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D E C I S I O N
of 27 June 1995

Case Number: T 0175/93 - 3.4.2

Application Number: 86101901.6

Publication Number: 0192200

IPC: G01J 3/28, G01N 30/74

Language of the proceedings: EN

Title of invention:
Instantaneous reading multichannel polychromatic spectrophotometer method and apparatus

Applicant:
THE PERKIN-ELMER CORPORATION

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56

Keyword:
"Novelty and inventive step - (yes) after amendment"

Decisions cited:
-

Catchword:
-

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Case Number: T 0175/93 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 27 June 1995

Appellant: THE PERKIN-ELMER CORPORATION
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Decision under appeal: **Decision of the Examining Division of the European Patent Office dated 15 September 1992 refusing European patent application No. 86 101 901.6 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: E. Turrini
Members: R. Zottmann
L. C. Mancini

Summary of Facts and Submissions

I. European patent application No. 86 101 901.6 with publication No. 0 192 200 was refused by decision of the Examining Division.

The reason given for the refusal was that the subject-matters of the independent claims did not involve an inventive step with respect to the prior art disclosed in the following documents of the Search Report:

D1: JP-A-59/043321,
D2: US-A-3 973 118 and
D3: DE-A-3 224 549.

II. The Appellant (Applicant) lodged an appeal against said decision.

III. In a communication pursuant to Article 110(2) EPC and a consultation by telephone, the Board of Appeal expressed its preliminary opinion that the application did not meet the provisions of the EPC and informed the Appellant by which amendments the existing deficiencies could be removed.

The conclusions of the Board were based on a translation of the claims and description of D3 into the English language provided by the language service of the European Patent Office and sent to the Appellant.

To meet these objections, the Appellant filed amended claims and a correspondingly revised description and requested further amendment of the documents.

IV. The Appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the following application documents:

description:
pages 1 and 12 to 14 as filed with the letter dated 22 June 1995;
pages 2 to 6, 9 to 11, 15, 17, 20 to 23 and 25 as originally filed;
pages 7, 7a, 16, 18, 19, 24 and 26 as filed with the letter dated 6 March 1995;
page 8 as filed with the letter dated 30 November 1990;

Claims 1 to 5 (partly) filed with the letter dated 22 June 1995;
Claims 5 (partly) to 20 filed with the letter dated 6 March 1995;

drawings: sheets 1/5 to 5/5 as originally filed.

V. The independent claims according to the Appellant's request read as follows:

"1. A method for determining the wide-spectrum spectrophotometric characteristics of the constituents of a sample of a chromatographic column comprising:

directing a beam of radiation into a liquid sample cell receiving illumination emanating from the sample cell as a result of the beam of radiation from the radiation source and diffracting the emanated radiation into a polychromatic spatially divergent beam,

directing the divergent beam to a linear array of photodetectors with different spectral segments of the beam being intercepted by different photodetectors of the array,

further processing the signals from said detectors,

characterized in that

the sample to be analyzed in solution is flowing through the liquid sample cell,

the electrical signals being present at the output terminals of each of the detectors are separately and sequentially integrated during sampling intervals and then held,

the said held signals are, in synchronism with the sequential sampling of the signals, converted from analog to digital form

and then said digital signals are further processed and analysed to thereby obtain said wide-spectrum spectrophotometric characteristics."

"5. A wide-spectrum spectrophotometer comprising

a liquid sample cell (14),

a radiation source means (10) for directing a beam of radiation into said sample cell,

a diffraction means (18) positioned and arranged to receive illumination emanating from said sample cell as a result of said beam of radiation from said radiation source means,

said diffraction means being operable to diffract the emanated radiation into a polychromatic spatially divergent beam (20),

a linear array of photodetectors (22) positioned and arranged such that different spectral segments of said beam are intercepted by different photodetectors of said array,

separate signal channel means (24, 26-164) for each of said photodetectors,

means for further processing the signals from said detectors,

characterized in that

means (232, 236-246) are provided effecting that a sample to be analyzed in solution is flowing through said cell,

each of said signal channel means (24, 26-164) includes a sample-and-hold circuit being operable to receive and integrate signals from each of said detectors (22) during sampling intervals and to hold said integrated signals,

analog-to-digital conversion means (172) are provided connected to said sample-and-hold circuits (96-164),

control means (166, 168) are provided operable to sequentially actuate said separate signal channel means (24, 26-164) for all of said detectors, wherein said control means (166, 168) cause said analog-to-digital conversion means (172) to operate in synchronism with the sequential operation of said separate signal channel means (24, 26-164) to convert the held signals to digital signals in sequence, and

storage and processing means (174) are provided connected to receive, store and process said digital signals to thereby provide wide-spectrum spectrophotometric characteristics."

Claims 2 to 4 are dependent on Claim 1 and Claims 6 to 20 are dependent on Claim 5.

VI. Strong arguments supporting the request to grant a patent on the basis of the present claims were not submitted by the Appellant. However, mainly the following arguments put forward in the grounds of appeal seem to support also said request:

The combination of features of each Claim 1 and 5 cannot be derived from one of the cited references and thus the invention according to Claims 1 and 5 is novel. There is no suggestion to combine the teachings of D1 and D2 since these publications operate on completely different principles. Even a combination of them would not result in the present invention.

Reasons for the Decision

1. The appeal is admissible.

2. The Board is satisfied that the present application documents do not contain subject-matter extending beyond the content of the application as originally filed (requirements of Article 123(2) EPC).

3. *Novelty of Claim 5*

3.1 The spectrometer according to D1 comprises a light source (1) emitting white light (7) which enters a sample chamber (2) and passes through a sample cell (3) contained in said chamber to a spectroscope (4). The spectroscope uses a prism (5) for separating light into a plurality of essentially monochromatic light rays (8) of different wavelengths. Said plurality of light rays are intercepted by a linear photodiode array (6). Partly, (the pins 15 of) a plurality of neighboured photodiode elements (14) are mutually interconnected to form groups of diodes (see Fig. 3). The output terminals of single photodiodes and of said groups of photodiodes are connected to a shift register and a multiplexer (9) which inputs the signals to a data processor (CPU 10) which is connected to a cathode ray tube (CRT 11) and a recorder (12) (see particularly the Figs).

3.2 D2 describes an electro-optical detector array and spectrum analyser system comprising an electro-optical detector array with a plurality of photodetectors (24, 66) arranged on a common substrate (22), each detector being covered by a different narrow band optical filter (34). When said array is irradiated with non-monochromatic light being equally distributed over a spot size large enough to cover the area of the total detector array, each detector outputs an electrical signal in correspondence with the intensity of light of a wavelength region comprised in the broad band light which is capable of being transmitted through the narrow band optical filter covering the respective detector. Each photodetector (66) may be connected to an amplifying means (68, 70) and, in addition, a memory unit may be used in conjunction with the system of D2 to retain readings from the detectors for comparison when signals are of very short duration, such as in high

speed pulsed illumination sources. The only embodiment of such a memory unit disclosed in D2 comprises peak-detect-and-hold circuits (64). Any signals from said circuits may be requested by sequentially scanning said circuits with a multiplexer. Means are provided to sequentially display and record said requested analog signals (see Figs 1,2 and particularly 7, col. 1 lines 54 to 66 and col. 5 lines 30 to 51).

3.3 The chromatographic detector according to the third embodiment of D3 (see Fig. 3 and page 8 lines 10 to 31 and page 13 line 10 to page 15) comprises a chromatographic column (10) and a sample cell (14) through which a sample to be analysed or a carrier fluid without a sample is flowing. A spectrum obtained from a spectrometer (16) not further specified is detected by a photodetector array (20). Detector array signals representing a photometrical quantity in a certain small wavelength interval are preferably digitalized and are stored under different addresses in a memory unit (46, 54). In suitable units (48, 50, 52, 58, 60, 62), the stored data undergo mathematical operation (such as subtraction and logarithmation). The treated signals are integrated over a certain wavelength range by summation of said signals (which correspond to single wavelength intervals forming said range) to obtain a chromatogram which is a function of time but not of wavelength. Therefore, the spectrophotometric characteristics of the individual wavelength intervals are lost. The remaining embodiments are less relevant with respect to Claim 5.

3.4 Thus, in none of the prior art documents D1 to D3 means are disclosed effecting that the photodetector signals are separately and sequentially integrated during sampling intervals and then held. Since the remaining

documents of the Search Report do not disclose such a feature either, the subject-matter of Claim 5 is novel in the sense of Article 54 EPC.

4. *Inventive step of Claim 5*

4.1 From Section 3. above follows that the nearest prior art is disclosed in D1.

The main difference between the spectrophotometer of this document and Claim 5 consists in the means provided to treat the signals being present at the output terminals of the detectors. In D1, data acquisition of the signals coming from single photodetectors and the groups of detectors is effected by a shift register and a multiplexer, whereas according to Claim 5 individual channels for each of the detectors receive, integrate said signals during sampling intervals and hold them. These individual channels allow independent and simultaneous processing of the electrical signals acquired from each of the detectors and thus a very quick take up of the signal of all wavelength intervals of the spectrum of a desired wavelength range and also a wide spectrum spectrogram of a non-stationary sample at a high data read-out speed.

The problem underlying the subject-matter of Claim 5 is, therefore, to improve the device of D1 to obtain a high quality wide spectrum chromatogram for a non-stationary sample at a high data read-out speed.

4.2 In view of the considerably differences of the means for treating the signals from the photodetectors between D1 and Claim 5 (disclosed in the characterizing part of said claim), the Board is of the opinion that the

skilled person could not arrive at the apparatus of Claim 5 when taking into account the teachings of D1 alone.

4.3 Furthermore, he would not take into consideration the teachings of D2 since the systems of D1 and D2 and their use differ considerably (see Sections 3.1 and 3.2 above).

If, nevertheless, the skilled person would do so, the transfer of the circuit elements of D2 effecting the sampling of the detector signals would not lead to a spectrophotometer with all the essential features of Claim 5. The single disclosure of such sampling means (in the single example) in D2 describes peak-detect-and-hold circuits but not sample-and-hold circuits effecting an integration of the detector signals during sampling intervals of Claim 5 of the application-in-suit.

4.4 Document D3 is silent about details of the sampling of the photodetector signals. The signals are integrated after over the wavelength but not over time (sampling intervals) and they are integrated after being submitted to mathematical operations.

4.5 The Board has also considered the remaining documents of the Search Report and found them non-prejudicial to the present Claim 5, either alone or in combination with other documents of the Search Report.

5. Therefore, the subject-matter of Claim 5 involves also an inventive step as defined in Article 56 EPC with respect to the documents of the Search Report, and consequently said claim is allowable under Article 52(1) EPC.

6. Since the independent method Claim 1 reflects nothing but the normal use of the apparatus according to Claim 5, a corresponding reasoning leading to the same result is valid for Claim 1, too.

7. The dependent claims concern particular embodiments of the subject-matters of Claim 1 or 5. Therefore, they are likewise allowable under Article 52(1) EPC.

8. In the result, the Board takes the view that the claims comply with the requirements of the EPC. Since this applies also to the other documents of the application, a patent can be granted on the basis of the documents according to Section IV. above.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to grant a patent on the basis of the following application documents as agreed by the Board:

description:
pages 1 and 12 to 14 as filed with the letter dated 22 June 1995;
pages 2 to 6, 9 to 11, 15, 17, 20 to 23 and 25 as originally filed;
pages 7, 7a, 16, 18, 19, 24 and 26 as filed with the letter dated 6 March 1995;
page 8 as filed with the letter dated 30 November 1990;

Claims 1 to 5 (partly) filed with the letter dated 22 June 1995;
Claims 5 (partly) to 20 filed with the letter dated 6 March 1995;

drawings: sheets 1/5 to 5/5 as originally filed.

The Registrar: The Chairman:

P. Martorana E. Turrini