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Datasheet for the decision of 8 February 2024

Case Number: T 0925/21 - 3.5.03

Application Number: 15179091.2

Publication Number: 2981100

IPC: H04R25/00, G10L21/0208

Language of the proceedings: EN

Title of invention:
Automatic directional switching algorithm for hearing aids

Patent Proprietor:
Starkey Laboratories, Inc.

Opponent:
GN Hearing A/S / Oticon A/S / Widex A/S

Headword:
Automatic mode switching/STARKEY

Relevant legal provisions:
EPC Art. 123(2)

Keyword:
Added subject-matter - all claim requests (yes)

Catchword:

As to the proprietor's argument that the board should not question the compliance of its auxiliary claim requests with the EPC since the opponent had not challenged the admittance or the allowability of those auxiliary requests, see point 3.1 of the Reasons.

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Case Number: T 0925/21 - 3.5.03

D E C I S I O N
of Technical Board of Appeal 3.5.03
of 8 February 2024

Appellant: (Joint Opponents)	GN Hearing A/S / Oticon A/S / Widex A/S Lautrupbjerg 7 Kongebakken 9 Nymøllevej 6 2750 Ballerup/2765 Smørum/3450 Lynge (DK)
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Representative:	Vossius & Partner Patentanwälte Rechtsanwälte mbB P.O. Box 86 07 67 81634 München (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 16 April 2021 rejecting the opposition filed against European patent No. 2981100 pursuant to Article 101(2) EPC.**

Composition of the Board:

Chair	K. Bengi-Akyürek
Members:	K. Peirs
	R. Romandini

Summary of Facts and Submissions

I. The appeal of the joint opponents (appellant) lies from the decision of the opposition division to reject the opposition (Article 101(2) EPC). The opposition division deemed that the grounds for opposition invoked by the joint opponents under

- Article 100(a) EPC in conjunction with Articles 54 and 56 EPC

and

- Article 100(b) EPC

did not prejudice the maintenance of the patent as granted.

II. A communication was issued under Article 15(1) RPBA 2020 including the board's negative preliminary opinion concerning added subject-matter (Article 123(2) EPC).

III. Oral proceedings before the board were held on 8 February 2024. The parties' final requests were as follows:

- The appellant requested that the decision under appeal be set aside and that the patent be revoked.

- The patent proprietor (respondent) requested that the appeal be dismissed, i.e. that the patent be upheld as granted (**main request**). In the alternative, the respondent requested that the patent be maintained in amended form on the basis of the set of claims according to one of eighteen

auxiliary requests, where **auxiliary requests 1, 3 to 5 and 7 to 17** were filed in the opposition proceedings, **auxiliary requests 2 and 6** were filed with the written reply to the appeal and **auxiliary request 18** was filed in response to the board's communication with the letter dated 8 January 2024.

IV. Claim 1 of the **main request** reads as follows (board's feature labelling):

(a) "A hearing aid, comprising
(b) an input transducer (105) for converting an audio input into an input signal, wherein the input transducer (105) may be operated in either an omnidirectional or directional mode;
(c) a digital signal processor (DSP) (100) for processing the input signal into an output signal in a manner that compensates for a patient's hearing deficit; and
(d) an audio amplifier and speaker (160) for converting the output signal into an audio output;
(e) wherein the DSP (100) is configured to:
derive a current noise floor from the input signal by estimating a noise floor from a minimum input signal power observed over a specified time period and equating the current noise floor to the estimated noise floor;
(f) operate (203, 204) the input transducer (105) in a directional mode if the current noise floor is greater than an upper threshold value;
(g) operate (205, 206) the input transducer (105) in an omnidirectional mode if the current noise floor is less than a lower threshold value; and,
(h) leave the operating mode of the input transducer unchanged if the current noise floor is between the

upper and lower threshold values."

V. Claim 1 of **auxiliary request 1** differs from claim 1 of the main request in that it further comprises, at the end, the following feature (board's feature labelling):

(i) "wherein the DSP (100) is configured to:
extract a plurality of frequency components of the input signal in a specified frequency range;
compute powers of the extracted frequency components and sum the computed powers to result in an input power signal;
compute the estimated noise floor as a minimum value of the input power signal over a specified time period; and
equate the current noise floor to the estimated noise floor".

VI. Claim 1 of **auxiliary request 2** differs from claim 1 of auxiliary request 1 in that it further comprises, at the end, the following feature (board's feature labelling):

(j) "wherein the DSP (100) is configured to:
estimate the noise floor at the end of each time interval having a duration equal to the specified period of time by finding the minimum value of the input signal power during the time interval; and
equate the current noise floor to the estimated noise floor at the end of each time interval but equate the current noise floor to a value of the input signal power before the end of the time interval if that value is less than the current noise floor".

VII. Claim 1 of **auxiliary request 3** differs from claim 1 of the main request in that feature (e) is replaced by the following feature (board's feature labelling and underlining, the latter reflecting amendments vis-à-vis feature (e)):

(k) "wherein the DSP (100) is configured to:
check for presence of wind noise based upon characteristics of the input signal and derive a current noise floor from the input signal by estimating a noise floor from a minimum input signal power observed over a specified time period and equating the current noise floor to the estimated noise floor;
switch the input transducer to omnidirectional mode if wind noise is present; and if no wind noise is present,".

VIII. Claim 1 of **auxiliary request 4** differs from claim 1 of the main request in that

- the expression "input transducer (105)" in features (f) and (g) and the expression "input transducer" in feature (h) are each replaced by the term "microphone"

and in that

- feature (b) is replaced by the following feature (board's feature labelling and underlining, the latter reflecting amendments vis-à-vis feature (b)):

(l) "an input transducer (105) for converting an audio input into an input signal, wherein the input transducer (105) comprises a microphone that may be

operated in either an omnidirectional or directional mode;".

IX. Claim 1 of **auxiliary request 5** differs from claim 1 of the main request in that

- the phrase ", wherein the input transducer (105) may be operated in either an omnidirectional or directional mode" is deleted in feature (b)

and in that

- feature (c) is replaced by the following feature (board's feature labelling and underlining, the latter reflecting amendments vis-à-vis feature (c)):

(m) "a digital signal processor (DSP) (100) for processing the input signal into an output signal in a manner that compensates for a patient's hearing deficit, wherein the input transducer (105) may be operated in either an omnidirectional or directional mode as controlled by an omni/directional switch (180) operated by the DSP (100); and".

X. Claim 1 of **auxiliary request 6** differs from claim 1 of auxiliary request 3 in that it further comprises, at the end, features (i) and (j).

XI. Claim 1 of **auxiliary request 7** differs from claim 1 of auxiliary request 5 in that the expression "input transducer (105)" in features (f) and (g) and the expression "input transducer" in feature (h) are each replaced by the term "microphone".

XII. Claim 1 of **auxiliary request 8** differs from claim 1 of auxiliary request 4 in that it further comprises, at the end, feature (i).

XIII. Claim 1 of **auxiliary request 9** differs from claim 1 of auxiliary request 4 in that feature (e) is replaced by feature (k).

XIV. Claim 1 of **auxiliary request 10** differs from claim 1 of auxiliary request 5 in that it further comprises, at the end, feature (i).

XV. Claim 1 of **auxiliary request 11** differs from claim 1 of auxiliary request 5 in that feature (e) is replaced by feature (k).

XVI. Claim 1 of **auxiliary request 12** differs from claim 1 of auxiliary request 3 in that it further comprises, at the end, feature (i).

XVII. Claim 1 of **auxiliary request 13** differs from claim 1 of auxiliary request 7 in that it further comprises, at the end, feature (i).

XVIII. Claim 1 of **auxiliary request 14** differs from claim 1 of auxiliary request 7 in that feature (e) is replaced by feature (k).

XIX. Claim 1 of **auxiliary request 15** differs from claim 1 of auxiliary request 8 in that feature (e) is replaced by feature (k).

XX. Claim 1 of **auxiliary request 16** differs from claim 1 of auxiliary request 11 in that it further comprises, at the end, feature (i).

XXI. Claim 1 of **auxiliary request 17** differs from claim 1 of auxiliary request 14 in that it further comprises, at the end, feature (i).

XXII. Claim 1 of **auxiliary request 18** differs from claim 1 of the main request in that feature (a) is replaced by the following feature (board's feature labelling and underlining, the latter reflecting amendments vis-à-vis feature (a)):

(n) "A hearing aid for improving speech intelligibility, comprising".

Reasons for the Decision

1. *Technical background*

1.1 The opposed patent relates to a hearing aid with a microphone arrangement that can be operated in a directional or an omnidirectional mode. The former mode is typically used when the user of the hearing aid is engaged in a conversation. The latter mode is normally set when the user is in a relatively quiet sound environment.

1.2 The microphone arrangement according to the opposed patent will operate in one of those two modes depending on the prevailing noise conditions. The claimed "hearing aid" switches between the two modes under the control of the digital signal processor (DSP) according to **features (e) to (h)**.

2. *Main request: claim 1 - added subject-matter*

2.1 In Reasons 3.5 of the appealed decision, the opposition division found that the ground for opposition under Article 100(c) EPC did not prejudice the maintenance of the patent as granted. In particular, the opposition division deemed that there was a direct and unambiguous disclosure for granted claim 1 in original claims 1 and 2 combined with page 3, line 17 to page 4, line 10 and page 6, last four lines of the description as filed and original Figure 2 (cf. Reasons 3.3.1 and 3.3.2 of the appealed decision).

2.2 For the reasons set out in points 2.3 and 2.4 below, the board holds, however, that the appellant's objections regarding added subject-matter introduced to the claim by the amendment of features (e) and (h) are justified.

2.3 In relation to **feature (e)**, the respondent referred to original claims 1 and 2 together with passages on pages 4 and 7 of the description as filed as well as original Figure 4. The board is not convinced that these references provide for a direct and unambiguous disclosure in this respect, for the reasons set out below.

2.3.1 Original claim 1 discloses the first part of feature (e), namely "wherein the DSP [(100)] is configured to: derive a current noise floor from the input signal". Original claim 2 states that "the DSP is configured to estimate the noise floor from the minimum input signal power observed over a specified time period". From this, it can be immediately discerned that original claims 1 and 2 relate to two configurations of the DSP, namely one configuration to

perform a "derive" action and another one to execute an "estimate" action. There is not necessarily any correlation between these two actions, contrary to what is implied by the phrase "by estimating a noise floor" (emphasis added) in feature (e). Moreover, in the board's view, the skilled reader would understand the term "the noise floor" in original claim 2 to refer to "the current noise floor" of original claim 1, since this is the only noise floor that was mentioned in that regard. Nonetheless, feature (e) does not require "the current noise floor" but, instead, "a [general] noise floor" to be used in the step of "estimating". In addition, original claims 1 and 2 are silent regarding the last part of feature (e), namely "and equating the current noise floor to the estimated noise floor". Summarising, feature (e) can be marked up as follows to underline the subject-matter for which original claims 1 and 2 do not provide a direct and unambiguous disclosure:

> "wherein the DSP (100) is configured to:
> derive a current noise floor from the input signal by estimating a noise floor from a minimum input signal power observed over a specified time period and equating the current noise floor to the estimated noise floor;".

2.3.2 Such a direct and unambiguous disclosure is neither provided on pages 4 and 7 of the description as filed nor in original Figure 4. In particular, the passage at page 4, lines 7 and 8 as filed states that "the minimum of the noise power over a sufficiently long time period can be considered". This "minimum of the noise power" is not necessarily the same as the "minimum input signal power" mentioned in feature (e). The same applies to the "sufficiently long time period", which

is not mandatorily equal to the "specified time period" according to this feature. Moreover, the term "equating" is also not present on page 4 as filed. As pointed out by the appellant, this term only occurs in the two paragraphs on page 7 of the original application. In this respect, the board notes that these two paragraphs also do not provide the skilled reader with a direct and unambiguous disclosure for feature (e). To explain this in more detail, it is observed that the first paragraph of page 7 as filed states to compute the "estimated noise floor" as the minimum value of the input power *signal*. This is not the same as the minimum input signal *power* to which feature (e) refers. Even if the skilled reader were indeed immediately to understand, as alleged by the respondent, that the same is meant in the context of the application as filed, the first paragraph of page 7 as filed would still not directly and unambiguously disclose all technically viable constructions of feature (e) that would objectively occur to the skilled reader. This is because the first paragraph of page 7 mentions three intermediate steps prior to the "[equating] the current nose floor to [the] estimated noise floor", namely

- extract a plurality of frequency components of the input signal in a specified frequency range,
- compute the powers of the extracted frequency components and sum the computed powers to result in an input power signal and
- compute an estimated noise floor as the minimum value of the input power signal over a specified time period.

These three intermediate steps are inextricably linked to the "equating" step according to feature (e) because

they define how the "minimum value of the input power signal" - or, for that matter, the "minimum input signal power" in accordance with this feature - for use in that "equating" step is determined. This means that the "minimum input signal power" as per feature (e) can be determined using other ways than specified in the original application. It needs not even be "computed" as set out on original page 7. Instead, it could, for instance, simply be "set" to some average value that has been assessed by an audiologist based on historical values, e.g. using a data log of various listening situations that the hearing-aid user has experienced while wearing the hearing aid. The audiologist could do so based on their experience and without any immediate need for any computation e.g. simply by means of a visual inspection of a diagram representing the logged data. This means that feature (e) constitutes an unallowable intermediate generalisation.

The second paragraph of page 7 as filed leads to the same conclusion in a different way. This second paragraph explains that, for a series of time intervals, the "noise floor" is estimated at the end of each time interval by finding the minimum value of the hearing-aid signal power during that time interval. At the end of each time interval, the "current noise floor" is equated to the "estimated noise floor". This way of estimating the noise floor is in line with the disclosure in Figure 4 as filed and its associated description in the second and third paragraphs of original page 5: the minimum value of the input signal amplitude in a well-defined time interval (of 4 seconds in original Figure 4) is used as an "estimate of the noise floor" for the *next* time interval. The same is, however, not necessarily valid for feature (e). There, the "specified time period" can be of any arbitrary

duration. It does not necessarily need to correspond to a series of well-defined time intervals of each 4 seconds as in the application as filed. In the data-log example given above for the first paragraph of page 7, the "specified time period" could, for instance, relate to the entire time period covered by the data log. Such an "entire time period" typically allows to draw conclusions on the hearing aid's average daily use. This in turn means that the skilled reader would regard the time span of "one day" rather than of "4 seconds" to be the basic unit underlying this "entire time period". This time span represents a time scale that was however not considered in the application as filed. In addition, the notion of the estimation of the noise floor during one particular time interval being used as the "current noise floor" of the *next* time interval is not present in granted claim 1. The respondent's argument that an estimate of the current noise floor during a particular time interval before the end of that time interval was not technically possible is clearly only valid for time intervals of a particularly short duration. It does not hold for the general "specified time period" in accordance with feature (e).

2.4 Concerning **feature (h)**, the respondent opined that the skilled reader, with a mind willing to understand claim 1 as granted, would recognise that the term "between" in accordance with this feature is "clearly inclusive". This meant, in the respondent's view, that feature (h) expressed the same as set out in the sentence bridging pages 3 and 4 of the description as filed. There, it is disclosed that the current operating microphone mode is left unchanged if "the noise floor is neither above the upper threshold nor below the lower threshold".

The board remains unconvinced that the skilled reader would invariably construe the term "between", as occurring in feature (h), to encompass both the "upper and lower threshold values". During the appeal proceedings, both parties provided abundant examples of the term's usage in accordance with their respective opposing perspectives. This alone already demonstrates, in the board's view, that the respondent's "inclusive interpretation" is not the sole plausible one. Therefore, granted claim 1 does not necessarily specify the setting of the input transducer's operating mode to the upper or lower threshold values. To illustrate this, a scenario can be considered involving a relatively quiet listening environment, wherein one or more sound sources attract the hearing-aid user's interest and wherein a gradually varying noise source is present, such as a slowly traversing vehicle. When the vehicle approaches, the claimed hearing aid may switch from the *omni-directional* to the *directional* mode *as soon as* the current noise floor reaches the upper threshold value. Conversely, when the vehicle moves away from the hearing aid, the hearing aid may switch back to the *omni-directional* mode *immediately* when the noise floor drops to the lower threshold value. Such a scenario with immediate switching at the upper and lower threshold values was not directly and unambiguously foreseen in the application as filed.

2.5 In conclusion, claim 1 of the main request does not comply with Article 123(2) EPC.

3. *Auxiliary requests 1 to 18: claim 1 - added subject-matter*

3.1 The respondent argued that the board should not question the compliance of the present auxiliary

requests with the EPC, since the appellant had not challenged the admittance or the allowability of those auxiliary requests. The appellant, however, convincingly submitted that it had challenged claim 2 of the main request, which was, for instance, included already in claim 1 of auxiliary request 1.

In addition, in order for a patent to be maintained in amended form, it must satisfy the requirements of the EPC (see Article 101(3)(a) EPC). It follows from the latter provision that the board must, at least, consider whether the objections raised against claim 1 of the main request are overcome in the amended form of the opposed patent. Similarly, the board has discretion to consider or disregard late-filed claim requests - whether or not a party to the appeal proceedings has objected to their admittance.

3.2 However, for reasons of procedural economy, even if all the auxiliary requests in question represent an "amendment" to the respondent's appeal case, the board will, in the case at hand, focus on their allowability. Indeed, the amendments underlying claim 1 of all auxiliary requests on file, specifically **features (i) to (m)**, cannot provide a remedy for all of the issues raised in points 2.3 and 2.4 above. In particular, the board makes the following observations.

3.2.1 **Feature (i)** relates to the three intermediate steps referred to in point 2.3.2 above. However, it does not address the deficiency that the first paragraph of page 7 as filed relies on the "minimum value of the input power *signal*" to compute the "estimated noise floor", whereas feature (e) does the same using the "minimum input signal *power*". Even if, again, it is assumed that the skilled reader were to recognise

immediately that, in fact, the same is meant in the context of the application as filed, the board notes that the configuration of the DSP to "equate" the "current noise floor" to the "estimated noise floor" in accordance with feature (i) does not mandatorily concern the same "equating" as in features (e) or (k). This means that feature (i) introduces a *second* step of "equating" the "current noise floor" to the "estimated noise floor". There is no direct and unambiguous disclosure of such a second step in the application as filed. If anything, therefore, feature (i) leads to a further objection under Article 123(2) EPC.

3.2.2 As regards the replacement of feature (e) by **feature (k)**, the board notes that the latter feature merely concerns the involvement of "wind noise" when the input transducer is switched to omnidirectional mode. It does not relate to any of the objections raised in point 2.3 above for claim 1 of the main request. Similarly, **features (l) and (m)** are not directed to those objections either.

3.2.3 Moreover, as acknowledged by the respondent, the issue relating to **feature (h)** as set out in point 2.4 above is not addressed in any of the present auxiliary requests.

3.3 Hence, claim 1 of all of the auxiliary requests on file likewise does not comply with Article 123(2) 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 Chair:

B. Brückner K. Bengi-Akyürek

Decision electronically authenticated