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D E C I S I O N
of 16 October 1996

Case Number: T 0778/94 - 3.5.2

Application Number: 86900459.8

Publication Number: 0208711

IPC: H02J 1/00

Language of the proceedings: EN

Title of invention:

DC to DC converter

Applicant:

MOTOROLA, INC.

Opponent:

-

Headword:

-

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step - yes"

Decisions cited:

-

Catchword:

-



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Boards of Appeal

Chambres de recours

Case Number: T 0778/94 - 3.5.2

D E C I S I O N
of the Technical Board of Appeal 3.5.2
of 16 October 1996

Appellant:

MOTOROLA, INC.
1303 East Algonquin Road
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Representative:

Ibbotson, Harold
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Decision under appeal:

Decision of the Examining Division of the
European Patent Office posted 24 March 1994
refusing European patent application
No. 86 900 459.8 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: W. J. L. Wheeler
Members: R. G. O'Connell
B. J. Schachenmann

Summary of Facts and Submissions

I. The appellant contests the decision of the examining division refusing European patent application No. 86 900 459.8. The reason given for the refusal was that the subject-matter of the claims did not involve an inventive step, having regard to the following prior art:

D1: US-A-4 355 277

D2: US-A-4 155 112.

II. On 24 May 1994 the appellant faxed a notice of appeal and paid the appeal fee. On 3 August 1994 the appellant faxed a statement of grounds of appeal, which bore the date 24 May 1994, and which included the words "In my letter dated 24 May 1994 claim 1 was revised ...". Following a communication from the board pointing out that the claim referred to appeared not to have been received, the appellant submitted that the date of 24 May 1994 appearing in the statement of grounds in the passage cited above was incorrect and should have been 4 October 1993, which was when claim 1 was most recently revised.

III. The appellant requested that the decision under appeal be set aside and a patent granted on the basis of the application in its present form, namely:

Claims: claims 1 to 3 faxed 4 October 1993,
claims 4 to 8 faxed 17 May 1991;

Description: pages 1, 2, 5 to 24 as originally filed,
page 4 faxed 24 January 1990,
pages 3 and 3a faxed 4 October 1993;

Drawings: sheets 1 to 8 as originally filed.

IV. Claim 1 is worded as follows:

"1. A DC to DC converter comprising:

a pulse width modulated (PWM) converter (16) having a power input means for receiving power at an input voltage (B+), a current controlled means having a first control input and coupled to the power input means for providing output power at a predetermined output voltage and current, and characterised by:

control means (44) coupled to a second control input providing selectively for continuous mode and intermittent mode operation of the converter, the continuous mode providing a first output current level and the intermittent mode providing a second reduced output current level, both at a stepped-up voltage, the control means (44) through the second input sequentially actuating the current controlled means when the converter is in said intermittent mode, wherein the PWM converter (16) is alternately actuated ON through the second input for a first predetermined time period and OFF through the second input for a second predetermined time period to provide the reduced power level."

Claims 2 to 8 are dependent on claim 1.

V. The appellant argued essentially as follows:

The argument in the decision under appeal that, starting from the agreed closest prior art D1, the claimed converter was an obvious application of the teaching of D2 was based on a misinterpretation of the latter and did not give due weight to the terms of claim 1. The claimed device was distinguished from that

of D2 by having a second control mode of operation, accessed by a second control input, in which the PWM converter was periodically powered ON and OFF to minimise the power drain while maintaining the required output voltage. This differed from the operation described in D2 in which the converter was disabled in response to a high (battery) input voltage.

The argument at point 5 of the refusal decision that the claimed further mode was equivalent to operating a PWM converter at a very low duty cycle to provide a low power output failed to take into account that such an operation would be inefficient, because various elements of the converter would still dissipate power even in the "off" portion of the duty cycle, and that a proper interpretation of the claim required the PWM converter as a whole to be switched on and off. The further argument at point 6 of the refusal decision that the claim could not be interpreted in this way, since such an operation would require a storage element, eg a capacitor, for supplying the load with power in the "off" phase of the PWM converter, failed to take into account the presence of the capacitor 40 in the described embodiment (Fig 4 and description at page 11, line 31 to page 12, line 5).

Reasons for the Decision

1. Admissibility

It may be deduced from the statement at page 3, of the grounds as faxed 3 August 1994: "...that no amendment thereof is necessary", that claim 1 had not been amended on appeal and that the reference to "the amended claim 1" was a reference to the claim as last amended, submitted by fax on 4 October 1993, ie the

claim as refused by the examining division. This is supported by the fact that the arguments in the grounds of appeal are relevant to this version of the claim. Thus the statement of grounds as faxed on 3 August 1994 is sufficient to meet the requirement of Article 108 EPC, third sentence. The appeal is admissible.

2. *Novelty*

None of the cited prior art documents discloses a DC to DC converter comprising all the features recited in claim 1; see also point 3 below. Hence the subject-matter of the claim is new within the meaning of Article 54 EPC.

3. *Inventive step*

3.1 A DC to DC converter comprising all the features of the prior art portion of claim 1 is undisputedly known from D1, Fig 2. Starting from a converter as specified in the preamble of the claim, the problem addressed by the present application is to overcome the drawback of such a circuit that it cannot provide a very low power output in an efficient manner; see page 3 of the description of the present application. According to the teaching of the present application this problem is solved by providing an intermittent mode of operation of the converter wherein the PWM converter is alternately actuated ON and OFF for respective predetermined time periods as specified in claim 1.

3.2 As indicated in the cited passage, the problem arises, eg in the field of microprocessor based paging decoders, as a result of the development of new devices which have a drastically reduced power drain in standby mode. Hence no contribution to inventive step is involved in formulating the problem identified above, since the skilled person would be expected to recognise changed design requirements as a matter of routine.

3.3 Prior art document D2 also discloses a DC to DC converter comprising a circuit whose output is pulse width modulated to provide a desired voltage output from a wide range of battery input voltages; see D2, column 3, lines 13 to 17 and column 5, lines 22 to 67. In this circuit the situation can arise that the input voltage is greater than the desired output voltage so that the operation of the DC to DC up-converter is not required and, in these circumstances, in accordance with the teaching of D2 the PWM up-converter is disabled, while the input voltage is provided directly to the output; D2, column 2, lines 34 to 39. In the judgement of the board, this is - despite some similarities - a different solution to a different problem. The problem solved by the present application is coping with a wide range of required output power, whereas D2 is concerned with coping with input voltage variation. The solution specified in claim 1 of the present application involves turning the PWM converter on and off with a controllable duty cycle dependent on the required power output, whereas D2 teaches turning the PWM converter off for as long as the input voltage is greater than a predetermined value. During this mode of operation the output current level of D2 is not controlled as the input (battery) voltage is directly applied to the output. Although the D2 teaching does involve an intermittent operation of the PWM converter, it is not the intermittent operating mode specified in claim 1, and, because of the different rationale underlying D2, the board is not persuaded that the skilled person, starting from D1 and addressing the problem of efficient provision of a wide range of power outputs, including an extremely low power output, would find in D2 a suggestion which would lead him in the direction of the presently claimed solution.

3.4 The board concludes therefore that, having regard to the cited prior art, the subject-matter of claim 1 is not obvious to a person skilled in the art and is thus considered as involving an inventive step within the meaning of Article 56 EPC.

4. In the judgement of the board, the application documents in their present form meet the requirements of the EPC.

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 in accordance with the appellant's request (see paragraph III above).

The Registrar:


M. Kiehl

The Chairman:


W. J. L. Wheeler