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CHAMBRES DE RECOURS
DE L'OFFICE EUROPEEN
DES BREVETS

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File Number: T 155/92 - 3.5.2

Application No.: 85 904 855.5

Publication No.: 0 195 822

Title of invention: Converter device

Classification: H02M 7/06

DECISION
of 14 December 1992

Applicant: Mitsubishi Denki Kabushiki Kaisha

Headword:

EPC Article 56

Keyword: "Inventive step - yes"
"Hindsight analysis to be avoided"
"Remittal to Examining Division"



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Boards of Appeal

Chambres de recours

Case Number : T 155/92 - 3.5.2

D E C I S I O N
of the Technical Board of Appeal 3.5.2
of 14 December 1992

Appellant :

Mitsubishi Denki Kabushiki Kaisha
2-3 Marunouchi 2-chome
Chiyoda-ku
Tokyo (JP)

Representative :

S.J. Hackett
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Decision under appeal :

Decision of the Examining Division 064 of the
European Patent Office dated 16 October 1991
refusing European patent application
No. 85 904 855.5 pursuant to Article 97(1) EPC.

Composition of the Board :

Chairman : E. Persson
Members : W.J.L. Wheeler
M. Villemin

Summary of Facts and Submissions

I. The appeal contests the decision of the Examining Division to refuse the Appellant's European patent application No. 85 904 855.5 on the ground that the subject-matter of Claim 1 (as filed with the letter dated 24 January 1990) did not involve an inventive step.

II. The following prior art was considered in the proceedings before the Examining Division:

The conventional AC to DC converter shown in Figure 2 of the present application;

D1: EP-A-0 076 599.

III. In reply to a communication from the Board of Appeal raising objections to the wording of Claim 1 and offering a suggestion as to how the objections could be overcome, the Appellant filed new Claims 1 and 2 and a new page 3 of description with an accompanying letter dated 16 November 1992 in which it was stated: "Claim 1 has been revised so that features of claim 1 in common with the prior art circuit are defined in the preamble. The wording proposed by the Appeal Board is acceptable to the applicant."

IV. Claim 1, as suggested by the Board, reads as follows:

"1. A converter device comprising two smoothing capacitors (2a, 2b) connected in series across the DC output side of a converter (1) for converting AC power into DC power, a first load (3) connected across both of the smoothing capacitors (2a, 2b) and a second load (4) connected across only one of the smoothing capacitors (2b), characterised by a voltage balance circuit (11) comprising a dummy resistor (10) connected in parallel with the other smoothing capacitor (2a), a current

detector (6) for detecting a current (I_0) flowing between the connecting point (Q) of the two smoothing capacitors (2a, 2b) and the second load (4), and means (7, 8, 9) operative to allow current (I_1) to flow through the dummy resistor (10) in response to detection of the current (I_0) thereby effectively eliminating any voltage unbalance between the terminals (P, Q; Q, N) of the smoothing capacitors."

- V. Claim 1, as filed by the Appellant, departs from the above wording in that the word "other" in the phrase "comprising a dummy resistor (10) connected in parallel with the other smoothing capacitor (2a)" has been omitted.
- VI. The Appellant argued essentially that the present invention was an improvement of the conventional converter shown in Figure 2 of the present application and provided a simple power unit for supplying two different loads with voltages of different magnitude. Power loss was reduced and voltage unbalances, which might damage the smoothing capacitors, were avoided. The power unit known from D1 produced two output voltages of opposite polarity relative to a common zero potential. It did not supply one load with a full voltage and another load with a partial voltage. It did not measure current flowing from the connecting point of the smoothing capacitors, but measured the line current through resistors R1 and R2, thereby wasting power and teaching away from the present invention.
- VII. The Appellant requests that the decision under appeal be set aside and the application allowed to proceed to grant or be remitted to the Examining Division for further prosecution. The Appellant also submitted a conditional request for oral proceedings if the Board was considering upholding the decision under appeal.

VIII. In its present form, the application consists of:

Claims 1 and 2 filed with the letter dated 16 November 1992 (received 17 November 1992);

Description: page 3 filed with the letter dated 16 November 1992 and pages 1, 2 and 4 to 6 as published in EP-A-0 195 822;

Drawings: sheet 1/1 as published in EP-A-0 195 822.

Reasons for the Decision

1. The appeal is admissible.
2. As noted in paragraph III above, the Appellant's letter dated 16 November 1992 contains an unequivocal statement to the effect that the wording of Claim 1 proposed by the Board is acceptable to the Appellant. However, as noted in paragraph V above, the version of Claim 1 submitted with that letter departs from the proposed wording. This appears to be the result of a clerical error. In the opinion of the Board, the word "other" is necessary to make it clear that the dummy resistor is connected in parallel with that one of the two smoothing capacitors across which the second load is not connected. The Board will therefore consider the present appeal on the basis of Claim 1 as recited in paragraph IV above, such a course being clearly in accord with the Appellant's expressed intention.
3. The Appellant, the Examining Division and the Board are in agreement that the closest prior art is represented by the conventional AC to DC converter shown in Figure 2 of the present application.

- 3.1 This prior art device comprises two smoothing capacitors (2a, 2b) connected in series across the DC output side of a converter (1) for converting AC power into DC power, a first load (3) connected across both of the smoothing capacitors and a second load (4) connected across only one of the smoothing capacitors (2b).
- 3.2 In this prior art device two dummy resistors (5a, 5b) are connected in series across the DC output side of the converter (1) and their connecting point is connected to the connecting point (Q) of the smoothing capacitors to prevent damage to the capacitor 2a when the second load is drawing current. Without the dummy resistors, the resulting decrease in the voltage across the capacitor 2b when the second load is drawing current would cause an undesirably large increase in the voltage across the other capacitor 2a (called "voltage unbalance" in the present application), which could damage that capacitor. This arrangement suffers from the disadvantage that the dummy resistors, which are constantly connected across the output of the converter, consume power.
- 3.3 Starting from this prior art, the present invention solves the problem of eliminating the voltage unbalance between the terminals of the smoothing capacitors with less power loss.
- 3.4 Instead of dummy resistors constantly connected across the output of the AC to DC converter, the present invention has a voltage balance circuit comprising a dummy resistor (10) connected in parallel with that one of the two smoothing capacitors across which the second load is not connected, a current detector (6) for detecting a current (I_0) flowing between the connecting point of the smoothing

capacitors and the second load, and means operative to allow current to flow through the dummy resistor in response to detection of the current (I_0), thereby effectively eliminating any voltage unbalance between the terminals of the smoothing capacitors.

4. Document D1 (EP-A-0 076 599) describes a power unit with two rectifiers (D1, D2) for converting AC power to two DC outputs of opposite polarity with respect to a line at a common zero potential and a linear longitudinal regulator (IC1, IC2) for each output voltage. A current balancing circuit (4, 5, 6) is arranged between the rectifiers and the longitudinal regulators for balancing the current on the zero potential line, which is connected to one of the AC lines to reduce the number of lines that have to be installed.
 - 4.1 As shown in Figure 2 of D1, the current balancing circuit comprises a comparator arranged to detect any difference in the currents (J1, J2) flowing through resistors (R1, R2) connected one in each of the DC lines between the rectifier (D1, D2) and the longitudinal regulator. The output of the comparator controls transistors (T1, T2) to allow current to flow through resistors (R13, R14) connected in parallel with smoothing capacitors (C1, C2) between the DC lines and the common zero potential line in such a way as to tend to equalise the currents (J1, J2) flowing in the DC lines and provide a balanced current on the zero potential line.
 - 4.2 As pointed out by the Appellant, in the power unit shown in Figure 2 of D1, the two DC output voltages ($+U_A$, $-U_A$) are of equal magnitude and opposite polarity relative to the common zero potential (0). There is no disclosure in D1 of a first load being supplied with a full voltage ($=2U_A$) and a second load with a partial voltage ($=U_A$).

There is no detection of current flowing from the connecting point of the smoothing capacitors to a load comparable with the second load of the present invention. The resistors R1 and R2 waste power.

4.3 Furthermore, it is an essential feature of the power unit known from D1 that the line carrying the zero potential, and consequently the connection between the smoothing capacitors (C1, C2), is connected to one side of the AC supply (cf. D1, Claim 1). Thus it is not possible for the voltage across one of the smoothing capacitors to increase when the power unit delivers current to a load. The purpose of the current balancing circuit in D1 is to reduce cost by making it possible to utilise a common neutral conductor connected to one side of the AC supply. D1 does not teach a solution to the problem with which the present invention is concerned, namely eliminating the voltage unbalance between the terminals of the smoothing capacitors with less power loss.

5. In the opinion of the Board, it would not be obvious to a person skilled in the art who was trying to eliminate the voltage unbalance between the terminals of the smoothing capacitors in the prior art circuit shown in Figure 2 of the present application with less power loss, to turn to D1 for help, because it does not address his problem.

5.1 Even supposing, for the sake of argument, a skilled person did think of applying the current balancing circuit known from D1 to the circuit shown in Figure 2 of the present application, the resulting device would not have all the features specified in Claim 1 of the present application, because there would be no current detector for detecting a current flowing between the connecting point (Q) of the two smoothing capacitors and the second load (4).

- 5.2 With the benefit of hindsight, it is possible to identify similarities between the arrangement of the comparator and the circuit branch comprising transistor T1 and resistor R13 in Figure 2 of document D1 and that of the comparator and the circuit branch comprising transistor 9 and resistor 10 in Figure 1 of the present application. However, it is important to consider document D1 as it would be considered by a person skilled in the art who was trying to solve the stated problem without knowledge of the present invention. To such a person, D1 does not offer a solution ready for the taking, or one requiring only obvious adaption.
6. In the result, the Board concludes that document D1 does not render it obvious to modify the prior art device shown in Figure 2 of the present application in such a way as to arrive at a device falling within the terms of the present Claim 1. The claimed subject-matter involves an inventive step within the meaning of Article 56 EPC. Consequently, the decision under appeal must be set aside.
7. The Board has not examined Claim 2 (apart from checking that it is dependent on Claim 1) or the description (apart from reading it to obtain an understanding of the invention) to see if they meet the requirements of the EPC, but makes use of its powers under Article 111(1) EPC to remit the case to the Examining Division for further prosecution, including adaption of the description on page 3 to the wording of Claim 1 (recited in paragraph IV above).
8. For avoidance of doubt, it is pointed out that according to Article 111(2) EPC the Examining Division is bound by the present decision only to the extent that it has been decided that the subject-matter of Claim 1 as recited in paragraph IV above involves an inventive step over the prior art considered in the present decision.

Order

For these reasons, it is decided that:

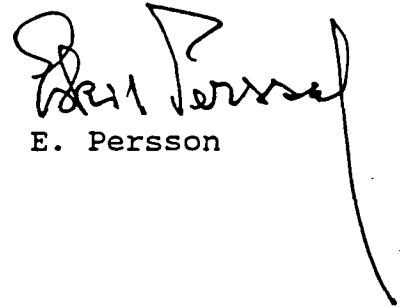
1. The decision under appeal is set aside.
2. The case is remitted to the Examining Division for further prosecution on the basis of Claim 1 as recited in paragraph IV above and the other documents listed in paragraph VIII above, having regard to the remarks in paragraphs 7 and 8 above.

The Registrar:



M. Kiehl

The Chairman:



E. Persson

in/jm