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D E C I S I O N
of 14 March 2000

Case Number: T 1218/97 - 3.3.3

Application Number: 84902562.2

Publication Number: 0146620

IPC: C08F 20/04

Language of the proceedings: EN

Title of invention:

Interpolymers of ethylene and unsaturated carboxylic acids

Patentee:

THE DOW CHEMICAL COMPANY

Opponent:

Bayer AG

E.I. Du Pont de Nemours & Company, Inc.

Headword:

-

Relevant legal provisions:

EPC Art. 83

Keyword:

"Disclosure - sufficiency (yes) "

Decisions cited:

-

Catchword:

-



Case Number: T 1218/97 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 14 March 2000

Appellant:
(Proprietor of the patent)

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Decision under appeal:

Decision of the Opposition Division of the
European Patent Office posted 23 October 1997
revoking European patent No. 0 146 620 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: C. Gérardin
Members: B. ter Laan
J. C. M. De Preter

Summary of Facts and Submissions

- I. Mention of the grant of European patent No. 0 146 620 in respect of European patent application No. 84 902 562.2, filed on 12 June 1984 as the International Patent Application No. PCT/US84/00914, claiming priority from an earlier application in the United States of America (504032 of 13 June 1983), was published on 30 December 1992 on the basis of twelve claims, Claim 1 reading:

"A process for producing homogeneous, random inter-polymers of ethylene and at least one olefinically unsaturated comonomer selected from the group comprising acrylates, methacrylates, vinyl esters and olefinically unsaturated carboxylic acids, said process comprising inter-polymerizing the monomers in a substantially constant environment, under steady state conditions, in a single-phase reaction mixture, under the influence of a free-radical initiator, and in a well-stirred autoclave reactor operated in a continuous manner as the monomers are fed into the reactor and the reaction mixture is withdrawn, said process being characterized by the use of synthesis conditions of temperature and pressure which are elevated to a level high enough above the phase boundary between two-phase and single-phase operation such that the molecular weight distribution (MWD) boundary is reached, or surpassed, the said molecular weight distribution boundary being the highest ratio of weight average molecular weight/number average molecular weight obtainable in single-phase operation, said elevated pressure being greater than 14 M Pa (2000 psi) above, and said elevated temperature being greater

than 15°C above the synthesis conditions required at the phase boundary for a given mixture of ethylene and comonomer, thereby producing an interpolymer having less gels and/or grain."

Claims 2 to 8 referred to preferred embodiments of the process according to Claim 1.

Independent Claim 9 was directed to a random, homogeneous, single-phase interpolymer product fulfilling a number of specific conditions.

Claims 10 to 12 referred to elaborations of the interpolymer according to Claim 9.

II. On 15 September 1993 and 30 September 1993 two Notices of Opposition against the granted patent were filed, in which the revocation of the patent in its entirety was requested on the grounds set out in Article 100(a) and (b) EPC (Opponent 1) and Article 100(a), (b) and (c) EPC (Opponent 2).

III. By a decision issued in writing on 23 October 1997, the Opposition Division revoked the patent. That decision was based upon the set of twelve claims as granted as the main request, a set of twelve claims (Claims 1 and 9 as amended in the course of the opposition proceedings and Claims 2 to 8 and 10 to 12 as granted) as the first auxiliary request and a set of eight claims (Claims 1 to 8 as granted) as the second auxiliary request.

The Opposition Division held that none of the requests fulfilled the requirements of Article 83 EPC since the skilled worker was not informed about the exact

conditions necessary for reaching the MWD boundary, and, even if the MWD boundary could be determined, it would lay an undue burden of experimentation upon the shoulders of the skilled person. In particular,

- (a) In the statement of how to determine the MWD boundary by increasing the synthesis conditions while keeping the melt index constant, the patent in suit did not exclude the possibility of keeping the melt index constant by using telogens. In this case, as demonstrated by the experiments filed by Opponent 2, it was not possible to determine the MWD boundary.
- (b) Even if the melt index were to be kept constant by regulating only pressure and temperature, the relationship between these two entities for doing so was not indicated, so that it would require a large amount of experiments performed in full size equipment to establish the right conditions.
- (c) To determine the curve indicating the relationship between the synthesis conditions and the molecular weight distribution, which was necessary to carry out the invention as a whole, an indefinite amount of experiments would be necessary for every specific copolymer.

IV. On 17 December 1997 the Appellant (Proprietor) lodged an appeal against the above decision and paid the prescribed fee simultaneously. The Statement of Grounds of Appeal was filed on 20 February 1998. Written statements were received from both Respondents (Opponents), but only Respondent 2 was present at the oral proceedings held on 14 March 2000, Respondent 1 having informed the Board of its absence (letter dated 4 February 2000).

V. The Appellant argued essentially as follows:

Regarding an objection pursuant to Article 100(c) raised by Respondent 2 for the first time during the oral proceedings before the Board, it was stated that that was a new ground for opposition which should not be admitted and which also was not justified in view of the original disclosure.

As regards Article 83 EPC, in the light of the general knowledge as reflected by the state of the art, the patent in suit contained sufficient information for a skilled person to carry out the invention. The objection of undue burden was improper as the requirements mentioned by the Opposition Division were not founded upon the disclosure of the patent and were therefore at fault. In particular,

- (a) The patent in suit did not mention the use of telogens and the opposite effect of temperature and pressure on the molecular weight distribution was well-known, as demonstrated in numerous documents. Moreover, the use of additional variables would change the complete reaction system. Therefore, on the basis of the disclosure, there was no reason for a skilled person to use telogens in order to keep the melt index constant.
- (b) The exact relationship between the different effects that temperature and pressure have on the molecular weight distribution of any given reaction system was normally well-known to the person utilizing that system on a regular basis. It would not take an undue amount of experiments to establish at which "pairs" of temperature/pressure the melt index would be the

same, nor would it be necessary to carry out the experiments on a full scale plant since the skilled person was familiar with the "translation" rules from laboratory or pilot plant scale to full scale.

- (c) In order to establish whether one's polymerization system was below or above the MWD boundary, in principle it was sufficient to measure only a few points, at most four or five: if increased temperature and pressure resulted in a broader MWD, one was below the MWD boundary, whereas if the result was a narrower MWD, the boundary was passed, as indicated in the patent specification. Admittedly, more measuring points could be required when approaching the MWD boundary than when working well above it and to establish the exact position of the MWD boundary could require the measurement of several points. However, the latter was not necessary, nor was it necessary to construe the complete curve for all temperature/pressure pairs in relation to the MWD. It would not take more than a few hours for a skilled person to establish in which range he was working, because the measurements were not performed successively, but the next sample could be taken already when the first was one was being analysed.

- VI. During the oral proceedings before the Board Respondent 2 raised an objection pursuant to Article 123(2)/100(c) EPC. The differences between the claims as granted and the claims as originally filed were not supported by the original disclosure, which was limited to a specific copolymer. Respondent 2 admitted that this point had not been raised before; the reason for the late argument was that it had not been noticed at an earlier stage of the proceedings.

Regarding Article 83 EPC, both Respondents (Respondent 1 in writing and Respondent 2 both in writing and orally) contradicted the interpretation of the patent specification and the state of the art and concluded that the technical teaching of the patent in suit was insufficient to determine the MWD boundary and required an undue burden of experimentation. In particular,

- (a) According to the patent specification, the discontinuity in molecular weight distribution should be observed at a constant product melt index and comonomer concentration while changing the synthesis conditions. No explanation of this change was given. The usual way to keep the melt index constant was to use telogens, in which case no relationship between synthesis conditions and MWD existed, as demonstrated before the first instance. Therefore, when proceeding along the usual way, that is using telogens, the skilled person would not find any MWD boundary and it would be impossible to establish at which point one was working.
- (b) Even if the skilled person would not use telogens when maintaining the melt index at the same value, it would still be very cumbersome to find the correct pair of temperature and pressure at which the melt index would remain the same for each and every ethylene/comonomer combination. Since laboratory scale conditions were so different from plant scale conditions, they could not be simply transposed. Therefore, the measurements should be done at full plant scale and even a few minutes of measuring would result in the production of tons of undesired product.

(c) Although it was admitted that the skilled person would be able to repeat the examples and would know that the MWD boundary was passed if the temperature and pressure were raised to a sufficient extent, the exact location of the MWD boundary posed a problem. Since the use of high pressure was expensive, one would want to work at pressures as low as possible and it was necessary to work in the vicinity of the MWD boundary. In order to determine that limit, the measurement of at least 3 and more likely at least 5 points per ethylene/comonomer combination would be necessary. This would take many more than 10 hours, which amounted to an undue burden of experimentation for the skilled person as well as the loss of an unacceptable amount of product.

VII. The Appellant requested that the decision under appeal be set aside and the patent be maintained on the basis of Claims 1 to 8 of the second auxiliary request (Annex 3 of the decision under appeal).

The Respondents requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.

Article 123(2) EPC

2. During the oral proceedings Respondent 2 raised an objection against amendments allegedly extending beyond the original application (Article 123(2) EPC). Although the Appellant argued that a new opposition ground was sought to be introduced and the Respondent did not contradict that argument, in fact an objection pursuant

to Article 100(c) regarding Claims 9 to 12 as granted had already been raised before the first instance (Respondent 2's Notice of Opposition/Statement of Grounds of Opposition filed on 30 September 1993). Therefore, an objection under Article 123(2) EPC is not a new opposition ground. However, the specific point raised during the oral proceedings had not been criticised before.

That point concerned the introduction in Claim 1 of lower limits for the temperature and pressure, which were disclosed on original page 13, lines 5 to 9, which values referred to a specific copolymer of ethylene/acrylic acid, the latter monomer being present in an amount of 9 weight percent. However, the original description contained several examples disclosing temperature and pressure for other types of copolymer (e.g. Tables I and IV), so that the objection would not *prima facie* appear to be justified in view of the original disclosure. Therefore, the objection could not be accepted.

Sufficiency of disclosure

3. The Respondents' arguments regarding the insufficiency of disclosure were basically put forward along three lines:
 - (a) the use of telogens was not excluded from the process as claimed and that was the usual way for the skilled person to maintain a constant melt index, in which case no relationship between melt index and synthesis conditions existed,

- (b) establishing the pairs of temperature/pressure values at which a constant melt index was obtained for each and every copolymer posed an unacceptable problem, resulting in the production of an enormous amount of undesired product, and
- (c) to find out under which synthesis conditions exactly the MWD boundary occurred and to determine a curve such as indicated in Figure 1 of the patent in suit for each and every copolymer variation put an undue burden upon the skilled person.

4. The first line of argument concerned the use of telogens.

4.1 According to Claim 1 of the patent in suit, the synthesis conditions of temperature and pressure should be "elevated to a level high enough above the phase boundary between two-phase and single-phase operation such that the molecular weight distribution (MWD) boundary is reached, or surpassed, the said molecular weight distribution boundary being the highest ratio of weight average molecular weight/number average molecular weight obtainable in single-phase operation, said elevated pressure being greater than 14 M Pa (2000 psi) above, and said elevated temperature being greater than 15°C above the synthesis conditions required at the phase boundary for a given mixture of ethylene and comonomer...". Thus, the claim by itself contains the information that one should work at levels of temperature and pressure well above those at which the two-phase/single-phase boundary is attained, and high enough to reach or surpass the MWD boundary, that parameter being also defined.

4.2 In the patent specification (page 4, line 52 to page 5, line 3), it is stated that the MWD boundary can be conveniently identified at a given comonomer concentration by observing the discontinuity in molecular weight distribution at a constant product melt index and comonomer concentration as synthesis conditions are changed in a manner to pass through the MWD boundary. Before reaching that boundary, the MWD of single-phase random products is broader than that of two-phase random products or of non-random single-phase products. When the boundary is surpassed, the MWD narrows. The examples and tables give specific information about the various copolymers and their synthesis conditions.

4.3 The Respondents argued that the patent did not exclude the use of telogens. It is true that nowhere in the patent in suit telogens or their use are indicated. However, in view of the documents on file (e.g. D8 (US-A-4 248 990)) and the information in the patent specification (examples), there can be no doubt that a skilled person would know how to raise the temperature and pressure in such a way that the melt index would remain constant. The Appellant has brought sufficient evidence in the form of documents which show the relationship between temperature and pressure on the one hand and melt index on the other hand, and the Respondents have not contradicted either the relationship itself or the fact that this was common knowledge to the skilled person.

The Respondent's argument that it would have been simpler and hence more logical to use telogens if one would wish to keep the melt index at a constant level is beside the point. From the very wording of Article 83 EPC it is clear that it is the information in the original disclosure which is decisive; any other possible way of arriving at the same result is not

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relevant. If the skilled person can carry out the invention on the basis of the information contained in the patent specification, there is no reason to deviate from that information, even if there is a different or even simpler way. Therefore, the Board cannot accept the Respondents' argument.

5. The second line of argument concerned the finding of the pairs of temperature and pressure at which the melt index of the polymer remained constant, the other conditions remaining the same.

5.1 According to the Appellant, the molecular weight could be determined by gel permeation chromatography, which took a number of hours, whereas measuring the melt index was a question of minutes. Per value about 1 hour was required, so it was possible to measure 5 values in about 5 hours. Also, the measurements could be done on laboratory scale equipment; there was no necessity to run trials in the plant. Once the temperature/pressure pairs for constant melt index were determined in the laboratory, the skilled person could, without having to apply any inventive ingenuity, translate the information thus obtained to the full scale plant situation. Fine tuning the plant after any change was always necessary and part of the normal procedure. The Appellant's arguments were supported by a declaration by Mr G. I. Waples, one of the joint inventors, and reference was made to D8.

5.2 The Respondents argued that it was not possible to perform experiments on a small scale and then translate the results to full scale since the products were so different. Determining the pairs of values for temperature and pressure at which the melt index remained the same hence required experiments on full scale, causing enormous amounts of undesired product.

- 5.3 The point of discussion between the parties thus was the (im)possibility for a skilled person to determine the conditions to maintain the melt index at different pressure/temperature values and to translate the conditions of laboratory or pilot plant scale experiments to full scale in order to produce a minimum of unwanted material.

However, the Respondents' arguments merely relied on unsubstantiated assertions, whereas the Appellant's arguments were supported by a declaration of a person used to working in the particular field of high pressure polyethylene production. Also, the disclosure of D8, in which laboratory scale experiments are exemplified (autoclaves of 0.72 and 2.0 litre volume) with a reference to commercial scale production (column 6, lines 5 to 51, in particular lines 42 to 44), does not contradict the Appellant's statements.

Apart from this, the Board considers that the Appellant's viewpoint reflects common practice in that new synthesis conditions are tested at a small (laboratory and/or pilot plant) scale before being upgraded. In the light of the above considerations, the Board deems the Appellant's statements more plausible and accepts these.

6. Regarding the necessity to determine the exact position of the MWD boundary or the complete curve of change in MWD vs. change of synthesis conditions, the following considerations are made.

6.1 According to the Appellant, not more than 4 or 5 points are sufficient to determine on which side of the MWD boundary one is working (see point V (c) above). Respondent 2 admitted that a skilled person would have no problem in repeating the examples of the patent, nor in working within the claimed range at a level well above the MWD boundary.

6.2 In accordance with the conclusions drawn above (see points 4.3 and 5.3), the Board takes the view that a small number of measuring points is sufficient to determine whether a polymerization system falls within the claimed range. As indicated in the patent specification (page 5, lines 1 to 3) when the MWD narrows at increased synthesis conditions, the MWD boundary is passed. Although this can be established in theory with as few as two measuring points, in practice four or five points are needed to obtain fairly accurate information (see the Appellant's statement, point V (c)). Hence it is not necessary to establish the full and complete relationship between change in MWD vs. change of synthesis conditions. Likewise, in order to carry out the process as defined in Claim 1, it is not necessary to know the exact location of the MWD boundary. This information would be of interest only

- (a) to determine the exact limit of the scope protection, which is a matter of Article 84 EPC and cannot be objected to in opposition proceedings, and
- (b) to work as economically as possible - higher temperatures and pressures being more energy-consuming - which is a matter of optimization, not of carrying out the process.

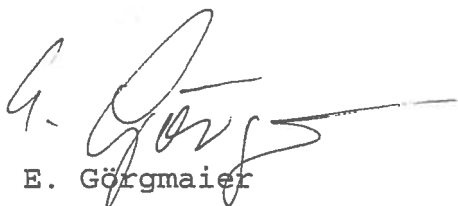
- 6.3 In the light of the above considerations the Board comes to the conclusion that the patent specification contains sufficient information as to how to test whether one is working below, at or above the MWD boundary without causing an undue burden.
7. For the reasons given in points 3 to 6.3 the requirements of Article 83 EPC must be regarded as fulfilled.
8. Although the Board has come to the conclusion that the requirements of Article 83 EPC are met, the Appellant's request that the patent be maintained on the basis of Claims 1 to 8 of the second auxiliary request (Annex 3 of the decision under appeal) cannot be granted, because the grounds for opposition pursuant to Article 100(a) EPC have not yet been considered by the first instance. To that end the case has to be remitted to the Opposition Division for further prosecution.

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 for further prosecution on the basis of Claims 1 to 8 (Annex 3 of the decision under appeal).

The Registrar:



E. Görgmaier

The Chairman:



C. Gérardin