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Datasheet for the decision of 21 September 2021

Case Number: T 1198/18 - 3.4.03

Application Number: 03810514.4

Publication Number: 1559129

IPC: H01J49/48

Language of the proceedings: EN

Title of invention:
CHARGED PARTICLE SPECTROMETER AND DETECTOR THEREFOR

Applicant:
Kratos Analytical Limited

Headword:

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - (yes) - non-obvious combination of known features

Decisions cited:

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

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Case Number: T 1198/18 - 3.4.03

D E C I S I O N
of Technical Board of Appeal 3.4.03
of 21 September 2021

Appellant: (Applicant)	Kratos Analytical Limited Wharfside, Trafford Wharf Road Manchester M17 1GP (GB)
Representative:	Mewburn Ellis LLP Aurora Building Counterslip Bristol BS1 6BX (GB)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 13 December 2017 refusing European patent application No. 03810514.4 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	G. Eliasson
Members:	J. Thomas
	W. Van der Eijk

Summary of Facts and Submissions

I. The appeal is against the decision of the examining division refusing European patent application No. 03 810 514 on the grounds that the subject-matter defined in the main request and the first to third auxiliary requests did not fulfil the requirements of Article 52(1) EPC in combination with Article 56 EPC 1973. Additionally, the subject-matter defined in the first and second auxiliary requests did not comply with Article 84 EPC 1973.

II. In the statement setting out the grounds of appeal the appellant requested to set aside the decision under appeal and to remit the case to the examining division either for grant or for further prosecution on the basis of the main request or of one of the first to third auxiliary requests. In the event that the main request could not be granted oral proceedings were requested as an auxiliary measure.

III. In a communication according to Rule 100(2) EPC, the Board invited the appellant to submit a new main request in order to overcome an objection under Article 84 EPC 1973.

IV. With letter of 10 May 2021 the appellant submitted a new main request and an auxiliary request. The appellant requests that the decision under appeal be set aside and that a patent be granted on the basis of the main request or the auxiliary request, both filed with letter dated 10 May 2021.

V. Reference is made to the following documents:

D2: Sobottka, S. E. and Williams, M. B: "Delay line readout of microchannel plates", IEEE Transactions on Nuclear Science, vol. 35, no. 1, February 1988, pages 348-351;

D3: "High performance Imaging XPS - The Spherical Mirror Analyser", 1 January 1998, XP055353287, provided by the applicant;

D4: "Axis Ultra", 1 January 1999, XP055353306, provided by the applicant;

D5: Pollak, C. et al.: "Differential Image Distortion Correction", Microscopy and Microanalysis, vol. 7, no. 04, 1 July 2001, pages 335-340.

VI. Claim 1 of the main request reads as follows:

A photoelectron spectrometer which is operable in a first mode using a hemispherical analyser (16) to produce an energy spectrum relating to the composition of a sample (4) being analysed, and in a second mode using a spherical mirror analyser (22) to produce a photoelectron image of the surface of the sample (4) being analysed, wherein the spectrometer includes control means for controlling its operation and enabling a user to select which of the two modes is operating, characterised in that:

the spectrometer includes a detector (30, 32, 34) which is used to detect photoelectrons produced in both modes of operation;

the detector includes a plate means (40), on to which, in use, primary electrons are directed in both modes of operation, wherein the detector emits a plurality of secondary electrons for each primary electron received;

the detector includes a first delay line means (60, 76) for using the plurality of secondary electrons to produce a pair of electrical pulses in a first delay

line from which a signal processing means can calculate the location of the primary electron on the plate means in a first direction; and

the detector includes a second delay line means (78) for using the plurality of secondary electrons to produce a pair of electrical pulses in a second delay line from which the signal processing means can calculate the location of the primary electron on the plate means in a second direction;

wherein the plate means is a micro channel plate or includes a plurality of micro channel plates.

VII. The examining division was of the opinion that the subject-matter defined in claim 1 of the then main request differed by two features from the teaching of document D3 or D4. Each feature was found to solve a separate technical problem, so that no synergistic effect was acknowledged. These differentiating features were found to be obvious for the skilled person starting from the teaching of document D3 or D4 and combining it with the teaching of document D2.

Reasons for the Decision

1. The invention

The invention concerns a photoelectron spectrometer which combines two different measuring modes, a spectrum mode and an image mode. The proposed device integrates a single type of detector for both modes. It thereby increases the detector's surface and reduces the device complexity.

Main Request

2. Amendments

The amendments submitted with the letter dated 10 May 2021 concerned the addition of the features "*wherein the plate means is a micro channel plate or includes a plurality of micro channel plates*". These amendments satisfy the requirements of Article 123(2) EPC, since they recite the wording disclosed in the originally filed description on page 9, lines 1 to 4. The rest of claim 1 corresponds to a combination of claims 1 to 6 as originally filed.

3. Inventive step

3.1 Closest prior art

The examining division and the appellant selected documents D3 and D4 which are both directed to the same device as the closest prior art, which the Board agrees with. The device disclosed in documents D3 and D4 is also shown in figure 1 of the application referring to the prior art.
As only reference numerals are given in figure 1 of the present application, these reference numerals are used in the following paragraph to represent the features disclosed in documents D3 and D4.
Hence, documents D3 and D4 disclose a photoelectron spectrometer which is operable in a first mode using a hemispherical analyser (16) to produce an energy spectrum relating to the composition of a sample (4) being analysed, and in a second mode using a spherical mirror analyser (22) to produce a photoelectron image of the surface of the sample (4) being analysed,

wherein the spectrometer includes control means for controlling its operation and enabling a user to select which of the two modes is operating, wherein the spectrometer includes three detectors (18, 20, 24); the detector includes a plate means (24), onto which, in use, primary electrons are directed wherein the detector emits a plurality of secondary electrons for each primary electron received. Both documents D3 and D4 also indicate that the plate means (24) are realised using a micro channel plate (e.g., document D3, second paragraph).

3.2 Distinguishing features

The subject-matter defined in present claim 1 differs from the device disclosed in documents D3 and D4 by the following features:

(i) the photoelectrons produced in both modes of operation are detected by only one detector being realised by a micro channel plate;

(ii) the detector includes a first delay line means for using the plurality of secondary electrons to produce a pair of electrical pulses in a first delay line from which a signal processing means can calculate the location of the primary electron on the plate means in a first direction and the detector includes a second delay line means for using the plurality of secondary electrons to produce a pair of electrical pulses in a second delay line from which the signal processing means can calculate the location of the primary electron on the plate means in a second direction.

The examining division came to the same conclusion (cf. decision under appeal, point 2.2).

3.3 Objective technical problem and solution

3.3.1 The objective technical problem which is solved by the above-mentioned distinguishing features is - as cited in the application (page 3, lines 19 to 21) - a reduction of the complexity of the detector system.

3.3.2 This problem is solved by the combined implementation of the two distinguishing features, which allows the omission of the detectors used for the spectrum mode and using the micro channel plate (MCP) for both modes, the spectrum mode and the image mode.

3.3.3 The Board is, contrary to the examining division, of the opinion that the two distinguishing features are closely linked together as will be explained in the following and that neither the implementation of feature (i) nor that of feature (ii) is obvious to the skilled person.

3.3.4 The use of the MCP for both modes of detection, spectral mode and image mode, is only possible due to the use of the delay lines which provide much higher time resolution and therefore much better precision than the phosphor-camera system used in the prior art. The skilled person would not extend the MCP-phosphor-camera detector used in documents D3 and D4 to both detection modes, since the intensities of the photoelectrons striking the detector in the plane of the three detectors (18, 20, 24) in the image mode and the spectrum mode are extremely different (a factor in the order of several hundred). It is therefore common practice to use different sensors for such different

intensity ranges. The skilled person is aware that the two different detectors used in each of the two modes are not suitable for the other mode. In particular, if the MCP in combination with the phosphor-camera detection would be used in the spectral mode, the measurement results would be very inaccurate due to the very poor linearity of the system. This poor linearity comes from the high rate of striking electrons in combination with a limited read-out time frame for the detection using the phosphor-camera combined with the MCP. Only by using delay lines it is possible to use the MCP for a large number of striking electrons as well, since the temporal response rate of the delay line is extremely high. Hence, the skilled person would not simply extend the MCP-phosphor-camera detection known and used for the image mode also for the spectrum mode. This would not give satisfactory results.

Therefore, the argument of the examining division that the difference between the detector used in spectral mode (detector 18 and 20 in figure 1, typically realised by channeltrons) and the MCP (used in combination with a phosphor-camera detection) for image mode is only the difference in measurement dimensions (one-dimensional versus two-dimensional) is too restricted and does not reflect the real problem faced by the skilled person (variability of the linearity in the MCP-phosphor-camera device in both, image and spectrum mode, due to the large difference in electron flux arriving at the MCP).

The Board is consequently of the opinion that feature (i) is not obvious starting from one of the documents D3 or D4 and using the general knowledge of the skilled person. The skilled person would not replace the channeltron detectors by the MCP as it is

used in the prior art, namely in combination with the phosphor-camera detection.

3.3.5 A further consequence from the above is that the two distinguishing features are closely linked one to the other, contrary to the examining division's opinion.

3.3.6 The use of the second distinguishing feature (ii) which replaces the use of a phosphor-camera combination in the detection of the electron avalanche created by the MCP by a two dimensional delay line is according to the Board's view not obvious starting from the teaching of document D2 contrary to the examining division's argumentation.

The skilled person would not consider the teaching of document D2, because it is obvious from the above, that the flux of the striking photoelectrons is important for the selection of the detector used. Since it cannot be assumed that the electron flux in the measurements of diffracted X-rays (as shown in D2) would be of a similar order of magnitude as the one present in X-ray photoelectron spectroscopy (like in the present application), the skilled person would not consider the teaching of D2 in the present case. In addition, the technical field of diffracted X-rays as disclosed in document D2 should not be equated with a X-ray photoelectron spectroscopy as in the present application, in particular because of the different intensities of electron fluxes.

The mere fact that document D2 discloses the use of a MCP with delay lines is not sufficient to suggest that the skilled person would take this information into account. It is used in a different technical field with different intensities of electron fluxes, so that the

skilled person would not obviously integrate this teaching into the device shown in documents D3 or D4 without any further hint.

4. The Board is consequently of the opinion, that the subject-matter defined in claim 1 of the main request is new and involves an inventive step over the available prior art. The same conclusion also applies for claims 2 to 8, which directly or indirectly depend on claim 1.

5. The Board is satisfied that the patent application according to the main request and the invention to which it relates meet the requirements of the EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the examining division with the order to grant a patent in the following version:

   - Description
     - pages 1, 2 and 13 to 23 as published,
     - pages 3 to 12 of the main request filed with letter of 10 May 2021;

   - Claims 1 to 8 of the main request filed with letter of 10 May 2021;

   - Drawings, sheets 1/7 to 7/7 as published.

The Registrar: The Chairman:

S. Sánchez Chiquero G. Eliasson

Decision electronically authenticated

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Case Number: T 1198/18 - 3.4.03

D E C I S I O N
of the Technical Board of Appeal 3.4.03
of 12 October 2021
correcting an error in the decision
of 21 September 2021

Appellant: (Applicant)	Kratos Analytical Limited Wharfside, Trafford Wharf Road Manchester M17 1GP (GB)
Representative:	Mewburn Ellis LLP Aurora Building Counterslip Bristol BS1 6BX (GB)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 13 December 2017 refusing European patent application No. 03810514.4 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman:	G. Eliasson
Members:	J. Thomas
	W. Van der Eijk

Pursuant to Rule 140 EPC, the Decision T 1198/18 of the Board of Appeal given on 21 September 2021 is hereby corrected as follows:

In the order to grant a patent, page 2 of the description according to the main request shall be page 2 filed with the letter of 17 August 2011 instead of page 2 as published.

The Registrar: The Chairman:

S. Sánchez Chiquero G. Eliasson

Decision electronically authenticated