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Datasheet for the decision of 13 October 2009

Case Number: T 1594/06 - 3.5.02

Application Number: 99921254.1

Publication Number: 1081499

IPC: G01R 31/36

Language of the proceedings: EN

Title of invention:
Means for estimating charged state of battery and method for estimating degraded state of battery

Patentee:
Toyota Jidosha Kabushiki Kaisha

Opponent:
DaimlerChrysler AG

Headword:
-

Relevant legal provisions:
EPC Art. 54

Relevant legal provisions (EPC 1973):
-

Keyword:
"Novelty - no (all requests)"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 1594/06 **-** 3.5.02

D E C I S I O N
of the Technical Board of Appeal 3.5.02
of 13 October 2009

(Opponent) DaimlerChrysler AG
Epplestrasse 225
D-70567 Stuttgart (DE)

Representative: -

Respondent:
(Patent Proprietor) Toyota Jidosha Kabushiki Kaisha
1, Toyota-cho
Toyota-shi, Aichi-ken, 471-8571 (JP)

Representative: TBK-Patent
Bavariaring 4-6
D-80336 München (DE)

Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office posted 21 April 2006 concerning maintenance of European patent No. 1081499 in amended form.**

Composition of the Board:

Chairman: M. Ruggiu
Members: R. Lord
H. Preglau

Summary of Facts and Submissions

I. Both the proprietor and the opponent appealed against the interlocutory decision of the opposition division concerning the European patent No. 1 081 499 that, account being taken of the amendments made by the patent proprietor, the patent and the invention to which it related met the requirements of the EPC.

II. In the contested decision the opposition division held *inter alia* that the subject-matter of claim 1 of the first auxiliary request filed during the oral proceedings of 21 February 2006 was new in the sense of Article 54 EPC and involved an inventive step in the sense of Article 56 EPC.

III. Of the documents cited during the opposition and appeal proceedings, only the following is relevant to this decision:

DC01:EP-A-0 505 333.

IV. In a communication dated 8 May 2009 accompanying a summons to oral proceedings, the board indicated that it had difficulty in clearly identifying the technical feature (or features) which distinguish(es) the claimed means according to claim 1 of the then sole request of the patent proprietor (current main request) from the means of document DC01, and that it was thus possible to interpret that claim in such manner that its subject-matter would not be new according to Article 54(1) and (2) EPC.

Oral proceedings before the board took place on 13 October 2009, at which the opponent was not represented, as he had previously indicated in his letter dated 14 September 2009.

The appellant proprietor requested that the decision under appeal be set aside and that the patent be maintained in amended form on the basis of claims 1 to 7 filed with letter dated 31 August 2006 (main request), or in the alternative on the basis of claims 1 to 5 received during the oral proceedings (first auxiliary request), or on the basis of claims 1 to 7 filed with letter dated 11 September 2009 (second auxiliary request).

The board noted that the appellant opponent had requested in writing that the decision under appeal be set aside and that the patent be revoked.

V. Claim 1 of the patent according to the proprietor's main request and according to his second auxiliary request reads as follows:

"Means for estimating a state of charge of a battery, comprising a battery model for determining a pseudo-SOC, i.e., state of charge, as a temporary value representative of the SOC of the battery and estimating a voltage of the battery by considering the pseudo-SOC and a change in state of the battery, whereby a real SOC is estimated by correcting the pseudo-SOC so that the estimated voltage of the battery is equal to an actually measured voltage of the battery,
wherein the battery model includes:
pseudo-SOC estimating means (14) for determining the

pseudo-SOC from charging/discharging current of the battery,
electromotive force estimating means (16) for estimating the voltage (Voc) of the battery in accordance with the pseudo-SOC output from the pseudo-SOC estimating means,
voltage change estimating means (18) for estimating a change in the voltage of the battery caused by internal resistance, and
dynamic voltage change estimating means (20) for estimating a change in the voltage of the battery based on a change in the charging/discharging current of the battery,
wherein the voltage of the battery is estimated from the sum of output values of the electromotive force estimating means, the voltage change estimating means, and the dynamic voltage change estimating means."

VI. Claim 1 of the patent according to the proprietor's first auxiliary request reads as follows:

"Means for estimating a state of charge of a battery, comprising a battery model for determining a pseudo-SOC, i.e., state of charge, as a temporary value representative of the SOC of the battery and estimating a voltage of the battery by considering the pseudo-SOC and a change in state of the battery, whereby a real SOC is estimated by correcting the pseudo-SOC so that the estimated voltage of the battery is equal to an actually measured voltage of the battery,
wherein the battery model includes:
pseudo-SOC estimating means (14) for determining the pseudo-SOC from charging/discharging current of the battery by integrating the charging/discharging current

detected by a current sensing means (10) and adding it to a predetermined initial SOC value,
electromotive force estimating means (16) for estimating the voltage (Voc) of the battery in accordance with the pseudo-SOC output from the pseudo-SOC estimating means,
voltage change estimating means (18) for estimating a change in the voltage of the battery caused by internal resistance, and
dynamic voltage change estimating means (20) for estimating a change in the voltage of the battery based on a change in the charging/discharging current of the battery,
wherein the voltage of the battery is estimated from the sum of output values of the electromotive force estimating means, the voltage change estimating means, and the dynamic voltage change estimating means."

VII. The arguments of the appellant proprietor, as far as they are relevant to the present decision, are essentially as follows:

The estimating means of claim 1 of the main and second auxiliary requests was distinguished from that of DC01 in that in the claimed means the pseudo-SOC is determined solely from the charging/discharging of the battery, and is then corrected to generate the real SOC, whereas in that of DC01 (as depicted in Fig. 3) the measured current, not the pseudo-SOC, is corrected, and the correction of the SOC is then generated by the integration block.

The amendment to claim 1 in the first auxiliary request represented merely a clarification of the definition of

the pseudo-SOC estimating means, and was intended to address the interpretation of that definition raised by the board during the oral proceedings, so should be admitted into the procedure. The amendment had a clear basis in paragraph [0026] of the patent, and therefore met the requirements of Article 123(2) EPC. Finally, by defining explicitly how the pseudo-SOC is calculated on the basis of the measured current, the amendment clearly distinguished the claimed means from that of DC01.

VIII. The relevant arguments of the appellant opponent can be summarised as follows:

Document DC01 disclosed a means for estimating a charge of a battery including all of the technical features of claim 1 according to the proprietor's main request with the exception that in the claimed estimating means a pseudo-SOC is determined in a first step, and the SOC is then calculated by addition of a correction to that value, whereas in DC01 the correction is provided already to the initial value of the SOC.

Reasons for the Decision

1. The appeals are both admissible.

2. *Main request of patent proprietor*

2.1 The document DC01 describes a means for estimating a state of charge of a battery, comprising a battery model (page 3, lines 37 and 38, Figs. 1, 2 and 3) for determining a value representative of the SOC (Q in

Fig. 2, ^Q in Fig. 3) of the battery (referred to here as "SOC", so as to clearly distinguish it from the real SOC) and estimating a voltage of the battery by considering the "SOC" and a change in state of the battery, whereby a real SOC is estimated by correcting the "SOC" (correction generated by block C of Fig. 3) so that the estimated voltage of the battery is equal to an actually measured voltage of the battery (page 4, lines 26 to 31, and in Fig. 3 the summing element below block A), wherein the battery model includes:

"SOC" estimating means for determining the "SOC" from charging/discharging current of the battery (Figs. 1 to 3, in particular blocks C, D and E of Fig. 3),

electromotive force estimating means for estimating the voltage (E_p) of the battery in accordance with the "SOC" output from the "SOC" estimating means (in Fig. 2 E_p depends on Q, and in Fig. 3 ΔE_p depends on ^Q),

voltage change estimating means for estimating a change (ΔV_p) in the voltage of the battery caused by internal resistance (page 3, lines 34 and 35, page 4, line 45, Fig. 3, block D), and

dynamic voltage change estimating means for estimating a change (ΔV_d, ΔV_w) in the voltage of the battery based on a change in the charging/discharging current of the battery (Fig. 3, block D, the boxes indicating the fast and slow time constants T_d and T_w, page 4, lines 41 and 42),

wherein the voltage of the battery is estimated from the sum of output values of the electromotive force estimating means, the voltage change estimating means and the dynamic voltage change estimating means (see the three summing elements in the lower part of block D of Fig. 3).

2.2 Furthermore, DC01 describes (see page 5, lines 30 to 56 and Figs. 4 and 5) that the battery model operates as a computer program running on a microprocessor, from which it follows that the estimated value of the SOC is calculated iteratively. On this basis, it can be considered that the SOC estimate produced in the first iteration corresponds to the pseudo-SOC of the present claim 1, and that the estimates from subsequent iterations correspond to the real SOC. Thus the estimating means of DC01 includes all the technical features of claim 1 according to the patent proprietor's main request, so that the subject-matter of this claim is not new according to Article 54(1) and (2) EPC.

2.3 The proprietor has argued that the interpretation of the definition of the pseudo-SOC estimating means which is inherent in the previous paragraph is incorrect, because the claim defines that the pseudo-SOC is determined solely from the charging/discharging current of the battery, whereas Fig. 3 of DC01 indicates that the initial iteration of the calculation of the SOC (like all subsequent iterations) involves applying corrections to the measured current (i.e. the corrections generated in the block D and the correction derived from the comparison of the measured and estimated voltages which is added at the left of block C) before this corrected current is used to generate the SOC correction (at the right of block C).

2.4 This argument is not found convincing, because the present claim 1 does not define either that no other terms are involved in determining the pseudo-SOC or that other calculation steps between the current

measurement and the final determination of the pseudo-SOC are excluded. Thus, since the first iteration of the estimation carried out by the estimating means as depicted in Fig. 3 of DC01 involves the measurement of the charging/discharging current (I in block A) and the use of that parameter in calculating the first estimate of the SOC (via the summing elements at the top left of block B and the left of block C, the integration element at the right of block C, and the summing with parameter Q_0 between blocks B and D), this aspect of the estimating means of DC01 is as defined in the present claim 1. In this context it is noted that the interpretation proposed by the proprietor that the pseudo-SOC is determined solely from the charging/discharging current is not consistent with the patent at issue as a whole, since both the embodiment of Fig. 3, and the present dependent claim 3 indicate that the estimate of the pseudo-SOC also takes into account the temperature.

2.5 Moreover, since the majority of the parameters used in the correction terms in DC01 (i.e. in block D) are functions of ^Q (the SOC estimate), the correction of the SOC in the subsequent iterations is on the basis of the initial estimate of the SOC (i.e. the pseudo-SOC), as defined in claim 1 of this request.

3. *Auxiliary requests of patent proprietor*

3.1 The first auxiliary request was filed by the proprietor only at the oral proceedings of 13 October 2009. However, since the amendment introduced in this request served merely to clarify one of the technical features of claim 1 of the main request, this amendment did not

change the substance of the issues to be discussed during the oral proceedings. The board therefore considers it appropriate to make use of its discretion under Article 13(1) of the Rules of Procedure of the Boards of Appeal to admit this request into the procedure.

3.2 Claim 1 according to the proprietor's first auxiliary request defines, in addition to the technical features of claim 1 of the main request, that the determining of the pseudo-SOC is carried out by integrating the charging/discharging current detected by a current sensing means and adding it to a predetermined initial SOC value. The means of DC01 as discussed above performs the corresponding calculation (i.e. the calculation of the SOC in the first iteration) in the same manner, since Fig. 3 of that document depicts that the current is measured (thus implying a current sensing means) in block A, and this result is fed via two adders (see paragraph 2.4 above) to the element at the right of block C, where it is integrated, the result of this integration then being added to the initial SOC (Q_0) as stored in block B. Therefore the subject-matter of this claim is also not new according to Article 54(1) and (2) EPC.

3.3 Claim 1 according to the proprietor's second auxiliary request is identical to that of the main request, so that its subject-matter is not new according Article 54(1) and (2) EPC for the reasons given above for that request.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is revoked.

The Registrar: The Chairman:

U. Bultmann M. Ruggiu