heat set, thin walled tray by thermoforming a sheet having a cristallinity not exceeding 10% consisting of 98 to 95 weight percent of a polyethylene terephthalate with an intrinsic viscosity as measured in a 60/40 by volume mixed solvent of phenol/tetrachloroethane of 0,85 to 1,2 and of 2 to 5 weight percent of a polyolefin with repeat units derived from olefin monomers containing 2 to 6 carbon atoms, wherein said thermoforming is carried out in a heated mold for a time sufficient to achieve levels of cristallinity of said article of 15 to 30 percent, and no nucleating agent is used."

During Oral Proceedings held on 5 May 1992, following certain suggestions from the Board, the Appellant filed an auxiliary request based on a set of four claims reading as follows:

"1. A process for making a heat set, thin walled article which comprises thermoforming a sheet having a certain cristallinity not exceeding 10%, consisting of  
(a) a polyethylene terephthalate with an intrinsic viscosity as measured in 60/40 by volume mixed

solvent of phenol/tetrachloroethane of 0.85 to 1.2 at 30°C,

- (b) 1 to 3 weight percent of low density polyethylene, and
- (c) optionally, 0.05 to 2.0 weight percent of a heat stabilizer,

wherein said thermoforming is carried out in a heated mold for a time sufficient to achieve levels of crystallinity of said article of above 15 to 30 percent.

2. The process of Claim 1 wherein said low density polyethylene is linear low density polyethylene.

3. The process of Claim 1 or 2 wherein said heat stabilizer is a polyphenol selected from 1,3,5-trimethyl-2,4,6-tris-(3,5-di-t-butyl-4-hydroxybenzyl)benzene and 3-(3,5-di-t-butyl-4-hydroxyphenyl)propionate)methane.

4. A thermoformed, heat set, thin walled article obtained according to the process of any of Claims 1 to 3."

VI. As to the main request, the Appellant argued that (1) taught that thin walled thermoformed articles could only be successfully produced if a nucleating agent was present, and it was surprising that better mold release, shorter cycle times and broader operating temperature ranges were possible as well as improved impact resistance and improved high temperature service life of said articles were provided when the nucleating agent was omitted. Moreover it was not obvious that articles having a crystallinity of 15 to 30% would show the above mentioned superior properties. No convincing arguments were provided in the impugned decision why a skilled man should have any reason to distinguish between two kinds of nucleating agents.

VII. So far as the subject-matter of the auxiliary request is concerned, crystallinity was increased in the thermoformed article by the addition of LDPE or LLDPE. For PE it was known that crystallinity decreases with density, and it was not at all obvious to improve crystallinity by adding LDPE or LLDPE to a composition of PET since from (8) it was only known to improve impact strength, but not crystallinity, in such a way. Moreover, from his general knowledge and from what had been taught in the abstract of (26), a man skilled in the art would expect that the level of crystallinity would influence impact strength, i.e. the higher the crystallinity the lower the impact strength. Only (1) dealt with both properties, but it was taught therein that the addition of two components was mandatory.

VIII. The Respondents argued that the beneficial effects of omitting a "further" nucleating agent as alleged by the Appellants were not supported by any document or other evidence and Table VIII of the patent in suit showed that crystallisation characteristics and mechanical properties were about the same with or without a "further" nucleating agent.

The degree of crystallinity could not amount to evidence for the existence of an inventive step since in (26) and in (35) it was taught that physical properties of articles of PET could be improved by increasing their degree of crystallinity.

IX. The Appellant requested to set the decision under appeal aside and to maintain the patent on the basis of the main or the auxiliary request with a description to be amended accordingly.



The Respondents requested to dismiss the appeal.

Reasons for the Decision

1. The appeal is admissible (cf. items III and V).
2. Claim 1 of the main request is not admissible with regard to the provisions of Article 123(2) EPC since no temperature to determine the viscosity is given, nor is there any support for a crystallinity range of the shaped article of (starting from) 15%. Hereinbelow, therefore, the Board will only further consider the auxiliary request.

The main basis for Claim 1 of the auxiliary request is Claim 6 of the original documents and of the patent specification. A sheet having a "certain" crystallinity "not exceeding 10 percent" finds its basis on page 10, lines 29 to 35 of the original documents (page 4, lines 56 to 59 patent specification), and a viscosity of 0.85 on page 5, line 15 (page 3, line 19 patent specification). Nature and amount of component (b) are supported by the worked examples as well as page 21, first paragraph (page 8, lines 1 to 5 patent specification). A crystallinity of "above" 15% is based on page 11, lines 28 to 34 (page 5, lines 9 and 10). Page 4, line 13 of the original documents (page 2, line 65 patent specification) referred to the invention being directed to a process for making a "thin walled article". As to Claim 1 defining the material to be thermoformed as consisting of (a) and (b) and optionally (c), there is no need to specify the amounts of the main component (a) since the amount of PET follows automatically and unambiguously from the amounts for (b) and (c) expressed in weight percent, for a

composition of (a) and (b) and (c) adding up to 100 weight percent.

In the Board's view, Claims 2 to 4 do not give rise to any objection as to formal admissibility either.

For these reasons the provisions of Article 123(2) EPC are met. Compared to the granted version of Claim 1, the present Claim 1 is narrower in scope, thus not objectionable under Article 123(3) EPC.

3. The claimed subject-matter is novel over the printed prior art, since a process for producing thermoformed articles as specified in Claim 1 with a crystallinity of above 15 to 30% and consisting of the components (a) and (b) and optionally (c) in the amounts stated was not disclosed in any single prior art document. This has not been disputed by the parties, hence no detailed reasons need be given.

4. The Board considers (26) to represent the closest prior art. It relates to a molded PET-product (Claim 9) and a process for making same (Claims 1 to 8). The product has a degree of crystallinity higher than 25%. A high degree of impact resistance is maintained in spite of the greater crystallinity. Moreover the thermoformed product is dimensionally stable and capable of withstanding relatively high temperatures up to 180°C (column 5, lines 68 to 72). This document teaches (cf. Claim 1) that said product is produced by a process wherein

(a) a sheet of PET having a solution viscosity of above 1.7 to 2.0, measured as a 1% solution in meta-cresol at 25°C, and a degree of crystallisation of at least 5% is heated (between 85 and 200°C);

(b) the heated sheet is shaped (by vacuum deep-drawing onto a mold surface); and

(c) further heat treated (140 to 220°C) for a period sufficient to produce the desired degree of crystallinity (i.e. higher than 25%).

A certain amount of crystal nuclei is said to be necessary to avoid a long induction time and to get a high degree of crystallinity (column 5, lines 53 to 61). Higher temperatures and/or longer duration of the heat treatment will promote the desired increase in crystallinity (column 5, lines 51 to 54). Moreover crystallisation is also dependent on the molecular weight of PET (column 4, lines 40 to 52). In column 6, lines 14 to 29 it is stated that impact strength of PET prepared according to previously known procedures decreases rapidly as the degree of crystallisation increases - this was not the case with PET having the specified solution viscosity (cf. (a) above).

This is in line with the disclosure on page 2, lines 37 to 44 of the patent in suit insofar as a heat treatment of 30 to 600 seconds, depending on the temperature, is said to be required in order to attain the desired level of crystallinity (up to 50% or more).

5. The problem underlying the patent in suit with regard to (26) may thus be seen in preparing a process
- (a) with an increased rate of crystallisation (which translates in reduced cycle times; page 7, lines 35 to 38 of the patent in suit) and, at the same time,
  - (b) leading to further improved mechanical properties such as impact strength.

On the basis of the results given in Tables II, IV and V of the patent in suit with regard to (a) and in Tables I, III and VI with regard to (b) the Board is satisfied that both of the above partial problems are effectively solved.

6. It remains to be considered whether the solution proposed, i.e. the (mere) addition of 1 to 3 weight percent of a low density polyethylene, involves an inventive step.

6.1 Document (26) is silent on any addition of components different from usual additives (column 2, lines 59 to 61), such as of nucleating agents or impact strength improvers, and does not provide any hint to the addition of LDPE.

6.2 Document (8), on the other hand, teaches an injection moulding process aiming at the improvement of impact resistance of previously known injection moulded PET articles of high dimensional stability and containing up to 10% by weight of high molecular weight polyolefins, the improvement being achieved by selecting appropriate, generally higher quantities of polyethylene, particularly polyethylene with a specific gravity of e.g. 0.915 (i.e. LDPE) (cf. page 2, line 123 to page 3, line 7; Claims 2 and 3), optionally together with stabilising additives (cf. page 2, lines 95 to 96). The articles obtained show adequate dimensional stability in addition to their outstanding impact strength which depends also on the relative viscosity of the PET used (page 3, lines 8 to 14 and 19 to 25).

6.3 A man skilled in the art of processing PET and seeking to modify a thermoforming process leading to improved mechanical properties such as impact strength, would not limit his attention to just measures known in the thermoforming art but would look as well on general

processes available for shaping thermoplastic, especially PET articles, e.g. injection molding, embossing or extruding, when problems common to all of these processes are concerned, e.g. problems of flex (crack or impact strength), dimensional stability and rate of crystallisation (cf. (1), column 1, lines 21 to 53; column 5, lines 33 to 57; (35) page 698, lines 31 to 36; page 699, lines 6 to 16 and (8) page 1, lines 20 to 26; page 2, lines 7 to 9, 27 to 31, 56 to 62 and page 3, lines 24 and 25). This has not been disputed by the parties during the oral proceedings.

A man skilled in the art seeking to improve mechanical properties such as impact strength would, therefore, not hesitate to combine the teachings given in (26) and (8) when seeking to solve the above partial problem (b). He would learn from (8) that addition of LDPE to PET of specified viscosity would increase the impact strength (cf. Tables 2 and 3). Thus it was obvious to add LDPE in amounts as indicated to PET having the specified intrinsic viscosity in order to provide a formed article showing improved impact resistance.

- 6.4 The above conclusion is not affected by the fact that the claimed proposal additionally serves to solve above partial problem (a) (increasing the rate of crystallisation). Crystallisation and characteristics dependent thereon are important for all processes of shaping thermoplastic, especially PET articles. It is common general knowledge of a skilled person that the rate of crystallisation depends on temperature ((35) page 699, Figure 1) and on nucleation ((35) page 700, Figure 2). Moreover, many different nucleating agents for PET are common general knowledge as evidenced by Table 1 on page 701 of (35). In said table, three different groups of

nucleating agents are specified, one of them listing polymers such as polyethylene (item c of Table I).

Furthermore, it was known to a man having average skill in this technical field that mold release and cycle times depend on crystallisation (cf. (35) page 699, lines 6 to 16 in combination with page 698, lines 31 to 36) and that the relevant induction period will be reduced by the addition of nucleating agents (cf. page 699, item 2.2.2, paragraph 1).

On the basis of this general knowledge, the skilled man would expect to solve partial problem (a) along with partial problem (b) by following the claimed proposal.

- 6.5 In his arguments on page 2, lines 51 to 56 of the specification in suit the Appellant has made reference to a prior art proposal pointing into a different direction: document (1), which teaches that, in order to improve the impact resistance of the articles, the mould release and the rate of crystallisation, it was essential to use a composition having three essential components, viz.
1. PET (having an IV of at least .75)
  2. a crack stopping agent, preferably a polyolefin (especially polyethylene)
  3. A nucleating agent (organic or inorganic).

This amounted to a prejudice against omitting the additional nucleating agent, which prejudice he had overcome by showing that the use of "common" nucleating agents (in addition to polyethylene) was completely unnecessary in the practice of the invention of the patent in suit. The latter fact was confirmed by the results given in Table VIII, whereagainst the further assertion

that such an omission would even lead to better results, in the absence of any supporting evidence, must be disregarded.

6.6 The existence of such a prejudice, which could conceivably establish an inventive step, cannot be accepted by the Board. The alleged prejudice is based on a single document which, being a patent specification and not a handbook such as (35), does not (absent special circumstances) constitute common general knowledge of a man skilled in the art. Accordingly, in the Board's view, even if (1) were chosen to be the starting point ("closest prior art"), no different result would be arrived at. It would be obvious for the skilled man trying to simplify the thermoforming process known from (1) - which would then be the underlying problem - on the basis of his general knowledge as evidenced by (35) to try using polyethylene not only as crack improving agent, but at the same time for improving the rate of crystallisation.

Order

For these reasons, it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

E. Görgmaier

F. Antony