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D E C I S I O N
of 13 December 2004

Case Number: T 0183/03 - 3.4.2

Application Number: 96250030.2

Publication Number: 0730153

IPC: G01N 33/18

Language of the proceedings: EN

Title of invention:
Water impurity analyzer

Applicant:
ISCO, Inc.

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 52(1), 54, 56

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

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0183/03 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 13 December 2004

Appellant: ISCO, Inc.
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Representative: UEXKÜLL & STOLBERG
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 23 September 2002 refusing European application No. 96250030.2 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: A. G. Klein
Members: A. G. M. Maaswinkel
M. J. Vogel

Summary of Facts and Submissions

I. The appellant lodged an appeal, received on 25 November 2002, against the decision of the examining division, dispatched on 23 September 2002, refusing the European patent application 96250030.2. The fee for the appeal was paid on 23 September 2002 and the statement setting out the grounds of appeal was received on 23 January 2003.

II. The examining division objected that the application did not meet the requirements of Article 123(2) EPC because the amendments of Claims 1 and 4 carried out during the examination procedure introduced subject-matter extending beyond the content of the application as filed. Furthermore an objection under Article 84 EPC against the amended claims was raised.

The following documents were referred to in the examination procedure:

D1: US-A-4 277 438

D2: EP-A-0 256 684

D3: GB-A-2 165 360

D4: WO-A-88/06730

D5: EP-A-0 202 820.

III. In reply to a Communication of the Board and after a telephone consultation with the Rapporteur the appellant filed with a letter dated 26 November 2004 a set of revised claims. The appellant requested that the decision under appeal be set aside and a patent be granted on the basis of the following documents:

Claims: 1 to 9, as filed with the letter of 26 November 2004;

Description: pages 1-3, 20, 21, 23 as filed with the letter of 11 November 2004;
pages 4-19, 22, 24-31 as originally filed.

Drawings: sheets 1 - 7 as originally filed.

IV. The wording of independent claim 1 reads as follows:

"A method of measuring total organic carbon content comprising applying a sample liquid and an oxidizer to a multisection ultraviolet reactor (10); and oxidizing carbon in the sample liquid as it flows through the reactor (10),

characterized in that the sample liquid flows upward through a column (56) of at least two residence chambers (e.g. 172) for slow linear upward movement of the sample liquid during a residence time which is adequate for mixing and forcing the liquid along at least one curvilinear narrow path (174) adjacent to an ultraviolet source (150) between and connecting the at least two residence chambers."

The wording of independent claim 4 reads as follows:

"An organic carbon content analyzer (10) for water comprising a plurality of stages (156, 158, 178, etc.) adapted to be connected one to the other with means (150) for supplying ultraviolet light, reactant and water (162, 164 and 166)

characterized in that at least some of said stages include a residence chamber (e.g. 172) and a reaction chamber (e.g. 174); said stages forming a vertical column, a central opening (182) adapted to receive an

ultraviolet lamp (150); reactant, water and carrier gas inlet ports (162, 164 and 166) near the bottom (154) of said vertical column (56) with the at least one outlet port being near the top of said vertical column; and at least some of said reaction stages (e.g. 156, 158, etc.) including helical grooves (at 174) formed of helical lands (200) and helical recessions; said helical lands (200) forming an inner diameter substantially the same as the outer diameter of said ultraviolet lamp, wherein helical passageways are formed around said lamp to permit the rapid movement of liquid close to and adjacent to said ultraviolet lamp between residence chambers."

Claims 2, 3 and 5 to 9 are dependent claims.

V. The appellant's arguments may be summarised as follows:

The set of claims now on file essentially corresponds to the originally filed claims, whence the objections under Articles 84 and 123(2) EPC raised by the examining division in the appealed decision should no longer apply.

As to the issue of patentability, documents D1 or equally D4 had been considered by the examining division as the closest prior art. Document D1 discloses a continuous process for measuring the total organic content of water wherein the organic carbon is oxidized as the water flows through an ultraviolet reactor and the amount of water flowing through the reactor is measured. In the device disclosed in D1, each of the stages for oxidation of carbon has its own ultraviolet source and may have its own source of

oxidizing agent and/or oxygen, which is expensive. The columns are arranged such that there are multiple top positions which frequently result in the loss of gas and the prevention of an accurate measurement. D1 does not disclose the helical path in a single movement up the column about a single light tube.

Document D4 discloses a helix which includes a catalyst imbedded in its wall through which a fluid flows along a curvilinear path upward and back around to a junction and from there to the pump to be recirculated. This is a multi-circulatory system with multiple passing of gas and liquid by junctions that may permit loss of the gas. The system is not designed to provide sufficient light to the liquid for a complete reaction. Indeed, the reaction process is a contact process against a semiconductor with less concern about an oxidant for oxidizing the carbon since it is a solid surface catalytic reaction apparently with the coating of the tube that causes the oxidation and apparently requires multiple passes pass the light to accomplish complete oxidation.

Document D5 had been cited in the decision under appeal against the then valid claims. According to the examining division, this document discloses a curvilinear and narrow path adjacent to an ultraviolet source within a single column, which ensures that all the water is brought in close contact to the ultraviolet source. In the opinion of the examining division it would be obvious to combine the teachings of D1 and D5 to ensure a better contact between the water and the ultraviolet source to obtain a more complete oxidation of the water. However, document D5

does not solve the problems underlying the apparatus of D1, because the device shown in D5 is a horizontal water purifier which is intended to permit the water to be exposed to ultraviolet light for purification and is not a reactor of the type claimed, nor is it upright to prevent loss of gas by providing a clear upward path for the gas to flow and be removed. It does not have an upright position because it does not require the removal of gas but is only designed to purify the water with ultraviolet light. Therefore the combination of these documents is not obvious and does not result in the claimed subject-matter.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

2.1 The objections under Article 84 and 123(2) EPC in the decision under appeal had been raised against amendments in Claims 1 and 4, which during the appeal procedure were withdrawn by the appellant, thereby circumventing the objections.

2.2 In addition to minor textual amendments in Claim 1 the claim now includes the additional features "(applying a sample liquid) and an oxidizer" and "(for slow linear upward movement of the sample liquid) during a residence time which is adequate for (mixing and) forcing the liquid along (at least one curvilinear narrow path)". These amendments are fairly supported by the passages on page 10, lines 6, 7 and line 10 of the

application as originally filed (Article 123(2) EPC). The Board is satisfied that the Claim also meets the requirements of Article 84 EPC.

A further amendment at the end of Claim 2 ("*the residence chambers ...helical groove*") is equally supported by the original description on page 23, lines 5 to 9. Furthermore the adaptation of the description and the acknowledgement of the prior art (documents D1, D2 and D3) are admissible.

Therefore the amendments are formally admissible.

3. *Patentability*

3.1 Novelty

3.1.1 Document D1 discloses a method and an apparatus for measuring the amount of carbon and other organics in an aqueous solution. The apparatus comprises a multistage reactor with individual, separated stages, each stage having input and output apertures and an ultraviolet lamp within each stage for directly contacting the test solution (*see Figure 2*). The stages are arranged in a horizontal cascade. There are first (11) and second (12) means for introducing an oxidizer (*persulfate ions, oxygen*) into the sample liquid.

The measuring method defined in Claim 1 differs from the method in D1 in that the liquid flows through a column of at least two residence chambers in a slow linear upward movement and along a curvilinear narrow path between and connecting the two residence chambers, an ultraviolet source being adjacent to this path. The

apparatus defined in Claim 4 similarly differs from the device shown in Figure 2 of D1 in the vertical arrangement of the stages in a column; and in that these include residence chambers connected by a helical structure around an ultraviolet lamp source as defined in the characterising portion of this claim.

3.1.2 Document D4 discloses a method and an apparatus for determining total organic carbon in aqueous solutions. The reactor used in that method differs from the apparatus defined in Claim 4 and used in the method of Claim 1 in that it comprises a *single* section reactor and that the sample solution is *pumped around a closed loop 102-105-106-104 by pump 106* (*see page 9, 2nd paragraph and Figure 1*). Furthermore the reactor column (104) disclosed in D4 does not comprise two (or more) residence chambers as defined in Claims 1 and 4. Rather, the curvilinear narrow path (104) adjacent to the ultraviolet source (103) is in direct contact with the loading port (102) and the pump (106).

3.1.3 Document D5 discloses a water purifier comprising a tubular ultraviolet lamp surrounded by a transparent water jacket. Water flows longitudinally in the jacket but is guided by baffles which induce a turbulent flow. The baffles may be helically shaped. This document is not related to measuring total organic carbon content. The arrangement is horizontal, not vertical and there is no teaching that organic carbon would be oxidized. Rather, the aim of the ultraviolet lamp is to provide lethal doses to the micro-organisms in the water (*see page 5, lines 16 to 19*).

3.1.4 The further documents from the European Search Report disclose a more remote prior art and are less relevant.

3.1.5 The subject-matter of independent Claims 1 and 4 is therefore new (Article 52(1) and 54 EPC).

3.2 Inventive step

3.2.1 Closest prior art

In the decision both documents D1 and D4 had been mentioned as apparatuses and methods for measuring organic carbon content and representing the closest prior art. Since document D4 is based on the different principle of circulating the sample in closed-loop and it employs a photocatalytic oxidizing semiconductor (*see point 3.1.2*) it would appear that the disclosure in document D1 forms a more suitable starting point for the discussion of inventive step.

3.2.2 The differences between the method defined in Claim 1 and the method disclosed in document D1 (*see point 3.1.1*) which are also expressed by the two-part form of this claim address the problems summarised on page 2, lines 9 to 14 of the application, namely that in the prior art apparatus there is a tendency for the carbon to escape before it is collected and measured, that because of the plurality of UV-sources the costs are high, and that it is difficult to obtain complete oxidation of the carbon.

3.2.3 Having regard to the embodiment shown in Figure 2 of document D1, the person skilled in the art might consider to arrange the three reactor stages 59, 60 and

61 in a vertical series arrangement, for instance as a viable alternative to the horizontal arrangement shown in the Figure. The method defined in Claim 1 and the analyzer device according to Claim 4 would then still differ from such an arrangement and its use by the requirement that the sample liquid should flow through a column of at least two residence chambers in a slow linear upward movement during a residence time which is adequate for mixing and should be forced along a curvilinear narrow path between and connecting the two residence chambers.

For this further modification of a vertically arranged apparatus of Figure 2 of document D1 the prior art does not provide any obvious hint. It is true that document D4 shows a spiral or helical reactor arranged around a UV-fluorescent tube, but this does not cooperate together with residence chambers so that the sample moves slowly upwardly in these chambers while being mixed by forcing it along the curvilinear path. Indeed, apart from defining that the glass photoreactor has a spiral shape (*see page 8, last paragraph*) document D4 is silent about any requirements concerning forcing or mixing the fluid. Rather it appears that, because of the close-loop circulation system 102-105-106-104 in this document the sample fluid is pumped through the apparatus in a laminar flow. Therefore a combination of the teachings of document D4 and D1 would not result in the method defined in Claim 1 nor in the apparatus defined in Claim 4.

3.2.4 If confronted with the problems of the prior art devices mentioned in point 3.2.2 *supra* it is also not apparent why the skilled person should consider to

combine the teaching of document D5 with the disclosure in document D1, because document D5 does not relate to oxidation of organic carbon, whence the problems of escaping carbon or incomplete carbon oxidation are not addressed at all in D5. Furthermore, also this document does not teach or suggest the concept of two residence chambers so that the sample moves slowly upwardly in these chambers while being mixed and forcing it along the curvilinear path.

3.2.5 Therefore the subject-matter of Claims 1 and 4 is considered to involve an inventive step within the meaning of Article 56 EPC.

3.2.6 Claims 2 and 3 are dependent of the independent Claim 1; similarly Claims 5 to 9 are dependent of independent Claim 4 and therefore these claims also define patentable subject-matter.

4. For the above reasons, the Board finds that the appellant's request meets the requirements of the EPC and that a patent can be granted on the basis thereof.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance with the order to grant a patent on the basis of the following documents:

   Claims: 1 to 9, filed with the letter of 26 November 2004;

   Description: pages 1-3, 20, 21, 23 as filed with the letter of 11 November 2004;
   pages 4-19, 22, 24-31 as originally filed.

   Drawings: sheets 1 - 7 as originally filed.

The Registrar: The Chairman:

P. Martorana A. G. Klein