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D E C I S I O N
of 23 May 2005

Case Number: T 0515/01 - 3.3.7

Application Number: 97943564.1

Publication Number: WO 98/11987

IPC: B01J 47/08

Language of the proceedings: EN

Title of invention:

Electrodeionization apparatus and method

Applicant:

USFilter Corporation

Opponent:

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Headword:

-

Relevant legal provisions:

EPC Art. 54, 82, 84, 111(1), 123(2)

Keyword:

"Amendments - allowable"
"Clarity - yes"
"Novelty - main request - yes"
"Unity - yes"
"Remittal - yes"

Decisions cited:

-

Catchword:

-



Case Number: T 0515/01 - 3.3.7

D E C I S I O N
of the Technical Board of Appeal 3.3.7
of 23 May 2005

Appellant:

USFilter Corporation
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Representative:

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Decision under appeal:

Decision of the Examining Division of the
European Patent Office posted 11 December 2000
refusing European application No. 97943564.1
pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: R. E. Teschemacher
Members: B. J. M. Struif
P. A. Gryczka

Summary of Facts and Submissions

I. European patent application No. 97 943 564.1 originating from international patent application No. PCT/US97/17189 published as WO 98/11987, has a filing date of 23 September 1997. The application as originally filed comprised 77 claims. Independent claims 1 and 72 read as follows.

"1. An electrodeionization apparatus, comprising:
an ion-concentrating compartment,
an ion-depleting compartment,
anode and a cathode,
an anolyte compartment and a catholyte compartment, and
an electroactive media positioned within at least one
of the ion-concentrating and ion-depleting compartments,
the electroactive media comprising anion resin material
with Type I functional groups in combination with anion
resin material selected from the group consisting of
anion resin material with weak base groups, anion resin
material with Type II functional groups, and mixtures
thereof."

"72. A method of purifying a liquid in an
electrodeionization apparatus, comprising:
providing an electrodeionization apparatus, including
an ion-concentrating compartment, an ion-depleting
compartment, an anode and a cathode;
positioning a first electroactive media within at least
one of the ion-concentrating and ion-depleting
compartments to promote dissociation of water molecules
along the entire pH range, the first electroactive
media comprising anion resin material with Type I
functional groups in combination with anion resin

material selected from the group consisting of anion resin material with weak base groups, anion resin material with Type II functional groups, and mixtures thereof;
applying an electrical current across the electrodeionization apparatus; and
passing the liquid through the compartments."

II. In a decision notified in writing on 11 December 2000, the examining division refused the application in suit *inter alia* in view of the following documents:

D1: GB-A-1 137 679

D3: US-A-5 316 637

That decision was based on set of claims 1 to 23 as the sole request and an amended description all filed with letter dated 19 July 2000. Claim 1 reads as follows:

"1. An electrodeionisation apparatus, comprising:
an ion-concentrating compartment,
an ion-depleting compartment,
an anolyte compartment, and a catholyte compartment,
and
an electroactive media positioned within at least one of the compartments,
wherein the electroactive media is selected from the group consisting of
(a) synthetic activated carbon,
(b) hypercrosslinked sorbent resin,
(c) synthetic carbonaceous adsorbent,
(d) polymeric adsorbent resin,
(e) catalytic carbon, and

(f) anion resin material with Type I functional groups in combination with anion resin material selected from the group consisting of anion resin material with weak base groups, anion resin material with Type II functional groups, and mixtures thereof."

The decision can be summarized as follows:

- (a) As regards novelty, D3 disclosed an electrodeionisation apparatus, comprising: an ion-concentrating compartment, an ion-depleting compartment, an anolyte compartment and a catholyte compartment, and an electroactive media positioned within at least one of the compartments. The electroactive media of D3 which could be a polymeric adsorbent resin comprising a polystyrene matrix, absorbed ions and also some adsorption took place. Therefore, embodiment (d) of claim 1 lacked novelty over D3.
- (b) As regards clarity, the terms "Type I functional group" and "Type II functional group" were vague and indefinite. The definitions in the description, which referred to dimethyl ethanol amine as Type II group and quaternary ammonium as Type I functional group were not limiting.
- (c) Further objections, which were not part of the reasons for refusal, were as follows:

The amendments on page 5a filed with letter of 19 July 2000 providing a definition of Type I and Type II anion resins were not originally disclosed

and thus did not fulfil the requirements of Article 123(2) EPC.

The claimed subject-matter lacked unity within the meaning of Article 82 EPC, since the linking concept of the independent embodiments (a), (b), (c), (d), (e) and (f) of claim 1 was known from *inter alia* D1 and D3. Hence, these independent groups of inventions were not linked by a single inventive concept.

D3 described high and low crosslinked sorbent resins which included Purolite type resins which were covered by the term hypercrosslinked sorbent resins in the application in suit. Thus, embodiment (b) of claim 1 was not novel either.

Furthermore, D1 disclosed embodiments (c) and (d) of claim 1.

III. On 19 January 2001, the applicant (appellant) filed a notice of appeal against the above decision, the prescribed fee being paid on the same day. In the statement setting out the grounds of appeal filed on 10 April 2001, the appellant submitted an amended set of claims 1 to 10 as an auxiliary request.

IV. In an annex to the summons to attend oral proceedings dated 8 October 2004, the board addressed the points to be discussed at the oral proceedings including clarity, original disclosure, novelty and unity under Articles 84, 123(2), 54(2) and 82 EPC, respectively. Furthermore, WO-A-98/20972 (D7), which had been brought to the attention of the board in the appellant's

statement setting out the grounds of appeal, was cited as a document possibly relevant under Article 54(3) and (4) EPC.

- V. On 10 December 2004, the appellant filed a second auxiliary request. In a communication dated 21 December 2001, the board raised objections in relation to this request. On 31 December 2004 in reply to that communication, the appellant submitted three sets of claims as third, fourth and fifth auxiliary request. In reply to a further communication of the board dated 10 January 2005, the appellant filed on the same day amended claims 1 to 5 as main request.

Independent claims 1 and 3 according to the main request read as follows:

"1. An electrodeionisation apparatus comprising:
an ion-concentrating compartment,
an ion-depleting compartment,
anode and a cathode,
an anolyte compartment, and a catholyte compartment,
and
an electroactive media positioned within at least one of the ion-concentrating and ion-depleting compartments, the electroactive media comprising anion resin material with Type I quaternary ammonium functional groups in combination with anion resin material selected from the group consisting of anion resin material with weak base groups, anion resin material with Type II dimethyl ethanol amine functional groups, and mixtures thereof, and wherein the electroactive media is mixed with anion exchange resin beads and cation exchange resin beads."

"3. A method of purifying a liquid in an electrodeionisation apparatus, comprising: providing an electrodeionisation apparatus, including an ion-concentrating compartment, and ion-depleting compartment, and anode and a cathode; positioning a first electroactive media within at least one of the ion-concentrating and ion-depleting compartments to promote dissociation of water molecules along the entire pH range, the first electroactive media comprising anion resin material with Type I quaternary ammonium functional groups in combination with anion resin material selected from the group consisting of anion resin material with weak base groups, anion resin material with Type II dimethyl ethanol amine functional groups, and mixtures thereof, and wherein the electroactive media is mixed with anion exchange resin beads and cation exchange resin beads; applying an electrical current across the electrodeionisation apparatus; and passing the liquid through the compartments."

VI. On 14 January 2005, the appellant was informed that the oral proceedings had been cancelled and that the proceedings would be continued in writing on the basis of the main request attached to the letter dated 10 January 2005.

VII. The appellant argued in substance as follows:

- (a) The amendments to the claims were based on the application as filed and met the requirements of Article 123(2) EPC.

- (b) The objected terms "Type I functional group" and "Type II functional group" were supplemented by the features "quaternary ammonium groups" and "dimethyl methanol amine", respectively, which provided a clear teaching in accordance with Article 84 EPC.
- (c) As regards novelty, D1 had not been cited against the subject-matter of original claim 1. Although D3 individually mentioned Type I resins and Type II resins, it did not disclose the specific electroactive media including a combination of two specific anion exchange resin materials in the form of a mixture as claimed. The claimed subject-matter was thus novel.
- (d) The application in suit was entitled to the claimed priority so that D7 was not a valid novelty citation. Furthermore, D7 related to alternating layers of anion exchange resins and cation exchange resins in the same compartment but not to mixtures of Type I in combination with Type II and/or weak base anion exchange resins, anion exchange resin beads and cation exchange resin beads, all in the same compartment.

VIII. The appellant requested that the decision under appeal be set aside and that the case be remitted to the department of first instance on the basis the main request (claims 1 to 5 attached to the appellant's letter dated 10 January 2005) and that all further requests were withdrawn, if the board considered that the main request overcame or avoided the objections to novelty, clarity and unity previously raised.

Reasons for the Decision

1. The appeal is admissible.

Main request

Amendments

2. Amended claim 1 is based on a combination of original claims 1 and 2, whereby the terms "Type I functional group" and "Type II functional group" were supplemented by the features "quaternary ammonium groups" and "dimethyl methanol amine", respectively, in line with pages 9 and 10, bridging paragraph. It is noted that these groups are furthermore illustrated by several commercially available anion exchange resins on page 10 of the application as filed and are also used in the examples.

Independent method claim 3 is based on original claim 72 and includes the same amendments as incorporated into claim 1. Claim 2 corresponds to original claim 3. Claims 4 and 5 are based on original claims 74 and 76, respectively.

Thus, the amendments can be directly and unambiguously derived from the application as filed. Consequently, the amended claims meet the requirements of Article 123(2) EPC.

Clarity

3. The objected terms "Type I functional group" and "Type II functional group" have been supplemented by the terms "quaternary ammonium groups" and "dimethyl methanol amine", respectively, and are thus limited to clearly defined structural groups as required under Article 84 EPC. No clarity objections were raised in respect of these specific chemical groups in the decision under appeal (see Reasons, point 11). Consequently, the amendments to the claims overcome the clarity objections raised.

Novelty

4. D3 discloses an electrodeionisation apparatus comprising at least one ion concentrating compartment positioned adjacent to at least one ion depleting compartment, the ion depleting compartment comprising an ion exchange resin positioned between an anion exchange membrane and a cation exchange membrane, the membranes having a conductance, wherein at least one membrane comprises means for allowing an increase in the transfer of large or highly charged ions across the membrane on an equivalent weight basis of at least 25%, when subjected to an increase in voltage across the membrane causing an increase in electric current across the membrane of the order of two times or less (claim 1).
 - 4.1 According to D3 the ion exchange resin may comprise a mixture of an anion exchange resin and a cation exchange resin (claim 17), wherein the anion exchange resin comprises either a Type I resin (claim 18) or a

Type II resin (claim 20), which resins may be crosslinked to a certain degree (claims 19, 21 and 22).

Among the anion resins different types are specified, such as Purolite A-300 (Type II), A-450 (Type I), A-400 (Type I), Dow 550 A (Type I) and Dow Dowex IX2 (table columns 11 to 13). The above resins generally comprise a polystyrene matrix crosslinked with divinyl benzene to which a variety of functional groups may be added. Type I resins contain $\text{CH}_2 \text{N}(\text{CH}_3)_3 \text{Cl}$ functionality, whereas Type II resins contain $\text{CH}_2 \text{NC}_2 \text{H}_4 \text{OH}(\text{CH}_3)_2 \text{Cl}$ functionality (column 11, lines 21 to 26).

4.2 Although D3 mentions anion exchange resins comprising either a Type I resin or a Type II resin, there is, however, no disclosure in D3 to use a mixture of a Type I anion resin in combination with a Type II anion resin in the same compartment. Still less D3 discloses an electroactive media comprising anion resin material with Type I quaternary ammonium functional groups in combination with anion resin material selected from the group consisting of anion resin material with weak base groups, anion resin material with Type II dimethyl ethanol amine functional groups, and mixtures thereof, the electroactive media being mixed with anion exchange resin beads and cation exchange resin beads as now required by the amended claims. Thus, the novelty objection with respect to D3 has been overcome by the amended subject-matter.

4.3 The novelty objection with respect to D1, which did not form part of the reasons on which the impugned decision was based (Reasons, point 15), referred only to embodiments (c), and (d) of claim 1 underlying the

impugned decision, but not to embodiment (f) to which the present claims are restricted. Since D1 does not concern anion resin material with Type I quaternary ammonium functional groups in combination with anion resin material with weak base groups and/or Type II dimethyl ethanol amine functional groups, mixed with anion exchange resin beads and cation exchange resin beads as now claimed, D1 cannot be prejudicial to the novelty of the subject-matter now claimed.

- 4.3.1 D7 cited during the appeal proceedings is a copending application originating from international application No. PCT/US/97/17190 having a filing date of 23 September 1997, claiming priority of US 08/747,505 dated 12 November 1996 and published on 22 May 1998. D7 has entered the European phase in the form of European patent application No. 97 942 683.0 for the designated contracting states DE, FR, GB and IT and meets the requirements under Article 158(1) and (2) EPC.
- 4.3.2 The application in suit originates from international application No. PCT/US/97/17189 having a filing date of 23 September 1997, claiming priority of US 08/717,781 dated 23 September 1996 and has been designated for the contracting states DE, FR and GB. D7 is thus published after the filing date of the application in suit.
- 4.3.3 D7 may become prior art relevant for examining novelty under Article 54(3) and (4) EPC for the designated contracting states DE, FR, and GB, depending on whether or not the claimed priorities in the application in suit and D7 are validly claimed. However, the question whether or not the claimed subject-matter of the application in suit and D7 is entitled to the claimed

priority dates, can be left open, since the amended subject-matter differs in any case from the disclosure of D7.

- 4.3.4 D7 discloses an electrodeionisation apparatus comprising an ion-concentrating compartment; an ion-depleting compartment; and an anode and a cathode; wherein alternating layers of anion exchange resins and cation exchange resins are positioned in said ion-depleting compartment, and said anion exchange resins comprise Type II anion resin material (claim 1). The electrodeionisation apparatus further comprises a Type I anion exchange resin material layer positioned between said alternating layers of anion exchange resins and cation exchange resins (claim 2). Alternating layers of cation resins, anion resins of Type II and anion resins of Type I are illustrated in Figure 2C and 2F of D7. Furthermore, the anion exchange resins may further include anion exchange resins selected from the group consisting of Type II anion exchange resins, anion exchange resins with weak base surface groups, and mixtures thereof (claim 7). An inert material layer may be positioned between said alternating layers of anion exchange resins and cation exchange resins (claim 11). Furthermore, the ion-concentration compartment including the alternating layers may be divided by at least one anion or cation permeable membrane and said at least one anion permeable membrane comprises Type II anion resins (claims 9 and 12).
- 4.3.5 However, D7 only mentions alternating layers of anion exchange resins and cation exchange resins and does not disclose mixtures of anion resin material with Type I

quaternary ammonium functional groups in combination with anion resin material with weak base groups and/or Type II dimethyl ethanol amine functional groups together with anion exchange resin beads and cation exchange resin beads in the same compartment as now required by the claims. Thus, D7 is not novelty destroying for the claimed subject-matter.

- 4.4 Consequently, the novelty objections raised in the decision under appeal and in the communications of the board have been overcome by the subject-matter as now claimed.

Unity

5. Amended claims 1 and 3 define the same electroactive media. The unity objections of the opposition division were based on the fact that claim 1 underlying the decision under appeal encompassed different types of electroactive media a) to f). Since the electroactive media is now restricted to one embodiment according to feature f) which was considered as a single separate invention 6 (decision under appeal, point 14), the unity objection raised has been overcome. Thus, the requirements under Article 82 EPC have been met as well.
6. Since the main request has overcome all the objections raised, the applicant's conditional request that all other requests are withdrawn (see above, point VIII) comes into effect.

Remittal to first instance

7. Since the decision under appeal has not yet dealt with inventive step and since the appellant requested that the case be remitted to the first instance if the objections had been overcome, the board within its discretion finds it appropriate to remit the case to the first instance (Article 111(1) EPC, second sentence).

Since the objection raised in relation to amended page 5a of the description did not form part of the reasons, on which the impugned decision was based (Reasons, point 13), and since the adaptation of the description will depend on the final version found allowable in the further examining proceedings, the board finds it appropriate, not to deal with that issue in substance at this stage. If necessary, the objected page 5a can be brought into line with an allowable claim version at a later stage.

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 for further prosecution on the basis of claims 1 to 5 attached to the letter dated 10 January 2005.

The Registrar:

The Chairman:

C. Eickhoff

R. Teschemacher