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Datasheet for the decision of 15 November 2023

Case Number: T 1914/19 - 3.5.06

Application Number: 12783238.4

Publication Number: 2776918

IPC: G06F7/58, H03K3/84

Language of the proceedings: EN

Title of invention:
METHOD OF AND DEVICE FOR GENERATING TRUE RANDOM NUMBERS AND A GAMING SYSTEM

Applicant:
Novomatic AG

Headword:
Quantum dots/NOVOMATIC

Relevant legal provisions:
EPC Art. 84, 56
RPBA Art. 12(4)

Keyword:
Claims - clarity (no)
Inventive step - (no)
Discretion not to admit submission - submission admitted (no)

Decisions cited:

Catchword:

Europäisches Patentamt
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Beschwerdekammern

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Case Number: T 1914/19 - 3.5.06

D E C I S I O N
of Technical Board of Appeal 3.5.06
of 15 November 2023

Appellant: (Applicant)	Novomatic AG Wiener Strasse 158 2352 Gumpoldskirchen (AT)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 28 January 2019 refusing European patent application No. 12783238.4 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	M. Müller
Members:	G. Zucka
	K. Kerber-Zubrzycka

Summary of Facts and Submissions

I. The appeal is against the decision by the examining division, dispatched with reasons on 28 January 2019, to refuse European patent application 12783238.4, on the basis that the subject-matter of none of the claims was inventive, Article 56 EPC. The following documents cited during the first instance proceedings are referred to in the present decision:

D1: US 2007/127718 A1;
D2: GB 2 352 087 A;
D4: US 7 492 901 B2;
D5: US 2006/115086 A1.

II. A notice of appeal was received on 28 March 2019, the appeal fee being paid on the same day. A statement of grounds of appeal was received on 28 May 2019.

III. The board issued a summons to oral proceedings. In an annex to the summons, the board set out its preliminary opinion according to which the appealed decision should be maintained.

IV. On 19 October 2023, the appellant submitted additional reasons and withdrew its request for oral proceedings. The oral proceedings were subsequently cancelled.

V. The appellant requests

- as a main request, that the decision of the examining division to refuse the application be set aside and a patent be granted on the basis of claims 1 to 12 received on 30 October 2017;

- alternatively, that a patent be granted on the basis of an "amended main request...as described at the end of the comments on the main request", viz. on page 7 of the statement of grounds of appeal, in which the term "pulse series" is removed;

as a "1st auxiliary request", that a patent be granted on the basis of the claims received on 18 December 2018, i.e. the claims which were the object of the refusal.

VI. Independent claim 1 of the main request reads as follows:

"A device (400) for generating true random numbers (460) by way of a quantum optic process, the device comprising:

a light source (405), at least two detectors (410, 415) and control means (420), characterized in that the light source (405) is capable of generating a single-photon (450) pulse series within a light beam;

the least two detectors (410, 415) each are capable of detecting single-photons (450) within the light beam thereby providing detector signals; and

wherein the detectors (410, 415) for detecting single-photons each comprises at least one quantum dot (430,435); and

wherein the detectors (410, 415) are positioned at substantially equivalent but spatial different position of detection probability of single-photons in the light beam; and wherein the control means (420) are provided and adapted to control the generation of the single-photon pulse series and to register the detector signals for generating the true random numbers (460), wherein the light source (405) for generating the

single-photon pulse series is based on a quantum dot structure."

VII. The difference between claim 1 of the auxiliary request and that of the main request is that the wording "single-photon (450) pulse series" is replaced by "series of single-photons (450)", and the wording "substantially equivalent but spatial different position of detection probability" is replaced by "substantially equivalent but different spatial positions with identical detection probability".

VIII. Claim 8 of the main and auxiliary request concerns a method having method features corresponding to the device features of claim 1 of the respective request.

IX. No claim set was filed for what the statement of grounds of appeal refers to as the "amended main request". According to that statement (top of page 7) it consists in a request to delete the expression "pulse series" from the "main claims".

X. The further text on file is:

description pages
1, 3 to 10 and 12 to 23 as published,
11 received on 16 January 2015,
2 and 2a received on 30 October 2017;

drawing sheets
1 to 4 as published.

Reasons for the Decision

1. *The invention*

The application relates to the generation of random numbers by way of a quantum optic process (page 1, lines 7 to 9).

In order to avoid typical problems created by the use of detectors based on Geiger mode avalanche photo detectors (see page 3, lines 5 to 23), the application instead uses quantum dot detectors (page 2, lines 22 to 30).

2. *Admittance of the main request and the "amended main request" into the appeal proceedings (Article 12(4) RPBA 2007)*

2.1 The appellant's main request is identical to the request received on 30 October 2017 during the first instance proceedings. This request was replaced by a new request in the applicant's response, received on 18 December 2018, to the summons to oral proceedings before that instance.

The present main request was not maintained during the first instance proceedings.

2.2 The reason indicated by the applicant for replacing said former request by the request received on 18 December 2018 was to deal with objections under Articles 123(2) and 84 EPC raised in the summons. The applicant did not provide any arguments to refute those objections.

It is the board's opinion that the applicant should have maintained and argued the allowability of this former request before the examining division. Instead, by not maintaining the request, the applicant prevented the examining division from taking a decision on that request. This means that the board of appeal would be the first instance which would need to take a decision with regard to the objections formulated by the examining division regarding said request.

2.3 The board can see no valid reason why the present main request should be admitted into the appeal proceedings, Ie.g. because it would aim to solve some other objection raised in the appealed decision.

2.4 The board therefore exercises its discretion not to admit the main request into the appeal proceedings (Article 12(4) RPBA 2007).

2.5 The "amended main request" consists in a request to delete the expression "pulse series" from the "main claims" (see statement of grounds of appeal, top of page 7).

The board considers that also such request should have been introduced and argued during the first instance proceedings, and that *a priori* it does not constitute an attempt to remedy any previously raised objection.

The board therefore exercises its discretion also not to admit the "amended main request" into the appeal proceedings (Article 12(4) RPBA 2007).

3. *Auxiliary request 1: clarity; Article 84 EPC*

3.1 The expression "substantially equivalent" in claim 1 of auxiliary request 1 is unclear (Article 84 EPC).

3.2 The appellant states the following in its response to the summons (first page, last paragraph):

"An analysis of the claim language yields that the expression “substantially equivalent” refers to the spatial position of each of the at least two detectors relative to the light source. The at least two detectors are positioned at different spatial positions wherein the spatial positions of the at least two detectors are selected such that the at least two detectors have identical detection probability. In the embodiment shown in FIG. 4 of the application, the spatial positions of the at least two detectors are substantially equivalent because the distances between each of the at least two detectors and the light source are substantially equivalent. However, there are spatial positions that are not substantially equivalent but have identical detection probability due to the spatial distribution of the detection probability."

3.3 According to this reasoning, the spatial positions of the at least two detectors could be "substantially equivalent" for instance because the distances between each of the at least two detectors and the light source are "substantially equivalent", which presumably was intended to mean in this reasoning that those distances are substantially the same. The reasoning however leaves out which other conditions could lead to the spatial positions of the two detectors being considered "substantially equivalent". The last sentence in the paragraph in question only says that identical

detection probability does not (necessarily) mean that the spatial positions are substantially equivalent.

Said reasoning therefore does not even explain the *intended* meaning of "substantially equivalent".

4. *Auxiliary request 1: inventive step; Article 56 EPC*

4.1 Document D1 represents a suitable prior art document on which to base an inventive step analysis. The document discloses a device for generating true random numbers (as opposed to so-called "pseudo-random numbers") by way of a quantum optic process (par. [0029]: "apparatus 12 for generating true random numbers 30 by way of a quantum optics process"), the device comprising:

a light source ("light source 14"), at least two detectors ("single-photon detectors 22 and 22'") and control means ("electronic circuitry 38"). In addition:

the light source is capable of generating single-photons within a light beam ("beam 16");
the at least two detectors ("single-photon detectors 22 and 22'") each are capable of detecting single-photons within the light beam, thereby providing detector signals ("detected values 26"); and
the detectors are positioned at substantially equivalent but different spatial positions with identical detection probability of single-photons in the beam (see par. [0036] and Figure 3); and
the control means are provided and adapted to control the generation of the single-photons (see e.g. par. [0035]: "In an optional seventh step 114, the sequences so generated are processed to remove a possible bias, to produce numbers in a different

dimension, or to tailor the probability distribution") and to register the detector signals (par. [0029]: the "electronic circuitry 38" comprises a buffer) for generating the true random numbers.

4.2 The subject-matter of claim 1 therefore differs from the disclosure of D1 in that

(a) each detector comprises at least one quantum dot; and

(b) the light source is capable of generating a series of single-photons based on a quantum dot structure.

This finding was not contested by the appellant.

4.3 The board agrees with the appealed decision (point 2.3, lst paragraph) that features (a) and (b) produce no synergetic effect.

According to the statement of grounds of appeal (middle of page 4), the advantage of both features is that a truly quantum state based random number generator is provided which is more reliable and works without substantial correction mechanisms. No reason is however given why such effect would follow from the combination of features (a) and (b).

In fact, when reading the application's description (page 3, lines 5 to 23) only feature (a) affects the reliability of the random number generator, in that it avoids certain problems of Geiger mode avalanche photo detectors. The description does not explain why feature (b) would contribute to increasing the reliability of the random number generator.

The response to the summons (second half of the second page) states that a light source based on a quantum dot structure assures the generation of a single photon within a certain time span and that this ensures that only one of the detectors is hit by a single photon at a time, which is essential for generating random numbers without the need for substantial correction mechanisms.

Also here, however, no explanation is given for this statement, especially why it would apply within the context of D1, where the effectiveness of the disclosed device would apparently not be affected if more than one detector is hit by a photon at a given moment.

Features (a) and (b) should therefore be seen as juxtaposed features that have to be considered separately for the assessment of inventive step.

4.4 Feature (a) solves the problem of achieving a faster and more reliable random number generator.

4.5 The board considers that the skilled person will naturally want to solve this problem.

In order for a true random number generator based on a quantum optic process to be fast and reliable, the detection of the photons on which the generation of the random numbers is based should obviously function properly and fast.

4.6 The skilled person who consults the literature on this subject will see that D2 deals with the disadvantages of single-photon detectors based on single photon avalanche photodiodes, in particular relatively low

gain and high dark count rates, especially at higher repetition rates (see D2, page 2, second paragraph).

To this end, D2 provides a detector comprising at least one quantum dot (see paragraph spanning pages 2 and 3).

The skilled person would have a strong incentive to implement the teaching of D2, as it provides a solution to the problem mentioned above. He or she would then replace the single-photon photodetector of D1 by a detector comprising at least one quantum dot, i.e. feature (a).

4.7 According to the appellant (statement of grounds of appeal, page 5, first paragraph), D2 does not disclose a device for generating true random numbers by way of a quantum optic process.

The board however considers that this is irrelevant for the skilled person, as he or she will not be looking for the disclosure of a complete random number generator but only for the component that needs to be improved, i.e. the single-photon photodetector. D2 discloses such a photodetector, including features which solve the problem that the skilled person has set out to solve.

4.8 The appellant argues that feature (b) is not disclosed by D1, which the board acknowledges.

The appellant further argues (statement of grounds of appeal, page 4, last paragraph and page 7, first paragraph) that D1 teaches away from producing single-photon states, give that this document states (in par. [0012]) that "In practice, producing single-photon states is difficult and impractical. Attenuated light

pulses produced for example by a laser were used instead."

The board observes in this regard that this comment in D1 relates to a particular prior art document cited in D1. Another document cited in D1 (in par. [0014]) does mention the use of a stream of single photons. In general, D1 does not teach that the production of single-photon states should not be attempted.

For the rest, D1 does not limit itself to a particular kind of light source; see par. [0031], where it is written that the light source can for example be an LED or laser diode. The operation of the device of D1 does not depend on the kind of light source which is used, provided its intensity is set such that the detection rate of the detector array is far from saturation (see par. [0041]).

4.9 Given that, with the above proviso, the choice of light source will not have a technical effect as far as the operation of the device disclosed by D1 is concerned, the skilled person would make a choice from available alternatives depending on circumstances. He or she could for instance choose to use a light source based on a quantum dot structure, which was known at the priority date of the present application (see for instance D4 or D5), to produce a series of single-photon pulses.

4.10 The skilled person would thereby arrive at the subject-matter of claim 1 of auxiliary request 1, which is consequently considered not inventive (Article 56 EPC).

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

L. Stridde Martin Müller

Decision electronically authenticated