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Datasheet for the decision of 9 June 2010

Case Number: T 1682/07 - 3.5.03

Application Number: 97953394.0

Publication Number: 0948761

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Language of the proceedings: EN

Title of invention:
On-line control of a chemical process plant

Patentee:
ExxonMobil Chemical Patents Inc.

Opponents:
Bayer AG
Bran + Luebbe GmbH
BASF Aktiengesellschaft
Borealis Technology OY

Headword:
On-line control of a chemical process plant/EXXONMOBIL

Relevant legal provisions:
EPC Art. 56, 83, 100(a), (b), (c), 123(2) and (3)

Keyword:
"inventive step (main request and 1. - 6. auxiliary requests - no"
"inventive step (7. auxiliary request) - yes"
"sufficiency of disclosure (7. auxiliary request) - yes"
"extension of protection - no"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 1682/07 - 3.5.03

D E C I S I O N
of the Technical Board of Appeal 3.5.03
of 9 June 2010

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Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office posted 2 August 2007 concerning maintenance of the European patent No. 0948761 in amended form.**

Composition of the Board:

Chairman: A. S. Clelland
Members: A. J. Madenach
R. Moufang

Summary of Facts and Submissions

I. The present appeal arises from the interlocutory decision of the opposition division posted on 2 August 2007, finding that European Patent No. 948 761 in amended form met the requirements of the EPC.

II. The opposition division came to the conclusion that the then main request met the requirements of Article 123(2) and (3) EPC but not those of Article 83 EPC.

With respect to the then first auxiliary request the opposition division came to the conclusion that it met the requirements of Articles 123(2) and (3) EPC and Article 83 EPC, and that independent claims 1 and 28 met the requirements of Article 54 EPC but not those of Article 56 EPC.

With respect to the then second auxiliary request the opposition division came to the conclusion that it met the requirements of the EPC. As regards Article 56 EPC, reference was made inter alia to the following documents:

E12a: EP 304 232 B

E13: E. Stark et al.: "Near-Infrared Analysis (NIRA): A Technology for Quantitative and Qualitative Analysis"; Applied Spectroscopy Reviews, 22(4), pages 335-399, 1986.

III. An appeal was filed against this decision by the patentee (hereafter referred to as appellant 1) with letter received on 12 October 2007. The appropriate fee was paid and the corresponding statement of grounds was

filed. It was requested that the appealed decision be set aside and that the patent be maintained on the basis of the main request of 23 April 2007 or, as an auxiliary measure, on the basis of one of the auxiliary requests I to VII filed with the grounds for appeal on 12 December 2007. The claims according to auxiliary request VII correspond to those maintained by the opposition division. Oral proceedings were requested as an auxiliary measure. With letter received on 30 June 2008 further auxiliary requests VIII - XII were submitted and arguments in support of the requests were filed.

IV. An appeal was also filed against this decision by opponent 1 (Bayer AG, hereafter referred to as appellant 2) with letter received on 1 October 2007. The appropriate fee was paid and the corresponding statement of grounds was filed. It was requested that the appealed decision be set aside and the patent revoked. Oral proceedings were requested as an auxiliary measure.

Appellant 2 based its appeal on the grounds for opposition according to Articles 100 (a) and (b) EPC arguing inter alia that the invention was obvious to a person skilled in the art (Article 56 EPC) having regard to the state of the art as shown in E12a, as well as in

E1: US 5 121 337 A,

and that the invention was not disclosed in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art (Article 83 EPC).

V. An appeal was also filed against this decision by opponent 3 (BASF AG, hereafter referred to as appellant 3) with letter received on 11 October 2007. The appropriate fee was paid and the corresponding statement of grounds was filed. It was requested that the appealed decision be set aside and the patent revoked. Oral proceedings were requested as an auxiliary measure. Further arguments in support of these requests were filed with letters received on 30 June 2008 and on 7 May 2010.

Appellant 3 based its appeal on the grounds for opposition according to Articles 100 (a) and (c) EPC arguing inter alia that the invention was obvious to a person skilled in the art (Article 56 EPC) having regard to the state of the art as shown in E12a and in E13, and that the European Patent was amended in such a way as to extend the protection it confers (Article 123(3) EPC).

VI. Opponents 2 and 4 (Bran + Luebbe GmbH and Borealis Technology; hereafter referred to as respondents 1 and 2, respectively) did not file any submissions.

VII. In a communication of 24 February 2010 pursuant to Article 15(1) of the Rules of Procedure of the Boards of Appeal, accompanying a summons to oral proceedings, the board gave its preliminary opinion.

Pursuant to the summons, respondents 1 and 2 informed the board that they would not participate at the oral proceedings.

VIII. Further submissions were filed by appellant 1 with letter of 12 May 2010 which included three auxiliary requests.

IX. During the oral proceedings which took place on 9 June 2010, appellant 1 submitted claims 1 to 33 of a new auxiliary request VII and requested that the decision under appeal be set aside and the patent be maintained in amended form on the basis of the main request, filed as "Auxiliary Request V" with letter of 11 December 2007, or, in the alternative, on the basis of the first auxiliary request, filed as "Auxiliary Request I" with letter of 11 December 2007, or the second auxiliary request, filed as "Auxiliary Request II" with letter of 12 May 2010, or that the appeals of appellants 2 and 3 be dismissed (third auxiliary request), or that the decision under appeal be set aside and the patent be maintained in amended form on the basis of the fourth auxiliary request, filed as "Auxiliary Request IX" with letter of 12 May 2010, or the fifth auxiliary request, filed as "Auxiliary Request VIII" with letter of 27 June 2008, or the sixth auxiliary request, filed as "Auxiliary Request VI" with letter of 11 December 2007, or the seventh auxiliary request, filed at the oral proceedings, or the eighth auxiliary request, filed as "Auxiliary Request IX" with letter of 27 June 2008, or the ninth auxiliary request, filed as "Auxiliary Request X" with letter of 27 June 2008, or the tenth auxiliary request, filed as "Auxiliary Request XI" with letter of 27 June 2008, or the eleventh auxiliary request, filed as "Auxiliary Request XIV" with letter of 12 May 2010.

Appellants 2 and 3 confirmed their requests that the appealed decision be set aside and the patent revoked.

At the end of the oral proceedings the chairman announced the board's decision.

X. Claim 1 according to the main request reads as follows:

"A method for online control of a process that has a plurality of steps and that produces a finished product with a property P having a desired value D, whereby a spectrum for a test sample at an intermediate step in said process is measured and used to control said product property P, comprising:

(a) obtaining a set of measured spectra having measurement errors for a set of calibration samples representative of at least one intermediate step in said process;

(b) producing a set of correction spectra that simulate data that arise from the measurement process itself and are not due to components in the calibration samples;

(c) correcting said measured spectra for said measurement errors by orthogonalizing said set of measured spectra with respect to the set of correction spectra to produce a set of corrected spectra for said set of calibration samples;

(d) determining a set of weights from the set of corrected calibration sample spectra relating said corrected spectrum of each of said calibration samples to a set of orthonormal basis functions;

(e) obtaining a value of said property P of the product that corresponds to each calibration sample of said set of calibration samples;

(f) determining a predictive model relating said value for said property P of said product to said set of weights;

(g) measuring a spectrum for a test sample at said at least one intermediate step in said process;

(h) obtaining a corrected spectrum for said test sample at said at least one intermediate step in said process by orthogonalizing said measured spectrum for said test sample with respect to the set of correction spectra;

(i) determining an estimated value E for said property P of the predicted product corresponding to said test sample from said predictive model and said corrected spectrum of said test sample; and

(j) controlling said process using a calculated difference between said estimated value E of said predicted product and said desired value D,

wherein said process is a polymerisation process."

Independent claim 28 relates to a corresponding process plant.

XI. Claim 1 according to the first auxiliary request reads as follows:

"A method for online control of a process that has a plurality of steps and that produces a finished product with a property P having a desired value D, whereby a spectrum for a test sample at an intermediate step in said process is measured and used to control said product property P, comprising:

(a) obtaining a set of measured spectra having measurement errors for a set of calibration

samples representative of at least one intermediate step in said process;

(b) producing a set of correction spectra that simulate data that arise from the measurement process itself and are not due to components in the calibration samples;

(c) correcting said measured spectra for said measurement errors by orthogonalizing said set of measured spectra with respect to the set of correction spectra to produce a set of corrected spectra for said set of calibration samples;

(d) determining a set of weights from the set of corrected calibration sample spectra relating said corrected spectrum of each of said calibration samples to a set of orthonormal basis functions;

(e) obtaining a value of said property P of the product that corresponds to each calibration sample of said set of calibration samples;

(f) obtaining a value of at least one additional property for each calibration sample of said set of calibration samples;

(g) determining a predictive model relating said value for said property P of said product to said set of weights and said value of said at least one additional property of said calibration samples;

(h) measuring a spectrum for a test sample at said at least one intermediate step in said process;

(i) measuring said at least one additional property for said test sample at said at least one intermediate step in said process;

(j) obtaining a corrected spectrum for said test sample at said at least one intermediate step in said process by orthogonalizing said measured

spectrum for said test sample with respect to the set of correction spectra;

(k) determining an estimated value E for said property P of the predicted product corresponding to said test sample from said predictive model, said corrected spectrum of said test sample and said value of said at least one additional property of said test sample; and

(l) controlling said process using a calculated difference between said estimated value E of said predicted product and said desired value D."

Claim 1 according to the second auxiliary request corresponds to claim 1 of the first auxiliary request with the following additional feature:

"wherein said spectra for said set of calibration samples and for said test sample are measured by a Fourier Transform Near Infrared (FTNIR) spectrometer".

Claim 1 according to the third auxiliary request corresponds to claim 1 forming the basis of the patent as maintained by the interlocutory decision and is based on claim 1 of the first auxiliary request with the added feature that the process is a polymerisation process.

Claim 1 according to the fourth auxiliary request corresponds to claim 1 of the third auxiliary request with the following additional feature:

"wherein said spectra for said set of calibration samples and for said test sample are measured by a Fourier Transform Near Infrared (FTNIR) spectrometer".

Claim 1 according to the fifth auxiliary request corresponds to claim 1 of the third auxiliary request, with the following additional feature:

"wherein said property P is selected from the group consisting of: Mooney viscosity, polymer unsaturation, comonomer incorporation, halogen content, polymer concentration, monomer concentration, molecular weight, melt index, stream component composition, moisture in the product, and molecular weight distribution".

Claim 1 according to the sixth auxiliary request is based on claim 1 of the main request, with the feature "wherein said process is a polymerisation process" being replaced by:

"wherein said process is a butyl rubber polymerization process".

Claim 1 according to the seventh auxiliary requests is based on claim 1 according to the sixth auxiliary request with the property P being restricted to Mooney viscosity and polymer molecular weight.

Each of these auxiliary requests include a further independent claim relating to a corresponding process plant.

In view of the board's decision it is not necessary to reproduce any of the claims of the eighth to eleventh auxiliary requests.

Reasons for the decision:

1. *Consolidation of the appeals*

Pursuant to Article 10(1) RPBA the three appeals are considered in the same proceedings.

2. *Ground for opposition according to Article 100(c) EPC:*

2.1 Claim 1 as granted comprised the feature:

"A method for online control of a process ... whereby the spectra of a test sample **taken** at an intermediate step in said process is measured ..." (emphasis added by the board).

Claim 1 according to all present requests comprises a modification of this feature:

"A method for online control of a process ... whereby a spectrum for a test sample at an intermediate step in said process is measured ...".

2.2 The formulation in claim 1 as granted gives rise to a potential ambiguity in that it could mean either that the spectra can be taken, or that a test sample can be taken, at an intermediate step.

If the latter interpretation of claim 1 as granted were followed, the consequence would be that the step of taking a sample has been omitted in claim 1 according to all requests, extending the scope of the patent, Article 123(3) EPC.

If, however, the former interpretation of claim 1 as granted is followed, removing the word "taken" amounts to removing a tautology as in the context "spectra taken" has the same meaning as "spectra measured". No extension of scope is conferred by removing such a tautology.

2.3 According to established case law in the case of ambiguity in the wording of a claim recourse should be taken to the patent as a whole to determine the meaning of the claim.

As is clear from the apparatus shown in Figure 3 and the related description in paragraph [0017] of the patent in suit, spectra are monitored or "taken" in a flow stream through this apparatus but no test sample is removed or "taken" from the flow stream. Nothing in the patent warrants the interpretation that a sample is taken.

2.4 Appellants 2 and 3 argued that the German and French translations of claim 1 of the patent made clear that the protection sought by the patentee was for the taking of a test sample.

It is in fact correct that the German and French translations of claim 1 of the patent remove the above ambiguity and imply that a test sample is removed. These incorrect translations are not however relevant to the board's interpretation of claim 1 in the present appeal proceedings.

2.5 In view of the above, it follows that removal of the word "taken" from claim 1 of all requests does not give rise to an objection under Article 123(3) EPC.

3. *Grounds for opposition according to Article 100(a) EPC, main request:*

3.1 The invention according to claim 1 of the main request concerns a method for online control of a process that produces a finished product.

The actual control process is a forward or predictive control process which does not control a property of the finished product directly. Instead, an intermediate quantity (a spectrum of a test sample) is measured (step g). From these measurements, a property of the finished product is deduced on the basis of a predictive model (step i) and control is performed on the basis of the difference between the deduced property and its desired value (step j).

Prior to this actual control process, a process for correction of spectra for errors that are due to the measurement process itself (rather than components in the calibration samples) is performed. This part of the process essentially comprises obtaining spectra of calibration samples (step a), producing correction spectra for correcting errors arising from the measurement process itself (step b), correcting the obtained spectra to produce corrected spectra (step c), and determining a set of weights from the corrected calibration sample spectra which relate these spectra to a set of orthonormal basis functions (step d).

The predictive model used in the actual control process is determined by first obtaining values of the property of the finished product of the calibration samples (step e), and by relating these values to the set of weights (step f).

It is to be noted that in the actual control process (steps g-j) the measured spectrum of the test sample is corrected by orthogonalisation with respect to the correction spectra obtained in step b, and that the corrected spectrum is used for deducing a property.

3.2 The board notes that forward control which is based on an intermediate quantity which is used to deduce a quantity of a finished product based on a predictive model is well known in the art.

It appears that in most instances a single or several properties of an intermediate product are used for this purpose (see e.g. the abstract of the review article "Chemometric Methods for Process Monitoring and High-Performance Controller Design", M. H. Kaspar and W. H. Ray, American Institute of Chemical Engineers Journal, volume 38, pages 1593-1608, 1992, referred to as E17 in the opposition proceedings, and E13, sections F at page 357 and M at page 376).

The claimed invention is distinguished from such known control processes in that a property of the end product is deduced from the (corrected) spectrum on an intermediate product without first determining a particular property of the intermediate product.

3.3 The board therefore agrees with appellants 1-3 and the opposition division that E12a represents the closest prior art since it shows exactly this: deducing a property of a finished product from spectra taken of a product which forms a feedstock (page 2, lines 3-5).

Specifically, E12a discloses a method for the determination of the properties of the feedstock and the properties of the (end) product by carrying out near infrared analyses on the feedstock and correlating these with the desired properties of the product. The method is suitable for on-line and real time use and for incorporation in process control (page 2, lines 3-6 and lines 21-27).

E12a thus discloses a method for online control of a process (page 2, lines 5 and 6, claim 9) that has a plurality of steps (e.g. infrared analyses, correlation with the desired properties) and that produces a finished product with a property P (page 2, lines 17-19 as well as page 9, line 13 "maleic anhydride number" and page 10, line 6 "KUOP factor") having a desired value (page 2, line 5). A NIR absorption spectrum (see claims 1 and 5) for a feedstock at an intermediate step in said process is measured and used to control said product property P.

The board considers the plurality of discrete frequencies at which absorption is measured (claim 5) to correspond to a spectrum in the sense of claim 1 of the main request since there is no restriction on the spectrum to be measured, in particular with respect to the number of frequency points.

The patent in suit leaves it open as to where or when in the process an intermediate step would occur, or what the specific nature of the products of this step would be. According to E12a, a spectrum is measured on the feedstock. The feedstock is usually prepared in or obtained by a previous process and can for example comprise mixtures of variable compositions (page 17, line 22). It can be considered as a test sample at an intermediate step if the preparation of the feedstock is considered part of an overall process. In this context, the board notes that E12a provides an indication that the feedstock on which the measurements are made may result from a previous preparation (page 5, lines 5 and 6), thus pointing to an overall process with the provision of the feedstock forming an intermediate step.

The term "test sample at an intermediate step" cannot, as argued by appellant 1, be interpreted as relating to a step of an otherwise incomplete process in contrast to a (complete) process which results in the preparation of a feedstock as in E12a. Instead, a feedstock must be considered to be a result of an incomplete overall process since the preparation of a feedstock is not the intended result of the overall process.

Thus, the term "test sample at an intermediate step" must be interpreted in its most general sense and therefore comprises the feedstock. The claim therefore comprises the situation in which measurements on the feedstock constitute measurements at an intermediate step of an overall process involving preparational

steps for the feedstock as well as processing of the feedstock.

E12a therefore discloses all features of the preamble of claim 1.

Furthermore, according to E12a the correlation between the spectra measured on the feedstock and the property of the product is determined by multivariate regression (page 2, lines 25-26). The multivariate regression has, in this context, to be considered as a predictive model used for determining or predicting an estimated value of the properties of the final product (see also page 2, lines 10-11). This implies, as claimed in step f of claim 1, that a predictive model relating the value for said property of said product to said spectra is determined.

As explained above, spectra are measured for a test sample at at least one intermediate step in said process as claimed in step g of claim 1. An estimated value E for said property P of the predicted product corresponding to said test sample from said predictive model and said spectrum of said test sample is determined as claimed in step i of claim 1. The process is controlled using a calculated difference between the estimated value E of said predicted product and said desired value D as claimed in step j of claim 1 (claim 2 of E12a).

The known method also comprises obtaining a set of measured spectra from a set of feedstock used for "preliminary calibration" (page 3, lines 26-27). As reasoned above, obtaining spectra of a feedstock is

considered to correspond to obtaining spectra of samples of an intermediate step of the process in the language of claim 1. Consequentially, obtaining spectra from a set of feedstock used for preliminary calibration must be understood to correspond to obtaining a set of measured spectra for a set of calibration samples representative of at least one intermediate step in said process as claimed in step a of claim 1. The presence of a base line (claim 1 of E12a) implies that measurement errors in the measured spectra are present in E12a.

Furthermore, E12a discloses obtaining a value of said property P of the product that corresponds to each calibration sample of said set of calibration samples (page 3, lines 26-27; the constant C and the various coefficients defining the property of the product), as claimed in step e of claim 1.

3.4 Thus, all features of claim 1 apart from process steps b, c, d, h and an explicit reference to a polymerisation process are known from E12a, as was also conceded by appellant 1 (see point VI 1.b.i of the grounds of appeal).

3.4.1 Process steps b, c, d and h relate, as mentioned earlier at point 3.1, to a specific process for correcting the spectra of a set of calibration samples for errors that are due to the measurement process itself and are not due to components in the calibration samples (features b-d), and to the application of this correction to the measured test samples (feature h). The specific process of correction has to be compared with the baseline correction used in E12a (see claim 1).

The problem to be solved by using this specific process of correction can be seen in allowing correction for samples consisting of complex mixtures with a high level of correlation of the spectra of the calibration samples, which therefore can be distinguished from random spectral measurement noise. E1, referenced in the patent in suit at column 5, line 34, discusses this at column 1, line 50 - column 2, line 2.

3.4.2 The correction process comprising steps b-d is known from E1, which is extensively discussed in the patent in suit (column 5, line 34 - column 8, line 45). This was not disputed by appellant 1.

The question to be answered is whether the skilled person starting from E12a would have considered consulting and making use of the correction process known from E1 in the context of the online control process method known from E12a.

E1 does not explicitly mention the application of the correction process to control processes. The correction process is, however, preferably included in a method of estimating unknown properties and/or composition data of a sample under consideration (abstract). Such an estimation method is at the very heart of the control process of E12a (page 2, line 11). For this reason, the skilled person would in the board's view have taken account of the teaching of E1 also in respect of a control process of the type known from E12a.

Even if the process known from E12a already incorporates correction in the form of a baseline

correction (claim 1) the skilled person would have considered replacing this by the more elaborate correction method known from E1 in order to better process samples consisting of complex mixtures with a high level of correlation of the spectra of the calibration samples.

3.4.3 It would therefore have been obvious for the skilled person not only to take account of the teaching of E1 but also without inventive activity to apply it as a correction process within the control process known from E12a, thus arriving at a process with the claimed features a-g and i-j. It would furthermore have been straightforward and logical for the skilled person to apply the correction method not only to the calibration samples but also to the test samples as claimed in step h in the same way as the baseline correction is applied to the measurements of the feedstock in E12a (claim 1).

3.4.4 The explicit reference to a polymerisation process is a restriction to a specific field of application in which the method is used, which is unrelated to the specific correction process mentioned above at points 3.4.1 - 3.4.3 other than as an example of a process comprising a complex mixtures of samples. The contribution this feature makes to an inventive step can thus be assessed independently from that of the correction process.

E12a relates to hydrocarbon conversion or separation processes (page 2, line 4) which are closely related to polymerisation processes since the latter processes use as starting products those obtained by the former.

The skilled person faced with the control of polymerisation processes would thus find it obvious to try control processes known for hydrocarbon conversion or separation processes.

3.4.5 In conclusion, it was obvious to the skilled person to apply the correction process known from E1 and corresponding to claimed steps b-d to the control process known from E12a and corresponding to claimed steps a, e-g and i, j. The claimed step h follows straightforwardly and logically, and the restriction to a polymerisation process was obvious because it is unrelated to steps b-d and h with regard to inventive step. The subject matter of claim 1 lacks therefore an inventive step (Article 56 EPC).

The main request is therefore not allowable.

4. *First to sixth auxiliary requests: inventive step (Article 56 EPC)*

4.1 The subject-matter of claim 1 according to the first auxiliary request is not restricted to a polymerisation process but otherwise essentially comprises the subject-matter of claim 1 of the main request with the additional feature of obtaining a value of at least one additional property for each calibration sample and for the test sample and also using this at least one additional property as part of the predictive model.

E12a states on page 5, lines 33-36 that further processing conditions in addition to spectral measurements may be used for an efficient computer model.

Although E12a does not clearly state whether these further processing conditions form part of the predictive model, it would in the board's view have been obvious to the skilled person that this would be the case.

Likewise, it would have been obvious to measure this at least one additional property at the same intermediate step (at the same feedstock according to E12a) as the spectrum in order to avoid complications from steps intervening between the measurements.

The subject-matter of claim 1 of the first auxiliary request does not therefore comply with the requirements of Article 56 EPC.

The first auxiliary request is therefore not allowable.

4.2 The subject-matter of claim 1 of the second auxiliary request essentially comprises the subject-matter of claim 1 according to the first auxiliary request together with the feature that the spectra are measured by a Fourier Transform Near Infrared Spectrometer.

Although it was not contested by appellant 1 that it was common general knowledge at the claimed priority date to perform near infrared spectroscopy by using Fourier transforms, it was claimed that a high number of frequency points are necessary for performing a meaningful Fourier transform. The limited number of frequency points considered in E12a would not allow a meaningful application of Fourier transform spectroscopy. It would, thus, not have been obvious for

the skilled person to consider applying Fourier transform spectroscopy to the control process known from E12a.

The board does not accept this argument for the following reasons:

The specific examples for spectroscopy performed in E12a are indeed limited to a small number of frequencies (e.g. 18 frequencies in claim 5) which is arguably insufficient to be the result of a meaningful Fourier transform.

The basic idea of E12a, i.e. the relation of spectroscopic measurements to properties of the end product, is however not limited to a particular number of frequency points. The choice of a small number of frequency points appears rather to be dictated by computing power available at the priority date of E12a to measure and analyse the spectra, and the skilled person would have been aware of the possibility of measuring and analysing more extended spectra if it had been necessary in the context of a particular production process, all the more so considering the development of computing power during the almost ten years between the priority date of E12a and that of the patent in suit. For the measurement of more extended spectra, the skilled person would routinely have used Fourier transform methods, and would thus have arrived at the claimed subject-matter without the exercise of inventive skill.

The subject-matter of claim 1 of the second auxiliary request thus lacks an inventive step (Article 56 EPC) and the request is therefore not allowable.

4.3 The subject-matter of claim 1 according to the third auxiliary request corresponds to that of claim 1 forming the basis of the patent as maintained by opposition division and corresponds to the subject-matter of claim 1 according to the first auxiliary request restricted to a polymerisation process.

Since the measurement and consideration of at least one additional property is not specific to polymerisation processes and no unexpected advantage is obtained by the combination of these two features, the reasoning set out above at point 3.4.4 applies likewise for a process which takes account of at least one additional property (see point 4.1 above), with the result that the subject-matter of claim 1 according to the third auxiliary request lacks an inventive step (Article 56).

The third auxiliary request is therefore not allowable.

4.4 The subject-matter of claim 1 according to the fourth auxiliary request corresponds to the subject-matter of claim 1 according to the third auxiliary request restricted to the spectra being measured by a Fourier Transform Near Infrared Spectrometer.

Spectral measurement by means of Fourier transform methods has no technical relationship to the claimed polymerisation process and which comprises the measurement of at least one additional property.

Therefore, the reasoning set out above at point 4.2 in relation to Fourier transform methods and at point 4.3 in respect of the remaining features also applies to the subject-matter of claim 1 according to the fourth auxiliary request, which thus lacks an inventive step (Article 56 EPC).

The fourth auxiliary request is therefore not allowable.

4.5 The subject-matter of claim 1 according to the fifth auxiliary request corresponds to the subject-matter of claim 1 according to the third auxiliary request additionally restricted to the property P as a selection from several possibilities including a number of properties specifically related to polymerisation processes.

Since the various alternatives for the property P include several typical for polymerisation processes the reasoning set out above at point 3.4.4 with respect to polymerisation processes applies likewise for the subject-matter of this claim with the result that the subject-matter of claim 1 according to the fifth auxiliary request lacks an inventive step (Article 56).

The fifth auxiliary request is therefore not allowable.

4.6 The subject-matter of claim 1 according to the sixth auxiliary request essentially restricts the polymerisation process of claim 1 according to the main request to a butyl rubber polymerisation process.

Given the board's finding above that the subject-matter of claim 1 of the main request lacks an inventive step, the restriction to a butyl rubber polymerisation process is an arbitrary restriction unrelated to any particular problem. The skilled person would have considered applying the teaching of E12a to any suitable polymerisation process, including butyl rubber polymerisation, without the exercise of inventive skill.

The subject-matter of claim 1 of the sixth auxiliary request therefore lacks an inventive step (Article 56 EPC) and the request is not allowable.

5. *Seventh auxiliary request*

5.1 The subject-matter of claim 1 according to the seventh auxiliary request is essentially based on claim 1 according to the sixth auxiliary request with the property P being restricted to Mooney viscosity and polymer molecular weight.

5.2 Claim 1 according to the seventh auxiliary request fulfils the requirement of Article 56 EPC for the following reasons:

The patent is directed to overcoming problems of predictive control in the case of a process comprising two variables and specifically to the production of butyl rubber using both Mooney viscosity and polymer molecular weight as process control parameters (column 1, lines 26-31 and 40-43).

None of the cited prior art documents discloses this specific combination of product and properties. E12a can still be considered the single most relevant prior art document.

Even if it is obvious to the skilled person from the teaching of E12a to conceive a control process for controlling a polymerisation process (see point 3.4.4 above) and more specifically a butyl rubber polymerisation process (see point 4.6 above), or a control process with a product property P selected from a group of properties (see point 4.5 above), there is no suggestion in this document for the particular combination of these features as claimed in claim 1 according to the seventh auxiliary request. The choice of butyl rubber as the end product and the Mooney viscosity and polymer weight as process control parameters cannot be considered as an arbitrary choice among known end products and control parameters since their combination serves to solve a specific existing need (column 1, lines 40-43 of the patent in suit).

None of these findings were contested by appellants 2 and 3.

Similar considerations apply to independent claim 21 of the request.

The seventh auxiliary request therefore complies with the requirements of Article 56 EPC.

5.3 The seventh auxiliary request also satisfies the requirements of Article 83 EPC.

The objection of appellant 2 with regard to Article 83 EPC concerned essentially the patent in the form as maintained in the interlocutory decision of the opposition division (the present third auxiliary request). It was argued that a general polymerisation process as claimed in claim 1 of this request comprised too many different reaction types for the skilled person to be able to predict an unspecified property of the end product with the help of an unspecified predictive model over the whole range of the claim without undue effort. Appellant 2 extended its argument also to the specific case of a butyl rubber polymerisation process.

Although the objection based on Article 83 EPC was not explicitly maintained with respect to the seventh auxiliary request, the board has considered whether this request complies with the requirements of this article.

For the requirements of Article 83 EPC to be met, the skilled person must, without undue effort, be able to (a) determine whether a relationship between characteristics of a spectrum taken at an intermediate step and the finished product exists, (b) select an appropriate product property and intermediate step exhibiting such a relationship, and (c) establish a predictive model based on this relationship.

With respect to point b), the board notes that claim 1 according to the seventh auxiliary request restricts the product properties P specifically to Mooney viscosity and polymer molecular weight and the product to butyl rubber. The patent indicates furthermore in

the embodiment shown in Figures 1 and 2 the intermediate step at which the spectrum is to be taken (column 4, lines 23-27).

With respect to points a) and c), the board notes that the patent does not provide a specific predictive model, not even for the preferred embodiment relating to butyl rubber, linking the measured spectra taken at an intermediate step to the property of the end product. This, however, is due to the nature of the multivariate regression method, in which the correlation is determined experimentally (see E12a, page 2, lines 25-26), as opposed to a specific model, which required detailed information normally obtained by laboratory analysis and therefore not always available in real time (see E12a, page 2, lines 13-16).

As multivariate regression methods are well known in the art (see E12a, page 2, lines 25-26 and E17, referred to at point 3.2 above), the board takes the view that the skilled person would have been able to establish a predictive model based on the relationship between characteristics of a spectrum taken at an intermediate step and the finished product using such methods without undue effort.

The seventh auxiliary request therefore complies with the requirements of Article 83 EPC.

5.4 Claim 1 of the seventh auxiliary request also fulfils the requirements of Article 123(2) EPC.

The claimed specific properties Mooney viscosity and molecular weight find an original basis in original

claim 10 which refers back to original claim 8, which however requires eigenspectra determined by a singular value decomposition. A more direct disclosure is found in column 1, lines 28-31 and 40-43 of the patent, which corresponds to the original disclosure at page 1, lines 23-25 and page 2, lines 3-5. These passages disclose these specific properties without the requirement specified in original claim 8. The latter passage also refers explicitly to the property "molecular weight".

Similar considerations apply to independent claim 21 of the request.

The seventh auxiliary request therefore complies with the requirements of Article 123(2) EPC.

5.5 The board therefore concludes that the seventh auxiliary request fulfils the requirements of the EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance with the order to maintain the patent in amended form on the basis of the seventh auxiliary request filed at the oral proceedings.

The Registrar The Chairman

D. Magliano A. S. Clelland