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**Datasheet for the decision
of 12 May 2016**

Case Number: T 1253/11 - 3.4.03

Application Number: 00976836.7

Publication Number: 1232515

IPC: H01J33/00

Language of the proceedings: EN

Title of invention:
PARTICLE BEAM PROCESSING APPARATUS

Applicant:
Energy Sciences Inc.

Headword:

Relevant legal provisions:

EPC Art. 123(2)
EPC 1973 Art. 84, 113(1), 116(1) sentence 1
EPC 1973 R. 71(2)
RPBA Art. 15(1), 15(3), 15(6)

Keyword:

Amendments - added subject-matter (yes)
Claims - unclear characterization by parameters
Right to be heard - non-attendance at oral proceedings

Decisions cited:

T 0002/80, T 1129/97, T 1156/01, T 0412/02

Catchword:



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Case Number: T 1253/11 - 3.4.03

D E C I S I O N
of Technical Board of Appeal 3.4.03
of 12 May 2016

Appellant: Energy Sciences Inc.
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Wilmington,
Massachusetts 01887 (US)

Representative: Beresford, Keith Denis Lewis
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Decision under appeal: **Decision of the Examining Division of the
European Patent Office posted on 28 December
2010 refusing European patent application No.
00976836.7 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman G. Eliasson
Members: T. M. Häusser
T. Bokor

Summary of Facts and Submissions

- I. The appeal concerns the decision of the examining division refusing the European patent application No. 00976836 for lack of clarity.
- II. Oral proceedings took place before the board in the absence of the appellant, of which the board had been informed beforehand.
- III. The appellant had requested in writing that the decision under appeal be set aside and that a patent be granted on the basis of claims 1-18 of the main request, or alternatively on the basis of claims 1-15 of the auxiliary request, both requests being accompanied with a respective adapted description, all filed with letter dated 12 April 2016.
- IV. The wording of independent claim 1 of the requests is as follows (board's labelling "(i)"):

Main request:

"1. An electron beam processing device (100) for causing a chemical reaction on a target substrate (10), comprising:

an electron generating assembly (110), located in a vacuum chamber (114), the electron generating assembly including at least one filament (112) for generating a plurality of electrons upon heating for forming an electron beam, and an extractor grid (116) to control the quantity of the plurality of electrons being drawn from the at least one filament;

a power supply (102), connected to the electron generating assembly (110), for supplying an operating voltage in a range of 110 kVolts or less to said

filament, and for supplying a grid voltage to the extractor grid (116);

a process control system (200) configured to control maintenance of a vacuum within the vacuum chamber (114), to calculate dose and depth of electron penetration into the target substrate, to initiate operation with predetermined operating and grid voltages and filament power, and to synchronise electron generation with process speed;

a grounded foil support assembly (140) comprising a thin foil (142) made of titanium or alloys thereof having a thickness of 10 micrometers or less; and

a processing assembly (170) for conveying the target substrate (10) for receiving said electrons exiting the foil support assembly to cause said chemical reaction thereon;

wherein:-

(i) said process control system (200) is calibrated in dependence on a predetermined value of machine yield "K" of the processing device, wherein the machine yield K is a proportionality constant of the electron beam processing device (100) regulating the quantity of electrons generated by the electron beam processing device (100) so the electron beam output is proportional to the speed in accordance with the following relationship:

$$K = \frac{\text{Dose} \cdot \text{Speed}}{\text{Current}},$$

wherein

K, the machine yield, is expressed in Mrads · feet/min/mAmp (≡ 50 J.m/kg.s.mA),
Dose is energy absorbed per unit mass expressed in Mrads (1 Mrad ≡ 10⁴ J/kg),
Speed is feed rate of the substrate expressed in

feet/min (1 ft/min \equiv 0.5 cm/s),

and

Current is the number of electrons per second extracted from the filament expressed in mAmp;

and

the predetermined value of the machine yield K, measurable using thin film nylon dosimetry, is above $30/L$ where L is the electron beam width measured in feet (1 ft \equiv 0.30 m)."

Auxiliary request:

The set of claims of the auxiliary request differs from the set of claims according to the main request merely in that some claims are deleted. In particular, claim 1 of the auxiliary request is identical with claim 1 of the main request.

V. The appellant argued - as far as it is relevant for the present decision - in relation to the basis of the amendments and clarity of the claims as follows:

(a) Amendments

The amendment of claim 1 clarified that the machine yield was a proportionality constant regulating the quantity of electrons generated so that the electron beam output was proportional to speed. Explicit support in the description could be found at page 9, 2nd paragraph, and page 11, 1st paragraph. Furthermore, page 10, 3rd full paragraph, was mentioned as a basis for the amendments.

(b) Clarity of the claims

There was no suggestion in the specification that the fixed constant K would depend on the kind of substrate treated or on the thickness of the substrate. It was only determined using thin film nylon dosimetry to measure dose applied to a particular processing device. The value of K would be measured for every beam processing unit and was dependent on the electron beam width and the operating voltage; it could be used to compute the amount of beam current required to deliver a given dose at a given line speed. For example, if the speed rate increased or decreased, the K-value was used to adjust the beam current so that the required radiation dose was maintained despite the changes in speed.

Reasons for the Decision

1. Procedural matters
 - 1.1 With letter dated 9 May 2016, three days before the date arranged for oral proceedings before the board, the appellant stated that it would not be attending the hearing. Since the board considered oral proceedings to be expedient in the present case (Article 116(1) EPC 1973, first sentence), they were continued without the appellant in accordance with Rule 71(2) EPC 1973.
 - 1.2 According to Article 15(3) and (6) RPBA, the board shall "not be obliged to delay any step in the proceedings, including its decision, by reason only of the absence at the oral proceedings of any party duly summoned who may then be treated as relying only on its written case" and "ensure that each case is ready for decision at the conclusion of the oral proceedings, unless there are special reasons to the contrary."

Furthermore, the purpose of oral proceedings is to give the party the opportunity to present its case not only in writing but also orally and to be heard on potentially contentious issues. However, a party gives up that opportunity if it does not attend the oral proceedings. This view is supported by the explanatory note to Article 15(3) RPBA (former Article 11(3) RPBA) which reads: "This provision does not contradict the principle of the right to be heard pursuant to Article 113(1) EPC since that Article only affords the opportunity to be heard and, by absenting itself from the oral proceedings, a party gives up that opportunity" (see CA/133/02 dated 12 November 2002).

- 1.3 In the present case, the main request and the auxiliary request were filed with the letter dated 12 April 2016, i. e. after that the oral proceedings before the board had been arranged, and were found to be not allowable because of added subject-matter and lack of clarity for the reasons set out below.

The appellant had to expect a discussion on these issues during the oral proceedings. The compliance of the amendments with the requirement that no subject-matter extending beyond the application as filed has been added must be examined as a matter of course. Furthermore, it had been pointed out in the board's communication pursuant to Article 15(1) RPBA annexed to the summons to oral proceedings that the board had doubts concerning the requirements of clarity of the claims, in particular in relation to the parameter K referred to in the claims. By not attending the oral proceedings the appellant gave up the opportunity to present its case on these issues and could thus be treated as relying only on its written submissions.

The board's decision was therefore in conformity with the requirement of Article 113(1) EPC 1973 that the EPO's decisions may only be based on grounds or evidence on which the parties concerned have had an opportunity to present their comments.

Accordingly, the case was ready for decision at the conclusion of the oral proceedings in accordance with Article 15(6) RPBA.

2. Main request

2.1 Amendments

2.1.1 In claim 1 of the main request it is specified (see feature (i)) that the process control system is calibrated in dependence on a predetermined value of machine yield K of the processing device, wherein K is a proportionality constant of the electron beam processing device regulating the quantity of electrons generated by the electron beam processing device so the electron beam output is proportional to the speed in accordance with the relationship $K = (\text{Dose} \cdot \text{Speed}) / \text{Current}$.

2.1.2 The appellant argued that a basis for the amendments could be found at page 9, 2nd paragraph, page 10, 3rd full paragraph, and page 11, 1st paragraph, of the description.

2.1.3 In the passages cited by the appellant it is specified that the particle beam processing device includes a processor to regulate the quantity of electrons generated so that the electron beam output is proportional to the feeding speed of the substrate. In particular, a

process control system 200 is provided to synchronize electron generation with process speed to maintain constant treatment level.

It is thus disclosed in the application as filed that it is the *process control system 200* which regulates the quantity of electrons generated in such a way that the electron beam output is proportional to the feeding speed, rather than the *machine yield K* as defined in claim 1 of the main request. This is plausible as the process control system 200 controls the filament power and the relevant voltages thereby controlling the electron beam output (see page 6, last paragraph - page 7, paragraph 5; page 9, paragraph 2).

Therefore, the subject-matter of claim 1 of the main request extends beyond the application as filed, contrary to the requirements of Article 123(2) EPC.

2.2 Clarity of the claims

2.2.1 In claim 1 of the main request it is specified that the process control system of the claimed electron beam processing device is calibrated in dependence on a predetermined value of machine yield K , which is a proportionality constant satisfying the relationship $K = (\text{Dose} \cdot \text{Speed}) / \text{Current}$.

It is further specified that the predetermined value of the machine yield K is above $30/L$, where L is the width of the electron beam.

It is thus attempted in the claim to define the claimed electron beam processing device by means of the parameter K . It has to be examined whether this definition

meets the requirement under the EPC as to claim clarity.

- 2.2.2 Article 84 EPC 1973 stipulates that the claims define the matter for which protection is sought and that they must, *inter alia*, be clear.

It is established jurisprudence that the claims must be *clear in themselves* when read by the person skilled in the art, without the need to resort to information derived from the description of the patent application (see T 2/80, point 2; T 1129/97, point 2.1.2).

In particular, in case the invention is defined by a parameter, the method for measuring the parameter and the conditions of measurement having an influence on the value of the parameter must be indicated in the claim, either expressly or - if appropriate - by way of reference to the description in accordance to Rule 29(6) EPC 1973. Such indication would only be superfluous if the skilled person knew from the outset which method and conditions to employ (see T 412/02, points 5.8 and 5.9; T 1156/01, point 2.3).

- 2.2.3 In the present case it is specified in claim 1 of the main request that the machine yield K is "measurable using thin film nylon dosimetry".

From the description of the application it emerges (see page 12, second paragraph) that the dosimeters used in Example 2 relating to the measurement of the machine yield K involve nylon films containing radio-chromic dye that changes colour from colourless to blue when the dye is exposed to electromagnetic radiation. By measuring the intensity or optical density of the blue colour using a densitometer, one can convert the

measured optical density to absorbed dose. The reference to "nylon" in the claim specifies thus merely the matrix material in which the dye is incorporated, while "dosimetry" only indicates that absorbed dose is to be determined. The method of measuring the ionizing radiation using radio-chromic dye is however not specified in claim 1.

Due to the complex interaction between the ionizing radiation and the detection material (e. g. the nylon film containing radio-chromic dye) and the differences of the ionizing radiation used during the calibration of the detection material on the one hand and during the determination of the machine yield K on the other hand (e. g. regarding energy and energy density of the radiation), the precise method of detecting the ionizing radiation is however considered an important factor affecting the dose actually inferred during the determination of K and therefore has an influence on the value of the machine yield K.

In the description of the application it is further mentioned (*ibid.*) that the Co⁶⁰ Gamma facility at the National Institute of Standards and Technology in Gaithersburg, Maryland, is used for calibrating the densitometers thus providing the conversion from optical density to dose in Mrads. In claim 1 of the main request there is however no indication regarding the radiation source used for calibrating the claimed thin films. For the reasons mentioned above, the precise radiation source used for calibrating the detection material is also considered an important factor having an influence on the value of the machine yield K.

It remains to be considered whether the skilled person knew from the outset which method of detecting the ionizing radiation during calibration and the determination of the machine yield K and which calibration source should be employed during calibration. This is not considered to be the case as there are well-known alternatives to the thin film dosimeters containing radio-chromic dye and to the Co⁶⁰ irradiation source, for example film badge dosimeters involving black and white photographic film and accelerators generating electron beams, respectively.

- 2.2.4 Moreover, it is specified in claim 1 of the main request that the "Dose", which appears in the relationship defining the machine yield K (see point 2.2.1 above), "is energy absorbed per unit mass expressed in Mrads (1 Mrad \equiv 10^4 J/kg)".

It is however not mentioned in claim 1 of the main request in what substance the energy is to be absorbed.

The appellant argued that there was no suggestion in the specification that the fixed constant K would depend on the kind of substrate treated. It is however well-known to the skilled person that, when the densitometers are calibrated, the absorbed dose is measured in a reference material measurable for instance by an adiabatic calorimeter. Since the absorbed dose depends on the reference material and the machine yield K is proportional to the absorbed dose, it is crucial to know in what reference material the absorbed dose is measured in order to be able to reliably determine the machine yield K.

Water is often used as a reference material when calibrating densitometers, because it is typically the

human body whose exposure to radiation dose is to be monitored by means of the densitometers and the human body consists largely of water and has an overall density close to that of water. The present application is however not concerned with monitoring the human body but with exposing a substrate or coating to electron beams for causing a chemical reaction, e. g. a cross-linking, polymerization or sterilization reaction. Furthermore, other reference materials used for calibrating dosimeters, e. g. silicon or graphite, are well-known to the skilled person. Therefore, the skilled person would not know from the outset in which reference material the dose is to be measured.

- 2.2.5 There is no indication in claim 1 of the main request in relation to the thickness of the film used in the claimed "thin film nylon dosimetry" or in which way the films are to be used for the measurement of the machine yield K (e. g. single films or stacks of films).

The appellant argued that there was no suggestion in the specification that the fixed constant K would depend on the thickness of the substrate.

In experiment 2 described in the application as filed, which relates to determining the machine yield K, for each combination of values of the thickness of the titanium foil and operating voltage used in the processing device, the dose and thus the value of K is determined by calculating the average of the respective doses inferred from nine dosimeters used in parallel. Each dosimeter has a thickness "in the range of 9-10 micrometers" (description of the application, page 12, second paragraph; page 14, first paragraph).

However, one object of the present invention is to avoid the electron beam from penetrating too far into the sealant layer of a flexible food packaging foil so that undesirable odors and an increase in the seal initiation temperature can be avoided (*ibid.* page 15, penultimate paragraph). In order to show that this can be achieved by operating at a voltage of 110 kV or less, depth dose profiles are measured using stacks of dosimeters (*ibid.* page 13, first paragraph; page 15). Figure 6 of the application shows that the dose varies significantly across the stack for all operation voltages, albeit the depths at which the dose has a given percentage of the front surface varies for the different voltages. In such circumstances it would be appropriate to take the average dose as inferable from the respective dosimeter films in order to determine the applied dose and thus the machine yield K.

It is thus evident that the thickness of the dosimeter films and the manner in which the dosimeter films are used have an influence on the value of the machine yield K.

Moreover, dosimeters of relatively thick dosimeter films or stacks of thin films better represent the target substrates for which the claimed electron beam processing device is intended to be used. On the other hand, in the only example describing the determination of the machine yield K, relatively thin dosimeter films are used in parallel. It is thus not evident for the skilled person from the outset what thickness the dosimeters should have and how they should be used when determining the machine yield K, while the value of K is apparently significantly dependent on the value of the thickness and the measurement method.

2.2.6 In view of the above claim 1 of the main request is not clear, contrary to the requirements of Article 84 EPC 1973, in particular in relation to the definition of the electron beam processing device by means of the machine yield K.

3. Auxiliary request

Claim 1 of the auxiliary request is identical with claim 1 of the main request. Therefore, the objections concerning added subject-matter and lack of clarity in relation to claim 1 of the main request mentioned above under points 2.1 and 2.2, respectively, also apply to claim 1 of the auxiliary request.

4. Conclusion

Since claim 1 of the main request and claim 1 of the auxiliary request are not in conformity with the requirements of the EPC, a patent cannot be granted as requested by the appellant and the appeal has to be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



S. Sánchez Chiquero

G. Eliasson

Decision electronically authenticated