BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

Internal distribution code:
(A) [ ] Publication in OJ
(B) [ ] To Chairmen and Members
(C) [ ] To Chairmen
(D) [X] No distribution

Datasheet for the decision of 25 September 2013

Case Number: T 0918/09 - 3.4.01

Application Number: 03002991.2

Publication Number: 1340992

IPC: G01R 31/36

Language of the proceedings: EN

Title of invention:
Method and apparatus for charge and discharge control of battery pack

Applicant:
TOYOTA JIDOSHA KABUSIKI KAISHA

Headword:
-

Relevant legal provisions (EPC 1973):
EPC Art. 83, 84, 52, 54(1)(2), 56,

Keyword:
"Single request: Amendments allowable (yes), clarity (yes); disclosure (yes), novelty and inventive step (yes)"

Decisions cited:
-

Catchword:
-

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0918/09 - 3.4.01

D E C I S I O N
of the Technical Board of Appeal 3.4.01
of 25 September 2013

Appellant: (Applicant)
TOYOTA JIDOSHA KABUSHIKI KAISHA
1, Toyota—cho,
Toyota—shi,
Aichi—ken, 471—8571 (JP)

Representative:
Kuhnen & Wacker
Patent— und Rechtsanwaltsbüro
Prinz-Ludwig—Straße 40A
D-85354 Freising (DE)

Decision under appeal:
Decision of the Examining Division of the European Patent Office posted 5 December 2008 refusing European patent application No. 03002991.2 pursuant to Article 97(2) EPC.

Composition of the Board:

Chairman: G. Assi
Members: T. G. Zinke
C. Schmidt

Summary of Facts and Submissions

I. The appeal filed on 10 February 2009 lies from the decision of the Examining Division, posted on 5 December 2008, refusing European patent application No. 03 002 991.2 published with the publication No. 1 340 992. The appeal fee was paid on the same day. The statement setting out the grounds of appeal was filed on 8 April 2009.

II. In the decision under appeal, the Examining Division found that the subject-matter of independent claims 1 and 7 according to the then pending main request and auxiliary request did not fulfil the requirements of Article 84 EPC 1973 and Article 83 EPC 1973. In particular, the Examining Division held that the parameters *"state quantity"*, *"least state quantity"*, *"set of predetermined number of cells"* mentioned in the claims as well as the parameters *"capacity"*, *"remaining capacity"*, *"state of charge"*, *"SOC"*, *"lower limit value"* and *"upper limit value"* mentioned in the description were ambiguous. These parameters were essential for the definition of the invention but were not clearly defined in the description and therefore could not be measured unambiguously by a skilled person.

Despite the lack of clarity and disclosure, the Examining Division *"for reasons of procedural economy"* also raised objections under Articles 54(1), (2) and 56 EPC 1973 thereby following the applicant's interpretation of the ambiguous parameters mentioned above.

The documents considered were:
D1: EP-A-0 967 108
D3: US-A-6 020 718.

III. During oral proceedings before the Board on 25 September 2013 the Appellant (Applicant) requested, as single final request, that the decision under appeal be set aside and a patent be granted based on the following documents:

- Claims 1 to 4 as filed during oral proceedings;
- Description pages 1 to 6 as filed during oral proceedings; and
- Figures 1 to 4 as filed during oral proceedings.

IV. Independent claim 1 of the final request reads as follows:

1. A charge/discharge control method for a hybrid vehicle battery pack (12) having a plurality of battery cells connected in series (10), wherein the charge/discharge control method comprises:
measuring the voltage of each battery cell (10),
computing a state quantity value of each battery cell (10),
performing a charge control and a discharge control of the battery pack based on a least state quantity value determined as the least value of the computed state quantity values of the battery cells (10),
wherein the state quantity value of each battery cell (10) is the percentage of the remaining capacity value to the fully charged capacity value,

wherein the remaining capacity value of each battery cell (10) is computed from the measured voltage of the battery cell (10),
wherein the charge control is performed so that the least state quantity value is smaller than 80 % and the discharge control is performed so that the least state quantity value is higher than 20 %.

Independent claim 3 of the final request reads:

3. A charge/discharge control apparatus for a hybrid vehicle battery pack (12) having a plurality of battery cells connected in series (10), for carrying out the method of claim 1 or 2,
the apparatus comprising:
voltage detection means (14) for measuring the voltage of each battery cell (10);
computation means (16) for computing the state quantity value of each battery cell (10); and
charge/discharge control means (18) for performing the charge control and the discharge control of the battery pack based on the least state quantity value determined as the least value of the computed state quantity values of the battery cells (10).

Claims 2 and 4 are dependent claims.

V. The Appellant argued that claims 1 and 3 of the final request fulfilled the requirements of Article 123(2) EPC and of Article 84 EPC 1973. In addition, due to the amendments and clarifications in the formulation of the claims a person skilled in the art could unambiguously measure the parameters that were objected to under Article 83 EPC 1973. Further, the subject-matter of

claims 1 and 3 of the final request fulfilled the requirements of novelty and inventive step, since neither of the documents D1 or D3 disclosed the use of the *"least state quantity value"* for controlling the charging and discharging step of the battery pack.

Reasons for the Decision

1. The appeal is admissible.

2. Article 123(2) EPC and Article 84 EPC 1973

2.1 In the claims formerly objected terms *"state quantity"*, *"least state quantity"*, *"set of a predetermined number of cells"* have been replaced or specified by specific expressions originally disclosed in the application as filed, e.g. *"state quantity"* by *"percentage of the remaining capacity value to the fully charged capacity value"* (cf. par. [0024]), *"set of a predetermined number of cells"* by *"battery cells"* (cf. par. [0024]), *"battery pack"* by *"hybrid vehicle battery pack"* (cf. par. [0001] to [0003]), *"upper limit value"* by *"80%"* and *"lower limit value"* by *"20%"* (cf. par. [0004]).

2.2 Further, it is now clear that both the charge and the discharge control are based on the least state quantity value, as it is disclosed originally e.g. in par. [0011].

2.3 The Board has no objections under Articles 123(2) EPC and Article 84 EPC 1973 with regard to the claims on file.

3. Article 83 EPC 1973

The person skilled in the art, when reading the whole disclosure of the application, will conclude that generic terms as e.g. *"state quantity"*, *"state of charge"*, *"upper limit value"* or *"lower limit value"* used in the description can be understood in a more precise way as meaning *"remaining capacity"*, *"80%"* or *"20%"*. With this understanding, the person skilled in the art is able to carry out the invention. Hence, the objection under Article 83 EPC 1973 no longer applies.

4. Novelty (Article 54(1),(2) EPC 1973)

4.1 Document D1 at least does not disclose that the charge control is performed so that the *"least state quantity value"* is smaller than 80%. Hence, the subject-matter of claims 1 and 3 is novel as compared to document D1.

4.2 Document D3 does not deal with hybrid vehicle batteries and, in addition, also does not disclose that the charge control of a battery pack is performed so that the *"least state quantity value"* is smaller than 80%. Hence, the subject-matter of claims 1 and 3 is also novel with regard to document D3.

5. Inventive Step (Article 56 EPC 1973)

5.1 Since document D1 deals with hybrid vehicle batteries, it is considered to represent the closest prior art document. Starting from D1 the distinguishing feature of the battery control based on the *"least state quantity value"* has the technical effect that the calculation needed for the control is simpler, since

only the *"least state quantity value"* has to be computed.

5.2 Neither document D1 nor document D3 discloses that the *"least state quantity value"* can be used for control of the charge of the battery.

5.3 Document D1 discloses that the *"SOC value"* is set to a *"lower control limit value"* of e.g. 20% when a voltage difference above a predetermined value is detected between individual battery cells (cf. e.g. par. [0035], 0036]) indicating an overdischarged cell during discharge operation. However, D1 is silent about the meaning of the *"SOC value"* that is used for controlling the charging operation of the battery pack (cf. e.g. par. 0026]).

5.4 Document D3 discloses that excessive discharge of battery cells is prevented by cutting off the output of a battery unit when the output voltage of at least one battery cell becomes less than or equal to an excessive discharge limit voltage (cf. col. 6, lines 23 to 28). Hence, the discharge of a battery unit is controlled by evaluating a least voltage among the battery cells. Charging of a battery unit is disclosed in the second embodiment (cf. Fig. 3). In connection with this second embodiment D3 explicitly mentions that excessive charging of the battery unit is prevented by cutting off a charger when the output voltage of at least one battery cell becomes greater than an excessive charge limit voltage (cf. col. 9, lines 44 to 65 of D3). Hence, in D3 it is only disclosed that a greatest voltage of a cell(i.e. a greatest remaining capacity) is controlled when charging the battery unit.

Further, in the embodiment of Fig. 10 and the corresponding description (col. 12, lines 23 to 54) of D3 it is disclosed that a minimum voltage received from the battery unit is used to calculate an output voltage of the battery unit as a whole and that the output voltage of the battery unit as a whole is output to a user. However, it is not disclosed that this output voltage of the battery unit is used for control of charging the battery unit.

5.5 Since neither document D1 nor document D3 provides any hint towards the claimed solution of using the *"least state quantity value"* for charge and discharge control, the subject-matter of claims 1 and 3 is based on an inventive step (Article 56 EPC 1973).

5.6 Hence, the reasons for refusing the application are invalidated by the amendments made by the Appellant.

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 in the following version:

   – claims 1 to 4 received during oral proceedings of 25 September 2013;

   – description pages 1 to 6 received during oral proceedings of 25 September 2013; and

   – figures 1 to 4 received during oral proceedings of 25 September 2013.

The Registrar: The Chairman:

R. Schumacher G. Assi