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Datasheet for the decision of 4 May 2021

Case Number: T 0256/19 - 3.5.03

Application Number: 12794164.9

Publication Number: 2920980

IPC: H04R25/00

Language of the proceedings: EN

Title of invention:
Own voice shaping in a hearing instrument

Patent Proprietor:
Sonova AG

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

Headword:
Own-voice signal processing/SONOVA

Relevant legal provisions:
EPC Art. 54, 56, 84
EPC R. 80
Guidelines for examination H-II, 3.2

Keyword:

Novelty - main request (no)
Amendment occasioned by ground for opposition - auxiliary request 1 (no)
Inventive step - auxiliary requests 2, 3, 5 to 7, 7a (no)
Clarity - auxiliary request 4' (no)

Decisions cited:

G 0001/04, R 0006/19, T 0223/05, T 1404/05, T 1127/16, T 0966/17

Catchword:

Rule 80 EPC represents a non-discretionary provision of the EPC that relates to the allowability of a patent as amended rather than to admissibility (see point 4.7 of the Reasons).

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Case Number: T 0256/19 - 3.5.03

D E C I S I O N
of Technical Board of Appeal 3.5.03
of 4 May 2021

Appellant I: (Patent Proprietor)	Sonova AG Laubisrütistrasse 28 8712 Stäfa (CH)
Representative:	Frei Patent Attorneys Frei Patentanwaltsbüro AG Postfach 8032 Zürich (CH)
Appellant II: (Opponents)	GN Hearing A/S / Widex A/S / Oticon A/S Lautrupbjerg 7 Nymøllevej 6/Kongebakken 9 2750 Ballerup/3450 Lynge/2765 Smørum (DK)
Representative:	Guardian IP Consulting I/S Diplomvej, Building 381 2800 Kgs. Lyngby (DK)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 14 November 2018 concerning maintenance of the European Patent No. 2920980 in amended form.**

Composition of the Board:

Chair	K. Bengi-Akyürek
Members:	K. Peirs
	C. Almberg

Summary of Facts and Submissions

I. The appeals are against the interlocutory decision of the opposition division to maintain the patent according to the proprietor's sixth auxiliary request.

The proprietor's main request and first to fifth auxiliary requests were deemed to be not allowable for lack of compliance with Article 54 EPC or Article 123(2) EPC, or not admissible for not fulfilling the requirements of Rule 80 EPC.

II. A communication was issued pursuant to Article 15(1) RPBA 2020 including the board's preliminary opinion having regard to the following prior-art documents:

D1: EP 1 640 972 A1;
D2: US2009/147966 A1;
D4: US 2010/310084 A1.

III. Oral proceedings before the board were held on 4 May 2021 by videoconference.

IV. Appellant I (proprietor) requests that

- the decision under appeal be set aside;
- as a **main request**, the opposition be rejected, i.e. the patent be maintained as granted;
- in the alternative, the patent be maintained in amended form according to one of **eight auxiliary requests** (1 to 3, 4', 5 to 7 and 7a).

The main request is the same as the main request underlying the decision under appeal. Likewise, auxiliary requests 1 to 3 and 5 to 7 are the same as

their respective counterparts underlying the decision under appeal. Auxiliary requests 4' and 7a were filed for the first time with the statement of grounds of appeal.

V. Appellant II (opponents) requests that the decision under appeal be set aside and that the patent be revoked. They also contest admittance with regard to all auxiliary requests.

VI. At the end of the oral proceedings, the board's decision was announced.

VII. Claim 1 of the **main request** (patent as granted) reads as follows:

"A method of processing a signal in a hearing instrument, the hearing instrument comprising at least one outer microphone (1) oriented towards the environment, an inner microphone (11) oriented towards the user's ear canal, and at least one receiver (5) capable of producing an acoustic signal in the ear canal, the method comprising the steps of:

- Processing an outer microphone signal from the outer microphone (1) and an inner microphone signal from the inner microphone (11) to yield an ambient sound portion signal estimate and an own voice sound portion signal estimate;
- Processing the ambient sound portion signal estimate into a processed ambient sound portion signal;
- Processing the own voice sound portion signal estimate into a processed own voice sound portion signal;
- Adding the processed ambient sound portion signal

and the processed own voice portion signal for producing the acoustic signal in the ear canal."

VIII. Claim 1 of **auxiliary request 1** includes all the features of claim 1 of the main request and further comprises the expression "sound" before the word "portion" within the expression "the processed own voice portion signal" of the adding step in claim 1.

IX. Claim 1 of **auxiliary request 2** reads as follows (amendments vis-à-vis claim 1 of the main request emphasised as in the original document):

"A method of processing a signal in a hearing instrument, the hearing instrument comprising at least one outer microphone (1) oriented towards the environment, an inner microphone (11) oriented towards the user's car canal, and at least one receiver (5) capable of producing an acoustic signal in the ear canal, the method comprising the steps of:

- Processing an outer microphone signal from the outer microphone (1) and an inner microphone signal from the inner microphone (11) to yield an ambient sound portion signal estimate ~~and~~
- Processing the outer microphone signal from the outer microphone (1) and the inner microphone signal from the inner microphone (11) to yield an own voice sound portion signal estimate;
- Processing the ambient sound portion signal estimate into a processed ambient sound portion signal;
- Processing the own voice sound portion signal estimate into a processed own voice sound portion signal;

- Adding the processed ambient sound portion signal and the processed own voice portion signal for producing the acoustic signal in the ear canal."

X. Claim 1 of **auxiliary request 3** includes all the features of claim 1 of auxiliary request 2 and further comprises the following expression between the last "Processing" step and the "Adding" step of claim 1:

", wherein the ambient sound portion signal estimate and the own voice portion signal estimate are processed separately".

XI. Claim 1 of **auxiliary request 4'** reads as follows (amendments vis-à-vis claim 1 of the main request highlighted by the board):

"A method of processing a signal in a hearing instrument, the hearing instrument comprising at least one outer microphone (1) oriented towards the environment, an inner microphone (11) oriented towards the user's ear canal, and at least one receiver (5) capable of producing an acoustic signal in the ear canal, the method comprising the steps of:

- Processing an outer microphone signal from the outer microphone (1), said outer microphone signal comprising a mixture of signal portions coming from ambient sound and signal portions coming from the own voice, and an inner microphone signal from the inner microphone (11), said inner microphone signal comprising a mixture of signal portions coming from ambient sound and signal portions coming from the own voice, to yield an ambient sound portion signal estimate and an own voice sound portion signal estimate by separation of said signal portions;

- Processing the ambient sound portion signal estimate into a processed ambient sound portion signal;
  Processing the own voice sound portion signal estimate into a processed own voice sound portion signal
  wherein the ambient sound portion signal estimate and the own voice portion signal estimate are processed separately;
- Adding the processed ambient sound portion signal and the processed own voice portion signal for producing the acoustic signal in the ear canal."

XII. Claim 1 of **auxiliary request 5** reads as follows (amendments vis-à-vis claim 1 of auxiliary request 3 highlighted by the board):

"A method of processing a signal in a hearing instrument, the hearing instrument comprising at least one outer microphone (1) oriented towards the environment, an inner microphone (11) oriented towards the user's car canal, and at least one receiver (5) capable of producing an acoustic signal in the ear canal, the method comprising the steps of:

- Processing an outer microphone signal from the outer microphone (1) and an inner microphone signal from the inner microphone (11) to yield an ambient sound portion signal estimate;
- Processing the outer microphone signal from the outer microphone (1) and the inner microphone signal from the inner microphone (11) to yield an own voice sound portion signal estimate;
- Processing the ambient sound portion signal estimate into a processed ambient sound portion signal;

- Processing the own voice sound portion signal estimate into a processed own voice sound portion signal,
  wherein the ambient sound portion signal estimate and the own voice portion signal estimate are processed separately;
- Adding the processed ambient sound portion signal and the processed own voice portion signal to yield a receiver signal for producing the acoustic signal in the ear canal,
- wherein for obtaining an estimate of the own voice portion of the inner microphone signal, the filtered receiver signal is subtracted from the inner microphone signal."

XIII. Claim 1 of **auxiliary request 6** includes all the features of claim 1 of auxiliary request 1 and further comprises the following phrase at the end:

"wherein the step of processing an outer microphone signal and an inner microphone signal comprises obtaining an own voice signal portion estimate and subtracting the own voice signal portion estimate from the outer microphone signal to yield the ambient sound signal portion".

XIV. Claim 1 of **auxiliary request 7** includes all the features of claim 1 of auxiliary request 5 and further comprises, preceded by the expression ", and", the same phrase at the end as cited for auxiliary request 6 in point XIII. above.

XV. Claim 1 of **auxiliary request 7a** reads as follows (amendments vis-à-vis claim 1 of the main request highlighted by the board):

"A method of processing a signal in a hearing instrument, the hearing instrument comprising at least one outer microphone (1) oriented towards the environment, an inner microphone (11) oriented towards the user's ear canal, and at least one receiver (5) capable of producing an acoustic signal in the ear canal, the method comprising the steps of:

- Processing an outer microphone signal from the outer microphone (1) and an inner microphone signal from the inner microphone (11) to yield an ambient sound portion signal estimate and an own voice sound portion signal estimate;
- Processing the ambient sound portion signal estimate into a processed ambient sound portion signal;
- Processing the own voice sound portion signal estimate into a processed own voice sound portion signal,
  wherein the ambient sound portion signal estimate and the own voice portion signal estimate are processed separately;
- Adding the processed ambient sound portion signal and the processed own voice portion signal to yield a receiver signal for producing the acoustic signal in the ear canal,
- wherein for obtaining an estimate of the own voice portion of the inner microphone signal, the filtered receiver signal is subtracted from the inner microphone signal, and
- wherein the step of processing an outer microphone signal and an inner microphone signal comprises obtaining an own voice signal portion estimate and subtracting the own voice signal portion estimate from the outer microphone signal to yield the ambient sound signal portion."

Reasons for the Decision

1. *The opposed patent*

The invention underlying the opposed patent relates to the question how a user of a hearing instrument perceives their own voice, in particular its naturalness and pleasantness. In the case where the user is speaking, their own voice is picked up by the hearing instrument's microphone together with sound coming from the surrounding environment. When wearing a hearing instrument which, at least partially, seals the ear canal, the occlusion of the ear canal will typically change the user's perception of their own voice. The present invention addresses this change and aims to shape the user's voice in a way that is considered to be pleasant for the user. Figure 3 of the opposed patent illustrates a relevant embodiment relating to the signal processing according to the present invention (using outer microphone 1, inner microphone 11, gain functions G and G_V, filters H and P and transfer functions H_1 and H_2):

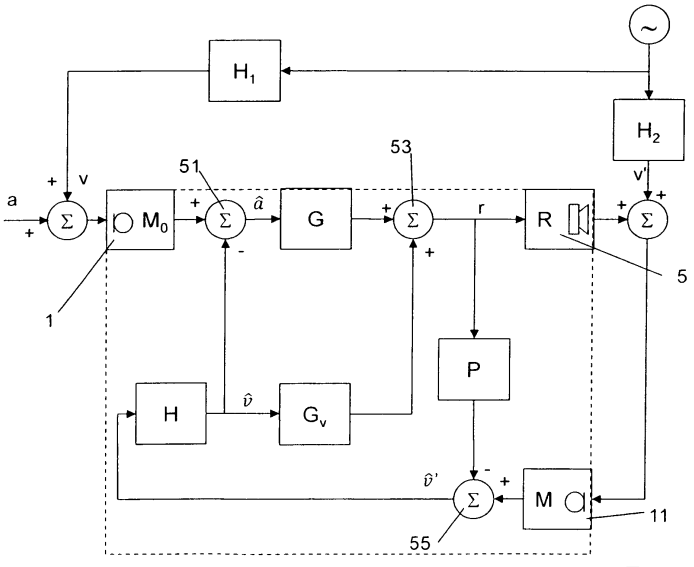

Fig. 3

2. *Main request: claim 1 - feature labelling*

Claim 1 of the **main request**, i.e. claim 1 as granted, includes the following limiting features (as labelled by the board in view of Figure 3 above):

(a) A method of processing a signal in a hearing instrument, the hearing instrument comprising at least one outer microphone (M_0) oriented towards the environment, an inner microphone (M) oriented towards the user's ear canal, and at least one receiver capable of producing an acoustic signal in the ear canal,
the method comprising the steps of:
(b) processing an outer microphone signal (a) from the outer microphone and an inner microphone signal (v) from the inner microphone to yield an ambient sound portion signal estimate (â) and an own voice sound portion signal estimate ($\hat{\boldsymbol{v}}$);
(c) processing the ambient sound portion signal estimate into a processed ambient sound portion signal (output of gain G);
(d) processing the own voice sound portion signal estimate into a processed own voice sound portion signal (output of gain G_v);
(e) adding the processed ambient sound portion signal and the processed own voice portion signal for producing the acoustic signal (r) in the ear canal.

3. *Main request: claim 1 - novelty*

3.1 Claim construction

Article 84 EPC requires that the claims define the subject-matter for which patent protection is sought and that therefore the meaning of their features should

be clear for the person skilled in the art from the wording of the claims alone (see G 1/04, Reasons 6.2). Thus, the claims should essentially be read and interpreted by a skilled reader on their own merits, rather than with the aid of the description and drawings, as suggested by appellant I (see e.g. T 223/05, Reasons 3.5; T 1404/05, Reasons 3.6; T 1127/16, Catchword (1)).

Accordingly, the board holds that the skilled reader would adopt the following construction of claim 1 of the main request:

3.1.1 The skilled reader would readily interpret the term "hearing instrument" of **feature (a)** as an equivalent of the term "hearing aid". This is also in line with paragraphs [0038] and [0041] of the patent in suit.

3.1.2 Concerning the term "estimate" of **features (b) to (d)**, the skilled reader would readily understand that an *estimate* of a signal corresponds to a predicted form of a *real* signal.

3.1.3 The parties did not contest this construction of the above terms. In addition, as regards **feature (b)**, the skilled reader would discern two possible interpretations, namely that

(i) the processing of the outer-microphone signal (a) yields the ambient-sound-portion signal estimate â and the processing of the inner-microphone signal (v) yields the own-voice-sound-portion signal estimate $\tilde{v}$ (because the outer-microphone signal mainly comprises ambient sound and the inner-microphone signal mainly comprises the

user's voice), i.e. in mathematical language $\hat{a} = f_1(a)$ and $\hat{v} = f_2(v)$.

or

(ii) both the inner and the outer microphone signals (a and v) are processed, yielding two results, namely the ambient-sound and the own-voice-portion-signal estimate â and $\hat{v}$, i.e. $\hat{a} = f_1(a,v)$ and $\hat{v} = f_2(a,v)$.

Appellant I failed to convince the board that interpretation (i) would not be applicable to present claim 1: while the signals detected by the inner and outer microphones will, in general, comprise components of the surrounding environment and of the user's own voice as brought forward by appellant I, it is unquestionable that the inner microphone will pick up *predominantly* the user's own voice when the user is speaking. The same applies to the outer microphone detecting *mainly* the surrounding environment. Given that claim 1 is silent on the accuracy level required for the estimates of the ambient sound portion and the own voice sound portion, the skilled reader would readily understand that the detection of one microphone signal is sufficient to provide an *estimate* of that signal's most dominant component.

3.2 Feature analysis

In view of the claim construction according to point 3.1 above, novelty of claim 1 of the **main request** cannot be acknowledged for the following reasons:

3.2.1 As to feature (a), document **D2** discloses a "hearing instrument" in paragraph [0030], in particular in view

of the clause "filter sound in accordance with a Personalized Hearing Level (PHL)". While appellant I contested that D2 would concern a "hearing instrument" as considered in the opposed patent, the skilled reader would understand immediately that an earpiece which filters sound in accordance with a personalised hearing level in fact represents a hearing aid and thus also a hearing instrument.

Moreover, as stated in paragraph [0028] of D2, earpiece 100 includes

- an ambient-sound microphone (ASM) 111, which is, as shown in Figure 1 of D2, an *outer* microphone in accordance with feature (a),

and

- an ear-canal microphone (ECM) 123, which is, as also shown in Figure 1 of D2, an *inner* microphone in accordance with feature (a).

Furthermore, ear-canal receiver (ECR) 125 according to paragraph [0028] of D2 anticipates the "receiver" of feature (a).

3.2.2 As to **feature (b)**, the board adopts interpretation (i) as set out in point 3.1.3 above. In accordance with paragraph [0033] of D2, earpiece 100 uses analog-to-digital (A/D) converters coupled to microphones 111 and 123 and a digital-to-analog (D/A) converter connected to receiver 125. The former converters process the signals coming from microphones 111 and 123 and yield an ambient and an own-voice sound portion signal estimate. These estimates are respectively labelled with reference

numerals "426" and "410" in paragraph [0042] of D2. Signal 410 is referred to as an "internal signal" in paragraph [0042] of D2 and captures internal sound in the ear canal. The skilled reader would immediately recognise that the main component of this internal signal is the user's own voice when the user is speaking. This is confirmed by paragraph [0044] of D2, which states that "the internal voice created in the ear canal 131 [is] captured by the ECM 123".

Given that the processor of earpiece 100 is supposed to provide a signal either

- to a voice-recognition system (paragraph [0034] of D2),

or

- to users to hear themselves (see the last sentence of paragraph [0051] and the term "loopback listening" in paragraph [0047] of D2),

it is immediately apparent that this internal voice must be the user's own voice within the meaning of feature (b).

Appellant I's argument that an A/D converter would simply "convert" rather than "estimate" a signal could not convince the board because the sampling operation underlying *any* A/D conversion necessarily results in a predicted (sampled) form of the real signal, in which the accuracy of the prediction depends on the sampling rate of the conversion. Appellant I also drew the attention to the word "yield" in feature (b) which would imply that this feature *generates* a sound that is desired by the user and emphasised that such a sound

must be distinguished from mere "noise". By contrast, the phrase "the ECR 125 is configured to pass, process, or play acoustic audio content 402" of paragraph [0042] of D2 would, in appellant I's view, not disclose that a desired sound is generated. The board cannot share this view given the broad way in which claim 1 is phrased: claim 1 does not provide any indication to the skilled reader how to distinguish, in technical terms, a *desired* sound from a mere *noise* signal. As a result, there is no distinction between the ways in which, on the one hand, estimates "426" and "410" are produced in D2 and, on the other hand, the ambient and own-voice sound-portion-signal estimates are "yielded" in claim 1.

3.2.3 Concerning **features (c) and (d)**, signals 426 and 410 are provided to "acoustic management module 201" as illustrated in Figure 4 and described in D2 (see e.g. paragraphs [0045] to [0047]). This module comprises an automatic gain control (AGC) to measure background-noise characteristics in signal 426 and a voice-activity detector (VAD) to estimate a voice-activity level. Paragraph [0046] of D2 mentions an "AGC processed electronic ambient signal 426" and a "VAD processed electronic signal 410" (emphasis in both cases by the board). This wording already anticipates the processing according to features (c) and (d).

A further processing of those "processed" signals takes place by means of multiplication 304 (amplification of the ambient-noise related signal with gain G1 as determined by the results of the AGC and the VAD) and by multiplication 308 (amplification of the own-voice related signal with gain G2 as determined also by the results of the AGC and the VAD), see Figure 4 and paragraphs [0046] and [0047] of D2. These

multiplications further anticipate the processing of features (c) and (d).

3.2.4 **Feature (e)** is anticipated by the adding or mixing step producing "mixed signal 323" of Figure 4 as described in paragraphs [0046] to [0051] of D2.

3.3 In conclusion, the subject-matter of claim 1 of the main request is not new over D2 (Article 100(a) in conjunction with Article 54 EPC).

4. *Auxiliary request 1: claim 1 - Rule 80 EPC*

4.1 Claim 1 of **auxiliary request 1** differs from claim 1 of the main request in that here the word "sound" is inserted between the words "voice" and "portion" of feature (e).

4.2 The appealed decision states that the "first auxiliary request does not fulfill *[sic]* the requirements of Rule 80 EPC, and thus is not **admissible**" (see point 3.1 of the Reasons; board's emphasis; see also point 6, second paragraph of the Reasons) and refers in that context to the Guidelines for Examination in the EPO (see point 3.1.1, last sentence of the Reasons).

4.3 The board understands from the above statement that the opposition division did not admit the present auxiliary request into the opposition proceedings ("first auxiliary request [...] is thus not admissible"). In that regard, it is worth noting that the referred Guidelines for Examination (edition of November 2017, H-II, 3.2, second paragraph) have the following wording (board's emphasis):

> "... where a '**clarification**' can be considered as a limitation of the claim, it would be **admissible**

under Rule 80 and could form the basis for maintaining the patent in amended form ...".

The board can only surmise that the opposition division assumed that, if an amendment made to a claim of a granted patent can be considered to be a limitation of that claim, the set of claims (such as the present first auxiliary request) containing that claim is to be *admitted* into the proceedings, otherwise it is *not to be admitted*. This suggests that Rule 80 EPC would relate to the matter of admittance (implying a discretionary decision) rather than the matter of allowability (as invoked for the other claim requests on file under Articles 54, 56 and 123(2) EPC).

4.4 As a consequence, appellant II explicitly requested that the first auxiliary request not be admitted into the appeal proceedings.

4.5 Appellant I argued that auxiliary request 1 was introduced in view of an objection regarding insufficiency of disclosure (Article 83 EPC).

While this may provide a reason why appellant I felt compelled to submit auxiliary request 1, it cannot be understood how the insertion of the mere word "sound" could be occasioned by such an objection. In view of the term "processed own voice sound portion signal" (emphasis added) of feature (d), the insertion of the word "sound" between the words "voice" and "portion" of the term "processed own voice portion signal" of feature (e) only ensures consistency of terminology within claim 1, which relates, at most, to clarity (Article 84 EPC), but not to sufficiency of disclosure.

4.6 Rule 80 EPC reads as follows (board's emphasis):

> "Without prejudice to Rule 138, the description, claims and drawings may be amended, provided that the amendments are occasioned by a ground for opposition under Article 100, even if that ground has not been invoked by the opponent".

This means that claims may be amended if the amendments are occasioned by an opposition ground; they may not be amended otherwise. The requirement of Rule 80 EPC is therefore similar to that of Article 123(2) EPC, which states that the "European patent application or European patent may not be amended in such a way that it contains subject-matter which extends beyond the content of the application as filed" (emphasis added by the board).

4.7 Accordingly, this board considers Rule 80 EPC to be a **non-discretionary** provision with a substantive requirement that relates to the *allowability* of a patent as amended rather than to *admissibility*, i.e. whether or not an amended version of the patent should be admitted into the opposition or appeal proceedings.

This conclusion is also corroborated by the preparatory work to Rule 80 EPC (cf. notes on the introduction of Rule 57a EPC 1973, i.e. the predecessor of Rule 80 EPC, in Notice dated 1 June 1995, OJ 1995, 409; see in particular pages 416 and 417, point 2) and thus in line with the legislator's intent (board's emphasis):

> "New Rule 57a [Rule 80 EPC] ... addresses the purely **substantive aspects** of the proprietor's entitlement to amend his patent, and does not specify the point in time up to which amendment is allowed ... Its restriction of the right to amend is in line with the sense and purpose of opposition proceedings, and does away with the need for a **discretionary provision** like Rule 86(3) [Rule 137(3) EPC]".

In the board's view, discretion to disregard an amended

version of a patent in *inter partes* proceedings can only emanate from Article 123(1) EPC in conjunction with Rule 79(1) and/or 81(3) EPC and, in case of arranged oral proceedings, with Rule 116(2) EPC (see also T 966/17, Catchword 1; R 6/19, Reasons 6 and 7).

4.8 In conclusion, contrary to appellant II's request, auxiliary request 1 cannot be disregarded in these proceedings. However, given that the underlying amendment does not lend itself to counter any invoked opposition ground in the present case (cf. point 4.5 above), claim 1 of auxiliary request 1 is not occasioned by such a ground for opposition and is thus **not allowable** under Rule 80 EPC.

5. *Auxiliary request 2: claim 1 - inventive step*

5.1 Claim 1 of **auxiliary request 2** differs from claim 1 of the main request in that it additionally specifies that

(f) the ambient and own-voice sound-portion-signal estimates (â and $\hat{\boldsymbol{v}}$) are <u>each</u> yielded by processing <u>both</u> the outer and the inner microphone signal.

5.2 **Feature (f)** is not disclosed in D2 because this feature precludes interpretation (i) of point 3.1.3 above.

5.3 The technical effect of **feature (f)** is closely related to the inner and outer microphones <u>both</u> detecting, albeit to different extents, the user's own voice when the user is speaking as well as sound from the surrounding environment (cf. point 3.1.3 above). The skilled reader would readily understand that the estimation of the user's own voice and of the sound of the surrounding environment will typically be improved when these estimations are based on the signals of <u>both</u>

of the inner and outer microphones rather than on merely one of those signals.

It is not credible that feature (f) would lead, as alleged by appellant I, to the user perceiving their own voice in a more natural or a more pleasant way, because the processing according to feature (f) is formulated so broadly that no judgement is possible of how the user would perceive the result of this processing.

5.4 The objective technical problem can therefore be framed as "how to improve the estimation of the ambient noise and of the user's own voice in the system of D2".

The board cannot follow appellant I's argument that this objective technical problem would be based on hindsight, because the aim to improve estimations does not point in any way at the solution presented in feature (f). Moreover, the problem (i.e. "subjective technical problem") as indicated in the opposed patent according to which the user's perception of their own voice is to be optimised, in particular to shape the user's own voice in a manner pleasant for the user (cf. paragraph [0013] of the opposed patent, corresponding to lines 17 to 20 of page 3 of the application as filed), cannot be credibly solved by the features of present claim 1. This is mainly because the mere fact that the ambient and own-voice estimates are each yielded by processing both the outer and the inner microphone signal - without further details on the specific configuration of the filters, the gain functions and the respective transfer functions in the underlying hearing instrument (see point 1 above) - cannot plausibly contribute to the solution of that

alleged problem. This is based on mere speculation.

5.5 The skilled person to whom the above objective technical problem is addressed, i.e. the person skilled in the field of sound-signal processing, would have been aware of **D1** and would have readily consulted this document in view of the objective technical problem posed because it discloses

- a signal-processing scheme to separate a user's voice from ambient sound (see paragraphs [0001], [0002], [0008] and [0010] of D1);

- an earplug ("10") comprising an outer microphone ("M1") and an inner microphone ("M2") in Figure 1 and paragraph [0029] of D1, which is similar to the configuration of the earpiece of D2.

The skilled person would have inferred from paragraphs [0001], [0002], [0010] to [0012], [0031] and [0032] of D1 that a high speech intelligibility can be achieved even in noisy environments by applying "blind source separation" on the signals coming from microphones M1 and M2 to provide for a clear separation between the user's own voice and the ambient sound (as also proposed in paragraph [0022] of the opposed patent). Therefore, the skilled person would have immediately realised that the application of "blind source separation" to outer microphone signal 426 and inner microphone signal 410 of D2 would indeed solve the objective technical problem because it improves, at least in noisy situations, the estimation of the ambient noise and user's own voice.

5.6 Alternatively, D2 itself already suggests to provide for an echo-cancelled estimation of the user's own

voice in paragraphs [0052] to [0056] and Figure 6, which is particularly useful in the scenario with a lea ky seal causing echo feedback as addressed in paragraph [0044] of D2. The board agrees with appellant II that, once such an improved own-voice estimation has been obtained, it would have been straightforward for the skilled person, when tasked with the objective technical problem of point 5.4 above, to update the ambient-noise estimate accordingly, namely by removing, i.e. subtracting, that improved own-voice estimate from the signal provided by the outer microphone, e.g. based on the teachings in paragraph [0045] and Figure 4 of **D4**.

5.7 The board does not agree with appellant I's assessment that D1 and D4, on the one hand, and D2, on the other hand, would concern different arrangements. It is acknowledged that **D1** does not necessarily concern a "hearing instrument" but the skilled person would have immediately understood that the device mentioned in paragraph [0001] and shown in Figure 1 of D1 is at least compatible with the earpiece of **D2**. Moreover, the board does not see how the "body noise" mentioned in paragraph [0027] of **D4** or the "relative phase difference" between air-conducted and bone-conducted sound as addressed in paragraphs [0051] and [0052] of D4 could possibly imply a microphone arrangement that *differs* from the arrangement of D2 with

- ambient sound microphone 111 being configured to capture ambient sound (cf. paragraph [0028] of D2)

and

- ear-canal microphone 123 being "configured to capture internal sound in the ear canal" (cf.

paragraph [0042] of D2),

certainly not to the extent that such a difference between the microphones could impact the compatibility between the sound-signal processing of D2 and of D4 in any way. Likewise, the fact brought forward by appellant I that D4 (e.g. paragraph [0050]) uses implanted microphones rather than an ear-canal microphone to detect this body noise has no bearing on this compatibility either.

Furthermore, the board is also not convinced by appellant I's allegation that

- Figure 6 of D2 only teaches to improve the own-voice estimate

and

- that a corresponding improvement of the ambient-noise estimate is not necessary, given that D2 would not require any reproduction of sound from the surrounding environment.

Rather, the board concurs with appellant II that it would have been immediately apparent for the skilled person that the hearing instrument of D2 is not meant to isolate the user completely from their environment. For instance, safety in traffic situations may already necessitate to provide for environmental awareness when using D2's hearing instrument.

5.8 In view of the above, the subject-matter of claim 1 of auxiliary request 2 does not involve an inventive step (Article 56 EPC).

6. *Auxiliary request 3: claim 1 - inventive step*

6.1 Claim 1 of **auxiliary request 3** differs from claim 1 of auxiliary request 2 in that it additionally specifies that

(g) the ambient-sound-portion-signal estimate (â) and the own voice portion signal estimate ($\tilde{v}$) are processed separately.

6.2 **Feature (g)** cannot lead to the acknowledgement of an inventive step, since this feature is already anticipated by paragraphs [0045] to [0047] and Figure 4 of D2.

6.3 Thus, claim 1 of auxiliary request 3 is also not allowable under Article 56 EPC.

7. *Auxiliary request 4': claim 1 - clarity*

7.1 Claim 1 of **auxiliary request 4'** differs from claim 1 of the main request in that it additionally specifies that

(h) the inner and outer microphone signals each comprise a mixture of signal portions coming from ambient sound and signal portions coming from the user's own voice,
(i) the ambient-sound-portion-signal estimate and the own-voice-sound-portion-signal estimate are yielded by separation of said signal portions.

7.2 **Feature (h)** is unclear because the inner and outer microphone signals will only then comprise a mixture as required by feature (h) under *particular* circumstances, namely when the user is speaking in an environment where ambient noise is present. When the user is not

speaking or is in a quiet environment, there is however no such mixture. In the absence of these particular circumstances, the skilled person would be in doubt as to what the limitations imposed by feature (h) are.

Stated differently, as brought forward by appellant II, feature (h) concerns a property of the *environment* and not of the *hearing instrument* mentioned in claim 1. The skilled person would not immediately discern the limitations attributed by such a property to the method of claim 1.

7.3 Consequently, claim 1 of auxiliary request 4' is unclear (Article 84 EPC).

8. *Auxiliary request 5: claim 1 - inventive step*

8.1 Claim 1 of **auxiliary request 5** differs from claim 1 of auxiliary request 3 in that it additionally specifies that

(j) adding the processed ambient sound and own voice portion signals yields a receiver signal;
(k) for obtaining an estimate of the own voice portion of the inner microphone signal, the filtered receiver signal is subtracted from the inner microphone signal.

8.2 **Features (j) and (k)** are already disclosed in paragraph [0056] of D2, where adaptive filter 610 monitors, in other words "filters", mixed signal 323, i.e. the signal that is provided to receiver 125 ("receiver signal"), to produce an echo estimate y(n). This echo estimate is subtracted from inner microphone signal 410.

8.3 Hence, the subject-matter of claim 1 of auxiliary request 5 likewise does not involve an inventive step (Article 56 EPC).

9. *Auxiliary request 6: claim 1 - inventive step*

9.1 Claim 1 of **auxiliary request 6** differs from claim 1 of auxiliary request 5 in that it additionally specifies that

(l) the step of processing an outer microphone signal and an inner microphone signal comprises obtaining an own voice signal portion estimate and subtracting the own voice signal portion estimate from the outer microphone signal to yield the ambient sound signal portion.

9.2 **Feature (l)** cannot lead to the acknowledgement of an inventive step for the same reasons as indicated in the alternative inventive-step reasoning for claim 1 of auxiliary request 2 mentioned in point 5.6 above, where **D2** is combined with the teaching of **D4**. The echo-cancelled estimation of the user's own voice can be seen as the own-voice-signal-portion estimate of feature (l) and, based on the teaching of D4, it would be subtracted from the outer microphone signal to obtain the ambient sound signal portion.

Appellant I's argument that feature (l) would lead to a computationally less expensive processing and would especially obviate the need for blind-source separation is not credible, given that the processing according to feature (l) is silent concerning any limitations that could support this argument. In particular, the fact that feature (l) mentions a subtraction does not mean that its processing is restricted to merely this

subtraction. Even if appellant I's argument were agreed to, it would still not lead to the acknowledgement of an inventive step, given that the combination of D2 with D4 does not involve blind-source separation.

9.3 In conclusion, contrary to the finding of the appealed decision, also claim 1 of auxiliary request 6 is not allowable under Article 56 EPC.

10. *Auxiliary request 7 and auxiliary request 7a: claim 1 - inventive step*

10.1 Claim 1 of **auxiliary request 7** is a combination of claim 1 of auxiliary request 5 with feature (l) of auxiliary request 6. For the reasons set out in point 9 regarding claim 1 of auxiliary request 6, the conclusion of point 8.3 concerning claim 1 of auxiliary request 5 cannot be altered in view of feature (l).

10.2 Likewise, claim 1 of **auxiliary request 7a** is identical to claim 1 of auxiliary request 7 but without feature (f). The conclusions for claim 1 of auxiliary request 7 therefore apply here *a fortiori*.

10.3 Accordingly, also the subject-matter of claim 1 of auxiliary request 7 and of auxiliary request 7a respectively does not involve an inventive step (Article 56 EPC).

11. Since there is no allowable set of claims, the patent is to be revoked.

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