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Datasheet for the decision of 21 April 2023

Case Number: T 0342/20 - 3.3.03

Application Number: 08790238.3

Publication Number: 2174970

IPC: C08G64/40, B29C47/08

Language of the proceedings: EN

Title of invention:
POLYCARBONATE RESIN AND METHOD FOR PRODUCING THE SAME

Patent Proprietor:
Mitsubishi Chemical Corporation

Opponents:
SABIC Global Technologies B.V.
Covestro Deutschland AG

Relevant legal provisions:
EPC Art. 100(b), 100(a), 54, 111(1)
RPBA 2020 Art. 11

Keyword:
Grounds for opposition - insufficiency of disclosure (yes)
Novelty - (yes)
Remittal - special reasons for remittal

Decisions cited:
G 0003/89, G 0011/91, G 0001/03, G 0002/10, G 0003/14,
T 0051/00, T 1845/14

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Case Number: T 0342/20 - 3.3.03

D E C I S I O N
of Technical Board of Appeal 3.3.03
of 21 April 2023

Appellant: (Patent Proprietor)	Mitsubishi Chemical Corporation 1-1, Marunouchi 1-chome Chiyoda-ku Tokyo 100-8251 (JP)
Representative:	Hoffmann Eitle Patent- und Rechtsanwälte PartmbB Arabellastraße 30 81925 München (DE)
Respondent: (Opponent 1)	SABIC Global Technologies B.V. Plasticslaan 1 4612 PX Bergen op Zoom (NL)
Respondent: (Opponent 2)	Covestro Deutschland AG Kaiser-Wilhelm-Allee 60 51373 Leverkussen (DE)
Representative:	Levpat c/o Covestro AG Gebäude 4825 51365 Leverkusen (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 12 December 2019 revoking European patent No. 2174970 pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman	D. Semino
Members:	F. Rousseau
	W. Ungler

Summary of Facts and Submissions

I. The appeal by the patent proprietor lies from the decision of the opposition division revoking European patent No. 2 174 970 whose claims 1 to 8 read as follows:

"1. A process for producing a polycarbonate resin from a dihydroxy compound and a carbonic acid diester by an ester exchange method using a polycarbonate resin producing apparatus comprising at least one reactor and at least one extruder, in which when the extruder inlet resin temperature is represented by T1 (°C) and the extruder outlet resin temperature by T2 (°C), T2 is not higher than 370°C, and ΔT given by the following equation (I) is not higher than 70°C:

$$\Delta T = T2 - T1 \quad (I)$$

2. The process according to Claim 1, wherein the difference between the maximum preset temperature (Tmax) and the minimum preset temperature (Tmin) of the extruder barrel satisfies the following equation (II):

$$(Tmax) - (Tmin) = 40 \text{ to } 120°C \quad (II)$$

3. The process according to Claim 2, wherein Tmin is 200 to 240°C.

4. The process according to any one of Claims 1 to 3, wherein at least one of said extruders is a vented melt extruder.

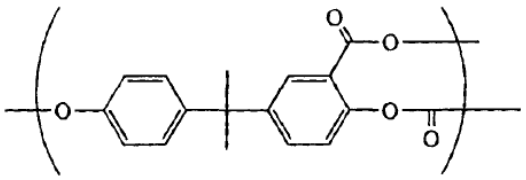
5. The process according to Claim 4, wherein the last one of said extruders is a vented melt extruder.

6. The process according to any one of Claims 1 to 5 using a devolatilization assistant in the extruders.

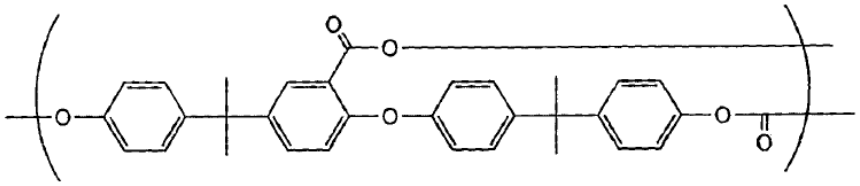
7. The process according to any one of Claims 1 to 6, wherein the viscosity-average molecular weight of the polycarbonate resin is 13,000 to 30,000.

8. The process according to Claim 7, wherein the aromatic polycarbonate resin satisfies the following conditions (1) and (2):

(1) the amount of the residual aromatic monohydroxy compound and the amount of the residual aromatic dihydroxy compound in the resin are each not more than 20 ppm; and
(2) the resin contains at least one of the structural units of the following formulae (1) to (5), with the total amount of such structural units being 1,000 to 6,000 ppm:



(1)



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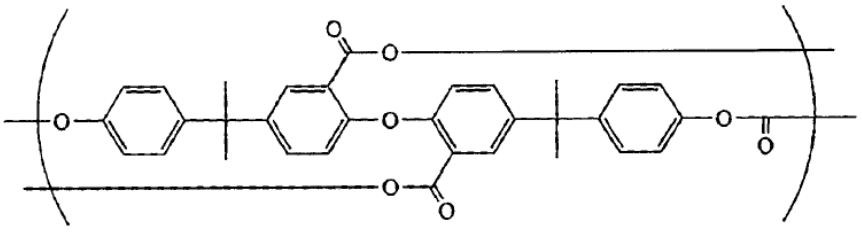

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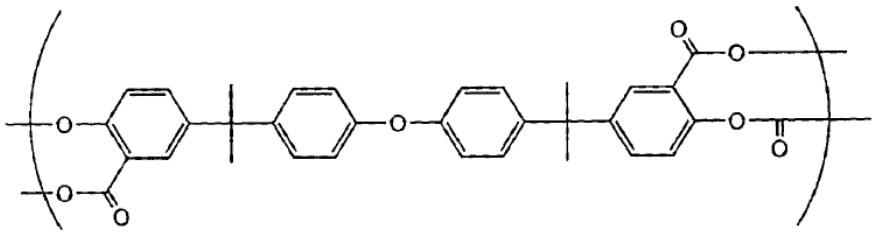

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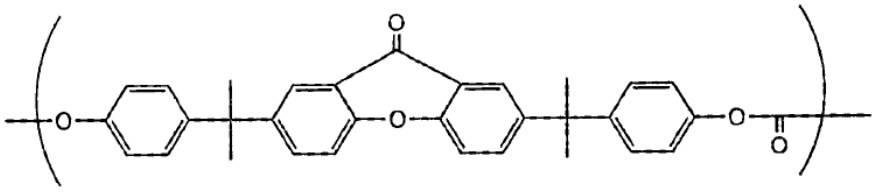

(5)

"

The decision was also based on auxiliary requests 1 to 3 all filed during the oral proceedings on 13 November 2019.

II. The decision was taken having regard *inter alia* to the following documentary evidence:

D1: EP 2 048 181 A1
D3: JP 2000-102919 A and machine translation thereof in English
D5: JP H 8-208829
D8: EP O 738 579 A2
D11: WO 00/07799 A1
D24: Extrusion, The Definitive Processing Guide and Handbook, second edition, Elsevier, 2014, pages 32, 33 and 138 to 145,
D26: DE 1 495 730
D26a: US 3,535,280
D31: US 2004/0147655 A1
D33: KOBUNSHI, Volume 11, Issue 2, pages 164-169 (1962) "Problems of measurement and control in extrusion molding", Hisao Inoue, and partial translation thereof in English (D33a)

D34: Extrusion molding, 5th Edition (1973), Editor: Kenkichi MURAKAMI, pages 270-273 and partial translation thereof in English (D34a)
D35:Industrial and Engineering Chemistry Vol.46, No.4, pages 660-664
D36: Extrusion molding; 6th Edition (1983); Editor: Kenkichi MURAKAMI, pages 114-115 and partial translation thereof in English (D36a)

III. According to the reasons for the contested decision which are pertinent in the appeal proceedings:

(a) Documents D26 and D26a, D31, D33, D33a, D34, D34a, D35, D36 and D36a were admitted into the proceedings.

Main request

Sufficiency of disclosure

(b) The subject-matter of claims 1, 2, 5, 7 and 8 was sufficiently disclosed.

Novelty

(c) The method of granted claim 1 was novel over the disclosures of documents D1, D3, D5, D8, D11 and D26, but was anticipated by example 4 of D31.

Auxiliary request 1

(d) Claim 1 of auxiliary request 1 was not admitted into the proceedings.

Auxiliary request 2

(e) Compared to claim 1 of the main request, claim 1 of auxiliary request 2 defined in addition a viscosity-average molecular weight of the polycarbonate in range of 13 000 to 30 000, an amount of the residual aromatic monohydroxy compound and an amount of the residual aromatic dihydroxy compound in the resin, each being not more than 20 ppm and a total amount of Fries branching (structural units of formulae (1) to (5)) being between 1000 and 6000 ppm.

(f) It was undisputed that novelty was to be acknowledged. Concerning inventive step, the closest prior art was D31 and not D26 as contended by the patent proprietor, since D31 also aimed at reducing the content of volatile components such as residual monomer, oligomer and solvent. D26, which did not disclose the use of an extruder, could at best be considered as an equally suitable starting point for assessing inventive step.

The process of claim 1 of auxiliary request 2 differed from the disclosure in D31 in that the amount of residual aromatic dihydroxy content compound was not more than 20 ppm and the combined amount of Fries branching was in the range of 1 000 and 6 000 ppm.

The objective problem solved by these distinguishing features could be seen in the provision of an alternative process to the one already known from D31.

Although the use of a filter could generate bisphenols in the polycarbonate, this did not mean that it was impossible to achieve the claimed content of bisphenol using an apparatus containing a filter. Furthermore, it was generally desirable to prepare polycarbonates with low amounts of impurities, and in particular with a monomer content as low as possible. D31 itself disclosed in paragraph [0150] that this could be done using a vacuum treatment. In addition, the limitation of Fries branching, which were well-known by-products of the preparation of polycarbonates by the melt process, was also an obvious measure known in the art. The subject-matter of claim 1 of auxiliary request 2 lacked therefore an inventive step.

Auxiliary request 3

(g) Auxiliary request 3 was not admitted into the proceedings.

IV. An appeal against that decision was lodged by the patent proprietor (appellant). With the statement of grounds of appeal, the appellant filed auxiliary requests 1 to 3, whose wording is not relevant for the present decision.

V. In response to the rejoinders of opponent 1 and opponent 2 (both respondents), the appellant submitted with letter of 15 September 2021 the following document:

D37: Excerpt of Extrusion Molding, by Hiroshi Yagi, Extruder, pages 168-169, 1973, edited by K. Murakami and partial translation thereof in English (D37a).

VI. Oral proceedings before the Board were held on 21 April 2023.

VII. The final request of the parties were as follows:

The appellant requested that the decision of the opposition division be set aside and the patent be maintained based on the claims as granted, or, in the alternative, that the patent be maintained on the basis of one of auxiliary requests 1 to 3, all submitted with the statement of grounds of appeal.

The respondents requested that the appeal be dismissed. The respondents also requested that auxiliary requests 1 and 3 not be admitted into the proceedings. Furthermore the respondents requested that the case be remitted to the opposition division in case the invention as defined in the granted claims was found to be sufficiently disclosed and novel.

VIII. The parties' submissions, in so far as they are pertinent to the present decision, may be derived from the reasons for the decision below. The contentious points essentially concerned sufficiency of disclosure of the methods in accordance with all granted claims and novelty of the method of granted claim 1 over the disclosure of each of D31, D1, D3, D5, D8, D11 and D26.

Reasons for the Decision

Main request

Sufficiency of disclosure

Claim 1

1. Respondent-opponent 1 submits that the patent in suit is completely silent as to the exact location for measuring the temperature and also fails to define accurately what constitutes an "extruder".

The Board notes that an extruder is a well-known piece of equipment, the use of which is extensively documented in the field of thermoplastic polymers, as illustrated, for example, by the excerpts from textbooks D24 and D33 to D36 referred to by the appellant. As regards the exact location for measuring the temperatures defined in claim 1, i.e. the extruder inlet resin temperature and the extruder outlet resin temperature, there is no doubt, as these terms indicate, that these temperatures should be measured as the resin enters and leaves the extruder, respectively. The exact point at which these temperatures should be measured at the inlet and outlet of the extruder is at most an issue of clarity which, however, is not open to an objection under Article 84 EPC in accordance with the ruling of G 3/14 (OJ 2015, A102). In any event, respondent-opponent 1 has not explained how the exact location where the temperature of the resin is measured would affect the ability of the skilled person to fulfil the functional requirement of operative claim 1 defined with those temperatures. This is not apparent to the Board.

2. Respondent-opponent 2 contends that claim 1 does not provide any indication as to how the requirements concerning the extruder inlet resin temperature and the extruder outlet resin temperature can be met. On this basis and without any indication of which features should be missing in claim 1, respondent-opponent 2 concludes that the process according to claim 1 is insufficiently disclosed (rejoinder, page 13, section II.2.2.1 (a)).

This objection is not convincing for the Board, since according to the established jurisprudence of the Boards of Appeal of the EPO the requirement of sufficiency of disclosure is not to be assessed on the basis of a particular passage of the patent in suit (here claim 1 as argued by respondent-opponent 2), but on the basis of the information provided in the patent specification as a whole and, if necessary, using common general knowledge, taking into account a reasonable amount of experimentation.

3. Respondent-opponent 2 also submits, not only with respect to claim 1, but also with respect to claims 2, 4 and 7, that the invention as defined in those claims cannot be carried out in such a way as to solve the problem underlying the patent in suit.

Also this objection is not convincing. As recalled in decision T 1845/14 (points 9 to 9.8 of the Reasons), the achievement of a particular technical effect which is not part of the claim definition, in the present case the achievement of a certain degree of stability, is not a question of sufficiency of disclosure, but may be relevant to the question of inventive step (see decision of the Enlarged Board of Appeal G 1/03, OJ EPO

2004, 413, point 2.5.2, third paragraph of the reasons).

4. Respondent-opponent 2 also submits that it has not been shown that the invention as defined in claim 1 can be carried out when using different types of extruders, such as those listed in the penultimate paragraph on page 13 of its rejoinder, or any selection, configuration and arrangement of means for such devices, such as kneading discs and screw elements (rejoinder, page 14, last paragraph and page 15, lines 7-13).

Firstly, the patent in suit does not specifically teach the use of all the extruders mentioned by respondent-opponent 2 or any possible design for them. In this respect, the question is not whether the skilled person can provide a process which satisfies the extruder inlet resin temperature and the extruder outlet resin temperature with any equipment not taught in the specification, but whether the skilled person can generally achieve the functional feature defined on the basis of those temperatures by an appropriate selection of the design of the extruder and its operating parameters.

Secondly, the process parameters which influence the temperature of the resin during its extrusion or the equipment to be used for the extruders are well-known in the art, as is abundantly shown by documents D24 and D33 to D36 cited by the appellant. In particular, reference is made to the known power dissipation due to viscous shearing (D33/D33a, D34/D34a, D35 and D36/D36), which is also addressed below in relation to novelty.

Thirdly, according to the established jurisprudence of the Boards of Appeal of the EPO, the objection of lack of sufficient disclosure presupposes that there are serious doubts, substantiated by verifiable facts (Case Law of the Boards of Appeal of the EPO, 10th edition 2022, II.C.7.1.4). In the present case, no evidence has been provided by the respondents to show that the skilled person having regard to the common general knowledge about extrusion, as documented for example by D24 and D33 to D36, would not be in the position, with a reasonable amount of experimentation, to generally adjust the parameters of the extrusion so as to obtain a process which satisfies the functional feature of operative claim 1 with respect to the extruder inlet resin temperature and the extruder outlet resin temperature.

Claim 2

5. Respondent-opponent 2 submits that claim 2 lacks sufficiency of disclosure, as the term preset temperature does not provide any information or limitation about the temperature at which the barrel is actually operated.

In this respect, it can be agreed with the appellant that the actual and the set barrel temperature are parameters known to the skilled person to be taken into account when operating extruders. This is shown in D24 (section 3.7, right-hand column, first bullet point) to which the appellant refers. Whether the singular form used in granted claim 2 is to be understood as meaning that each temperature zone of the barrel has to fulfil equation (II) or that Tmax and Tmin refer to the overall maximum and minimum temperatures, respectively, i.e. of all temperature zones of the barrel, is a

matter of clarity of the subject-matter of granted claim 2 which cannot be objected in view of decision G 3/14 (*supra*). Respondent-opponent 2, however, did not explain, let alone demonstrate, how this alleged lack of clarity would prevent the skilled person to put into practice for each of these alternatives the process claimed.

Claims 3 to 6

6. Respondent-opponent 2 argues that the additional feature of claim 3, i.e. a range for the extruder inlet resin temperature, cannot overcome any lack of sufficiency concerning claims 1 and 2. The same argument is made in relation to claim 6 which defines the additional use of a devolatilization assistant. A specific objection concerning these additional features of claims 3 and 6 is however not raised. In view of this, there is nothing more in this respect on which the Board needs to decide.

With respect to claims 4 and 5, which define the use of a vented melt extruder, the arguments made by respondent-opponent 2 are in essence the same as those put forward in respect of claim 1, i.e. they concern the ability for the skilled person to find a suitable vented melt extruder to fulfil the requirements concerning the extruder inlet resin temperature and the extruder outlet resin temperature.

For the reasons already stated in point 4 above, the objection to claims 4 and 5 is not convincing.

Claim 7

7. Respondent-opponent 2 also contends that the invention according to claim 7 is insufficiently disclosed because the polycarbonate concentration to be used for determining the viscosity-average molecular weight is not specified.

As rightly pointed out by the appellant, this is at most an objection to the clarity of the subject-matter of a granted claim, which is not open to objection in view of decision G 3/14 (*supra*). In any event, as pointed out by the appellant, the skilled person would understand from page 6, lines 12-13 of the specification that this concentration is 0.6 g/dL, since paragraph 53 defines that the viscosity-average molecular weight is calculated on the basis of the measurement of the intrinsic viscosity.

Claim 8

8. Respondent-opponent 1contends that the viscosity average molecular weight, which by reference to claim 7 is also a feature of claim 8, and the number of Fries branching units are not dependent on the extrusion measures defined in claim 1. These features are the result of the synthesis of the polycarbonate prior to the extrusion step. The same is said to be true for the amount of free phenol and free bisphenol A (rejoinder , bottom of page 3), which are meant not to depend only on the extrusion step. Respondent-opponent 2 submits that the teaching of the patent in suit is insufficient in order to enable the skilled person to rework the invention throughout the entire scope of claim 8 with respect to providing the claimed amount of free phenol and free bisphenol A, since the claim is not limited

with respect to the number of reactors, types of reactors, residence times, temperatures, pressures, and catalysts. In view of paragraphs 6 and 44 of the specification and as shown by a comparison of example 3 and comparative example 2, respondent-opponent 1 stresses that the nature of the filter is essential in order to satisfy condition (1) which defines the amount of the residual aromatic monohydroxy compound and the amount of the residual aromatic dihydroxy compound in the resin, each of which being not more than 20 ppm.

However, the question to be answered is not whether any conceivable possible combination of process features for the production of polycarbonates, including any possible device, can provide the desired amount of free phenol and free bisphenol A, but whether the skilled person has sufficient information to select suitable means to generally prepare such polycarbonates. In particular, in view of its wording or the wording of any of the claims 1 to 7 to which it directly or indirectly refers, dependent claim 8 does not require the use of a polymer filter. Consequently, the arguments relating to the use of a polymer filter for preparing an aromatic polycarbonate resin having an amount of the residual aromatic monohydroxy compound and an amount of the residual aromatic dihydroxy compound in the resin of no more than 20 ppm each are not convincing, since they do not concern the subject-matter of the present claims, i.e. the invention whose sufficiency of disclosure must be assessed.

Furthermore, it is not disputed that examples 1 and 2 are examples of a process according to claim 8. These examples provide two particular and concrete ways of achieving in combination the low amounts of residual aromatic monohydroxy compound and residual aromatic

dihydroxy compound and the amount of structural units of formulae (1) to (5) required in claim 8 (see table 1 in paragraph 67) for a viscosity-average molecular weight of the polycarbonate within the range defined in claim 7 to which claim 8 refers (paragraph 61).

Moreover, as regards the removal of free phenol and free bisphenol A before the extrusion step, paragraph 25 of the specification provides relevant guidance which is standard in the present field.

Respondent-opponent 2 submits in relation to claim 1 that it is difficult for the skilled person to remove volatile components when the temperature of the resin rises above 370 °C or the difference between the extruder inlet resin temperature and the extruder outlet resin rises above 70 °C.

However, firstly, this is not relevant to claim 1, which does not contain any limitation as to the amount of volatile components, but only to claim 8. Secondly, these temperature constraints are part of the teaching of the patent in suit in order to achieve the amount of volatiles defined in claim 8. Accordingly, they rather direct the skilled person to the claimed subject-matter. Therefore, for the same reasons as set out in point 4 above, the skilled person, taking into account these temperature constraints, is generally capable of providing a process in accordance with operative claim 8.

Respondent-opponent 2 also argues that comparative examples 1 and 2 demonstrate that the invention cannot be carried out because the phenol content already increases significantly when the extruder outlet resin temperature is 342 °C without a filter and 355 °C with

a filter. Again, this argument again is only relevant to claim 8. However, as pointed out by the appellant, the process referred to by respondent-opponent 2 does not correspond to that defined in the present claims. On that basis alone, this argument is not convincing.

Respondent-opponent 2 also submits that formulae (1) and (3) in paragraph 34of the patent in suit (page 6, line 5 and page 6, lines 56, respectively) show in combination with the results shown in tables 1 and 2 that an extruder outlet resin temperature of at most 321°C (using formula 1) or 341°C (using formula 3) can be used to provide the amount of volatiles defined in claim 8.

However, these formulae, only refer to a preferred embodiment and are a function of the intrinsic viscosity of the polycarbonate. This also gives additional guidance to the skilled person in selecting the extruder outlet resin temperature as a function of the intrinsic viscosity of the polycarbonate.

9. In view of the above, it has not been shown that the subject-matter defined in the granted claims lacks sufficiency of disclosure. Consequently, the ground for opposition under Article 100(b) EPC does not prejudice maintenance of the patent as granted.

Novelty

10. Novelty of the method of claim 1 has been objected in the light of the disclosure of each of D31, D1, D3, D5, D8, D11 and D26.

Novelty over D31

11. The appellant contests the finding of the opposition division that example 4 of D31, as is further submitted by the respondents, would implicitly disclose a process in which:

- the difference between the extruder outlet resin temperature (T2) and the extruder inlet resin temperature (T1) $\Delta T = T2-T1$ is not higher than 70°C and

- the extruder outlet resin temperature (T2) is not higher than 370°C.

11.1 According to the case law of the Boards of Appeal the term "implicit disclosure" refers to a disclosure which any person skilled in the art would objectively consider to be necessarily implied by the the explicit content, i.e. the direct and unambiguous consequence of what is explicitly mentioned (Case Law, *supra*, I.C.4.3).

11.2 The objection of respondent-opponent 1, in line with the conclusion of the opposition division, is based on the allegation that

(i) the setting temperature of 285°C for the second post-polymerization tank disclosed in paragraph 241 is not only the temperature of the polycarbonate leaving that tank, but also approximately the temperature of the resin continuously supplied and entering the extruder,

(ii) the temperature of 310°C disclosed in paragraph 244 of D31, which is the temperature of the

polycarbonate that is supplied to the polymer filter, i.e. after it was passed through a gear pump, can be equated with the temperature of the resin at the extruder outlet.

11.3 Allegation (ii) is based on an interpretation of the term "extruder" in claim 1 as covering an apparatus comprising one or more zones in which the resin is transported by means of one or two screws, a gear pump, a melt filter and ultimately an extrusion die (rejoinder, page 9, second paragraph), i.e. an interpretation of claim 1 according to which the gear pump described in example 4 of D31 would be part of the extruder.

Respondent-opponent 1 then refers to paragraph 35 of the patent in suit (rejoinder, page 9, third paragraph) and argues that it suggests that the resin outlet temperature is the temperature of the polycarbonate before it is supplied to the melt filter (rejoinder, page 9, third paragraph).

First of all, paragraph 35 of the patent in suit does not support the interpretation of the term "extruder" given by respondent-opponent 1. It can be inferred from paragraph 34 (page 6, line 52) and paragraph 35 of the patent in suit ("*It is necessary to elevate the extruder outlet resin temperature for preventing the rise of pressure loss experienced in the polymer filter treatment*") that the filter treatment is conducted after the extrusion. This is consistent with the indication in paragraph 6 of the specification of the problem solved by the present invention.

Moreover, respondent-opponent 1 has not referred to any evidence showing that such a sequence of devices would

be considered by the skilled person as an extruder, even if these devices are not disclosed to be within the same apparatus, as is the case for example 4 of D31. For this reason alone, the objection of respondent-opponent 1 that example 4 of D31 anticipates the subject-matter of granted claim 1 is not convincing, since it is based on an unreasonable interpretation of the term "extruder" in granted claim 1.

11.4 In any event, even if one were to accept the interpretation of respondent-opponent 1 of the term "extruder", i.e. including all the features mentioned by respondent-opponent 1 with an extrusion die at the end, example 4 of D31 would not disclose the temperature at the outlet of the "extruder", which, according to the allegation of respondent-opponent 1, in the case of example 4 of D31, is the temperature of the resin coming out of the die.

In view of paragraph 191 of D31, which specifies that the polymer temperature during the filtration operation is more preferably not higher than 330° C, and the apparent absence of any teaching on the temperature set for the filter, the skilled person understands that the temperature of 310°C mentioned in paragraph 244 of D31 is that of the molten polycarbonate. However, example 4 does not describe the part of the apparatus used between the extruder outlet and the filter, which part will include the gear pump and any connections between those devices. There is also no indication of whether measures have been taken to prevent heat loss and to what extent.

11.5 Similarly, while the skilled person concludes from the wording of paragraph 241 of D31 that the molten

polycarbonate is transported from the second post-polymerisation tank to the extruder in a molten state, since a solidification step is not described, the skilled person does not find any information on the means used to transport the molten carbonate to the extruder, such as the dimensions of the pipe used and as to whether measures are taken to insulate the pipes or to control the temperature of the polycarbonate. On this basis, a certain temperature drop between the second-post polymerisation tank and the extruder inlet cannot be excluded.

11.6 Concerning the compounding extruder used in example 4 of D31, the appellant's argument that it is known that the temperature of the molten polycarbonate increases during extrusion is not disputed. Power dissipation due to viscous shearing is common general knowledge, as shown by D33/D33a, D34/D34a, D35 and D36/D36a, which documents show that the temperature rise along the screw is a function of multiple factors such as the geometry of the extruder (screw diameter, depth of the screw groove) and the extrusion conditions, in particular rotating speed. No argument has been provided as to why, given the information on the extrusion step provided in example 4 of D31, the temperature rise should necessarily be at most 70°C as required by granted claim 1. In the absence of any information on the extrusion parameters in example 4 of D31, the difference between the extruder outlet resin temperature (T2) and the extruder inlet resin temperature (T1) $\Delta T = T2-T1$ in example 4 of D31 cannot be estimated.

11.7 Given the preference for a maximum resin temperature of 350°C, and more preferably 330°C, for the filtration operation described in paragraph 191, and the above

conclusion regarding the possibility of a significant temperature rise of the resin during the extrusion operation, it is also conceivable that a drop in temperature is required to filter the resin at a temperature preferably recommended in D31. The argument of respondent-opponent 1, that it would be common practice in an industrial process to keep the piping used to transport of chemicals as short as reasonably possible and further to ensure that the piping is insulated and/or temperature controlled to prevent disturbance of the temperature at which the chemical is transported, is not convincing. This is highly context dependent and in the present case is not supported by any evidence relating to the transport of a molten bisphenol A polycarbonate from the last reactor to a compounding extruder where, as mentioned above, the temperature of the molten polycarbonate is expected to rise.

11.8 On this basis, in the absence of any information in example 4 of D1 on (i) the means of connection between the second post-polymerisation tank and the extruder inlet, (ii) the extrusion parameters which determine the extent of the temperature rise of the resin during extrusion and (iii) the means of connection and the gear pump device between the extruder outlet and the filter, no firm conclusion can be drawn as to whether the temperature of the polycarbonate resin of 310 °C when it reaches the filter device is the result of a difference between the extruder outlet resin temperature and the extruder inlet resin temperature of at most 70°C. In other words, the subject-matter of granted claim 1 cannot objectively be considered to be the direct and unambiguous consequence of what is explicitly described in example 4 of D31.

11.9 The Board therefore does not concur with the finding in the contested decision that the subject-matter of claim 1 is anticipated by example 4 of D31.

Novelty over D1

12. The objection is based on the production of an aromatic polycarbonate described in example 1 of this document (paragraph 67 and following). Example 1 of D1 does not provide sufficient information on the extrusion conditions so that the difference between the extruder outlet resin temperature (T2) and the extruder inlet resin temperature (T1) $\Delta T = T2-T1$ cannot be estimated on this basis. As rightly pointed out by respondent-opponent 1, a maximum resin temperature of 278°C is explicitly disclosed in paragraph 74 of D1, which means that the extruder outlet temperature cannot be higher than this maximum value. The general teaching of D1 in paragraph 63 thereof confirms that the conditions in extruder 11a, i.e. the first line of production represented in figure 1 and used in example 1 of D1, are such that the maximum resin temperature is about 278°C. Respondent-opponent 1 is also correct in stating that the temperature of 265°C in the fourth reactor defined in paragraph 73, together with the pressure and the number of revolutions of blade, is the temperature used for the reaction, as confirmed in paragraph 38.

12.1 However, as stressed by the appellant, example 1 of D1 does not explain how and by what means the molten polycarbonate is drawn from the fourth horizontal reactor and supplied to the extruder. As already indicated in point 11.7 above, the argument of respondent-opponent 1 that it is common practice for an industrial process to ensure that the piping is sufficiently short, insulated and/or the temperature

controlled to prevent disturbance of the temperature at which the chemical is transported, is not convincing. In the process described in example 1 of D1, the temperature of the molten polycarbonate resin is also expected to rise during compounding in the extruder, with a maximum value indicated in paragraph 74. In this case, a necessary temperature drop of the molten polycarbonate between the outlet of the fourth reactor and the inlet of the extruder in order to compensate for the temperature rise in the compounding extruder cannot be excluded.

12.2 The argument of the respondents that, given the maximum resin temperature of 278°C and the temperature of 265 °C in the fourth reactor, it is unlikely that the difference between the extruder outlet resin temperature (T2) and the extruder inlet resin temperature (T1) for the process of example 1 of D1 is not more than 70°C is not persuasive because likelihood is not an appropriate criterion for assessing the disclosure of a document.

The concept of disclosure was defined by the Enlarged Board of Appeal in opinion G 3/89 and decision G 11/91 (OJ EPO 1993, 117 and 125), which concept was reaffirmed in decision G 2/10 (OJ EPO 2012, 376). It is limited to what a skilled person would derive directly and unambiguously, using common general knowledge, and seen objectively and relative to the relevant date, from the whole document. This concept is the same for the purposes of Articles 54, 87 and 123 EPC, as outlined in decisions of the Enlarged Board of Appeal G 1/03 (OJ EPO 2004, 413, point 2.2.2 of the Reasons) and G 2/10 (*supra*, point 4.6 of the Reasons). It is therefore a general and consistently applied principle of the Boards of Appeal that, in order for novelty to

be denied, there must be a direct and unambiguous disclosure in the state of the art which inevitably leads the skilled person to a subject-matter falling within the scope of what is claimed.

12.3 Taking into account (i) the same considerations as for D31 in relation to a temperature increase in the extruder due to power dissipation and (ii) the lack of concrete information on how the molten polycarbonate is transported between the fourth polymerisation reactor and the extruder inlet, it cannot be concluded with certainty that the difference between the extruder outlet resin temperature and the extruder inlet resin temperature for the process described with example 1 of D1 is in the range defined in present claim 1. In other words, with reference to decision T 0051/10 cited by respondent-opponent 1, and taking into account the overall context of D1, which does not provide sufficient details as to both the transport of the molten polycarbonate between the fourth reactor and the extruder and the extrusion conditions, a $\Delta T = T2 - T1$ higher than 70°C is a realistic alternative for the skilled person.

12.4 Since the subject-matter of granted claim 1 cannot be regarded as the inevitable consequence of what is disclosed by example 1 of D1, the objection that claim 1 is anticipated by example 1 of D1 is not persuasive.

Novelty over D3

13. According to respondent-opponent 1, the reasoning with regard to D3 is essentially similar to that for D1, reference being made to paragraph 35 of D3, which describes a polymerisation process at a temperature of

280°C in the last reaction tank and a maximum temperature of the resin in the extruder of 330°C, as indicated in the fourth column of the table in paragraph 41 (see version of the document in Japanese). Again, having regard to considerations similar to those taken into account for D31 in relation to a temperature increase in the extruder due to power dissipation, and the absence of concrete information on how the molten polycarbonate is transported between the fifth polymerisation reactor and the inlet of the extruder, it cannot be concluded with certainty that the difference between the extruder outlet resin temperature and the extruder inlet resin temperature for the method of D3 is within the range defined in present claim 1.

Novelty over D5

14. The opposition division found that claim 1 was novel over the disclosure of D5. Respondent-opponent 1 made a general reference to its notice of opposition, but did not explain why the reasoning of the opposition is incorrect. Therefore, the submissions of respondent-opponent 1 in relation to the issue of novelty over D5 do not comply the requirements of Article 12(3) RPBA 2020, according to which the reply to the statement of ground of appeal shall expressly specify all the requests, facts, objections, arguments and evidence relied on. On that that basis, the Board make uses of its discretionary power under Article 12(5) RPBA 2020 not to admit this part of the submissions of respondent-opponent 1.

Novelty over D8

15. According to the contested decision, D8 merely describes the preferred temperature range for operating the extruder, but does not clearly and unambiguously disclose the extruder inlet and outlet temperatures. Respondent-opponent 1 does not rely on any specific disclosure of D8 for the alleged disclosure of the difference in resin temperature between the outlet and the inlet of the extruder. Rather, it relies for that difference on possible combinations of the lower and upper limits taken from the range of temperatures generally taught on page 4, lines 22-26 of D8 for the polycondensation reaction, considered as the resin inlet temperature, and the range of temperatures during the devolatizing extrusion treatment given on page 5, lines 27 to 29, taken as the resin outlet temperature. These possible combinations of temperatures C1 to C4 are indicated at the bottom of page 15 of the rejoinder of respondent-opponent 1.

Firstly, not all of these possible combinations result in a difference between the extruder outlet resin temperature and the extruder inlet resin temperature which falls within the definition of operative claim 1, i.e. it cannot be inferred from D8 that the process described in D8 inevitably results in what is presently claimed. But more importantly, none of these specific possible combinations of temperatures C1 to C4 between various lower and upper limits has been shown to be directly and unambiguously disclosed in D8. A pointer to these particular combinations in D8 was not cited by respondent-opponent 1. On this basis, it has not been shown that the subject-matter of granted claim 1 is anticipated by D8.

Novelty over D11

16. The objection of respondent-opponent 1 in view of D11 relates to example 6 on pages 59 and 60 of this document. It describes a process in which the reaction temperature in the last reactor is 270°C and the polycarbonate is then continuously supplied in the molten state to a compounding extruder. No information is given on the temperature of the molten resin in the extruder for the specific process described in this example. However, respondent-opponent 1 argues that this disclosure must be read in the light of the general teaching on page 32, lines 9-18 to carry out the extrusion, preferably at 240 to 320°C. This is not convincing because it has not been shown that D11 provides a direct and unambiguous disclosure for selecting this specific example within the teaching of D11 and carry it out at a temperature in the lower part of that temperature range. Furthermore, the manner and means of transferring the molten polycarbonate resin to the extruder is also not disclosed in that document. Therefore, there is no reason to believe that the temperature of the molten resin at the entry of the extruder is at most 70°C lower than the temperature of the resin at the exit of the extruder. On this basis, novelty over D11 is also acknowledged.

Novelty over D26

17. Respondent-opponent 2 objects that claim 1 lacks novelty over example 1 of D26 (column 2, lines 26-40). The reasoning of respondent-opponent 2 is based on the contention that the externally heated and vented pipe described in example 1 which comprises a coil spring through which an incompletely polymerised polycarbonate having a temperature of 250°C is continuously fed,

conveyed and further polymerized, is an extruder. Since the pipe is described as being externally heated to a temperature in the range of 270 to 300° C, the difference in temperature between the inlet and the outlet of this pipe, which is considered by respondent-opponent 2 to be an extruder, is considered by this party to meet the condition defined in operative claim 1. In addition, respondent-opponent 2 submits that D24 shows that single-screw extruders were already state of the art.

According to the common general knowledge, an extrusion process, or the means used for an extruder, requires that sufficient pressure can be built up to force the material (here the polycarbonate resin) out of the extruder. However, neither the specific disclosure of example 1, nor the general disclosure of claim 1 of D26 defines such an extrusion process.

Although claim 1 of D26 cannot be novelty-destroying because it does not relate specifically to polycarbonate resins, its teaching is relevant to understanding the embodiment described by example 1 of that document. Claim 1 of D26 describes a process for the production of thermoplastic polycondensation products, in which the volatile products of the reaction and optionally the solvent are separated, the product being distributed and transported as a thin film over the inner wall of the pipe. This implies that the polymer does not completely fill the available internal space of this reactor. This is incompatible with the requirement for an extrusion to built up sufficient pressure to force the resin out of the apparatus. The text of example 1 concerning the production of a polycarbonate resin does not define that the resin is forced through a die or a similar

device, as would be required for an extrusion process, as is argued by the appellant on the basis of D37.

D26a, which is a US application claiming priority of D26, confirms that the polymerisation reactor described in D26 was not considered by the inventors of that document to be an extruder. The appellant refers in this respect to column 3, line 50 of D26a (statement of grounds of appeal, page 26, first full paragraph). Reference may also be made to column 2, lines 56-60, column 3, lines 28-36 and column 3, lines 70-72 of D26a. All these passages refer to the possible use of an extruder in addition to the heated and vented pipe and confirm that the heated and vented pipe described in D26a and also in D26 is not an extruder.

Considering the drawing sheet representing two embodiments of the polymerisation reactor of D26, the only extruder described in D26 is shown with reference sign 7 in the figure on the right-hand side of the drawing sheet (statement of grounds of appeal, page 26, first full paragraph). That extruder is located inside the pipe at its outlet as a means of discharging the polycarbonate (column 2, lines 19-20). However, it is undisputed that D26 does not contain any information on the temperature of the resin entering the extruder located inside the pipe, as shown in that figure, let alone on a process for the production of polycarbonate.

Accordingly, the disclosure of D26 does not anticipate the subject-matter of granted claim 1.

18. In view of the above, the ground for opposition under Article 100(a) EPC in conjunction with Article 54 EPC

does not prejudice maintenance of the patent as granted.

Remittal

19. Since the objection under Article 100(a) EPC in conjunction with Article 54 EPC, on the basis on which the opposition division did not allow the main request, does not prejudice the maintenance of the patent as granted, the impugned decision is to be set aside. However, the respondents also object that the subject-matter of the opposed patent lacks an inventive step. Both respondents requested that the case be remitted to the opposition division, while the appellant requested that the Board in exercise of its discretion pursuant to Article 111(1) EPC decide on this remaining issue.

20. Article 11 RPBA 2020 provides that the Board shall not remit a case to the department whose decision was appealed for further prosecution, unless special reasons present themselves for doing so. Whether "special reasons" present themselves is to be decided on a case-by-case basis (see explanatory remarks on Article 11 RPBA 2020, Supplementary publication 2, OJ 2020). This provision has also to be read in conjunction with Article 12(2) RPBA 2020, which provides that it is the primary object of the appeal proceedings to review the decision under appeal in a judicial manner.

As stated above, the main request meets the requirements of novelty, contrary to the finding of the opposition division in the contested decision. However, a method as defined in the main request was not examined with regard to inventive step by the opposition division. Whereas the issue of inventive

step issue debated during the oral proceeding and decided upon by the opposition division in relation to the then pending auxiliary request 2 concerned exclusively characteristics of the polycarbonate *per se*, i.e. the amount of residual aromatic dihydroxy content compound and the combined amount of Fries branching (see summary of the decision in points II e) and f) above), the issue to be decided in respect of the present main request would concern a process feature for the production of the polycarbonate, namely the difference between the extruder outlet resin temperature and the extruder inlet resin temperature. This obviously requires a fundamentally different analysis of the question of inventive step. This situation is seen by the Board to constitute "special reasons" within the meaning of Article 11 RPBA 2020 to remit the case for further prosecution to the department whose decision was appealed.

Accordingly, exercising its discretion under Article 111(1), second sentence, EPC, the Board decides to remit the case 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.

The Registrar: The Chairman:

D. Hampe D. Semino

Decision electronically authenticated