

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD., SAMSUNG ELECTRONICS
AMERICA, INC., HARMAN INTERNATIONAL INDUSTRIES, INC.

Petitioners

v.

STATON TECHIYA, LLC,

Patent Owner

Case IPR2024-01034

U.S. Patent No. 11,665,493

Petition for *Inter Partes* Review of

U.S. Patent No. 11,665,493

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PETITIONERS' EXHIBIT LIST

Exhibit No.	DESCRIPTION
1001	U.S. Patent 11,665,493 (“’493Pat”)
1002	Declaration of Dr. Kyriakakis (“Kyriakakis”)
1003	Curriculum Vitae of Dr. Kyriakakis
1004	File History of U.S. Patent 11,665,493
1005	U.S. Provisional Application 61/098,250
1006	U.S. Application 12/555,864 (Published as 2010/0074451)
1007	U.S. Patent 6,567,524 (“Svean”)
1008	U.S. Publication 2005/0096899 (“Padhi”)
1009	Certified Translation of Japanese Patent Application Publication 2002-204500 (“Hayashi”)
1010	Japanese Patent Application Publication 2002-204500
1011	U.S. Patent 5,182,774 (“Bourk”)
1012	U.S. Patent No. 8,401,198 (“Oh”)
1013	Chu, W.T., <i>A deterministic broad-band signal for acoustical measurements</i> , Inter-Noise 87 1199–1202 (“Chu”)
1014	US Patent No. 7,158,643 (“Lavoie”)
1015	US Patent App. Pub. No. 2005/0157891 (“Johansen”)
1016	WO2001089083A1 (“Anagnos”)
1017	’836 patent <i>Ex Parte Reexamination</i> , Final Rejection (07/28/2023)
1018	U.S. Pat. No. 6,048,320 (“Brainard”)

Exhibit No.	DESCRIPTION
1019	Schneider, T. et al., <i>A Dual-Channel MLS-Based Test System for Hearing-Aid Characterization</i> , J. Audio Eng. Soc., Vol. 41, No. 7/8 (1993)
1020	U.S. Patent No. 6,687,377 (“ <i>Voix</i> ”)
1021	Claim Construction Order, <i>Staton Techiya, LLC v. Samsung Electronics Co., Ltd.</i> , Case No. 2:22-CV-00053-JRG-RSP
1022	Letter from Nikhil Krishnan to Thomas J Friel, Jr.
1023	’836 patent <i>Ex Parte Reexamination</i> , Appeal Brief of PO Staton Techiya LLC (11/21/2023)
1024	United States District Courts – National Judicial Caseload Profile

LISTING OF CHALLENGED CLAIMS

Claim 1	
1.pre	An audio device configured to test a seal of an earphone comprising:
1.1	a memory that stores instructions; and
1.2	a processor, wherein the processor is configured to execute the instructions to perform operations, the operations comprising:
1.2.1	generating a test signal,
1.2.1.1	wherein the test signal includes multiple frequency components, wherein at least one component lies between a range of 30 Hz and 200 Hz;
1.2.2	sending the test signal to a speaker of an earphone, wherein the earphone includes a first microphone, the speaker, and a sealing section, and wherein the sealing section is configured to form an acoustic barrier between a first side of the earphone and a second side of the earphone when the earphone is worn by a user,
1.2.3	receiving a first microphone signal from the first microphone;
1.2.4	calculating a value, using a first signal and a second signal, wherein the value is the result of a non phase calculation of at least one of a coherence, a correlation, a cross-correlation, a difference, or a combination;
1.2.5	comparing the value to a threshold to determine a seal quality between the first side and the second side;
1.2.6	generating a message to convey the seal quality; and
1.2.7	sending the message to the user.
Claim 2	
2	The audio device according to claim 1, wherein the message is an acoustic message.
Claim 3	
3	The audio device according to claim 1, wherein the message is a visual message sent to a display of the audio device.

Claim 4	
4	The audio device according to claim 1, wherein the speaker plays the test signal from the first side.
Claim 5	
5	The audio device according to claim 4, wherein the first microphone measures sound from the first side.
Claim 6	
6	The audio device according to claim 4, wherein the first microphone measures sound from the second side.
Claim 7	
7	The audio device according to claim 1, wherein the first signal is the test signal and the second signal is the first microphone signal.
Claim 8	
8	The audio device of claim 1, wherein the first signal is the test signal and the second signal is a modified first microphone signal.
Claim 9	
9	The audio device according to claim 8, wherein the modified first microphone signal is generated by applying a low pass filter to the first microphone signal, wherein the upper cutoff frequency is less than or equal to 200 Hz.
Claim 10	
10	The audio device of claim 1, wherein the first signal is a modified test signal and the second signal is the first microphone signal.
Claim 11	
11	The audio device according to claim 1, wherein the first signal is a modified test signal and the second signal is a modified first microphone signal.
Claim 12	
12	The audio device according to claim 11, wherein the first microphone signal is generated by applying a low pass filter to the first microphone

	signal, wherein the upper cutoff frequency is less than or equal to 200 Hz.
Claim 13	
13	The audio device according to claim 1, wherein the earphone includes a second microphone.
Claim 14	
14	The audio device according to claim 13, wherein the operations further comprise: receiving a second microphone signal from the second microphone.
Claim 15	
15	The audio device according to claim 14, wherein the first signal is the first microphone signal and the second signal is the second microphone signal.
Claim 16	
16	The audio device of claim 14, wherein the first signal is a modified first microphone signal and the second signal is the second microphone signal.
Claim 17	
17	The audio device of claim 14, wherein the first signal is a modified first microphone signal and the second signal is a modified second microphone signal.
Claim 18	
18	The audio device of claim 1, wherein the seal quality is good if the value is at or above the threshold value.
Claim 19	
19	The audio device of claim 1, wherein the sealing section is composed of at least one of rubber, silicone, a flexible polymer, or a combination thereof.
Claim 20	
20	The audio device of claim 1, wherein the sealing section is an eartip.

I. INTRODUCTION

Samsung Electronics Co., Ltd., Samsung Electronics America, Inc. (together “Samsung”), and Harman International Industries, Inc. (“Harman”) (collectively, “Petitioners”) request *inter partes* review (“IPR”) of claims 1-20 (“Challenged Claims”) of Patent No. 11,665,493 (“the ’493Pat”).

II. GROUNDS FOR STANDING

Petitioners certify that the ’493Pat is available for IPR and that Petitioners are not barred or estopped from requesting IPR.

III. STATEMENT OF PRECISE RELIEF REQUESTED FOR EACH CLAIM CHALLENGED

Petitioners respectfully request review and cancellation under 35 U.S.C. §311 as follows:¹

Ground	Claims	Basis ²
1	1, 2, 4-8, 10, 11, 13, 14, 18-20	§103: <i>Svean</i> , <i>Voix</i> , and <i>Padhi</i>

¹ Petitioners do not concede that any Challenged Claims satisfy other requirements for patentability that cannot be raised in IPR.

² Petitioners’ obviousness grounds do not require bodily incorporation of components from one reference into another, but instead are directed to the application of the teachings of one reference to another.

Ground	Claims	Basis ²
2	3, 15-17	§103: <i>Svean</i> , <i>Voix</i> , <i>Padhi</i> , and <i>Hayashi</i>
3	9, 12	§103: <i>Svean</i> , <i>Voix</i> , <i>Padhi</i> , and <i>Bourk</i>

As shown below, each reference pre-dates the earliest possible priority date to which the Challenged Claims may be entitled (September 19, 2008).³

Reference	Date	AIA Art ⁴ At Least Under
U.S. 6,567,524 (“ <i>Svean</i> ”)	05/20/2003 (issued)	§102(a)(1)
U.S. 6,687,377 (“ <i>Voix</i> ”)	02/03/2004 (issued)	§102(a)(1)
U.S. 2005/0096899 (“ <i>Padhi</i> ”)	05/05/2005 (published)	§102(a)(1)
JP2002204500A (“ <i>Hayashi</i> ”)	07/19/2002 (published)	§102(a)(1)
U.S. Patent 5,182,774 (“ <i>Bourk</i> ”)	01/26/1993 (issued)	§102(a)(1)

³ Petitioners do not concede that the claims of the ’493*Pat* are entitled to a September 19, 2008 priority date.

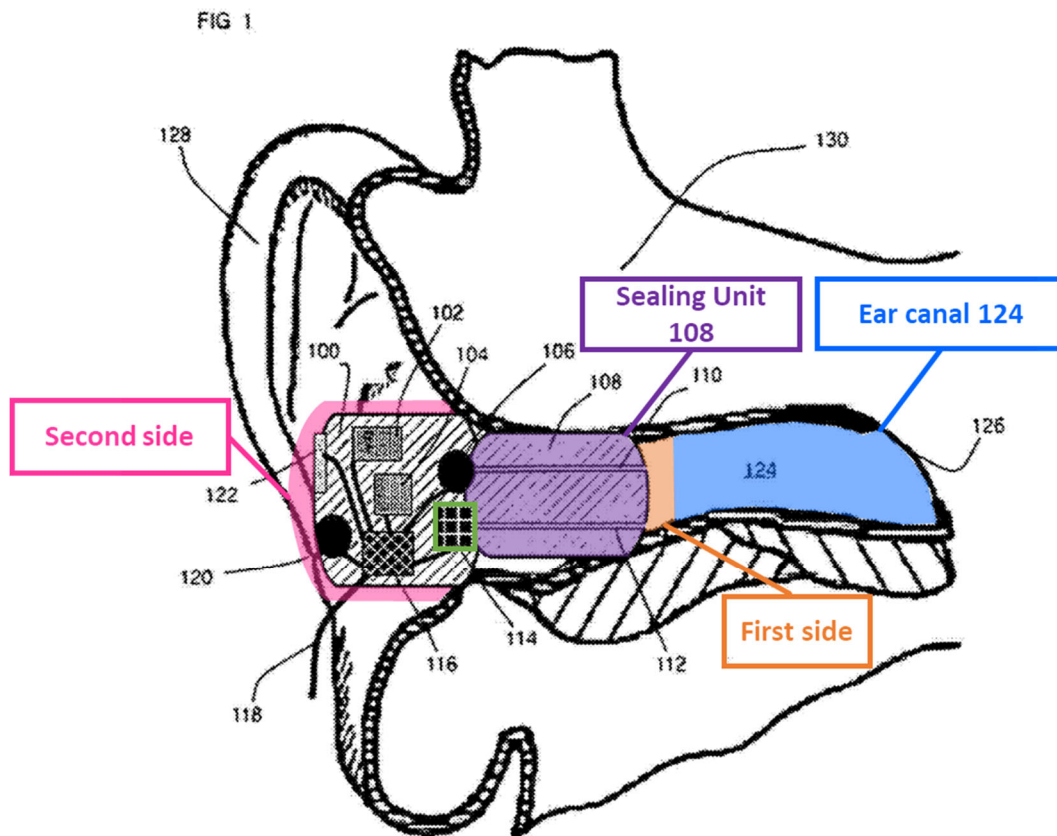
⁴ The ’493*Pat* is subject to the AIA because its parent, U.S. Patent No. 10,979,836 (“the ’836 patent”), was prosecuted under the AIA. *See* AIA §3(n)1(B).

IV. OVERVIEW OF THE '493Pat

A. The Specification

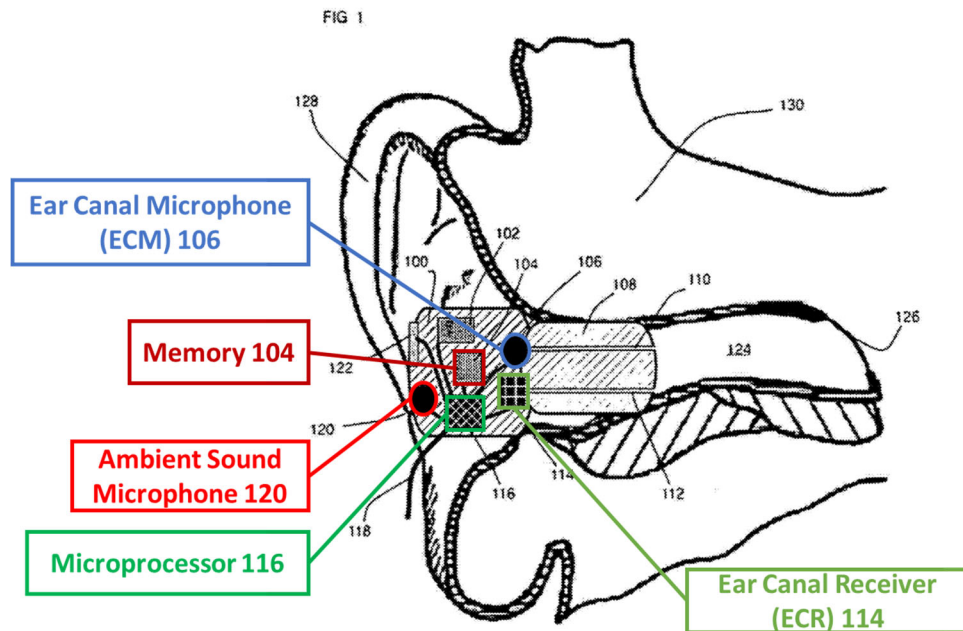
The '493Pat relates to “testing the seal of an orifice-inserted device ...”

'493Pat, 1:24-27. Figure 1, reproduced and annotated below, shows the earpiece comprising **sealing unit 108** “having a **first side** corresponding to **ear canal 124** and a **second side** corresponding to the ambient environment.”⁵ *Id.*, 4:34-36.



⁵ All emphasis added unless otherwise noted.

The earpiece includes “an **Ambient Sound Microphone (ASM) 120** to capture ambient sound, an **Ear Canal Receiver (ECR) 114** to deliver audio to an **ear canal 124**, and an **Ear Canal Microphone (ECM) 106** to capture and assess a sound exposure level within the **ear canal 124**.” *Id.*, 4:19-23. These components may be housed in an electronic housing unit 100, which may contain **microprocessor 116** operatively coupled to these components and to **memory 104**. *Id.*, 4:55-64.



The '493*Pat* discloses exemplary techniques for seal detection, e.g., with respect to Figs. 3-4, and 14.⁶ *Id.*, 7:54-8:40 (Fig. 3); *id.*, 9:14-52 (Fig. 4); *id.*,

⁶ Figure 14 and the corresponding description first appeared in U.S. Patent Application 12/555,864 filed on September 9, 2009. EX1006.

15:58-17:4 (Fig. 14). Fig. 3 discloses determining the degree of acoustic sealing via cross-correlation of a test signal with an **ECM signal**. *Id.*, 7:54-8:40.

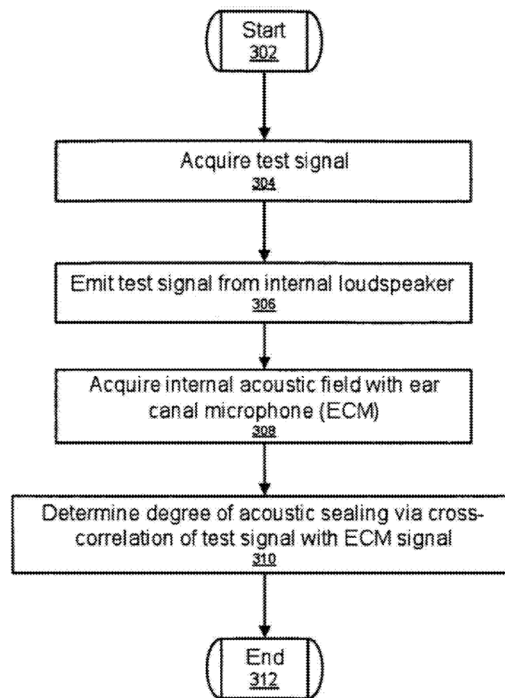


FIG. 3

Fig. 4 discloses cross-correlating a test signal and an **ECM signal** and comparing to a threshold to determine whether the seal test result should be FAIL or PASS. *Id.*, 9:14-52.

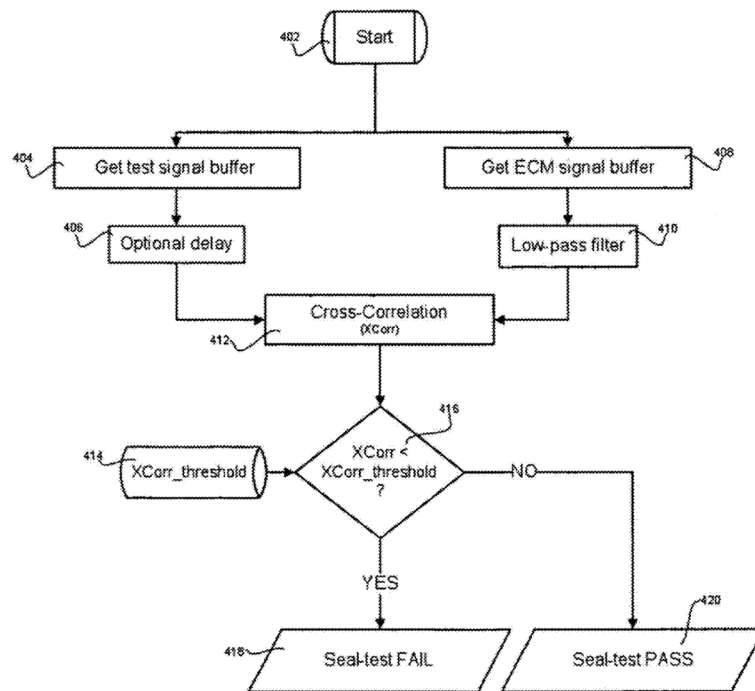
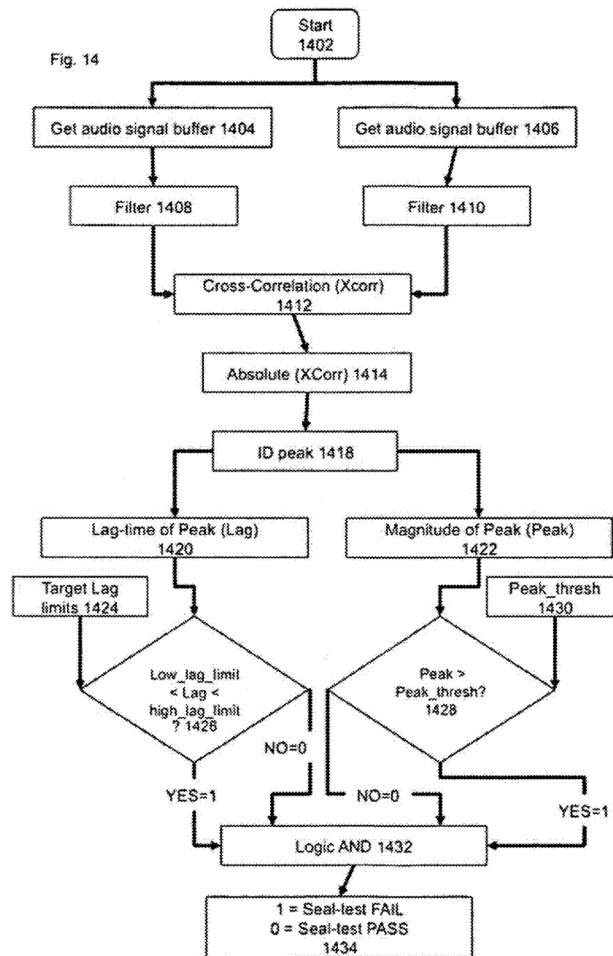


FIG. 4

Fig. 14 discloses another technique that involves cross-correlation of signals and comparing to a threshold to determine whether there is a proper seal. *Id.*, 15:58-17:4.



B. Prosecution History

The '493*Pat* issued from U.S. Application 17/182,570, filed on 2/23/2021, and purports to claim priority through a series of applications to Provisional Application 61/098,250, filed 9/19/2008.

On 2/14/2022, applicants filed a preliminary amendment that amended originally-filed claims 1-19 and added new claim 20. EX1004, 107-112. These amended claims are substantively the same as the issued claims.

The Office did not issue any rejections during prosecution. On 11/16/2022, the Office mailed a notice of allowance. *Id.*, 129. In relevant part, the Examiner stated that *Svean* was the “closest prior art of record” to independent claim 1 and disclosed several limitations. *Id.*, 135-36. However, the Examiner stated—without providing any reasoning—that *Svean* “fails to teach” the following limitations: “generating a test signal, wherein the test signal includes multiple frequency components, wherein at least one component lies between a range of 30Hz and 200Hz”; “sending the test signal to a speaker of an earphone”; “calculating a value, using a first signal and a second signal, wherein the value is the result of a non phase calculation of at least one of a coherence, a correlation, a cross-correlation, a difference, or a combination”; and “comparing the value to a threshold.” *Id.*, 136.

The Examiner’s search notes also indicate that the Examiner reviewed papers related to IPR2022-00410 regarding the ’493*Pat*’s parent, the ’836 patent. *Id.*, 144. On 11/18/2022, Applicants filed a request for continued examination and submitted Samsung’s request for *ex parte* reexamination of the ’836 patent (90/015,146). *Id.*, 183, 187.

On 12/23/2022, the Office mailed a notice of allowance. *Id.*, 222. The Examiner made identical statements regarding *Svean* as in the previous notice. *Id.*, 227-28. The Examiner also stated that several references, including *Padhi*, were “considered pertinent to applicant’s disclosure” and were “made of record and not

relied upon.” *Id.*, 228-29. As to *Padhi*, the Examiner stated that it “discloses an apparatus, method, and computer program for comparing audio signals.” *Id.*, 229. The ’493*Pat* issued on 5/30/2023. *Id.*, 380-387.

V. OVERVIEW OF THE PRIOR ART

The prior art references analyzed in the grounds below are analogous to the ’493*Pat* because they are within the same field of endeavor and/or reasonably pertinent to one or more problems addressed by the ’493*Pat*. Like the ’493*Pat*, *Svean*, *Voix*, and *Hayashi* similarly disclose embodiments for analyzing the acoustic seal of an ear worn device. *See, e.g., Svean*, 11:61-13:38; *Voix*, 3:33-58, 4:49-6:22, 6:53-7:48, 8:56-10:20; *Hayashi*, [0018]. *Padhi* is directed to techniques for comparing the similarity of two audio signals (*Padhi*, [0001], [0004]-[0006]), which is pertinent to the acoustic seal analysis problem addressed by the ’493*Pat* because—as references such as *Svean*, *Voix*, and *Hayashi* disclose—assessing acoustic seal involves a determination of the similarity of audio signals. *Kyriakakis*, ¶61. Further, like the ’493*Pat*, *Bourk* is directed to a device that provides audio to a user. *Bourk*, Abstract.

A. *Svean*

Svean is titled “Noise Protection Verification Device.” At 11:61-13:38, *Svean* discloses methods and systems for “[o]nline verification/control of hearing protector performance,” which “utilise[] [sic] the fact that a sound field locally

generated in the cavity near the eardrum is influenced by leakage in the hearing protector.” *Id.*, 11:61-65.

“FIG. 1 illustrates an embodiment of the invention where the verification device is integrated in a hearing protective earplug.” *Id.*, 12:24-26. Figure 1 is reproduced below with the **electronics unit 11**, **microphone M1**, **microphone M2**, **loud speaker/sound generator SG**, and **sealing section 2** annotated.

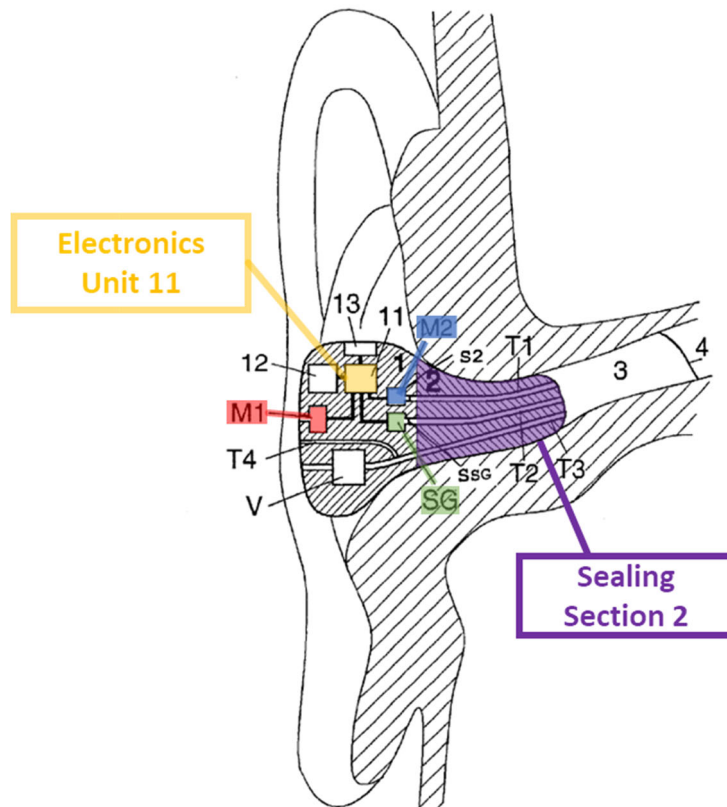


Fig. 1

Svean discloses that “[t]he **sound generator SG** produces a predetermined acoustic signal, which generates a sound field in the meatus 3.” *Id.*, 12:31-33. “An

acoustic transmission channel T1 connects **microphone M2** to the inner portion of the meatus 3.” *Id.*, 12:33-35. “**Microphone M2** picks up the sound field being set up by the **sound generator SG**.” *Id.*, 12:35-36. “The signal generation and analysis is carried out in a **digital signal processing (DSP) or microcomputer unit E3** with appropriate amplifiers and converters.” *Id.*, 12:36-38.

Svean discloses that “[t]he result of the analysis is compared to stored results from previous measurements of the same type in a situation with good sealing conditions,” and “[t]he user may get audible or other messaged confirmation if the leakage is acceptably low, or a warning signal if leakage is unacceptably high.” *Id.*, 12:9-14.

Fig. 8 “illustrates a signal processing arrangement according to a preferred embodiment of the invention.” *Id.*, 12:42-43. *Svean* discloses that **processing unit E3** generates “a signal which produces reliable characterisation of the sound field in the cavity, preferably while not being annoying to the user.” *Id.*, 12:43-45. As one example, *Svean* discloses a test signal that comprises “one or more sinusoidal components”; alternatively, *Svean* discloses that the test signal may be a “pseudorandom sequence.” *Id.*, 12:42-50.

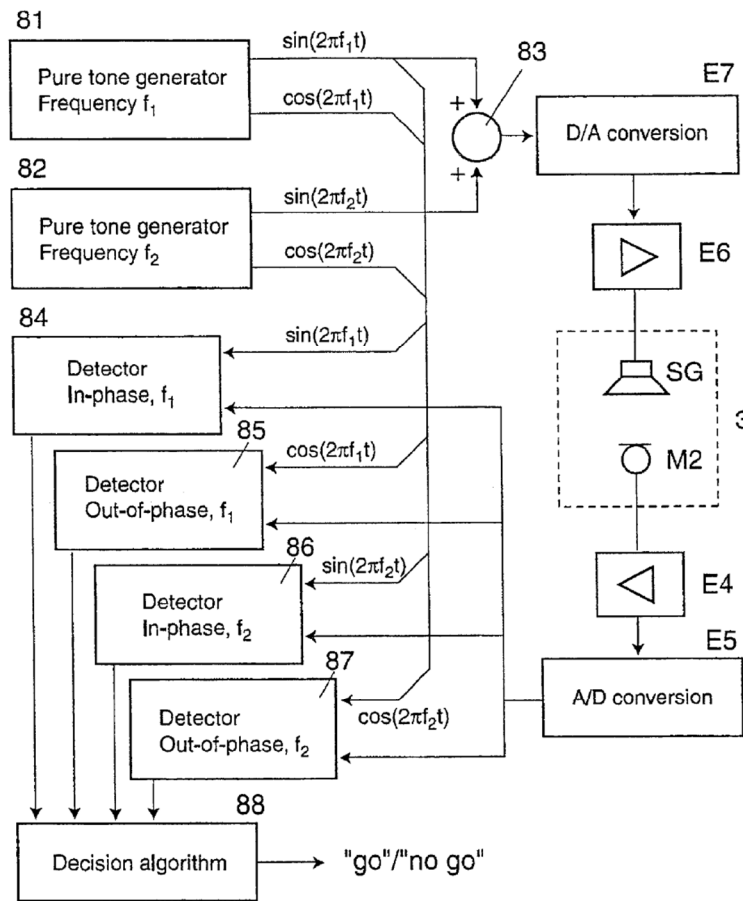


Fig. 8

B. Voix

Voix discloses “an apparatus for determining in situ an acoustic seal provided by an in-ear device inserted into an ear canal of an individual.” *Voix*, 3:33-36; *see also id.*, 3:36-58; *id.*, Abstract (disclosing that the “in-ear device” may be of a “hearing protection/aid nature”).

Fig. 1 discloses “an embodiment 100 of [the] apparatus for determining in situ the acoustic seal ...” *Id.*, 6:53-58. “The apparatus 100 comprises a **sound**

measurement device 41 as a remote device 40 ... that has a probe microphone 42 and a reference microphone 44 connected to a data processing unit 50 ...” *Id.*, 6:66-7:2. Sound measurement device 41 as a remote device 40 is shown in more detail in Fig. 3.

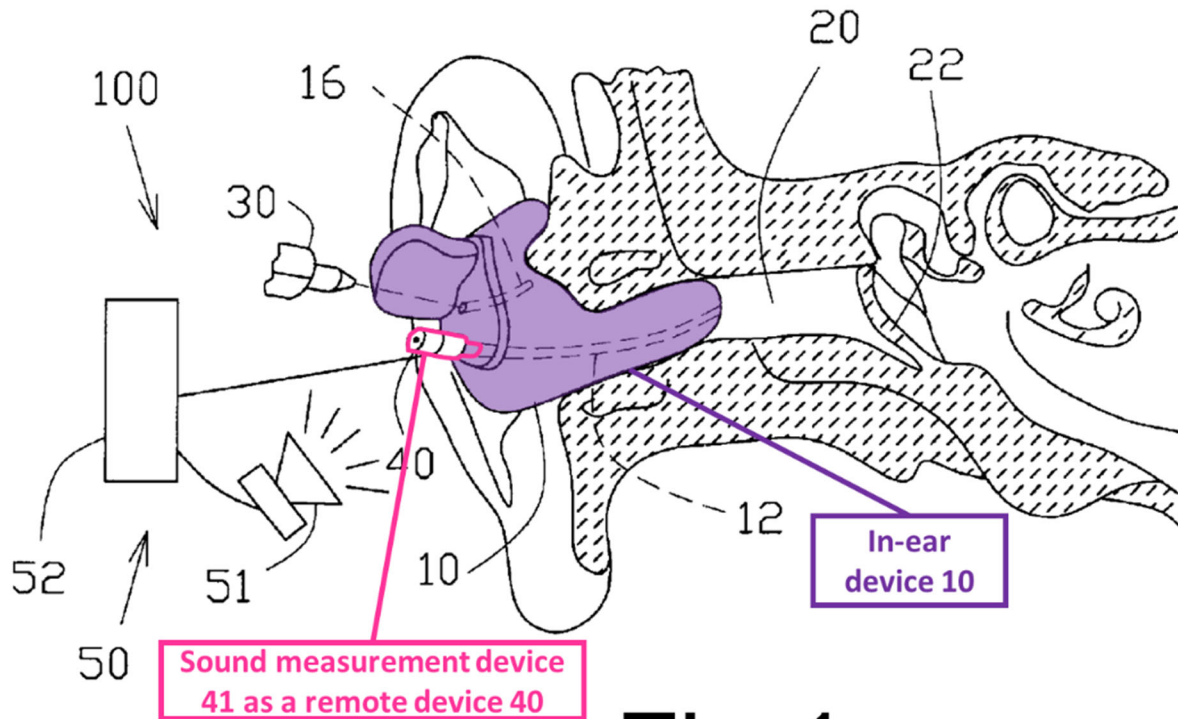


Fig.1

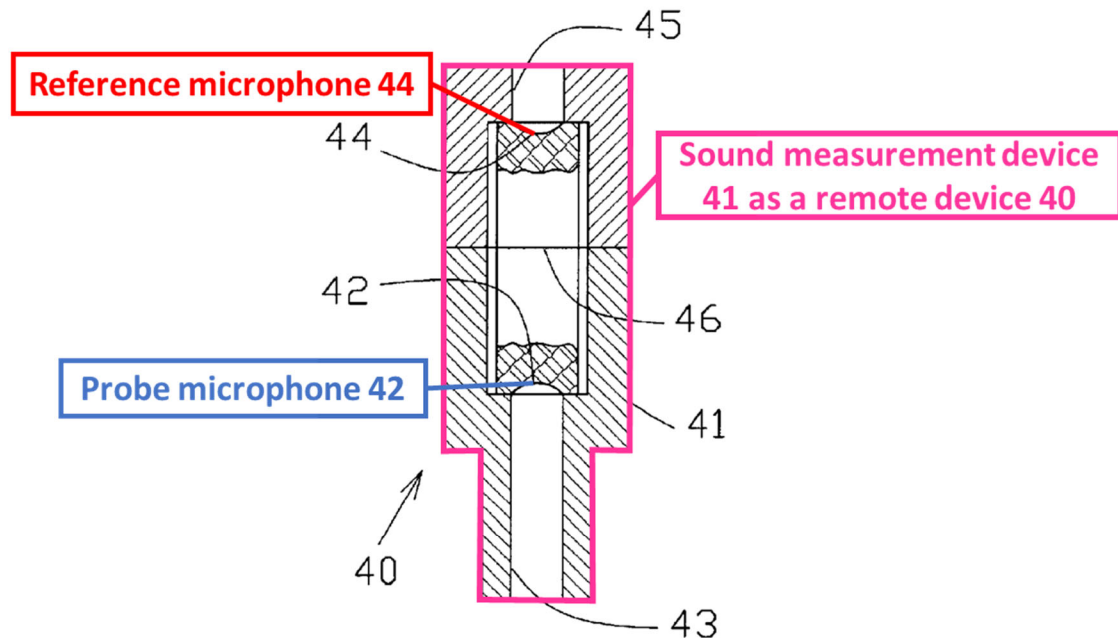
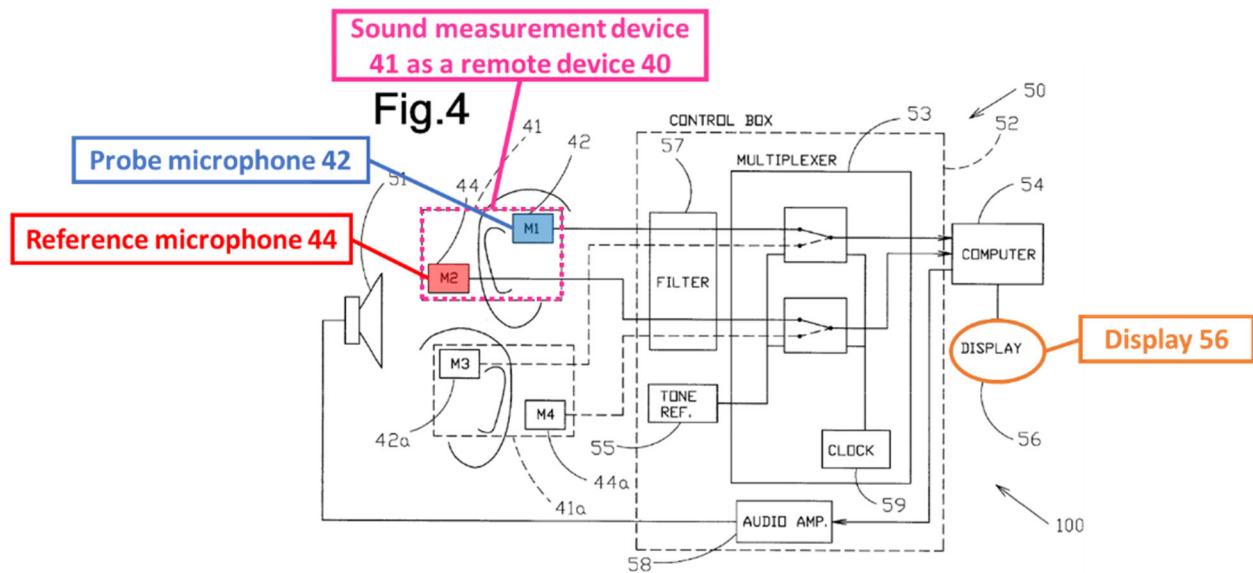


Fig.3

Voix discloses that the **probe microphone 42** and the **reference microphone 44** measure the sound pressure level inside the ear canal 20 and from the environment, respectively. *Id.*, 7:16-21. “The sound pressure levels correspond to a *known noise source signal, preferably of wide band ranging from twenty hertz (20 Hz) to twenty thousand hertz (20000 Hz) for enhanced measurements*, coming from the computer unit 54 via an audio amplifier 58 of the control box 52 and speaker 51.” *Id.*, 7:26-31; *see also id.*, 7:21-26.

The control box 52 gathers the sound pressure levels and transmits them to the computer unit 54 to be recorded and processed. *Id.*, 7:31-35. Specifically, “the sound pressure levels read by both **probe 42** and **reference 44** microphones

corresponding to the known noise pressure signal” are processed⁷ to provide a corresponding *calculated value of a sound level difference* provided by the **in-ear device 10.**” *Id.*, 7:39-44. “The computer unit 54 preferably includes a **display member 56** for *displaying the sound level difference calculated value* provided by the **in-ear device 10**, being either an attenuation or an amplification depending on the type of **in-ear device 10.**” *Id.*, 7:44-48.

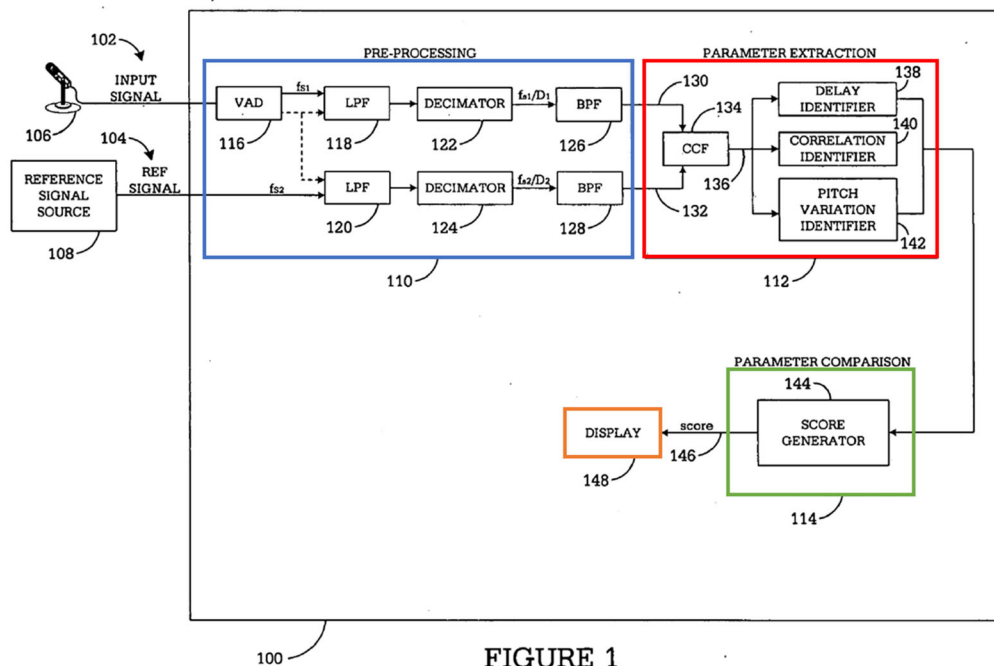


Voix similarly discloses a method utilizing the components above to determine the acoustic seal. *Id.*, 4:50-6:22; 8:63-10:20.

⁷ Here, *Voix* refers to data processing unit 50 processing the sound pressure levels. *Id.*, 7:39-44. Whether computer unit 54 or data processing unit 50 performs the processing is not relevant because the grounds rely on *Svean*’s processing.

C. *Padhi*

Padhi discloses “[a]n apparatus, method, and computer program [that] are capable of receiving and cross-correlating a first audio signal and a second audio signal.” *Padhi*, Abstract. *Padhi*’s Fig. 1, reproduced below, illustrates, *inter alia*, **pre-processing section 110**, **parameter extraction section 112**, **parameter comparison section 114**, and **display 148**. *Id.*, [0020]; *id.*, [0033].



The components “may represent software routines executed by one or more processors.” *Id.*, [0034]. Further, “various changes may be made to Fig. 1,” and “[v]arious components can be omitted or combined and additional components can be added according to particular needs.” *Id.*, [0035].

The apparatus in Figure 1 receives an **input audio signal 102** via a microphone. *Id.*, [0018]. A **reference signal 104** is supplied by a reference signal source. *Id.*

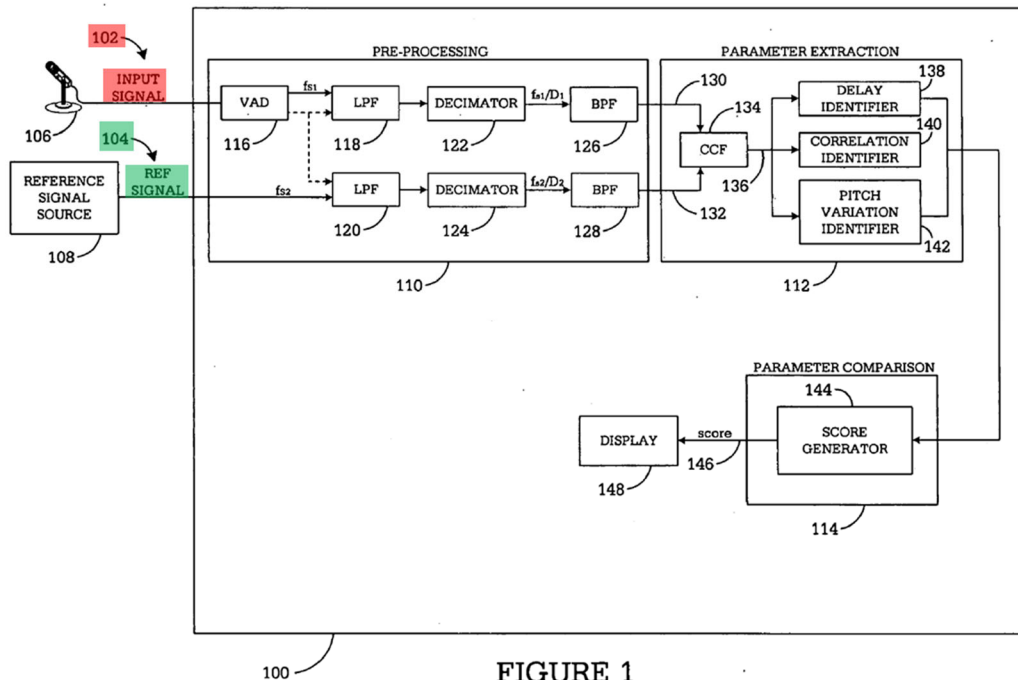


FIGURE 1

The signals “could be replaced by any suitable audio signals provided by any suitable source or sources.” *Id.* Prior to performing cross correlation, the microphone and reference signals may be pre-processed via low pass filtering, decimating, and/or band pass filtering. *Id.*, [0023], [0025], [0071]. The apparatus cross-correlates the two signals to determine the extent to which they match. *Id.*, [0017], [0027], [0028], [0030]. The amount of correlation between the signals is a component of an overall “score.” *Id.*, [0032]. The apparatus then presents the score

to an end user via a display. *Id.*, [0033]. *Padhi* discloses more details regarding an example technique for generating a score with reference to Figure 6, reproduced below. *Id.*, [0069]-[0078].

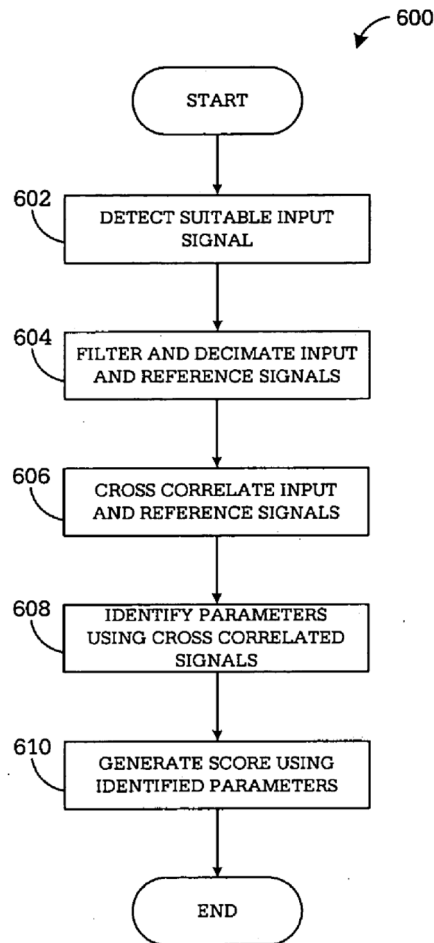


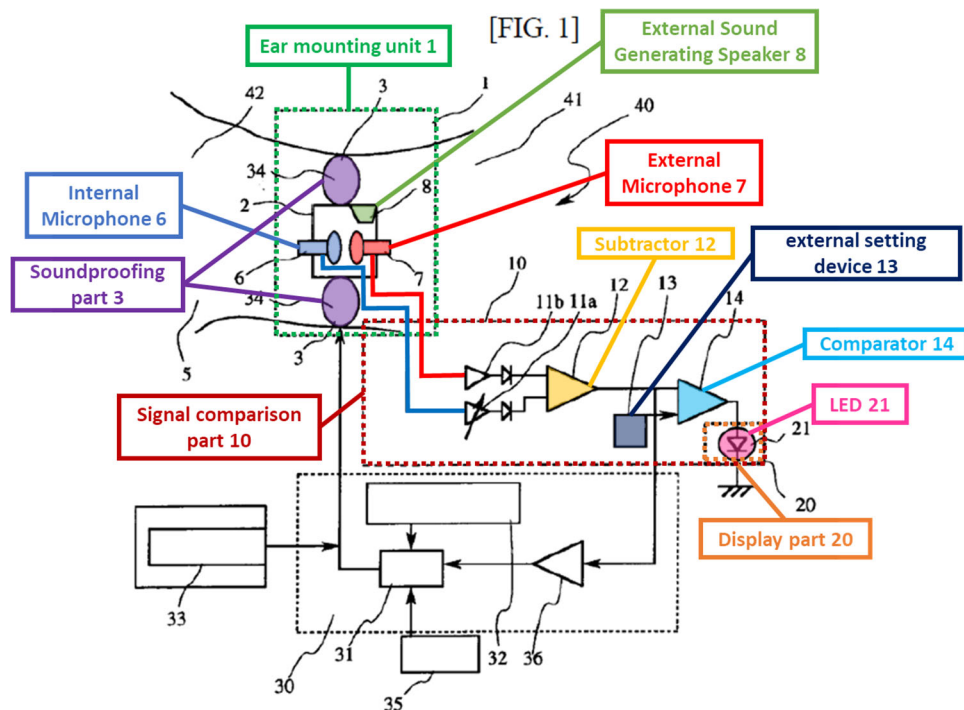
FIGURE 6

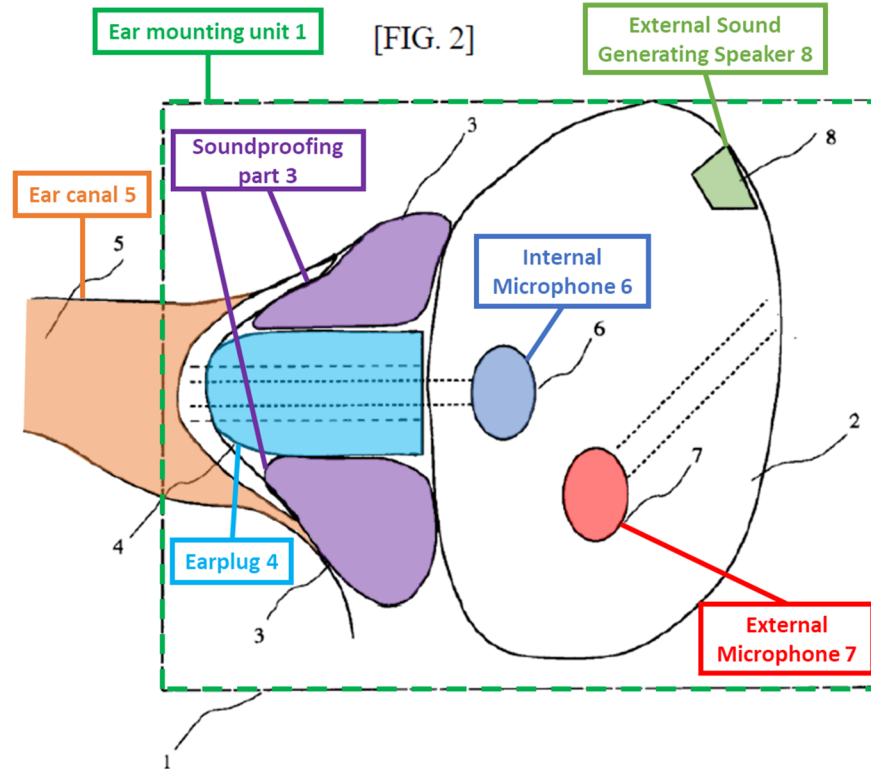
D. Hayashi

Hayashi is titled “Leak tester of ear-mounted external sound processing device.” *Hayashi*, Abstract; *id.*, [0004]. *Hayashi* discloses an **ear mounting unit 1**

and a technique to test its seal that involves subtracting microphone signals received by an **internal microphone 6** and an **external microphone 7** that receive sounds from opposite sides of a **soundproofing part 3**. The technique involves subtracting the two signals (**subtractor 12**), comparing the result (**comparator 14**) to a threshold set by **external setting device 13**, and displaying the result of the seal test using **display part 20/LED 21**. *Id.*, [0010]-[0014], [0018]-[0020].

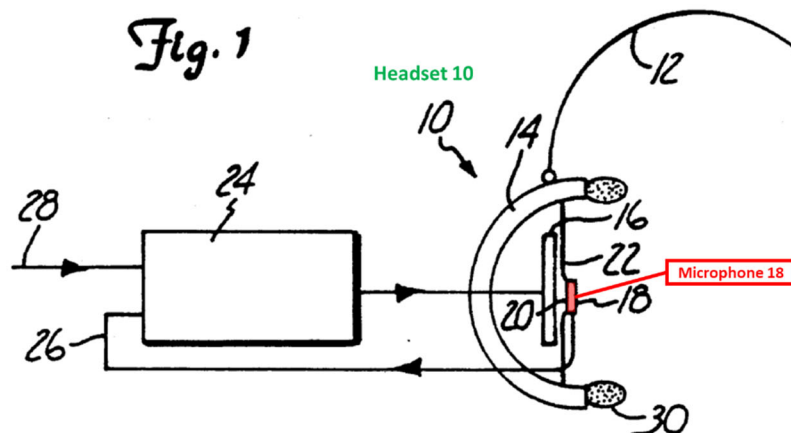
These components, as well as certain additional components/elements of *Hayashi's* Figures 1 and 2, are annotated below.

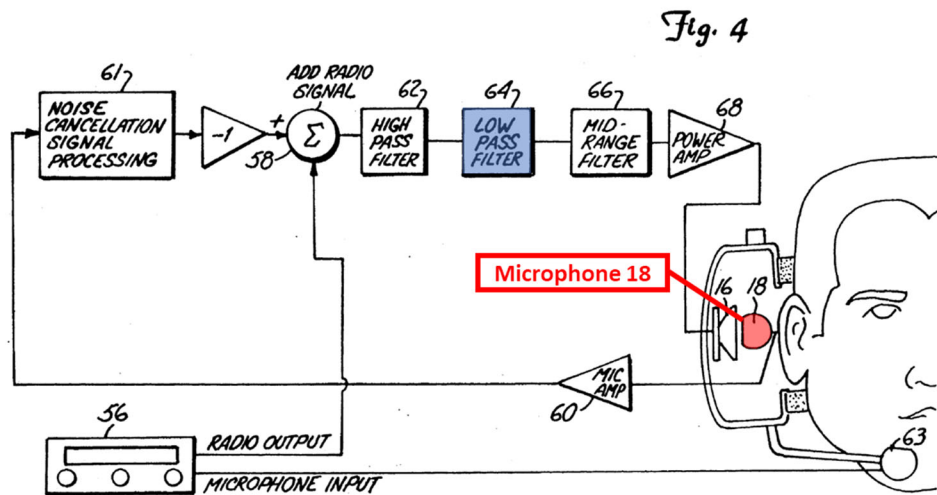




E. *Bourk*

Bourk is titled “noise cancellation headset.” Figures 1 and 4, reproduced below, illustrate **headset 10**, **microphone 18**, and **low pass filter 64**. *Bourk*, 3:50-4:27; *id.*, 6:37-7:17.





Bourk's additional relevant disclosures are discussed in Ground 3 below.

VI. LEVEL OF ORDINARY SKILL IN THE ART

A person of ordinary skill in the art at the time of the alleged invention of the '493*Pat* ("POSITA"), which for purposes of this proceeding is no earlier than 9/19/2008, would have had a bachelor's degree in electrical engineering, computer science, audio engineering, or a similar field and at least two years of experience with hearing instruments such as earphones, hearing aids and/or hearing protectors. *Kyriakakis*, ¶22. The POSITA could have also obtained similar knowledge and experience through other means. *Id.*

VII. CLAIM CONSTRUCTION

Petitioners are unaware of any "prior claim construction determination" by a District Court or the International Trade Commission. *See* 37 C.F.R. §42.100(b). As to the parent '836 patent and an unrelated patent PO has asserted against

Samsung (U.S. Patent 9,609,424), the Eastern District of Texas construed the following terms, which also appear in the challenged claims of the '493Pat:

- “*a processor . . . the processor*” ('836 patent, claims 1, 9, 14): “The same processor must perform each of the recited functions.”

EX1021, 48.

- “*seal quality*” ('424 patent, claim 1): “[T]he Court agrees with Samsung[’s] position that ‘seal quality’ is not binary in nature. Otherwise, this term will be given its plain and ordinary meaning.”

Id., 39, 50.

In the currently pending *ex parte* reexamination of the '836 patent (90/015,146), the Examiner asserted in a final rejection that the term “the processor is configured to execute the instructions to perform operations, the operations comprising” should be interpreted subject to §112(f). EX1017, 7-8. PO has appealed and disputed that the term is subject to §112(f). EX1023, 13-24.

Here, given the close correlation and substantial identity between the prior art references and the Challenged Claims, Petitioners submit that no express constructions of the claims are necessary. Thus, the claims should be given their

plain and ordinary meaning.⁸ *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc).

However, to the extent that the term “processor” is subject to §112(f), and to the extent there is corresponding structure disclosed in the *'493Pat*, that structure includes a processor or application specific integrated chip (ASIC) (*'493Pat*, 5:63-67) that performs the algorithm illustrated in figures 3 and 4, which includes generating a test signal (step 304), emitting the test signal from a speaker (step 306), obtaining a microphone signal from a microphone (step 308), calculating a value using cross-correlation (step 310/412), comparing the value to a threshold (step 414), and generating and sending a message to the user (step 418/420). *'493Pat*, 8:6-40 9:15-52; *Kyriakakis*, ¶116. A similar algorithm applicable to cross-correlation, correlation, and coherence is described in the context of figure 14. *'493Pat*, 16:6-17:4; *Kyriakakis*, ¶116. As explained in detail below, the prior art discloses a processor implementing this algorithm, using cross-correlation.

⁸ Petitioners reserve all rights to raise claim construction arguments and other arguments in any parallel or future litigation concerning the *'493Pat*. For example, comparing the claims to the accused products in the litigation may raise controversies that require construction of certain claim terms.

VIII. DETAILED EXPLANATION OF GROUNDS

A. Ground 1: *Svean, Voix, and Padhi* Render Obvious Claims 1, 2, 4-8, 10, 11, 13, 14, 18-20

1. Claim 1

a. [1.pre]⁹

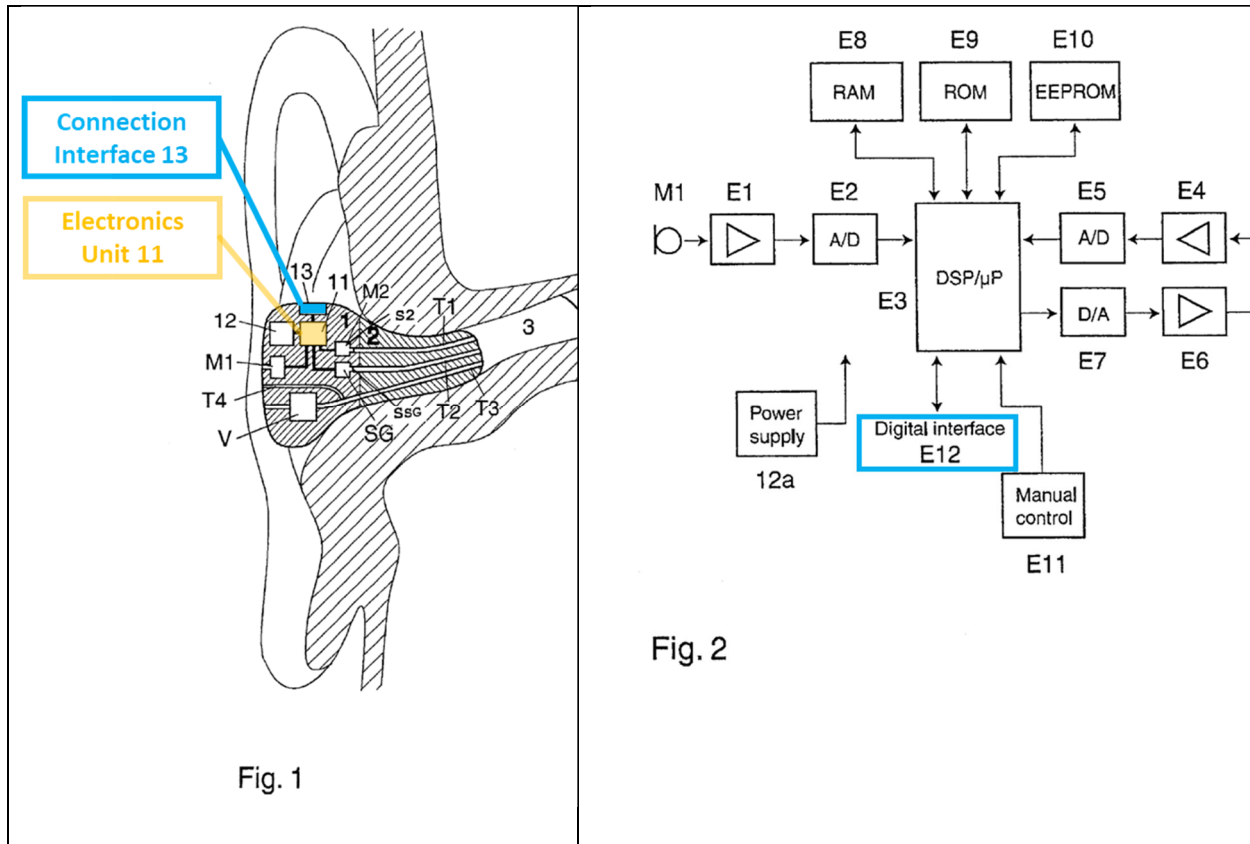
To the extent the preamble is limiting, *Svean* discloses/suggests this feature. *Kyriakakis*, ¶¶119-126.

Svean’s “ear terminal” shown, e.g., in Fig. 1, corresponds to the claimed “audio device configured to test a seal of an earphone.” *Svean*’s ear terminal includes **memory** and a **processing unit E3** that is configured to execute instructions to perform operations that test the seal of the ear terminal. *See* §§VIII.A.1.a-VIII.A.1.c(vi). At 11:61-13:38, *Svean* discloses methods and systems for “[o]nline verification/control of hearing protector performance,” which “utilise[] [sic] the fact that a sound field locally generated in the cavity near the eardrum is influenced by leakage in the hearing protector.” *Id.*, 11:61-65.

To the extent the Board finds that the “audio device” must be a separate structure from the “earphone,” *Svean* discloses/suggests this. *Svean* discloses that **electronics unit 11** may be connected to other equipment by a **connection interface 13** that may transmit digital or analog signals. *Id.*, 6:27-31. Further,

⁹ The claim language is reproduced in LISTING OF CHALLENGED CLAIMS.

“**electronic circuitry 11** may be connected to other electrical units by a **bidirectional digital interface E12**” and communicate with those units via a cable or wirelessly. *Id.*, 7:29-37.



Svean discloses that “signals that may be transmitted through this interface” include, e.g., “digitised audio signals in both directions to and from the ear terminal” and “control signals for controlling the operation of the ear terminal.” *Id.*, 7:38-48. *Svean*’s disclosure that the signals that may be transmitted include “control signals for controlling operation of the ear terminal” contemplates locating a processor and associated memory in a separate device to send such “control signals.” *Kyriakakis*, ¶123. POSITAs would therefore have considered

locating the “processor” and “memory” of the “audio device” in a separate structure “configured to test a seal of an earphone” to amount to following *Svean*’s express suggestion to connect the electronic circuitry of the ear terminal to other electrical units and to transmit “control signals for controlling the operation of the ear terminal” through the interface. Further, this would have amounted to applying a known technique to a known device (locating a processor and memory in a separate structure and communicating control signals from the first device to an ear terminal) ready for improvement to yield predictable results. *Id.*, ¶124.

As to the remaining claim limitations, the analysis is essentially the same unless otherwise noted regardless of whether the “audio device” is the ear terminal or a separate structure, with the only difference being that under the latter interpretation the “memory” and “processor” are located in a separate structure from the ear terminal and the instructions the processor is configured to execute also involve communication with the ear terminal over [E12/connection interface 13](#). *Id.*, ¶125.

Accordingly, POSITAs would have understood *Svean* to disclose or suggest an ear terminal—or a separate device that sends control signals to it—with a memory and a processor that is configured to test a seal of the ear terminal (the claimed “audio device configured to test the seal of an earphone”). *Id.*, ¶126.

b. [1.1]

Svean discloses/suggests this feature. *Kyriakakis*, ¶¶127-132.

Svean discloses that **processing unit E3¹⁰** is connected to **RAM (random access memory) E8, ROM (read only memory) E9, and EEPROM (electrically erasable programmable read only memory) E10** (collectively, “**memory elements**”). *Svean*, 7:23-29, Fig. 2. The **memory elements** are “for storing computer programs, filter coefficients, analysis data and other relevant data.” *Id.*, 7:26-29. Fig. 2 shows these **memory elements**.

¹⁰ To the extent the “processor” limitation is subject to §112(f), *Svean* in combination with *Voix* and *Padhi* discloses the ‘493*Pat*’s algorithm, as discussed in §VII.

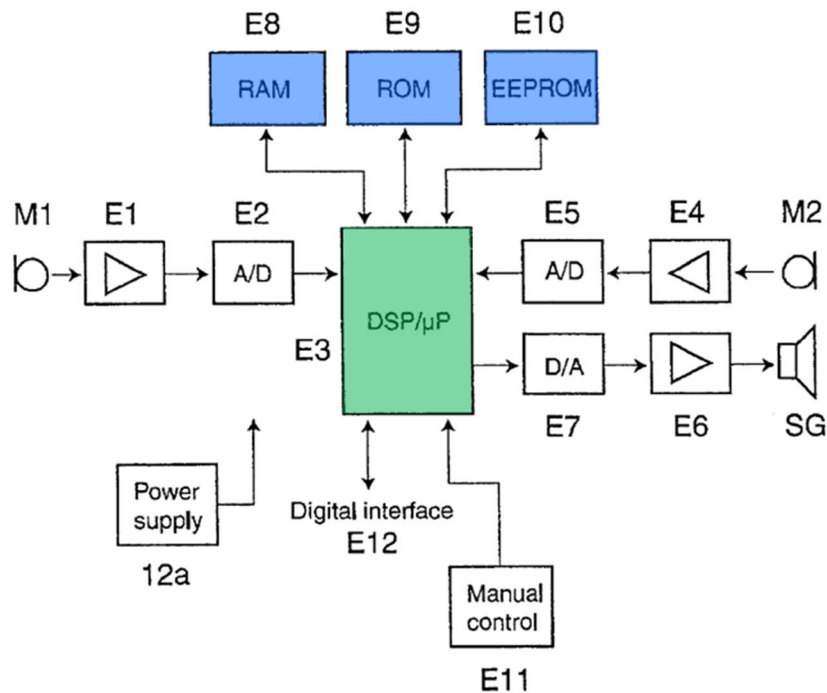


Fig. 2

POSITAs would have understood that one of these **memory elements** comprise memory that stores instructions for the **processing unit E3** to execute because computer programs are a series of instructions that must be stored. *Kyriakakis*, ¶130.

To the extent the Board finds that the “memory” must be located in an “audio device” that is a separate structure from the “earphone,” *Svean* discloses/suggests this. *See* §VIII.A.1.a.

Accordingly, POSITAs would have understood *Svean* to disclose or suggest that one of the **memory elements** stores instructions (“memory that stores

instructions”) and is located in the ear terminal or in a separate structure.

Kyriakakis, ¶132.

c. [1.2]

Svean discloses/suggests this feature. *Kyriakakis*, ¶¶133-137.

Svean discloses that **processing unit E3** “may be a digital signal processor (DSP), a microprocessor (uP)[,] or a combination of both.” *Svean*, 7:6-10. In addition to **processing unit E3**, *Svean* interchangeably refers to E3 as “digital signal processing (DSP) or microcomputer unit E3” (*id.*, 8:2-5, 8:16-19, 10:58-61, 12:1-6, 12:36-40), “digital signal processor or microprocessor E3” (*id.*, 12:7-10), “DSP/uP processing unit E3” (*id.*, 8:31-33, 9:64-66), “digital signal processor E3” (*id.*, 9:28-29), and “central processing unit E3” (*id.*, 11:26-29). In this Petition, “**processing unit E3**” is intended to refer to each of these alternative terms referring to the E3 component. *Svean* discloses that **processing unit E3** may be located in the **electronics unit 11**. See, e.g., *id.*, Fig. 1, 12:36-41 (“The signal generation and analysis is carried out in a digital signal processing (DSP) or microcomputer unit E3 with appropriate amplifiers and converters as described in the previous paragraphs. All the electronics 11 as well as the power supply 12 are provided in the outer section 1.”). POSITAs would have understood that **processing unit E3** is a processor, and that it corresponds to the claimed “processor.” *Kyriakakis*, ¶134.

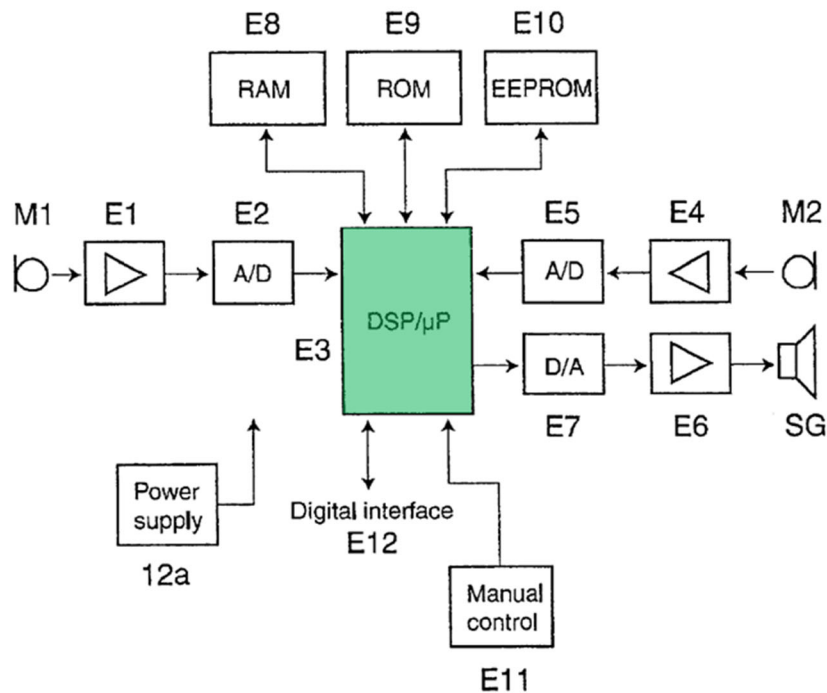


Fig. 2

Svean’s **processing unit E3** executes algorithms (“instructions”) to perform various operations including, for example, “signal generation and analysis.” *Svean*, 12:36-40; *see also id.*, 12:1-9, 12:42-54; §§VIII.A.1.c(i)-VIII.A.1.c(vi).

To the extent the Board finds that the “processor” must be located in an “audio device” that is a separate structure from the “earphone,” *Svean* discloses/suggests this, along with all subsequent limitations relating to the instructions the processor is configured to execute. *See* §VIII.A.1.a.

Accordingly, POSITAs would have understood *Svean* to disclose or suggest **processing unit E3** (“processor”) located in the ear terminal or a separate structure

that is configured to execute the instructions stored in one of the **memory elements** to perform operations such as signal generation and analysis (“configured to execute the instructions to perform operations”). *Kyriakakis*, ¶137.

(i) [1.2.1]

Svean discloses/suggests this feature. *Kyriakakis*, ¶¶138-142.

Svean discloses that **processing unit E3** generates “a signal which produces reliable characterisation of the sound field in the cavity.” *Svean*, 12:41-44; *see also id.*, 12:36-40 (disclosing that “**signal generation** and analysis is **carried out**” in the **processing unit E3**); *id.*, 12:1-9 (“**A digital signal processing (DSP) or microcomputer unit E3 ... is used to generate a predetermined signal ...**”).

In connection with Fig. 8, *Svean* discloses a test signal that comprises two pure tones. *Svean* also discloses an alternative embodiment where its test signal is a “pseudorandom sequence.” *Id.*, 12:42-50. This Petition asserts that *Svean*’s pseudorandom sequence test signal corresponds to the claimed “test signal.”

In the same way, the algorithm disclosed in figure 3 of the ’493*Pat* (step 304) requires “test signal...generated by a microprocessor.” ’493*Pat*, 8:7-8. *Kyriakakis*, ¶141.

Accordingly, POSITAs would have understood *Svean* to disclose or suggest that **processing unit E3** is configured to execute instructions stored in one of the

memory elements to generate a pseudorandom sequence test signal (“generating a test signal”). *Id.*, ¶142.

(a) [1.2.1.1]

The *Svean-Voix* combination discloses/suggests this feature. *Kyriakakis*, ¶¶143-153.

POSITAs would have recognized that *Svean*’s pseudorandom sequence test signal includes multiple frequency components, wherein at least one component lies between a range of 30 Hz and 200 Hz. The most common form of a pseudorandom sequence is an “MLS”/“maximum length sequence”/“m sequence.” *Id.*, ¶145. As was well known to POSITAs as of the priority date of the ’493*Pat*, such pseudorandom sequences include components of all frequencies in the range they cover and in this sense resemble white noise.¹¹ This was referred to in the art as having a “constant amplitude” in the frequency domain or a “flat” frequency

¹¹ A theoretical “white noise” input has flat spectrum over infinite bandwidth. A pseudorandom sequence is considered “white noise” if its bandwidth covers the range of interest. *Kyriakakis*, ¶145.

spectrum. *See, e.g.*, EX1012,¹² 4:58-63 (disclosing that an “MLS signal can be a pseudo random sequence signal of pulses” and the “***amplitude of the MLS signal may be constant across the entire frequency domain***”); EX1013, 1200 (disclosing that a “***pseudorandom sequence has an approximately flat spectrum***” and “***can be considered as a white noise input***”); EX1014, 7:7-9 (“The magnitude of a pseudo-random noise spectrum in the frequency domain is ***basically flat...***”); EX1015, [0052] (disclosing that an MLS resembles “random white noise” and the impulse response can be calculated “***by cross correlation***”); *Kyriakakis*, ¶146..

Further, POSITAs would have understood that the audible frequency range is 20 Hz - 20 kHz. *See, e.g.*, EX1012, 4:63-65 (“A reproduced MLS signal can include a frequency domain in the range of about ***20 Hz-20 kHz that is an audible frequency range.***”); EX1016, 1:8-10 (“The frequency range of human hearing spans from about ***20 Hertz (Hz) to 20 kilo-Hertz (kHz).***”); *Kyriakakis*, ¶147.

It would have been obvious for *Svean*’s pseudorandom sequence test signal to cover the audible frequency range in view of *Voix*. *Voix* discloses an acoustic seal test for an in-ear device that uses “a ***known noise source signal***, preferably of

¹² EX1012-EX1016 are cited to demonstrate POSITAs’ knowledge regarding the pseudorandom sequence expressly disclosed in *Svean*. None are part of the unpatentability grounds.

wide band ranging from *twenty hertz (20 Hz) to twenty thousand hertz (20000 Hz)* *for enhanced measurements...*” EX1020, 7:26-31. POSITAs would have understood that *Voix*’s disclosures regarding “known noise” are applicable to a pseudorandom sequence because a pseudorandom sequence is a form of “known noise”—i.e., noise that is not truly random and is repeatable. *Kyriakakis*, ¶149. Further, POSITAs would have understood that a pseudorandom sequence test signal in the audible range would produce “enhanced measurements” because it would allow the seal test to determine whether there was a good seal either across the entire audible range or for any particular frequency range of interest. *Id.*, ¶150. As to the latter point, *Voix* discloses that its apparatus may “*provide a difference calculated value for any pre-selectable frequency range* (any single frequency level included) that is either an average value or a frequency dependent variation over the selected range (such as discrete values for each octave over the frequency range).” *Voix*, 8:56-62.

Because of these advantages, POSITAs would have been motivated to utilize a pseudorandom sequence test signal in *Svean* that covers the audible frequency range as *Voix* discloses. *Kyriakakis*, ¶151. Further, POSITAs would have had a reasonable expectation of success in implementing a pseudorandom sequence covering the audible frequency range, as this was well-known to POSITAs. *See, e.g.*, EX1012, 4:63-65 (“A reproduced MLS signal can include a frequency domain

in the range of about *20 Hz-20 kHz that is an audible frequency range.*”);

Kyriakakis, ¶152.

Accordingly, POSITAs would have understood the *Svean-Voix* combination to disclose or suggest that **processing unit E3** is configured to execute instructions stored in one of the **memory elements** to generate a pseudorandom sequence test signal covering the audible range, which is a test signal that includes the claimed (1) “multiple frequency components” (because a pseudorandom sequence has a “flat” frequency spectrum); and (2) “at least one component” that “lies between a range of 30 Hz and 200 Hz” (because—as Dr. Kyriakakis explains and *Voix* and the background prior art demonstrates was well known to POSITAs—a pseudorandom sequence in the audible range includes the 20 Hz to 20 kHz range). *Id.*, ¶153.

(ii) [1.2.2]

The *Svean-Voix* combination discloses/suggests this feature. *Kyriakakis*, ¶¶154-160.

First, *Svean* discloses sending the test signal (*Svean*’s pseudorandom sequence test signal) to a speaker of the ear terminal (**loud speaker/sound generator SG**). See, e.g., *Svean*, 12:1-54 (disclosing that **processing unit E3** “is used to *generate a predetermined signal*[,] which is D/A converted ..., amplified...[,] and applied to the **sound source SG**, which generates a sound field

in the closed part of the meatus 3”). As previously explained, the generated test signal is a pseudorandom sequence. *See* §§VIII.A.1.c(i) and VIII.A.1.c(i)(a).

Second, *Svean* discloses that the ear terminal includes the claimed “first microphone,” “speaker,” and “sealing section.” Claim 1 does not specify the location of the claimed “first microphone.” *Svean* discloses microphones located on both the “first side” and the “second side,” and both fall within the scope of claims 1’s “first microphone.”

In particular, the claimed “first microphone” reads on either of *Svean*’s **microphone (M1)** or **microphone (M2)**. The claimed “speaker” reads on *Svean*’s **speaker (SG)**, while the claimed “sealing section” reads on *Svean*’s **sealing section 2**. *See, e.g., id.*, Fig. 1; *id.*, 11:5-19; *id.*, 11:65-12:1; *id.*, 12:24-30; *see also Kyriakakis*, ¶157.

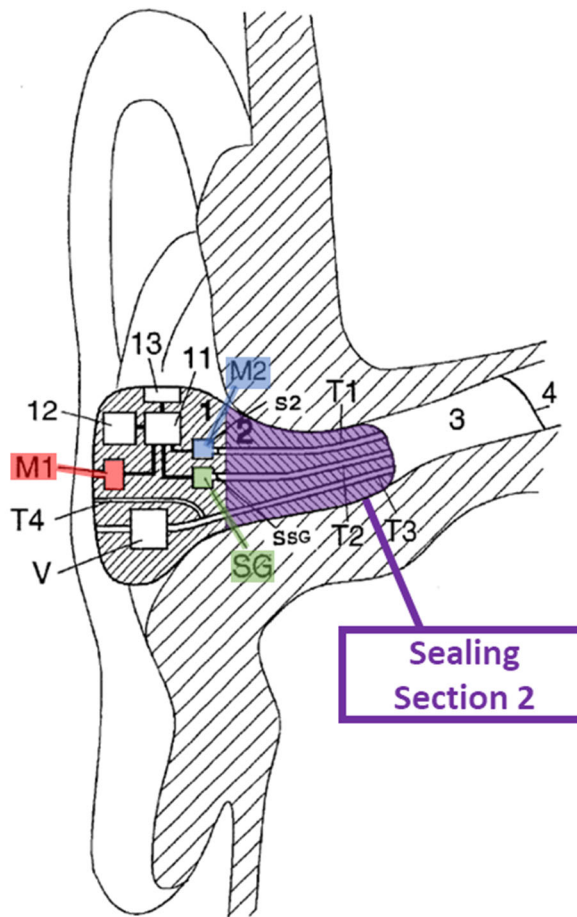


Fig. 1

Third, *Svean* discloses that **sealing section 2** is configured to form an acoustic barrier between a **first side** of the ear terminal (the side adjacent to the meatus of ear canal 3) and a **second side** of the ear terminal (the side adjacent to the ambient environment) when the ear terminal is worn by a user. *See, e.g., id.*, Fig. 1; *id.*, 11:5-19; *id.*, 11:65-12:1; *id.*, 12:24-30; *id.*, 5:4-8; *id.*, Claim 1 (“1. Ear protecting device comprising: a **sealing section (2)** for acoustically sealing the meatus (3) of a human...”); *see also Kyriakakis*, ¶158.

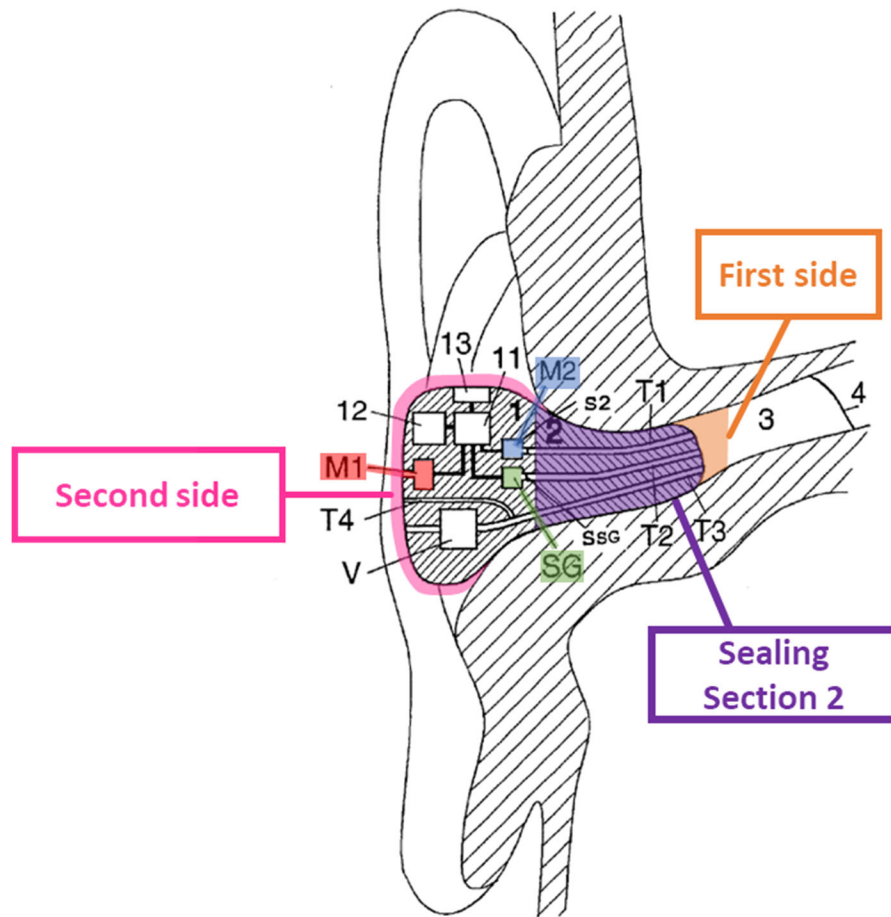


Fig. 1

In the same way, the algorithm of figure 3 of the '493Pat (step 306) requires “test signal is provided to the acoustic transducer [speaker].” '493Pat, 8:8-9; Kyriakakis, ¶159.

Accordingly, POSITAs would have understood the *Svean-Voix* combination to disclose or suggest that **processing unit E3** is configured to execute instructions stored in one of the **memory elements** to send the pseudorandom sequence test

signal to **loudspeaker/sound generator SG** of the ear terminal (“sending the test signal to a speaker of an earphone”). *Id.*, ¶160. Further, POSITAs would have understood the *Svean-Voix* combination to disclose or suggest that the ear terminal includes *Svean*’s **microphone M1** and **microphone M2** (either of which corresponding to the “first microphone”), **loud speaker/sound generator SG** (“speaker”), and **sealing section 2** (“sealing section”). *Id.* Finally, POSITAs would have understood the *Svean-Voix* combination to disclose or suggest that *Svean*’s ear terminal includes a **sealing section 2** that attenuates sounds between the ear canal 3 on the **first side** and the ambient environment on the **second side** of the ear terminal (“wherein the sealing section is configured to form an acoustic barrier between a first side of the earphone and a second side of the earphone when the earphone is worn by a user”). *Id.*

(iii) [1.2.3]

The *Svean-Voix* combination discloses/suggests this feature. *Kyriakakis*, ¶¶161-166.

Where *Svean*’s **microphone M2** is the claimed “first microphone,” *Svean* discloses that **processing unit E3** receives a first microphone signal from **microphone M2**. *Svean*, 12:1-9; *id.*, 5:66-6:1; *id.*, 6:12-14; *id.*, 7:10-15; *id.*, Fig. 2.

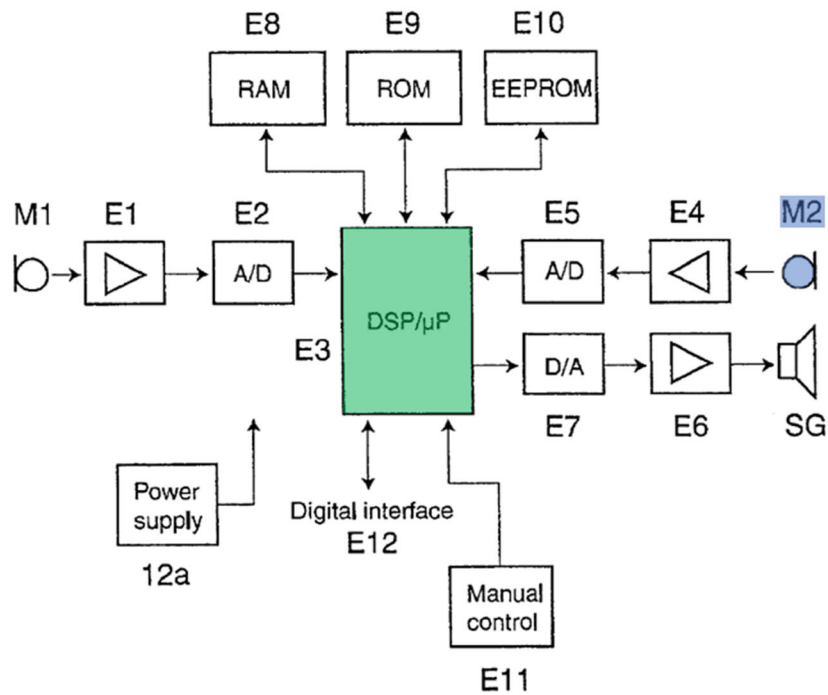


Fig. 2

Where *Svean*'s **microphone M1** is the claimed “first microphone,” *Svean* discloses that **processing unit E3** receives a first microphone signal from **microphone M1**. *Id.*, 7:6-10; *id.*, 5:66-6:1; *id.*, 6:10-12; *id.*, Fig. 2.

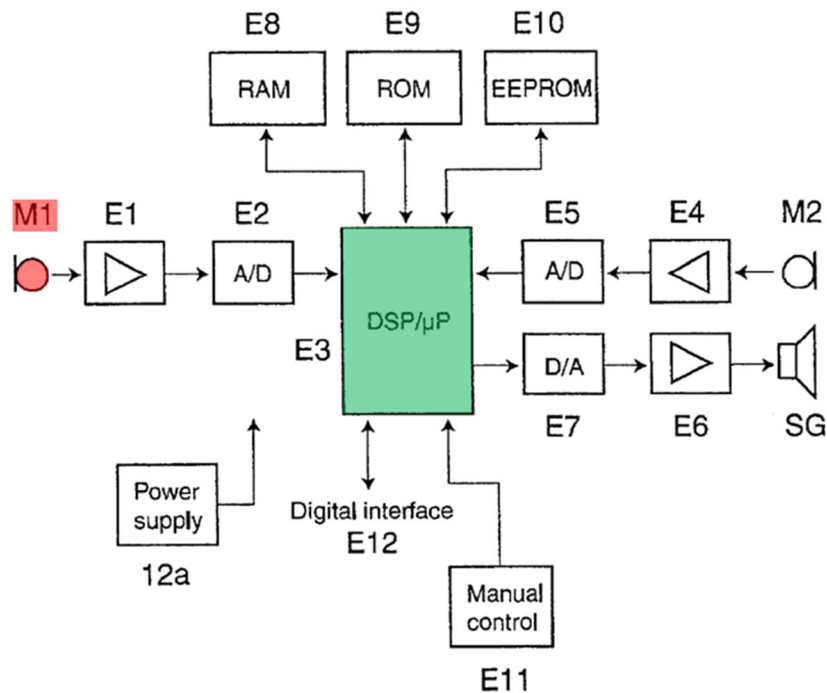


Fig. 2

Although *Svean* does not explicitly disclose that **processing unit E3** receives a microphone signal from **microphone M1** in the “verification” embodiment (*see id.*, 11:61-13:38), POSITAs would have understood and found it obvious that *Svean* would use **microphone M1** to collect external sounds—and **processing unit E3** would be configured to receive the collected sounds—while performing “verification.” This is because POSITAs would have understood and found it obvious that external sounds should be provided to a user while verifying the device, and *Svean* discloses that **microphone M1** is involved in collecting such “external sounds.” *Id.*, 5:24-41. Indeed, *Svean* contemplates that the “verification”

process may be run for long time periods—even continuously—such that receiving and providing external sounds to the user during “verification” would be necessary. *Id.*, 13:13-20; *id.*, 4:6-7.

In the same way, the algorithm of figure 3 of the *'493Pat* (step 308) requires “ECM 106 ... to measure the test signal in ear canal 124 and provide the measured test signal to processor 116.” *'493Pat*, 8:58-60, Fig. 3. *Kyriakakis*, ¶165.

Accordingly, POSITAs would have understood the *Svean-Voix* combination to disclose or suggest that **processing unit E3** is configured to execute instructions stored in one of the **memory elements** for receiving a microphone signal from **microphone M1** or **microphone M2** (“receiving a first microphone signal from the first microphone.”). *Id.*, ¶166.

(iv) [1.2.4]

The *Svean-Voix-Padhi* combination discloses/suggests this feature.
Kyriakakis, ¶¶167-184.

This limitation requires “calculating a value,” where the calculation uses “a first signal and a second signal.” Claim 1 does not specify what the recited “first signal” and “second signal” are or what generated them. Regardless, *Svean* discloses calculating a “value” using a “first signal” and a “second signal.” When *Svean*’s test signal comprises two pure tones of frequencies f_1 and f_2 , *Svean* discloses blocks 84 through 87 that perform “a sample by sample multiplication of

[] two input signals” and “smooth[] the result with a low pass filter.” *Svean*, 12:51-66; *id.*, Fig. 8.

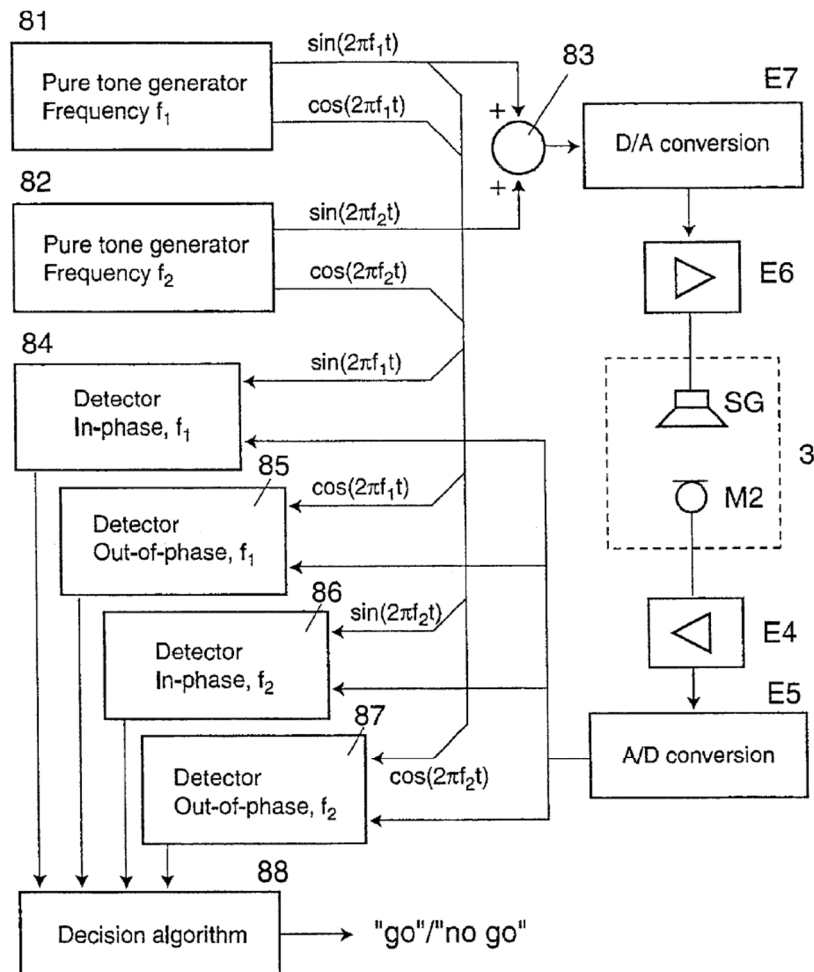


Fig. 8

Svean calculates a value using these test signal components and a signal output from **microphone M2**, which is also input to blocks 84-87. The blocks’ outputs “are applied to a decision algorithm represented by block 88 where they are compared to stored values.” *Id.*, 12:66-13:11. POSITAs would have understood that because the outputs “are compared to stored values,” the outputs are

themselves calculated values. *Kyriakakis*, ¶171. Further, POSITAs would have understood that the outputs of blocks 84-87 indicate the similarity between the two input signals. *Id.*

However, *Svean*'s Figure 8 algorithm is not designed for calculating such a value when the test signal is a pseudorandom sequence. Although *Svean* discloses that “preferably¹³ [sic] both the in-phase and the out-of-phase portions of the sound field are analysed [sic] and used in the verification algorithm” (*Svean*, 12:48-50), POSITAs would have recognized that it would be extremely computationally intensive to implement an algorithm that requires calculations with sines and cosines of each frequency for a pseudorandom sequence, which—unlike the two pure tones analyzed in Fig. 8—has a “flat” frequency spectrum with signal content at essentially every frequency within the range. *Kyriakakis*, ¶172. Thus, when *Svean*'s “verification” is performed with *Svean*'s pseudorandom sequence test signal, POSITAs would have been motivated to look to other

¹³ *Svean* also does not teach away as it does not criticize, discredit, or otherwise discourage an alternative verification algorithm such as *Padhi*'s cross correlation. See, e.g., *Incept LLC v. Palette Life Scis., Inc.*, 77 F.4th 1366, 1375 (Fed. Cir. 2023); *UCB, Inc. v. Actavis Lab'ys UT, Inc.*, 65 F.4th 679, 692-93 (Fed. Cir. 2023).

teachings for implementation details for calculating such a value and would have readily identified *Padhi. Id.*, ¶173.

Padhi provides details for how to calculate a value using cross correlation of a first signal and a second signal to determine the similarity between the two signals. It was well known to POSITAs that cross correlation was suitable for calculating values with pseudorandom sequence signals. *Id.*, ¶174; *see also, e.g.*, EX1015, [0052]; EX1018, 6:34-38; EX1019, 585.

Padhi's Fig.1 illustrates an apparatus that receives an **input audio signal 102** via a microphone. *Padhi*, [0018]. A **reference signal 104** is supplied by a reference signal source. *Id.* In the *Svean-Voix-Padhi* combination, *Svean*'s **microphone M2** signal is supplied as **input audio signal 102** and *Svean*'s pseudorandom sequence test signal is supplied as **reference signal 104**.

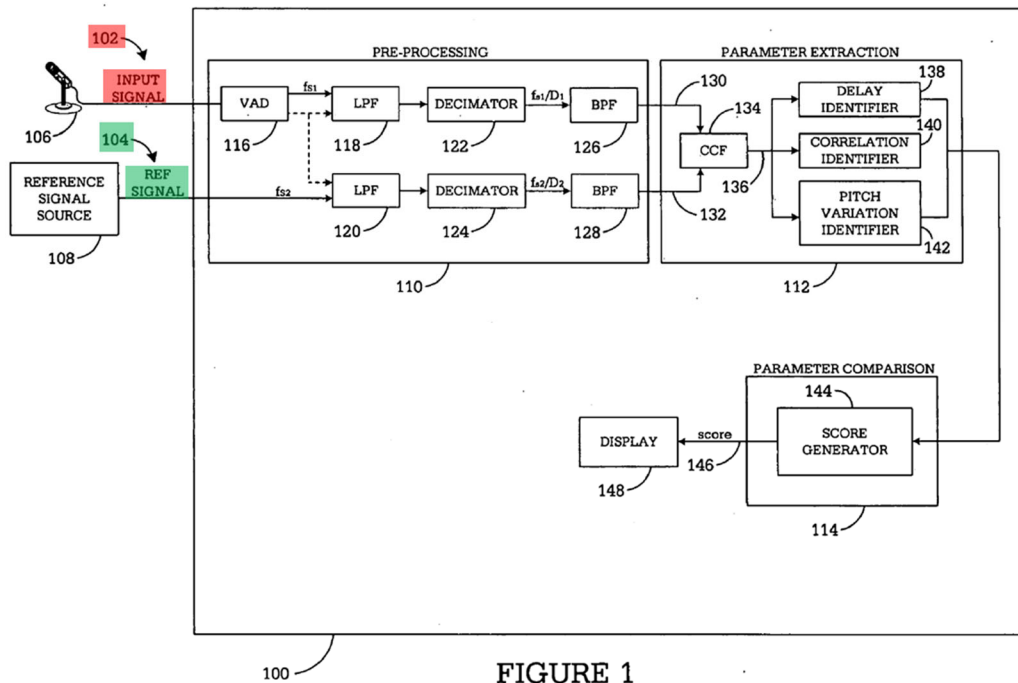


FIGURE 1

At step 604, “apparatus 100 filters and decimates the input and reference signals.” *Id.*, [0071]. “This may include ... filters 118, 120 performing low pass filtering” on the **input signal 102** (*Svean’s M2 signal*) and the **reference signal 104** (*Svean’s pseudorandom sequence test signal*). *Id.* At step 606, “apparatus 100 cross-correlates the processed signals.” *Id.*, [0072]. “This may include ... the **cross correlator 134** correlating the pre-processed input and reference signals 130, 132 to produce a cross-correlated signal 136.” *Id.* At step 608, “apparatus 100 identifies a plurality of parameters using the cross-correlated signals.” *Id.*, [0073]. “This may include ... the identifiers 138-142 using the cross-correlated signal 136 to identify

a delay between the signals 130, 132, an amount of correlation between the signals 130, 132, and a pitch variation between the signals 130, 132.” *Id.*

At [0077]-[0082], *Padhi* describes how score generator 144 generates a score. “First, the score generator 144 generates a value α using information from the delay identifier 138 and the correlation identifier 140.” *Id.*, [0077]. The value α is determined according to the formula $\text{local_maxout}/\text{max_out}$. *Id.*

“[L]ocal_maxout identifies the largest value of the cross-correlated signal within a certain range...” *Id.*, [0078]. Further, “max_out identifies the largest value in the cross-correlated signal.” *Id.*

Padhi’s α is a “value” that was calculated “using a first signal and a second signal” (*Svean*’s **microphone M2** signal and the pseudorandom test signal), “wherein the value is the result of a non phase calculation” that is a “cross-correlation.” POSITAs would have recognized that *Padhi*’s additional description regarding pitch (and values β_1 and β_2) would be unnecessary for cross correlating two audio signals for a seal test. *See Padhi*, [0079]-[0080]; *Kyriakakis*, ¶179.

Further, in the same way as obtained through applying *Padhi*’s cross-correlation to *Svean*, the algorithm shown in figure 9 of the ’493*Pat* (step 310) requires “[d]etermin[ing] degree of acoustic sealing via cross-correlation of test signal with ECM signal.” ’493*Pat*, Fig. 3 (step 310). *Kyriakakis*, ¶183.

POSITAs would not only have been motivated to look to *Padhi* for implementation detail, but also would have found *Padhi*'s technique to be an efficient and flexible solution that provides a calculated value that can then be compared to a threshold—just as *Svean*'s Figure 8 algorithm compares to stored values (i.e., thresholds) for a test signal that comprises two pure tones. Indeed, *Padhi* discloses that the reference and microphone signal that are inputs to its calculation “could be replaced by any suitable audio signals provided by any suitable source or sources.” *Padhi*, [0018].

POSITAs would also have considered the combination of *Svean* and *Voix* with *Padhi* to amount to the use of a known technique (calculating a value with two signals using cross correlation) to improve a similar device (*Svean*'s verification algorithm that involves calculating a value and comparing to thresholds to determine the seal) with a predictable result. Indeed, the Examiner in the parent '836 patent *ex parte* reexamination found that *Padhi*'s cross correlation was applicable to a seal test and that a cross correlation “was a notoriously well-known method of comparing audio signals at the time of the invention.” EX1017, 27. The same reasoning applies to the '493*Pat*, because *Padhi*'s cross correlation compares two signals by calculating a value with the two signals. *Kyriakakis*, ¶181.

POSITAs would also have had a reasonable expectation of success in combining *Svean*, *Voix*, and *Padhi*. It was well known to POSITAs that cross correlation was appropriate for pseudorandom sequences such as MLS signals. *See, e.g.*, EX1015, [0052] (disclosing that calculating the impulse response of a maximum length sequence emitted through a loudspeaker and measured by a microphone “**by cross correlation**”); EX1018, 6:34-38 (disclosing “**cross-correlation of the original MLS noise and the output of [a] microphone**, providing the impulse response of the total system”); EX1019, 585 (describing testing a hearing aid with a maximum length sequence (MLS) and explaining that “[t]o compute the [periodic impulse response] for the system, the system output and input are **cross-correlated**”).

Accordingly, POSITAs would have understood the *Svean-Voix-Padhi* combination to disclose or suggest that **processing unit E3** is configured to execute instructions stored in one of the **memory elements** to calculate a value that is the result of a non-phase cross correlation calculation (α) with the pseudorandom sequence test signal and the **microphone M2 signal** (“calculating a value, using a first signal and a second signal, wherein the value is the result of a non phase calculation of at least one of a coherence, a correlation, a cross-correlation, a difference, or a combination”). *Kyriakakis*, ¶184.

(v) [1.2.5]

The *Svean-Voix-Padhi* combination discloses/suggests this feature.

Kyriakakis, ¶¶185-192.

Padhi's algorithm also discloses comparing a calculated value to a threshold.

With respect to α , *Padhi* discloses comparing this value to a threshold to assign Score_1 —e.g., if α is greater than or equal to .75, Score_1 is assigned the highest value (60). *Padhi*, [0078]. See Table 1:

TABLE 1

Range	Score_1
$\alpha \geq 0.75$	60
$0.75 > \alpha \geq 0.5$	50
$0.5 > \alpha \geq 0.25$	40
$0.25 > \alpha$	30

In the *Svean-Voix-Padhi* combination, comparison to a threshold would demonstrate the level of similarity between the test signal and the **microphone M2 signal**. POSITAs reviewing the teachings of *Svean*, *Voix*, and *Padhi* would have understood that comparison of the calculated value to a threshold indicates whether these two signals are sufficiently similar such that there is a good seal quality.

Kyriakakis, ¶187.

POSITAs would have been motivated to combine *Svean*, *Voix*, and *Padhi* for the same reasons described with respect to [1.2.4]. See §VIII.A.1.c(iv). As noted

with respect to [1.2.4], *Svean* discloses that its detector outputs are compared to stored results (i.e., thresholds). *Svean* produces a decision result that is a “go”/“no go” real time signal. *Svean*, 12:66-13:11. Thus, in the combination, POSITAs would have understood that *Padhi*’s α would similarly be compared to a threshold (e.g., 0.75) to produce a “go”/“no go” signal just as *Svean* discloses, which is a determination of “seal quality” to the extent the Board finds that seal quality may be a binary result. *Kyriakakis*, ¶188. POSITAs also would have been motivated to use *Padhi*’s calculation, comparison to a threshold, and resulting score because POSITAs would have recognized that this would have the advantage of providing the user more useful and granular information in assessing the “seal quality” than a binary result. *Id.*, ¶189. For example, POSITAs would have understood that providing a score from a range of potential scores indicates a degree of seal quality, which allows the user to make a decision as to whether to attempt to reposition the ear terminal and perform another seal test to see if the seal quality—even if adequate—can be improved. *Id.*, ¶190.

Further, in the same way as obtained through applying *Padhi*’s comparison of a calculated value to a threshold to *Svean*, the algorithm disclosed in figure 4 of the ’493*Pat* (step 416) requires “cross-correlation...is compared with the cross-correlation threshold value.” ’493*Pat*, Fig. 4 (step 416); *Kyriakakis*, ¶191.

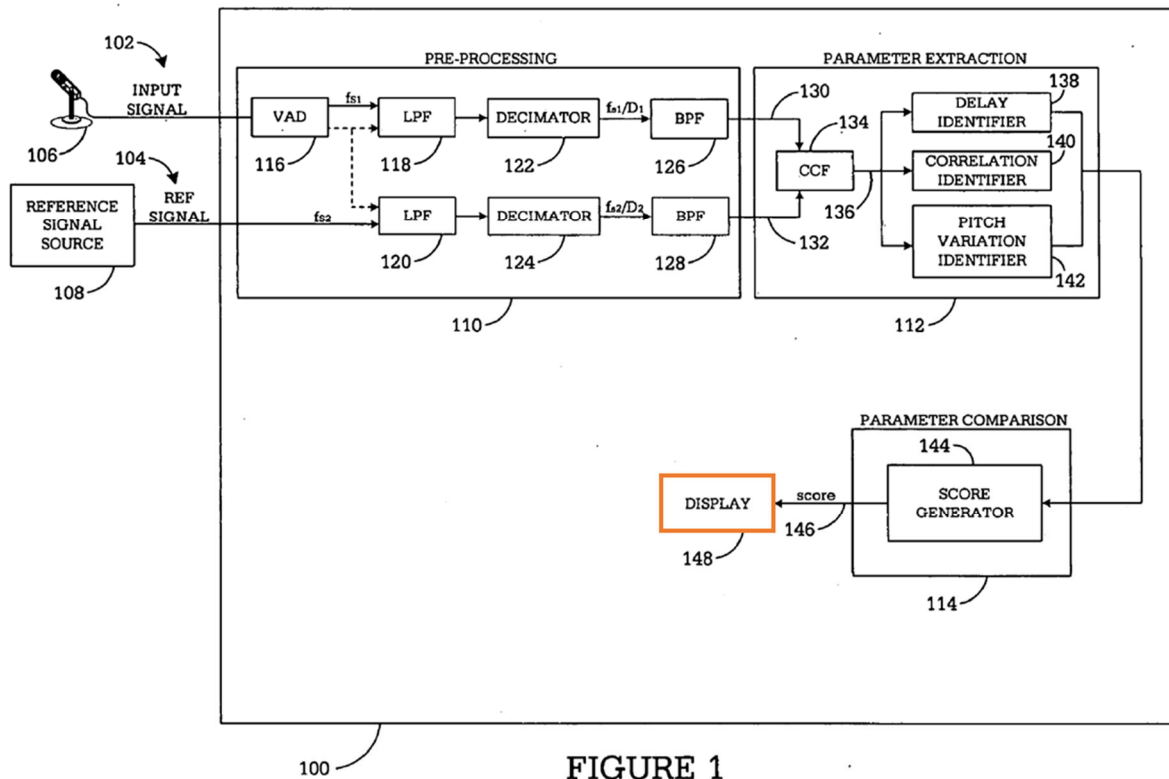
Accordingly, POSITAs would have understood the *Svean-Voix-Padhi* combination to disclose or suggest that **processing unit E3** is configured to execute instructions stored in one of the **memory elements** to compare a calculated value (α) to a threshold (comparing α to, e.g., .75) and to determine the seal quality (i.e., *Svean*’s “go”/“no go” real time signal or *Padhi*’s score) between the two sides of the ear terminal (“comparing the value to a threshold to determine a seal quality between the first side and the second side”). *Id.*, ¶192.

(vi) [1.2.6] and [1.2.7]

The *Svean-Voix-Padhi* combination discloses/suggests these features.
Kyriakakis, ¶¶193-198.

To the extent the Board finds that seal quality may be a binary result (e.g., “good” or “bad”), *Svean* discloses/suggests generating a message that conveys the “go”/“no go” decision and sending the message to the user. *Id.*, ¶194. In particular, *Svean* discloses that “the user may get audible or other messaged confirmation if the leakage is acceptably low, or a warning signal if leakage is unacceptably high.” *Svean*, 12:6-14; *id.* 12:66-13:11.

Otherwise, *Padhi* discloses/suggests these features. *Kyriakakis*, ¶195. *Padhi* discloses generating a score that “is presented to a user or other person or people on a **display 148**.” *Padhi*, [0033].



Padhi's score not only conveys a binary result, but also conveys granular information to the user regarding the seal level. *Kyriakakis*, ¶196. POSITAs would have been motivated to generate and send a message to the user that conveys this more granular information for the reasons discussed in §VIII.A.1.c(v).

Further, in the same way, the algorithm disclosed in figure 4 of the '493*Pat* (steps 418 and 420) require sending a message to a user indicating "PASS" or "FAIL" according to whether the cross-correlation is above or below the threshold. '493*Pat*, 9:48-52, 15:66-16:2; *Kyriakakis*, ¶197.

Accordingly, POSITAs would have understood the *Svean-Voix-Padhi* combination to disclose or suggest that **processing unit E3** is configured to execute instructions stored in one of the **memory elements** to generate and send a message to the user that conveys either *Svean*'s binary result or *Padhi*'s score regarding seal quality to the user (“generating a message to convey the seal quality” and “sending the message to the user”). *Id.*, ¶198.

2. Claim 2

The *Svean-Voix-Padhi* combination discloses/suggests this claim.
Kyriakakis, ¶¶199-203.

To the extent the Board finds that seal quality may be a binary result, *Svean*'s “audible or other messaged confirmation” is an acoustic message. *Svean*, 12:6-14; *id.*, 12:66-13:11.

Otherwise, *Padhi* discloses/suggests these features because *Padhi* teaches that it is desirable for such messaging to convey more granular seal quality information (a score). *Padhi*, [0033]. POSITAs implementing the *Svean-Voix-Padhi* combination would have been motivated to provide *Padhi*'s seal quality score in an audible format, as in *Svean*, because as in *Svean*, providing an audible message would be another method of ensuring that the user is aware of seal quality information. *Kyriakakis*, ¶202.

Accordingly, POSITAs would have understood the *Svean-Voix-Padhi* combination to disclose or suggest that **processing unit E3** is configured to execute instructions stored in one of the **memory elements** to generate and send an audible message to the user that conveys either a binary result or a score regarding seal quality to the user (“acoustic message”). *Id.*, ¶203.

3. Claim 4

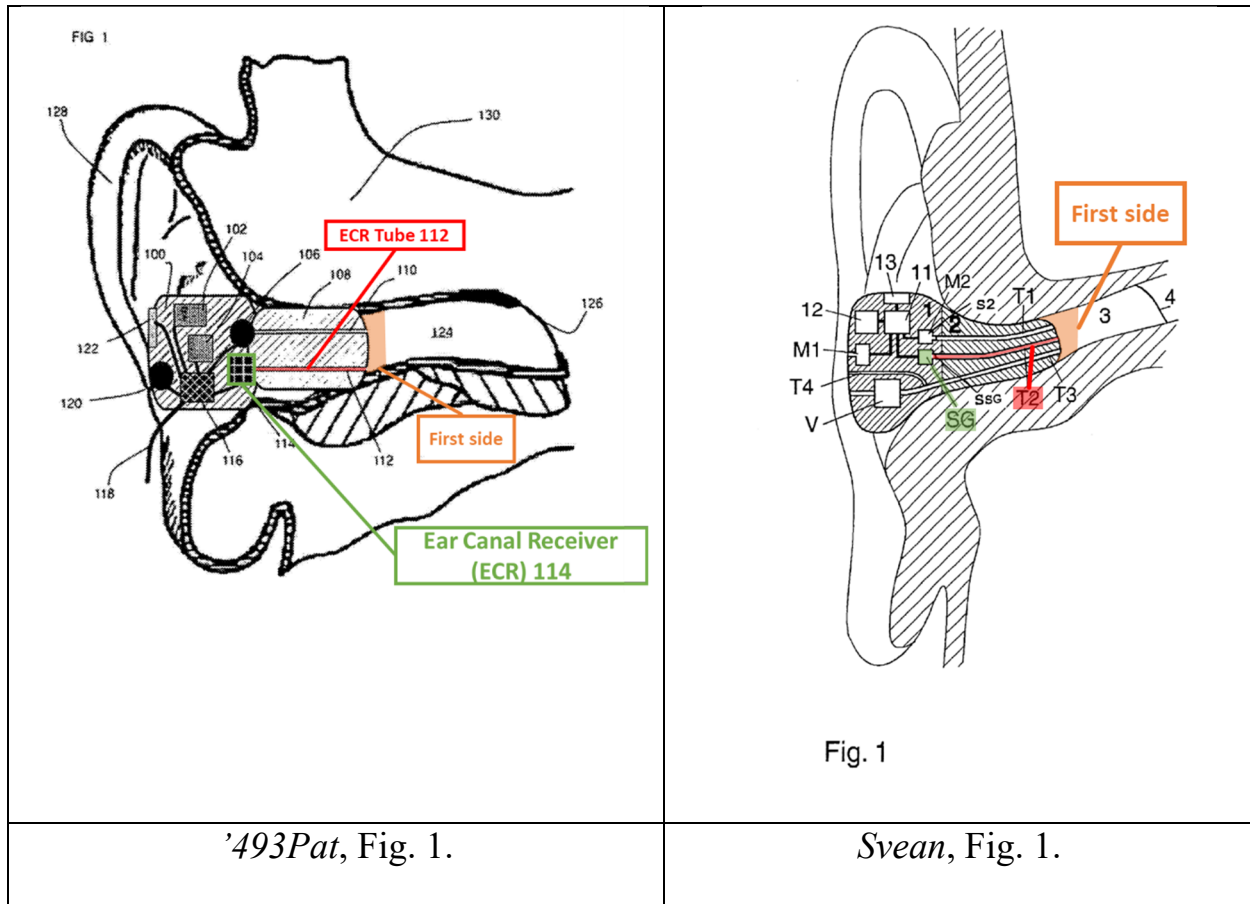
The *Svean-Voix-Padhi* combination discloses/suggests this claim.
Kyriakakis, ¶¶204-211.

This limitation requires that the speaker plays “the test signal from the **first side**,” i.e., inside the ear canal.

Svean discloses that it is “possible to mount ... the **sound generator SG** at the innermost part of the sealing section.” *Svean*, 6:22-26. In that case, **SG** is a “speaker” located on the **first side** of the earphone and “plays the test signal from” that location. *Kyriakakis*, ¶¶213-215.

In addition, *Svean* discloses in Fig. 1 that speaker **SG** is connected through a **transmission channel T2** to the inner portion of the meatus 3 so that the speaker plays a test signal propagating from the **first side**. *Svean*, 12:30-31; *id.*, 11:65-12:6. Similarly, the ’493*Pat* discloses that “**ECR 114** emits the test signal into Ear Canal Receiver Tube (**ECR Tube 112**). The test signal propagates through **ECR tube 112** and into ear canal 124.” ’493*Pat*, 8:51-54. The below comparison of

the '493Pat and *Svean* demonstrates that POSITAs would have understood that *Svean* discloses the speaker **SG** playing the test signal from the **first side** in the same way as the '493Pat. *Kyriakakis*, ¶¶208-210.



Accordingly, POSITAs would have understood the *Svean-Voix-Padhi* combination to disclose or suggest that **processing unit E3** is configured to execute instructions stored in one of the **memory elements** to send the test signal to **speaker SG** that plays the test signal from the side adjacent to the meatus of the ear canal (“the speaker plays the test signal from the first side”). *Id.*, ¶211.

4. Claim 5

The *Svean-Voix-Padhi* combination discloses/suggests this claim.

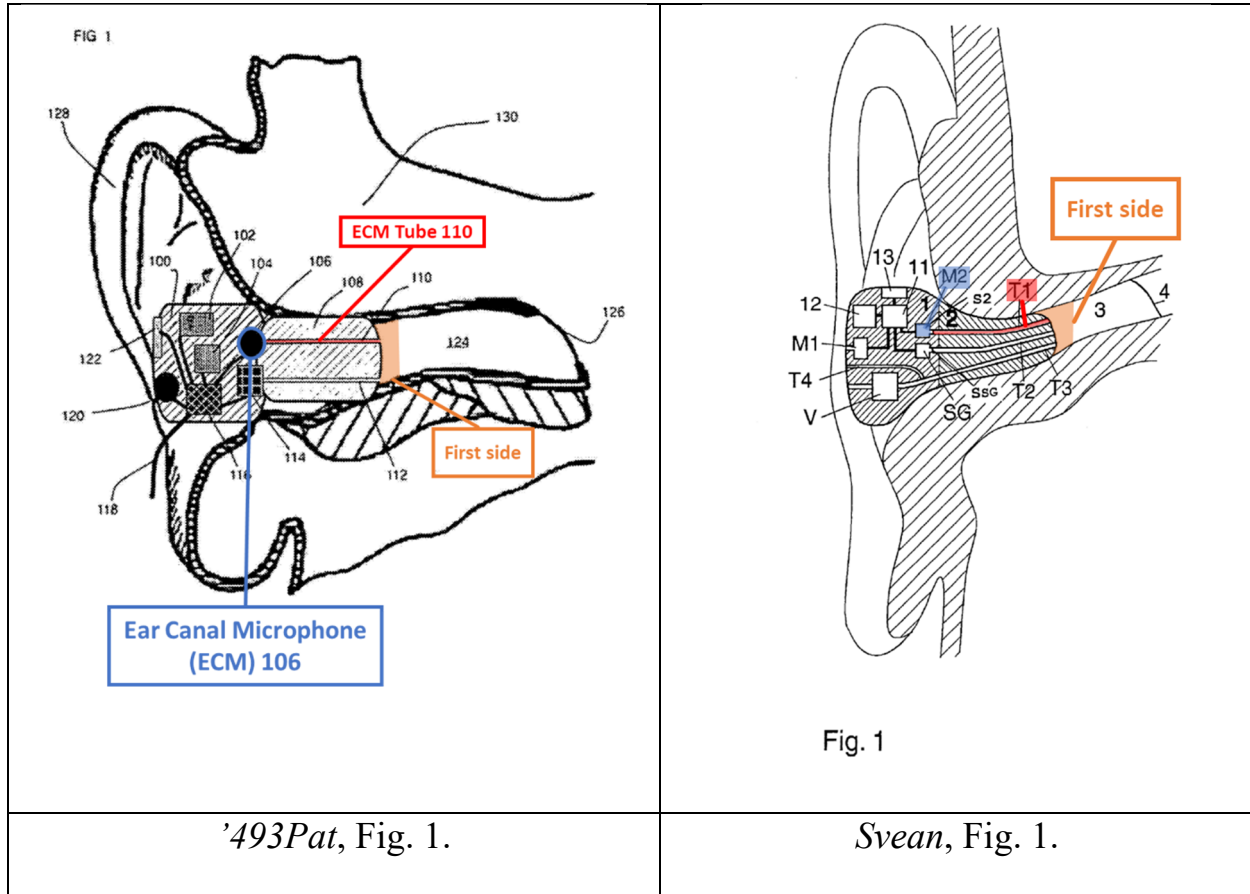
Kyriakakis, ¶¶212-219.

This limitation requires that the “first microphone measures sound from the **first side**,” i.e., from inside the ear canal.

Svean discloses that it is “possible to mount the **microphone M2** ... at the innermost part of the sealing section.” *Id.*, 6:22-26. In that case, **microphone M2** is a “first microphone” located on the **first side** of the earphone and “measures sound from” that location. *Kyriakakis*, ¶¶214-215.

In addition, *Svean* discloses in Fig. 1 that **microphone M2** is connected through a **transmission channel T1** to the inner portion of the meatus 3 so that **microphone M2** measures sound that propagates from the **first side**. *Svean*, 12:33-36; *id.*, 11:65-12:6; *id.*, 12:58-61. Similarly, the *'493Pat* discloses that “Ear Canal Microphone tube 110 (**ECM tube 110**) is configured to receive an acoustic signal incident on the **first side** of sealing unit 108. The test signal in ear canal 124 propagates through **ECM tube 110** and is received by **Ear Canal Microphone 106 (ECM 106)**. **ECM 106** is configured to *measure the test signal in ear canal 124* and provide the measured test signal to processor 116.” *'493Pat*, 8:54-60. The below comparison of the *'493Pat* and *Svean* demonstrates that POSITAs would

have understood that *Svean* discloses that **microphone M2** measures sound from the **first side** in the same way as the '493*Pat. Kyriakakis*, ¶¶216-218.



Accordingly, POSITAs would have understood the *Svean-Voix-Padhi* combination to disclose or suggest that **processing unit E3** is configured to execute instructions stored in one of the **memory elements** to send an acoustic signal and/or a test signal to **speaker SG** that plays them from the side adjacent to the meatus of the ear canal (“speaker plays the test signal from the first side” (claim 4)) and to receive a microphone signal from **microphone M2** that measures sound from the side adjacent to the meatus of the ear canal (“...analysing the

signal picked up by the microphone M2 that has access to the acoustic signal in the meatus 3.” *Svean*, 5:52-54. ”). *Kyriakakis*, ¶219.

5. Claim 6

The *Svean-Voix-Padhi* combination discloses/suggests this claim.

Kyriakakis, ¶¶220-224.

This limitation requires that the “first microphone measures sound from the **second side**,” i.e., the side adjacent to the ambient environment. Claim 6, like claims 4 and 1, from which it depends, does not specify whether the “first microphone” is located on the “first side” or “second side.” Thus, just as discussed in Section VIII.A.1.c(iii), the claimed “first microphone” can read on either of *Svean*’s microphone M1 or microphone M2.

For claim 6, Petitioners read the “first microphone” onto *Svean*’s Microphone M1. *Svean* discloses with respect to Fig. 1 that **microphone M1** is physically located on the **second side** (i.e., the side adjacent the ambient environment) and **processing unit E3** may receive a signal from **microphone M1** that measures external/ambient sound from the **second side**. *Svean*, 5:66-6:1; *id.*, 6:10-12; *id.*, 7:6-10; *see also* §VIII.A.1.c(iii).

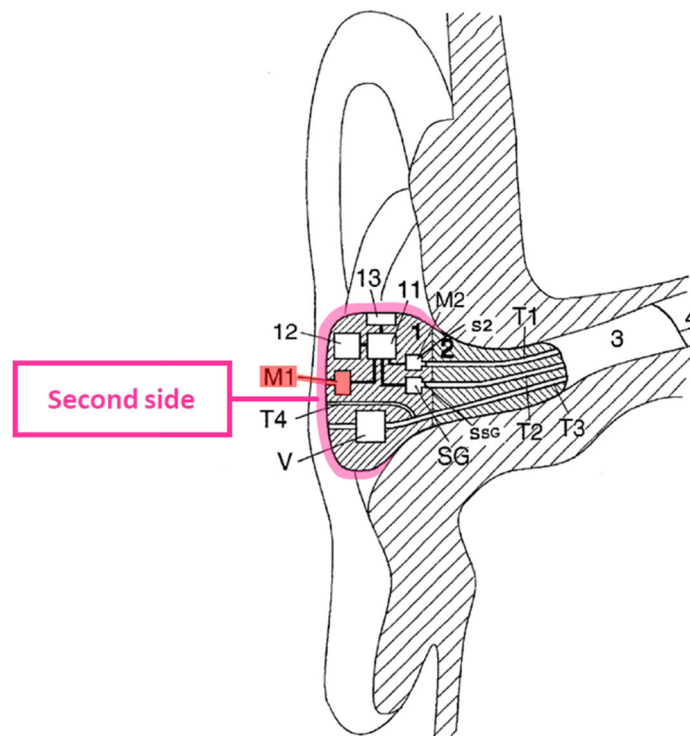


Fig. 1

As to [1.2.4] (“calculating a value using a first signal and a second signal...”), the same analysis described in §VIII.A.1.c(iv) applies—i.e., where the **microphone M1 signal** is the “first microphone signal,” the **microphone M2 signal** and the test signal are still the claimed “first signal” and “second signal” used in the calculation. Claims 1, 4, and 6 do not require that the “first microphone signal” received in [1.2.3] is used in the calculation.

Accordingly, POSITAs would have understood the *Svean-Voix-Padhi* combination to disclose or suggest that **processing unit E3** is configured to execute instructions stored in one of the **memory elements** to send a test signal to

speaker SG that plays the test signal from the side adjacent to the meatus of the ear canal (“speaker plays the test signal from the first side” (claim 4)) and to receive a signal from the **microphone M1** that measures sound from the side adjacent to the ambient environment (“first microphone measures sound from the second side”). *Kyriakakis*, ¶224.

6. Claims 7, 8, 10, and 11

These claims require that the first/second signal are “the” test signal/first microphone signal or a “modified” version of them. In the *Svean-Voix-Padhi* combination, these signals are “modified” if they are pre-processed in *Padhi*’s [section 110](#) before performing cross correlation in **block 134 of section 112**.

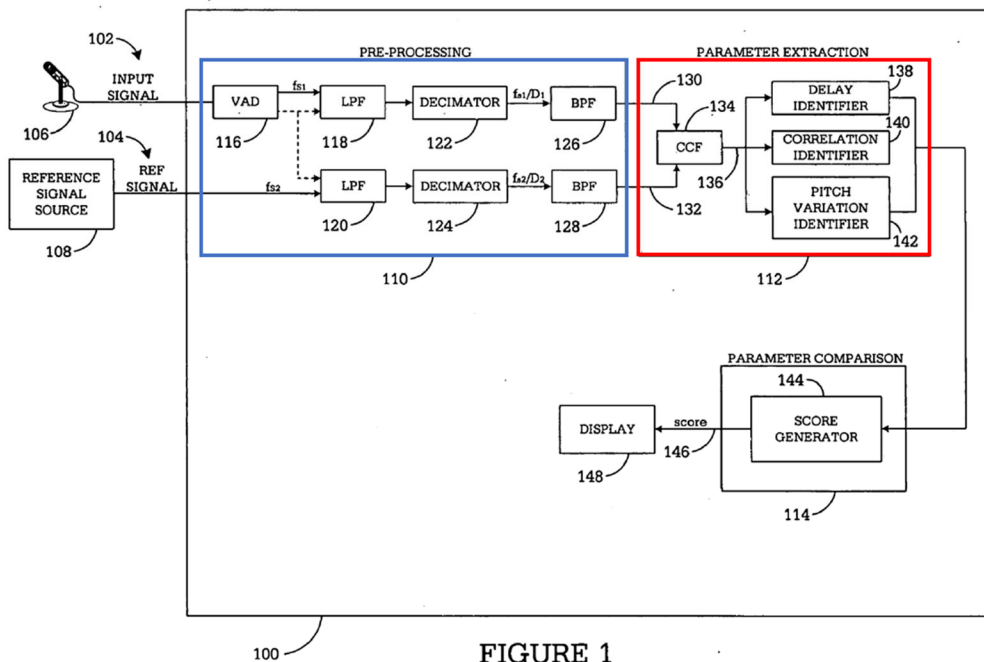


FIGURE 1

As to each claim, POSITAs would have found that using “the” signals or a “modified” version of them amounts to a simple substitution of known elements according to known techniques to yield predictable results. *See, e.g., Grit Energy Sols., LLC v. Oren Techs., LLC*, 957 F.3d 1309, 1323-1324 (Fed. Cir. 2020) (vacating and remanding Board’s nonobviousness determination in part because Board had reasoned that Petitioner “merely contended that a skilled artisan could make the change,” but Petitioner had contended that a “proposed modification amounts to nothing more than reorganizing familiar elements according to known methods to yield predictable results”).

Indeed, inputting an audio signal into *Padhi*’s **cross correlation function 134** without first performing **pre-processing in section 110** (such that it is “the” signal and not a “modified” version) is a simple substitution of one known element (a “modified” pre-processed signal) for another known element (“the” signal without pre-processing) to yield predictable results—and vice versa. *Kyriakakis*, ¶226. Regardless of whether one, both, or neither signal is pre-processed in *Padhi*’s **section 110**, it is input into *Padhi*’s **cross correlation function 134**, and POSITAs would have understood that the result would be cross correlating two signals to obtain a **cross-correlated signal 136**. Further, Dr. Kyriakakis explains that there are no technical reasons why pre-processing must be performed, and making the substitution would have been routine and well with the engineering

skill level of POSITAs. *Id.*, ¶227. Indeed, *Padhi* discloses that the components in pre-processing [section 110](#) can be omitted. *Padhi*, [0035]. Moreover, as Dr. Kyriakakis explains, POSITAs would have understood that the advantages and tradeoffs of making the substitutions were predictable, and the decision whether to implement one option or another would simply depend on the context. *Kyriakakis*, ¶229. For example, omitting pre-processing would have the advantage of being more efficient/less computationally intensive. *Id.*

Moreover, as to each audio signal, POSITAs would have two predictable choices: (1) omit the pre-processing as *Padhi* suggests may be done; or (2) include [pre-processing section 110](#), such that the signal is “modified.” POSITAs would have been motivated to make either of the design choices to achieve the claimed limitations. *Uber Techs., Inc. v. X One, Inc.*, 957 F.3d 1334, 1341 (Fed. Cir. 2020) (holding that POSITAs having “two of a finite number of known, predictable solutions” “would have faced a simple design choice between the two, and therefore would have been motivated to combine the teachings of [the prior art] to achieve the limitation”); *Arthrex, Inc. v. Smith & Nephew, Inc.*, 935 F.3d 1319, 1329 (Fed. Cir. 2019) (holding that Board correctly found that it “would have been an obvious design choice to a designer” to select between “two possible methods” disclosed in a reference) (quotations omitted).

As Dr. Kyriakakis explains, POSITAs would have had a reasonable expectation of success in making these predictable substitutions/choices.

Kyriakakis, ¶231.

a. Claim 7

The *Svean-Voix-Padhi* combination discloses/suggests this claim.

Kyriakakis, ¶¶232-236.

While *Padhi* discloses that **section 110** pre-processes audio signals prior to supplying them to **cross correlation function 134**, this pre-processing is consistent with the requirement that either or both of the test and first microphone signals, themselves, be *used* in the cross-correlation calculation, as the cross-correlation is ultimately obtained by “using” the original test and microphone signals. *Id.*, ¶233.

Nonetheless, to the extent the cross-correlation must be performed directly on the unmodified test and first microphone signals, the *Svean-Voix-Padhi* combination discloses/suggests supplying *Svean*’s pseudorandom sequence test signal and *Svean*’s **microphone M2 signal** to *Padhi*’s **cross correlation function 134** without first performing pre-processing on them in **section 110** to “modify” them.

It would have been obvious to use these signals in the *Svean-Voix-Padhi* combination for the reasons explained in §VIII.A.6.

Accordingly, POSITAs would have understood the *Svean-Voix-Padhi* combination to disclose or suggest that **processing unit E3** is configured to execute instructions stored in one of the **memory elements** to calculate a value that is the result of a non-phase cross correlation calculation (α) using “the” pseudorandom sequence test signal and “the” **microphone M2 signal** (“wherein the first signal is the test signal and the second signal is the first microphone signal”). *Id.*, ¶236.

b. Claim 8

The *Svean-Voix-Padhi* combination discloses/suggests this claim.
Kyriakakis, ¶¶237-242.

As discussed in §VIII.A.6.a, supplying *Svean*’s pseudorandom test signal to *Padhi*’s **cross correlation function 134** after pre-processing the signal in **section 110** is consistent with the requirement that the cross-correlation calculation “use” the unmodified test signal. Regardless, to the extent cross-correlation must be performed directly on the unmodified test signal and modified first microphone signal, the *Svean-Voix-Padhi* combination discloses/suggests supplying *Svean*’s pseudorandom sequence test signal with at least one component in the claimed frequency range to *Padhi*’s **cross correlation function 134** without first performing pre-processing on it in *Padhi*’s **section 110** to “modify” it.

Further, the *Svean-Voix-Padhi* combination discloses/suggests supplying *Svean*'s **microphone M2 signal** to *Padhi*'s pre-processing **section 110**—creating a “modified” version of it with, *inter alia*, a low pass filter—and supplying a “modified” version of the **microphone M2 signal** to *Padhi*'s **cross correlation function 134**.

It would have been obvious to use these signals in the *Svean-Voix-Padhi* combination for the reasons explained in §VIII.A.6.

Accordingly, POSITAs would have understood the *Svean-Voix-Padhi* combination to disclose or suggest that **processing unit E3** is configured to execute instructions stored in one of the **memory elements** to calculate a value that is the result of a non-phase cross correlation calculation (α) using “the” pseudorandom sequence test signal and “a modified” **microphone M2 signal** (“wherein the first signal is the test signal and the second signal is a modified first microphone signal”). *Kyriakakis*, ¶242.

c. Claim 10

The *Svean-Voix-Padhi* combination discloses/suggests this claim.
Kyriakakis, ¶¶243-248.

As discussed in §VIII.A.6.a, supplying *Svean*'s first microphone signal to *Padhi*'s **cross correlation function 134** after pre-processing the signal in **section 110** is consistent with the requirement that the cross-correlation calculation “use”

the unmodified first microphone signal. Regardless, the *Svean-Voix-Padhi* combination discloses/suggests supplying *Svean*'s pseudorandom sequence test signal with at least one frequency component in the claimed frequency range to *Padhi*'s **pre-processing section 110**—creating a “modified” version of it with, *inter alia*, a low pass filter—and supplying a “modified” pseudorandom sequence test signal to *Padhi*'s **cross correlation function 134**.

The *Svean-Voix-Padhi* combination also discloses/suggests supplying *Svean*'s **microphone M2 signal** to *Padhi*'s **cross correlation function 134** without first performing pre-processing on it in *Padhi*'s **section 110** to “modify” it. Indeed, *Padhi* states that “[v]arious components can be omitted or combined and additional components can be added according to particular needs.” *Padhi*, ¶[0035]. For example, if the “first microphone signal” is a narrow band audio signal, a POSITA may wish to filter the full-spectrum pseudorandom sequence to match the frequency range of the audio, which would reduce processing needs. *Kyriakakis*, ¶246.

It would have been obvious to use these signals in the *Svean-Voix-Padhi* combination for the reasons explained in §VIII.A.6.

Accordingly, POSITAs would have understood the *Svean-Voix-Padhi* combination to disclose or suggest that **processing unit E3** is configured to execute instructions stored in one of the **memory elements** to calculate a value that

is the result of a non-phase cross correlation calculation (α) using a “modified” pseudorandom sequence test signal and “the” **microphone M2 signal** (“wherein the first signal is a modified test signal and the second signal is the first microphone signal”). *Kyriakakis*, ¶248.

d. Claim 11

The *Svean-Voix-Padhi* combination discloses/suggests this claim.
Kyriakakis, ¶¶249-252.

The *Svean-Voix-Padhi* combination discloses/suggests supplying *Svean*’s pseudorandom sequence test signal with at least one frequency component in the claimed frequency range and *Svean*’s **microphone M2 signal** to *Padhi*’s **pre-processing section 110**—creating a “modified” version of them with, *inter alia*, a low pass filter—and supplying “modified” signals to *Padhi*’s **cross correlation function 134**.

It would have been obvious to use these signals in the *Svean-Voix-Padhi* combination for the reasons explained in §VIII.A.6.

Accordingly, POSITAs would have understood the *Svean-Voix-Padhi* combination to disclose or suggest that **processing unit E3** is configured to execute instructions stored in one of the **memory elements** to calculate a value that is the result of a non-phase cross correlation calculation (α) using a “modified” pseudorandom sequence test signal and a “modified” **microphone M2 signal**

(“wherein the first signal is a modified test signal and the second signal is a modified first microphone signal”). *Kyriakakis*, ¶252.

7. Claim 13

The *Svean-Voix-Padhi* combination discloses/suggests this claim.

Kyriakakis, ¶¶253-257.

Svean discloses an ear terminal having at least two microphones. Claim 1 recites a “first microphone,” and either of *Svean*’s **microphone M1** or **microphone M2** can satisfy the “first microphone” limitation. See §VIII.A.1.c(ii). *Svean*’s **microphone M1** and **microphone M2** can be seen in *Svean*’s Fig. 1:

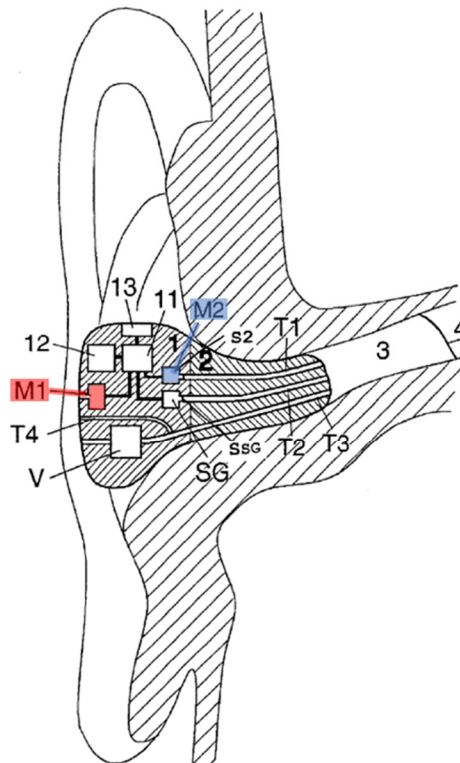


Fig. 1

Thus, if *Svean*'s **microphone M2** is the claimed “first microphone,” then *Svean*'s **microphone M1** corresponds to the “second microphone” recited in claim 13. Conversely, if *Svean*'s **microphone M1** is the claimed “first microphone,” then *Svean*'s **microphone M2** corresponds to the “second microphone” recited in claim 13.

Accordingly, POSITAs would have understood the *Svean-Voix-Padhi* combination to disclose or suggest an ear terminal that includes a “second microphone” (“wherein the earphone includes a second microphone”). *Kyriakakis*, ¶257.

8. Claim 14

The *Svean-Voix-Padhi* combination discloses/suggests this claim. *Kyriakakis*, ¶¶258-263.

When *Svean*'s **microphone M1** corresponds to the claimed “second microphone,” *Svean* discloses that the **processing unit E3** may receive a second microphone signal from **second microphone M1** corresponding to ambient/external sounds. *Svean*, 7:6-10; *id.*, 5:66-6:1; *id.*, 6:10-12; *id.*, Fig. 2; *see also* §VIII.A.1.c(iii).

Conversely, when *Svean*'s **microphone M2** corresponds to the claimed “second microphone,” *Svean* discloses that the **processing unit E3** may receive a

second microphone signal from **second microphone M2** corresponding to sound within the wearer's ear canal. *Svean*, 5:66-6:1; *id.*, 6:12-14; *id.*, 7:10-14.

In the same way, the algorithm disclosed in figure 3 of the '493*Pat* (step 308) requires "acquir[ing] internal acoustic field with...ECM," and the processor receives the signal from the ECM. '493*Pat*, 8:58-60, Fig. 3. *Kyriakakis*, ¶262.

Accordingly, POSITAs would have understood the *Svean-Voix-Padhi* combination to disclose or suggest that **processing unit E3** is configured to execute instructions stored in one of the **memory elements** to receive a second microphone signal from the "second microphone" ("receiving a second microphone signal from the second microphone"). *Kyriakakis*, ¶263.

9. Claim 18

The *Svean-Voix-Padhi* combination discloses/suggests this claim. *Kyriakakis*, ¶¶264-266.

As explained previously, the seal quality is good when, e.g., α is above a certain threshold. *See* §§VIII.A.1.c(v), VIII.A.1.c(vi) (limitations [1.2.5], [1.2.6], [1.2.7]); *Kyriakakis*, ¶265.

Accordingly, POSITAs would have understood the *Svean-Voix-Padhi* combination to disclose or suggest that **processing unit E3** is configured to execute instructions stored in one of the **memory elements** to compare a calculated value (α) to a threshold and to determine the seal quality is good when

the value is at or above the threshold (i.e., either as binary result or a score) (“the seal quality is good if the value is at or above the threshold value”). *Kyriakakis*, ¶266.

10. Claim 19

The *Svean-Voix-Padhi* combination discloses/suggests this claim.
Kyriakakis, ¶¶267-269.

In *Svean*, the **sealing section 2** may be made of slowly re-expanding shape polymer foam—i.e., a flexible polymer. *Svean*, 6:55-59; *id.*, 6:65-7:3.

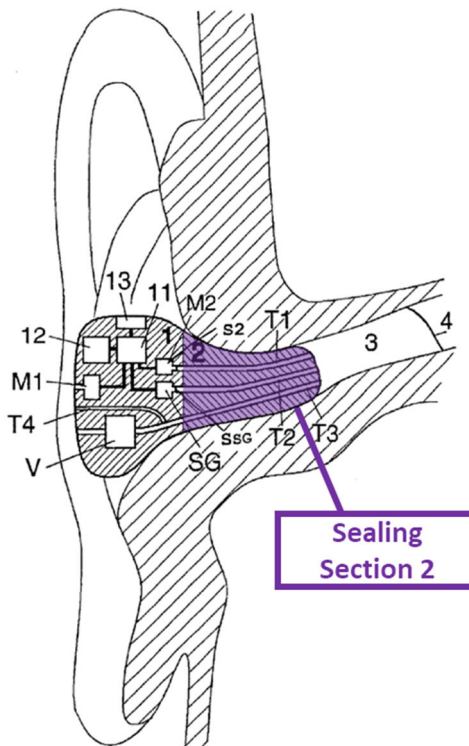
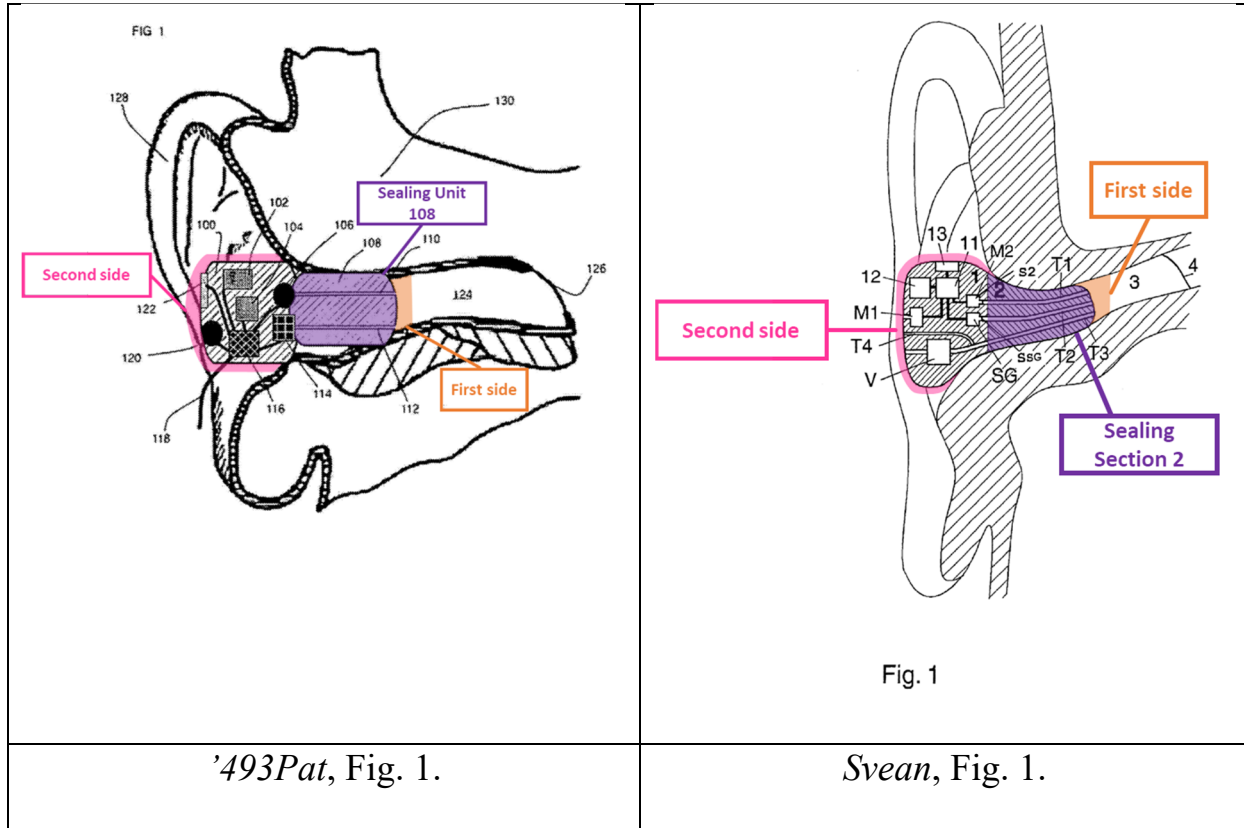


Fig. 1

Accordingly, POSITAs would have understood the *Svean-Voix-Padhi* combination to disclose or suggest that the **sealing section 2** of the ear terminal is composed of a flexible polymer (“wherein the sealing section is composed of at least one of rubber, silicone, a flexible polymer, or a combination thereof”).
Kyriakakis, ¶269.

11. Claim 20

The *Svean-Voix-Padhi* combination discloses/suggests this claim.
Kyriakakis, ¶¶270-272. The *'493Pat*'s specification does not use the term “eartip.” As shown in the below comparison of Figs. 1 of the *'493Pat* and *Svean*, *Svean* discloses an “eartip” in the same way the *'493Pat* discloses an eartip—i.e., a component that seals the **first side** of the ear terminal from the **second side**. Thus, POSITAs would have understood that *Svean* discloses that the sealing section is an eartip in the same way as the *'493Pat*. *Kyriakakis*, ¶271.



Accordingly, POSITAs would have understood the *Svean-Voix-Padhi* combination to disclose or suggest that **sealing section 2** of the ear terminal is an eartip (“sealing section is an eartip”). *Kyriakakis*, ¶272.

B. Ground 2: *Svean, Voix, Padhi*, and *Hayashi* Render Obvious Claims 3 and 15-17

1. Claim 3

The *Svean-Voix-Padhi-Hayashi* combination discloses/suggests this claim. *Kyriakakis*, ¶¶273-284.

Svean discloses that “the user may get audible or other messaged confirmation if the leakage is acceptably low, or a warning signal if leakage is unacceptably high.” *Svean*, 12:11-14.

Padhi discloses generating a score that “is presented to a user or other person or people on a **display 148**.” *Padhi*, [0033].

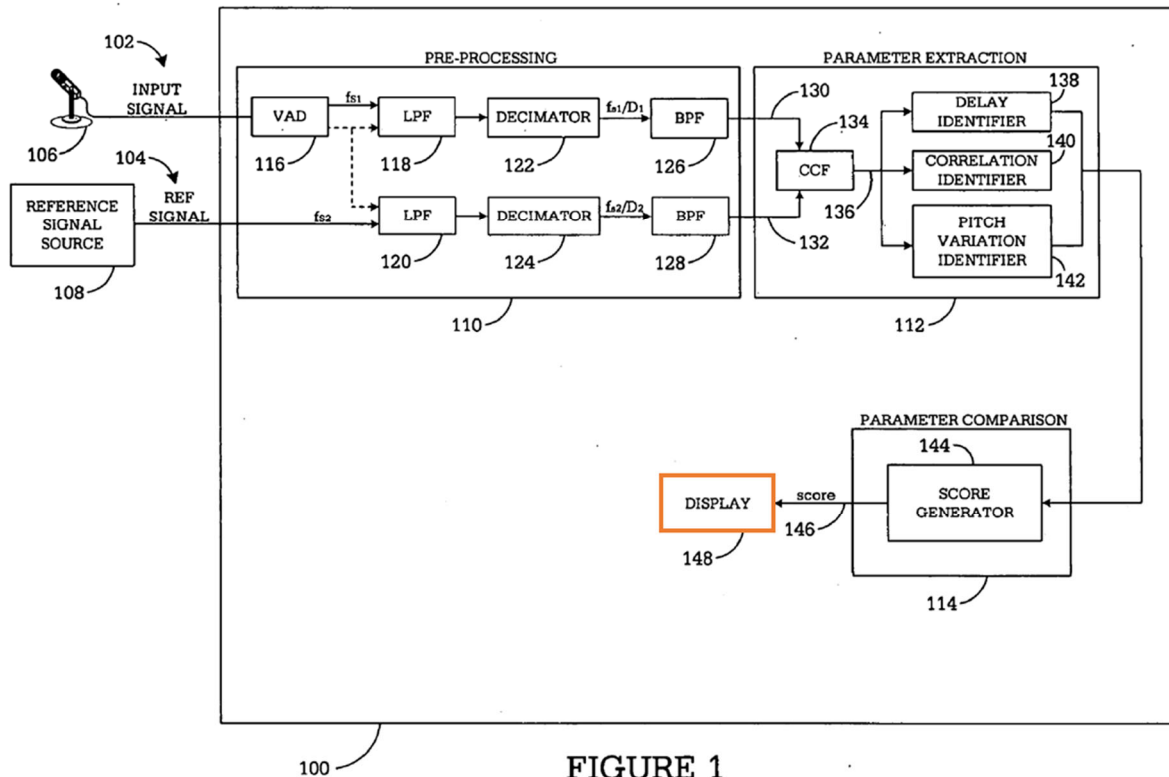
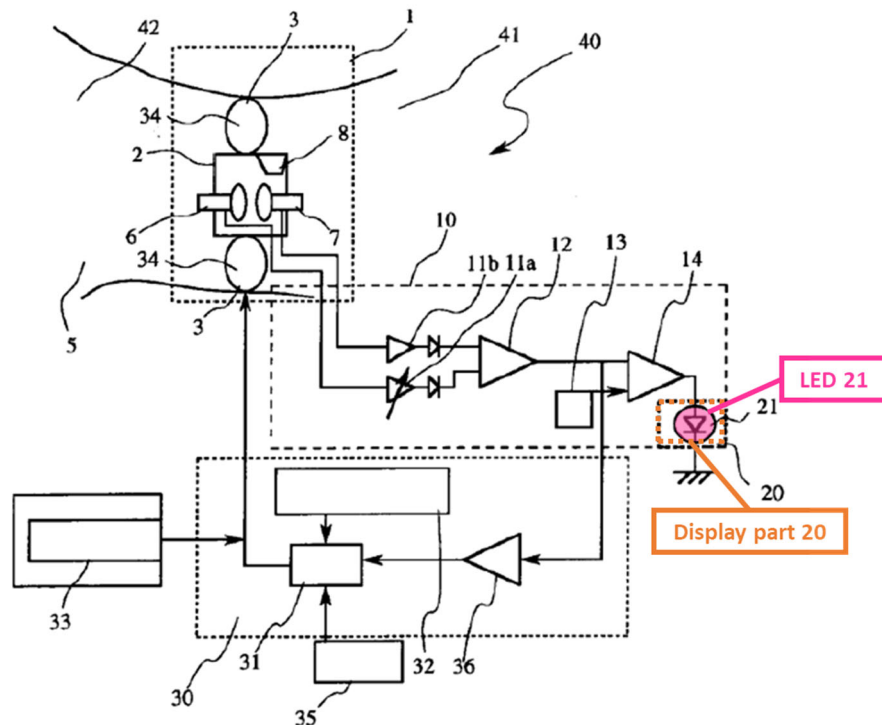


FIGURE 1

Hayashi discloses determining the similarity between two microphone signals to evaluate the seal of an in-ear device. *Hayashi*’s technique includes an **LED 21** in **display part 20** that indicates the level of sound leakage. *Id.*, [0013]-[0014]; *id.*, [0018]; *id.*, [0020] (disclosing that “[a]ccording to this invention, a

device having a function of objectively measuring and displaying a leakage amount of an external sound can be provided” and that “an external sound processing device such as a hearing aid having a function for displaying the leakage amount of sound ... can be acquired”).

[FIG. 1]



POSITAs would have been motivated to generate and send a visual message to a display of the audio device (in addition to or instead of sending an acoustic message conveying the seal quality).

First, to the extent the Board finds that *Svean*’s ear terminal may be the claimed “audio device” and seal quality may be a binary result, POSITAs would have been motivated to include *Hayashi*’s LED on *Svean*’s ear terminal to indicate

a “good” or “bad” seal. *Svean* already contemplates providing “other messaged confirmation” regarding the seal quality (*Svean*, 12:11-14), and *Svean*’s “verification” algorithm is designed to be used in the immediate vicinity of a noisy environment (*id.*, 12:14-23) where it may be difficult to hear an acoustic message if the seal quality is poor. *Kyriakakis*, ¶278. POSITAs would have been motivated to provide *Hayashi*’s LED display on the ear terminal to allow the user to view the result (e.g., in a mirror or other reflective surface), which—in addition to a gate controlling access to the noisy environment (*Svean*, 12:19-23)—would serve as an additional measure to prevent the user from being exposed to noise with an inadequate seal. Moreover, this would have the benefit of allowing another individual in the vicinity to view the LED and verify that the seal was adequate. In addition, in view of the teachings of *Padhi* and *Hayashi*, depending on design needs, POSITAs would also have been motivated to provide a display such as a two-digit LED display on the ear terminal that provides a more granular score that the user (and optionally, another individual) could view to assess the seal before the user enters the environment. *Kyriakakis*, ¶281.

Second, to the extent the Board finds that the “audio device” must be a separate structure, POSITAs would have been motivated to generate and send a visual message to the separate audio device in *Svean* to indicate either a binary result or, depending on design needs, a score in view of *Hayashi* and *Padhi*. For

the same reasons discussed above, POSITAs would have recognized that displaying the binary result or score on a separate audio device would allow the user to view the result/score and ensure that the user received the message. *Id.*, ¶282.

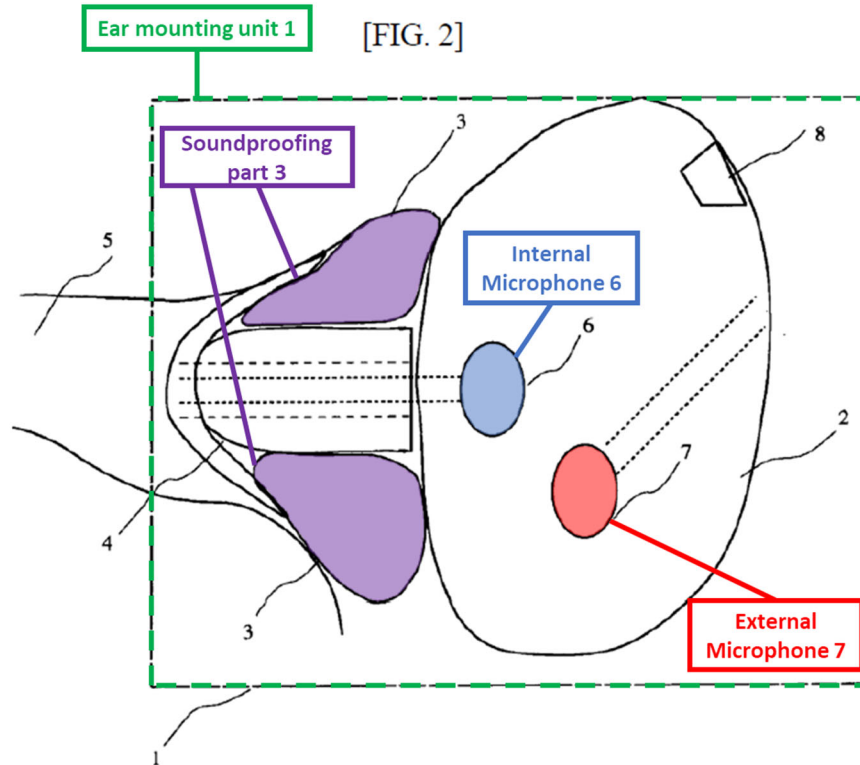
In either case, POSITAs would have had a reasonable expectation of success in implementing well-known display technology as described in *Hayashi* and *Padhi* to display the seal quality. *Id.*, ¶283.

Accordingly, POSITAs would have understood the *Svean-Voix-Padhi-Hayashi* combination to disclose or suggest that **processing unit E3** is configured to execute instructions stored in one of the **memory elements** to generate and send a visual message to a display of the ear terminal (or separate structure) to convey the seal quality—i.e., the binary result and/or *Padhi*'s score (“the message is a visual message sent to a display of the audio device”). *Id.*, ¶284.

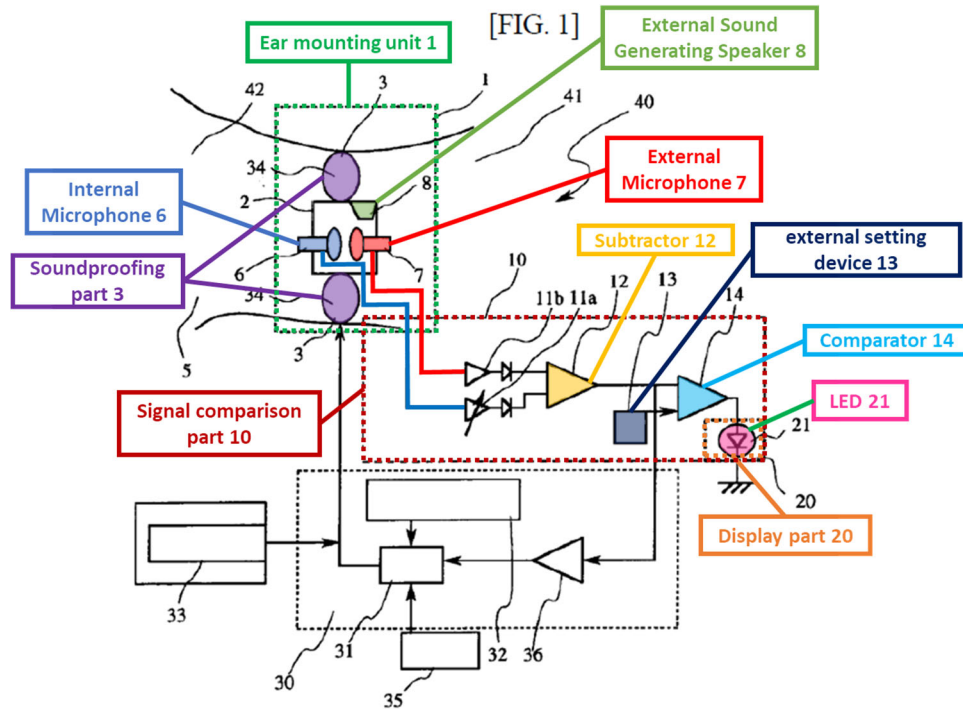
2. Claim 15

The *Svean-Voix-Padhi-Hayashi* combination discloses/suggests this claim. *Kyriakakis*, ¶¶285-297.

Hayashi discloses determining the similarity between two microphone signals to evaluate the seal of an in-ear device. In Figure 2, *Hayashi* discloses an **ear mounting unit 1** with an **external microphone 7**, **internal microphone 6**, and a **soundproofing part 3**.



Hayashi discloses an algorithm for calculating a value with the internal and external microphone signals to evaluate the level of seal. For context, *Hayashi's* Figure 1 is reproduced below with relevant components annotated.



Hayashi discloses that **signal comparison part 10** receives input signals from **internal microphone 6** and **external microphone 7** and supplies them to **subtractor 12**. *Hayashi*, [0013]. *Hayashi's* **subtractor 12** subtracts signals from the **internal microphone 6** and **external microphone 7**, and **comparator 14** compares the output of the subtractor to a reference voltage threshold set by **external setting device 13**. The reference voltage threshold corresponds to a predetermined sound pressure difference. If the input to the **comparator 14** is less than the threshold, the comparator outputs 0 volts. Otherwise, the **comparator 14** outputs a voltage to light up **LED 21** in **display part 20** to indicate the level of sound leakage through the **soundproofing part 3**. *Id.*, [0013]-[0014]; *id.*, [0018].

Thus, *Hayashi* discloses that two microphone signals measuring sound from opposite sides of a sealing section (**soundproofing part 3**) in an ear mounted unit may be utilized in a calculation to determine the seal quality.

In the *Svean-Voix-Padhi-Hayashi* combination for [1.2.4], *Svean*'s **microphone M2 signal** and **microphone M1 signal** would be inputs to *Padhi*'s **cross correlation function 134** either (1) in addition to the calculation performed with *Svean*'s pseudorandom test signal and the **microphone M2 signal**; or (2) instead of the pseudorandom test signal and the **microphone M2 signal**. The analysis of [1.2.5] and [1.2.6] remains the same, except that POSITAs would have recognized that where two microphone signals are used in the calculation, a lower cross correlation calculated value would correspond to a higher seal quality (i.e., the less correlated the two signals are, the better the seal), and would adjust the threshold comparison step accordingly before generating and sending the message to the user. *Kyriakakis*, ¶292.

As to (1), in view of *Hayashi*, POSITAs would have been motivated to use two microphone signals in an additional calculation to determine seal quality because POSITAs would have recognized that performing such a calculation would provide further assurance that the seal quality was adequate. POSITAs would have recognized that performing this additional calculation would be important for *Svean*'s ear terminal, because an erroneous seal quality determination

may result in the user being exposed to unsafe noise levels with an inadequate seal.
Id., ¶293.

Alternatively, as to (2), POSITAs would have been motivated to perform the calculation with *Svean*'s **microphone M1 signal** and **microphone M2 signal** instead of performing the calculation with the test signal and the **microphone M2 signal**. POSITAs would have recognized that performing the calculation with two microphone signals was one of three predictable solutions that would work equally well for determining seal quality. The other two predictable solutions would be performing the calculation with: (i) the **microphone M2 signal** and the test signal; and (ii) the **microphone M1 signal** and the test signal. POSITAs would have been motivated to choose one of these three predictable solutions to achieve the claimed invention. *See, e.g., Uber Techs.*, 957 F.3d at 1341.

The *Svean-Voix-Padhi-Hayashi* combination also discloses/suggests supplying *Svean*'s microphone signals output by *Svean*'s **microphone M2** and **microphone M1** to *Padhi*'s **cross correlation function 134** without first performing pre-processing on them in **section 110** to “modify” them. It would have been obvious to use “unmodified” microphone signals in the calculation performed in the *Svean-Voix-Padhi-Hayashi* combination for the same reasons explained in §VIII.A.6.

Accordingly, POSITAs would have understood the *Svean-Voix-Padhi-Hayashi* combination to disclose or suggest that **processing unit E3** is configured to execute instructions stored in one of the **memory elements** to calculate a value that is the result of a non-phase cross correlation calculation (α) using “the” **microphone M2 signal** and “the” **microphone M1 signal** (“wherein the first signal is the first microphone signal and the second signal is the second microphone signal”). *Kyriakakis*, ¶297.

3. Claim 16

The *Svean-Voix-Padhi-Hayashi* combination discloses/suggests this claim. *Kyriakakis*, ¶¶298-303.

For the reasons explained with respect to claim 15, it would have been obvious in view of *Hayashi* to use *Svean*’s **microphone M1 signal** and **microphone M2 signal** in *Padhi*’s calculation. See §VIII.B.2.

The *Svean-Voix-Padhi-Hayashi* combination discloses/suggests supplying *Svean*’s **microphone M2 signal** to *Padhi*’s **pre-processing section 110**—creating a “modified” version of it with, *inter alia*, a low pass filter—and supplying a “modified” **microphone M2 signal** to *Padhi*’s **cross correlation function 134**. *Svean* and *Padhi* also disclose or suggest supplying *Svean*’s **microphone signal M1** to *Padhi*’s **cross correlation function 134** without first performing pre-processing on it in *Padhi*’s **section 110** to “modify” it. It would have been obvious

to use these signals in the *Svean-Voix-Padhi-Hayashi* combination for the reasons explained in §VIII.A.6.

Accordingly, POSITAs would have understood the *Svean-Voix-Padhi-Hayashi* combination to disclose or suggest that **processing unit E3** is configured to execute instructions stored in one of the **memory elements** to calculate a value that is the result of a non-phase cross correlation calculation (such as α) using a “modified” **microphone M2 signal** and “the” **microphone M1 signal** (“wherein the first signal is a modified first microphone signal and the second signal is the second microphone signal”). *Kyriakakis*, ¶303.

4. Claim 17

The *Svean-Voix-Padhi-Hayashi* combination discloses/suggests this claim. *Kyriakakis*, ¶¶304-309.

For the reasons explained with respect to claim 15, it would have been obvious in view of *Hayashi* to use *Svean*’s **microphone M2 signal** and **microphone M1 signal** in *Padhi*’s calculation. See §VIII.B.2.

The *Svean-Voix-Padhi-Hayashi* combination discloses/suggests supplying *Svean*’s **microphone M2 signal** to *Padhi*’s **pre-processing section 110**—creating a “modified” version of it with, *inter alia*, a low pass filter—and supplying a “modified” **microphone M2 signal** to *Padhi*’s **cross correlation function 134**. *Svean* and *Padhi* also disclose or suggest supplying *Svean*’s **microphone M1**

signal to *Padhi*'s **pre-processing section 110**—creating a “modified” version of it with, *inter alia*, a low pass filter—and supplying a “modified” **microphone M1 signal** to *Padhi*'s **cross correlation function 134**. It would have been obvious to use these signals in the *Svean-Voix-Padhi-Hayashi* combination for the reasons explained in §VIII.A.6.

Accordingly, POSITAs would have understood the *Svean-Voix-Padhi-Hayashi* combination to disclose or suggest that **processing unit E3** is configured to execute instructions stored in one of the **memory elements** to calculate a value that is the result of a non-phase cross correlation calculation (such as α) using a “modified” **microphone M2 signal** and a “modified” **microphone M1 signal** (“the first signal is a modified first microphone signal and the second signal is a modified second microphone signal”). *Kyriakakis*, ¶309.

C. Ground 3: *Svean, Voix, Padhi*, and *Bourk* Render Obvious Claims 9 and 12

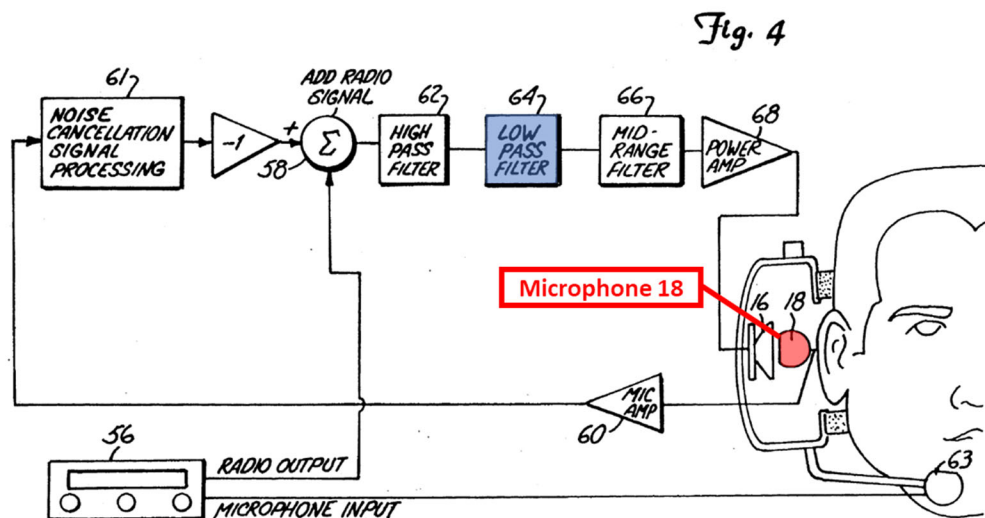
1. Claim 9

The *Svean-Voix-Padhi-Bourk* combination discloses/suggests this claim. *Kyriakakis*, ¶¶310-317.

Bourk discloses/suggests applying a low pass filter to a modified signal that includes a microphone signal, wherein the upper cutoff frequency is less than or equal to 200 Hz.

Specifically, *Bourk* discloses generating a modified signal that is provided to driver 16 (i.e., a loudspeaker) for acoustical reproduction by a headset. *Bourk* generates the modified signal by summing an audio signal (if any) and an anti-noise signal generated based on a signal from **microphone 18**. *Id.*, 4:7-16. *Bourk* discloses that “noise cancellation operates whether or not any such audio signal is provided,” such that the modified signal provided to driver 16 may consist solely of the anti-noise signal generated from **microphone 18**. *Id.*, 5:45-49; *id.*, 6:12-17.

The modified signal may be filtered before it is provided to driver 16. *Id.*, 4:23-27; *id.*, 6:25-35. The filters may include, e.g., a high pass filter 62 for filtering components below a first frequency and a **low pass filter 64 for filtering components above a second frequency**. *Id.*, 6:37-42. *Bourk* discloses that in the preferred embodiment, the first frequency is in the 17 to 70 Hz range and the **second frequency is a range from 150 Hz to 8 kHz**. *Id.*, 6:42-59.



POSITAs would have understood *Bourk* to disclose or suggest choosing an upper cutoff frequency anywhere in the range of 150 Hz to 8 kHz depending on design needs. *Kyriakakis*, ¶314. Further, POSITAs would have understood *Bourk* to suggest choosing an upper cutoff frequency of 200 Hz because *Bourk* discloses that is the upper end of the range where “maximum noise reduction” will occur. *Bourk*, 7:4-17; *Kyriakakis*, ¶314.

In view of *Bourk*, POSITAs would have found applying a low pass filter to *Svean*’s **microphone M2 signal** with an upper cutoff frequency less than or equal to 200 Hz amounts to a simple substitution of known elements according to known techniques to yield predictable results (i.e., applying a low pass filter to the microphone signal—as already suggested in *Padhi*—with an upper cutoff frequency less than or equal to 200 Hz—as suggested in *Bourk*). Thus, in the *Svean-Voix-Padhi-Bourk* combination, *Svean*’s **microphone M2 signal** would first be filtered with a low pass filter with an upper cutoff frequency of, e.g., 200 Hz, before it is supplied to *Padhi*’s **cross correlation function 134**.

Accordingly, POSITAs would have understood the *Svean-Voix-Padhi-Bourk* combination to disclose or suggest that **processing unit E3** is configured to execute instructions stored in one of the **memory elements** to calculate a value that is the result of a non-phase cross correlation calculation (α) using “the” pseudorandom sequence test signal and “a modified” **microphone M2 signal**

(“wherein the first signal is the test signal and the second signal is a modified first microphone signal”) as required by claim 8. *Kyriakakis*, ¶317. Further, POSITAs would have understood the *Svean-Voix-Padhi-Bourk* combination to disclose or suggest that the “modified” **microphone M2 signal** is generated by applying a low pass filter with an upper cutoff frequency that is less than or equal to 200 Hz and may be as low as 150 Hz (“wherein the modified first microphone signal is generated by applying a low pass filter to the first microphone signal, wherein the upper cutoff frequency is less than or equal to 200 Hz”). *Id.*

2. Claim 12

The *Svean-Voix-Padhi-Bourk* combination discloses/suggests this claim. *Kyriakakis*, ¶¶318-320.

As described with respect to claim 9, *Bourk* discloses/suggests applying a low pass filter to a modified signal generated based on a microphone signal, wherein the upper cutoff frequency is less than or equal to 200 Hz. *See* §VIII.C.1. Further, POSITAs would have found applying a low pass filter to *Svean*’s **microphone M2 signal** with an upper cutoff frequency less than or equal to 200 Hz amounts to nothing more than a simple substitution of known elements according to known techniques to yield predictable results. *Id.*

Accordingly, POSITAs would have understood the *Svean-Voix-Padhi-Bourk* combination to disclose or suggest that **processing unit E3** is configured to

execute instructions stored in one of the **memory elements** to calculate a value that is the result of a non-phase cross correlation calculation (such as α) using a “modified” pseudorandom sequence test signal and a “modified” **microphone M2 signal** (“wherein the first signal is a modified test signal and the second signal is a modified first microphone signal”) as required by claim 11. *Kyriakakis*, ¶320.

Further, POSITAs would have understood the *Svean-Voix-Padhi-Bourk* combination to disclose or suggest that the “modified” **microphone M2 signal** is generated by applying a low pass filter with an upper cutoff frequency that is less than or equal to 200 Hz and may be as low as 150 Hz (“wherein the first microphone signal is generated by applying a low pass filter to the first microphone signal, wherein the upper cutoff frequency is less than or equal to 200 Hz”). *Id.*.

IX. SECONDARY CONSIDERATIONS

There is no evidence in the *'493Pat*’s prosecution history or elsewhere supporting any secondary considerations arguments, or evidence of nexus of such alleged evidence to the challenged claims. *See generally* *'493FH*.

X. THE DISCRETIONARY FACTORS FAVOR INSTITUTING TRIAL

A. 35 U.S.C. §314(a)

The USPTO’s June 2022 updated discretionary denial guidance expressly noted that the PTAB will not discretionarily deny institution when, as here,

Samsung presents a Sotera stipulation. (EX1022). With regard to Harman, no schedule has been set in the Harman litigation, and the median time to trial in Delaware is three years, which would set the Harman trial in about July 2026, seven months after an expected FWD. EX1024, 14. Thus, the Board should not exercise its §314(a) discretion.

B. 35 U.S.C. §325(d)

The Board should not exercise its discretion under §325(d) to deny institution of this Petition. *See Becton, Dickinson & Co. v. B. Braun Melsungen AG*, IPR2017-01586, Paper 8, at 17-18 (PTAB Dec. 15, 2017) (precedential); *Advanced Bionic, LLC v. MED-EL Elektromedizinische Gerate GmbH*, IPR2019-01469, Paper 6, at 9-11 (PTAB Feb. 13, 2020) (precedential).

Under part one of *Advanced Bionics*, the Board considers “whether the same or substantially the same art previously was presented to the Office or whether the same or substantially the same arguments previously were presented to the Office.” *Advanced Bionics*, 8.

The Office did not issue any rejections during prosecution, and there is no evidence that the Office considered the combinations in the Grounds presented in this Petition. As discussed in §IV.B, the Office separately evaluated *Svean* and *Padhi* during prosecution and discussed these references in notices of allowability without explicitly considering their combined teachings. The Office also

considered the parent '836 patent IPR petition (which included grounds based on *Svean*) and the '836 patent *ex parte* reexamination request (which included grounds based on *Svean* and *Padhi*, but did not combine the two) during prosecution. However, neither the '836 IPR petition nor the '836 *ex parte* reexamination request combine *Svean* and *Padhi* in the manner presented in this Petition. Thus, although *Svean* and *Padhi* were before the Office, *Svean* and *Padhi* are presented in a different light in this Petition. Further, *Voix* was not before the Office, and thus each ground in this Petition is based on a new reference. Accordingly, the Board should not exercise its discretion under part one.

Under part two of *Advanced Bionics*, the Board considers “whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of the challenged claims.” *Advanced Bionics*, 9. Here, even if the Board finds part one is met (e.g., because the new art and arguments are somehow cumulative), the Board should find under part two that this Petition demonstrates that the Office committed material error. During prosecution, the Office stated that *Svean* was the “closest prior art of record” but found that *Svean* failed to disclose, e.g., “generating a test signal, wherein the test signal includes multiple frequency components, wherein at least one component lies between a range of 30Hz and 200Hz” and “sending the test signal to a speaker of an earphone.” The Office did not address *Svean*’s disclosure of a test signal that is a pseudorandom sequence, let

alone address this disclosure in view of the teachings of a reference like *Voix*, which—as this Petition demonstrates—renders obvious these limitations.

Petitioners respectfully submit that the Office’s failure to recognize *Svean*’s alternative embodiment of a pseudorandom sequence in view of the teachings of a reference such as *Voix* was a material error.

The Office also found that *Svean* failed to disclose “calculating a value, using a first signal and a second signal, wherein the value is the result of a non phase calculation of at least one of a coherence, a correlation, a cross-correlation, a difference, or a combination” and “comparing the value to a threshold.” As to *Padhi*, the Office stated that it was “made of record and not relied upon,” “pertinent to applicant’s disclosure,” and “discloses an apparatus, method, and computer program for comparing audio signals.” EX1004, 229. But the Office did not address, and thus overlooked, *Padhi*’s disclosure of a cross correlation calculation, *Padhi*’s disclosure of comparing a calculated value to a threshold, and the resulting combination of *Svean*, *Voix*, and *Padhi* as set forth in Ground 1. Petitioners respectfully submit that the Office’s failure to recognize these *Padhi* teachings was also a material error.

Accordingly, the Office materially erred by overlooking *Svean*’s and *Padhi*’s disclosures and this Petition’s combination of references. *See, e.g., Edwards Lifesciences Corp. v. Aortic Innovations, LLC*, IPR2021-01584, Paper 15

at 28 (PTAB Apr. 1, 2022) (finding “that the Examiner materially erred during prosecution by failing to fully consider the prior art teachings” where, although two prior art references “were presented to the Examiner, the Examiner did not issue any rejections during prosecution based on that prior art despite teachings that are closely related to the subject matter and claims” of the challenged patent).

Moreover, the expert evidence in this Petition shows how the references disclose or render obvious every limitation of the challenged claims and the reasons POSITAs would have made the combinations. Thus, Petitioners’ challenges are based on additional evidence and arguments that the Office did not consider, which weighs against exercising discretion under §325(d). *See Mylan Pharms. Inc. v. Merck Sharp & Dohme Corp.*, IPR2020-00040, Paper 21 at 20 (PTAB May 12, 2020) (new expert testimony weighs against exercising discretion under §325(d)).

XI. MANDATORY NOTICES UNDER 37 C.F.R. §42.8

A. Real Parties-in-Interest

Petitioners identify themselves as the real parties-in-interest.

1. Related Matters

To the best of Petitioners’ knowledge, the *'493Pat* has only been involved in the following district court litigations:

- *Staton Techiya, LLC v. Samsung Elecs. Co., Ltd. et al.*, 2:23-cv-00319-JRG-RSP (E.D. Tex.), filed July 10, 2023.

- *Staton Techiya, LLC v. Harman Int’l Indus., Inc. et al.*, 1:23-cv-00802-JCG (D. Del.), filed July 25, 2023.

U.S. Patent No. 10,979,836, the parent to the *'493pat*, is currently on appeal after a final rejection in ex parte reexamination. See Control No. 90/015,146.

Trial in Inter Partes Review Case No. IPR2022-00410 was denied.

The following chart identifies all patents/application that are in the same family as the *'493pat*:

U.S. Patent No. 11,889,275, which issued from U.S. App. No. 18/092,645
U.S. App. No. 18/515,254, which is a continuation of U.S. App. No. 17/182,570, and is pending
U.S. Patent No. 10,979,836, which issued from U.S. App. No. 16/838,277
U.S. Patent No. 10,701,499, which issued from U.S. App. No. 16/414,499
U.S. Patent No. 10,299,053, which issued from U.S. App. No. 15/700,511
U.S. Patent No. 9,781,530, which issued from U.S. App. No. 14/827,332
U.S. Patent No. 9,113,267, which issued from U.S. App. No. 14/054,015
U.S. Patent No. 8,600,067, which issued from U.S. App. No. 12/555,964
U.S. Provisional App. 61/098,250, filed September 19,2008.

B. Lead and Backup Counsel

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C. Service Information

Please address all correspondence to lead and back-up counsel at the addresses shown above. Petitioners consent to electronic service by email at the following addresses:

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D. Power of Attorney

Powers of attorney are filed herewith according to 37 C.F.R. §42.10(b).

XII. FEES

Petitioners concurrently electronically submits the required fees for this Petition. The Board is authorized to charge Arnold & Porter Kaye Scholer LLP's deposit account, No. 50-2387, for any fee deficiency.

Date: July 1, 2024

Respectfully submitted,

/Jeffrey A. Miller/

Jeffrey A. Miller (Reg. No. 35,287)
Lead Counsel

CERTIFICATE OF COMPLIANCE

The undersigned hereby certifies that the foregoing Petition for *Inter Partes* Review contains 13,944 words, excluding those portions identified in 37 C.F.R. §42.24(a), as measured by the word-processing system used to prepare this paper.

/Jeffrey A. Miller/

Jeffrey A. Miller (Reg. No. 35,287)
Lead Counsel

CERTIFICATE OF SERVICE

I certify that on July 1, 2024, I caused a true and correct copy of the foregoing Petition for *Inter Partes* Review of U.S. Patent No. 11,665,493 and supporting exhibits to be served via overnight delivery on the Patent Owner at the following correspondence address of record as listed on Patent Center:

Peter Chiabotti
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A courtesy copy was also sent via electronic mail to Patent Owner's litigation counsel listed below:

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