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Datasheet for the decision of 10 November 2009

Case Number: T 1708/07 - 3.5.03

Application Number: 99948621.0

Publication Number: 1119800

IPC: G05B 17/02

Language of the proceedings: EN

Title of invention:
A system for on line inference of physical and chemical properties and system for on line control

Patentee:
Braskem S.A.

Opponents:
Total Petrochemicals Research Feluy
Basell Poliolefine Italia S.r.l.
Borealis AS

Headword:
System for online inference and control/BRASKEM

Relevant legal provisions:
EPC Art. 123(2), (3)
EPC R. 103

Relevant legal provisions (EPC 1973):
-

Keyword:
"Added subject-matter - main request, third and fourth auxiliary requests (yes)"
"Extension of the protection conferred - first, second, fifth and sixth auxiliary requests (yes)"

Decisions cited:
T 0166/90

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 1708/07 - 3.5.03

D E C I S I O N
of the Technical Board of Appeal 3.5.03
of 10 November 2009

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Decision under appeal: **Decision of the opposition division of the European Patent Office posted 9 August 2007 revoking European patent No. 1119800 pursuant to Article 102(1) EPC 1973.**

Composition of the Board:

Chairman: A. S. Clelland
Members: F. van der Voort
R. Moufang

Summary of Facts and Submissions

I. This appeal is against the decision of the opposition division revoking European patent EP 1 119 800 B which is based on European patent application No. 99948621.0 which was published as international application WO 00/22489 A pursuant to Article 158(1) EPC 1973.

II. The opposition division held that claim 1 of a main request comprised subject-matter which extended beyond the application as filed and therefore did not meet the requirement of Article 123(2) EPC and that claim 1 of a first and a second auxiliary request included amendments which extended the protection conferred by the patent and therefore did not meet the requirement of Article 123(3) EPC. Five days before the oral proceedings the patent proprietor filed two further auxiliary requests, which the opposition division, with reference to Article 114(2) EPC, disregarded for the reason that they did not appear to be relevant to overcome the objections raised.

III. The proprietor (appellant) lodged an appeal against the decision and requested that it be cancelled in its entirety. With the statement of grounds of appeal the appellant filed claims of a main request and six auxiliary requests and requested that the decision under appeal be cancelled and that the case be remitted to the department of first instance for further prosecution on the basis of the claims of the main request or, alternatively, any one of the auxiliary requests. The appellant further requested that the appeal fee be reimbursed because of a substantial procedural violation during the oral proceedings before

the opposition division. Oral proceedings before the board of appeal were conditionally requested.

IV. In response to the statement of grounds of appeal, opponent 2 (respondent 2) and opponent 3 (respondent 3) each filed observations and in essence requested that the appeal be dismissed. Each conditionally requested oral proceedings.

Opponent 1 (respondent 1) made no submissions in the course of the appeal procedure.

V. The parties were summoned by the board to oral proceedings. In a communication accompanying the summons, the board informed the parties that at the oral proceedings only the opposition ground pursuant to Article 100(c) EPC would be considered and that, if the main request were held not to be allowable, it would be necessary to discuss whether or not the amendments made to the claims of the auxiliary requests complied with the requirements of Articles 84 and 123(2) and (3) EPC. The parties' attention was drawn to specific issues to be discussed at the oral proceedings in respect of the main request and, if necessary, each of the first to sixth auxiliary requests, and in respect of the request for the reimbursement of the appeal fee.

VI. In response to the summons, the appellant informed the board that it would not attend the oral proceedings and it requested that a decision be taken on the basis of the appellant's arguments and requests on file.

VII. Oral proceedings were held on 10 November 2009 in the absence of the appellant and of respondent 1.

In accordance with its written submissions, the appellant requested that the decision under appeal be set aside, that the case be remitted to the department of first instance for further prosecution on the basis of claims of the main request or, alternatively, any one of the auxiliary requests, all requests as filed with the statement of grounds of appeal, and that the appeal fee be reimbursed.

Respondents 2 and 3 requested that the appeal be dismissed.

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

VIII. Claim 1 of the **main request** is identical to claim 1 as granted and reads as follows:

"A method for on line control of a polymerization plant, that uses a multivariable non linear constrained model predictive control algorithm and inferred values for polymer properties which measurements *[sic]* are not continuously available, said inferred values being calculated by mathematical models of the process and periodically corrected by laboratory tests which use polymer samples collected from the production line, said method being directed to control the production of polypropylene and its copolymers in a plant comprising at least one loop reactor and, optionally, one or more gas-phase reactors disposed in a serial conformation with the loop reactor(s) preceding the gas-phase reactor(s), said method using preferably but not exclusively three layer feed-forward neural networks as

process models, and **characterized by** the following procedures:

- simultaneous calculation by the multivariable non linear constrained model predictive control algorithm of the sequence of adjustments to be effected on a set of manipulated variables (1) comprising:

- the ratio of cocatalyst flow rate to electron donor flow rate;
- the hydrogen concentration in the feed stream of each loop reactor;
- the flow rate of the catalyst fed to the reactor arrangement;
- the flow rate of propylene fed to the loop reactor(s); and
- the flow rate of comonomer(s) fed to the loop reactor(s);

and in case one or more gas-phase reactors are used:

- the ratio of hydrogen concentration to comonomer(s) concentration within gas-phase reactors;
- the ratio of each comonomer concentration to the sum of propylene concentration and comonomer(s) concentration within each gas-phase reactor; and
- the flow rate of each comonomer fed to each gas-phase reactor;

so as to bring the values of a set of controlled variables (8) close to the set points established for

these variables, said set of controlled variables comprising:

- the production rate of the arrangement of loop reactors;
- the production rate of each loop reactor;
- the ratio between the production rate of each loop reactor and the production rate of the arrangement of loop reactors;
- the density of the reaction medium within loop reactors;
- the melt flow index of the polymer produced in the arrangement of loop reactors;
- the melt flow index of the polymer produced in each loop reactor; and
- the percentage(s) of comonomer(s) incorporated in polymer in the arrangement of loop reactors;

and in case one or more gas-phase reactors are used:

- the melt flow index of the polymer produced in the arrangement of loop and gas-phase reactors;
- the percentage(s) of comonomer(s) incorporated in polymer in each loop reactor;
- the percentage(s) of comonomer(s) incorporated in the polymer produced in the arrangement of loop and gas-phase reactors;
- the percentage(s) of comonomer(s) incorporated in the fraction of the polymer produced in gas-phase reactors; and
- the intrinsic viscosity of the polymer;

without violating the rate of change (ROC) limits imposed on manipulated variables (1) and the limits

imposed for a set of constrained controlled variables (6) comprising:

- the power of the pump that promotes the circulation of the reaction medium within each loop reactor;
- the opening of the valve that controls the temperature of each loop reactor; and
- the difference between the reactor temperature and the bubble point of the liquid within each loop reactor;

and in case one or more gas-phase reactors are used:

- the pressure of each gas-phase reactor; and
- the opening of the valve that controls the temperature of each gas-phase reactor;

taking into consideration the following variables as disturbances (7):

- the density of the reaction medium within the loop reactor(s);
- the temperature of loop reactor(s); and
- the production rates of loop reactor(s);

and in case one or more gas-phase reactors are used:

- the bed level in the gas-phase reactor(s);
- the flow rate of the stream that returns from the comonomer/propylene separation tower; and

• on-line calculation of inferred values for a set of variables comprising:

- the melt flow index of the polymer produced in loop reactors;
- the percentage(s) of comonomer(s) incorporated in polymer in loop reactors; and
- the percentage of xylene-soluble matter;

and in case one or more gas-phase reactors are used:

- the melt flow index of the polymer produced in the arrangement of loop and gas-phase reactors;
- the percentage(s) of comonomer(s) incorporated in the polymer produced in the arrangement of loop and gas-phase reactors;
- the percentage(s) of comonomer(s) incorporated in the fraction of the polymer produced in gas-phase reactors;
- the intrinsic viscosity of the polymer; and
- the percentage of xylene-soluble matter."

Claim 1 of the **first auxiliary request** differs from claim 1 of the main request only in that the wording:

"without violating the rate of change (ROC) limits"

is replaced by:

"taking into consideration the physical limits".

Claim 1 of the **second auxiliary request** reads as follows, in which differences between this claim and

claim 1 of the main request are underlined by the board:

"A process for on line control of a polymerization plant, that uses a multivariable constrained model predictive control algorithm and inferred values for polymer properties which measurements *[sic]* are not continuously available, said inferred values being calculated by mathematical models of the process and periodically corrected by laboratory tests which use polymer samples collected from the production line, said method being directed to control the production of polypropylene and its copolymers in a plant comprising at least one loop reactor and, optionally, one or more gas-phase reactors disposed in a serial conformation with the loop reactor(s) preceding the gas-phase reactor(s), said method using neural networks as process models, and **characterized by** the following procedures:

- simultaneous calculation by the multivariable constrained model predictive control algorithm of the sequence of adjustments to be effected on a set of manipulated variables (1) comprising:

- the ratio of cocatalyst flow rate to electron donor flow rate;
- the hydrogen concentration in the feed stream of each loop reactor;
- the flow rate of the catalyst fed to the reactor arrangement;
- the flow rate of propylene fed to the loop reactor(s); and

- the flow rate of comonomer(s) fed to the loop reactor(s);

and in case one or more gas-phase reactors are used:

- the ratio of hydrogen concentration to comonomer(s) concentration within gas-phase reactors;
- the ratio of each comonomer concentration to the sum of propylene concentration and comonomer(s) concentration within each gas-phase reactor; and
- the flow rate of each comonomer fed to each gas-phase reactor;

so as to bring the values of a set of controlled variables (8) close to the set points established for these variables, said set of controlled variables comprising:

- the production rate of the arrangement of loop reactors;
- the production rate of each loop reactor;
- the ratio between the production rate of consecutive loop reactors;
- the density of the reaction medium within loop reactors;
- the melt flow index of the polymer produced in the arrangement of loop reactors;
- the melt flow index of the polymer produced in each loop reactor; and
- the percentage(s) of comonomer(s) incorporated in polymer in the arrangement of loop reactors;

and in case one or more gas-phase reactors are used:

- the melt flow index of the polymer produced in the arrangement of loop and gas-phase reactors;
- the percentage(s) of comonomer(s) incorporated in polymer in each loop reactor;
- the percentage(s) of comonomer(s) incorporated in the polymer produced in the arrangement of loop and gas-phase reactors;
- the percentage(s) of comonomer(s) incorporated in the fraction of the polymer produced in gas-phase reactors; and
- the intrinsic viscosity of the polymer;

taking into consideration the physical limits imposed on manipulated variables (1) and the limits imposed for a set of constrained controlled variables (6) comprising:

- the power of the pump that promotes the circulation of the reaction medium within each loop reactor;
- the opening of the valve that controls the temperature of each loop reactor; and
- the difference between the reactor temperature and the bubble point of the liquid within each loop reactor;

and in case one or more gas-phase reactors are used:

- the pressure of each gas-phase reactor; and
- the opening of the valve that controls the temperature of each gas-phase reactor;

taking into consideration the following variables as disturbances (7):

- the density of the reaction medium within the loop reactor(s);
- the temperature of loop reactor(s); and
- the production rates of loop reactor(s);

and in case one or more gas-phase reactors are used:

- the bed level in the gas-phase reactor(s);
- the flow rate of the stream that returns from the comonomer/propylene separation tower; and

• on-line calculation of inferred values for a set of variables comprising:

- the melt flow index of the polymer produced in loop reactors;
- the percentage(s) of comonomer(s) incorporated in polymer in loop reactors; and
- the percentage of xylene-soluble matter;

and in case two loop reactors and one gas-phase reactor are used:

- the melt flow index of the polymer produced in the loop and gas-phase reactors;
- the percentage(s) of comonomer(s) incorporated in the polymer produced in the loop and gas-phase reactors;
- the percentage(s) of comonomer(s) incorporated in the fraction of the polymer produced in the gas-phase reactor;

- the intrinsic viscosity of the polymer produced in the gas phase reactor; and
- the percentage of xylene-soluble matter produced in the gas phase reactor."

Claim 1 of the **third auxiliary request** differs from claim 1 of the main request only in that the wording:

"without violating the rate of change (ROC) limits"

is replaced by:

"without violating the limits of the plant".

Claim 1 of the **fourth auxiliary request** differs from claim 1 of the second auxiliary request only in that the wording:

"taking into consideration the physical limits"

is replaced by:

"without violating the limits of the plant".

Claim 1 of the **fifth auxiliary request** differs from claim 1 of the main request only in that the wording:

"without violating the rate of change (ROC) limits imposed on manipulated variables (1) and the limits imposed"

is replaced by:

"determining the values of the manipulated variables (1) and controlling the constrained controlled variables without violating the limits of the plant".

Claim 1 of the **sixth auxiliary request** differs from claim 1 of the second auxiliary request only in that the wording:

"taking into consideration the physical limits imposed on manipulated variables (1) and the limits imposed"

is replaced by:

"determining the values of the manipulated variables (1) and controlling the constrained controlled variables without violating the limits of the plant".

Reasons for the Decision

1. *Main request - Article 100(c) EPC*

1.1 Respondents 2 and 3 argued, *inter alia*, that the application as filed did not provide a basis for the feature "without violating the rate of change (ROC) limits imposed on manipulated variables (1)" in claim 1 as granted.

1.2 The appellant argued that this feature was implicitly disclosed in the application as filed. In support of its arguments, it referred to the following passages in the application as published (underlining by the board):

i) "Therefore, in order to obtain significant benefits, the control system of those processes should be multivariable (MIMO), comprising various controlled variables as well as various manipulated variables.
Besides, the control system must take into consideration the physical limits of the process under study as well as any disturbance which could possibly be measured. A control technique that presents these characteristics is the Model Predictive Control which is based on process models to determine the best set of actions to be taken so that the controlled variables reach desired values" (page 14, lines 4 to 12);

ii) "Then, the predictive controller solves a problem of non linear optimization to determine the values of the manipulated variables (set points of MV's), so that the controlled variables are maintained close to the desired values, without violating the limits of the plant." (page 30, lines 5 to 9); and

iii) "Thus, a balanced increase in the flow rates of catalyst and monomer is required so that the increase in production rate and density do not cause a violation of such limits as established for the opening of the valves for temperature adjustment, and for the power of the circulation pumps of the loop reactors." (page 30, line 23 to page 31, line 2).

More specifically, the appellant argued that a person skilled in the art knew that there were two types of physical limits inherent to chemical processes, namely

those related to static characteristics of the equipment in the plant, i.e. the upper and lower limits of parameters affecting the process, often called positional limits, and those related to the dynamic characteristics of the equipment, i.e. the speed at which various values were changing. Those of the latter type were the rate of change limits. Further, the skilled person was aware of the fact that only manipulated variables had their rate of change constrained. Therefore, it was directly and unambiguously derivable from the above passage i) that the rate of change limit should be taken into consideration, in other words, that the rate of change limits could not be violated. The appellant further argued that from the above passage ii) it was implicit that rate of change values which were impossible for the method must be avoided and, hence, that rate of change limits should not be violated. The limit for the opening rate of the valve, see passage iii), represented a rate of change limit which should not be violated.

1.3 The board notes that the application as filed does not explicitly disclose the contested feature. Further, it notes that in none of the claims as filed the term "limit" or "limits" occurs and that, apart from the above passages i) to iii), the only other passages in the application as filed which relate to limits are the following (underlining by the board):

iv) "Constrained Controlled Variables (CCV's) are variables that despite being controlled do not require to be maintained close to a set point.

However, constrained controlled variables must be controlled so as not to exceed certain limits. Manipulated Variables (MV's) are variables that must be adjusted so that controlled variables are maintained close to a set point or within certain limits." (page 9, lines 9 to 15);

v) "A further relevant point regarding process control is the fact that, generally, economic aspects require the process to be operated close to plant capacity limits. Thus, catalyst flow rate could be manipulated to control the production rate of the reactor, however, when polymerization heat exceeds the limit of the thermal exchange capacity of the reactor, the objective of increasing production even more should be restricted in favor of thermal stability. In view of *[sic]*

In view of this example, the importance of considering CCV's in a multivariable control strategy is clear, as these variables will determine the limits under which plant optimization is achieved." (page 11, lines 24 to page 12, line 8); and

vi) "These variables are of utmost importance for the process economics. Lower variance resulting from the use of a more advanced control method such as that described and claimed in the present invention makes that *[sic]* average figures for these variables be increased relative to state-of-the-art control systems, provided the upper limits of the reactors heat exchange capacity, which are

reflected in the temperature control valve opening, are not violated." (page 24, 8 to 14).

1.4 In the board's view, if it were assumed, as argued by the appellant, that the expressions "the physical limits of the process under study" and "the limits of the plant", as used in passages i) and ii), relate to the rate of change limits imposed on the manipulated variables, they would also relate to the static limits imposed on the manipulated variables, since the above-quoted, general expressions cover both. Claim 1, however, is only concerned with the rate of change limits and, hence, is more specific, it being noted that the other limits referred to in the claim, i.e. "limits imposed for a set of constrained controlled variables (6)", see point VIII above, are not concerned with manipulated variables. Further, the claim specifically refers to limits "imposed on" manipulated variables. Imposed limits need not necessarily be the same as the physical limits of the process or the limits of the plant as referred to in passages i) and ii).

Hence, the general disclosure in passages i) and ii) does not provide a basis for the above-mentioned contested feature (point 1.1).

Passage iii) does not unambiguously give an example of a rate of change limit, since the wording "the opening of the valves" may be interpreted as relating either to the way the valves are opened, e.g. at which speed, or, as asserted by the respondents, to the extent to which the valves are open. Even if it were an example of a rate of change limit, the passage would not provide a

basis for generalising this example to any rate of change limit imposed on manipulated variables, as is the case in claim 1. The board further notes that the opening of the valves for temperature adjustment and the power of the circulation pumps of the loop reactors, as referred to in passage iii), are referred to in claim 1 as part of the set of constrained controlled variables and not as manipulated variables (cf. page 19, lines 7 to 10, page 20, Table 2, and claims 29 and 30 of the application as filed).

Passage iv) refers to limits only in respect of controlled variables and constrained controlled variables, i.e. not in respect of manipulated variables.

The above considerations in respect of passages i) and ii) apply, *mutatis mutandis*, to passage v), in which reference is made to "plant capacity limits", "the limit of the thermal exchange capacity of the reactor" and, without further specification, "the limits under which plant optimization is achieved".

Passage vi) only relates to static characteristics of the equipment in the plant, namely "the upper limits of the reactors heat exchange capacity", i.e. not to rate of change limits.

Hence, the passages iii) to vi) do not provide a basis for the contested feature either.

1.5 The board also considered whether the contested feature defines a requirement which is automatically complied with when carrying out the method of controlling the

production of polypropylene and its copolymers, in the sense that physical limits of the plant can never be violated, and that therefore the feature is self-evident and thus redundant. However, the limits in question are limits which are "imposed on" manipulated variables and, hence, may be chosen well below any actual physical limits, for example in order to provide safety margins. The contested feature therefore constitutes a technically meaningful limitation of the claimed subject-matter.

1.6 In view of the above, the board concludes that the feature "without violating the rate of change (ROC) limits imposed on manipulated variables" in claim 1 is a technically meaningful feature which cannot directly and unambiguously be derived from the application as filed. Claim 1 as granted does not therefore meet the requirement of Article 123(2) EPC (opposition ground pursuant to Article 100(c) EPC).

1.7 The main request is therefore not allowable.

2. *First auxiliary request - amendments (Article 123(3) EPC)*

2.1 Claim 1 of the first auxiliary request differs from claim 1 of the main request in that the wording "without violating the rate of change (ROC) limits" is replaced by "taking into consideration the physical limits".

2.2 The appellant argued that the amendment did not extend the protection conferred by the patent, since it was a negative limitation; the more general definition of

"physical limits" as opposed to "rate of change limits" actually reduced rather than increased the scope of the claim. Further, the amendment did not change the technical nature of the process, since it merely expanded the limits which must be avoided. It resulted in "the same technical process (and either the same claim scope, or reduced claim scope) with a probability bordering on certainty". In support of its arguments, the appellant referred to decision T 166/90.

As to the expression "taking into consideration" the appellant argued that the whole purpose of "taking into consideration" a physical limit was to ensure that this limit was not violated; the only sensible interpretation of the meaning of "taking into consideration the physical limits" was that these limits were to be looked at in order to ensure that they were not violated. This interpretation was in accordance with the description, reference being made to the above-quoted passages ii) and iii) of the description as filed.

2.3 The board does not find these arguments convincing. In the board's view, the expression "taking into consideration", which replaces "without violating", is sufficiently clear for an addressee to be able to understand the claim without the need to refer to the description. Giving the expression its normal, broad meaning, i.e. similar to *taking into account*, *bearing in mind*, or *considering*, the claim no longer requires that, in the step of calculating, by means of the predictive control algorithm, of the sequence of adjustments to be effected on a set of manipulated variables, limits imposed on manipulated variables are

not violated. For example, a violation of a limit may be permitted in the calculation step on condition that it is of a transient nature only or as long as limits imposed on certain other manipulated variables are not violated at the same time. It may also be that, if a limit is violated in the calculation step, certain measures, not specified in the claim, are subsequently to be taken in order to compensate for this. In the board's view, each of these scenarios reads on the wording "taking into consideration the ... limits" and, hence, each would fall within the scope of the claim, whereas it would not in the case of claim 1 as granted. In this respect, it is of no relevance whether the limits are "rate of change (ROC) limits" as in claim 1 as granted or "physical limits" as in the present claim, since in each of these claims the limits are merely imposed limits, see also point 1.5 above.

Decision T 166/90 referred to by the appellant is concerned with a situation in which a deletion of a feature from the claim did not violate Article 123(3) EPC due to the presence of other features in the claim, which, in that board's view, implied the deleted feature, even if it could not be excluded that under extreme circumstances, which a skilled person would normally not have selected, results might have been achieved, which went beyond the effects which were aimed at and were achievable on skilfully carrying out the method (see T 166/90, points 3.3 and 3.4). The present case is not concerned with such extreme circumstances but is concerned with interpreting the expression "taking into consideration", giving it the meaning it normally has in the relevant art.

2.4 The amendment to claim 1 of the first auxiliary request therefore extends the protection conferred by the patent and, hence, does not comply with Article 123(3) EPC.

2.5 The first auxiliary request is therefore not allowable.

3. *Second auxiliary request - amendments (Article 123(3) EPC)*

3.1 Claim 1 of the second auxiliary request includes, *inter alia*, the same amendment as referred to above in relation to claim 1 of the first auxiliary request (see point 2.1). The reasoning set out above at point 2.3 in respect of this amendment applies *mutatis mutandis*, it being noted the remaining amendments are not linked in any way to this amendment (see point VIII). The appellant did not argue otherwise in this respect and did not submit any further arguments in relation to the amendment in question. The amendment to claim 1 of the second auxiliary request therefore extends the protection conferred by the patent and, hence, does not comply with Article 123(3) EPC.

3.2 The second auxiliary request is therefore not allowable.

4. *Third auxiliary request - amendments (Article 123(2) EPC)*

4.1 Claim 1 of the third auxiliary request differs from claim 1 of the main request in that the wording "without violating the rate of change (ROC) limits" is replaced by "without violating the limits of the plant".

4.2 As a basis for this amendment the appellant referred to passage ii) (see point 1.2). According to this passage the predictive controller solves the problem of non-linear optimization in order to determine the values of the manipulated variables, so that the controlled variables are maintained close to the desired values, without violating the limits of the plant.

In the board's view, this passage does not relate to limits of the plant imposed on manipulated variables, as defined in claim 1, but to limits of the plant in general, without specifying that, or how, any one of them is to be imposed on the manipulated variables in the course of the calculation performed by means of the predictive control algorithm. The passage referred to by the appellant does not therefore provide a basis for the amendment. Nor was the board able to find a basis in any of the other parts of the application as originally filed.

4.3 The board therefore concludes that the amendment to claim 1 adds subject-matter which extends beyond the content of the application as filed. Claim 1 does not therefore comply with the requirement of Article 123(2) EPC.

4.4 The third auxiliary request is therefore not allowable.

5. *Fourth auxiliary request - amendments (Article 123(2) EPC)*

5.1 Claim 1 of the fourth auxiliary request includes, *inter alia*, the same amendment as referred to above in

relation to claim 1 of the third auxiliary request (see point 4.1). The reasoning set out above at point 4.2 in respect of this amendment applies *mutatis mutandis*, it being noted the remaining amendments are not linked to this amendment (see point VIII). The appellant did not argue otherwise in this respect and did not submit any further arguments in relation to the amendment in question. Claim 1 does not therefore comply with the requirement of Article 123(2) EPC.

5.2 The fourth auxiliary request is therefore not allowable.

6. *Fifth auxiliary request - amendments (Article 123(3) EPC)*

6.1 Claim 1 of the fifth auxiliary request differs from claim 1 of the main request in that the wording "without violating the rate of change (ROC) limits imposed on manipulated variables (1) and the limits imposed" is replaced by:

"determining the values of the manipulated variables (1) and controlling the constrained controlled variables without violating the limits of the plant".

6.2 The appellant argued that the new wording was not broader than the wording it replaced. Both claim 1 as granted and claim 1 of this request made it explicitly clear that the limits could not be violated. Whilst in claim 1 as granted the rate of change limits imposed on the manipulated variables could not be violated, in the present claim the manipulated variables were determined and the constrained controlled variables were controlled in such a way that no limits of the plant

could be violated. This implicitly included both rate of change limits and static limits of the variables. Accordingly, more stringent limits were set, thereby having reduced the scope of the claim. Further, the negative limitation of the claim, "the limits of the plant", was more general than "rate of change limits" and thus reduced rather than increased the scope of the claim. The amendment did not change the technical nature of the process, since it merely expanded the limits which must be avoided. Accordingly, the amendment resulted in "the same technical process (and either the same claim scope, or reduced claim scope) with a probability bordering on certainty".

6.3 The board does not find these arguments convincing, since they ignore the fact that the claim no longer requires that limits are imposed on manipulated variables. Instead it is merely required that limits of the plant are not violated, without specifying that, or how, any one of them is to be imposed on the manipulated variables in the course of the calculation performed by means of the predictive control algorithm.

The deletion of the feature "without violating the rate of change (ROC) limits imposed on manipulated variables (1)", which the board considers to be a technically meaningful feature (see point 1.5), therefore extends the protection conferred by the patent and, hence, claim 1 does not comply with Article 123(3) EPC.

6.4 The fifth auxiliary request is therefore not allowable.

7. *Sixth auxiliary request - amendments (Article 123(3) EPC)*

7.1 Claim 1 of the sixth auxiliary request includes, *inter alia*, the same amendment as referred to above in relation to claim 1 of the fifth auxiliary request (see point 6.1). The reasoning set out above at point 6.3 in respect of this amendment applies *mutatis mutandis*, it being noted that the remaining amendments are not linked to this amendment (see point VIII). The appellant did not argue otherwise in this respect and did not submit any further arguments in relation to the amendment in question. Therefore, claim 1 does not comply with Article 123(3) EPC.

7.2 The sixth auxiliary request is therefore not allowable.

8. Since the opposition ground pursuant to Article 100(c) prejudices the maintenance of the patent as granted and since there is no amended set of claims on file which meets the requirements of Articles 123(2) and (3) EPC and on the basis of which a remittal to the department of first instance for further prosecution could have been considered, the board concludes that the appeal is to be dismissed.

9. *Request for reimbursement of the appeal fee*

The board notes that, in accordance with Rule 103 EPC, the appeal fee is to be reimbursed if the following three conditions are met:

i) a substantial procedural violation has been committed;

ii) a reimbursement is equitable; and

iii) the appeal is allowable.

Since the appeal is not allowable, the third condition is not met and therefore the request for reimbursement of the appeal fee must be refused.

Order

For these reasons it is decided that:

1. The appeal is dismissed.

2. The request for reimbursement of the appeal fee is refused.

The Registrar: The Chairman:

D. Magliano A. S. Clelland