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**Datasheet for the decision
of 12 September 2011**

Case Number: T 1252/08 - 3.3.03

Application Number: 03771971.3

Publication Number: 1525256

IPC: C08K 3/04

Language of the proceedings: EN

Title of invention:

Improved thermoplastic polymeric ovenware

Applicant:

E.I. DU PONT DE NEMOURS AND COMPANY

Opponent:

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Headword:

-

Relevant legal provisions:

EPC Art. 83, 84

Relevant legal provisions (EPC 1973):

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Keyword:

"Insufficiency of disclosure - main request, first and second auxiliary requests - yes"

Decisions cited:

T 0172/99, T 0133/03

Catchword:

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Case Number: T 1252/08 - 3.3.03

D E C I S I O N
of the Technical Board of Appeal 3.3.03
of 12 September 2011

Appellant: E.I. DU PONT DE NEMOURS AND COMPANY
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Decision under appeal: Decision of the Examining Division of the
European Patent Office dated 9 January 2008 and
posted 28 January 2008 refusing European patent
application No. 03771971.3 pursuant to
Article 97(2) EPC.

Composition of the Board:

Chairman: A. Däweritz
Members: M. C. Gordon
C.-P. Brandt

Summary of Facts and Submissions

- I. The appeal lies against the decision of the examining division dated 9 January 2008 and posted 28 January 2008 refusing European patent application number EP03771971.3.
- II. Claim 1 of the application as filed read as follows:
"An ovenware item comprising a thermoplastic polymer composition, wherein said thermoplastic polymer composition has a through plane thermal conductivity of 1.0 watt/m[°]K or more".

The decision was based on three sets of claims forming a main request, filed with a letter dated 16 November 2006 consisting of 8 claims, and first and second auxiliary requests consisting of 8 and 7 claims respectively and filed with letters dated 5 April 2007 and 7 December 2007 respectively.

Claim 1 of the main request which differed from claim 1 as originally filed in that the final phrase read:
"...has a through plane thermal conductivity of 1,0 [*sic*] W/m·K".

Claim 1 of the first auxiliary request read as follows:
"An ovenware item comprising a thermoplastic polymer composition, wherein the thermal conductivity of the thermoplastic polymer composition is raised by mixing the thermoplastic polymer with a particulate material having a high thermal conductivity and wherein said thermoplastic polymer composition has a through plane thermal conductivity of 1,0 [*sic*] W/m·K or more".

Claim 1 of the second auxiliary request differed from claim 1 of the first auxiliary request by specifying that the particulate material had an inherent thermal conductivity of 50 W/m·K or more.

III. According to the decision none of the requests met the requirements of Art 84 EPC since the feature "through plane conductivity" was not clear, in particular due to the failure to specify the temperature at which this was to be determined when measuring according to the standard identified in the application, namely ASTM D 5930.

(a) According to the Examining Division, Article 84 EPC required that the claims be clear in themselves when being read with the normal skills. This meant that, for the unambiguous characterisation in a claim of a product by a parameter, the parameter had to be clearly and reliably determined, and that the knowledge of the method and conditions of determination of the parameter was therefore necessary for the unambiguous definition of the parameter.

(b) A proposal by the applicant to insert a reference to ASTM D 5930 in the claims, which standard was referred to in the description of the application as being the method used to determine the through plane thermal conductivity, was considered by the division to be necessary, however not sufficient to overcome the objections pursuant to Art. 84 EPC.

(c) This method required, however, several parameters to be reported (i.e. the measuring conditions), which influenced to some extent the overall value of the measurement of the thermal conductivity. In particular the temperature was to be reported.

(d) The Examining Division additionally commented on ASTM D 618, which was referred to in ASTM D 5930. This defined the standard test conditions as being, unless otherwise specified, 23°C and a relative humidity of 50%.

The Examining Division took the view that there was absolutely no evidence that the standard conditions defined in ASTM D 618 were those which the skilled person would inevitably use in the determination of the thermal conductivity of the thermoplastic polymer composition according to ASTM D 5930, which mentioned only a temperature range of -40 to 400°C, but did not refer to a standard temperature of 23°C. In this connection the decision noted that reference was made in the application in suit to two different temperatures for this measurement, firstly in the context of the fillers, a temperature of 273 K and, secondly with reference to a comparative composition, a temperature of 100°C.

(e) Consequently the Examining Division came to the conclusion that:

- There was lack of information with respect to the exact conditions under which the thermal conductivity in Claim 1 of the main request was to be determined,
- This lack of information caused uncertainty as to the definition of the parameter "*thermal conductivity*", so that
- This parameter could not limit the subject-matter of Claim 1 in any clear way.

Therefore, Claim 1 of the Main Request was not clear as required by Article 84 EPC.

(f) The same argument applied claim 1 of the first and second auxiliary requests.

- IV. In their statement of grounds of appeal the applicant, now the appellant, maintained the three sets of claims as considered by the examining division.
- V. In a communication dated 17 February 2011 the Board raised an objection pursuant to Art. 83 EPC. It was not apparent to the Board how the method of ASTM D 5930 could be employed to determine the through plane thermal conductivity. The application provided no information as to how this could be determined employing the protocol of the standard.
- VI. The appellant/applicant replied with a letter dated 27 June 2011.
- VII. On 1 July 2011 the Board issued a summons to attend oral proceedings.
- VIII. The appellant/applicant provided further written arguments with a letter dated 11 August 2011.
- IX. Oral proceedings were held on 12 September 2011. The requests underlying the decision under appeal (see section II, above) were maintained.
- X. The written and oral arguments of the appellant insofar as they are relevant for this decision can be summarised as follows:
Regarding the manner in which the measurement was to be carried out:
- ASTM D 5930 contained a clear reference to ASTM D 618 defining a "Standard Laboratory

Atmosphere" of 23°C and a relative humidity of 50%. "According to that standard, the physical and electrical properties of plastics were to be measured at a temperature of 23°C 'unless otherwise specified'". Therefore, the skilled reader of the application in suit would have understood to use a temperature of 23°C for the determination of the thermal conductivity of the composition in Claim 1.

- Moreover, the thermal conductivity of the polymers *per se* as comprised in the claimed ovenware was a material constant of the polymer and would not therefore change much between room temperature and melting point. Therefore, a measurement at 23°C would also be representative for higher temperatures, so that it would be reasonable to measure the thermal conductivity of ovenware at 23°C. In support of this argument the Appellant referred to (i) a hard copy from the internet to show that nylon had a thermal conductivity of $<0.1 \text{ W/m}\cdot\text{K}$ at temperatures of between 233 and 473 K and to two published articles referring (ii) to a poly(ether ether ketone) having a thermal conductivity of $<0.2 \text{ W/m}\cdot\text{K}$ at between 100 and 400 K and (iii) to an LCP having a thermal conductivity of only about $0.1 \text{ W/m}\cdot\text{K}$ at from 50 to 275°C.
- ASTM D 5930 was a standard measurement and the skilled person would understand the term "through plane thermal conductivity" or "thermal conductivity" as defined therein. There was no indication that the parameter "thermal conductivity" as used in the description was to be understood in any other way;

- There existed two types of standard for the measurement of thermal conductivity - one for platen type samples whereby the measurement is carried out employing one or two plates and one for cylinders. The application relied on ASTM D 5930 which employed cylinders. There was no ASTM norm which employed samples in the form of plates/plaques. The skilled person is aware what to do based on the teaching of section 9 of the standard;
- The term "thermal conductivity" has been used in European patents and this term has not given rise to objections by the Board of Appeal, as witnessed by decision T 133/03 (19 September 2005, not published in the OJ EPO). On the contrary in this decision the Board itself had employed the term "perpendicular thermal conductivity" which was synonymous with "through plane thermal conductivity";
- ASTM D 5930 employed the "line-source" technique. As explained in section 4.1 of the standard, this was a transient method for determining thermal conductivity. The term "transient" indicated that the line-source technique was a non-invasive measurement method which did not adversely affect the test sample during measurement (letter of 27 June 2011, page 3, second complete paragraph);
- The method of ASTM D 5930 was independent of the size and shape of the sample as set out in sections 4.1, 5 and 9 thereof. Hence it was possible to determine the thermal conductivity either from samples having a specified and easy

- to handle shape such as a square block or from pieces of ovenware having any given shape;
- Specifying the test location as the thinnest cross section of the piece simply took account of the situation in which a more geometrically complicated piece was to be tested. This information indicated that it was at this part of the piece (thinnest cross section) to which the claimed thermal conductivity was to be applied.
 - However it was also submitted (at the oral proceedings) that "through plane" did not mean that the measurement was actually carried out through the plane of the article. According to section 9.5 of ASTM D 5930 relating to solid thermoplastics these materials were ground/cut up to permit placing this material into a cylindrical sample tube and embedding a line source into the sample. Thus the material to be used was to be taken from (cut out of) the thinnest part of the vessel. Hence it was less the case that the conductivity measurement was carried out on the object itself but on the contrary that the material for testing had to be taken from the thinnest cross section of the object.
 - Thermal conductivity, being a material constant (see above) depended on the material itself, not on the shape or form thereof. It was logical to take the sample for testing from the thinnest part of the vessel as heat was most efficiently transferred via this part of the article.
 - The skilled person would also be aware from DIN standards how to carry out the measurement

without employing a cylindrical sample of the material to be tested. The measurement could also be carried out on a block without the need to remould or reform. According to ASTM D 5930 it was immaterial whether the measurement was carried out through a plane or on the tube.

XI. When the Appellant indicated that it did not wish to make further submissions and before closing the debate on the questions of Articles 83 and 84 EPC, the Board established again the Appellant's requests.

The appellant/applicant requested that the decision under appeal be set aside and that a patent be granted:

- On the basis of the main request (claims 1-8) as submitted with the letter of 16 November 2006;
- Or in the alternative on the basis of the first auxiliary request (claims 1-8) as submitted with the letter of 5 April 2007;
- Or on the basis of the second auxiliary request (claims 1-7) as submitted with the letter of 7 December 2007.

XII. Moreover, the Appellant was informed that, if the Board came to the conclusion that the appeal was allowable, it would remit the case to the first instance for further prosecution.

Then the oral proceedings were interrupted for deliberation of the Board. After resuming the hearing, the Chairman informed the Appellant that the decision would be issued in writing.

Reasons for the Decision

1. The appeal is admissible.

2. *Main request - Article 83 EPC*

As addressed in the communication of the Board dated 17 February 2011, the crucial question for the allowability of the Main Request concerns the sufficiency of the disclosure. In other words, it has to be decided whether the skilled reader has been provided in the application text as originally filed in a clear and complete manner, i.e. in the form of a coherent, convergent and, hence, consistent teaching with all the information necessary for him/her to carry out the invention (Article 83 EPC).

2.1 Claim 1 relies on the property "through plane conductivity". This same property is relied upon in the summary of the invention at page 2 lines 5-7 (page references relate to the PCT publication).

In the passage bridging pages 3 and 4 it is stipulated that the thermal conductivity of the composition is measured "through the plane (thinnest cross section) of a test part or piece of ovenware, using ASTM Method 5930".

This is repeated on page 5 lines 10-12 relating to the examples.

2.2 In claim 1 of the Main Request the compositions comprised in the ovenware are defined by the presence of a thermoplastic polymer and in that the composition is required to have "*through plane thermal conductivity of 1.0 W/m·K or more.*"

- 2.2.1 The description of the useful polymeric components recommends that these polymers should be suitable for use at temperatures ordinarily found in cooking ovens and should preferably have a melting point and/or glass transition point of 200°C or more, especially preferably about 300°C or more (application page 2, lines 21-25). The permissible polymers include a broad range of different types of polymers (page 2 line 26 to page 3 line 7. A preferred polymer is an LCP, i.e. an anisotropic polymer (page 3, lines 1 to 7).
- 2.2.2 Due to the purely functional definitions of the above mandatory components and the optional presence of particulate materials to raise the thermal conductivity as discussed starting at page 3 line 9, it is, in the Board's view, necessary for the skilled reader to test each composition individually to determine whether or not it falls within the scope of the claims, i.e. he/she must be provided with clear information how to establish whether a given composition has the required "through plane thermal conductivity".
- 2.2.3 The only additional guidance given to the skilled reader as to the determination of the "through plane thermal conductivity" can be found in the passage bridging pages 3 and 4 according to which "*The thermal conductivity [...] is measured through a plane (thinnest cross section) of a test part or piece of ovenware, using ASTM Method D 5930*" and on page 5 and Table 1, within the context of the particular formulations used in the examples. After melt mixing an LCP with carbon fibres and, in Examples 3 and 4, glass fibres in a twin screw extruder and by chopping the resulting strand, the pellets thus obtained had been injection moulded into plaques and test pieces. According to the text

accompanying the examples, "*thermal conductivity (through the plane of the test piece) was measured by ASTM method D5930.*" and "*the thermal conductivity was measured through the thickness of the plaques*" (page 5 lines 10-12 and 16-18).

2.2.4 In view of this very short description, the skilled reader has to derive any details and marginal conditions necessary for reliably measuring the thermal conductivity from ASTM D 5930.

2.3 *Standard ASTM D 5930*

2.3.1 ASTM D 5930 defines thermal conductivity (section 3.2.2) as:

the time rate of steady heat flow/unit area through unit thickness of a homogeneous material in a direction perpendicular to the surface induced by a unit temperature difference.

2.3.2 Moreover, according to section 3.2.2.2 Discussion:

Thermal conductivity must be associated with the conditions under which it is measured, such as temperature and pressure, as well as the compositional variation of the material. Thermal conductivity may vary with direction and orientation of the specimen since some materials are not isotropic with respect to thermal conductivity.

2.3.3 Further statements concern some particulars to be observed in carrying out the measurement according to ASTM D 5930 and the reliability of the measurements:

A line source of heat is located at the center of the specimen being tested. The apparatus is at a constant initial temperature. (section 4.1).

The apparatus consists of a line-source probe imbedded in a specimen contained in a constant-temperature environment. (section 7.1)

Solid Thermoplastics--Load the sample in the same manner as in 9.4. The following precautionary steps are needed to account for shrinkage of the specimen as it solidifies. The probe shall be fitted with a dynamic sealing system permitting it to move with the shrinking specimen. Static

loads can then be placed on the probe to help maintain contact as the plastic shrinks. These loads optimally will apply a pressure of 1 to 7 MPa on the specimen. (item 9.5).

Thermosets and Rubber--Preheat the sample cell to a loading temperature, above the glass transition, where the specimen is fluid enough to be molded but will not undergo significant reaction (6) ... Charge or pour the uncured specimen in the same manner as in 9.4. (section 9.6).

2.3.4 Section 9.4 reads as follows:

Thermoplastics in the Melt--Preheat the sample cell to the lowest processing temperature of the thermoplastic. Loading specimens at a low temperature is desirable to ensure an air-free specimen. Pour a charge of the specimen, typically in pellet or powder form, into the cell and compress into a homogeneous specimen. Several charges, tamped well, may be needed to fill the sample cell. When the specimen is well molten, insert the probe so as to be near the axial center of the specimen. Sealing systems may be employed to contain the specimen. For thermally unstable materials, follow material manufacturers' recommendations on temperature exposure limits.

Because this test method does not contain a numerical precision and bias statement, it shall not be used as a referee test method in case of dispute. (section 5.1).

This statement can even be found twice in the ASTM:

Attempts to develop a full precision and bias statement for this test method have not been successful. Because this test method does not contain round-robin based precision data, it shall not be used as a referee test method in case of dispute (section 14.2).

2.3.5 Furthermore, according to section 1 of the norm-

"Scope":

1.1 This test method covers the determination of the thermal conductivity of plastics over a temperature range from -40 to 400°C. The thermal conductivity of materials in the range from 0.08 to 2.0 W/m.K can be measured covering thermoplastics, thermosets, and rubbers, filled and reinforced.

and in section 8 "Conditioning":

8.1 Many thermoplastic materials need to be dried because moisture can affect the properties. Moisture causes molten polymer samples to foam, which will affect the measured thermal conductivity. If conditioning is necessary, see the applicable material specification or Practice D 618.

Moreover, it is stated in section 6 "*Interferences*":

6.1.1 In the solid state, a contact resistance can develop due to the interface between the specimen and the measuring device.

2.3.6 Whilst the Appellant argued at the oral proceedings that thermal conductivity would be a property inherent to each polymer, even a material constant, it is evident not only from the various sections in ASTM D 5930, but also from page 3 lines 8-19 and page 4 lines 9-13 of the application text, that many variables (e.g. the temperature and the contact between solid composition and measuring device, the marginal conditions mentioned in section 3.2.2.2 of the norm or the exact composition to be measured) will affect the result. This influence has not been deemed to be neglectable by the authors of ASTM D 5930.

2.3.7 Furthermore the "scope" of the test method as defined in section 1.1 of the norm, i.e. being applicable to thermal conductivity in the range of 0.08 to 2.0 W/m·K gives rise to the question of whether this method is even suitable for reliably determining whether the thermal conductivity of compositions referred to in the description does in fact, comply with the requirement in the independent claims, i.e. whether it is ≥ 1.0 W/m·K. This question arises, in particular, with regard to the minimum values referred to on page 3 last partial paragraph of the application of "*...preferably about 2 watt/m^oK or more, more preferably about 3 watt/m^oK or more, and especially preferably about 5 watt/m^oK or more*".

2.4 However, it is does not emerge from the information given in the standard how the method described, i.e. involving a probe embedded into the centre of a

specimen of the material to be investigated, can be employed to measure thermal conductivity through the plane, i.e. thinnest cross section "test part" or "piece" of ovenware as is required by the passage bridging pages 3-4 of the application or of a plaque as is apparently done in the examples of the application.

- 2.5 On the contrary, there is an evident incompatibility between the measurement protocol set out in standard ASTM D 5930 and the statements in the application relating to the measurement, notably the use of fundamentally different samples for the measurement. The Board consequently cannot discern a coherent and convergent teaching in the application which would provide the person skilled in the art with the specific information necessary to arrive reliably, and in a directed manner at products as claimed in claim 1.
- 2.6 The determination of the "through plane thermal conductivity" is however not described in the application beyond the reference to ASTM D 5930 either explicitly or by reference to any other literature.
- 2.6.1 The other standard ASTM D 618 referred to by the Appellant for solving the problem caused by the missing measuring temperature, which had been discussed in the decision under appeal, does not, in the Board's opinion, provide the missing particulars for the determination of this parameter or remove the inconsistency between the statements in the application text and in ASTM D 5930.
- 2.6.2 ASTM D 618 is mentioned twice in ASTM D 5930, on the one hand, as one within a list of ASTM Standards including norms concerning other test methods (such as

C 177, C 518, C 1113 or E 1225) unrelated to the transient measurement method according to ASTM D 5930 and, on the other hand, in the strictly limited context of section 8 of ASTM D 5930 dealing with an - under some circumstances - necessary conditioning of molten thermoplastic polymer samples before starting the measurements.

2.6.3 Hence, the reference to ASTM D 618 cannot remedy the deficiency of missing marginal conditions for the measurement, which formed the basis for the decision of the Examining Division in the decision under appeal to refuse the application under Article 84 EPC.

2.7 This leads to the conclusion that ASTM D 5930 cannot supplement the short explanation of the parameter "*thermal conductivity*" as provided in the application in suit in a clear and unambiguous manner, but it leads to a new and unfamiliar definition of the thermal conductivity which even lacks clarity.

2.8 As held in T 172/99 (7 March 2002, not published in the OJ EPO) section 4.5.6 of the reasons, in the case of claimed subject-matter relying on a newly formulated, and thus unfamiliar parameter to define the solution to a technical problem by which a relevant effect is achieved the applicant is (in view of complying with the requirements of Art. 83 EPC) under a particular obligation to disclose all the information necessary reliably to define the new parameter such that its values can be obtained by a person skilled in the art without undue burden. Moreover, as held in section 4.5.9 of T 172/99, the question of "*whether there is a valid ground for opposition according to Article 100(b) EPC, respectively, can only be answered on*

the basis of the content of the application as originally filed. Further information cannot be relied upon to heal any deficiencies in the original disclosure (see T 10/86 of 1 September 1988, point 4 of the reasons)."

2.9 As reported in section X, above the Appellant/Applicant submitted a number of arguments in support of sufficiency. The Board however does not find any of these convincing:

2.9.1 The question of whether the standard ASTM D 5930 was a "standard measurement" is immaterial in the context of the definitions employed in the application in suit. What is significant is that regardless of the status of this standard, the term "through plane thermal conductivity" is not even employed therein, let alone defined in a clear and precise manner. Nor has it been convincingly demonstrated that it is possible to derive an understanding of this term as used in the application in suit from what is disclosed in the standard.

Consequently the appellant has failed to demonstrate that this standard would furnish the skilled person with an understanding of what is meant by this term.

2.9.2 The question of the existence of two (or more) standards for determining thermal conductivity is of no import insofar as the application explicitly refers to only one particular standard. Nor can any significance be attached to the - unsupported - submission of the appellant that that there is no ASTM standard for measuring "through plane thermal conductivity". On the contrary the application in suit is explicit in identifying specifically a particular standard as the

means by which this property is to be determined. Even if the skilled person were to conclude that the standard does not in fact measure this property there is no indication or guidance in the application as to which other standard should in fact be employed to determine this property.

Similarly the submission that there exist - non-identified - DIN standards for measuring through plane thermal conductivity which do not require the use of cylindrical samples cannot serve to repair the deficiency in the application arising from the explicit reference to standard ASTM D 5930, notwithstanding that there is no reference to any such DIN standards in the application.

2.9.3 It is equally immaterial that the term "thermal conductivity" or "perpendicular thermal conductivity" might have been used in the patent literature or a decision of a Board of appeal. The application in suit, requiring a specific limiting value of that property to be achieved, contains no references to any such documents. Further the Board notes that in the patent underlying Decision T 133/03 invoked by the Appellant (see section X, above) the term "*perpendicular thermal conductivity*" had been employed in a purely qualitative manner (Claim 1: "... *carbon material having high thermal conductivity ...*") and was used in the decision only to refer to relative improvements obtained in the examples in comparison with comparative examples of the same patent.

2.9.4 The submission that the method of ASTM D 5930 is a "transient" and hence "non invasive" method for determining thermal conductivity is in direct

contradiction to the further submission, made at the oral proceedings before the Board that what was in fact to be understood was that material to be subjected to the test according to ASTM D 5930 was to be taken from (cut out of) the thinnest part of the article of ovenware or test piece, and this excised material subjected to testing.

On the contrary it appears that the test method of ASTM D 5930 mandatorily requires partial destruction of the sample article (see passages of ASTM D 5930 cited in section 2.3.4, above).

- 2.9.5 Similarly the Board cannot reconcile this submission with the further submissions that the measurement of ASTM D 5930 could be carried out on a sample of the material of any given shape, as long as the thinnest part was selected as the location for carrying out the measurement on the sample.
- 2.9.6 The further submission that according to ASTM D 5930 it was immaterial whether the measurement was carried out "through a plane" or on a cylinder of material is inconsistent with the specification of the standard which requires preparation of a sample of specified minimum radius into which is inserted the probe for carrying out the measurement (sections 7 and 9, in particular 9.1 of standard ASTM D 5930).
- 2.10 The Board can therefore come to no conclusion other than that ASTM D 5930 does not provide a means to measure "through plane thermal conductivity" of an ovenware item as set out in the application in suit. Further the application provides no indication how this

parameter can be determined employing the method of this standard, or indeed by any other method.

2.11 The consequence of this is that the application does not provide a full and fair disclosure of the invention since the skilled person, even after reading the description and the standard referred to is not in a position to reproduce the invention, i.e. to obtain in a reliable manner polymer compositions or articles of ovenware having the necessary effect, i.e. the stipulated "through plane thermal conductivity". Consequently the main request does not meet the requirements of Art. 83 EPC.

2.12 The main request is therefore refused.

3. *First auxiliary request*

Claim 1 of the first auxiliary request relies on the same parameter as the main request to characterise its subject matter, i.e. a "through plane thermal conductivity".

The considerations pertinent to the main request apply *mutatis mutandis* to the first auxiliary request.

Consequently the first auxiliary request does not meet the requirements of Art. 83 EPC.

The first auxiliary request is refused.

4. *Second auxiliary request*

Claim 1 of the second auxiliary request likewise relies on the parameter "through plane thermal conductivity".

The considerations pertinent to the main request apply *mutatis mutandis* to the second auxiliary request.

The second auxiliary request thus does not meet the requirements of Art. 83 EPC.

The second auxiliary request is refused.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

E. Görgmaier

A. Däweritz