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Datasheet for the decision of 28 September 2021

Case Number: T 0276/19 - 3.5.02

Application Number: 11152181.1

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Title of invention:
Circuit for use with energy converter

Applicant:
General Electric Company

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - main request (yes)

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Case Number: T 0276/19 - 3.5.02

D E C I S I O N
of Technical Board of Appeal 3.5.02
of 28 September 2021

Appellant: (Applicant)	General Electric Company 1 River Road Schenectady, NY 12345 (US)
Representative:	Zimmermann & Partner Patentanwälte mbB Postfach 330 920 80069 München (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 13 August 2018 refusing European patent application No. 11152181.1 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	R. Lord
Members:	C.D. Vassoille
	J. Hoppe

Summary of Facts and Submissions

I. This is an appeal of the applicant against the decision of the examining division to refuse European patent application no. 11 152 181.1.

II. The following documents are relevant for the present decision:

D1: EP 0 250 719 A2
D2: EP 1 443 634 A2
D3: WO 2006/069569 A1

III. In the reasons for the decision the examining division found that the subject-matter of claim 1 of the sole request did not involve an inventive step in view of document D2 in combination with document D3.

IV. The applicant (appellant) has requested in writing that the decision under appeal be set aside and that a patent be granted on the basis of the main request filed with letter of 18 May 2018, received on 21 May 2018 or, if this was not possible, on the basis of the auxiliary request filed with the statement setting out the grounds of appeal on 20 December 2018.

V. Claim 1 of the main request reads as follows:

"A power unit, comprising:

at least one wind turbine (10) including a generator (50); characterized by:

at least one energy converter (300), said energy converter (300) being a 3-level converter bridge that

includes three series of four IGBT's with each IGBT in parallel with a diode, said converter bridge being connect [sic] to a positive DC bus (170,270), a neutral DC bus (175,275) and a negative DC bus (180,280), and including input terminals (310) connected to the generator (50) or a transformer (400);

said transformer (400) being configured to transfer electrical energy from the at least one energy converter (300) to an electrical grid; and

a circuit (100, 200), comprising:

a first switch (120, 220) serially connected to a first discharge resistor (130, 230), the first switch (120, 220) and the first discharge resistor (130, 230) directly connected to the positive direct current (DC) bus (170, 270);

a second switch (122, 222) serially connected to a second discharge resistor (132, 232), the second switch (122, 222) and the second discharge resistor (132, 232) directly connected to the negative DC bus (180, 280);

a capacitor bank (140) for storing a positive DC voltage and a negative DC voltage, the capacitor bank (140) including a first capacitor (142) in parallel with the first switch (122, 222) and the first discharge resistor (130, 230), and a second capacitor (144) in parallel with the second switch (122, 222) and the second discharge resistor (132, 232), wherein the first capacitor (142) is directly connected to the positive DC bus (170, 270) and the second capacitor (144) is directly connected to the negative DC bus (180, 280);

a first sensing unit (150) connected in parallel with the first capacitor (142) and directly connected to the positive DC bus (170, 270); and

a second sensing unit (152) connected in parallel with the second capacitor (144) and directly connected to the negative DC bus (180, 280), wherein the first and second sensing units (150, 152) are configured to measure a voltage across the first capacitor (142) and the second capacitor (144), respectively, and sense an overvoltage;

wherein the circuit (100, 200) further comprises a plurality of diodes (160, 162, 164, 166 268, 272, 274, 276), wherein each diode (160, 162, 164, 166 268, 272, 274, 276) is connected in parallel to each switch (120, 122, 220, 222, 224, 226) and/or each discharge resistor (130, 132, 230, 232, 234, 236); and

wherein, in response to a sensed overvoltage across the first capacitor (142), the first switch (120, 220) operates independently from the second switch (122, 222) to discharge the positive DC voltage through the first discharge resistor (130, 230) and, in response to a sensed overvoltage across the second capacitor (144), the second switch (122, 222) operates independently from the first switch (120, 220) to discharge the negative DC voltage through the second discharge resistor (132, 232) so as to dissipate energy that is created by the generator (50) during a grid fault."

Claims 2 and 3 are dependent on claim 1.

VI. In the statement setting out the grounds of appeal, the appellant provided arguments in support of the presence of an inventive step of the subject-matter of claim 1

of the main request, in particular having regard to documents D2 and D3.

Reasons for the Decision

1. The appeal is admissible.

2. Main request - Amendments (Article 123(2) EPC)

Claim 1 of the main request is a combination of original claims 1, 5 and 6 and is further based on the originally filed description on page 6, line 26 to page 7, line 8.

Claim 1 consequently fulfils the requirement of Article 123(2) EPC.

3. Main request - Inventive step (Article 56 EPC)

3.1 The subject-matter of claim 1 of the main request involves an inventive step in the sense of Article 56 EPC.

3.2 The appellant did not contest the examining division's finding that document D2 represents the closest prior art, and the board also does not see any reason to deviate from the decision under appeal in this respect.

3.3 The board agrees with the appellant that the subject-matter of claim 1 does not only differ from document D2 in that the power unit comprises at least one wind turbine including a generator, and that the circuit specified in claim 1 further comprises a plurality of diodes.

Rather, further distinguishing features are present, in particular regarding the specific type of energy converter, which in D2 is not a 3-level converter bridge including three series of four IGBTs, with each IGBT in parallel with a diode, as defined in claim 1. The board additionally does not recognise a first and a second sensing unit in document D2, wherein a first sensing unit is connected in parallel with a first capacitor and directly connected to the positive DC bus and a second sensing unit is connected in parallel with a second capacitor and directly connected to the negative DC bus, and wherein the first and second sensing units are configured to measure a voltage across the first capacitor and the second capacitor, respectively, and sense an overvoltage.

In particular, as regards the first and second sensing units defined in claim 1, the examining division in the reasons for the decision under appeal referred to claim 7 and paragraph [0018] of document D2. However, claim 7 (see also corresponding system claims 18 and 19) does not relate to the embodiment described in paragraph [0018] and illustrated in figure 5, but to the embodiment described in paragraphs [0032] and [0033] and illustrated in particular in figure 8a of D2. Claim 7 thus relates to an alternative embodiment, which expressly does not require an additional switching device for regenerative braking as illustrated in figure 5 of D2 and described in paragraph [0018] (braking circuit 134):

"As such, an additional switching device is not required for regenerative braking, such as transistor 138 of Fig. 5, which saves components and may therefore reduce costs." (see the last sentence of paragraph [0033])

This is confirmed by the description of D2 in paragraph [0031], stating that "the inverter system 110 of this embodiment only needs a single common braking resistor 137".

In the reasons for the decision under appeal, the examining division obviously confused the two embodiments by referring on the one hand to figure 5 and in particular to the braking circuit 134 with regard to the circuit defined in claim 1, and on the other hand to claim 7 with regard to the first and second sensor units defined in claim 1.

3.4 Furthermore, the board is not convinced that the voltage detector 145, described in paragraph [0033] and obviously referred to in claims 7 and 18, corresponds to a first sensing unit and at the same time to a second sensing unit as defined in claim 1, in particular as it can only detect the overall voltage between the positive and the negative DC buses and not the voltages across the first and the second capacitor, respectively, as defined in claim 1.

3.5 Given that document D2 does not disclose a first sensing unit connected in parallel with the first capacitor and directly connected to the positive DC bus, and a second sensing unit connected in parallel with the second capacitor and directly connected to the negative DC bus, the board agrees with the appellant that the power unit as described by document D2 cannot be used for the purposes of the present invention, i.e. to balance a neutral bus voltage during a grid fault as specified in claim 1 of the main request.

3.6 For the purposes of applying the "problem-and-solution approach", the board agrees with the appellant that the objective technical problem of the distinguishing features can be considered to be that of how to balance a neutral bus voltage during a grid fault.

3.7 As stated under point 3.3 above, document D2 is clearly concerned with a multi-inverter system for motor applications and discloses *inter alia* the dissipation of energy of two capacitors C1A and C1B during a braking mode, either by means of a particular brake circuit (see figure 5, paragraph [0018]) or by means of auxiliary switches GTR3A, GTR3B, GTR4A and GTR4B in combination with the voltage detector 145 and the resistor DBR-U 137 (see figure 8a, paragraph [0033]).

The board therefore agrees with the appellant that the person skilled in the art does not obtain any information from document D2 as to how to balance a neutral bus voltage during a grid fault, in particular not by means of a first sensing unit and a second sensing unit connected in parallel with the first and second capacitors and by independently operating the first and second switches such as to discharge DC voltage through the first and second discharge resistors.

3.8 The board further agrees with the appellant that document D3 is also not concerned with balancing a neutral bus voltage during a grid fault, and the board's assessment under point 3.7 above thus also applies to this document. Consequently, the board is convinced that even if the person skilled in the art were to combine documents D2 and D3, they would not arrive in an obvious manner at the subject-matter of claim 1.

The same applies to document D1, which was not referred to by the examining division in the reasons for the decision under appeal.

3.9 Therefore the board concludes that the subject-matter of claim 1 involves an inventive step in the sense of Article 56 EPC.

4. Result

Given that the subject-matter of claim 1 involves an inventive step in the sense of Article 56 EPC and since the main request also fulfils the further requirements of the EPC, the board had to accede to the appellant's main request.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the examining division with the order to grant a patent on the basis of the claims according to the main request filed with letter of 18 May 2018, received on 21 May 2018, and a description to be adapted thereto.

The Registrar: The Chairman:

U. Bultmann R. Lord

Decision electronically authenticated