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**Datasheet for the decision
of 15 November 2007**

Case Number: T 1517/06 - 3.3.03

Application Number: 00103818.1

Publication Number: 1038882

IPC: C08B 31/12

Language of the proceedings: EN

Title of invention:

Thermally inhibited starches and flours and process for their production

Patentee:

National Starch and Chemical Investment Holding

Opponent:

ROQUETTE FRERES, S.A.
Cerestar Holding B.V.

Headword:

-

Relevant legal provisions:

EPC Art. 54, 56, 123(2)
EPC R. 57a

Keyword:

"Novelty (yes) product-by-process"
"Inventive step (yes)"

Decisions cited:

T 0301/87

Catchword:

-



Case Number: T 1517/06 - 3.3.03

D E C I S I O N
of the Technical Board of Appeal 3.3.03
of 15 November 2007

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Decision under appeal: Interlocutory decision of the Opposition
Division of the European Patent Office dated
5 July 2006 and posted 31 July 2006 concerning
maintenance of European patent No. 1038882 in
amended form.

Composition of the Board:

Chairman: C. Idez
Members: W. Sieber
H. Preglau

Summary of Facts and Submissions

I. The mention of the grant of European patent No. 1 038 882, in respect of European patent application no. 00103818.1, in the name of National Starch and Chemical Investment Holding Corporation, filed on 18 January 1995 as a divisional application of the earlier European patent application no. 95908555.6 and claiming priority of PCT/US94/08559 (29 July 1994) and US 296211 (25 August 1994), was published on 12 November 2003 (Bulletin 2003/46). The granted patent contained 16 claims, whereby Claims 1, 3, 4 and 9 read as follows:

"1. A thermally-inhibited, non-pregelatinized granular starch or flour which starch or flour is not a waxy starch or flour and which is prepared by

- (a) dehydrating a non-pregelatinized granular starch or flour to a moisture content of less than 1% by weight to render the starch substantially anhydrous or anhydrous; and
- (b) heat treating the substantially anhydrous or anhydrous starch or flour at a temperature of 100°C or greater for a period of time sufficient to inhibit the starch or flour.

3. The starch or flour of claim 2, wherein the pH is 7.5-10.5, wherein the heating temperature is 120-180°C, and wherein the heating time is up to 20 hours.

4. The starch or flour of claim 3, wherein the pH is 8-9.5, wherein the heating temperature is 140-160°C, and wherein the heating time is 3.5-4.5 hours.

9. A food containing a thermally-inhibited waxy starch or flour which is prepared by

- (a) dehydrating a non-pregelatinized granular starch or flour to a moisture content of less than 1% by weight to render the starch substantially anhydrous or anhydrous; and
- (b) heat treating the substantially anhydrous or anhydrous starch or flour at a temperature of 100°C or greater for a period of time sufficient to inhibit the starch or flour.

Claims 2, 5-8 and 10-16 were dependent claims directed to preferred embodiments of the subject-matter of Claims 1 and 9, respectively.

II. Notices of opposition were filed by Roquette Frères S.A. (Opponent 01) on 6 August 2004 and Cerestar Holding B.V. (Opponent 02) on 11 August 2004. Both opponents opposed the patent on the grounds that its subject-matter was not patentable within the terms of Articles 54 and 56 EPC (Article 100(a) EPC), and that the invention was not sufficiently disclosed (Article 100(b) EPC). In addition, Opponent 02 based its opposition on the grounds of Article 100(c) EPC.

The following documents were *inter alia* cited during the opposition procedure:

D1: *Irving Martin*, "Crosslinking of Starch by Alkaline Roasting", *Journal of Applied Polymer Science*, vol. II, 1967, pages 1283-1288;

D2: "Starch: Chemistry and Technology", ed.
R.L. Whistler and E.F. Paschall, vol. I, Academic
Press, New York and London, 1965, pages 324-333;

D3: US-A-4 021 927;

D4: US-A-4 237 619; and

D9: Declaration of Professor Richard Tester dated
3 May 2006.

During prosecution of the case before the Opposition
Division, the Proprietor filed with letter dated 5 May
2006 amended sets of claims by way of a main request
and first to fifth auxiliary requests.

III. By an interlocutory decision which was announced orally
on 5 July 2006 and issued in writing on 31 July 2006,
the Opposition Division maintained the patent in
amended form based on the claims of the Proprietor's
third auxiliary request filed with letter of 5 May 2006.

Independent Claims 1 and 9 of the third auxiliary
request corresponded to Claims 1 and 9 as granted
except that the following further limitation has been
added at the end of each claim:

"..., wherein the dehydrating and heating steps are
conducted in a fluidized bed reactor."

Dependent Claims 2-8 and 10-16 corresponded to granted
Claims 2-8 and 10-16 except for a clerical amendment in
Claim 12 and the deletion of two types of starches from
Claim 16.

The following points were mentioned in the decision:

- (i) The Proprietor had contested the admissibility of D1 because it did not constitute an enabling disclosure. However, the Opposition Division held that the question whether a piece of prior art was reproducible did not affect its admissibility. Accordingly, there was no reason not to admit D1 into the proceedings.
- (ii) The Opposition Division decided that D1 was part of the state of the art according to Article 54 EPC, in particular because D9 proved that D1, published in 1967, was reproducible even after such a long time. Even if there was an inconsistency and/or inaccuracy in D1, the skilled person would disregard this particular detail and/or correct it.
- (iii) The subject-matter of each Claim 1 of the main, first and second auxiliary requests was considered to lack novelty over D1 which described a treatment comprising the step of impregnating a commercial corn starch with a solution of sodium bicarbonate to adjust the pH to 9.9, filtering the impregnated starch, drying the alkali-impregnated starch to a moisture content of 0% by weight and heating it for six or eight hours at a temperature of 140°C in a forced-air oven to give samples I₆ and I₈. The treated starches according to D1 met the definitions of thermally-inhibited starches provided in paragraph [0011] of the patent in suit.

- (iv) According to the Opposition Division, the claims of the third auxiliary request met the requirements of Articles 123(2) and (3), 84 and 83 EPC.

As regards novelty, it was pointed out that D1, the only relevant document in this context, did not disclose the use of a fluidized bed reactor for the preparation of thermally inhibited starches. The combined use of a fluidized bed reactor and a moisture content lower than 1% led to products that differed from those disclosed in D1, eg in organoleptic properties like colour, flavour and texture that satisfied food requirements. In addition, the Opponents had not demonstrated that the claimed products were not superior to the inhibited starches of D1.

As regards inventive step, D1 was considered to represent the closest prior art. The objective problem underlying the claimed subject-matter was to provide a food-grade starch. In paragraph [0035] of the patent in suit, thermally inhibited starches obtained by treatment in a fluidized bed reactor were presented as having high viscosities with no or low percentage breakdown in viscosity. There was no hint in D1 to use a fluidized bed reactor. Furthermore, the skilled person faced with the problem would not have considered D3 and D4 because they were concerned with the dextrination of starch by hydrolysis, and the moisture content disclosed therein was too high to achieve inhibition.

IV. Notices of appeal against the above decision were filed by Opponent 02 (Appellant Opponent 02) on 26 September 2006 and by the Proprietor (Appellant Proprietor) on 2 October 2006, the prescribed fees being paid on the respective same days.

V. With its statement of grounds of appeal, filed on 6 December 2006, Appellant Opponent 02 submitted the following documents:

D13: US-A-2 845 368; and

D14: *O.B. Wurzburg*, "Modified Starches: Properties and Uses", CRC Press, Boca Raton, Florida, Inc., 1986, pages 3-53; and

The arguments presented by Appellant Opponent 02 as far as they are relevant to this decision may be summarized as follows:

The third auxiliary request as maintained by the Opposition Division was not patentable as the claimed subject-matter was not novel over D1. The process disclosed in D1 differed from the subject-matter only in that the dehydrating and heating steps were conducted in a fluidized bed reactor. Claim 1 was a product-by-process claim. The crucial question in determining whether Claim 1 was novel with respect to the prior art was therefore whether a thermally-inhibited, non-pregelatinized granular starch or flour which was not a waxy starch or flour obtained by using a fluidized bed reactor for process steps (a) and (b) could be distinguished from a thermally-inhibited, non-pregelatinized granular starch or flour which was not a

waxy starch or flour obtained via any other process. It was acknowledged that various process parameters such as pH, heating temperature, heating time, moisture, the addition of proteins, etherification and esterification agents could have an influence on the result of the inhibition process. However, the apparatus, ie the means for bringing the chemical and physical changes which in this case were called inhibition, did not itself confer a specific chemical or physical property onto the starch or flour. The apparatus was simply a means to transfer the heat necessary to the sample in order to dehydrate it to a moisture content of less than 1% by weight and then to heat treat this anhydrous or substantially anhydrous starch or flour. Depending on the apparatus, the heating time and even the pH to achieve a certain level of inhibition for a particular sample would vary due to the distinct properties of the apparatus, eg heat transfer rate or ability to remove moisture. So, in principle, the process parameters for obtaining a certain level of inhibition needed to be adjusted by the person skilled in the art for each separate apparatus and starting material. There would be many different ways of carrying out a starch or flour inhibition process leading to the same inhibited product. In this context, Appellant Opponent 02 referred to Examples 4 and 5 of the patent in suit, which demonstrated that inhibited waxy maize starches obtained via the use of a thermal reactor (Example 4) and a fluidized bed reactor (Example 5) exhibited very similar viscosity behaviour. Therefore, the subject-matter of Claim 1 of the third auxiliary request could not be novel in regard of D1.

Claim 1 as maintained by the Opposition Division was also not inventive over D1 which was regarded as the closest prior art. The objective technical problem in view of D1 was to provide an alternative thermally-inhibited starch product with a low or moderate level of inhibition. The solution to this problem, ie to employ a fluidized bed reactor, must be regarded as obvious to a person skilled in the art because the use of fluidized bed reactors was well-known for similar applications, eg from D3. D3 taught that the fluidization process could also be used in the drying of starch. It further stated that the fluidization process provided remarkable energy and cost reductions over other drying processes for starch. These advantages alone would have led a person skilled in the art to use or at least experiment with a fluidized bed reactor. Employing a well-known technique in a neighbouring field of technology with the expectation of success was well within the capabilities of a person skilled in the art. Appellant Opponent 02 referred also to D13 to demonstrate that fluidization of starch in a fluidized bed reactor had been known since at least 1958.

VI. On 8 December 2006, the Appellant Proprietor filed its statement setting out the grounds of appeal and including a main request and 7 auxiliary requests. Furthermore, the following documents were filed (numbering by the Board):

D15: Declaration of Robert L. Billmers dated 17 August 2006;

D16: "Starch: Chemistry and Technology", ed.
R.L. Whistler and E.F. Paschall, vol. I, Academic
Press, New York and London, 1965, page 399; and

D17: Declaration of Neil Grimwood dated 29 November
2006.

The Opposition Division was wrong to admit D1 as valid prior art and was wrong in considering it to be novelty destroying. As read by the skilled person, D1 was speculative (it appeared from a literature search, D15, that no further work had ever been undertaken), contradictory and erroneous. For example, there was the highly doubtful allegation of 0% moisture content in the samples of D1. Further, the viscosity profile of the corn starch control in D1 was entirely wrong. This fact was confirmed by D16. Thus, D1 left the skilled reader with the impression that the apparent disclosure of the document was wrong, irreproducible and imposed an undue burden on the skilled reader to establish what the author of D1 (Martin) did do. Hence, despite its earlier publication date D1 was not an enabling document and thus not prior art at all.

Even if D1 was taken as prior art, in the light of the submissions on the errors inherent in D1 and the way in which it would be understood through the eyes of the skilled person it did not disclose a moisture content of less than 1%. D1 did not use dry air in the forced air oven and therefore the starch picked up moisture and was not heat treated at a moisture content of less than 1% moisture. This was confirmed by D9 since the author of D1 had obtained lower viscosity than Prof. Tester at 0.9% moisture. This was clearly

indicative of starch hydrolysis which would have occurred at a faster rate if moisture was higher. Further, there was no clear and unmistakable teaching in D1 that the starch material used in D1 was non-pregelatinized and granular.

D1, viewed through the eyes of the skilled person, was also not a document from which the skilled person would start to solve the problem of achieving non-chemically modified starches matching in properties, especially high viscosities, chemically inhibited starches for the purpose of achieving superior performance in food technology applications. Further, the starches produced by the patent in suit were unique in that they exhibited superior characteristics and benefits, particularly superior viscosity, without the need for chemical modification. As such, the starches of the patent in suit were "clean labelled" in that they could be claimed as natural and/or organic starches, yet had the superior functionality of modified starches. Further, the starches allowed for better flavour release in the final product compared to when chemically crosslinked starches were used.

VII. With its response dated 25 April 2007, Appellant Opponent 02 filed the following further documents:

D18: *A.L. Elder et al*, "Measuring the Useful Properties of Starch", *Cereal Science Today*, vol. 4, no.7, 1959, pages 202-208;

D19: GB-A-801 524; and

D20: US-A-3 527 606.

Appellant Opponent 02 submitted that the content of D9 effectively disproved the assertion of the Appellant Proprietor that the disclosure of D1 was wrong, irreproducible and imposed an undue burden on the skilled reader to establish what Martin did do. On the evidence presented in D9 it would seem that no undue burden was placed on the person skilled in the art by the teaching in D1 and that the experimental work reported in D1 was, indeed, reproducible. Although D9 did not report that dehydration to 0% moisture was achieved, it did nonetheless show that D1, together with good laboratory practice, enabled a person skilled in the art to achieve a starch having a moisture content of less than 1% by weight to render the starch substantially anhydrous or anhydrous.

Furthermore, D16 could not provide evidence that the Brabender/Amylograph curve presented in D1 for the control corn starch sample was unexpected and wrong. In this context, reference was made to D18. The focus of Martin's research was the results reported for the dry roasted starches and this new data would have been the focus for the skilled person. The skilled person would not simply write off the whole document in the way suggested by the Appellant Proprietor.

In addition, some observations in respect of the auxiliary requests filed by the Appellant Proprietor were presented. In this context, D19 and D20 were cited.

VIII. With a letter dated 11 April 2007, the Appellant Proprietor requested an extension of the time to reply

to the appeal of Appellant Opponent 02. Exercising its discretion, the Board favourably considered the request at this early stage of the procedure and allowed an exceptional extension of the time limit by two months (communication dated 18 April 2007).

In a letter dated 3 May 2007, Appellant Opponent 02 wished to place on record its objection to the allowed extension of the time limit. Furthermore, accelerated processing of the appeal was requested.

A second extension of the time limit requested by the Appellant Proprietor was not allowed by the Board (communication dated 19 June 2007).

- IX. In a letter dated 25 June 2007, the Appellant Proprietor pointed out that the products obtained by using a fluidized bed reactor (ie the subject-matter of Claim 1 of the third auxiliary request as maintained by the Opposition Division) or by using the process described in D1 differed. This was clear from paragraph [0035] of the patent in suit where it was stated that superior thermally-inhibited starches having high viscosities with no or low percentage of breakdown in viscosity were obtained in shorter times using a fluidized bed reactor. In fact, a product obtained by using a fluidized bed reactor differed from a product obtained by different processes in their viscosity profiles, colour and flavour. Further, more inhibited products could be achieved using a fluidized bed reactor in comparison to products obtained by different processes. The comparison between Examples 4 and 5 in the patent in suit referred to by Appellant Opponent 02 could not be made because the dehydrating

and heat treating times differed in these examples. Using a thermal reactor (Example 4) involved more time in order to arrive at a moisture content of less than 1% by weight. Consequently, hydrolysis and degradation might occur.

As regards inventive step, the person skilled in the art would not have combined D1 and D3 because D3 was concerned with dextrination of starch by hydrolysis and the moisture content in D3 was too high to achieve inhibition. This, however, led away from the present invention because the presence of water was undesirable. Nor would a combination of D1 with D13 lead to the present invention.

- X. In a letter dated 22 August 2007, the Appellant Proprietor filed a main request and first to ninth auxiliary requests and the following documents:

D21: Declaration of James J. Kasica dated 16 January 2007;

D22: Experimental Data of James J. Kasica dated 13 August 2007; and

D23: *P. Tomasik et al*, "The Thermal Decomposition of Carbohydrates. Part II. The Decomposition of Starch", in *Carbohydrate Chemistry and Biochemistry*, vol. 47, 1989, pages 279-343.

The Appellant Proprietor elaborated on its argument that the starch of D1 differed from that of the present invention in that it was hydrolyzed and therefore was not heat treated at substantially anhydrous conditions.

D21 and D22 proved again that the moisture content according to D1 must have been considerably higher than 1%. D22 showed again that D1 was not reproducible and that products obtained by a fluid bed drier differed from products obtained by an oven.

XI. In a letter dated 10 October 2007, Appellant Opponent 02 commented on various auxiliary requests filed by the Appellant Proprietor.

XII. With letter dated 23 October 2007, the Appellant Proprietor submitted again new claim sets. Furthermore, the following documents were filed:

D22': Original of D22;

D24: Declaration of Karen G. Kaiser and James P. Zallie dated 18 October 2007;

D25: US-A-3 977 897; and

D26: *R. Hoover et al*, "The Effect of Heat-Moisture Treatment on the Structure and Physiochemical Properties of Normal Maize, Waxy Maize, Dull Waxy Maize and Amylose V Starches", *J. of Cereal Science*, 23 (1996), pages 153-162.

XIII. With letter dated 14 November 2007, the Appellant Proprietor submitted a new main request and new auxiliary requests 1 to 3 which substituted its previous requests.

Claims 1, 3, 4 and 9 of the main request read as follows:

"1. A thermally-inhibited, non-pregelatinized granular starch or flour which starch or flour is not a waxy starch or flour and which is prepared by

- (a) dehydrating a non-pregelatinized granular starch or flour to a moisture content of less than 1% by weight to render the starch substantially anhydrous or anhydrous; and
- (b) heat treating the substantially anhydrous or anhydrous starch or flour at a temperature of 100°C or greater for a period of time sufficient to inhibit the starch or flour,

wherein the dehydrating and heating steps are conducted in a fluidized bed reactor or drier.

3. The starch or flour of claim 2, wherein the pH is 7.5-10.5.

4. The starch or flour of claim 3, wherein the pH is 8-9.5.

9. A food containing a thermally-inhibited waxy starch or flour which is prepared by

- (a) dehydrating a non-pregelatinized granular starch or flour to a moisture content of less than 1% by weight to render the starch substantially anhydrous or anhydrous; and
- (b) heat treating the substantially anhydrous or anhydrous starch or flour at a temperature of 100°C or greater for a period of time sufficient to inhibit the starch or flour."

Claims 2 and 5-8 and 10-16 were dependent claims directed to preferred embodiments of the subject-matter of Claims 1 and 9, respectively.

XIV. Opponent 01 (Respondent Opponent 01) made no submissions at all.

XV. On 15 November 2007, oral proceedings were held before the Board at which the Respondent Opponent 01 was not represented. Since it had been duly summoned, however, the oral proceedings were continued in its absence in accordance with Rule 71(2) EPC.

(i) As regards the main request submitted with the letter dated 14 November 2007, Appellant Opponent 02 raised objections under Article 83 and/or Article 123(2) EPC against the subject-matter of Claim 1 and/or Claim 9 and objections under Rule 57a EPC against Claims 3, 4, 11 and 12.

(ii) Following a discussion of these issues, the Appellant Proprietor submitted a new main request and new first and second auxiliary requests which substituted its previous requests.

(iii) The new main request corresponded to the main request filed with the letter dated 14 November 2007 except that all claims relating to a food had been deleted. Thus, the new main request contained only 8 claims.

- (iv) The auxiliary requests are not relevant to this decision and will not be discussed in further detail.
- (v) Appellant Opponent 02 raised no objection against admitting the new requests into the proceedings for consideration. However, he raised objections under Articles 83, 84, 56 and Rule 57a EPC against various claims of the main request.
- (vi) Appellant Opponent 02 argued that, although Claim 1 of the main request was directed to a thermally-inhibited, non-pregelatinized granular starch or flour which starch or flour was not a waxy starch or flour, it was not indicated in step (a) of Claim 1 that the starting material was not a waxy starch or flour. This gave rise to objections under Articles 83 and/or 84 EPC. Furthermore, the term "fluidized bed reactor or drier" was ambiguous and therefore unclear.

The amendment in dependent Claims 3 and 4 was not necessitated by any ground of opposition and therefore not allowable under Rule 57a EPC.

As regards inventive step, the parties basically relied upon their written submissions. Thus, Appellant Opponent 02 based its inventive step objection on a combination of D1 and D3.

- (vii) Following the discussion of the claims of the main request, the Appellant Proprietor filed, in connection with the claims of the main request, a correspondingly amended patent specification,

namely pages 2-22. Appellant Opponent 02 objected that various passages in the amended patent specification did not explicitly state that the dehydrating and heating steps were conducted in a fluidized bed reactor or drier.

XVI. Appellant Opponent 02 requested that the decision under appeal be set aside and the patent be revoked.

XVII. The Appellant Proprietor requested that the decision under appeal be set aside and that the patent be maintained on the basis of

Claims 1-8 filed as main request at the oral proceedings of 15 November 2007 and pages 2-22 filed at the oral proceedings of 15 November 2007,

or, in the alternative, on the basis of

Claims 1-7 of either the first or second auxiliary request, both requests filed at the oral proceedings of 15 November 2007.

XVIII. The Respondent Opponent 01 did not file any request.

Reasons for the Decision

1. The appeals comply with Articles 106 and 108 EPC and Rule 64 EPC and are therefore admissible.

2. *Admissibility of the new requests*

The Appellant Proprietor filed a new main request as well as a first and second auxiliary request at the oral proceedings of 15 November 2007 which substituted its previous requests. The necessity further to amend the claims submitted with the letter dated 14 November 2007 had become apparent during the oral proceedings because new objections under Articles 123(2) and 83 EPC were raised against independent Claim 9 relating to a food. Furthermore, objections under Rule 57a EPC were raised against two dependent claims directed to preferred embodiments of such a food.

If, as in the present case, it turns out for the first time during the oral proceedings that a particular claim does not meet all the requirements of the EPC, it is a question of procedural fairness to allow a proprietor to amend its requests accordingly. Since, furthermore, the new main request and the new first and second auxiliary requests are based on requests filed with the letter dated 14 November 2007 from which merely all claims relating to a food have been deleted, the Board was satisfied that the other party could properly deal with the late filed requests. Consequently, the main request and the first and second auxiliary requests were admitted into the proceedings for consideration. Nor did Appellant Opponent 02 raise any objection in this connection.

Main request

3. *Amendments (main request)*

3.1 Claim 1 of the main request (point XV(iii) in combination with point XIII, above) differs from Claim 1 as granted in that the following wording has been added at the end of the claim:

"wherein the dehydrating and heating steps are conducted in a fluidized bed reactor or drier."

This amendment is based on the passage at page 8, last paragraph of the application as originally filed. An identical passage can be found in the parent application (WO-A-96/04315) at page 8, last paragraph. Thus, the amendment meets the requirements of Articles 123(2) and 76(1) EPC, respectively.

Neither does the amendment extend the protection conferred, so that Claim 1 of the main request meets the requirements of Article 123(3) EPC, too. Nor did Appellant Opponent 02 raise any objection in this connection.

3.2 Appellant Opponent 02 submitted that the words "a fluidized bed reactor or drier" were not sufficiently clear in meaning to meet the requirements of Article 84 EPC. "A fluidized bed reactor or drier" might mean a choice of either a fluidized bed reactor or a fluidized bed drier, or, on the other hand, a fluidized bed reactor or a drier *per se* (ie any drier).

However, the use of only one indefinite article in the expression "a fluidized bed reactor or drier" is, in the Boards view, a clear indication that the term "fluidized bed" is a qualification which applies to both "reactor" and "drier". This view is supported by paragraph [0034] of the published patent specification where dehydrating and heat treating apparatus are listed. In this list, the words "fluidized bed reactors and driers" are set between commas. The punctuation makes it plain that the term "fluidized bed" applies to the whole section of this part of the list.

Thus, the amendment "fluidized bed reactor or drier" in Claim 1 is not objectionable under Article 84 EPC.

- 3.3 Furthermore, Appellant Opponent 02 pointed out that Claim 1 was directed to a thermally-inhibited, non-pregelatinized granular starch or flour which starch or flour was not a waxy starch or flour. Nevertheless, it was not indicated in step (a) of Claim 1 that the thermally-inhibited, non-pregelatinized granular starch or flour was **not a waxy starch or flour**. Thus, according to Claim 1, the starting material to be used in step (a) could be a waxy starch or flour and the final product had to be a non-waxy starch or flour. According to Appellant Opponent 02, this gave rise to an objection under Article 83 and/or Article 84 EPC.

However, the skilled reader knows that it is impossible to change the nature of the starch or flour from waxy to non-waxy or *vice versa*. In other words, if one wants to end up with a non-waxy starch or flour it is self-evident that one has to start with a non-waxy starch or flour. Neither the skilled person nor anybody with

common sense could possibly read Claim 1 in the way that one could start from a waxy starch or flour and end up with a non-waxy starch or flour. If anything, this slight inconsistency in the claim language is a clarity issue rather than a sufficiency issue. Since, however, this claim language is part of granted Claim 1 and has not been affected by the amendment, it is not open to objection under Article 84 EPC (eg T 301/87, OJ EPO 1990, 335, points 3.7 and 3.8 of the reasons).

- 3.4 Appellant Opponent 02 objected against amended Claims 3 and 4 of the main request under Rule 57a EPC because the amendment was not necessitated by any ground of opposition. However, the Board cannot concur with this view for the following reasons:

Claims 3 and 4 as granted (point I, above) specify a set of process conditions of the process described in Claim 1, namely the pH, the heating temperature and the heating time. Since, however, these process conditions are not disclosed in the application as originally filed in combination with a fluidized bed reactor or drier as such, ie the feature incorporated into Claim 1 of the main request, Claims 3 and 4 as granted could not be retained in the new main request unchanged in view of Article 123(2) EPC. The avoidance of an objection under Article 123(2) EPC is clearly in line with Rule 57a EPC which stipulates that "*... the description, claims and drawings may be amended, provided that the amendments are occasioned by grounds for opposition specified in Article 100, even if the respective ground has not been invoked by the opponent*". Consequently, the objection of Appellant

Opponent 02 under Rule 57a EPC against Claims 3 and 4 of the main request must fail.

Further, the amendment of Claims 3 and 4 of the main request (point XV(iii) in combination with point XIII, above) meets the requirements of Article 123(2) EPC because the application as originally filed contains at page 5, last paragraph a general reference to the preferred pH values indicated in Claims 3 and 4. This passage applies to all originally disclosed processes, ie also a process using a fluidized bed reactor or drier. A corresponding passage can be found at page 5, last paragraph of the parent application as originally filed (WO-A-96/04315) so that the requirements of Article 76(1) EPC are also met. Nor was an objection under Article 123(2) and/or Article 76(1) EPC raised by Appellant Opponent 02.

3.5 In summary, the amendments to Claims 1, 3 and 4 of the main request are allowable.

4. *Novelty (main request)*

4.1 The only relevant document with respect to novelty is D1. Although Appellant Opponent 02 did not raise a novelty objection against the subject-matter of Claim 1 in the oral proceedings of 15 November 2007 any more, it appears appropriate to elaborate on this issue at this juncture, in particular because the question as to what D1 actually discloses is a major issue in these proceedings.

4.2 D1 describes a process comprising heat treating a substantially anhydrous commercial corn starch.

Specifically, D1 describes a procedure where in the first step a commercial corn starch (page 1283, fifth line from the bottom of the page) was mixed with a solution containing sodium bicarbonate. The commercial corn starch used in D1 was not a waxy corn starch since this is mentioned in D1 as an alternative to the commercial corn starch (page 1286, line 6). The procedure described in D1 for the preparation of the alkali-impregnated corn starch involves a step of filtering the impregnated starch from suspension in a solution of sodium bicarbonate (page 1283, second line from the bottom of the page). Such a filtration could have been carried out only with a granular, non-pregelatinized starch. The starch of D1, therefore, had to be a non-pregelatinized, granular starch.

According to page 1284 of D1, the alkali-impregnated starch (which, as stated above, was not a waxy starch and which must have been a non-pregelatinized granular starch) was pre-dried to a moisture content of 7% and then placed in a forced-air oven. The temperature of the oven was raised as quickly as possible (about 1 hour) to 140°C and kept at this temperature (*roasting temperature*). When the oven first reached 140°C, the moisture content of the dried starch was determined to be 0%. The dried starch, according to D1, was heated at 140°C for six hours (to give sample I₆) or for eight hours (to give sample I₈). Both I₆ and I₈ samples exhibited a retarded rise and a retarded fall in viscosity compared to the untreated corn starch (D1, page 1285, Figure 1). Furthermore, it is stated on page 1285, 1st full paragraph, that "These experiments (and a number of unreported series of similar ones) suggest that alkaline roasting produces covalent

crosslinks". The fact that Martin (the author of D1) uses the word "suggest" indicates his caution in drawing conclusion. Nevertheless, it is apparent from D1, in particular Figure 1 and the above mentioned statement, that the dry roasting affects starch in a way that resembles chemical crosslinking. Thus, the roasted starches of D1 exhibit the viscosity behaviour of a thermally-inhibited starch as set out in paragraph [0054] of the patent in suit.

It is apparent from the above analysis that the process described in D1 differs from the process defined in Claim 1 only in the use of the drying apparatus: D1 uses a forced-air oven whereas Claim 1 requires the use of a fluidized bed reactor or drier.

- 4.3 The Appellant Proprietor attempted to discredit D1 as a valid piece of prior art because D1 was speculative, contradictory and erroneous. It was thus an example of a document which did not in fact convey to the skilled reader any reliable information, but rather left the skilled reader with the impression that the apparent disclosure of the document was wrong, irreproducible and imposed an undue burden on the skilled reader to establish what Martin did do. This left the skilled reader unable to discern the technical reality behind D1. Thus, despite its earlier publication date D1 was not an enabling document and thus not prior art at all.

According to the Appellant Proprietor, this view was supported by a number of unusual or freak results "reported" by Martin in D1 which would immediately be noticed by the skilled person. Notable examples included:

- The highly doubtful allegation to 0% moisture content in the samples.
- The anomalous form of the corn starch control Brabender/Amylograph viscosity/temperature curve, returning as it did to the baseline (in this context reference was made to D16).
- The anomalous Brabender/Amylograph viscosity/temperature curves for the samples A and B in Figure 1 of D1.
- The hydrolysis for the I₆ and I₈ samples which was evident from their Brabender/Amylograph viscosity/temperature curves, yet would not be possible without the presence of water (ie 0% moisture reported by D1).

In particular, D1 was erroneous in that it reported 0% moisture content but contained Brabender curves indicating hydrolysis. The presence of water, discussing sample degradation, and speculating on the presence of water were all indicative to the skilled person of the presence of significant moisture content in the samples. Furthermore, it had been established by D9 and D22 that it had not been possible to reproduce the work of Martin or his results. It emerged from the evidence of D9 that even using thinner sample layer, Professor Tester could only get down to approximately 0.9 % moisture content. This made it inconceivable that D1 did in fact achieve 0% moisture or anything even approaching it.

4.4 However, the Board cannot follow this line of argumentation for the following reasons:

4.4.1 D1 describes a treatment performed on alkaline dry starch and describes the effect of this on the properties of the starch. The treatment, succinctly stated in line 2 of the "Introduction" on page 1283 of D1, comprises "heating dry starch in air - at an alkaline pH - ...". The second paragraph of the "Introduction" states:

"Much work has been done on the aerobic alkaline heating of wet polysaccharides, little on dry polysaccharides. I hope this publication will stimulate others to investigate this subject more thoroughly."

The above passages indicate clearly that Martin was not interested in investigating the effect achieved by heat treating water-containing alkaline starch. It is even acknowledged that this has been investigated before. Therefore, a person skilled in the art would be well aware when reading D1 that it is **not** the subject-matter of D1 to degrade starches by heating them in the presence of moisture at a temperature of 140°C, but on the contrary, that it is the subject-matter of D1 to heat **dry starch** at a temperature of 140°C and to avoid the well-known phenomenon of hydrolysis. D1 states that the moisture content of the alkali-impregnated corn starch, at the end of the dehydrating step and before the heat treatment/roasting step is 0%. D1, therefore, instructs a person skilled in the art to measure the moisture content of the starch before the heat treatment/roasting procedure. Furthermore, D1 discloses that the process procedure "involved heating a dry mixture of starch and base in a thin layer at 140-160°C" (D1, page 1283, 9th line from the bottom of the page). Even if it were true that Martin did not

achieve 0% moisture content (as suggested by the repetitions of the Martin experiment in D9 and D22), the statement in D1 that the moisture content after the dehydrating step but before the heat treatment/roasting step was 0% at least indicates to a person skilled in the art that where Martin talks of "dry starch" he means starch with as small a moisture content as possible (ie as close to 0% as possible). D1, thus, clearly teaches the person skilled in the art the importance of using dry (as opposed to moisture-containing) starch for the heat treatment/roasting step.

Further, it appears that the question as to whether or not D1 reached a moisture content of below 1% before the heat treatment is irrelevant to this decision in view of the breadth of the process defined in Claim 1. It is explicitly stated in paragraph [0016] of the patent in suit that "in one embodiment, the dehydrating and heat treating steps occur simultaneously". In the Board's view, this can only mean that the patent in suit which is as D1 only interested in heat treating dry starch allows at least some variation with respect to the moisture content before the heat treatment is actually started. Hence, even if one admits that D1 had not achieved less than 1% moisture content before the heat treatment, this alone would not distinguish the claimed subject-matter over D1.

4.4.2 Further the Appellant Proprietor argued that the Brabender/Amylograph viscosity temperature/curve of the control corn starch sample in Figure 1 of D1 was unexpected and wrong and cited D16 as providing confirmation for this argument. However, it is

conspicuous to the Board that the dispersion of untreated corn starch used to produce the curve shown in Figure 1 of D1 contained 6% starch and had a pH of 3.0 (D1, page 1285, Figure 1). D16 does not identify the pH of the starch suspension used to produce the curve. Thus, D16 appears not suitable to provide evidence for the correctness of the statement made by the Appellant Proprietor.

4.4.3 The Appellant Proprietor also argued that the Brabender/Amylograph viscosity/temperature curves presented in D1 for the chemically crosslinked starches A and B were unexpected and "wrong" which was a further indication that there was something unusual and erroneous about Martin's work and his results. However, D1 does not specify the details for preparing samples A and B. It merely refers to covalently crosslinking corn starch with epichlorhydrin (0.3 and 0.4 wt%, respectively) in aqueous suspension according to a conventional method including a US patent. Thus, it appears impossible to deduce from D1 how the chemically crosslinked starches were actually prepared. Hence, a comparison between curves of the chemically crosslinked starches A and B in D1 and the curves of the chemically crosslinked starches in D9 appears not feasible. In any case, as explained above, the focus of Martin's research was the results reported for the dry roasted starches and these new data, rather than whether or not the curves presented for the chemically crosslinked derivatives were accurate, would have been the focus for the skilled person.

4.4.4 According to the Appellant Proprietor, the viscosity curves of I_6 and I_8 in Figure 1 of D1 indicated that

hydrolysis had taken place during the roasting of I₆ and I₈. This was a further indication that the 0% moisture reported in D1 was wrong (at 0% moisture hydrolysis would not be possible). Even if this is true and the curves of I₆ and I₈ in Figure 1 of D1 represent two inhibited starches which have been partially degraded by hydrolysis, the implicit teaching of D1, ie to dehydrate starch to a low moisture level before heating/roasting the starch, would still be valid.

4.4.5 In summary, a person skilled in the art would, in reality, not completely write off the whole of the teaching in D1 in the way suggested by the Appellant Proprietor but would, if he/she suspected any inaccuracy, conduct his/her own experiments with an earnest desire to make them work despite the suspected inaccuracy. This, apparently, is what has been done by Professor Tester and James J. Kasica in D9 and D22, respectively. Consequently, the Board agrees with the finding in the decision under appeal that D1 is state of the art according to Article 54(2) EPC.

4.5 The thermally-inhibited, non-pregelatinized granular starch or flour of Claim 1 is defined in the form of a product-by-process claim. In fact the distinguishing feature over the disclosure of D1 is the use of fluidized bed reactor or drier in the dehydrating and the heating step. Thus, the decisive question in the present case is whether or not a modification of the process parameters results in a different product. Only then, novelty of the product-by-process claim can be acknowledged (eg Case Law of the Boards of Appeal of the European Patent Office, 5th edition 2006, II.B.6).

4.5.1 It is conspicuous to the Board that paragraph [0035] of the patent in suit states that "superior thermally inhibited starches having high viscosities with no or low percentage breakdown in viscosity are obtained in shorter times in the fluidized bed reactor than can be achieved using other conventional heating ovens." This statement in the patent in suit is a first indication that the dehydrating and heat treating apparatus has an influence on the product.

4.5.2 Furthermore, the Appellant Proprietor has submitted additional experimental data, ie D22, where the products prepared by the oven method according to D1 are directly compared with products prepared by the fluidized bed method under identical conditions. These data demonstrate that the products prepared by the fluidized bed method differ from those prepared by the oven method according to D1. Specifically, Figure 1 of D22 displays the viscosity profiles of the oven and fluidized bed products performed under the teachings in D1. The (untreated) base starch gave a peak viscosity followed by a significant and continuous decrease in viscosity or breakdown while being held at 95°C for one hour. Both oven prepared products, ie $I_{6 \text{ oven}}$ (sample treated for 6 hours) and $I_{8 \text{ oven}}$ (sample treated for 8 hours) gave a peak viscosity after reaching 95°C followed by a significant decrease in viscosity or breakdown during the early stages of the 95°C hold. The oven prepared products increased in viscosity after approximately 30 minutes at 95°C before showing a second breakdown in viscosity as they completed their hold at 95°C for 1 hour. The corresponding fluidized bed products $I_{6 \text{ fbr}}$ and $I_{8 \text{ fbr}}$ reached a maximum viscosity after reaching 95°C and displayed little or no

viscosity breakdown and their viscosities remained levelled-off upon holding at 95°C for 23 minutes. Product I_{6 fbr} began to increase in viscosity before a second breakdown was observed during the later stage of the 95°C hold for 1 hour. After its first level-off phase, the I_{8 fbr} product continuously increased in viscosity until a second level-off phase during the later stage of the 95°C hold for 1 hour was reached without any signs of viscosity breakdown.

It is apparent from Figure 1 in D22 that the thermally inhibited starches prepared by the fluidized bed method differ from the thermally inhibited starches prepared by the oven method. Both of the products prepared by the oven method resulted in significant breakdown after they reached 95°C, having a similar slope to the base starch. However, the 6 hour product prepared by the fluidized bed method was near a level-off viscosity and the 8 hour product achieved a level-off viscosity after reaching 95°C, indicating a high degree of inhibition.

- 4.5.3 On the other hand, Appellant Opponent 02 has provided no evidence for its allegation that the apparatus itself does not confer a specific physical or chemical property on the starch or flour. Moreover, the results of the Appellant Proprietor appear plausible when taking general technical considerations into account. A fluidized bed reactor or drier has the ability to remove moisture quickly and efficiently and has a high heat transfer rate. This means that there is, for example, less contact between starch and moisture leading to less undesirable side reactions.

4.5.4 Finally, one has to keep in mind that for novelty the question is not whether the process parameters of D1 could be changed in order to arrive at something being identical with the claimed subject-matter. The decisive question is whether the claimed subject-matter differs from the **specific** disclosure of D1. And, in view of the evidence provided by the Appellant Proprietor, this question has to be answered in the affirmative.

4.6 In summary, the subject-matter of Claim 1, and, by the same token, the subject-matter of dependent Claims 2-8 is novel over the disclosure of D1.

5. *Problem and solution (main request)*

5.1 The patent in suit is directed to a thermally-inhibited, non-pregelatinized granular starch or flour which starch or flour is not a waxy starch or flour. This starch or flour is thermally inhibited in a process that results in a starch or flour having the characteristics of a chemically crosslinked starch without the addition of chemical reagents (paragraph [0011] of the patent specification).

5.2 As set out in point 4.2, above, D1 discloses likewise a heat treatment of starch which results in a starch having the characteristics of a chemically crosslinked starch without a chemical reagent being used. Thus, apart from being in the same technical field, D1 discloses technical effects most similar to the subject-matter of Claim 1 of the main request. Since, furthermore, the Board sees no reason to write off D1 as a valid disclosure (point 4.4, above), D1 is considered to represent the closest prior art.

5.3 In contrast to the starch disclosed in D1, the starch of Claim 1 is produced by a process where the dehydrating and heating steps are conducted in a fluidized bed reactor or drier. It has been shown by the additional experiments D22 that the product of Claim 1 of the main request will evidently bear a "fingerprint" of the specific process used to produce it. The use of a fluidized bed reactor or drier results in a different, in fact improved viscosity behaviour when compared with the products of D1 which were prepared in a forced-air oven.

Thus, contrary to the opinion of Appellant Opponent 02 the objective technical problem with respect to the closest prior art does not lie solely in the provision of an alternative process for producing thermally-inhibited starch or flour. Rather, the objective problem has to be seen in the provision of an improved thermally-inhibited starch or flour, in particular with respect to its viscosity behaviour.

In view of the data in D22 which provide a comparison with the prior art as fair as could be, the Board is satisfied that the above defined objective technical problem is solved by the features required in Claim 1 of the main request.

6. *Inventive step*

6.1 It remains to be decided whether the proposed solution, ie treating a non-pregelatinized granular starch or flour which starch or flour is not a waxy starch or

flour under the condition set out in Claim 1 of the main request, is obvious from the available prior art.

6.2 Appellant Opponent 02 basically relied upon a combination of D1 with D3. D3 describes a fluidization process, particularly well suited for the fluidization of solids difficult to fluidize, wherein the solids are introduced to either an upper or lower fluidized zone while continuously subjecting both the upper and lower fluidized zones to mechanical agitation (abstract). An aim of the invention in D3 is "to provide a process for the fluidization of solids difficult to fluidize which is characterized by the absence of "dead zones", improved homogeneity and improved heat transfer characteristics" (column 2, lines 52-56). A further aim is "to provide a process for fluidization of starches in the production of starch conversion products by processes wherein the starches are efficiently converted with relatively short residence times while minimizing thermal degradation and risks of explosion and/or fire" (column 2, lines 57-62). Furthermore, Example 3 of D3 illustrates what is known in the art as secondary drying of starch where the moisture content of starch is reduced from about 10-14% to about 3-5%. The actual moisture content achieved in Example 3 is 3.3% by weight, dry basis, and is well above the less than 1% required in Claim 1 of the main request.

6.3 It is conspicuous to the Board that D3 does not deal with the heat treating of starch under anhydrous or substantially anhydrous conditions. Thus, D3 cannot in principle provide any hint that the use of a fluidized bed reactor in such a heat treating process would yield a starch with improved properties. It is therefore hard

to see why a person skilled in the art, faced with the problem of providing a starch with improved properties, would try to modify the closest prior art by replacing the forced-air oven of D1 with the fluidized bed reactor of D3. Moreover, it appears that a combination of D1 with D3 is based on hindsight. Without the knowledge of the patent in suit a person skilled in the art had no incentive whatsoever to consider D3 as an appropriate solution to the posed problem.

6.4 Appellant Opponent 02 argued that the problem to be solved by the claimed subject-matter had to be seen only in the reduction of the drying time as mentioned in paragraph [0035] of the patent in suit. It would have been obvious for a person skilled in the art to substitute the less effective forced-air oven of D1 with the fluidized bed reactor of D3 having high heat transfer characteristics. The provision of a starch with an improved property was merely a bonus effect.

However, this line of argumentation is not convincing for the following reasons. Firstly, it ignores that the patent in suit is not directed to a process but to starches and flours *per se* (paragraph [0001]: "This invention relates to starches and flours ..."), in particular to superior starches and flours (paragraph [0035]: "Superior thermally inhibited starches having high viscosities with no or low percentage break down in viscosity are obtained in shorter times in the fluidized bed reactor ..."). Secondly, when defining the objective technical problem, all technical effects achieved by the claimed invention have to be taken into account. In its approach, Appellant Opponent 02 omits a key element

achieved by the claimed subject-matter, namely the improved viscosity behaviour. Hence, this approach must fail.

6.5 In summary, the subject-matter of Claim 1, and, by the same token, the subject-matter of dependent Claims 2-8 is based on an inventive step.

7. *Description (main request)*

Appellant Opponent 02 objected that various passages in the amended patent specification did not explicitly state that the dehydrating and heating steps were conducted in fluidized bed reactor or drier. However, paragraph [0001] of the patent specification has been amended to read as follows:

"This invention related to thermally-inhibited, non-pregelatinized granular starches or flours which starches and flours are not waxy starches and flours according to Claim 1."

The very first sentence in the patent specification makes it clear that the features required in Claim 1 are essential features of the invention, and one of these essential features is that the dehydrating and heating steps are conducted in a fluidized bed reactor or drier. In the Board's view, a repetition of "in a fluidized bed reactor and drier" at each and every occurrence of heating and drying steps is therefore not necessary, in particular as the patent specification as a whole is clear.

8. Since the main request of the Appellant Proprietor is allowable, any discussion of the auxiliary requests is superfluous.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to maintain the patent as amended in the following version:

Description:

Pages 2-22 filed during the oral proceedings of 15 November 2007

Claims:

No. 1-8 of the main request filed during the oral proceedings of 15 November 2007.

The Registrar:

The Chairman:

E. Görgmaier

C. Idez