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Datasheet for the decision of 21 December 2022

Case Number: T 2546/18 - 3.2.06

Application Number: 05254976.3

Publication Number: 1630633

IPC: F01D17/02, G05B23/02

Language of the proceedings: EN

Title of invention:
System for gas turbine health monitoring

Patent Proprietor:
Raytheon Technologies Corporation

Opponent:
Siemens Aktiengesellschaft

Headword:

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - (no)

Decisions cited:
T 0641/00, G 0001/19

Catchword:

Europäisches Patentamt
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Beschwerdekammern

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Case Number: T 2546/18 - 3.2.06

D E C I S I O N
of Technical Board of Appeal 3.2.06
of 21 December 2022

Appellant: (Patent Proprietor)	Raytheon Technologies Corporation 10 Farm Springs Road Farmington, CT 06032 (US)
Representative:	Dehns St. Bride's House 10 Salisbury Square London EC4Y 8JD (GB)
Appellant: (Opponent)	Siemens Aktiengesellschaft Werner-von-Siemens-Straße 1 80333 München (DE)
Representative:	Kaiser, Axel CT IP S DE Corporate Intellectual Property and Functions Postfach 22 16 34 80506 München (DE)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 12 September 2018 concerning maintenance of the European Patent No. 1630633 in amended form.**

Composition of the Board:

Chairman	M. Harrison
Members:	T. Rosenblatt
	W. Ungler

Summary of Facts and Submissions

I. The appellant (opponent) filed an appeal against the interlocutory decision of the opposition division, posted 12 September 2018, in which the opposition division found that European patent No. 1 630 633 in an amended form met the requirements of the EPC.

The proprietor (respondent) also filed an appeal against that decision (which was later withdrawn in the course of the appeal proceedings).

II. The parties were summoned to oral proceedings before the Board.

III. In a subsequent communication pursuant to Article 15(1) of the Rules of Procedure of the Boards of Appeal (RPBA 2020), the parties were informed of the Board's preliminary opinion on the case. The Board *inter alia* opined that independent claim 1 of the set of claims which the opposition division had considered to comply with the requirements of the EPC appeared to lack an inventive step.

IV. Oral proceedings before the Board were held on 21 December 2022 by videoconference, during which the proprietor withdrew its appeal.

V. The appellant (opponent) requested that the decision under appeal be set aside and the patent be revoked.

VI. The respondent (proprietor) requested that the appeal be dismissed.

VII. The following document was referred to by the appellant:

D2 : WO 02/03041 A1.

VIII. Independent claim 1 of the sole request of the respondent has the following wording:

"A method for assessing health of a device comprising the steps of:
receiving a plurality of sensory outputs in a data alignment module and outputting therefrom a synchronized data stream, wherein the data alignment module is for synchronizing data readings recorded at different rates;
receiving said synchronized data stream in an analysis module, performing analysis of said synchronized data stream, and extracting therefrom and outputting a plurality of device health features;
receiving said plurality of device health features in a high level diagnostic feature information fusion module and outputting therefrom a device health assessment;
wherein said receiving said plurality of sensory outputs comprises the additional steps of:
commencing to receive said plurality of sensory outputs at a beginning of a window duration;
sampling said plurality of sensory outputs to produce a sampled data stream; and
outputting said synchronized data stream comprising said sampled data stream at an end of said window duration."

The set of claims of this sole request also comprised a second independent (apparatus) claim 10. Its wording is however not relevant for the decision to be taken in the present case so that it does not need to be

reproduced here.

IX. The arguments of the appellant can be summarised as follows.

The finding of the opposition division that D2 did not disclose the feature "sampling said plurality of sensory outputs to produce a sampled data stream" was incorrect. This feature was known from page 14, lines 29 to 34 and page 15, lines 1 to 20 of D2, as there was no difference between the claimed method and the synchronisation of data streams disclosed in these passages. The only difference between the subject-matter of claim 1 and the method of D2 thus lay in the generation of a plurality of device health features. Analysing several series of measured parameters of a device was known from D2, for example from page 1, line 30 to page 2, line 7. The generation of a plurality of device health features achieved no technical effect over D2. According to paragraphs 14, 16, 17, 19 and 20 of the patent in suit, all method steps could be performed on normal computers. The operation of the claimed method was not linked to any technical alteration of the real world, for example the alteration of some separate device. The distinguishing features did not define technical features, they merely concerned data processing.

X. The arguments of the respondent can be summarised as follows.

Claim 1 was distinguished over the method disclosed in D2 by the provision of a plurality of device health features used in the establishment of the device health assessment and by the particular method of receiving the plurality of sensory outputs according to the three

final method steps defined in claim 1. The opposition division correctly concluded that D2 did not disclose outputting a plurality of device health features as claimed. There was also no disclosure in D2 of synchronising data where a "data alignment module **commences to receive** a plurality of sensory outputs **at a beginning** of a window duration, **samples** the sensory outputs, and then **outputs the sampled data stream** at the end of the window duration" (emphasis by the respondent). The different method disclosed in D2 on page 11, line 3 to page 12, line 16 and in more detail at page 15 onwards, represented a search algorithm rather than a means of synchronising data. The action of sampling mentioned on page 14 of D2 related to the generation of sensor outputs rather than to the subsequent sampling of already acquired sensor outputs. This resulted in the establishment of a kind of look-up table in which time stamps found with the search algorithm were recorded, whereas sampling as defined in claim 1 involved a reduction in the amount of data to be treated.

The problem to be solved by these two distinguishing features could be derived from paragraph 4 of the granted patent. The distinguishing features of claim 1 led to a more comprehensive health assessment due at least in part to the high level diagnostic feature information fusion module receiving a plurality of device health features, as opposed to a single health feature as disclosed in D2. The broad concept of D2 could be seen as providing a single, simplified signature value that could be easily compared with a reference value (see especially page 3, lines 21 to 25 of D2). The skilled person would not interpret claim 1 as broadly as suggested by the Board in point 2.6 of its preliminary opinion. The claimed technical features

require not just operations on data, but that those operations (i.e., commencing, sampling, and outputting) happen at defined points in time. Feature (ii) identified by the Board therefore involved a technical contribution. The technical solution of course being a method or apparatus that provided an improved health assessment of a device. An improved health assessment was a technical outcome in terms of a gas turbine engine. This of course went beyond the mere operation of the computer. Based on such improved health assessment, an operator may take an action manually which could however not be defined as a method step in the claim. The output of the health assessment was technical. For example in case of the health assessment indicating a "bird strike", such an outcome would be taken seriously and action taken accordingly.

Reasons for the Decision

1. The subject-matter of claim 1 does not involve an inventive step (Article 56 EPC) for the following reasons.

2. The method defined in claim 1 comprises a mixture of steps of a technical nature (such as "receiving a plurality of sensory outputs") and steps of data analysis which are merely based on mathematical methods and are therefore considered of non-technical nature (such as the features relating to data stream analysis). The Board therefore applies the COMVIK-approach (T 641/00, OJ EPO 2003, 352), also referred to in G 1/19 (OJ EPO 2021, A77).

3. It is common ground between the parties that the method for assessing health of a device disclosed in D2 can be considered to represent the closest prior art to the subject-matter of claim 1.

4. The appellant acknowledged that the method of D2 resulted in the extraction and outputting of only a single device health feature, which device health feature can be identified with the "condition signature" according to D2, rather than of "a plurality of device health features". This distinguishing feature is referenced as feature (i) in the following.

5. The parties disagreed on the question of whether the final feature defined in claim 1, referred to in the following also as feature (ii), was disclosed in D2. This feature defines more precisely the step of receiving said plurality of sensory outputs to comprise three additional steps of

> commencing to receive said plurality of sensory outputs at a beginning of a window duration;
> sampling said plurality of sensory outputs to produce a sampled data stream; and
> outputting said synchronized data stream comprising said sampled data stream at an end of said window duration.

Page 15, lines 1 to 4 of D2 discloses that the different data streams of acquired condition indicators, which correspond to the sensory outputs according to claim 1, are stored in separate files or buffers together with their time stamps. A file or buffer can only store data of finite length. Since the data in each buffer is time stamped (line 3), the necessary finite length of a data buffer implies a finite time interval to which the data corresponds. The

synchronisation algorithm starts from a last synchronised data item in each buffer and proceeds until there is no further data in the buffer remaining to be synchronised (see lines 5 to 20 or the box on page 16). The skilled person understands the entire passage on page 15 thus to imply that the synchronisation is performed on data acquired during a finite "window duration", such that there must be a point of commencing to receive data at the beginning as well as an end of such window duration (lines 19/20, "... and so on until there is no more data available to synchronise.").

Whether feature (ii) is disclosed in D2 in its entirety, in particular in view of the question whether the algorithm of D2 involves sampling as a step of that synchronisation algorithm, may however be left undecided for the purpose of this decision. It may be assumed in favour of the respondent that the method of claim 1 is distinguished over the known health assessment method disclosed in D2 by both features (i) and (ii).

6. As was already stated in the Board's preliminary opinion, the distinguishing features do not contribute to a (single or several) technical effect(s) necessarily achieved over the whole scope of the claim (see also G 1/19 and T 641/00, *ibid.*).

6.1 The claimed method certainly involves technical considerations, for example in receiving sensory output or in deriving from the sensory data a plurality of device health features, by establishing a link between measured or captured properties and technical condition of the device.

6.2 The purpose of the method according to claim 1 is the output of a device health assessment, or as it is formulated at the end of paragraph 17 of the patent in suit, "[t]he output of this process is an engine health assessment or a series of assessments with varying degrees of probability (or levels of belief)". The claim does not exclude that the output might be just a simple numerical value, e.g. "3", which might be looked up in a table by a technician to correspond to a particular condition of the device, e.g. "oil leakage detected" or "bird stroke impact" or even "all components in normal condition". Paragraph 20 and granted claim 3 specify that health assessment may lead to produce a recommended maintenance action.

6.3 It is not apparent from the patent, and it has also not been argued by the respondent, that the extracted and output health assessment is necessarily used to control the operation of the device undergoing health assessment. The mere output of the device health assessment cannot be considered to represent or achieve a technical effect, in particular as such output may also lead to a recommendation which may or may not be taken into account by a technician.

6.4 Both distinguishing features (i) and (ii) pertain only to the treatment of the previously obtained/sampled data, so as to derive further data characterising the state of the device ("health features" or a "health assessment").

6.4.1 Feature (i) just results in more device conditions being available to be taken into account in the health assessment. Although potentially based on technical considerations, the extraction of a plurality of device health features is essentially based on mental acts

(establishing mathematical models linking sensory data to a physical condition, see also granted claim 8) and/or mathematical methods (use of neural networks etc., see granted claim 9), which may then lead to a corresponding implementation on a normal computer (see also paragraphs 16, 19 and 20 of the patent). Mental acts and mathematical methods as such are not considered to be of a technical nature. Although features based on such aspects might in principle still contribute to a technical effect, this is not the case here, since the claimed method does not achieve a technical effect (see point 6.3 above). The mere implementation on multi-purpose computer(s) does not achieve anything going beyond the normal operation of such computer(s).

6.4.2 Similarly, the operations performed on the sensory output data according to feature (ii) - i.e. data synchronisation by sampling in a (pre-defined) window duration and extraction and output of a plurality of health features - also do not provide a technical effect which goes beyond the normal operation of the computer(s) employed for the execution of the claimed method. They also only rely on the insight that a certain momentary physical condition of the device is characterised by taking into account different measurements at that very moment and consequently that data of different sensory streams need to be synchronised, which is then implemented accordingly on a multi-purpose computer (paragraph 14 of the patent in suit). These considerations clearly imply also technical knowledge. The same is however also the case in D2, and the difference - assuming that there is indeed a different synchronisation method defined in feature (ii) of claim 1 compared to that implemented according to pages 15/16 in D2 - could only be seen in

that particular way defined by feature (ii) of synchronising or aligning data. However it is not apparent in the present case that this involves any further technical consideration which would necessarily achieve a technical effect going beyond the normal operation of the computer(s) on which the operations are performed.

6.4.3 Moreover, and as also argued by the appellant, it is also not apparent from the patent that these distinguishing method steps would provide for any technical effect compared to the method known of D2.

6.5 In the absence of any technical effect achieved by features (i) and (ii), the features cannot be considered to contribute to the solution of a technical problem. The subject-matter of claim 1 therefore cannot be considered to involve an inventive step (Article 56 EPC).

6.6 The respondent's arguments are unconvincing for the following reasons.

6.6.1 Contrary to the respondent's contention, the problem derivable from paragraph 4 of the patent in suit, namely to provide a method for performing data fusion on multiple streams of digital data having different sampling rates to obtain comprehensive diagnostic and prognostic knowledge regarding the health of an engine, cannot be accepted as representing an objective technical problem. In addition to the above established reason of a missing technical effect achieved by the distinguishing features (i) and (ii), D2 on e.g. page 2, line 31 to page 2, line 34 or on page 16, lines 26 to 34 discloses achieving the same purpose.

6.6.2 A potentially improved or more comprehensive health assessment based on a plurality of health features, compared to an assessment based on a single health feature or condition signature according to the method of D2, does not constitute a "technical outcome in terms of a gas turbine engine", as argued by the respondent during the oral proceedings, at least as long as it does not necessarily lead to a corresponding direct consequence or action on the assessed device or as long as the health assessment data is not suitable or adapted to control the device operation. Moreover, according to the disclosure at the end of paragraph 17 and in paragraph 18 of the patent in suit, the results of the health assessment are obtained and output with varying degrees of probability ("levels of belief" or "confidence"). This means that any health assessment obtained from the claimed method could (almost) never be used to produce a technical effect without further human decision making or possibly the introduction of further equipment being designed to respond to a particular output with a defined action.

6.6.3 The Board can also not see that feature (ii) could involve the technical contributions alleged by the respondent. In as far as it was argued that the different synchronisation method defined by the three specific steps (commencing [...], sampling [...], outputting [...]) of claim 1, would contribute to an improved health assessment, this argument fails for the same reasons as stated in the preceding point 6.6.2. That otherwise these steps would avoid the need to post-process data, compared to data synchronisation based on a search algorithm as in D2, resulting possibly in a faster health assessment, is also not necessarily a result of the features defined in claim 1. The claim does not define that all sensor outputs

are received directly from the respective sensors, excluding temporary storage or buffering of sensory data streams prior to their receiving in the data alignment module and the synchronising operation according to the relevant three steps. It is additionally noted that paragraph 13 as well as Figure 1 of the patent in suit disclose at least the application of intermediate data analysis and feature extraction modules (23) before the so treated data is passed on to the alignment module. In the absence of any data in the patent in suit in regard to the speed of execution of the claimed method, it cannot be concluded that the claimed data processing would be necessarily advantageous compared to the method of D2 in this or any other respect. Moreover, and as also argued by the appellant, D2 clearly envisages real time processing (e.g. page 3, line 34).

7. Absent any set of claims complying with the requirements of the EPC, the patent has to be revoked (Article 101(3)(b) EPC).

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is revoked.

The Registrar: The Chairman:

D. Grundner M. Harrison

Decision electronically authenticated