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D E C I S I O N
of 13 October 1994

Case Number: T 0790/91 - 3.3.3

Application Number: 84102051.4

Publication Number: 0123816

IPC: C08L 23/02

Language of the proceedings: EN

Title of invention:

Pre-expanded particle of polyolefin and process for preparing the same

Patentee:

KANEGAFUCHI KAGAKU KOGYO KABUSHIKI KAISHA

Opponent:

Headword:

Relevant legal provisions:

EPC Art. 54, 56, 87

Keyword:

"Entitlement to priority (yes) - use, in a claim, of technical terminology not in common use at the filing date of the first priority document, but denoting subject-matter implicitly disclosed therein"

"Novelty (yes) - implicit disclosure of relevant parameters in prior art (no)"

"Inventive step (yes) - no pointer to solution of problem"

Decisions cited:

Catchword:



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Boards of Appeal

Chambres de recours

Case Number: T 0790/91 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 13 October 1994

Appellant: KANEGAFUCHI KAGAKU KOGYO KABUSHIKI KAISHA
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Decision under appeal: Interlocutory decision of the Opposition Division
of the European Patent Office of 10 April 1991,
issued in writing on 6 August 1991, concerning
maintenance of European patent No. 0 123 816 in
amended form.

Composition of the Board:

Chairman: C. Gérardin
Members: R. Young
W. M. Schar

Summary of Facts and Submissions

- I. The mention of the grant of European patent No. 0 123 816 in respect of application 84 102 051.4, filed on 28 February 1984 and claiming priorities of:
- 5 April 1983 (JP 60591/83) and
18 January 1984 (JP 7634/84), was announced on 1 June 1988 (cf. Bulletin No. 88/22).
- II. Notice of Opposition was filed on 12 October 1988. The opposition was supported by the following documents:
- D1: AT-A-278 374;
D2: EP-A-95 109;
D3: Kirk-Othmer Encyclopedia of Chemical Technology, Vol. 16 (1981), pages 385-389 and
D4: JP-A-58/55 231 of 1983 (English translation).
- III. By a decision which was given at the end of oral proceedings held on 10 April 1991 and issued in writing on 6 August 1991, the Opposition Division found that the patent could be maintained in amended form on the basis of an auxiliary request.

According to the decision, Claim 1 of the main request, which was worded as follows:

"A pre-expanded particle of non-crosslinked linear low density ethylene polymer which is a copolymer of ethylene and α -olefin of C₄ to C₂₀, said copolymer having a melt index of 0.1 to 50 g/10 min, a density of 0.910 to 0.940 g/cm³ and a melting point of 110 to 123°C."

lacked novelty in the light of D1, since Example 5 of the latter disclosed pre-expanded particles from non-crosslinked copolymers having a melting point which corresponded to 122°C when measured by the method given in the patent in suit, the copolymer furthermore having been shown to have the other requirements set out in the claim.

As to the granted auxiliary request, Claim 1 of which was worded as follows:

"A process for preparing pre-expanded particles of non-crosslinked linear low density ethylene polymer which is a copolymer of ethylene and a α -olefin of C₄ to C₂₀, said copolymer having a melt index of 0.1 to 50 g/10 min, a density of 0.910 to 0.940 g/cm³ and a melting point of 110 to 123°C, which comprises: dispersing the ethylene copolymer particles and a volatile foaming agent into water in the presence of a dispersing agent in an autoclave, heating the resulting dispersion with stirring up to a temperature in a following range: (a melting point of the copolymer -25)°C to (a melting point of the copolymer +10)°C, thereby the copolymer particles are impregnated with the foaming agent, and then, releasing the dispersion of the particles into an atmosphere having a pressure lower than that in the autoclave.",

it could not be considered obvious to apply the method known from D4, which was applied essentially to polypropylenes of higher melting points, to the lower melting point polymers of D1.

IV. Appeals were filed by both parties. Thus, a Notice of Appeal was filed on 5 October 1991 by the Patentee, together with payment of the prescribed fee, a respective Statement of Grounds of Appeal being filed on

16 December 1991. Furthermore, a Notice of Appeal was filed by the Opponent on 11 October 1991, the fee being paid on the following day, and a Statement of Grounds of Appeal being filed on 13 December 1991.

V. In its Statement of Grounds of Appeal, and in a subsequent submission filed on 8 September 1994, the Appellant (Patentee) argued, in relation to the decision under appeal, essentially as follows:

(i) It was denied that the copolymer of Example 5 of D1 was the same as that used according to the patent in suit. In particular there was no mention in D1 of linear low density polymers. Furthermore, although the decision under appeal had accepted that the copolymer of Example 5 in D1 had the claimed parameters of density and melt index, this was necessarily speculative.

(ii) As regards the repetition of Example 5 of D1 by the Opponent, the DSC chart supplied with the letter of 26 October 1990 in support of the melting point value did not correspond to a typical DSC chart. On the contrary, the multiple peaks implied that the copolymer used could not have had the relevant melting point and indeed could not have been the copolymer disclosed in Example 5.

Hence, there could have been no relationship between the values of the parameters of density and melt index recorded by the Opponent and the corresponding values in Example 5.

VI. In a submission filed on 25 April 1992, the Appellant (Opponent) cited for the first time the following document:

D8: JP-A-58/076 433 (publication date: 9 May 1983)

in connection with obviousness. This was accompanied by a partial translation in German.

- VII. In a Communication issued by the Board on 5 August 1994 together with a summons to oral proceedings, it was questioned whether the claims of the main and auxiliary requests of the Patentee were entitled to the first priority date claimed in the patent in suit. It was also indicated that the partial translation appeared sufficiently pertinent further to be considered and the Opponent was invited to file a full translation.
- VIII. With the submission filed on 8 September 1994, the Patentee presented new sets of claims corresponding to a main request and seven auxiliary requests, as well as arguments in support of the earliest priority date claimed.
- IX. The Opponent informed the Board, with a submission received on 29 September 1994, that it would not be attending the oral proceedings, and with a further submission received on 12 October 1994, that its appeal was withdrawn.
- X. Oral proceedings were held on 13 October 1994. The Patentee, who was the only party present, filed a declaration by the inventor, Mr. Senda, and a document
- D10: "Chemische Technologie" Volume 6, "Organische Technologie II", 4th edition, Carl Hanser Verlag 1982, pages 359 to 366 and 500,
- in further support of an entitlement to the earliest priority date, and an amended description.

XI. The Patentee requested that the patent be maintained on the basis of Claims 1 to 7 of the main request filed on 8 September 1994, together with an amended description as filed at the oral proceedings, or, alternatively, on the basis of Claims 1 to 7 of the first auxiliary request, or on the basis of Claims 1 to 5 of the second, third, fourth, fifth, sixth or seventh auxiliary request, as filed on 8 September 1994.

As to the wording of the main request: Claim 1 is identical with Claim 1 of the main request refused, and independent Claim 4 is identical with Claim 1 of the auxiliary request granted, respectively, in the decision under appeal (cf. section III. above). Dependent Claims 2 and 3 are directed to further elaborations of the pre-expanded particle according to Claim 1, and dependent Claims 5 to 7 to further embodiments of the process according to Claim 4.

Reasons for the Decision

1. The appeal is admissible.

Main Request

2. *Allowability of amendments*

Claim 1 is supported by Claims 1, 2, 3, 4 and 6 of the application as filed (Claim 1 as granted), and, as regards the upper temperature limit of 123°C, by original Example 2, run 2. Thus Claim 1 is narrower in scope than Claim 1 as granted.

Claim 2 is supported by Claim 1 as filed (Claim 2 as granted).

Claim 3 is supported by the description at page 7, lines 5 to 9 as filed (Claim 3 as granted).

Claim 4 is supported by Claims 7, 8 and 14 as filed (Claim 4 as granted).

Claims 5 to 7 are supported by Claims 8 to 10 respectively, as filed (Claims 5 to 7 as granted).

The description has been adapted to the claims.

No objection thus arises under Article 123 EPC to the amendments.

3. *Priority date*

The first question to be decided is that of priority date.

- 3.1 The objection raised in the Communication of the Board dated 5 August 1994 was occasioned by the complete silence, in the first priority document on which the patent in suit is based (JP 60591/83, of 5 April 1983), as to the requirement for a "linear, low density ethylene polymer", forming an essential limitation of Claim 1.

Since the monomer composition and all the other parameters of the copolymer used for making the pre-expanded particle of Claim 1 are explicitly disclosed in the first priority document, the issue to be determined is whether the above mentioned remaining feature would have been directly and unambiguously derivable by the skilled person, at the relevant priority date (5 April 1983).

3.2 According to D3, which is an extract from a work of general technical reference published in 1981, there were two processes by which polyethylene was industrially prepared at the time, namely the historically older, high pressure process, and the more modern, relatively low pressure process (cf. pages 385, 386). The product of the high pressure process, termed "low density polyethylene" (LDPE) was a highly branched polymer, whereas the product of the low pressure process, which could be of high or low density, was a relatively linear product (cf. page 387, Fig. 1).

Thus, information about the degree of branching of a polyethylene was derivable from a knowledge of the process by which it had been prepared.

3.3 The first priority document does not, however, refer explicitly to the method of preparation used for the copolymers from which the pre-expanded particles are made. It is therefore necessary to examine more closely the implicit content of its disclosure.

3.4 There are several references in the first priority document to a high pressure process, low density polyethylene, and also to a high density polyethylene (cf. page 2, lines 23/24, 25/26 and 27/28; page 3, lines 3/4; page 4, lines 22/23; page 5, lines 10 to 13, and page 7, lines 3/4.). It is, however, clear from the context of these repeated references that they are presented as examples of what was **conventionally** used, or what could be used as an **optional additive**, to the copolymers forming the enabling disclosure of the document.

Thus it is implicitly clear that the polymer taught to be used was **neither** a high pressure process, low density polyethylene (LDPE), **nor** a low pressure process, high

density polyethylene (HDPE), the general term polyethylene including ethylene copolymers.

- 3.5 It was, furthermore, known that the only commercially available polyethylenes at the relevant date were HDPE, LDPE and what is now called "linear low density polyethylene" (LLDPE). This is confirmed by the declaration of the inventor (cf. third paragraph).

Consequently, the material of the pre-expanded particles according to the teaching of the first priority document must, by default, have been a low density, low pressure process polyethylene.

- 3.6 This is consistent with the parameters used explicitly to characterise the relevant copolymer in the first priority document, in particular the presence of an α -olefin comonomer and a density of 0.910 to 0.940 g/cm³ (cf. first priority document, page 3, second paragraph, and paragraph bridging pages 3/4).

In this connection, according to the independent definition in D3, the term LLDPE designated "any ethylene - α -olefin copolymer prepared by a low pressure process and ranging in density from 0.910 to 0.940 g/cm³" (cf. page 386, second paragraph).

Consequently, it would have been clear to the skilled person at the filing date of the first priority document that the α -olefin copolymer taught by the priority document was nothing else than a linear, low density polyethylene prepared by a low pressure process.

- 3.7 Hence, the first priority document disclosed, in substance, the copolymer defined in Claim 1 as granted.

3.8 The only question remaining is thus why the term "linear low density polyethylene" is absent from the first priority document.

3.8.1 The Board accepts the submission of the Patentee during oral proceedings that the reason for the failure to use the term in the first priority document was the fact that, at the relevant date (1983), the term was not yet universally in common use.

3.8.2 This is consistent with D3, which was published in 1981, since the latter defines the term (cf. section 3.6, above) and indicates that, although the first comprehensive comparison of LDPE and LLDPE was presented in 1970, production figures for, say, 1979 were difficult to obtain because LLDPE production was not recorded separately from LDPE production (cf. page 386, third paragraph). In other words, the distinctive LLDPE terminology was not established in common use before 1981.

3.8.3 Furthermore, the document D10, filed at the oral proceedings, and which has a publication date in 1982, mentions that the term "linear low density polyethylenes" was applied "neuerdings", i.e., recently (cf. page 366, section 4.1.13 "Eigenschaften", third paragraph).

Hence the term was still considered new in 1982.

3.8.4 Finally, it is stated in the declaration of the inventor himself that because the term was not so well known in 1983, such a polymer was defined by its composition and its physical parameters (cf. third paragraph).

3.9 In summary, the only feature of Claim 1 as granted which was lacking from the disclosure of the first priority document was a term of art which the Patentee has succeeded in showing became universally current in the time between filing the priority document and the final application. The essential nature of the copolymer itself on the other hand was directly and unambiguously derivable by the skilled person from the information given in first priority document.

Consequently, the reservation expressed by the Board (see section 3.1, above) concerning the earliest priority date of the patent in suit no longer applies.

4. *Late-filed document*

The publication date of document D8, referred to in the Communication of the Board, is later than the filing date of the first priority document.

In view of the conclusion reached in section 3.9 above, therefore, D8 cannot be considered as forming state of the art in the sense of Article 54 EPC.

5. *The closest state of the art*

The patent in suit is concerned, in its product aspect, with a pre-expanded particle of an ethylene polymer which is a copolymer of ethylene and α -olefin of C₄ to C₂₀.

Such particles are known from D1, which is considered to represent the closest state of the art.

5.1 According to D1, which relates to a process for preparing closed-cell foam particles of ethylene polymer by storage of the foamed particles under increased

pressure in a gaseous atmosphere, the foamed particles may be prepared either by mixing the ethylene polymers with a blowing agent in an extruder and chopping the extruded strand (page 2, lines 6 to 10), or by treating ethylene polymer particles, the surfaces of which have been crosslinked so as to prevent their sintering together on heating, with a blowing agent under pressure until a homogeneous gel is formed, and then releasing the latter (page 2, lines 11 to 15).

5.2 According to Example 5, foamed particles of a copolymer of 95% ethylene and 5% butene-1, having a crystallite melting point of 128°C and a volume weight of 21 g/l, are prepared as in Example 4, i.e. by extrusion after mixing under pressure with dimethylpropane in a double screw extruder (L/D = 30) and subsequent comminution. The particles are then stored at 95°C under nitrogen at a pressure of 1 (sic) atm. for 20 h, and have the original volume weight of 21 g/l. Storage at normal pressure leads to a shrinkage to a volume weight of 25 g/l.

6. Novelty

6.1 Neither the relevant physical parameters such as density and melt index, which would unambiguously identify the copolymer used in Example 5, nor its method of preparation, is stated in D1. The polymer used in Example 4, to which Example 5 explicitly refers, however, is prepared by a high pressure process (cf. page 4, line 28). This is consistent with the situation at the filing date of D1 (1967), since, according to the historical information in D3, the commercial production of LLDPE was pioneered only later, in 1968 (cf. page 386, third paragraph).

Thus there are no grounds for concluding that D1 discloses a linear, low density, non-crosslinked ethylene polymer. Its disclosure cannot therefore be novelty destroying for the subject matter of Claim 1.

It consequently does not depend on whether a crystallite melting point of 128°C as stated in Example 5 corresponds to a "second DSC melting point" within the range defined in Claim 1 of the patent in suit or not (cf. section V.(ii), above).

6.2 According to D2, which forms state of the art only by virtue of Article 54(3) EPC, pre-expanded particles of linear, low density polyethylene are indeed prepared (cf. Example 4). There is no disclosure, however, of a copolymer of ethylene and α -olefin of C₄ to C₂₀ as required by Claim 1.

Consequently, the disclosure of D2 is not novelty destroying for the subject matter of Claim 1.

6.3 According to D4, pre-foamed particles of a polyolefin resin are prepared by impregnating particles of a polyolefin polymer with a volatile blowing agent, dispersing the particles in a dispersing medium in a closed vessel, heating the particles to a prescribed temperature and opening one end of the vessel to release the particles (cf. Claim 1).

The polyolefin may be a polyethylene polymer, a polypropylene polymer, e.g. a propylene homopolymer, ethylene-propylene random or block copolymer, or mixtures of these with other polymers (page 3, first complete paragraph and also Example, Table 1, page 10).

Thus D4 does not disclose any copolymer of ethylene and α -olefin of C₄ to C₂₀, let alone the further relevant parameters.

6.4 The remaining documents are more remote.

Consequently, the subject matter of Claim 1 is novel.

7. *The technical problem and its solution*

A disadvantage of the pre-expanded particles to which the process of D1 is applied is their tendency to shrink, within a few minutes after foaming, to 50 to 90% of their volume directly after foaming, and not to return to their original expansion ratio (page 1, lines 9 to 16). Such a disadvantage is moreover recognized in the patent in suit as resulting in difficulties in obtaining a moulded article of satisfactory appearance and good mechanical properties (cf. patent in suit, page 2, lines 14 to 35 and 45 to 50).

7.1 Compared with this state of the art, the technical problem underlying the patent in suit can be seen in the search for an alternative pre-expanded particle which has no tendency to shrink, and is capable of yielding moulded articles of high quality, especially of smooth appearance and uniform density.

7.2 The solution proposed according to Claim 1 is to provide the ethylene copolymer starting material in the form of a non-crosslinked linear low density polymer having a melt index of 0.1 to 50 g/10 min, a density of 0.910 to 0.940 g/cm³ and a melting point of 110 to 123°C, whereby the post-treatment of the particle by storage under increased pressure can be omitted.

7.3 It can be seen, for instance, from Example 1 of the patent in suit, that pre-expansion ratios of 24 to 28 are achieved in the pre-expanded particles, without any reported shrinkage. The moulding properties of the foamed articles are, moreover, excellent (page 6, lines 10 to 19 and Table 1; page 7, lines 38 to 42 and Table 3).

Although no direct information is given in D1 regarding the moulding properties of the treated particles, the uncontested evidence of a comparison, given in the patent in suit, using high pressure process, low density polyethylene particles (cf. starting material of Example 4 in D1), shows that no moulded product can be produced due to shrinkage of the particles (cf. page 6, lines 45 to 60; Comparative Example 1; Table 2). This is considered to represent a fair comparison.

It is thus credible to the Board that the claimed measures are effective to solve the stated problem.

8. *Inventive step*

This issue boils down to the question whether the skilled person, starting from the closest state of the art D1 and wishing to provide a further shrinkage resistant pre-expanded particle of excellent moulding properties, would have expected that, by choosing a linear, low density ethylene polymer having the stated melt index, density and melting point as the starting material, this would be achieved and the entire pressure storage treatment of D1 could thus be dispensed with.

8.1 There is no hint in this direction in D1 itself.

8.2 The relevant information concerning the copolymers of ethylene and alpha-olefin of C₄ to C₂₀ and forming the solution to the stated problem is also absent from D4. Thus there is no hint to the solution of the stated problem in this document either.

8.3 The remaining relevant documents, although mentioning LLDPE, are silent as to any utility for pre-expanded particles.

There is thus no pointer in any of these documents to a solution of the stated problem.

8.4 In summary, the subject matter of Claim 1 does not arise in an obvious manner from the closest state of the art, whether taken alone or in combination with the other documents. On the contrary, the fact that the use of the specified copolymers renders superfluous the entire post-treatment forming the teaching of D1 must be regarded as surprising.

Thus the subject matter of Claim 1 involves an inventive step.

The same conclusion applies to the subject-matter of independent Claim 4, which is directed to a process of preparing the pre-expanded particles of Claim 1.

Claims 2 and 3, which are dependent on Claim 1, and Claims 5 to 7, which are dependent on Claim 4, are also by the same token directed to subject matter involving an inventive step.

Auxiliary requests

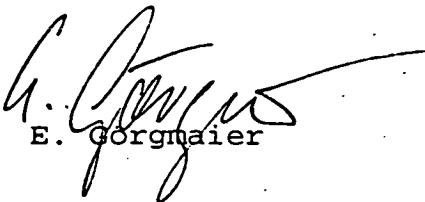
9. There is no need for the Board to consider any of the auxiliary requests, since the main request can be allowed.

Order

For these reasons it is decided that:

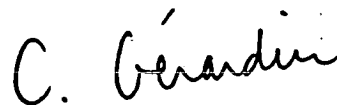
1. The decision under appeal is set aside..
2. The case is remitted to the first instance with the order to maintain the patent on the basis of Claims 1 to 7 filed as main request on 8 September 1994 and the description filed during the oral proceedings.

The Registrar:



E. Gorgnauer

The Chairman:



C. Gérardin