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Datasheet for the decision of 25 January 2022

Case Number: T 0771/15 - 3.4.01

Application Number: 07735458.7

Publication Number: 2027478

IPC: G01R31/12

Language of the proceedings: EN

Title of invention:
INSTRUMENT AND METHOD FOR MEASURING PARTIAL ELECTRICAL DISCHARGES IN AN ELECTRICAL SYSTEM

Patent Proprietor:
Techimp HQ S.R.L.

Opponent:
Omicron electronics GmbH

Headword:
Partial discharges / TECHIMP

Relevant legal provisions:
EPC 1973 Art. 100(a), 56
RPBA Art. 12(4)

Keyword:
Inventive step - (no)
Late-filed request - submitted with the statement of grounds of appeal - request should have been filed in first instance proceedings (yes)

Decisions cited:
R 0011/11

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Beschwerdekammern

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Case Number: T 0771/15 - 3.4.01

D E C I S I O N
of Technical Board of Appeal 3.4.01
of 25 January 2022

Appellant: (Patent Proprietor)	Techimp HQ S.R.L. Via Toscana 11/C 40069 Zola Predosa (BO) (IT)
Representative:	Conti, Marco c/o BUGNION S.p.A. Via di Corticella, 87 40121 Bologna (IT)
Respondent: (Opponent)	Omicron electronics GmbH Oberes Ried 1 6833 Klaus (AT)
Representative:	Banzer, Hans-Jörg Kraus & Weisert Patentanwälte PartGmbB Thomas-Wimmer-Ring 15 80539 München (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 9 March 2015 revoking European patent No. 2027478 pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman	P. Scriven
Members:	T. Alecu
	D. Rogers

Summary of Facts and Submissions

I. The appeal is against the Opposition Division's decision to revoke the patent. The proprietor requested that the decision be set aside and that the opposition be rejected, or that the patent be maintained in the form according to one of two auxiliary requests filed with the statement setting out the grounds of appeal, the first auxiliary request being identical to the first auxiliary request underlying the decision of the Opposition Division.

II. In its response to the appeal, the opponent requested that the appeal be dismissed and that the patent be revoked.

III. The patent was opposed on grounds under Articles 100(a) and (b) EPC. The following prior art was cited, inter alia:

O1: Public prior use of the MPD 540 instrument from mtronix GmbH

O2: J. Borghetto , A. Cavallini et al., "Partial Discharge Inference by an Advanced System. Analysis of Online Measurements Performed on Hydrogenerator", IEEE Transactions on Energy Conversion 19(2), June 2004, 333-339

O6: A. Contin, A. Cavallini et al., "Digital detection and fuzzy classification

of partial discharge signals", IEEE Transactions on Dielectrics and Electrical Insulation 9(3), June 2002, 335-348.

IV. As evidence for the public prior use, the opponent provided copies of invoices (documents O1-1 to O1-6), published technical papers (O1-7 to O1-13), a letter from a customer (O1-14), and offered as witnesses Messrs Casper Steinecke and Burkhard Daniel. The following are relevant for the current decision:

O1-8: K. Rethmeier, W. Kalkner, and R. Plath, "On-site PD decoupling and localization at cross bonded HV cable systems." Proceedings of the XIVth International Symposium on High Voltage Engineering, 2005

O1-9: R Plath, "Multi-channel PD measurements" Proceedings of the XIVth International Symposium on High Voltage Engineering, 2005

O1-13: R. Plath, "System concept for partial discharge monitoring on HV/EHV cable systems." IEEE International Conference on Condition Monitoring and Diagnostics, April 2006

V. In the notice of opposition, the opponent raised novelty objections based on O1 and on O2, and multiple objections of a lack of inventive step. Among them was one based on the combination of the public prior use with document O6.

VI. The Opposition Division considered that the objections under Article 100(b) EPC did not prejudice the maintenance of the patent. The main request (patent as granted) and the first auxiliary request were, however, considered to lack novelty in view of O2.

VII. Regarding the prior use, the Opposition Division did not see the need to hear the offered witnesses because the disclosures of documents O1-8 to O1-10 already contained what "the Opponent alleges (and the Proprietor acknowledges) as the public prior use disclosure."

VIII. With the statement of grounds of appeal, the appellant disputed the conclusions of the Opposition Division regarding O2.

IX. In the reply to the proprietor's appeal, the opponent maintained the novelty objection based on O2; and reiterated the novelty objection based on the public prior use, again offering the two witnesses. It also contested inventive step based on the prior use in combination with O6. The new second auxiliary request was objected to for insufficient disclosure.

X. The Board sent a preliminary communication, asking the parties for further submissions as to what they considered to be disclosed, or not, by the alleged public prior use in view of the provided documents; and raised the question of consideration of the second auxiliary request and the respondent's objection to insufficiency of disclosure.

XI. In view of the parties' replies, the Board indicated, in the preliminary opinion sent with a summons to oral proceedings, that it saw no need to hear the witnesses, because there was sufficient evidence of the technical characteristics of the MPD 540 device, as alleged by the respondent and not per se contested by the proprietor, in cited documents, in particular O1-8, O1-9, O1-13, which were published before the priority date of the patent.

XII. The Board also indicated that it regarded the subject matter of the various versions of claim 1 to be new in light of both O2 and the alleged public prior use.

XIII. In response to the summons, the proprietor submitted auxiliary request 3. This was later withdrawn, during oral proceedings.

XIV. Claim 1 of the patent (main request) defines (reference signs omitted):

> *An instrument for measuring partial electrical discharges in an electrical system, comprising:*
> *- an input stage set up to receive an analogue signal representing one or more pulses of partial discharges to be measured and to generate at its output a digital representation of the entire wave form* [sic] *of said one or more pulses,*
> *- an output stage set up to transfer data in digital shape at the output from the instrument,*

_[sic]data processing means operatively associated both with the input stage and with the output stage to receive said digital representation of the entire wave form of said one or more pulses, extract the value of predetermined parameters relating to the wave form of said one or more pulses and transfer to the output stage a processed digital signal comprising said values, the processing means operating substantially in real time, i.e. with no need for a memory for the intermediate storage of the data,
wherein said predetermined parameters comprise amplitude of the discharge pulses, phase parameters, equivalent duration (T) and equivalent bandwidth (W).

XV. Claim 1 of the first auxiliary request adds the following:

... wherein the processing means comprise a block for processing / extracting said predetermined parameters from said digital representation, wherein the block is configured for operating in real time for extracting the predetermined parameter values from samples of segments constituting a digital representation of the entire profile over time of PD pulses, wherein the segments in themselves are not maintained by the block.

XVI. Claim 1 of the second auxiliary request is dependent claim 5 of the patent, so that the following is added to claim 1 of the main request:

> *... wherein the processing means comprise a conditioning element, inserted upstream of the output stage, to operate a digital filtering of the processed signal, as a function of the derived values.*

Reasons for the Decision

1. The patent relates to an instrument and method for measuring partial discharge patterns. It proposes to digitize the input signals and extract, in real time, parameters, in particular related to the pulse waveform, that allow an analysis of the discharges, so as to differentiate signals from different sources and from noise. The pulse waveform data may then be dropped to reduce memory and data transfer requirements.

Main request

2. Document O2 (abstract) describes a *system aimed at performing partial discharge measurements and condition assessment on electrical apparatus*, which enables the separation and identification of partial discharge patterns. It is said that, in contrast to the known systems, the system of O2 exploits information about the pulse waveform useful to distinguish one discharge

source from another.

3. On page 334, the system is described as follows:

> *This system is able to record the whole PD pulse shape, extract information and store the data into memory. Once a number of PD pulses sufficient to achieve statistics of PD-associated quantities (e.g., pulse height, phase and rate, Normalized Quantity Number, etc.) has been collected, the recorded data are sent to a remote host computer for post-processing.*

4. The system comprises a hardware and a software part, shown as two boxes in Figure 1. The hardware part includes an analogue-digital converter, a sample and hold circuit, a trigger system, a DSP (digital signal processor) unit, and a RAM. The DSP (bottom of page 334, left-hand column) *was introduced to extract online some relevant pulse features. These are the so-called equivalent time length and equivalent bandwidth, defined on the basis of the pulse representation in both time and frequency domain*.

5. It is said that these two parameters allow a separation, using an unsupervised clustering procedure, of the pulses into groups or (page 334, right-hand column): *sub-datasets, each of them characterized by pulses having similar shape or localization in the time/frequency plane. Thus, the measured PRPD pattern can be decomposed into sub-patterns, each of them relevant to pulses with similar shape (separation)*.

6. For each of these groups, the source of the discharge is identified using a set of markers and *Fuzzy*

Inference Systems (FIS) which processes the markers in order to estimate the nature of the underlying defect. This is, however, *work in progress* (penultimate paragraph of section II, on page 335).

Novelty and inventive step in view of O2

7. The parties disagree as to whether O2 discloses the *real time computation* of amplitude and phase; they agree that O2 discloses all other features of claim 1, in particular that the DSP performs real time computations of the equivalent bandwidth and equivalent duration.

8. The opponent argues that the claimed instrument was disclosed in two ways in O2. In the first, the instrument corresponded only to the hardware part (the upper box in Figure 1); in the second, it also included the hardware for post processing, i.e. the hardware on which the software part was implemented (both boxes of Figure 1).

9. Considering the first possible disclosure, O2 stated that the DSP was introduced to extract, online, some relevant pulse features (pulse height, phase and rate, Normalized Quantity Number) which were necessary for the statistical analysis in post processing. So the skilled person would understand that these had to be computed before the post processing, namely by the DSP.

10. Even if the skilled person were to understand that the DSP did not compute the phase and amplitude, such a modification would have been obvious, because the two parameters were already designated in O2 as relevant pulse features, so the skilled person would consider

computing them with the DSP.

11. Their computation with the DSP would also have been an obvious simplification. The system of O2 was experimental - a commercial product would be cheaper, using less storage, and would discard the post processing stage. It would use the DSP to compute the amplitude and phase, because such calculation on a DSP was bread and butter to the skilled person, who was used to the amplitude/phase representation. This was visible in that O2 presented the results of the clustering procedure in terms of phase and amplitude (Figures 2, 3, 5), although clustering was performed using the equivalent duration and equivalent bandwidth.

12. Regarding novelty, the proprietor argued that the DSP of O2 clearly computed only the equivalent bandwidth and the equivalent duration, based on the phrasing in O2 (...*to extract online some relevant pulse features. These are* ...). There was no unambiguous disclosure that the phase and amplitude were also computed by the DSP.

13. Regarding inventive step, the proprietor argued that, while the skilled person could have computed the phase and amplitude parameters with the DSP, they would not have done so, because they had no reason to.

14. O2 emphasised the importance of the pulse shape, and this taught away from dropping the pulse waveforms to save storage. O2 explained that the identification procedure of O2 was still work in progress, so the skilled person would have kept the waveforms so as to be able to refine this procedure.

15. One might compute other parameters with the DSP, but this would require that an algorithm be fixed, which would mean giving up some flexibility, both in how the amplitude and phase were computed, and in the selection of parameters that were available for identification.

16. Furthermore, the skilled person would not burden the DSP unnecessarily, unless some savings were expected. None were, because O2 did not mention why a DSP was used and there was no suggestion it could be used to save on storage.

17. The opponent's argument that the skilled person would have dropped the pulse waveforms and would have computed exactly the four parameters defined, but not the other statistical parameters indicated in O2, for instance the rate or the Normalized Quantity Number, was the result of hindsight.

18. Regarding novelty, the Board agrees with the proprietor. There is indeed no unambiguous disclosure that the phase and amplitude are computed by the DSP, or before the post processing stage. It is, on the contrary, clear from the passages provided that only the two parameters of equivalent bandwidth and equivalent duration are computed by the DSP.

19. Regarding inventive step, the Board remarks that the skilled person knows that the function of a DSP is to provide (efficient) hardware support for signal processing tasks, including, for example, filtering and parameter extraction. The skilled person would, therefore, in principle, consider using the DSP made available in O2 to take over other signal processing tasks defined in O2, and, in particular, similar tasks to those that the DSP is already employed for.

19.1 Thus, in the view of the Board, the skilled person would have considered computing all relevant pulse features mentioned in O2 using the DSP, which include in particular the phase and amplitude, as the respondent argued. It follows that a modification of O2 in which the DSP computes all relevant pulse features, but is otherwise the same, would have been obvious.

20. Such a modification of O2 is covered by claim 1 of the patent: the claim neither defines that only the four parameters mentioned are computed, nor that the pulse waveforms are dropped. This latter fact also means that the arguments regarding simplification to save storage and the counter arguments thereto based on teaching away and on hindsight are not pertinent to this set of claims.

21. The Board agrees that the skilled person may be giving up some flexibility in how, for example, the phase and amplitude parameters are computed, but this is not an issue in O2. Any standard way of computing them is good enough. The issue in O2 is rather which other parameters, extracted from the pulse waveform, may be necessary for identification; because the waveforms are not discarded, there is no loss of flexibility in that respect.

22. The Board concludes, therefore, that the subject matter of claim 1 of the patent lacks inventive step starting from O2 (Article 100(a) and 56 EPC).

First auxiliary request

23. For this request, the opponent relies on documentary evidence regarding the MPD 540 instrument (O1), to demonstrate a lack of inventive step.

24. The opponent relies, in particular, on document O1-13, making reference to Figures 3 and 6, and the passage following figure 6::

> *For example, each PD device MPD540 (see fig. 3) reduces its input raw data stream generated by the A/D-converter from 128 MByte/s to max. 1.4 M events/s, applying state-of-the-art real-time digital filters. One event represents one detected PD (or noise) pulse and consists of four parameters: pulse amplitude (charge), time of occurrence, AC phase position and PD pulse polarity (parameter extraction). Consequently, only the parameters of detected pulses are transmitted by optical fiber.*

25. The proprietor agrees that an instrument, MPD 540, with technical characteristics evidenced on the basis of the disclosures in the cited documents O1-8, O1-9 and O1-13, was prior art, as the Board indicated in its preliminary opinion.

26. Both parties agreed that, in terms of novelty, O1-13 disclosed all the features of claim 1 of this request, including the computation of the amplitude and phase in real time and the added feature of not maintaining the pulse waveform, but with the exception of the

computation of the equivalent duration and the equivalent bandwidth, whether in real time or not.

27. In the view of the opponent, the objective technical problem was that of separating and identifying the different partial discharge sources.

28. Starting from O1-13 and searching for a solution to this problem, the skilled person would have found document O6, which taught a method for the separation and classification of PD-pulses, and PD-source identification. This method required the extraction of two parameters: equivalent bandwidth, and equivalent time-length. The skilled person would, therefore, have implemented the extraction of these parameters using the MPD 540 instrument, so as to allow for PD-source separation and identification.

29. This would be done using the FPGA that also extracted the phase and amplitude, in addition to those computations which were of general interest for the skilled person. This would pose no difficulties to the skilled person, because the signal at the FPGA input contained all the necessary information, and the skilled person knew how to program the FPGA to compute, in parallel, the two extra parameters. The opponent compared the upper frequency of the anti-aliasing filter and the sampling rates indicated in O1-13 (20 Mhz and 64 Ms/s - figure 3) to those used in O2 (25 Mhz and 100 MS/s - beginning of section III) for acquiring the pulse waveforms and computing the same parameters, stating that the parameters used in O1-13 were sufficient to preserve the pulse waveform information at the FPGA input.

30. The proprietor did not dispute the formulation of the objective technical problem, but argued that the usage of the MPD 540 was incompatible with the extraction of the two parameters.

31. With reference to O1-8 and O1-9, the proprietor also submitted that, for the skilled person, the digital filtering performed in the FPGA of the MPD 540 device implied, as a first step, a narrow band quasi-integration filter which facilitated peak height and phase determination, but which suppressed the waveform information. Analysing the waveform to determine the two new parameters would mean a change of paradigm and of FPGA implementation.

32. Furthermore, when looking for a solution to the objective technical problem, the skilled person would rather use the 3PARD approach presented in O1-8 and O1-9, developed by the author of O1-13. O1-9 actually discussed the pulse waveform analysis (O1-9, below figure 5) and explained that it was disadvantageous in comparison with the 3PARD approach - this taught away from the pulse waveform approach. Thus the skilled person would not implement the method of O6 in conjunction with the MPD 540 instrument.

33. The Board is of the opinion that, when looking for a solution to the objective technical problem, the skilled person would investigate all avenues that appear to be promising. The 3PARD approach, presented in O1-8 or O1-9, is one of them. But so is, in principle, the alternative approach of pulse waveforms analysis, as presented in O6.

34. The Board notes that, in respect of this alternative, O1-9 states:

As long as PD pulses are detected close to their origin and without significant distortion of the original waveform, waveform analysis provides a suitable tool for separating different types of PD and impulse-type interference. [...] Due to on-site interference, however, band-pass filtering often is required to improve SNR. Then, the PD pulse waveform is dominated by the filter response and loses all information about origin or propagation, respectively.

35. The Board does not see here a "teaching away" from the invention, but rather a presentation of a suitable approach, which may not work in all circumstances.Thus the skilled person would have considered using the pulse waveform approach, even when considering the statements of O1-9.

36. In order to implement this approach, it is necessary to perform the computation of the two extra parameters introduced in O6 at the instrument level, because no other data than the computed parameters is output by the MPD 540, according to O1-13 - for data compression purposes. The Board considers that it would have been a routine task for the skilled person to program the FPGA to do this in parallel with the computation of the phase and amplitudes using the unfiltered signal provided at its input.

37. In conclusion, the subject matter of claim 1 of this request lacks inventive step starting from O1, in particular O1-13, in view of O6 (article 56 EPC).

Second auxiliary request

38. The opponent objected to the consideration of the second auxiliary request, on the grounds that it was divergent, and that it should have been filed before the Opposition Division proceedings because the proprietor should have been prepared for the possibility that the Opposition Division might find the patent to lack novelty. With reference to R 11/11 "Petition clearly unallowable", the opponent also indicated that the appellant had chosen not fully to use the possibilities for defending the patent before the Opposition Division.

39. The proprietor argued that the request was convergent, as it addressed the same problem, that of reducing memory, by filtering out partial discharge events that, for example, could be attributed to noise. There had been no reason to file the request before the Opposition Division, where the discussion focused on novelty, namely on the question of whether, in O2, two or four parameters were computed in real time, and on the question of whether the public prior use was an admissible objection. Not asking for oral proceedings had been a mistake and not a tactic.

40. The Board notes that there was no unexpected turn of events in the first instance - the decision of the Opposition Division was to revoke the patent on a ground which was filed with the notice of opposition (lack of novelty in view of O2). The appellant should have filed all responses they deemed appropriate in view of that ground already at that point of the procedure, that is during the opposition procedure.

41. In these circumstances, as auxiliary request 2 was not filed before the opposition division, the Board has the discretion not to admit it (Article 12(4) RPBA 2007). This discretion is normally exercised if a new request amounts to bringing a "fresh case", i.e. a substantial change in the subject of proceedings (see the Case Law of the Boards of Appeal, 9th Edition, V.A.4.11.1).

42. The Board notes that in the present case, although the general problem addressed may be the same, the problem addressed by this request is different from the one addressed in the main and first auxiliary requests, namely filtering out unwanted signals vs. data compression. It follows that this request is substantially different from the ones that were the subject of the decision under appeal.

43. The Board therefore declines to admit this request (Article 12(4) RPBA 2007).

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

D. Meyfarth P. Scriven

Decision electronically authenticated