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Datasheet for the decision of 18 December 2015

Case Number: T 0120/12 - 3.5.03

Application Number: 07254405.9

Publication Number: 1921531

IPC: G05F1/569, H02H1/00, H02H3/00

Language of the proceedings: EN

Title of invention:
Solid state power controller with lightning protection

Applicant:
Hamilton Sundstrand Corporation

Headword:
Switch controller with over-voltage protection/HAMILTON

Relevant legal provisions:
EPC Art. 56, 123(2)
EPC R. 103(1)(a)

Keyword:
Amendments - main request - added subject-matter (no)
Inventive step - main request (yes)
Reimbursement of appeal fee (no)

Decisions cited:

Catchword:

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Case Number: T 0120/12 - 3.5.03

D E C I S I O N
of Technical Board of Appeal 3.5.03
of 18 December 2015

Appellant: (Applicant)	Hamilton Sundstrand Corporation One Hamilton Road Mail Stop 1-1-BC18 Windsor Locks, CT 06096-1010 (US)
Representative:	Tomlinson, Kerry John Dehns St Bride's House 10 Salisbury Square London EC4Y 8JD (GB)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 4 August 2011 refusing European patent application No. 07254405.9 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	F. van der Voort
Members:	K. Schenkel
	P. Guntz

Summary of Facts and Submissions

I. This appeal is against the decision of the examining division refusing European patent application No. 07254405.9, publication number EP 1 921 531 A.

II. The reasons given for the refusal were that the subject-matter of the independent claims of a main request and first and second auxiliary requests did not involve an inventive step (Article 52(1) and 56 EPC) when starting out from

D5: US 5 723 915 A

and taking into account the disclosure of either

D1: WO 98/59420 A or

D4: US 6 169 425 B.

Further, the independent claims of the first auxiliary request were held not to comply with Article 123(2) EPC.

III. In the statement of grounds of appeal, the appellant requested that the decision be set aside and that a patent be granted on the basis of claims of a main request or, in the alternative, a first or a second auxiliary request, the main request as filed during the oral proceedings held on 5 July 2011 before the examining division and the first and second auxiliary requests as filed with the statement of grounds of appeal.

Further, reimbursement of the appeal fee was requested.

Oral proceedings were conditionally requested.

IV. In a communication accompanying a summons to oral proceedings, the board raised, without prejudice to its final decision, an objection under Article 123(2) EPC (added subject-matter) in respect of the independent claims of each request.

V. In response to the summons, the appellant filed a substantive response dated 18 November 2015 together with new sets of claims of a main request and first to third auxiliary requests, and informed the board that it would not be attending the oral proceedings.

VI. With a letter dated 3 December 2015, the appellant filed an amended set of claims 1 to 14 by way of an amended main request.

VII. Oral proceedings were held on 18 December 2015 in the absence of the appellant.

The appellant had requested in writing that the decision under appeal be set aside and that a patent be granted on the basis of the claims of the main request as filed with the letter dated 3 December 2015 or, in the alternative, on the basis of the claims of one of the first to third auxiliary requests as filed with the letter dated 18 November 2015. Further, the appellant requested reimbursement of the appeal fee.

At the end of the oral proceedings, after due deliberation, the chairman announced the board's decision.

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

"A method of controlling a solid state power controller (18), comprising:
determining whether a voltage across a solid state power control switch (42) is within a predetermined voltage threshold wherein the predetermined voltage threshold is a range of voltage values;
characterised in that the method further comprises:
limiting, by a current limit module (46), an electric current through the solid state power control switch to a non-zero amount of the electric current when the voltage is outside of the predetermined voltage threshold; and
selectively disabling the current limit module (46) that limits the electric current through the solid state power control switch (42) in response to an in-rush electric current coming from a load to permit the in-rush electric current through the solid state power control switch (42)."

Claim 9 of the main request reads as follows:

"A solid state power controller system (18) comprising:
a solid state power control switch (42) that normally operates within a predetermined voltage threshold, wherein the predetermined voltage threshold is a range of voltage values;
a microcontroller (38) that controls the solid state power control switch; and
a current limit module (46) that controls the solid state power control switch;
characterised in that the current limit module is operative to selectively limit an electric current through the solid state power control switch to a non-zero amount when a voltage across the solid state power

control switch is outside of the predetermined voltage threshold, wherein the current limit module is selectively disabled in response to an in-rush electric current coming from a load to permit the in-rush electric current through the solid state power control switch."

Claims 2 to 8 and 10 to 14 of the main request are dependent claims.

In view of the board's decision with respect of the main request, the claims of the first to third auxiliary requests need not be reproduced here.

Reasons for the Decision

1. Main request - amendments - *Article 123(2) EPC*

1.1 Claim 1 is based as follows on claims 1, 7 and 11 as originally filed and the description as originally filed, the basis for the respective features being indicated in square brackets:

A method of controlling a solid state power controller (18), comprising:
determining whether a voltage across a solid state power control switch (42) is within a predetermined voltage threshold [claim 1] wherein the predetermined voltage threshold is a range of voltage values [claim 11];
characterised in that the method further comprises:
limiting, by a current limit module (46) [column 4, lines 43 to 45], an electric current through the solid state power control switch to a non-zero amount of the

electric current when the voltage is outside of the predetermined voltage threshold [claim 1]; and selectively disabling the current limit module (46) (see point 1.2 below) that limits the electric current through the solid state power control switch (42) in response to an in-rush electric current coming from a load to permit the in-rush electric current through the solid state power control switch (42) [claim 7].

The board notes that the description, column 4, lines 43 to 45 (reference is made to the application as published), refers to a current limit module 46 for limiting an electric current through the solid state power control switch to a non-zero amount of the electric current when the voltage is outside of the predetermined voltage threshold. Further, in column 4, line 58, to column 5, line 8, the description states that this current limit module 46 is disabled to permit an in-rush current through the switch. Thus, the board is satisfied that the application as filed provides a basis for the feature according to which, in response to an in-rush electric current coming from a load, the current limit module which limits the electric current through the solid state power control switch to a non-zero amount when the voltage across the switch is outside of the predetermined voltage threshold is selectively disabled to permit the in-rush electric current through the solid state power control switch.

1.2 Claim 9 is based as follows on claims 1, 7, 11 and 12 as originally filed and the description as originally filed, the basis for the respective features being indicated in square brackets:

A solid state power controller system (18) comprising:

a solid state power control switch (42) that normally operates within a predetermined voltage threshold [claims 1 and 12], wherein the predetermined voltage threshold is a range of voltage values [claim 11];
a microcontroller (38) that controls the solid state power control switch; and
a current limit module (46) that controls the solid state power control switch;
characterised in that the current limit module is operative to selectively limit an electric current through the solid state power control switch to a non-zero amount when a voltage across the solid state power control switch is outside of the predetermined voltage threshold [claims 1 and 12], wherein the current limit module is selectively disabled in response to an in-rush electric current coming from a load to permit the in-rush electric current through the solid state power control switch [claim 7 and column 4, lines 43 to 45 and line 58 to column 5, line 8] (cf. point 1.1 above).

Regarding the combination of features from method claims 1, 7 and 11 as originally filed and features of device claim 12 as originally filed, the board notes that the description as originally filed discloses the structure and the operation of an embodiment of the invention which includes the features of both the method claims 1, 7 and 11 and the device claim 12. From this, it is apparent that the features of the device and method claims are linked and may thus be combined.

1.3 The dependent claims, i.e. claims 2 to 8 and 10 to 14, are respectively based on claims 2 to 5, 8 to 10 and 13 to 17 as originally filed.

1.4 The board therefore concludes that the claims of the main request meet the requirement of Article 123(2) EPC.

2. Main request - inventive step - *Articles 52(1) and 56 EPC*

2.1 D5 discloses, using the language of claim 1, a method of controlling a solid state power controller (cf. the title, the abstract, and claim 1), comprising limiting, by a current limit module ("MOSFET Drive and Current Limiting circuit section 40", cf. column 12, lines 11 to 18, and Fig. 1), an electric current through a solid state power control switch.

2.2 The subject-matter of claim 1 differs from the method disclosed in D5 in that the method according to claim 1 further comprises:

a) determining whether a voltage across the solid state power control switch is within a predetermined voltage threshold, wherein the predetermined voltage threshold is a range of voltage values; and limiting, by the current limit module, an electric current through the solid state power control switch to a non-zero amount of the electric current when the voltage is outside of the predetermined voltage threshold; and

b) selectively disabling the current limit module that limits the electric current through the solid state power control switch in response to an in-rush electric current coming from a load to permit the in-rush electric current through the solid state power control switch.

2.3 Starting out from D5, the problem underlying the claimed method may thus be seen as providing an over-voltage protection in the known control method, whilst allowing an in-rush current through the switch.

2.4 The skilled person would consider document D4, since it relates to limiting a voltage across a switch (column 1, lines 5 to 20). More specifically, D4 discloses a circuit which is protected against over-voltage across a solid state switch. The circuit compares the switch voltage to a limiting voltage and limits the switch current when the switch voltage exceeds the limiting voltage (abstract and Fig. 1). Thus, feature a) is known from D4 for the same purpose.

2.5 The examining division, at point 2.4 of the reasons for the decision, identified as a technical effect of feature b) that triggering of the over-voltage protection according to feature a) is avoided in the presence of in-rush currents. Further, the examining division argued that the skilled person, when adding the over-voltage protection mechanism of D4 to the method of D5, would be aware of the requirements of certain loads regarding in-rush currents and would therefore provide the necessary circuitry to prevent in-rush currents triggering the over-voltage protection. Consequently, according to the examining division, feature b) did not contribute to an inventive step either.

The board notes that for the above argument of the examining division to be convincing it is a precondition, *inter alia*, that there is no other feasible solution available, i.e. other than implementing feature b), in order to avoid the

triggering of the over-voltage protection by an in-rush current.

However, in a system with a switch, in-rush currents with or without active current limitation can only give rise to a voltage across the switch which is equal at most to the supply voltage of the system. It is thus possible to avoid the triggering of the over-voltage protection by setting its activation threshold to a higher value than the supply voltage of the system. Thus, it is not mandatory to implement feature b) in order to avoid triggering of the over-voltage protection by an in-rush current.

Further, the board notes that although D5 does not mention a specific supply voltage, it does mention aircraft power distribution systems as a field of application (column 1, lines 13 and 14). These systems commonly use a supply voltage of 28 Volt in a direct current system (cf. the application in suit, column 4, lines 31 to 38 and 50 to 58 and Fig. 2). Further, the board notes that D4 mentions as an example of the activation threshold of the over-voltage protection circuit in D4 a value of 120 Volt (Fig. 2 of D4). This threshold voltage would thus be substantially above the commonly used supply voltage and would thus, in any case, exclude the possibility that an in-rush current could trigger the over-voltage protection.

2.6 Further, the board notes that the method of D5 already comprises measures for allowing in-rush currents. These measures are referred to as a "trip mechanism" (D5, column 1, lines 13 to 47, and column 6, lines 44 to 60). However, this trip mechanism, in contrast to the method of claim 1 (which involves disabling a current limitation), uses for this purpose a delay in switching

off the current according to a trip time versus load current curve (D5, column 1, lines 13 to 47, column 6, lines 44 to 60).

Further, it is noted that D5 also discloses an additional current limitation which, however, is independent of the above-mentioned trip mechanism, is always active, and is set to a fixed value (column 6, lines 49 to 50, and column 13, lines 24 to 37).

Hence, D5 does not disclose or suggest a deactivation or disabling of the current limitation in order to permit an in-rush current through the switch.

2.7 Consequently, the skilled person would, when applying the over-voltage protection known from D4 to the method of D5, arrive at a method in which the current limitation already comprised in the method of D5 would be dependent on the voltage across the switch and in which a trip mechanism using a trip time versus load current curve would permit in-rush currents. This would thus differ from the method of claim 1, in which for permitting an in-rush current through the switch the current limitation is selectively disabled.

2.8 With respect to document D1, which was also referred to by the examining division in its decision, the board notes the following. D1 discloses a method of protecting a field-effect transistor switch by monitoring the voltage across the switch and by switching it into the conducting state when the voltage across it exceeds a certain threshold value (see the abstract). It further discloses a short circuit protection which switches off the current completely when a preset current limit value is exceeded (page 5, line 34, to page 6, line 21, and Fig. 4). The short

circuit protection is disabled in the case of an over-voltage (page 6, lines 23 to 33, and page 7, lines 11 to 14). In contrast, in the method of claim 1, the over-voltage triggers a current limitation which is disabled in response to an in-rush current. Hence, D1 does not disclose either of the features a) and b), see point 2.2 above.

2.9 The above considerations apply, *mutatis mutandis*, to the subject-matter of claim 9 and the dependent claims.

2.10 The board therefore concludes that the subject-matter of the claims of the main request involves an inventive step when starting out from D5 and taking into account the teaching of D4 or D1 (Art. 52(1) and 56 EPC).

2.11 Other prior-art documents

None of the remaining documents available in the examination proceedings discloses or suggests the above-mentioned distinguishing features a) and b) (see point 2.2 above):

EP 1 298 770 A, which was cited in the search report as technological background, discloses a method of controlling a switch in which the switch is constantly turned on when the load current is below a first threshold, is turned off after a predefined time when the load current is between the first and a second threshold, and is pulsed by turning it on and off alternately when the load current is greater than the second threshold (paragraph [0008]). Hence, this document discloses a limitation of the current in a predetermined range, but not in response to an over-voltage (cf. feature a) at point 2.2 above).

US 5 440 441 A, which was also cited in the search report as technological background, discloses a method of controlling a switch in which, when a switch current is above a predetermined level, as measured via a voltage drop at a current sensing device, the switch is opened and automatically closed again after a defined time delay. If, after the switch has been closed, the current is still above the predetermined level, the switch is opened again (abstract). Further, this document discloses an over-voltage protection, in which the supply voltage is measured and, in case of an over-voltage, the switch is shut off (page 5, lines 42 to 54).

The remaining available documents, i.e. US 6 225 797 B and EP 474 611 A, were also cited in the search report as technological background. Both documents disclose methods of controlling a switch in which an in-rush current is limited, which thus teaches away from the subject-matter of claims 1 and 9, each including features permitting an in-rush current to flow with a current limitation being disabled.

2.12 The board therefore concludes that the subject-matter of the claims of the main request involves an inventive step (Art. 52(1) and 56 EPC).

3. In view of the above, the decision under appeal is to be set aside.

4. *Request for reimbursement of the appeal fee*

4.1 The appellant requested reimbursement of the appeal fee on the grounds that the examining division committed a substantial procedural violation by appointing oral

proceedings "without good basis". Its arguments in support may be summarised as follows:

The request of the applicant for oral proceedings was conditional on the examining division intending to refuse the application. Hence, oral proceedings should only have been appointed if the examining division was in a position to issue a decision refusing the application. However, the summons to oral proceedings made reference to new evidence, i.e. documents D4 and D5, as a basis for objections which had not been notified previously to the appellant. The applicant's conditional request for oral proceedings therefore did not apply. Further, although it was open to the examining division to appoint oral proceedings of its own motion, this would have required that some justification be given. The Guidelines for Examination in the European Patent Office (hereinafter the Guidelines) required in this respect an attempt at clarification in writing as well as the necessity for oral proceedings to be the most efficient course of action. No clarification in writing was however attempted before issuance of the summons. Further, introducing a limited timescale and the procedural limitations of oral proceedings were not an efficient mechanism for addressing new prior art that had never before been raised or discussed.

4.2 The board, however, does not find these arguments convincing for the following reasons:

4.3 Article 116(1) and Rule 115(1) EPC give the examining division the possibility to appoint oral proceedings of its own motion if it considers this to be expedient. According to the Guidelines, E-II, 4, oral proceedings will normally only be expedient under certain

circumstances. This, therefore, does not exclude other circumstances in which appointing oral proceedings would be expedient. Hence, it is up to the examining division to decide, taking the specific circumstances of the case into account, whether or not it considers it to be expedient to summon the applicant to oral proceedings under Rule 115(1) EPC. Neither the EPC nor the Guidelines require that reasons for this decision be given with the summons.

4.4 No other possible procedural violation in connection with the summons to oral proceedings and the citation of new documents in the communication annexed to the summons can be discerned by the board. Nor did the appellant argue otherwise. In this respect, the board notes that the appellant explicitly stated in its letter dated 18 November 2015 (page 4, third paragraph) that the introduction of the new documents at the oral proceedings did not contravene the applicant's right to be heard. Indeed, as follows from the minutes, the new documents were extensively discussed at the oral proceedings and there is no suggestion that the applicant was not given sufficient time to present its case. The board can thus only agree that the right to be heard was respected.

4.5 The board therefore concludes that the examining division did not commit a substantial procedural violation in arranging for oral proceedings under Article 116(1) EPC and Rule 115(1) EPC.

4.6 It follows that the request for reimbursement of the appeal fee is to be rejected (Rule 103(1)(a) EPC).

5. *Remittal*

The board notes that the description does not appear to comply with the requirements of Rule 42(1)(b) and (c) EPC. These issues are however considered best dealt with by the examining division.

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 on the basis of the claims of the main request and a description to be adapted accordingly.

3. The request for reimbursement of the appeal fee is rejected.

The Registrar: The Chairman:

G. Rauh F. van der Voort

Decision electronically authenticated