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D E C I S I O N
of 12 July 2005

Case Number: T 0914/02 - 3.4.1

Application Number: 97300544.0

Publication Number: 0786782

IPC: G21C 5/00

Language of the proceedings: EN

Title of invention:

Method for determining nuclear core loading arrangement

Applicant:

General Electric Company

Opponent:

-

Headword:

-

Relevant legal provisions:

EPC Art. 52(2), 52(3)

Keyword:

"Method of performing mental act excluded from patentability
yes (main request), no (first auxiliary request)"

Decisions cited:

T 0453/91, T 0931/95, T 1173/97, T 0641/00, T 0258/03

Headnote:

Having technical character is an implicit requirement of the EPC to be met by an invention within the meaning of Article 52(1) EPC. The involvement of technical considerations, however, is not sufficient for a method which may exclusively be carried out mentally to have technical character. Technical character may be provided through the technical implementation of the method, resulting in the method providing a tangible, technical effect, such as the provision of a physical entity as the resulting product or a non-abstract activity, such as through the use of technical means.



Case Number: T 0914/02 - 3.4.1

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 12 July 2005

Appellant: General Electric Company
Applicant:

Representative: Mr E. Tomlinson
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 30 January 2002
refusing European application No. 97300544.0
pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: B. Schachenmann
Members: R. Bekkering
M. Rognoni

Summary of Facts and Submissions

- I. European patent application 97 300 544.0 (publication No. EP-A-0 786 782) was refused pursuant to Article 97(1) EPC by a decision of the examining division dispatched on 30 January 2002, on the grounds of Article 123(2) EPC (main request) and Article 52(2) EPC (auxiliary request).
- II. The applicant (appellant) lodged an appeal against the decision on 21 March 2002 and paid the appeal fee on the same day. The statement of the grounds of appeal was received on 29 May 2002.
- III. Oral proceedings, requested as an auxiliary measure by the appellant, were held on 12 July 2005.
- IV. The appellant requested that the decision under appeal be set aside and a patent be granted on the basis of the following documents:

Main request:

Claims: No. 1 filed as main request in the oral proceedings on 12 July 2005;

Description: Pages 1 to 14 as originally filed;

Drawings: Sheet 1/1 as originally filed.

First auxiliary request:

Claim 1 filed as first auxiliary request in the oral proceedings on 12 July 2005;

Description and drawings as for the main request.

Second auxiliary request:

Claim 1 filed as second auxiliary request in the oral proceedings on 12 July 2005;

Description and drawings as for the main request.

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

*"1. A method for designing a core loading arrangement for loading nuclear reactor fuel bundles into a reactor core to optimize an amount of energy, termed the cycle energy, that the reactor core generates before the core needs to be refreshed, the core loading arrangement being required to satisfy predetermined design constraints concerning the interaction between fuel bundles, said method comprising the steps of:
assigning (102) to each bundle a relative reactivity value according to a reactivity of the bundle relative to the reactivity of the other bundles;
assigning (104) to each core location a core location relative reactivity value according to an acceptable reactivity level at that core location relative to the acceptable reactivity level at the other core locations;
assigning (106) values to each predetermined constraint;
creating (108) rules for each reactor core location to specify a direction in which to change the core location relative reactivity value a bundle [sic] to maximize the cycle energy or satisfy a predetermined constraint, or both;
initially simulating (112) a core loading wherein each bundle is loaded into the core location having a core*

location relative reactivity value equal to the bundle relative reactivity value of that bundle;
determining initial values for cycle energy and design constraints for the initial core loading arrangement;
and

identifying (200) an optimum core loading arrangement based on the initial core loading arrangement wherein identifying (200) the optimum core loading arrangement comprises the steps of:

(i) for a first core location,

(1) determining (202) whether the core loading arrangement satisfies the design constraints at the core location; and

(2) if at least one design constraint is not satisfied at the core location, then searching the rules to determine a direction in which the relative reactivity value of the core location should be changed in order to satisfy the constraint (204);

(3) searching the rules to determine a direction in which the core location relative reactivity value should be changed in order to improve cycle energy (206) if all the design constraints are satisfied at the core location;

(4) randomly selecting a core location relative reactivity value change for the core location if there is no rule for changing the core location relative reactivity value;

(5) determining the constraint values and cycle energy for the core loading arrangement which results from changing the relative reactivity value of the core location according to the direction determined by the rule or rules or the randomly selected change and re-arranging the fuel bundles such that the bundle

relative reactivity value matches the core location relative reactivity value, and
(ii) repeating steps (1)-(5) above for each core location, thereby using the changed core loading arrangement if the change results in an improved core loading arrangement".

VI. Claim 1 according to the first auxiliary request reads:
"A method **using a suitably programmed computer** for designing a core loading arrangement..." (emphasis added by the board) and further corresponds to claim 1 of the main request.

VII. Claim 1 according to the second auxiliary request corresponds to claim 1 of the first auxiliary request with a further step added to the method.

Reasons for the Decision

1. The appeal complies with the requirements of Articles 106 to 108 and Rule 64 EPC and is, therefore, admissible.

2. *Main request*

2.1 Amendments

Claim 1 is based on originally filed claims 1 to 6, as well as the original description, in particular page 10, line 15 to page 12, line 19, whereby the claimed method has been restricted to the so called "depth mode".

The board is thus satisfied that the amendments to the claim comply with the requirements of Article 123(2) EPC.

2.2 Articles 83 and 84 EPC

The claim, and the description as well for that matter, refer to rules for each reactor core location of a nuclear reactor specifying a direction in which to change the core location relative reactivity value in order to maximize the cycle energy or satisfy a predetermined constraint, without, however, concretely specifying these rules. Similarly, reference is made to design constraints, without specification of the exact parameters considered, besides the reactor shutdown margin mentioned in the description (see page 9, second paragraph). The board is, however, satisfied that the skilled person, working in the technical field of nuclear reactor core reload designing at issue, using his general knowledge in this field would be able to conceive the necessary rules for changing the reactivity at each location so as to optimize the cycle energy as well as meet all relevant regulatory and customer specific reactor design constraints. In the board's view, requiring a full specification of the relevant rules and design constraints under these circumstances would place an undue burden on an applicant, all the more in view of the fact that these rules and constraints vary depending on reactor type, local operating conditions and applicable local regulations. Furthermore, it would appear that, in general, publications in the technical field at issue refer to such rules and constraints without much further details.

Accordingly, the board is satisfied that the requirements of Articles 83 and 84 EPC are met in this respect.

2.3 Articles 52(2) and (3) EPC.

2.3.1 The claimed method aims at identifying optimum fuel bundle loading arrangements in a nuclear reactor core. It consists in a series of steps which may be purely abstract, as at no stage the use of any technical means is implied. The whole method may be performed mentally, based on the appropriate, available data pertaining to the geometry of the core, the number of fuel bundles, the respective reactivities of the bundles, the reactor design rules etc.. Moreover, as a result, the claimed method provides a design of a core loading arrangement which may be a purely mental, abstract scheme of how bundles could be arranged in an actual, real-world nuclear reactor core, rather than a concrete, physical reactor core loading.

2.3.2 In the appellant's view, however, the claimed method has technical character and, therefore, does not constitute a method for performing a mental act as such, excluded from patentability according to Articles 52(2) and (3) EPC. The appellant sees this technical character being given in that the claimed method addresses a technical problem in the field of nuclear reactors, involves technical considerations, lies in the field of technology in general and leads to a solution providing a technical contribution.

2.3.3 As generally accepted in the case law of the boards of appeal, having technical character is an implicit requirement of the EPC to be met by an invention within the meaning of Article 52(1) EPC (see eg T 931/95 (OJ 2001, 441) (see headnote 1)). Undoubtedly, in the present case, the claimed method is based on technical considerations to the extent that it concerns the designing of a technical object, ie an optimized loading of the core of a nuclear reactor, lies in the field of technology in general and involves scientific considerations in respect of the reactivity of the fuel bundles and its impact on cycle energy and constraints such as the shutdown margin.

In the board's opinion, however, the involvement of technical considerations is not sufficient for a method which may exclusively be carried out mentally to have technical character. In fact, other non-inventions listed in Article 52(2) EPC, such as scientific theories, but also computer programs, typically involve technical considerations.

In the present case, rather, technical character would be provided through the technical implementation of the method, resulting in the method providing a tangible, technical effect, such as the provision of a physical entity, eg a reactor core loaded according to a given design, or a non-abstract activity, such as through the use of technical means. The claimed method, however, lacks such a technical implementation.

2.3.4 The appellant seeks to derive from an alleged sheer complexity of the proposed solution an implied use of technical means, in particular a computer. The alleged

mentally irresolvable complexity, due to the large number of fuel bundle locations in a reactor core and relevant rules, however, is not given in present case, as the method is equally applicable to a limited number of core locations and rules. Furthermore, it is doubtful as a matter of principle whether complexity can be used to disqualify an activity as a mental activity. Rather, generally it would appear that if computer means indeed are indispensable, they should be included in the claim as an essential feature of the invention.

The appellant has also argued that the step of assigning a relative reactivity value required the assessment of the reactivity of a particular bundle, which was of technical character. It is, however, noted that the claimed method does not comprise the actual measurement of the reactivity, but merely provides for an assignment of relative reactivity values based on already available reactivity data.

- 2.3.5 In general, the above finding is consistent with case T 453/91 (see point 5 of the reasons) referred to by the appellant, in which it was held that a method for designing a semiconductor chip merely resulting in a design in form of an image of something which does not exist in the real world and which may or may not become a real object, ie the result of the method not necessarily becoming a physical entity, would be considered an abstract, non-technical method excluded from patentability.

The above finding is also consistent with more recent case law (see T 258/03 (OJ 2004, 575), point 4 of the

reasons) according to which a method (always) has technical character when it involves the use of technical means.

- 2.3.6 The appellant has also made reference to decision T 1173/97 (OJ 1999, 609), in which a distinction was made between programs for computers as such, excluded from patentability in accordance with Articles 52(2)(c) and 52(3) EPC, and programs for computers having technical character. By analogy, it was argued that a distinction should be made in the present case between methods of performing a mental act "as such" and methods of performing a mental act having technical character, the claimed method pertaining to the latter.

In the board's view it may be questioned, whether the distinction made in the decision referred to above for programs for computers can be sensibly extended to the other entities and activities listed in Article 52(2) EPC, or whether rather the particular character of programs for computers should be acknowledged in this respect. In any case, the present findings are not in contrast with the above cited decision. The distinction between methods of performing a mental act "as such" and methods of performing a mental act having technical character may be drawn where the method provides a tangible technical effect, such as the provision of a physical entity as the resulting product or a non-abstract activity, such as through the use of technical means.

- 2.3.7 Finally, merely for the sake of completeness, it may be noted that the above findings are consistent with the Guidelines for Examination in the EPO (cf C-IV, 2.3.3)

according to which eg a mathematical method for designing electrical filters would not be regarded as an invention under Article 52(2) and (3) EPC.

- 2.3.8 For the aforementioned reasons, the method of claim 1 represents a method of performing a mental act as such, excluded from patentability in accordance with Articles 52(2)(c) and 52(3) EPC.

Accordingly, the main request is not allowable.

3. *First auxiliary request*

Claim 1 as amended according to the first auxiliary request contains the feature "using a suitably programmed computer" and thus contains a definition of technical means to be used in the method. Accordingly, the claimed method no longer relates to a mental act as such but rather provides a technical implementation thereof and is, therefore, not excluded from patentability within the meaning of Articles 52(2)(c) and (3) EPC.

In this respect, it should be borne in mind, following the above cited decision T 258/03 (see reasons 5, confirming T 641/00 (OJ 2003, 352)), that where a claim contains both features pertaining to the realm of non-inventions listed in Article 52(2) EPC as well as further features, such as features pertaining to the use of technical means, for the purposes of the assessment of inventive step only those features of the claim can be disregarded which do not contribute to a technical character of the claimed subject-matter.

4. On request of the appellant, and in view of the fact that in particular the issues of novelty and inventive step have not been dealt with by the first instance so far, the board makes use of the powers conferred on it by Article 111(1) EPC to remit the case to the first instance for further prosecution.
5. In view of the above there is no reason to decide on the second auxiliary request.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The main request is rejected.
3. The case is remitted remit to the first instance for further prosecution on the basis of the first auxiliary request filed in the oral proceedings.

The Registrar:

The Chairman:

R. Schumacher

B. Schachenmann