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Datasheet for the decision of 7 December 2021

Case Number: T 2660/18 - 3.5.07

Application Number: 03257922.9

Publication Number: 1435626

IPC: G06F17/50, G21C5/02

Language of the proceedings: EN

Title of invention:
Method and arrangement for developing rod patterns in nuclear reactors

Applicant:
Global Nuclear Fuel-Americas, LLC

Headword:
Developing rod patterns in nuclear reactors/GLOBAL NUCLEAR FUEL-AMERICAS

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - main, first and second auxiliary requests (no)

Decisions cited:
G 0001/19, T 0625/11

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It can be changed at any time and without notice.

Catchword:

In case T 625/11, the board concluded that the determination, as a limit value, of the value of a first operating parameter conferred a technical character to the claim which went beyond the mere interaction between the numerical simulation algorithm and the computer system. The nature of the parameter thus identified was, in fact, "intimately linked to" the operation of a nuclear reactor, independently of whether the parameter was actually used in a nuclear reactor (T 625/11, Reasons 8.4).

The board is of the opinion that, in the case at hand, no technical effect is achieved by the method's functionality as the method merely produces a test rod pattern (i.e. a fuel bundle configuration) design and data "indicative of limits that were violated by the proposed test rod pattern design during the simulation".

Contrary to case T 625/11, no parameter is identified that is "intimately linked to" the operation of a nuclear reactor.

A rod pattern design appears to have non-technical uses such as for study purposes. These are "relevant uses other than the use with a technical device", and therefore a technical effect is not achieved over substantially the whole scope of the claimed invention (G 1/19, points 94 and 95).

The data "indicative of limits that were violated by the proposed test rod pattern design during the simulation" do even not, or at least do not entirely, reflect the physical behaviour of a real system underlying the simulation (see G 1/19, point 128).
The board notes that, due to the breadth of the wording of claim 1 of the main request, the obtained rod pattern design might violate any number of limits by an almost unlimited amount.

Hence, this is not an "exceptional case" in which calculated effects can be considered implied technical effects (see decision G 1/19, points 94, 95 and 128).

This datasheet is not part of the Decision.
It can be changed at any time and without notice.

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Case Number: T 2660/18 - 3.5.07

D E C I S I O N
of Technical Board of Appeal 3.5.07 of 7 December 2021

Appellant: (Applicant)
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Decision under appeal:
Decision of the Examining Division of the European Patent Office posted on 6 June 2018 refusing European patent application No. 03257922.9 pursuant to Article 97(2) EPC.

Composition of the Board:

Chairman J. Geschwind
Members: C. Barel-Faucheux
M. Jaedicke

Summary of Facts and Submissions

I. The appeal lies from the decision of the examining division to refuse European patent application No. 03257922.9. In reply to the examining division's summons, the appellant had withdrawn its request for oral proceedings and requested a decision "according to the state of the file". The decision was thus taken in writing after cancellation of the scheduled oral proceedings. It refers to the communication of 3 January 2018 accompanying the summons to attend oral proceedings and is based on the sole request filed on 20 January 2017.

The communication, referred to by the decision, cited the following document:

D1: Lian Shin Lin and Chaung Lin, "A Rule-Based Expert System for Automatic Control Rod Pattern Generation for Boiling Water Reactors", Nuclear Technology, vol. 95, July 1991, pp. 1-8

The examining division decided that the subject-matter of all claims was not inventive (Article 56 EPC).

II. In the statement of grounds of appeal, the appellant maintained the sole request considered in the appealed decision and submitted anew with the statement of grounds.

III. The appellant was summoned to oral proceedings. In a subsequent communication, the board expressed its preliminary opinion that claim 1 of the sole request was not inventive having regard to the disclosure of document D1 and was also not inventive over a known general-purpose computer in a system comprising a conventional interface to a database server, a conventional interface to a calculation server and a user interface (Article 56 EPC).

IV. With a letter of reply of 19 November 2021, the appellant filed a first and a second auxiliary request.

V. Oral proceedings were held as scheduled. At the end of the oral proceedings, the Chair announced the board's decision.

VI. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the main request underlying the contested decision or, in the alternative, the first or second auxiliary request filed with letter of 19 November 2021.

VII. Claim 1 of the main request reads as follows:
"A computer-implemented method of developing a rod pattern design for a nuclear reactor, the rod pattern design representing a control mechanism for operating the reactor, comprising the steps of:

defining via a database server (250) a set of limits that is a set of limiting or target operating and core performance values for a specific reactor plant or core energy cycle, wherein the set of limits is applicable to a proposed test rod pattern design to be tested, the proposed test rod pattern design comprising one of a design of notch positions and sequences of control blade patterns in a boiling water reactor core and a design of group sequences for control rods in a pressurized water reactor core;

establishing via a user and an interface (300), based on the limits, a sequence strategy for positioning one or more subsets of the proposed test rod pattern design;

simulating via a calculation server (400) reactor operation on at least a subset of the proposed test rod pattern design to produce a plurality of simulated results;

comparing the simulated results against the limits by using a total objective function to compare how closely a simulated proposed test rod pattern design meets the defined set of limits, wherein the total objective function is a summation of all individual constraint components defined by

$OBJ_{par} = MULT_{par} * (RESULT_{par} - CONS_{par})$,

wherein CONS is a limit of the defined set of limits for a particular constraint parameter (par); RESULT is one of the simulation results for that particular constraint parameter, and MULT is a multiplier for the constraint parameter; and

providing via the calculation server data indicative of limits that were violated by the proposed test rod pattern design during the simulation."

VIII. Claim 1 of the first and second auxiliary requests differs from claim 1 of the main request in that the text "and" before "providing via the calculation server" was deleted and the following text was added at the end:

";

storing information related to the test rod pattern design, limits, simulated results and data from the comparison;

modifying the test pattern design to create a derivative rod pattern design;

repeating the simulating, comparing and providing steps to develop data indicating limits that were violated by the derivative rod pattern design during the simulation;

selecting a type of nuclear reactor, wherein the reactor is selected from a group comprising a boiling water reactor, a pressurized water reactor, a gas-cooled reactor and a heavy water reactor;

iteratively repeating the modifying, simulating, comparing and providing steps to develop N iterations of the derivative rod pattern design, and, for selected ones of the N iterations, storing information related to the rod pattern design, limits, simulated results and data from the comparison,

wherein the iteratively repeating step is performed until the comparing in a particular iteration indicates that all limits have been satisfied, or satisfied within an acceptable margin; and

outputting data related to an acceptable rod pattern design for the nuclear reactor."

The board notes that the second auxiliary request differs from the first auxiliary request only by the deletion of independent claim 4.

IX. The appellant's arguments, where relevant to this decision, are addressed in detail below.

Reasons for the Decision

The application

1. The application relates to determining rod pattern (or blade pattern) designs for a nuclear reactor core.

Main request - Lack of inventive step over document D1

2. Document D1 was considered an appropriate starting point for assessing inventive step by both the examining division and the appellant (see communication

to which the decision refers, point 3.1 and statement of grounds, page 1, last paragraph). It discloses a rule-based "expert" system for automatic control rod pattern generation for boiling water reactors (BWR) (title and abstract). The expert system consists of two main components: a knowledge base and an inference engine, the knowledge base containing expert knowledge from which the inference engine draws conclusions (page 1, right-hand column, second full paragraph). In essence, a program running on a workstation is developed that contains two main parts: an expert system that generates a control rod pattern and a three-dimensional core simulation model (page 5, left-hand side, section "V. Results and discussion").

3. When designing the control rod pattern, a set of limits is defined, such as:
   - the difference between actual and target "eigenvalues" which must not exceed a predetermined criterion at each burn-up (i.e. fuel-utilisation) step
   - the values of thermal limits, such as the linear heat generation rate (LHGR), the average planar linear heat generation rate (APLHGR), and the critical power ratio (CPR), which must be within limit values at each burn-up step
     (page 2, right-hand side, under section "II. Control rod programming" and page 5, right-hand side, ordered list "1." and "2."; see also, for comparison, the description of the application as originally filed, page 19, first paragraph and page 20, second full paragraph mentioning the LHGR and the maximum APLHGR as possible limits)

4. After determination of an initial control rod pattern or a modified control rod pattern, a three-dimensional

simulation is performed. The simulation results are compared to the "eigenvalues" and the thermal limit value (Figure 3).

5. The appellant argued that D1 did not disclose or hint at, in a BWR core, designing notch positions in rods or sequences of control blade patterns but in contrast merely taught determining the position of the control rods based on using a set of rules and predetermined notches on the control rods (letter of reply dated 19 November 2021, paragraph bridging pages 3 and 4).

5.1 The board concurs with the appellant that, in document D1, the positions of the control rods are determined. In particular, a determination of control rod(s) location and depth is described (D1, paragraph following section "IV. Development of the knowledge base"). In the example given, the full length of a control rod is 48 notches, and full insertion is when the control rod is at the 0^{th} notch (page 4, left-hand side, first full paragraph). The depth of a "deep rod" is defined as 18 notches; an "intermediate rod", 36 notches; a "shallow rod", 48 notches, i.e. "fully withdrawn" (page 6, right-hand side, last full sentence).

5.2 However, the board notes that the control rods of document D1 are also divided into two groups, "A" and "B". The B group has "quarter-core" mirror symmetry, and the A group has "eighth-core" symmetry "to simplify the design" (D1, page 2, left-hand side, first paragraph, section "II. Control rod programming"). This corresponds to the "model size" and "core symmetry option" of the application (description of the application, last paragraph of page 10 and first paragraph of page 11).

5.3 In document D1, the rods in the A and B groups are further divided into four groups Al, A2, B1 and B2. During operation, one of the four groups is partially inserted, and the other groups are completely withdrawn. For example, when the control rods in group Al are inserted, the reactor is said to be operating in the Al sequence. During a fuel cycle, the control rod pattern is changed from one sequence to another at every interval of a certain amount of exposure to flatten the exposure distribution. One of two sequences is chosen: "A2 then B1 then A1 then B2 then A2" or "A1 then B2 then A2 then B1 then A1" (D1, page 2, section "II. Control rod programming"; see, for comparison, the description of the application, paragraph bridging page 11 to page 12 and first full paragraph of page 12). The board notes that this is similar to what is described in the application as "selection of the rod groups (sequences) and placement of the control rod positions within the groups as a function of time during the cycle" (see application, first full paragraph of page 26).

5.4 Therefore, the board was not convinced that D1 does not disclose designing notch positions in rods or sequences of control blade patterns as argued by the appellant.

6. Thus, document D1 discloses, in the wording of claim 1 of the main request (the struck out features being present in claim 1 but not in document D1):

"A computer-implemented method of developing a rod pattern design for a nuclear reactor, the rod pattern design representing a control mechanism for operating the reactor, comprising the steps of:

defining ~~via a database server~~ a set of limits that is a set of limiting or target operating and core performance values for a specific reactor plant or core energy cycle, wherein the set of limits is applicable to a proposed test rod pattern design to be tested, the proposed test rod pattern design comprising <u>one of</u> a design of notch positions and sequences of control blade patterns in a boiling water reactor core ~~and a design of group sequences for control rods in a pressurized water reactor core~~;

establishing via a user and an interface, based on the limits, a sequence strategy for positioning one or more subsets of the proposed test rod pattern design;

simulating via a calculation server reactor operation on at least a subset of the proposed test rod pattern design to produce a plurality of simulated results;

comparing the simulated results against the limits ~~by using a total objective function~~ to compare how closely a simulated proposed test rod pattern design meets the defined set of limits~~, wherein the total objective function is a summation of all individual constraint components defined by~~
~~OBJpar = MULTpar * (RESULTpar- CONSpar),~~
~~wherein CONS is a limit of the defined set of limits for a particular constraint parameter (par); RESULT is one of the simulation results for that particular constraint parameter, and MULT is a multiplier for the constraint parameter~~; and

providing via the calculation server data indicative of limits that were violated by the proposed test rod pattern design during the simulation."

7. The distinguishing features of claim 1 having regard to the disclosure of document D1 are thus:
(DF1) defining the sets of limits using a database server

(DF2) comparing the simulated results against the limits using a total objective function which is the sum of all individual constraint components defined by $OBJ_{par} = MULT_{par} * (RESULT_{par} - CONS_{par})$, where CONS is a limit of the defined set of limits for a particular constraint parameter (par); RESULT is one of the simulation results for that particular constraint parameter and MULT is a multiplier for the constraint parameter

8. D1 discloses that the "rules" (or "set of limits" in the wording of claim 1) contain expertise that human experts possess and are the corpus of the system (page 2, right-hand side, section "III. Expert system"). For example, 31 rules have been constructed to eliminate thermal limit violations and 11 rules to estimate eigenvalue change(s) (page 3, right-hand side, first full paragraph and page 4, right-hand side, lines 2 to 3). D1 states that the rule sets in the "knowledge base" are derived from the accumulated experience and understanding of BWR core characteristics (page 3, left-hand side, section "IV. Development of the knowledge base").

Using a database server for storing the knowledge base is an obvious possibility for the skilled person.

Therefore, distinguishing feature DF1 is obvious.

9. The board notes that the expression "$(RESULT_{par} - CONS_{par})$", where CONS is a limit of the defined set of limits for a particular constraint parameter and RESULT is a simulation result for that particular constraint parameter, corresponds, for example, to the calculation of the difference between a target thermal value and a corresponding "actual" (i.e. simulated)

thermal value or the calculation of the difference between a target eigenvalue and an "actual" (i.e. simulated) eigenvalue of document D1.

9.1 The appellant argued that D1's eigenvalue changes were "likely" related to a change in a state of the system due to a change in the positioning of the control rods in the system by moving one or more of the control rods from a first predetermined notch position to a second predetermined notch position. D1 did not provide any limiting constraints on predetermined notch positions because these positions were "predetermined (i.e., their respective positions on the rod were fixed and were not being designed)" (letter of 19 November 2021, paragraph bridging page 4 to page 5).

9.2 The board notes that, in document D1, rules are constructed to eliminate thermal limit violations or to estimate eigenvalue changes. The control rods are indeed moved to achieve a target eigenvalue or to eliminate the violation of thermal limits (page 3, right-hand side, first full paragraph). First, D1 teaches that values of thermal limits, such as LHGR and APLHGR, depend on the local power density, and therefore violations of these thermal limits are usually located near the bottom of the core. Document D1 thus discloses controlling the insertion depth of the rods, as a control of the possible "positions" of rods, to lower these "local power peaks" or eliminate CPR violations (section "IV.A. Heuristic Methods for Conforming to Thermal Limits"). Second, D1 stipulates that "[w]hen the control rods are moved to achieve the target eigenvalue or to eliminate violated thermal limits", it is necessary to estimate the eigenvalue change due to these movements. It also discusses "eigenvalue change due to a 2-notch control rod movement" and discloses that the eigenvalue change due to a 2-notch control rod movement in the quarter-core depends on its location in the core, inserted depth, the control rod numbers in the full core, and an exposure value. Thus, constructing a first table that can estimate the eigenvalue change based on changes in these four factors is considered "helpful". When the control rod movement has been determined, the eigenvalue change is estimated by finding the corresponding value from the first table and multiplying it by ratios from a second table (reflecting the location, depth and exposure of the control rod) and the number of notches moved. Furthermore, document D1 discloses that the eigenvalue change must be multiplied or weighted by a value determined by the exact number of rods in the core. Moreover, D1 discloses repeating the process of modifying the control rod pattern and core simulating until the "eigenvalue and thermal limit conditions" are all satisfied.

9.3 D1 does not directly relate the eigenvalue change to the difference between the "actual" and "target" eigenvalue of the "design requirement" (see page 5, right-hand side). But a skilled person would understand that the "actual" eigenvalue is updated based on this eigenvalue change.

9.4 Thus, D1 discloses an "individual constraint component" as defined in feature DF2 of claim 1 (section "IV.C. Heuristic Methods for Reaching a Target Eigenvalue" and section "V. Results and discussion").

10. The appellant has argued that the multipliers $MULT_{par}$ for the different parameters were either "empirically derived" and/or "user modified" and therefore were not

the same as Dl's non-empirically derived "exact number of rods" in the core. D1 did not hint at multipliers determined by the user having certain "weights" to assign different weights to different constraints to provide an objective function to evaluate the system operating under a proposed test rod pattern design (letter of 19 November 2021, page 5, third full paragraph). However, the board notes that claim 1 does not define the constraint parameter further.

10.1 The board is of the opinion that assigning weights to individual constraint components and summing all individual constraint components, such as the difference between the actual eigenvalue and the target eigenvalue or the thermal limits excursion values of document D1, is an obvious possibility for comparing the simulated results against the set of limits, depending on the relative importance of each limit.

11. Feature DF2 is therefore obvious.

12. Thus, the board is of the opinion that claim 1 is not inventive having regard to the disclosure of document D1.

Main request - Lack of inventive step over a general-purpose computer

13. It appears that the computer-implemented method of claim 1 can be implemented as a computer program on a well-known general-purpose computer in a system comprising a conventional interface to a database server, a conventional interface to a conventional calculation server and a conventional user interface.

14. It appears that no inventive step can be based on the method's implementation on a computer system as described in point 13. since the claim specifies no details of this implementation going beyond this well-known computer system. Moreover, the description of the application states that the database server might be a known "Oracle 8i Alpha ES 40" relational database server and the calculation server might be a known "Windows 2000" server (description, page 8, third and fourth paragraphs). The user interface might be a well-known web-based internet browser (description, page 6, lines 15 to 18). Moreover, the description, on page 5, lines 4 to 6, states that a known three-dimensional simulation using simulation codes licensed by the Nuclear Regulatory Commission (NRC) might be performed.

15. The appellant argued that the technical effect was "reducing the time to design rods and doing so in a safe manner" and the "implicit use of the modified rods in the reactor that was simulated for operating the reactor safely within target operating and core performance value limits". The technical effect resulted from a computer-based arrangement that provided "a way to efficiently develop a rod pattern design for a nuclear reactor, where the rod pattern design represented a control mechanism for operating the reactor", as well as a "computer-based method for providing internal and external users the ability to quickly develop, simulate, modify and perfect a rod pattern design for (implicit) use in their reactor" (letter of 19 November 2021, pages 8 and 9).

15.1 The board does not see such an effect coming from the distinguishing features. Moreover, the same effects are achieved by the method disclosed in document D1 (see abstract: "The system is successfully demonstrated by generating control rod programming for the 2894-MW (thermal) Kuosheng nuclear power plant in Taiwan. The computing time is tremendously reduced compared to programs using mathematical methods.").

16. During the oral proceedings, the appellant also cited decision T 625/11. In case T 625/11, the board concluded that the determination, as a limit value, of the value of a first operating parameter conferred a technical character to the claim which went beyond the mere interaction between the numerical simulation algorithm and the computer system. The nature of the parameter thus identified was, in fact, "intimately linked to" the operation of a nuclear reactor, independently of whether the parameter was actually used in a nuclear reactor (T 625/11, Reasons 8.4).

17. The board notes that the method of claim 1 of the case at hand only provides "data indicative of limits that were violated by the proposed test rod pattern design during the simulation"; it does not develop per se a rod pattern design for a nuclear reactor.

17.1 The limits are "limiting or target operating and core performance values for a specific reactor plant or core energy cycle". They might correspond to limits set by an administrative authority such as the NRC mentioned in the application (page 2, second full paragraph).

17.2 Compared to a prior-art document disclosed in the application (page 2, second full paragraph), the comparison of the simulated results against the limits is done by the computer, not the designer.

17.3 Data indicative of limit violations (corresponding to a "failure to meet a design criteria" in the application, page 2, second full paragraph) might trigger a manual change by a user (here a designer) of the "sequence strategy for positioning one or more subsets" of the test rod pattern design. This change is not defined in the claim.

18. The board is of the opinion that no technical effect is achieved by the method's functionality as the method merely produces a test rod pattern (i.e. a fuel bundle configuration) design and data "indicative of limits that were violated by the proposed test rod pattern design during the simulation".

19. Thus, contrary to case T 625/11, no parameter is identified that is "intimately linked to" the operation of a nuclear reactor.

Although the method yields a rod pattern design and provides limits of core performance values for a reactor plant having this design, this rod pattern design and the limits cannot be used directly in a nuclear reactor system. The rod pattern would first need to be manufactured.

Moreover, a rod pattern design appears to have non-technical uses such as for study purposes. These are "relevant uses other than the use with a technical device", and therefore a technical effect is not achieved over substantially the whole scope of the claimed invention (G 1/19, points 94 and 95). In fact, the reactor for which the rod pattern was designed may not yet have been built and may never be built.

The data "indicative of limits that were violated by the proposed test rod pattern design during the simulation" do even not, or at least do not entirely, reflect the physical behaviour of a real system underlying the simulation (see G 1/19, point 128).

The board notes that, due to the breadth of the wording of claim 1, the obtained rod pattern design might violate any number of limits by an almost unlimited amount. Building a nuclear reactor core by using such a rod pattern design might even yield a non-functioning and dangerous reactor core.

Hence, this is not an "exceptional case" in which calculated effects can be considered implied technical effects (see decision G 1/19, points 94, 95 and 128).

20. Even if, for the sake of argument, contrary to the board's position as expressed in the preceding paragraph, a rod pattern design were to be equated, for the purpose of assessing inventive step, with a manufactured rod pattern loaded in a suitable nuclear reactor core, it appears that none of the features of the design method would make an inventive contribution. This is because any technical effect achieved by the rod pattern would be the result of specific modifications made to the rod pattern such as notch positions and sequences of control blade patterns in a BWR core and to the group sequences for control rods in a pressurised water reactor core, such modifications not being specified in the claim.

21. During the oral proceedings, the appellant argued that the "Logikverifikation" decision of the German Federal Court of Justice (Case X ZB 11/98, GRUR 2000, 498) supported its view that the claimed subject-matter brings about a technical effect. However, the board referred the appellant to decision G 1/19, Reasons 124, which takes a different view. As the board endorses the

reasoning provided in decision G 1/19, it is not convinced by the appellant's argument.

22. Hence, the subject-matter of claim 1 of the main request also lacks inventive step over a known general-purpose computer in a known system (Article 56 EPC).

First and second auxiliary requests - Lack of inventive step over document D1

23. Claim 1 of the first and second auxiliary requests differs from claim 1 of the main request by adding the steps of:

(F1) storing information related to the test rod pattern design, limits, simulated results and data from the comparison

(F2) modifying the test pattern design to create a derivative rod pattern design

(F3) repeating the simulating, comparing and providing steps to develop data indicating limits that were violated by the derivative rod pattern design during the simulation

(F4) selecting a type of nuclear reactor, with the reactor being selected from a group comprising a boiling water reactor, a pressurised water reactor, a gas-cooled reactor and a heavy water reactor

(F5) iteratively repeating the modifying, simulating, comparing and providing steps to develop N iterations of the derivative rod pattern design, and, for selected ones of the N iterations, storing information related to the rod pattern design, limits, simulated results and data from the comparison

(F6) where the iteratively repeating step is performed until the comparing in a particular iteration indicates that all limits have been satisfied or satisfied within an acceptable margin

(F7) outputting data related to an acceptable rod pattern design for the nuclear reactor

24. The board notes that, with regard to the analysis of point 17.3 above, claim 1 does not specify whether the "modifying the test pattern design to create a 'derivative' rod pattern design" (feature F2) is performed automatically by the computer or manually by a user.

25. Document D1 implicitly discloses feature F4 (see abstract: "2894-MW (thermal) Kuosheng nuclear power plant").

It also implicitly discloses feature F1 (Figure 4 shows an example of the control rod pattern generating process for "Kuosheng Unit 2 cycle 6", Figure 6 shows the control rod programming of "Kuosheng Unit 1 cycle 5" and Figure 7 shows the control rod programming of "Kuosheng Unit 2 cycle 6").

Document D1 further discloses feature F2 of modifying the test pattern design to create a derivative rod pattern design (Figure 3, "Modify Control Rod Pattern").

It also discloses iteratively repeating the simulating and comparing (Figure 3, "Three-Dimensional Core Simulation", "Satisfy Eigenvalue and Thermal Limits?" and "Modify Control Rod Pattern" loop) (feature F3 and part of feature F5) and feature F6 (page 5, paragraph bridging the left-hand side to the right-hand side).

26. The distinguishing features of claim 1 of the first and second auxiliary requests having regard to document D1 are thus:

(DF3) for selected ones of the N iterations, storing information related to the rod pattern design, limits, simulated results and data from the comparison (remaining part of feature F5)
(DF4) outputting data related to an acceptable rod pattern design for the nuclear reactor (feature F7)

27. When designing a rod pattern, it is obvious for the skilled person to study the effects of the modification and simulation steps and store "information related to the rod pattern design, limits, simulated results and data from the comparison".

Therefore, feature DF3 is obvious.

28. The board notes that, in comparison with case T 625/11 referred to by the appellant, a rod pattern design in a particular iteration for which all limits have been satisfied, or satisfied within an acceptable margin, might be considered "intimately linked to" the operation of a nuclear reactor (see point 19. above). But claim 1 of the first and second auxiliary requests does not define as output the positions and insertion depths of the rods for such a rod pattern design. Nor does it define the relationship between the output data and the "acceptable rod pattern design".

29. The appellant has argued that the method of claim 1 of the first and second auxiliary requests solved the technical problem of "how to provide an optimisation routine that iterates the steps over a number of different rod pattern designs, constantly improving on violated limits in order to achieve an optimal rod pattern design to be (implicitly) used in a nuclear reactor core". The iterative process might be done in an extremely short period of time, i.e. compared to a

number of weeks using the current state of the art manual iterative process of changing one parameter at a time, followed by a reactor core simulation.

29.1 The board notes that claim 1 defines neither the relationship between the output data and an "acceptable" rod pattern design nor what is considered an "acceptable" rod pattern design. It merely states that data "related to" an acceptable rod pattern design for the nuclear reactor are output. Thus, DF4 does not provide any technical effect over the whole range claimed.

30. The subject-matter of claim 1 of the first and second auxiliary request is therefore not inventive having regard to the disclosure of document D1 (Article 56 EPC).

31. Since none of the requests is allowable, the appeal is to be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chair:

S. Lichtenvort J. Geschwind

Decision electronically authenticated