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**Datasheet for the decision
of 26 September 2018**

Case Number: T 0044/17 - 3.3.05

Application Number: 03757346.6

Publication Number: 1518287

IPC: H01M6/16

Language of the proceedings: EN

Title of invention:

NONAQUEOUS ELECTROCHEMICAL CELL WITH IMPROVED ENERGY DENSITY

Patent Proprietor:

Energizer Brands, LLC

Opponents:

Koninklijke Philips N.V.
The Gillette Company
Spectrum Brands, Inc.

Headword:

Nonaqueous electrochemical cell/ Energizer

Relevant legal provisions:

EPC Art. 56
RPBA Art. 12(4)
EPC R. 103(1)(a)

Keyword:

Inventive step - (no)

Late-filed auxiliary requests - admitted (no)

Reimbursement of appeal fee - (no)

Decisions cited:

T 0939/92, T 0971/11

Catchword:



Beschwerdekammern

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Case Number: T 0044/17 - 3.3.05

D E C I S I O N
of Technical Board of Appeal 3.3.05
of 26 September 2018

Appellant:
(Patent Proprietor)

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Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted on 4 November 2016
revoking European patent No. 1518287 pursuant to
Article 101(3) (b) EPC**

Composition of the Board:

Chairman E. Bendl
Members: G. Glod
 P. Guntz

Summary of Facts and Submissions

- I. The present appeal lies from the decision of the opposition division to revoke European patent EP 1 518 287 for lack of inventive step.

The following documents cited in the impugned decision are of relevance to the present decision:

E1a: EP 0 930 664 A2

E28: Drawing of a cell according to Example 2 of the patent-in-suit

- II. In appeal proceedings the appellant re-submitted the main request which formed the basis of the impugned decision and additionally presented five auxiliary requests which had not been admitted by the opposition division.
- III. In the communication pursuant to Article 15(1) RPBA, the board was of the preliminary opinion that the appeal was likely to be dismissed.
- IV. Claim 1 of the main request reads as follows:

"1. An electrochemical cell comprising a nonaqueous electrolyte, an anode and a cathode assembly, the electrolyte comprising a solvent, the cathode assembly comprising a metallic cathode current collector having two major surfaces and a cathode coating disposed on at least one of the two major surfaces, the coating comprising iron disulfide, and the anode being a lithium metallic foil anode alloyed with aluminum, wherein the anode to cathode input ratio is less than or equal to 1.0, wherein the anode to cathode input ratio is determined as follows:

anode to cathode input ratio = anode capacity per 2.54 cm [linear inch]/cathode capacity per 2.54 cm [linear inch]

wherein the anode capacity per 2.54 cm [linear inch] = (foil thickness) x (interfacial electrode width) x (2.54 cm) [1 linear inch] x (density of lithium foil at 20°C) x (lithium energy density, 3861.7 mAh/g) and the cathode capacity per 2.54 cm [linear inch] = (final cathode coating thickness) x (interfacial electrode width) x (2.54 cm) [1 inch] x (cathode dry mix density) x (final cathode packing percentage) x (dry weight percent FeS₂) x (percent purity FeS₂) x (FeS₂ energy density, 893.58 mAh/g)."

V. Oral proceedings took place on 26 September 2018.

VI. The arguments of the **appellant (patent proprietor)** may be summarised as follows:

The opposition division did not sufficiently substantiate why Ela could be considered to be the closest prior art. In fact, example 2 of the patent in suit was the closest prior art. Ela related to a different field of technology (medical devices) and a different technical problem and provided teaching contrary to the essence of the present invention. Ela related to Li/silver vanadium oxide (SVO) cells, and iron disulfide was only disclosed as an additional material. The swelling problem was specific to the type of batteries disclosed in Ela. Taking into account the problem of providing a non-aqueous Li/FeS₂ electrochemical cell with improved discharge capacity, Ela taught that the discharge capacity was reduced when the interfacial A/C ratio was decreased. Ela also pointed out that the optimal A/C ratio depended on the type of cathode chosen, so the skilled person would

understand that the teaching of Ela was limited to the type of battery (Li/SVO) described. Ela did not teach the skilled person that results opposite to those disclosed in Ela would be achieved for Li/FeS₂ cells. In Li/FeS₂ cells swelling could not be prevented and the cathode swelling was unaffected by the A/C ratio.

The problem was to provide a cell having improved discharge properties.

In a Li/FeS₂ cell, the cell capacity increased as the A/C ratio decreases. Further, the cathode efficiency was only weakly dependent on A/C ratios ranging between 1.15 and 0.89. The cells swelled at all depths of discharge. The comparison shown in Table 2 demonstrated that the feature distinguishing the claimed cell over the conventional prior art cell, i.e. the interfacial anode to cathode input capacity ratio, gave rise to an unexpected technical improvement in terms of an improved discharge time/discharge capacity which extended significantly beyond what would have been expected by the person skilled in the art. From Table 2 of the patent, it could be deducted that the inventive cell had a better discharge efficiency than the comparative one according to example 2.

There was no pointer towards the specific combination of features.

By not admitting auxiliary requests 1 to 5 into the proceedings, the opposition division had not properly exercised its discretion and had thereby committed a substantial procedural violation. Therefore, the case should be remitted and the appeal fee reimbursed. These auxiliary requests were designed to more closely encompass the inventive experimental example of the

opposed patent and were a reply to the invitation of the opposition division to submit amended claims. The amendments are based on dependent claims. No further substantiation was provided, since it was not clear whether the requests were formally admitted into the proceedings.

VII. The arguments of **respondent 1 (opponent 1)** are essentially as follows:

Claim 1 of the main request was not limited to iron disulfide, but allowed for the presence of other materials in the cathode. In any event iron disulfide was explicitly mentioned in E1a. The only difference between claim 1 and E1a was the fact that E1a did not explicitly refer to the interfacial area. The problem to be solved could only be seen in the provision of an alternative cell. It was generally known that the anode to cathode ratio based on the total anode and cathode input capacities in an arrangement of E1a was substantially the same as the ratio calculated on the interfacial basis, especially since E1a disclosed a jellyroll structure.

The auxiliary requests should not be admitted into the proceedings. They had only been filed before the second oral proceedings before the opposition division and were not substantiated.

VIII. The arguments of **respondent 2 (opponent 2)** are essentially as follows:

E1a was the closest prior art and no data were provided that showed an effect linked to the distinguishing technical features. The problem was to provide an

alternative cell. The solution was obvious in view of E1a.

There was no apparent reason why the auxiliary requests had only been filed at a very late stage of the proceedings. No reasons were given why they should be clearly allowable.

IX. The arguments of the **respondent 3 (opponent 3)** may be summarised as follows:

E1a was the closest prior art, since it also linked the swelling problem to the cell capacity. The patent failed to establish that there was any unexpected benefit or new technical effect involved in rebalancing the A/C ratio of the exemplified cell whether or not measured on an interfacial basis. In the example of the patent, there was only a 20% increase in discharge capacity attributable to the increased cathode material, which was an entirely predictable increase in battery performance arising from an increase of around 25% in cathode theoretical input capacity.

The data of the patent failed to demonstrate that there was an improvement over the whole scope of claim 1. Example 1 of the patent was a very specific cell that was far from being reflected in claim 1. There was no relevant comparative data which compared the behaviour of the exemplified cathode materials in E1a with cells of claim 1.

The problem could only be seen as the provision of an alternative cell. The solution was obvious in view of the teaching of E1a.

The auxiliary requests should not be admitted into the proceedings. No substantiation of why the added features involved an inventive step had been provided before the opposition division, and there was still none during the appeal proceedings.

- X. The appellant requests that the impugned decision be set aside and that the patent be maintained in amended form on the basis of the main request submitted on 30 January 2014, or alternatively, that the patent be maintained on the basis of one of auxiliary requests 1 to 5, submitted on 22 July 2016.

Respondents 1 to 3 request that the appeal be dismissed.

Reasons for the Decision

Main request

1. Article 56 EPC

- 1.1 Invention

The invention relates to a non-aqueous cell having lithium as active anode material and iron disulfide as active cathode material.

- 1.2 Closest prior art

E1a is considered the closest prior art, since it generally relates to a lithium/metal or metal oxide or mixed metal oxide or metal sulfide (claim 9) battery that is dischargeable to deliver high capacity, but which experiences little, if any, swelling during

discharge (paragraph [0004]). E1a does not relate to the problem of swelling only, but to a combination of high capacity and little swelling (see also page 2, lines 8 and 9, and page 7, lines 32 and 33). E1a discloses specifically a Li/silver vanadium oxide (Li/SVO) cell activated with 1.0M LiAsF₆ in a 50:50 mixture, by volume, of PC (propylene carbonate):DME (1,2-dimethoxyethane) (page 5, lines 18 and 19; page 6, lines 3 to 5). However, the disclosure is not limited to this specific embodiment, but encompasses other cathode materials (see paragraph [0020]).

Example 2 of the patent in suit cannot be taken as prior art, since it is not clear whether exactly those cells with the specific composition were publicly available. Even if it were accepted that said cells were prior art, it was still not known in what context they were used and which properties were especially relevant to them. Therefore, it cannot be argued that they implicitly related to discharge capacity and discharge efficiency and that they related to the same technical problem.

1.3 Problem

The problem to be solved is to provide a cell with increased energy density and discharge efficiency that accommodates the volume increase of the reaction products generated during discharge (paragraph [0006] of the patent).

1.4 Solution

As a solution to the problem a cell according to claim 1 is proposed characterised in that the cathode coating comprises iron disulfide and the anode is a

lithium metallic foil anode alloyed with aluminum, wherein the anode to cathode input ratio is less than or equal to 1.0, wherein the anode to cathode input ratio is determined as follows:

anode to cathode input ratio = anode capacity per 2.54 cm [linear inch]/cathode capacity per 2.54 cm [linear inch]

wherein

the anode capacity per 2.54 cm [linear inch] = (foil thickness) x (interfacial electrode width) x (2.54 cm) [1 linear inch] x (density of lithium foil at 20 °C) x (lithium energy density, 3861.7 mAh/g)

and

the cathode capacity per 2.54 cm [linear inch] = (final cathode coating thickness) x (interfacial electrode width) x (2.54 cm) [linear inch] x (cathode dry mix density) x (final cathode packing percentage) x (dry weight percent FeS₂) x (percent purity FeS₂) x (FeS₂ energy density, 893,58 mAh/g).

1.5 Success of the solution

According to the appellant the cell accommodates the volume increase of the reaction products generated during discharge. However, according to paragraph [0003] of the patent the cell design needs to be such that it is able to accommodate the volume increase. Claim 1 does not contain a feature that allows for such accommodation. As a consequence, the appellant's argument that swelling was not a problem, as it could not be avoided anyway is not convincing, since said problem has to be solved by a special cell construction, which is not present in claim 1.

Example 1 of the application was carried out with a very specific cathode coating composition different

from the coating composition of example 2. The coating weight was approximately 25% higher than in example 2. Yet the actual discharge capacity increase attributed to the difference in anode to cathode input ratio is only 20% (see page 6, lines 54 and 55).

The difference in the discharge efficiency between example 1 and 2 was indicated to be 7%. However, this difference is based not only on the different anode to cathode input ratio, but on the different coating composition, which is not reflected in the claim. It is evident from the description that the choice of other factors, like the use of highly crystalline synthetic graphite, can improve high rate discharge performance (page 3, lines 48 to 59). Furthermore, it is indicated that applying a slurry formulation when coating the cathode also has an impact on the discharge efficiency of the cell (page 3, lines 15 to 20).

There is also no evidence that the cathode coating comprising iron disulfide in combination with the lithium metallic foil anode alloyed with aluminum allows for any improvement in energy density and discharge efficiency compared to the cell materials used in example 1 of E1a.

In view of all these factors, the board is not convinced that the problem is solved over the whole range claimed.

1.6 Reformulation of the problem

The problem has to be reformulated in a less ambitious way and can be seen as the provision of an alternative electrochemical cell.

1.7 Obviousness

E1a discloses Li-Al alloy in the form of a foil as one possible anode material among others (page 3, lines 20 to 24). E1a teaches iron disulfide as cathode active material (page 4, line 5). There is no doubt that iron disulfide is presented as a possible cathode material that can be used either alone or in mixtures with other materials (claim 9 in combination with paragraph [0020]). Claim 1 of the request encompasses both possibilities.

The preferred anode to cathode capacity ratio from about 0.68 to 0.96 (claim 3 of E1a) will lead to an anode to cathode input ratio that is less than or equal to 1.0, even if only the interfacial electrode width is considered. E1a also relates to a jellyroll configuration (page 4, line 23), in which case the difference between interfacial electrode width and electrode width is expected to be small. As indicated in the impugned decision, this is confirmed by E28.

The argument that the range indicated in E1a would not be considered, since swelling was not relevant, cannot be accepted, since swelling is also important for iron disulfide cathodes as stated in paragraph [0003] of the patent in suit. Furthermore, claim 1 of the request is not limited to any type of electrolyte, so the argument that the reaction shown in E1a (page 5, line 25) does not apply in the present case is without merit. Although the drawing on page 25 of the statement of grounds of appeal is intended to show that in Li/FeS₂ cells swelling cannot be completely prevented and the cathode swelling was unaffected by the A/C ratio in the small range of 0.88 to 1.01, it appears that there is still a difference between 25 and 100% DOD and between

an interfacial A/C ratio of 0.88 and 1.01. As already indicated in the formulation of the problem, swelling (volume increase) is relevant in the present case.

Although Ela does not explicitly disclose the claimed features in combination, as indicated in T 249/11, their combination is one possibility among others taught in Ela. The solution proposed to the (not very ambitious) problem has to be considered to be within the teaching of Ela, since a mere arbitrary choice from the possible solutions cannot involve an inventive step (T 939/92, Reasons 2.5.3).

- 1.8 The requirements of Article 56 EPC are not met and the main request must fail.

Auxiliary requests 1 to 5

2. Article 12(4) RPBA

These requests were submitted before the opposition division on 22 July 2016, within the time limit of Rule 116 EPC. However, the only substantiation that was provided with respect to inventive step reads as follows:

"The observations set forth above with respect to the unobviousness of claim 1 of the Main Request mutatis mutandis apply to the claim 1 of the sets of claims of the Auxiliary Requests. It is submitted that none of the prior art References cited contains and teaching of [sic] suggestion towards the subject-matter claimed which essentially reflects the embodiment of Example 1 shown in Table 2 of the Opposed Patent."

The opposition division regarded the requests as not substantiated and considered that substantiation of the requests only during oral proceedings was unfair. It decided not to admit the requests in accordance with Article 114(2) EPC.

The board understands from the decision (II.2.3.1) that the opposition division considered the requests as having been submitted only on the date of their substantiation. This is in line with case law (see Case Law of the Boards of Appeal of the EPO, 8th edition 2016, IV.E.4.2.4).

Even during the oral proceedings before the opposition division, the appellant did not provide any reasons why these requests had only been filed at that stage and why they were not substantiated when filed. It was only argued that the requests were based on dependent claims, so no objections under Article 123(2) EPC could arise (see minutes of the oral proceedings before the opposition division, points 8.1 and 8.3). In the present case, objections against all granted claims had already been raised when the oppositions were filed. Therefore, it was up to the appellant to explain why these objections were without merit and why the requests would overcome them. Simply stating that the requests reflect example 1 is not considered to satisfy this requirement, as that is not immediately apparent from the broad wording of the claim. Further, it is not apparent why the amendments overcome previous objections, since according to the appellant's arguments the observations made with regard to the main request also apply to the auxiliary requests.

In the present case, there are no apparent reasons why the appellant only intended to substantiate requests

that should overcome objections raised from the outset during the second oral proceedings before the opposition division after remittal from the boards of appeal. Therefore, such a way of proceeding can be judged as unfair and contrary to procedural economy. The opposition division when exercising its discretion under Article 114(2) EPC took this behaviour into consideration. The opposition division's course of action is considered acceptable in the present case and no procedural violation, let alone a substantial one can be identified.

Since the admission of requests is often based on allowability criteria and since the other party must have the opportunity to properly respond to newly filed requests, it is evident that the requests need to be substantiated when filed.

Applying the conclusion of T 971/11 (Reasons 1.3) to requests, the board could still admit the requests not admitted by the opposition division. However, even at the appeal stage, the appellant provided only a general statement that the sets of claims for auxiliary requests 1 to 5 were directed to preferred embodiments of the main request which were designed to more closely encompass the inventive experimental example of the opposed patent. According to the appellant, there was no teaching regarding the specific combination of features presented therein, and so in common with the subject-matter of the main request the auxiliary requests were inventive over the prior art cited. It cannot be understood from such a general statement why the auxiliary requests could be considered to involve an inventive step. Rather, it confirms the view that the conclusion as to the main requests also applies to the auxiliary requests. Therefore, the board sees no

reason why the auxiliary requests should still be admitted into the proceedings.

3. Reimbursement of the appeal fee (Rule 103(1)(a) EPC)

As indicated above, the board cannot identify any procedural violation that the opposition division has committed by not admitting the auxiliary requests.

Further, the opposition division chose E1a as the closest prior art for the reasons given under II.2.2.2 (second paragraph). Although it did not provide reasons why example 2 of the patent could not be considered the closest prior art, it appears from the cited paragraph that it considered E1a to be particularly relevant in view of the features disclosed. A lack of reasoning is not apparent.

In any case, since the appeal is not allowable, so the request for reimbursement of the appeal fee cannot be granted.

Order

For these reasons it is decided that:

1. The appeal is dismissed.
2. The request for reimbursement of the appeal fee is rejected.

The Registrar:

The Chairman:



C. Vodz

E. Bendl

Decision electronically authenticated