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**Datasheet for the decision
of 25 June 2024**

Case Number: T 1029/22 - 3.4.02

Application Number: 14726277.8

Publication Number: 2989438

IPC: G01N9/00, G01N9/34, G01N11/16,
G01F23/296, G01F1/84

Language of the proceedings: EN

Title of invention:

A METHOD OF GENERATING A DRIVE SIGNAL FOR A VIBRATORY SENSOR

Applicant:

Micro Motion, Inc.

Headword:

Relevant legal provisions:

RPBA 2020 Art. 13(2)
EPC Art. 123(2), 56

Keyword:

Amendment after summons - exceptional circumstances (yes)
Amendments - allowable (yes)
Inventive step - (no)

Decisions cited:

Catchword:



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Case Number: T 1029/22 - 3.4.02

D E C I S I O N
of Technical Board of Appeal 3.4.02
of 25 June 2024

Appellant: Micro Motion, Inc.
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Boulder, CO 80301 (US)

Representative: Ellis, Christopher Paul
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Decision under appeal: **Decision of the Examining Division of the
European Patent Office posted on 19 November
2021 refusing European patent application No.
14726277.8 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chair R. Bekkering
Members: C. Kallinger
B. Müller

Summary of Facts and Submissions

- I. The appeal by the applicant (hereinafter "appellant") is against the decision of the examining division to refuse the European patent application No. 14 726 277.8.
- II. In the decision under appeal, the examining division held that the subject-matter of claim 1 of the main request was not novel, that the subject-matter of claim 1 of auxiliary request 1 did not involve an inventive step, and that the amendments in claim 1 of auxiliary request 2 were not disclosed in the application as originally filed.
- III. In the statement of grounds of appeal, the appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the claims according to the main request or, in the alternative, the first auxiliary request, both filed with a letter dated 8 October 2021, or the second auxiliary request filed during the oral proceedings before the examining division on 10 November 2021.
- IV. In accordance with the appellant's request, the board summoned to oral proceedings and, in a communication in accordance with Article 15(1) RPBA 2020, set out its preliminary opinion with respect to the objections discussed in the decision under appeal. In this communication, the board also raised a new objection under Article 84 EPC.
- V. In response to the summons dated 14 April 2024, the appellant submitted claims according to a third and fourth auxiliary request.

VI. On 25 June 2024 oral proceedings were held by videoconference during which the appellant withdrew the then-pending main and first and second auxiliary requests.

VII. The appellant's final requests were that the decision under appeal be set aside and a patent be granted on the basis of the claims of the main request or the auxiliary request filed as the third and fourth auxiliary requests, respectively, with a letter dated 15 April 2024.

VIII. This decision refers to the following document:

D8 GB 2 236 591 A

IX. Claim 1 of the main request reads as follows:

"A method (600) of generating a drive signal for a vibratory sensor (5), the method comprising: vibrating a vibratory element (104, 510) configured to provide a vibration signal; receiving the vibration signal from the vibratory element (104, 510) with a receiver circuit (134); generating the drive signal that vibrates the vibratory element (104, 510) with a driver circuit (138) coupled to the receiver circuit (134) and the vibratory element (104, 510); and comparing a phase of the generated drive signal with a phase of the vibration signal to determine a measured phase difference ϕ_m ; comparing the measured phase difference ϕ_m with a target phase difference ϕ_t to determine if the measured phase difference ϕ_m is at the target phase difference ϕ_t ; and

generating a command frequency ω to achieve the target phase difference ϕ based on the comparison of the measured phase difference ϕ_m and the target phase difference ϕ_t ;
wherein the drive signal is generated at the command frequency ω by the open-loop drive (147) in the driver circuit (138)."

- X. Claim 1 of the auxiliary request reads as follows (amendments in comparison to the main request marked by the board):

"A method (600) of generating a drive signal for a vibratory sensor (5), the method comprising:
vibrating a vibratory element (104, 510) configured to provide a vibration signal;
receiving the vibration signal from the vibratory element (104, 510) with a receiver circuit (134);
generating the drive signal that vibrates the vibratory element (104, 510) with a driver circuit (138) coupled to the receiver circuit (134) and the vibratory element (104, 510); and
comparing a phase of the generated drive signal with a non-shifted phase of the vibration signal to determine a measured phase difference ϕ_m ;
comparing the measured phase difference ϕ_m with a target phase difference ϕ_t to determine a difference between measured phase difference ϕ_m is at the target phase difference ϕ_t ; and
generating ~~determining~~ a command frequency ω to achieve the target phase difference ϕ_t based on the difference between the measured phase difference ϕ_m and the target phase difference ϕ_t
providing the command frequency ω to a signal generator (147c); and

generating the drive signal at the command frequency ω
with the signal generator (147c)
~~wherein the drive signal is generated at the command
frequency ω by the open-loop drive (147) in the
driver circuit (138)."~~

Reasons for the Decision

1. Main request

1.1 Admittance - Article 13(2) RPBA

The Applicant requested that the claims be admitted on the grounds that the amendment overcame a newly raised clarity objection that was not part of the decision under appeal.

The board agrees with the appellant's reasoning. In its communication under Article 15 RPBA, the board raised a new clarity objection. The amendments to the claims were made in order to overcome that objection. The board therefore considers there are exceptional circumstances and takes the main request into account(Article 13(2) RPBA).

1.2 Inventive step - Article 56 EPC

1.2.1 Closest prior art and differences

Document D8 represents the closest prior art and discloses the following features of claim 1:

- A method of generating a drive signal for a vibratory sensor (page 2, 3rd paragraph to page 3, 1st paragraph), the method comprising:

- vibrating a vibratory element configured to provide a vibration signal (page 9, 2nd paragraph to page 11, 2nd paragraph);
- receiving the vibration signal from the vibratory element with a receiver circuit (page 10, 2nd paragraph and Figure 2);
- generating the drive signal that vibrates the vibratory element with a driver circuit (Figure 2: 16, 17, 19, 20 and 15) coupled to the receiver circuit and the vibratory element (page 10, 2nd paragraph and Figure 2); and
- comparing a phase of the generated drive signal with a phase of the vibration signal (see paragraph bridging pages 10 and 11, Figure 2 and claim 4) ~~to determine a measured phase difference ϕ_m ;~~
- ~~comparing the measured phase difference ϕ_m with a target phase difference ϕ_t to determine if the measured phase difference ϕ_m is at the target phase difference ϕ_t ; and~~
- generating a command frequency ω ~~to achieve the target phase difference ϕ based on the comparison of the measured phase difference ϕ_m and the target phase difference ϕ_t ;~~
- wherein the drive signal is generated at the command frequency ω ~~by the open-loop drive (147) in the driver circuit (138) (see paragraph bridging pages 10 and 11, Figure 2 and claim 6).~~

Document D8 does not disclose the features marked by strike-through.

In regard to the feature "*open-loop drive*", the board is of the opinion that the claim is not clear: the invention as claimed and as presented in the description, ultimately employs the vibration signal received from the vibrating element as feedback for the

generation of the drive signal. Therefore, the board is of the opinion that the claimed method functions in a closed-loop manner. Consequently, the feature "*open-loop drive*" is deemed to not limit the claimed subject-matter. Therefore, it cannot contribute to the presence of an inventive step.

The board notes that the appellant, with respect to the current requests, no longer contended that the feature "*open-loop drive*" constituted a fundamental difference with respect to the disclosure of document D8.

Furthermore, the appellant argued that D8 was an old document and that any modification of D8 had to be considered in view of new trends in the technology. In particular, at the priority date of document D8, i.e. in 1989, digital signal processing was not used in the technical field of the present invention. The appellant appears to argue that document D8 may not serve as a suitable starting point because it either related to outdated technology and/or was associated with well known disadvantages.

The board is not convinced by this line of argument for the following reasons.

Firstly, the board is of the opinion that document D8 does not concern an outdated technology as the same measurement principles and almost identical signal processing are used in document D8 and the present invention.

Secondly, the appellant did not identify any well-known disadvantages associated with the approach taken in document D8, and the board is unable to discern any such disadvantages.

Finally, the board is of the opinion that neither the claims nor the description of the current invention relate to any *"new trends in technology"* which would render document D8 unsuitable to serve as closest prior art. In particular, claim 1 is not limited to digital signal processing, which, according to the appellant, was not employed in 1989, the publication date of D8.

1.2.2 Problem to be solved

The examining division held that the objective problem to be solved starting from D8 as the closest prior art was *"how to provide an alternative way to compare the phases of the drive signal and of the vibration signal to a target phase difference"*.

The appellant argued that the objective technical problem had to be a technical problem and that the examining division's formulation (see decision, page 8, fourth paragraph) was not a formulation *"in light of"* document D8's technical teaching. This was because the signal provided in document D8 could not be derived from any comparison between phase differences and, moreover, was *"plainly not based on a difference between phase differences"*.

Furthermore, the examining division's objective technical problem was impermissibly abstract because it distorted the technical teachings of document D8. The appellant formulated the technical problem to be solved as *"to provide a more accurate and stable vibratory sensor"*.

The board is not convinced by the appellant's arguments for the following reasons.

Document D8 discloses a method of generating a drive signal based on the comparison of the phases of a (generated) drive signal and a (measured) vibration signal (see paragraph bridging pages 10 and 11 and claim 4 and 6). The signal generation in document D8 is therefore clearly based on a phase comparison.

Furthermore, the formulation of the objective technical problem by the examining division as *"how to provide an alternative way to compare the phases of the drive signal and of the vibration signal to a target phase difference"* is a valid formulation of the objective technical problem (see Case Law of the Boards of Appeal, 10th edition 2022, I.D.4.5, entitled "Alternative solution to a known problem").

1.2.3 Obvious alternative

With regard to the question of obviousness of the above identified differences, the board agrees with the examining division's conclusion (see decision, page 8, 5th paragraph) that the two approaches for phase comparison are mathematically equivalent and merely alternative ways of arranging the terms expressing the phase of the generated drive signal (A), the phase of the vibration signal (B) and the target phase difference (T): $(A-B)-T$ according to claim 1 of auxiliary request 1 instead of $A-(B+T)$ as in document D8.

The board is of the opinion that the mathematical equivalents as explained by the examining division are within the common general knowledge of the skilled person.

The board notes that the examining division did not base its argument on non-documented common general knowledge but clearly explained the mathematical equivalence of the two approaches as defined in claim 1 of then auxiliary request 1 and disclosed in document D8 for comparing phases of two signals and a target phase.

The board agrees that the claimed phase comparison represents an obvious alternative to the phase comparison known from document D8 and that the skilled person would consider this mathematically equivalent approach in order to solve the problem posed, namely to *"provide an alternative way to compare the phases of the drive signal and of the vibration signal to a target phase difference"*.

The appellant argued that relying on a mathematical equivalent that was neither explicitly nor implicitly disclosed by document D8 showed that there was at least "ambiguity or doubt" as to whether D8 disclosed the claimed comparison.

As set out above, the board agrees that document D8 does not explicitly or implicitly disclose the aforementioned differences. However, the question of whether these differences are disclosed explicitly or implicitly is a question of novelty, whereas in the present case the obviousness of these differences is assessed under inventive step.

The appellant's argument that document D8 failed to suggest the claimed solution is not convincing. Since the contribution of the invention is to propose an alternative, it is not required to justify the

selection of a particular solution (see Case Law of the Boards of Appeal, 10th edition 2022, I.D.4.5).

The appellant further argued that document D8 disclosed the provision of the output from a comparator to an integrator. The integrator produced a signal that could not be derived from any comparison between phase differences, and moreover, was plainly not based on a difference between phase differences. Therefore, document D8 even taught away from the use of the claimed alternative of the phase comparison.

This argument is not convincing since, as set out above, the signal generation in document D8 is clearly based on a phase comparison.

The appellant also argued that document D8 disclosed that the input of the voltage-controlled oscillator received an integrated voltage but not, as claimed, the voltage output of the phase comparator.

The board is not convinced by this line of argument. Claim 1 defines the command frequency (which is used for generating a drive signal) as being generated from the phase comparison. However, claim 1 does not exclude additional signal treatment, such as low-pass filtering via an integrator, as illustrated in document D8. The board thus agrees with the examining division that the claimed approach for the signal generation is known from document D8, in which the signal from the phase comparator is low-pass filtered in an integrator 20 before it is used to generate the drive signal in a voltage controlled oscillator 15 (see page 11, lines 2 to 5).

The appellant further argued that the examining division failed to explain how the disclosure of document could be modified to arrive at the claimed method.

The board is of the opinion that the skilled person would not encounter any technical difficulties when implementing the alternative approach for comparing the phases by replacing the comparison A-(B+T) known from document D8 by (A-B)-T.

In conclusion, the board is of the opinion that the subject-matter of claim 1 of the main request lacks inventive step starting from D8 in view of common general knowledge.

2. Auxiliary request

2.1 Admittance - Article 13(2) RPBA

For the same reasons as indicated above for the main request the auxiliary request is taken into account in the appeal proceedings (Article 13(2) RPBA).

2.2 Amendments - Article 123(2) EPC

The examining division held that the addition of the feature "*non-shifted*" constituted a non-disclosed disclaimer which introduced subject-matter which extended beyond the content of the application as filed.

The board is not convinced by the examining division's reasoning and agrees with the appellant for the following reasons:

The application as originally filed discloses a non-phase shifted signal in equation [6] (see page 13) in which the phase difference is the difference between the phases of the generated drive signal and the vibration signal. Although this equation, and therefore also the claimed comparison of a phase of the generated drive signal with a non-shifted phase of the vibration signal, is disclosed in connection with the embodiment shown in Figure 5 of the application, the board is of the opinion that this feature is not inextricably linked to other features of this embodiment.

In conclusion, the board is of the opinion that the aforementioned equation provides a basis for the added feature "non-shifted". Therefore, this amendment does not introduce subject-matter which extends beyond the content of the application as filed and Article 123(2) EPC is not infringed in this respect.

2.3 Inventive step

The appellant argued that claim 1 now explicitly defined *"comparing a phase of the generated drive signal with a non-shifted phase of the vibration signal to determine a measured phase difference"*. D8 did not disclose this feature and, in addition, nothing in D8 would have prompted a person skilled in the art to replace the phase-shifted approach of D8 with the non-shifted approach claimed in claim 1 of the auxiliary request.

The board is not convinced by the appellant's arguments for the following reasons.

The board agrees that the embodiment shown in Figure 2 of document D8 employs a phase-shifter and that, therefore, D8 does not disclose that a "non-shifted phase of the vibration signal" is used for the phase comparison.

The board is however of the opinion that this amendment does not change the assessment of inventive step as set out above.

The phase comparison approach used in document D8 is based on the comparison of the phase of a generated drive signal (A) with the phase of the shifted vibration signal (B+T), mathematically represented by the term $A-(B+T)$. The approach claimed in claim 1 of the auxiliary request compares the generated drive signal (A) with a non-shifted phase of the vibration signal (B) and then compares this with a target phase difference (T) (in order to determine a difference), mathematically represented by the term $(A-B)-T$.

The second approach is mathematically equivalent to the approach known from D8 and employs the comparison of the generated drive signal (A) with a non-shifted phase of the vibration signal (B).

Therefore, the added feature merely represents an obvious alternative and cannot contribute to the presence of an inventive step.

The appellant further argued that the method disclosed in document D8 required the signal to be phase-shifted as it would otherwise not function.

The board is not convinced by this argument, as it focusses too much on the specific embodiment disclosed in Figure 2 of document D8 which shows the use of a phase shifter, a phase comparator and a voltage controlled oscillator. However, document D8 discloses

in a general manner the generation of a drive signal based on the comparison of the phases of a (generated) drive signal and a (measured) vibration signal (see paragraph bridging pages 10 and 11 and claim 4 and 6). Starting from this disclosure, the skilled person would not have any difficulties to implement the obvious alternative for the phase comparison as discussed above and would, if necessary, adapt the circuitry of document D8 accordingly.

In conclusion, the board is of the opinion that the subject-matter of claim 1 of the auxiliary request lacks an inventive step starting from D8 in view of common general knowledge.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chair:



D. Meyfarth

R. Bekkering

Decision electronically authenticated