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Datasheet for the decision of 9 April 2025

Case Number: T 0243/24 - 3.4.02

Application Number: 12883406.6

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Language of the proceedings: EN

Title of invention:
Power converter

Patent Proprietor:
Toshiba Mitsubishi-Electric Industrial Systems Corporation
Tokyo Institute of Technology

Opponent:
Hitachi Energy Ltd

Relevant legal provisions:
EPC Art. 100(c), 123(2), 123(3)

Keyword:
Amendments - extension beyond the content of the application as filed - main request and auxiliary reques 3 (yes) - extension of the scope of protection - auxiliary requests 1, 2, 4-9 (yes)

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Case Number: T 0243/24 - 3.4.02

D E C I S I O N
of Technical Board of Appeal 3.4.02
of 9 April 2025

Appellant: (Opponent)	Hitachi Energy Ltd Brown-Boveri-Strasse 5 8050 Zürich (CH)
Representative:	Vossius & Partner Patentanwälte Rechtsanwälte mbB Siebertstraße 4 81675 München (DE)
Respondent: (Patent Proprietor 1)	Toshiba Mitsubishi-Electric Industrial Systems Corporation 1-1, Kyobashi 3-chome Chuo-ku Tokyo 1040031 (JP)
Respondent: (Patent Proprietor 2)	Tokyo Institute of Technology 2-12-1, Ookayama Meguro-ku Tokyo 152-8500 (JP)
Representative:	TBK Bavariaring 4-6 80336 München (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 14 December 2023 rejecting the opposition filed against European patent No. 2887524 pursuant to Article 101(2) EPC.**

Composition of the Board:

Chairman	H. Bronold
Members:	C.D. Vassoille
	D. Rogers

Summary of Facts and Submissions

I. The opponent has filed an appeal against the decision of the opposition division rejecting the opposition against European patent no. 2 887 524.

II. In the decision under appeal, the opposition division came to the conclusion that the grounds for opposition under Article 100(a) EPC in combination with Articles 54 and 56 EPC, as well as under Articles 100(b) and 100(c) EPC, did not prejudice the maintenance of the patent as granted.

III. The parties were summoned to oral proceedings. In a communication under Article 15(1) RPBA annexed to the summons, the board set out its preliminary observations on the appeal, concluding, *inter alia*, that claim 1 of the main request contravened Article 100(c) EPC, which under Article 123(2) EPC also applied to auxiliary request 3. The auxiliary requests 1, 2 and 4 to 9 were found to contravene Article 123(3) EPC.

IV. Oral proceedings were held on 9 April 2025 in the format of a videoconference.

The appellant (opponent) requested that the decision under appeal be set aside and the patent revoked. Alternatively, the appellant requested that the decision under appeal be set aside and that the case be remitted to the opposition division for further prosecution upon the basis of the respondents' auxiliary requests on file.

The respondents (patent proprietors) requested that the appeal be dismissed, that is that the patent be

maintained as granted (main request), or alternatively, that the decision under appeal be set aside and the patent be maintained in amended form according to one of auxiliary requests 1 to 9.

V. Claim 1 of the main request (patent as granted) reads as follows (feature numbering added in squared brackets):

"**[1.1]** A power converter (1) for three-phase AC,
[1.2]comprising
[1.2a] AC input terminals, three AC input terminals being disposed for one corresponding phase (U, V, W) on a three-phase AC input side,
[1.2b] reactors connected to the respective AC input terminals,
[1.2c] further comprising AC output terminals, each one of the AC output terminals being disposed for one corresponding phase on a three-phase AC output side, and
[1.3] clusters (u-a, v-a, w-a, u-b, v-b, w-b, u-c, v-c, w-c) comprising
[1.3a] single-phase full-bridge converters,
[1.3b] wherein each single-phase full-bridge converter includes a DC capacitor,
[1.3c] wherein the single-phase full-bridge converters of a cluster are connected in series between an input side of the cluster and an output side of the cluster,
[1.4] wherein the clusters form groups of three clusters, wherein each cluster of a group is connected via a reactor (L) to a different AC input terminal than the other two clusters of the group, and wherein the clusters of a group are connected to the same AC output terminal,
[1.5] wherein the power converter comprises: a circulating current controller (11)

[1.6] an AC input/output current controller (12) configured to control current on the three-phase AC input side to follow an AC input current command value and controlling current on the three-phase AC output side to follow an AC output current command value; characterized in that the power converter comprises:
[1.7] an effective power controller (13, B6) configured to control effective power flowing in the power converter from the three-phase AC input side so that a whole DC capacitor voltage average value obtained by averaging voltages of all the DC capacitors in the power converter follows a predetermined DC capacitor voltage command value; and
[1.8] a DC capacitor voltage balancing controller (21, B7, B8, B9) configured to generate a command value for the circulating current in order to control the circulating current circulating in the power converter so that each of inner-cluster DC capacitor voltage average values obtained by averaging voltage values of the DC capacitors of the respective clusters follows the whole DC capacitor voltage average value; and
[1.9] the circulating current controller (11, B10) configured to control the circulating current circulating in the power converter to follow the predetermined circulating current command value obtained by the DC capacitor voltage balancing controller (21, B7, B8, B9), such that control of the circulating current controller does not interfere with control of AC input/output current controller." (emphasis added by the board)

VI. Claim 1 of auxiliary request 3 comprises feature 1.9, relevant to this decision, unchanged.

VII. In claim 1 of auxiliary requests 1, 4, 6 and 8, feature 1.9 was amended as follows:

"...such that control of the circulating current of the circulating current controller does not interfere with control of the current on the three-phase AC input side and the three-phase AC output side of AC input/output current controller"

VIII. In claim 1 of auxiliary requests 2, 5, 7 and 9, feature 1.9 was amended as follows:

"... such that all the DC capacitors are collectively controlled by controlling circulating current circulating in the power converter, an imbalance of voltages of the DC capacitors in the respective bridge cells among the clusters is removed without interfering with control of input/output currents ~~control of the circulating current controller does not interfere with control of AC input/output current controller~~"

IX. The relevant arguments of the parties are discussed in the reasons for the decision below.

Reasons for the Decision

1. Main request - Ground for opposition under Article 100(c) EPC

1.1 Claim 1 of the main request extends beyond the content of the application as filed.

1.2 During the pre-grant examination proceedings, feature 1.9 was added to claim 1. The board agrees with the appellant that the application as filed does not directly and unambiguously disclose feature 1.9 to the extent that "control of the circulating current controller does not interfere with control of AC input/output current controller". In the following, reference is made to the published European patent application no. EP 2 887 524 A1.

1.3 Reference was made by the respondents to paragraphs [0022], [0028], [0029], [0071], [0170] and [0195] of the published application. In particular, they argued that paragraph [0029] described that the control of the circulating current of the current controller did not interfere with the control of the AC input/output current controller, which corresponded to the relevant wording of feature 1.9.

1.4 The board cannot agree with the respondents' arguments. In none of these passages is it described that the control of the circulating current controller does not interfere with the control of the AC input/output current controller. Contrary to the respondents' view, the meaning of "control of the circulating current controller" and "control of AC input/output current controller" is different from the meaning of "control

of the circulating current of the circulating current controller" or "control of the current ... of AC input/output current controller".

Claim 1 clearly and unambiguously refers to the control mechanisms themselves, specifically to two distinct control systems, rather than to their respective control outputs, such as the controlled currents. The phrase "control of the circulating current controller" clearly refers to the execution and operation of a particular control logic or algorithm. This includes aspects such as signal processing, feedback structures and command generation. Hence, the control of a controller describes how a controller works, which variables it monitors, how it calculates control actions and how it interacts with other components. In contrast, the control of a current by a controller refers to the physical effect or result of such a controller, specifically in this context, the circulating current and the AC input/output current. It therefore makes a difference whether a non-interference relates to the control of the controller itself or to the physical variable that the controller is controlling, such as a current.

It is further noted that the board cannot see that the skilled person would read claim 1 as a whole in such a way as to override this distinction or to give a different meaning to the wording "control of the [...] controller".

1.5 Consequently, in the present case it is not sufficient to show that the circulating current and the AC input/output current are described in the application as filed as not interfering with each other. Rather, the decisive question is whether the control of the

respective controllers are described to not interfere with each other, which is not the case. In detail, the passages cited by the respondents are as follows:

1.6 Paragraph [0022] of the published application merely describes the object of the present invention and contains a general statement that the DC capacitor can be stably controlled without interfering with the control of the input/output currents. There is no disclosure in this section of the control of the circulating current controller that does not interfere with the control of the AC input/output current controller.

1.7 Paragraph [0028] states that an imbalance in the voltages of the DC capacitors in the respective bridge cells generated between the clusters can be eliminated without interfering with the control of the input/output currents. Again, only the control of the currents is disclosed, but there is no disclosure of non-interference between the control of the circulating current controller and the control of the AC input/output current controller.

1.8 Paragraph [0029] of the published application essentially states that the control by the DC capacitor voltage fluctuation inhibiting controller is realised by controlling the circulating current circulating in the power converter and that therefore the DC capacitor voltage fluctuation inhibiting control can be realised without interfering with control of the input/output currents. Again, only the control of the AC input/output currents is disclosed, but the non-interference between the control of the circulating current controller and the control of the AC input/output current controller is not disclosed.

1.9 The analysis of paragraphs [0022], [0028] and [0029] also applies to paragraphs [0071], [0170] and [0195] of the published application to which the respondents referred in writing.

1.10 Since the application as filed does not directly and unambiguously disclose feature 1.9 in its entirety, the board concluded that the ground for opposition under Article 100(c) EPC prejudices the maintenance of the patent as granted.

2. Auxiliary request 3 - Amendments (Article 123(2) EPC)

2.1 Claim 1 of auxiliary request 3 includes feature 1.9 of the main request in unamended form. Therefore, also the amendment to claim 1 of auxiliary request 3 is not directly and unambiguously derivable from the application as filed for the reasons set out with respect to the main request.

2.2 Consequently, the board concluded that claim 1 of auxiliary request 3 contravenes Article 123(2) EPC.

3. Auxiliary requests 1, 4, 6 and 8 - Extension of the scope of protection (Article 123(3) EPC)

3.1 In claim 1 of auxiliary requests 1, 4, 6 and 8, feature 1.9 was amended to read "...such that control of the circulating current of the circulating current controller does not interfere with control of the current on the three-phase AC input side and the three-phase AC output side of AC input/output current controller".

3.2 The board agreed with the appellant that there is an extension of the scope of protection of claim 1 of each of the auxiliary requests 1, 4, 6 and 8 resulting from the amended wording of feature 1.9.

3.3 The respondents' argument that the amendment is only a clarification and corresponds to the original wording of feature 1.9 according to the main request is not convincing. In particular, as explained in point 1.4 above, the expressions "control of a [...] controller" and "control of the [...] current of the [...] controller" have a fundamentally different meaning for the person skilled in the art and cannot therefore be regarded as equivalent.

3.4 The board concluded that claim 1 of each of auxiliary requests 1, 4, 6 and 8 contravenes Article 123(3) EPC.

4. Auxiliary requests 2, 5, 7 and 9 - Extension of the scope of protection (Article 123(3) EPC)

4.1 In claim 1 of auxiliary requests 2, 5, 7 and 9, feature 1.9 was amended to read "... such that all the DC capacitors are collectively controlled by controlling circulating current circulating in the power converter, an imbalance of voltages of the DC capacitors in the respective bridge cells among the clusters is removed without interfering with control of input/output currents ~~control of the circulating current controller does not interfere with control of AC input/output current controller~~".

4.2 Again, reference is made to point 1.4 above, where the board explained that the expressions "control of a [...] controller" and "control of the [...] current of the [...] controller" have a fundamentally different

meaning for the person skilled in the art and cannot therefore be regarded as equivalent. This also applies to claim 1 of each of auxiliary requests 2, 5, 7 and 9, in which a reference to "control of the [...] controller" was deleted and replaced by a feature which refers to non-interfering control of the circulating current and the input/output currents. The board agreed with the appellant that this amendment constitutes an extension of the scope of protection of claim 1 of each of the auxiliary requests 2, 5, 7 and 9 resulting from the amended wording of feature 1.9.

4.3 The board concluded that claim 1 of each of auxiliary requests 2, 5, 7 and 9 contravenes Article 123(3) EPC.

5. Request for remittal

Since the board considered that none of the auxiliary requests 1 to 9 was allowable, there was no need to decide on the appellant's request to remit the case for further prosecution upon the respondents' auxiliary requests.

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:

C. Moser H. Bronold

Decision electronically authenticated