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**Datasheet for the decision
of 11 January 2013**

Case Number: T 0300/09 - 3.5.02

Application Number: 04104340.7

Publication Number: 1635448

IPC: H02P 21/00

Language of the proceedings: EN

Title of invention:

Speed sensorless control of an induction machine using a PWM inverter with output LC filter

Patentee:

ABB Oy

Opponent:

SEW-EURODRIVE GmbH & Co. KG

Headword:

-

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step (yes) "

Decisions cited:

-

Catchword:



Case Number: T 0300/09 - 3.5.02

D E C I S I O N
of the Technical Board of Appeal 3.5.02
of 11 January 2013

Appellant:
(Opponent)

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Respondent:
(Patent Proprietor)

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Representative:

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Decision under appeal:

**Decision of the Opposition Division of the
European Patent Office posted 3 December 2008
rejecting the opposition filed against European
patent No. 1635448 pursuant to Article 101(2)
EPC.**

Composition of the Board:

Chairman: M. Ruggiu
Members: G. Flyng
P. Mühlens

Summary of Facts and Submissions

I. The opponent has appealed against the decision of the opposition division rejecting the opposition.

In the contested decision, the opposition division held that the ground for opposition under Article 100(b) EPC was not sufficiently substantiated during the opposition period and hence did not take that ground for opposition into account.

Regarding the ground for opposition under Article 100(a) EPC the opposition division held that claim 1 was novel vis-à-vis the prior art cited in the opposition procedure and gave particularly detailed reasons for that finding with respect to the prior art documents D16 and D9 (see the document references listed on pages 5 and 6 of the reasons for the decision). The opposition division expressed the opinion that the feature "LC filter" was a limiting feature of claim 1 and held that none of the [cited] documents discloses an LC filter in combination with an inverter output current vector and an estimated stator current vector.

Furthermore, the opposition division found that the subject-matter of granted claim 1 was inventive vis-à-vis the combination of document D9 with the common general knowledge of the person skilled in the art, or document D6, or any other cited document. The opposition division commented on the following lines of attack that had been raised:

- D6 combined with common general knowledge;
- D6 combined with D9;

- D6 combined with D16 and common general knowledge;
- D9 combined with common general knowledge;
- D9 combined with D16.

The opposition division held that the further attacks of the opponent with respect to lack of inventive step were based on groups of plural documents without any precise references or argumentation as to where the claimed features could be found and why the skilled person would combine them. The opposition division was not convinced by what it characterised as these "general attacks".

- II. The Board summoned the parties to oral proceedings, setting out its preliminary observations on the appeal in an annex to the summons.
- III. With a letter dated 10 December 2012 the respondent (proprietor) submitted amended claims according to a first auxiliary request.
- IV. Oral proceedings were held as scheduled on 11 January 2013.

The appellant (opponent) requested that the decision under appeal be set aside and that the patent be revoked.

The respondent (patent proprietor) requested that the appeal be dismissed, or, if that was not possible, that the patent be maintained in amended form on the basis of claims 1 to 3 of the first auxiliary request filed with letter dated 10 December 2012.

V. Claim 1 of the patent reads as follows:

"A method of controlling of an induction machine using an inverter with output LC filter, comprising the steps of
of
determining the inverter output current vector (\underline{i}_A),
determining the inverter output voltage vector (\underline{u}_A),
forming a full-order observer having a system matrix (\hat{A}) and gain vector (\underline{K}), the observer producing the estimated rotor flux linkage vector ($\hat{\underline{\psi}}_R$), the estimated stator current vector ($\hat{\underline{i}}_s$), the estimated stator voltage vector ($\hat{\underline{u}}_s$) and the estimated inverter output current vector ($\hat{\underline{i}}_A$),
determining the estimation error ($\underline{i}_A - \hat{\underline{i}}_A$) of the inverter output current vector, **characterised by** the steps of forming a speed adaptation law based on estimation error of the inverter output current vector for determining the estimate for electrical angular speed ($\hat{\omega}_m$) of the induction machine, and
controlling the induction machine based on the produced estimates and the measured inverter output current."

The remaining claims of the patent (claims 2 and 3) are dependent on claim 1.

VI. The submissions of the appellant may be summarised as follows:

The appellant expressed doubts concerning clarity and sufficiency of disclosure (Article 100(b) EPC) in the grounds for appeal, but did not substantiate these objections at any stage of the appeal procedure.

The appellant argued that the introductory wording of claim 1 of the patent, "A method of controlling of an induction machine using an inverter with output LC filter", was to be interpreted merely as a statement of the purpose for which the claimed method should be suitable ("Zweckangabe"), and that the "LC filter" was not a limiting feature of the method.

According to the appellant, with this interpretation of claim 1 the inverter output current and the stator current could be read as being one and the same, in which case claim 1 lacked novelty and inventive step. During the appeal procedure the appellant did not go into detail as regards the prior art disclosures that would lead to this conclusion, but referred to the submissions made during the first instance proceedings.

VII. The submissions of the respondent may be summarised as follows:

The respondent argued that the ground for opposition under Article 100(b) EPC had not been substantiated within the opposition period and that the opposition and appeal were inadmissible in respect of this ground for opposition.

Considering the objections raised under Article 100(a) EPC, the respondent argued that the feature "A method of controlling of an induction machine using an inverter with output LC filter" defined the structural arrangement within which the claimed method was applied, such that the "LC filter" was indeed a limiting feature of the claimed method.

Furthermore, the claimed method involved:

- determining (i.e. measuring) the inverter output current vector (\underline{i}_A),

and also involved the observer producing:

- the estimated stator current vector ($\hat{\underline{i}}_s$); and
- the estimated inverter output current vector ($\hat{\underline{i}}_A$).

According to established case law, the claim had to be construed with a mind willing to understand it and interpretations which make no technical sense should be ruled out.

In the context of the claimed arrangement of an inverter with output LC filter, the skilled person would understand the "inverter output current vector" and "stator current vector" as referring respectively to current before the LC filter and the current after the LC filter. No other interpretation made sense technically.

Considering novelty and inventive step the respondent argued that the appellant's attacks were solely based on the incorrect interpretation of the "LC filter" feature as being non-limiting. The respondent argued that the subject-matter of granted claim 1 was novel over D16 as well as over D9, and furthermore was not obvious for the skilled person starting either from D6 or from D9.

Reasons for the Decision

1. The appeal is admissible.

2. *Sufficiency of disclosure, Article 100(b) EPC*

The ground for opposition under Article 100(b) EPC (sufficiency of disclosure) was not raised during the opposition period and the opposition division decided not to admit this ground into the first instance proceedings. The appellant has not put forward any reason why the opposition division should have admitted this ground for opposition and the Board can find no fault with the opposition division's decision in this respect. Hence, the Board decided to disregard the ground of sufficiency of disclosure.

3. *Novelty and inventive step, Article 100(a) EPC*

3.1 It is evident from their submissions that for the parties the assessment of novelty and inventive step hinges on the question whether or not the "LC filter" mentioned in granted claim 1 should be considered as a limiting feature of the claimed method.

3.2 The opening phrase of claim 1 specifies "A method of controlling of an induction machine using an inverter with output LC filter, comprising the steps of ..."
(emphasis added).

The claimed method involves a step of determining the inverter output current vector (i_A) (i.e. measuring it, cf. the last line of claim 1 and paragraph [0022] of the patent, EP 1 635 448 B1).

Furthermore, the claimed method involves a step of forming an observer which produces *inter alia*:

- an estimated stator current vector (\hat{i}_s); and
- an estimated inverter output current vector (\hat{i}_A).

Finally, the claimed method involves a step of controlling the induction machine based on the produced estimates and the measured inverter output current.

3.3 Given that the claimed method of controlling an induction machine involves measuring the output current of an inverter, it stands to reason that an inverter must be present in order to enable the method to be carried out. Furthermore, given that claim 1 specifies a method of controlling of an induction machine using an inverter with output LC filter it is evident that there has to be an LC filter at the output of the inverter that is used to carry out the method. For these reasons the Board considers that the LC filter mentioned in claim 1 has to be construed as a limiting feature of the claimed method and not merely as a statement of the purpose for which the claimed method need only be suitable.

Having found that the LC filter at the output of the inverter has to be construed as a limiting feature of claim 1, the inverter output current and the stator current mentioned in claim 1 cannot be construed as being one and the same, because the LC filter is between the inverter output and the stator of the electrical machine. The Board is convinced by the respondent's argument that in the context of the claimed arrangement of an inverter with output LC

filter, the skilled person would understand the "inverter output current vector" and "stator current vector" as referring respectively to current before the LC filter and the current after the LC filter.

- 3.4 In the contested decision the opposition division mentioned that during the oral proceedings before it the chairman informed the opponent that the opposition division was of the opinion that the LC filter was a limiting feature (see Reasons for the Decision, section 3.4). On that basis, the opposition division set out its reasons for the conclusion that the subject-matter of claim 1 was novel and involved an inventive step over the cited prior art.

Apart from contesting the finding that the LC filter was a limiting feature, the appellant (opponent) did not, in the appeal proceedings, put forward any detailed argumentation challenging the opposition division's analysis of claim 1 vis-à-vis the cited prior art. The appellant merely made reference to the submissions made in writing in the first instance proceedings before the opposition division. It seems to the Board that those submissions were taken into account by the opposition division in its decision and the Board can see no reason to question the conclusion that the opposition division came to.

4. For the reasons set out above the Board concludes that the appeal has to be dismissed.

Order

For the above reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

U. Bultmann

M. Ruggiu