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D E C I S I O N
of 17 May 2000

Case Number: T 0341/97 - 3.4.2

Application Number: 90115597.8

Publication Number: 0413313

IPC: H01M 4/50, H01M 10/40

Language of the proceedings: EN

Title of invention:
Non-aqueous secondary cell

Patentee:
SANYO ELECTRIC CO., LTD.

Opponent:
VARTA Batterie AG

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56

Keyword:
"Inadmissible fresh ground for opposition (no) assessment of novelty with respect to the closest prior art"
"Inventive step (yes) ex post facto analysis"

Decisions cited:
G 0007/95

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0341/97 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 17 May 2000

Appellant: (Opponent)
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Representative:
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Respondent: (Proprietor of the patent)
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 5 February 1997 rejecting the opposition filed against European patent No. 0 413 313 pursuant to Article 102(2) EPC.**

Composition of the Board:

Chairman: E. Turrini
Members: S. V. Steinbrener
V. Di Cerbo

Summary of Facts and Submissions

I. The appellant (opponent) lodged an appeal against the decision of the Opposition Division rejecting the opposition against European patent No. 0 413 313.

II. The opposition filed by the appellant against the patent as a whole was based on Article 100(a) EPC since the subject-matter of the patent in suit allegedly lacked novelty and/or inventive step.

III. In its decision, the Opposition Division held that the subject-matter of claim 1 as granted was novel and inventive with respect to the available prior art comprising (in the numbering of the Opposition Division), *inter alia*, document:

D3: EP-A-0 265 950.

IV. The above document was again referred to by the appellant in the statement of grounds of appeal.

Furthermore, the appellant cited the following additional documents

D7: Second International Symposium on Manganese Dioxide - Extended Abstracts, 27 to 29 October 1980, Tokyo, The Electrochemical Society of Japan, pages 177 to 182

D8: Journal of Power Sources, Vol. 26, Nos. 3 & 4, 16 May 1989, pages 355 to 363 (Proceedings of the 4th International Meeting on Lithium Batteries, Vancouver, B.C., Canada, 24 to 27 May 1988), and

D9: Extended Abstracts, 3rd International Meeting on Lithium Batteries, 27 to 30 May 1986, The Electrochemical Society of Japan (ed.), Kyoto 1986, pages 287 to 288

for the first time in the said statement.

V. In a communication pursuant to Article 11(2) of the Rules of Procedure of the Boards of Appeal, the Board shared the parties' view that document D3 came closest to the subject matter of the patent in suit. From the explicit disclosure of said prior art, the subject matter of claim 1 as granted seemed to differ by the specific ranges of surface area and grain sizes of the final product which were not given in D3.

At the scheduled oral proceedings, it should however be addressed whether or not

- said specific parameter ranges were independent from each other or related to redundant requirements;

- said specific parameter ranges would inevitably result from the very similar parameter values chosen in D3 for fabricating the known electrode material, in particular as regards molar ratio and particle size of the starting material and subsequent heat treatment.

If novelty of the claimed subject matter could be established with respect to D3, the question of whether or not, starting from D3, any different features of the claimed subject matter would be obvious to a skilled person should also be discussed at the oral

proceedings.

Since the additional documents D7 to D9 referred to by the appellant in this context had already been filed with the statement of grounds of appeal and seemed to be at least as relevant as the further prior art cited before the first instance, they should be considered at the oral proceedings, in particular having regard to

- the disclosure of any remaining features of claim 1 different from the secondary cell described in D3, and

- the obviousness of utilising such disclosed features for the cell known from D3, i.e. whether or not a skilled person taking account of the teaching of said documents would modify the cell known from D3 in order to arrive at the claimed invention.

VI. The respondent (patent proprietor) reacted to this communication by questioning the admissibility of an assessment of novelty of the claimed subject matter with respect to document D3, which in his opinion amounted to the introduction of a new opposition ground not considered in the impugned decision (see the letter dated 11 April 2000). A referral of this issue to the Enlarged Board of Appeal was requested as a precautionary matter.

Apart from these formal objections, the respondent considered the subject matter of the patent in suit to be clearly new over the teaching of document D3.

VII. The appellant informed the Board that it would not

attend the scheduled oral proceedings.

VIII. Oral proceedings which had been appointed at the respondent's subsidiary request took place on 17 May 2000 in the appellant's absence. At the end of the oral proceedings, the decision of the Board was given.

IX. The appellant requested in writing (see the letter dated 20 March 2000) that the decision under appeal be set aside and that the European patent be revoked.

X. At the oral proceedings, the respondent requested that the appeal be dismissed and the patent be maintained (sole request).

XI. The wording of claim 1 as granted reads as follows:

"1. A rechargeable non-aqueous secondary cell comprising a negative electrode (1), a positive electrode (7) and a separator (8) interposed between said positive and said negative electrodes (1, 7) and impregnated with a non-aqueous electrolyte, said cell being **characterized** in that a positive electrode (7) comprises a lithium-including manganese oxide, acting as an active material, which has a certain range of specific surface area, the above certain range of specific surface area being 9,0 m^2/g to 41,6 m^2/g when measured by the BET method and having a certain range of grain sizes being substantially 20 µm or less when observed by a scanning electron microscope."

Claims 2 to 5 are appended to claim 1.

XII. The appellant advanced the following arguments in the statement of grounds of appeal:

Document D3 discloses a method of fabricating manganese oxides and the use of such oxides in lithium ion cells. The manganese oxides provided in the patent in suit fall within the range of oxides known from D3, the heat-treating temperatures and mixing ratios claimed being already preferred in D3.

Hence, the subject matter of the contested patent differs from the closest prior art only in that a specific range of BET surface areas has been selected and that the range of grain sizes has been further limited. These selections, however, cannot be considered inventive in view of documents D7 to D9.

From Figures 2 and 3 in combination with Table 1 of document D7, it is clearly apparent that BET-surfaces of the manganese oxides in the range of 8,6 to 34,2 m^2/g lead to long discharge times, i.e. guarantee particularly good conditions for the incorporation of lithium. Therefore, a skilled person would be immediately aware of the suitability of this surface area range for lithium ion cells.

Document D8 dealing with the synthesis and specification of manganese oxides for lithium ion cells verifies the fact that a skilled person would utilise lithium-including manganese oxides having a particle size of substantially 20 µm or less, "substantially" meaning that more than 50 weight% of the particles have a grain size < 20 µm.

Therefore, a further specification of the manganese oxides obtained according to D3 with respect to their BET-surfaces and grain sizes would fall within the

competence of a skilled person since, as confirmed by document D9, the electrode materials applied would be routinely tested having regard to the influence of various physical parameters on the chargeability of the cells thus fabricated.

In accordance with established jurisprudence of the boards of appeal, a bonus effect (here: a small increase in cell thickness when overcharged) cannot serve as a basis for inventive step if it is obvious for a skilled person to arrive at the solution claimed because an advantageous effect had to be expected from the combination of prior art teachings.

In consequence, the subject matter of the patent in suit does not involve an inventive step with respect to the overall teaching resulting from documents D3, D7, D8 and D9.

XIII. The respondent's argument in support of its request may be summarised as follows:

The view that document D3 comes closest to the subject matter of claim 1 is not contested. However, the examination of novelty with respect to this prior art relates to a fresh ground for opposition which had been initially raised, but was no longer maintained before the first instance (see the impugned decision) and thus does not form part of the subject matter of the present appeal. Therefore, when taking account of decision G 7/95 of the Enlarged Board of Appeal, an introduction of said fresh ground into the appeal proceedings without the agreement of the patentee is not admissible.

It is not excluded that cells A1 and A2 of document D3 might fall within the scope of claim 1, however the burden of proof for this allegation to inevitably occur is carried by the appellant who has not given any unambiguous evidence in this respect. As can be seen from the respondent's letter dated 11 April 2000, there is no one to one relationship between the specific surface area and the grain size. The specific surface area *inter alia* depends on the initial specific surface area of the manganese dioxide used, which is influenced by varying pore distributions due to different fabrication methods and crystalline structures. Furthermore, the surface area is dependent on lithium content and the heat-treating temperature. Hence, the grain size does not fully determine the specific surface area.

Moreover, the grain size of the cells of D3 resulting from the use of an initial average particle size not exceeding 30 µm remains unclear since the final size is not given and may be influenced by different parameters, e.g. even by the time provided for mixing manganese dioxide and lithium hydroxide (see cells D1 and Z1 of the patent in suit).

As has been exemplified above, the properties of the electrode material are determined by a plurality of parameters in a rather complex way. Although it is admitted that the orders of magnitude of the parameter ranges claimed were known in the art (see documents D7 and D8), there is no indication of the advantageous effects achieved for lithium-including manganese oxide cells. Since these effects are not available for cells which do not contain lithium ions, a skilled person would not apply any parameter values of such cells to

lithium ion cells with a reasonable expectation of success. Therefore, the appellant's arguments are based on a typical ex-post-facto analysis.

Reasons for the Decision

1. *Admissibility of appeal*

The appeal meets the requirements of Rule 65 EPC and is therefore admissible.

2. *Article 54 EPC*

2.1 In the present case, the Board does not consider the objection of lack of novelty with respect to document D3 to be a fresh ground for opposition which cannot be introduced into the appeal proceedings without the agreement of the patent proprietor.

Firstly, said objection had already been raised in the notice of opposition with respect to documents D2 and D3 (see page 2, third paragraph underlining the fact that the novelty objection based on document D2 also holds for document D3) and was actually reconsidered in the impugned decision (see point 5 of the reasons) despite the appellant's alleged declaration that novelty was no more contested (see the impugned decision, point 2 of the reasons). Therefore, the assessment of novelty over D3 forms, in fact, part of the subject matter of the present appeal proceedings.

Moreover, in accordance with decision G 7/95 of the Enlarged Board of Appeal (see the Headnote), the Board would in any case be entitled to consider the

allegation that the claims lack novelty in view of the closest prior art (which in the present case has been agreed by all parties to be document D3) in the context of deciding upon the ground of lack of inventive step.

2.2 The Board arrives at the conclusion that the subject-matter of claim 1 is not anticipated by any one of the documents identified, as can also be seen from the discussion of inventive step below.

In particular, document D3 describes a rechargeable non-aqueous secondary cell comprising a negative electrode, a positive electrode and a separator interposed between said electrodes and impregnated with a non-aqueous electrolyte. Furthermore, the known positive electrode comprises a lithium-including manganese oxide, acting as an active material (see D3, in particular Figure 2 and associated text).

However, the claimed ranges for the specific surface area (i.e. 9,0 m^2/g to 41,6 m^2/g when measured by the BET-method) and the grain sizes (i.e. substantially 20 µm or less when observed by a scanning electrode microscope) of the resulting electrode material are not disclosed in document D3 mentioning only the upper limit of 30 µm for the average particle size of the MnO_2 starting material, and there is no evidence that the process steps used for fabricating cells A1 and A2 of document D3 (see column 4) would inevitably lead to materials falling within said ranges.

As the respondent has plausibly pointed out in the present proceedings, although surface area and grain size are not entirely uncorrelated, both parameters are nevertheless influenced by various further parameters.

Apart from those parameter values specified in D3, i.e. the mixing ratio, the particle size of the MnO_2 starting material and the heat-treating temperature, in particular the distribution of pores and the mixing time are crucial factors determining the surface area and the grain size, respectively. The contribution of pores to the surface area can be seen from a simple model calculation based on 1 µm cubes and resulting in surface areas of about an order of magnitude lower than the lower limit claimed, despite the very small particle size. If the mixing time is reduced from 30 minutes to ten minutes, 20% of the grains have grain sizes of larger than 20 µm (see cells D1 and Z1 of the patent in suit).

In consequence, lacking the necessary information about further relevant factors no persuasive conclusions can be drawn from the knowledge of the prior art process steps so that novelty of the claimed subject matter must be accepted.

3. *Article 56 EPC*

3.1 In accordance with the above findings, the subject matter of claim 1 differs from the closest prior art, i.e. document D3, by the specification of surface area and grain size ranges.

Apparently, the technical effects achieved by said specifications reside in an increased discharge capacity, an improved resistance against overcharge and improved cycle characteristics (see page 2, lines 41 to 46; page 8, lines 33 to 57 and page 10, lines 25 to 34 of the patent in suit).

3.2 Document D7 discloses a broad range of heat-treated MnO_2 samples to be used as positive electrodes for non-aqueous Li/MnO_2 cells, said samples having specific surface areas between 8,6 m^2/g and 87,5 m^2/g (see D7, Table 2).

In the Board's view, a skilled person would, however, not take this prior art into consideration because the electrodes known from D7 do not contain lithium. Since the surface areas must be expected to be modified by the incorporation of lithium, a skilled person would not assume that surface area ranges optimised for MnO_2 could be successfully utilised for lithium-including MnO_2 without any further adjustment. Moreover, even if document D7 were taken into account, its teaching cannot be considered conclusive: an optimum discharge capacity was found for a specific surface area of as low as 8,6 m^2/g (see D7, Table 2 and Figure 3: sample I.C. 11), whereas samples having specific surface areas of 21,8 and 34,2 m^2/g only show mediocre discharge characteristics (see D7, Table 2 and Figure 2: samples I.C. 3 and 4). The authors of D7 therefore expressly find that they were not able to clarify the relation between surface areas and discharge characteristics (see D7, page 181, paragraph iii)).

Hence, the claimed surface area range cannot be considered obvious from document D7.

3.3 Document D8 concentrates on the synthesis of ã-MnO_2 by lithium extraction from the spinel $LiMn_2O_4$ and mentions a mean particle size of 7,5 µm for the resulting product (see D8, page 357, last paragraph and Table 2). The specific spinel-derived ã-MnO_2 can be transformed to

â-MnO_2 by annealing (see D8, page 359, first paragraph). Cathodes of this â-MnO_2 phase are reported to give surprisingly high capacities (see D8, page 360, last paragraph to page 361, first paragraph). The high reactivity of the material is *inter alia* attributed to its small particle size leading to amorphous lithiated products. However, the cells lost capacity rapidly on cycling, as expected by the authors (see D8, page 361, penultimate paragraph).

Again, the high discharge capacity reported in D8 seems to relate to material not including any lithium. If lithiated, the known material becomes amorphous so that a grain size could no longer be characterised, and the cycling characteristic is rather poor. In consequence, the Board does not see how an improved discharge capacity and cycle characteristic could be derived from said disclosure for lithium-including manganese dioxide having grain sizes below 20 µm.

3.4 Therefore, the Board is convinced that neither the claimed surface area range nor the claimed grain size range as such are obvious from documents D7 and D8, respectively. Nor is there any incentive given by said documents to combine the claimed ranges for the solution of the above problem since both documents only deal with one of said respective parameters and are completely silent on the other. In the Board's view, selecting individual elements of a disclosed invention from various pieces of prior art without taking account of the proper context amounts to a typical *ex-post facto* analysis.

This finding is not altered by document D9 only mentioning a non-exhaustive list of parameters

correlated with rechargeability and physical properties of Li secondary batteries using MnO_2 as the cathode material (see D9, page 287, last paragraph). Even if surface area and particle size are included in this list, this does not mean that a skilled person would select on an *ad hoc* basis any isolated numerical values published somewhere in the prior art.

3.5 Therefore, the subject-matter of claim 1 as granted involves the inventive step required by Articles 52(1) and 56 EPC, and claim 1 is accordingly allowable.

Dependent claims 2 to 5 concerning specific embodiments of claim 1 and the remaining parts of the patent specification also in substance meet the requirements of the EPC.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman::

E. Görgmaier E. Turrini