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D E C I S I O N
of 3 February 1995

Case Number: T 0042/93 - 3.4.1

Application Number: 84106312.6

Publication Number: 0128492

IPC: G01R 19/00

Language of the proceedings: EN

Title of invention:
Method of measuring the D.C. level of the output of an A.C.-to-D.C. power converter

Patentee:
Mitsubishi Denki Kabushiki Kaisha

Opponent:
Siemens AG

Headword:

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (no)"

Decisions cited:

Catchword:

Case Number: T 0042/93 - 3.4.1

D E C I S I O N
of the Technical Board of Appeal3.4.1
of 3 February 1995

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Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office dispatched on 23 October 1992 maintaining European patent No. 0 128 492 in amended form pursuant to Article 102(3) EPC.**

Composition of the Board:

Chairman: G. D. Paterson
Members: Y. van Henden
U. Himmler

Summary of Facts and Submissions

I. European patent No. 0 128 492 comprising two claims was opposed by the Appellant on the ground that, having regard to the state of the art which can be derived from, inter alia, document

D1: DE-C-2 454 601,

neither of said claims involved an inventive step.

II. The Opposition Division maintained the patent on the basis of Claim 1 as granted and of an amended Claim 2.

III. The Opponent lodged an appeal against the decision of the Opposition Division, requesting that said decision be set aside and that the patent in suit be revoked. Oral proceedings were subsidiarily requested.

With its Statement of Grounds of Appeal, the Appellant introduced the further document

D2: U. Tietze et al. "Halbleiter-Schaltungstechnik" Springer-Verlag Berlin Heidelberg New York, 1980, pages 466 to 469, 526 to 529, 588 to 593 and 700 to 914

into the proceedings.

IV. The Board summoned the parties to oral proceedings to be held on 18 January 1995. In a communication annexed to the summons, the Board took the provisional view that, to arrive at the subject-matter of either of the European patent's claims, a person skilled in the art

of measuring electrical parameters and attempting to apply the teachings of document (D2) while carrying out the invention disclosed in document (D1) would not have to display inventive talent.

V. In a letter dated 16 December 1994, the Respondent (Proprietor of the patent) requested that the patent in suit be maintained in the form accepted by the Opposition Division. Subsidiarily, the Respondent requested that the patent be maintained on the basis of a single claim filed simultaneously, which claim combines the features of Claim 1 as granted and those of Claim 2 as amended during the proceedings of opposition.

Said single claim forming the basis of the Respondent's auxiliary request reads:

"A method of measuring d.c. voltage and current components to calculate the mean values of the output of a d.c. output power converter including a ripple component related to the frequency of its a.c. power supply, wherein said method comprises the steps of:

a) selecting either the voltage or current component output of the power converter,

b) in response to each pulse of a train of pulses at a frequency which is N times that of the ripple frequency, where N is greater than 1, and in synchronism therewith, performing the following steps:

i) sampling the value of said selected output,

ii) converting said sample values into digital data, and storing said data in a memory,

iii) calculating a mean value of the most recent N values in a digital manner,

c) repeating steps a) and b) for the other component output, and using said digital data to calculate the mean values of the output voltage and current;

wherein said pulse train is generated by a phase-locked loop circuit which receives said frequency of said a.c. power supply as a reference input, and wherein use is made of a microcomputer which operates in response to the output signal of the PLL, which microcomputer controls said selection of either voltage or current and calculates the mean values of the output voltage and current."

VI. By facsimiles received on 17 January 1995, the Respondent and the Appellant informed the Board that they would not attend the oral proceedings fixed for 18 January 1995.

VII. The Appellant put forward the following arguments:

From document (D1) is known a method of determining the mean value of the intensity of a ripply DC current delivered by an AC to DC converter and comprising an AC component of period (T). The periodically varying intensity is measured at a sampling frequency (n/T), the sampled values are stored and the mean value of the DC intensity is calculated from the last stored (n) values. To this purpose, the latter are summed up and their sum is divided by (n). These steps are performed in synchronism with a train of pulses.

Document (D2) teaches to use a multiplexer for testing various logical states of any one of a plurality of

variables and for transmitting the results to a common output. This means that a multiplexer is needed if, by means of the same device, a plurality of measured physical parameters such as intensity and voltage have to be processed. If the method known from document (D1) is carried out digitally instead of analogically, the measured parameters have previously to be digitalised and, therefore, to be fed to an A/D converter via a multiplexer. The digitalised data shall then be processed by a microcomputer. Document (D2) furthermore discloses the use of a phase locked loop circuit for generating pulses at a frequency which is a multiple of an input frequency. Designing a method according to any one of the patent's claims, therefore, would not require any inventiveness from a skilled person attempting to apply the teachings of document (D2) while carrying out the invention disclosed in document (D1).

VIII. The Respondent's argumentation may be summarised as follows:

With respect to the disclosure in document (D1), the claimed method is distinguished in that it not only relates to the measure of DC voltages but also to that of DC current intensity practically at the same time, so that both values can be interrelated or combined with each other. Accordingly, either voltage or intensity is selected. Furthermore, the sample values are converted into digital data. Therefore, they can be stored in a digital memory and the most recent sample values can be averaged digitally instead of analogically. Finally, a PLL circuit is used in order to generate sampling pulses with a more precise timing

than would be the case when merely multiplying the ripple frequency of the input signal.

Document (D2) shows that multiplexers with two data inputs, provision of a clock frequency, synchronised frequency multipliers in the form of PLL circuits and digital measuring instruments comprising a microprocessor were known per se. Nevertheless, the Appellant did not explain why a skilled person starting from the disclosure in document (D1) would automatically be led to the claimed invention when taking into consideration the above teachings of document (D2).

Reasons for the Decision

1. Document (D1) concerns a device for measuring an electrical parameter characterising the DC output of an AC to DC converter, and more particularly the intensity supplied by a 3-phase converter. The output of the converter comprises AC components, of which the one having the lowest frequency has a period (T) - see: column 1, lines 59 to 63; column 2, lines 26 to 32. At time intervals (T/n), for instance (T/6), values of the intensity are sensed and cyclically stored in (n) memories - (n) being thus an integer. In a time interval of duration (T), (n) values of the intensity are thus measured, of which the mean value corresponds to that of the DC component of the converter's output - see column 2, lines 32 to 39.

With regard to Figure 2 of (D1), the device comprises (n) switches (S_1-S_n) which are cyclically operated in

response to pulses outputted at frequency (n/T), i.e. (n) times the ripple frequency (1/T), by a pulse generator (8) - see from the last line of column 2 to line 6 of column 3, and take into account the confusion made there between period and frequency; see also column 2, lines 11 to 14. Each time one of the switches (S_1-S_n) is closed, a voltage (U) representative of the intensity of the ripply DC current is applied across a respective capacitor - see column 2, lines 51 to 56. The charges stored in the (n) capacitors connected to the switches (S_1-S_n) are thus representative of the most recent (n) values of the intensity sensed at time intervals (T/n). The mean value of these most recent (n) values, therefore, corresponds to the mean DC intensity of the ripply current during the last (n) time intervals of duration (T/n) - see: column 2, lines 36 to 39; column 3, lines 6 to 9.

2. The subject-matter of the single claim filed with the Respondent's letter dated 16 December 1994, therefore, is distinguished over the method implemented by the device described in (D1) with reference to Figure 2 in that:

- the DC voltage component of the converter's output is also measured;

- either the intensity or the voltage is measured first;

- the sample values of the selected output are converted into digital data;

- the second component - i.e. voltage or intensity - of the DC output is determined by repeating the same steps as in the case of the first one, and

- the mean values of the output voltage and intensity are calculated by a microcomputer, which microcomputer controls the selection of either voltage or current and operates in response to the output signal of a phase locked loop circuit receiving the frequency of the AC power supply as a reference input.

3. According to (D1), the mean value of the DC intensity of an AC to DC converter's output is determined by averaging a sampled voltage signal, the amplitude of this signal being representative of the DC output's intensity. To the person skilled in the art of electrical measuring devices, it is consequently obvious that the mean value of the DC output's voltage can be determined by sampling either this voltage or a voltage signal of proportional amplitude, and then by processing the voltage samples in the same manner as in the case of a measure of intensity.

At this stage, it is within the discretion of the skilled person to decide whether only one of the voltage and intensity or both of them will be measured, as well as to decide whether any of them will or will not be measured each time the other one has been measured. Besides, it is clear to him that using the same circuit for processing the sampled signals represents a cheaper solution but makes it impossible to measure simultaneously both the voltage and the intensity. Therefore, no inventive talent is required

to envisage the selection of either the voltage or the intensity as first electrical parameter to be measured, nor to measure the other electrical parameter after the first one has been measured.

4. Document (D1) claims a priority from 1974, i.e. nine years before that of the patent in suit. In the meantime, however, the advantages of digital techniques have been universally acknowledged, and components for generating, processing and converting digital signals have become comparatively cheap. In the Board's judgment, therefore, the specialist of electrical measurement devices would not have attempted to replace analogical components of the circuit described in (D1) by digital ones, as the Respondent contended. Furthermore, said specialist knew that, in electronics, as far as means suitable for performing each individual step of a method are available, designing a device for carrying out that method in its entirety is always possible. From document (D2), he knew, as the Appellant relevantly pointed out, that arithmetical operations can be carried out on the basis of data stored in memories - see the first two lines of page 528 - that microcomputers operate in response to pulses - see page 527 - that phase locked loop circuits are suitable for producing trains of such pulses at a frequency which is a multiple of an input frequency - see page 714 - and that multiplexers allow the selective transmission of digital data stored in separate memories - see pages 466 and 467. Besides, it is clear that calculating the mean value of a plurality of sample values requires no more than a few arithmetical operations. Therefore, starting from the method implicitly disclosed in document (D1), the specialist

of electrical measurements would not have been deterred from envisaging a digital processing, whereby previous conversion of the sampled values into digital data is of obvious necessity. The Board furthermore concurs with the Appellant that, to said specialist designing a device in which a microcomputer has to be operated by pulses at a frequency which is n times that of an alternating current, the particular interest of generating said pulses by means of a phase locked loop circuit receiving that alternating current as reference input is also obvious. Finally, it is at the discretion of the skilled person to decide whether the selection of either voltage or intensity as first parameter to be measured shall be controlled by the microcomputer or left to a human operator. Besides, it is obvious that no unexpected effect can result from the choice of any one of these alternatives. Therefore, before the priority date of the patent in suit, envisaging to carry out the distinguishing steps recited in Section 2 of the present decision instead of those featuring the method known from document (D1) did not involve the skilled person in the exercise of inventive ingenuity.

5. In the Board's judgment, therefore, the single claim submitted with the Respondent's letter dated 16 December 1994 and forming the basis of the Respondent's auxiliary request does not involve an inventive step. Moreover, since the scope of protection defined by this claim is included within that of Claim 1 as granted, the latter claim too lacks an inventive step.

6. None of the independent claims forming the respective bases of the Respondent's main and auxiliary request,

therefore, is allowable - Article 52(1) EPC in conjunction with Article 56 EPC. The European patent has consequently to be revoked - Article 102(1) EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The European patent No. 0 128 492 is revoked.

The Registrar: The Chairman:

M. Beer G. D. Paterson