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D E C I S I O N
of 25 November 1993

Case Number: T 0987/92 - 3.4.2

Application Number: 85300129.5

Publication Number: 0150923

IPC: G01N 33/18

Language of the proceedings: EN

Title of invention:
Instrument for measurement of the organic carbon content of water

Patentee:
Anatel Corporation

Opponent:
Hüls Aktiengesellschaft

Headword:
-

Relevant legal norms:
EPC Art. 54, 56

Keyword:
After amendments:
"Novelty (yes)"
"Inventive step (yes)"

Decisions cited:
-

Catchword:
-

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Case Number: T 0987/92 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 25 November 1993

Appellant: (Opponent)
Hüls Aktiengesellschaft
Patentabteilung/PB 15
D - 45764 Marl (DE)

Representative:
-

Respondent: (Proprietor of the patent)
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Decision under appeal:
Interlocutory decision of the Opposition Division of the European Patent Office dated 27 August 1992 concerning maintenance of European patent No. 0 150 923 in amended form.

Composition of the Board:

Chairman: E. Turrini
Members: M. Chomentowski
M.V.E. Lewenton

Summary of Facts and Submissions

I. The Respondent is proprietor of European patent No. 0 150 923 (application No. 85 300 129.5), which discloses an invention for solving problems arising from the technique known from

US-A-3 958 941.

II. The Appellant (Opponent) filed an opposition against the European patent on the grounds that the subject-matter of the claims of the opposed patent lacked novelty or an inventive step having regard *inter alia* to the disclosure in

DE-A-3 223 167.

III. The patent was maintained in amended form. The Opposition Division took the view that the opposed technique for the measurement of the total organic carbon content of a static sample of ultrapure water and the claimed corresponding method was novel and inventive because **DE-A-3 223 167** did not disclose or suggest a technique wherein in particular the exposure of the sample to irradiation and the sensing of the electrical conductivity with only one pair of electrodes take place within one sample cell.

IV. The Appellant lodged an appeal against this decision.

V. During the oral proceedings which the Respondent had requested auxiliarily and which took place on 25 November 1993, he filed a request that the appeal be dismissed and that the patent be maintained on the basis of a main request filed in the oral proceedings or a set of auxiliary requests presented with letter of

20 October 1993, and the description and drawings to be adapted whenever necessary.

VI. Claims 1 and 6 of the main request read as follows:

"1. A method of measuring the total organic carbon (TOC) content of a static sample of water having a TOC content of up to 1 ppm, comprising:
(i) providing an apparatus having:
a sample cell (10) with a chamber for holding water, an inlet port (12) and an outlet port (14) communicating with the chamber, and means to retain the water statically within the chamber;
a source of ultraviolet radiation (34) of a frequency which encourages oxidation of organic carbon compounds, the source being associated with the sample cell so as to enable water held within the chamber to be exposed to the ultraviolet radiation;
conductivity-sensing electrodes;
means connected to the electrodes to monitor the conductivity of a static sample of water maintained in said chamber, between said electrodes; and
means connected to the monitoring means to determine any change in conductivity of said sample of water as monitored by the monitoring means;
there being not more than a single pair of electrodes (26, 28) disposed within the chamber for sensing the conductivity of the water retained in the chamber, all of the faces of the electrodes which are arranged to be in contact with the water sample being aligned such that they are exposed to the ultraviolet radiation;
(ii) admitting a sample of said water into said chamber and retaining it statically therein;
(iii) exposing said static sample to ultraviolet radiation, thus oxidising organic material in the sample to CO_2, said CO_2 being dissociated in the sample of water;

(iv) monitoring the conductivity between the said electrodes as a function of time during which the sample is exposed to said radiation; and
(v) determining the change in conductivity resulting from said oxidation.

6. An apparatus suitable for the measurement of the total organic carbon (TOC) content of a static sample of water having a TOC content of up to 1 ppm, having:
a sample cell (10) with a chamber for holding water, an inlet port (12) and an outlet port (14) communicating with the chamber, and means to retain the water statically within the chamber;
a source of ultraviolet radiation (34) of a frequency which encourages oxidation of organic carbon compounds, the source being associated with the sample cell so as to enable water held within the chamber to be exposed to the ultraviolet radiation;
conductivity-sensing electrodes;
means connected to the electrodes to monitor the conductivity therebetween;
and means connected to the monitoring means to determine the change in conductivity resulting from oxidation as monitored by the monitoring means;
characterised in that:
there is not more than a single pair of electrodes (26, 28) disposed within the chamber, the electrodes having faces for contact with the water to sense the conductivity of the water retained in the chamber, all of the said faces being aligned such that they are exposed to the ultraviolet radiation."

Claim 2 to 5 and 7 to 29 of the main request are dependent claims. The auxiliary requests comprise sets of claims.

VII. The Appellant requested that the decision under appeal be set aside and that the European patent be revoked. He submitted the following arguments in support of his request:

In the method of **DE-A-3 223 167**, which is also suited for the measurement of the total organic carbon content of static samples of water, the conductivity of the water can be sensed in the chamber where the ultraviolet irradiation of the water sample has taken place, and thus the electrodes are also irradiated. Therefore, the main claims are not novel or, since this feature of the location of the conductivity-sensing electrodes is obvious from the document and its effect for avoiding organic fouling of the electrodes is questionable, are not inventive.

VIII. The Respondent argued as follows in support of his main request:

The main claims have been amended to specify in particular that, as shown in Figures 1, 11 and 12, there is not more than a single pair of electrodes disposed within the chamber for sensing the conductivity of the water retained in the chamber, all of the faces of the electrodes which are arranged to be in contact with the water sample being aligned such that they are exposed to the ultraviolet radiation. These features, which solve the problems due to the transport of the CO_2 resulting from the ultraviolet irradiation in said chamber, are not suggested by the prior art.

Reasons for the Decision

1. The appeal is admissible.

2. *Main request*

2.1 Allowability of the amendments

2.1.1 Claim 1 in dispute is based in particular on Claim 28 and dependent Claims 29 to 31, all as granted, and is restricted to a method of measurement for a static sample of water with only a pair of conductivity sensing electrodes located in such a way in the utilised cell chamber that said electrodes are also irradiated by the ultraviolet radiation, as derivable in particular from the Figures 1 and 11 and 12. Claim 6 in dispute is based on Claim 1 as granted and comprises similar restrictions. It is also to be noted that the subject-matter of the granted claims was disclosed in the original application. Therefore, the Board is satisfied that the European patent has not been amended in such a way that the protection conferred has been extended or that its subject-matter extends beyond the content of the application as filed (Article 123(2) and (3) EPC).

2.2. Clarity

2.2.1 Claim 1 in dispute is concerned with a method of measuring the total organic carbon (TOC) content of a static sample of water retained within a sample cell chamber of an apparatus, and specifies in particular that the water held within the chamber is exposed to ultraviolet radiation and that there is no more than a single pair of electrodes disposed within the chamber for sensing the conductivity of the water retained in the chamber, all of the faces of the electrodes which are arranged to be in contact with the water sample being aligned such that they are exposed to the ultraviolet radiation. Thus, the Board is satisfied that, since in particular it is derivable from the claim

in dispute that the pair of conductivity-sensing electrodes are located in the part of the apparatus chamber where the water sample is irradiated, there is no ambiguity concerning the locations in the chamber where the steps of the method in dispute take place and the claim is clear in the sense of Article 84 EPC.

Claim 6 in dispute is also clear for the same reasons.

2.3 Novelty

2.3.1 Contrary to Claim 1 in dispute, in the method known from **US-A-3 958 941** (see column 1, line 60 to column 2, line 23; see also Figure 1), the conductivity-sensing electrodes are not irradiated by the ultraviolet radiation because said sensing takes place in another part of the apparatus wherein the generated carbon oxide is transferred.

2.3.2 A method for the measurement of the organic carbon content of a sample of water is known from **DE-A-3 223 167** (see page 8, line 28 to page 9, line 33; see also page 6, lines 11 to 15 and page 12, lines 23 to 31, "Example 3"; the Figure); the apparatus for implementing this method comprises:

a sample cell including the part (3);
a source of ultraviolet radiation (4) of a frequency which encourages oxidation of organic carbon compounds;
a pair of electrodes of a sensing device (21) for sensing the conductivity of the water;
means (23, 24) for monitoring the conductivity between said electrodes of the sensing device (21); and
means (21, 23, 24) for determining the change in conductivity resulting from said oxidation.

It is to be noted that the known apparatus is suitable for static measurements in that sense that the pumping and dosing device (2) can be put off. In the known Example 3, wherein in particular the pumping device (10) is put off, and all decomposition products resulting from the UV-irradiation are increasing the conductivity of the liquid to be tested, said decomposition products are measured only by using the electrodes of the sensing devices (21) and (22), and thus in particular of the sensing device (21). Since the sensing device (21) is in fluid communication through the pipe (5) with the part (3) of the cell, said sensing device (21) is within said cell (3, 5, 21) and both the exposure of the sample to ultraviolet radiation and the sensing of the conductivity take place within one sample cell (3, 5, 21). In this respect, it is to be noted that **DE-A-3 223 167** (see page 6, lines 11 to 15) indicates that the conductivity of the sample can be measured within or at the outlet of the cell and that thus conductivity sensing means can be included within the chamber of the apparatus.

However, **DE-A-3 223 167** in particular does not specify that all of the faces of the electrodes which are arranged to be in contact with the water sample, and which indeed can be located within the chamber, are aligned such that they are exposed to the ultraviolet radiation.

2.3.3 Therefore, the subject-matter of Claim 1 in dispute is novel in the sense of Article 54 EPC.

2.4 Inventive step

2.4.1 According to the patent in suit (see page 2, lines 20 to 24 and 31 to 59), a drawback of the method known from **US-A-3 958 941** is that the exposure of the water sample

to ultraviolet light for oxidising the carbon-containing organics to carbon dioxide takes place in a first cell, the carbon dioxide being then transported to a pure water sample, and the change in conductivity of the pure water due to the presence of the additional ionic species being monitored to determine the amount of organic material thus oxidised, thus making necessary the transport of the carbon dioxide with resulting possible addition of impurities and loss of CO_2, i.e. lack of accuracy of the measurement.

2.4.2 The method of the patent in suit (see also page 2, line 56 to page 3, line 2) credibly overcomes these problems in that, in particular, all of the faces of the electrodes which are arranged to be in contact with the water sample are aligned such that they are exposed to the ultraviolet radiation, thereby resulting in no transport of the carbon dioxide.

2.4.3 **US-A-3 958 941** does not provide any indication for avoiding the transport of CO_2.

DE-A-3 223 167 addresses neither the problem, nor its solution. Indeed, in the method of **DE-A-3 223 167** (see page 6, lines 11 to 15), the conductivity may be sensed in the chamber where irradiation of the water sample takes place; it is also derivable from the only Figure and the Example 3 on page 12 that some of the electrode pairs, in particular the pairs (22) and (21), are in contact with the water in the chamber (3) and are thus in direct communication with the interior of the chamber (3) and, in that sense, in the chamber. However, it is not derivable from this document that said location of the probes (21, 22) should be such that all of the faces of the electrodes which are arranged to be in contact with the water sample are aligned such that they are exposed to the ultraviolet radiation; thus, since as

schematically shown in the Figure the conductivity sensing in the known method can take place in the chamber where ultraviolet irradiation is performed but at another location of said chamber, avoidance of the transport of the CO_2 resulting from the irradiation to the sensing electrodes is not suggested by **DE-A-3 223 167**.

The Appellant has argued that the feature concerning the irradiation of the faces of the electrodes, which is presented in the patent in suit (see page 2, line 64 to page 3, line 2) as solving a problem, i.e. the organic fouling of said electrodes which can arise in the two-chamber system of **US-A-3 958 941**, is not an inventive feature because its real effect, which depends on the orientation of said electrodes with respect to the irradiation, is questionable. However, the Board is of the opinion that this argument is not convincing because this advantageous effect is derivable as being a supplementary effect, whereby the main effect resulting from said feature, i.e. the avoidance of any transport of CO_2, is credible.

2.4.4 Therefore, the subject-matter of Claim 1 in dispute involves an inventive step in the sense of Article 56 EPC.

2.5 The subject-matter of Claim 6 in dispute, which is concerned with an apparatus 1 suitable for making such measurements and having the means for this purpose, is also novel and involves an inventive step for the same reasons.

2.6 Therefore, since the patent as amended meets the requirements of the Convention, the patent may be maintained (Articles 52(1) and 102(3) EPC).

3. *Auxiliary requests*

3.1 Since the main request is considered as allowable, it is not necessary to take into account the Respondent's auxiliary requests.

Order

For these reasons, it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the Opposition Division with the order to maintain the patent in the amended form according to the main request presented by the Respondent in the oral proceedings of 25 November 1993 and consisting of Claims 1 to 29 and a description and drawings to be adapted thereto whenever needed.

The Registrar: The Chairman:

P. Martorana E. Turrini