

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 IPR2024-01031

U.S. Patent No. 11,659,315

Petition for *Inter Partes* Review of

U.S. Patent No. 11,659,315

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d.	[1.4]: a speaker;	60
e.	[1.5] and [1.6]: a memory that stores instructions; a logic circuit, where the logic circuit is configured to execute the instructions to perform operations comprising:	60
f.	[1.6.1]: generating a noise-reduction signal using at least one of the first microphone signal or the second microphone signal or the third microphone signal or a combination of microphone signals;	62
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PETITIONERS' EXHIBIT LIST

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1001	U.S. Patent 11,659,315 (“’315pat.”)
1002	Declaration of Dr. Polish (“ <i>Polish</i> ”)
1003	Curriculum Vitae of Dr. Polish
1004	File History of U.S. Patent 11,659,315
1005	U.S. Provisional Application 61/737,932
1006	U.S. Application 16/266,829 (“’829App”)
1007	Summary of all applications in the ’315 patent’s family
1008	Order Granting Proposed Docket Control Order in <i>Staton Techiya, LLC et al. v. Samsung Electronics Co., Ltd. et al.</i> , 2:23-cv-00319 (E.D. Tex. Feb. 8, 2023)
1009	Letter from Nikhil Krishnan to Thomas J. Friel, Jr.
1010	U.S. Publication 2011/0026724 (“ <i>Doclo</i> ”)
1011	U.S. Publication 2006/0153394 (“ <i>Beasley</i> ”)
1012	U.S. Publication 2007/0014423A1 (“ <i>Darbut</i> ”)
1013	U.S. Publication 2018/0115818 (“ <i>Asada</i> ”)
1014	U.S. Publication 2014/0270200 (“ <i>Usher</i> ”)
1015	WO2009023633 (“ <i>Goldstein</i> ”)
1016	U.S. Patent 7,903,825 (“ <i>Melanson</i> ”)
1017	U.S. Publication 2007/0027676A1 (“ <i>Chambers</i> ”)
1018	U.S. Publication 2007/0172087A1 (“ <i>Olsen</i> ”)
1019	U.S. Publication 2004/0202340A1 (“ <i>Armstrong</i> ”)

Exhibit No.	DESCRIPTION
1020	U.S. 6,826,286 (“ <i>Arndt</i> ”)
1021	U.S. 5,862,065 (“ <i>Muthusamy</i> ”)
1022	U.S. Publication 2008/0107297A1 (“ <i>Fischer</i> ”)
1023	U.S. Publication 2006/0018496A1 (“ <i>Niederdrank</i> ”)
1024	U.S. 5,826,064 (“ <i>Loring</i> ”)
1025	Blattner et al., “Earcons and Icons: Their structure and Common Design Principles,” Human-Computer Interaction, Vol. 4 at 11-44 (1989) (“ <i>Blattner</i> ”)
1026	U.S. Publication 2007/0127660A1 (“ <i>Roberts</i> ”)
1027	U.S. 6,760,754 (“ <i>Isaacs</i> ”)
1028	U.S. 2014/0166122A1 (“ <i>Goldstein-122</i> ”)
1029	U.S. Publication 2015/0170645A1 (“ <i>DiCenso</i> ”)
1030	U.S. Publication 2018/0160211 (“ <i>Kirsch</i> ”)
1031	Sumit Basu et al., <i>Smart Headphones: Enhancing Auditory Awareness Through Robust Speech Detection and Source Localization</i> , 5 IEEE INT’L CONF. ON ACOUSTICS SPEECH & SIGNAL PROCESSING PROC. 3361 (2001) (“ <i>Basu</i> ”)
1032	Excerpt from COMPUTER DICTIONARY (2d ed. 1994) (“ <i>Computer Dictionary</i> ”)
1033	U.S. Publication 2007/0223717A1 (“ <i>Boersma</i> ”)
1034	U.S. Patent 5,636,351 (“ <i>Lee</i> ”)
1035	U.S. District Courts – National Judicial Caseload Profile

LISTING OF CHALLENGED CLAIMS

Claim 1	
1.pre	An earpiece comprising:
1.1	a first ambient microphone configured to generate a first microphone signal;
1.2	a second ambient microphone configured to generate a second microphone signal;
1.3	an ear canal microphone configured to generate a third microphone signal;
1.4	a speaker;
1.5	a memory that stores instructions;
1.6	a logic circuit, where the logic circuit is configured to execute the instructions to perform operations comprising:
1.6.1	generating a noise reduction signal using at least one of the first microphone signal or the second microphone signal or the third microphone signal or a combination of microphone signals;
1.6.2	receiving an audio signal;
1.6.3	generating a mixed audio signal by mixing the noise reduction signal with the audio signal; and
1.6.4	sending a modified audio signal to the speaker, where the modified audio signal includes the mixed audio signal.
Claim 2	
2	The earpiece according to claim 1, wherein the operations further comprise: generating an ambient sound signal using at least one of the first microphone signal or the second microphone signal or a combination of both.
Claim 3	
3	The earpiece according to claim 2, wherein the operations further comprise: generating the modified audio signal by mixing the ambient sound signal with the mixed audio signal.

Claim 4	
4	The earpiece according to claim 1, wherein the operations further comprise: receiving an indication of an event.
Claim 5	
5	The earpiece according to claim 4, wherein the event is at least one of a scheduled meeting, an incoming phone call, an email, a voice message, or a text message.
Claim 6	
6	The earpiece according to claim 5, wherein the operations further comprise: retrieving an Earcon from the memory, where the Earcon matches the event.
Claim 7	
7	The earpiece according to claim 5, wherein the operations further comprise: sending the Earcon to the speaker.
Claim 8	
8	The earpiece according to claim 1, further comprising: a sealing section.

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 1-8 (“Challenged Claims”) of U.S. Patent No. 11,659,315 (“’315pat.”).

II. GROUNDS FOR STANDING

Petitioners certify that the ’315pat. is available for IPR and that Petitioners are not barred or estopped from requesting IPR to challenge the claims on the grounds herein.

III. STATEMENT OF PRECISE RELIEF REQUESTED FOR EACH CLAIM CHALLENGED

Petitioners respectfully request review and cancellation under 35 U.S.C. §311 of the Challenged Claims in view of:¹

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

Ground	Claims	Basis ²
1A	1-3	§103: <i>Doclo, Beasley</i>
1B	4-8	§103: <i>Doclo, Beasley, Goldstein</i>
1C	1-3	§103: <i>Doclo, Beasley, Darbut</i>
1D	4-8	§103: <i>Doclo, Beasley, Darbut, Goldstein</i>
2A	1-5, 8	§103: <i>Asada</i>
2B	4-7	§103: <i>Asada, Goldstein</i>
2C	1-5, 8	§103: <i>Asada, Usher</i>
2D	4-7	§103: <i>Asada, Usher, Goldstein</i>

As to Grounds 1A-1D, *Doclo, Beasley, Goldstein*, and *Darbut* predate the December 17, 2012 filing date of Provisional Application No. 61/737,932, which is the earliest priority date to which the Challenged Claims may be entitled.

Reference	Date	Pre-AIA Art ³ At Least Under
U.S. 2011/0026724 (“ <i>Doclo</i> ”)	02/03/2011 (published)	§102(b)
U.S. 2006/0153394 (“ <i>Beasley</i> ”)	07/13/2006 (published)	§102(b)
WO2009023633 (“ <i>Goldstein</i> ”)	02/19/2009 (published)	§102(b)

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

³ If the claims are not entitled to a priority date before March 16, 2013, all references would qualify as prior art under AIA §102(a)(1).

U.S. 2007/0014423 (“ <i>Darbut</i> ”)	01/18/2007 (published)	§102(b)
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As to Grounds 2A-2D, this Petition asserts that the Challenged Claims are entitled to a priority date no earlier than the filing date of the *'315pat.* on March 24, 2021. *See* §VII. *Asada*, *Usher*, and *Goldstein* each predate March 24, 2021.

Reference	Date	AIA Art At Least Under
U.S. 2018/0115818 (“ <i>Asada</i> ”)	04/26/2018 (published)	§102(a)(1)
U.S. 2014/0270200 (“ <i>Usher</i> ”)	09/18/2014 (published)	§102(a)(1)
WO2009023633 (“ <i>Goldstein</i> ”)	02/19/2009 (published)	§102(a)(1)

IV. LEVEL OF ORDINARY SKILL IN THE ART

A person of ordinary skill in the art at the time of the alleged invention of the *'315pat.* (POSITA) would have had a Bachelor’s of Science degree (or equivalent) in electrical engineering, computer science, or a similar field, and two years of experience in the design of digital audio systems and associated signal processing such as voice and/or speech processing and/or acoustic pattern recognition. *Polish* ¶19. The POSITA could have also obtained similar knowledge and experience through other means. *Id.* This is the appropriate level of skill whether the claims are entitled to priority as of December 17, 2012, or March 24, 2021. *Id.* ¶18.

V. CLAIM CONSTRUCTION

Petitioners are unaware of any “prior claim construction determination” related to the *'315pat.* See 37 C.F.R. §42.100(b).

A preamble may be limiting “if it recites essential structure or steps, or if it is ‘necessary to give life, meaning, and vitality’ to the claim.” *Arctic Cat Inc. v. GEP Power Prod., Inc.*, 919 F.3d 1320, 1327 (Fed. Cir. 2019) (citations omitted). Here, the preambles of the challenged claims are non-limiting. The bodies of the claims do not rely on the preambles for antecedent basis and the preambles were not relied upon to overcome the prior art during prosecution.

Even if the preambles are deemed limiting, the specification uses the term “earpiece” to encompass more than a *single* earpiece. *Polish* ¶38. For example, the specification states that “earbuds” and “headphones” are examples of “an earpiece.”⁴ *'315pat.*, 3:25-28 (“At least one exemplary embodiment is directed to ... a Personal Audio Assistant incorporated within *an earpiece (e.g., earbuds, headphones)*”); see also *id.*, 3:39-41. The *'315pat.*, in turn, defines “headphones” as “a pair of transducers.” *Id.*, 7:30-43. Thus, if treated as a limitation, a POSITA would have understood the claimed “earpiece” to encompass a left and/or right device. *Polish* ¶38.

⁴ All emphases/color/annotations added unless noted otherwise.

With the exception of determining whether the preamble is limiting, and if so, whether “earpiece” is limited to a single earpiece, Petitioners believe that no other constructions of the claims are necessary to assess whether the prior art reads on the Challenged Claims. Thus, the claims should be given their plain and ordinary meaning.⁵ *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc).

VI. OVERVIEW OF THE ’315PAT.

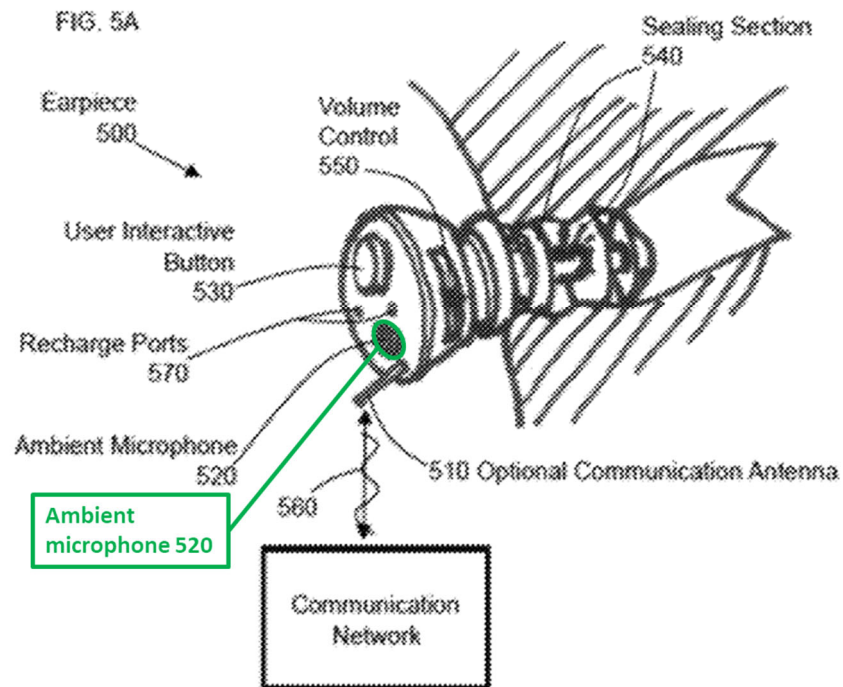
The ’315pat. specification can be considered in two parts. The title, abstract, “Field of the Invention,” column 18, line 28 to column 22, line 67, and Figures 7-22 generally relate to “methods and mechanisms for inflation” and “inflation of a balloon in a device that operates cooperatively with an accessory device.” ’315pat., Abstract, 1:21-25, 18:28-22:67, FIGs. 7-22.

A second part of the specification, including the “Background of the Invention” and column 3, line 25 to column 18, line 27, and Figures 1-6, relates to “a system for Personalized Services delivered to a Personal Audio Assistant incorporated within an earpiece (e.g., earbuds, headphones).” In this part, the

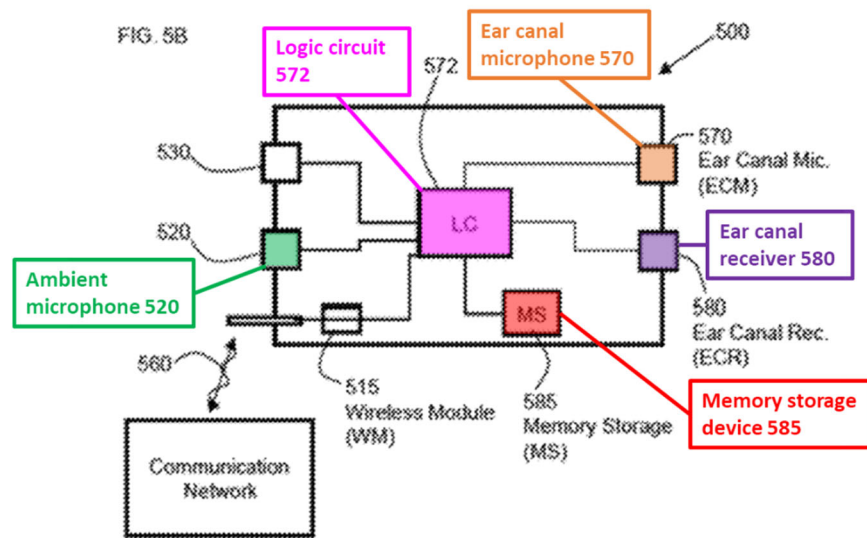
⁵ Petitioners reserve all rights to raise claim construction arguments and other arguments in any parallel or future litigation concerning the ’315pat. For example, comparing the claims to the accused products in the litigation may raise controversies that require construction of certain claim terms.

specification describes a “Personal Audio Assistant” that “mitigat[es] the need to carry a personal music player” and provides a subscription-based service for audio content. *Id.*, 3:39-48.

In Figures 5A and 5B, the specification describes “an earpiece.” ’315pat., 1:63-65. The earpiece includes a **logic circuit 572** operatively coupled to an **ambient microphone (AM) 520**, an **ear canal microphone (ECM) 590**, an **ear canal receiver (ECR) 580**, and a **memory storage device 585**. *Id.*, 10:15-18, 10:31-40.



’315pat., Figure 5A (annotated)



'315pat., Figure 5B (annotated)

From column 11, line 19 through column 18, line 27, the specification describes more than two dozen “exemplary embodiments.” In one paragraph, the '315pat. mentions an embodiment including mixing environmental audio input signals with audio playback. '315pat., 14:32-35. The '315pat. also notes that one embodiment can include “active noise reduction.” *Id.*, 14:43-49.

VII. THE CLAIMS OF THE '315PAT. ARE NOT ENTITLED TO A PRIORITY DATE EARLIER THAN MARCH 24, 2021

The Board can consider the Challenged Claims' priority date. *See Parus Holdings, Inc. v. Google LLC*, 70 F.4th 1365, 1374 (Fed. Cir. 2023). A priority claim to an earlier application is valid only if the earlier application, *inter alia*, provides adequate written description for the claims pursuant to §112. *See* 35 U.S.C. §120; *Anascape, Ltd. v. Nintendo of Am., Inc.*, 601 F.3d 1333, 1335 (Fed. Cir. 2010). “[T]he critical inquiry is whether the applicant has provided a description that in a

definite way identifies the claimed invention in sufficient detail that a person of ordinary skill would understand that the inventor was in possession of it at the time of filing.” *Alcon Rsch. Ltd. v. Barr Labs., Inc.*, 745 F.3d 1180, 1190-91 (Fed. Cir. 2014) (quotations omitted).

The ’315pat. issued from U.S. 17/211,814 (“’814App”) filed on March 24, 2021. The ’814App is a continuation of U.S. 16/266,829 (“’829App”), filed on February 4, 2019. As explained below, the ’829App does not describe certain limitations of at least claim 1 and claim 3, and the claims at best reflect a combination of elements that the specification never links together or explains with adequate disclosure. *Polish* ¶50. Therefore, independent claim 1 and each of the remaining Challenged Claims—which depend from claim 1 directly or indirectly—are entitled to a priority date no earlier than the date the ’814App was filed on March 24, 2021.

A. The ’829App Does Not Disclose “generating a noise reduction signal” Using Any Specific Microphone Signal or Combination of Microphone Signals (Claim 1)

Limitation [1.6.1] requires “generating a noise reduction signal using at least one of the first microphone signal or the second microphone signal or the third microphone signal or a combination of microphone signals.” A POSITA would have understood that a noise reduction signal is a signal that, when mixed with a noisy signal, reduces noise. *Polish* ¶51. The claim requires generating a noise reduction signal using specific microphone signals. *Id.*

At best the '829App includes passing references to noise-cancellation or “active noise reduction”:

At least one exemplary embodiment can include ***active noise reduction***, echo cancellation and signal conditioning that can be environmentally customized through the registration process to better meet the user’s specific needs (i.e., occupation-related noise cancellation); A typical application would be a special set of noise cancellation parameters tuned to the drilling equipment used by a dentist.

'829App ¶[0113]; *see also id.* ¶[0128] (describing an embodiment with a “Walkie-Talkie mode” and a related “noise-cancellation system”). Beyond this cursory identification, the '829App does not explain any of the details related to implementing active noise reduction or noise reduction, including “generating a noise reduction signal using at least one of the first microphone signal or the second microphone signal or the third microphone signal or a combination of microphone signals.” *Polish* ¶¶52-53.

Accordingly, a POSITA would not have understood the '829App to disclose, expressly or inherently, generating a noise reduction signal using at least one of the first microphone signal or the second microphone signal or the third microphone signal or a combination of microphone signals. *Id.* ¶54.

B. The '829App Does Not Disclose “generating a mixed audio signal by mixing the noise reduction signal with the audio signal” (Claim 1)

The '829App does not disclose generating a noise reduction signal as claimed. *See* §VII.A. As a result, the '829App also does not disclose mixing a noise reduction signal with an audio signal and provides no support for this limitation. *Polish* ¶55. At best the '829App discloses mixing environmental audio with an audio signal—***not mixing a noise reduction signal with an audio signal*** as claimed. *See, e.g.:*

[0047] At least one exemplary embodiment includes input Acoustic Transducers (microphones) for capturing user's speech as well as Environmental Audio. In further embodiments, stereo input Acoustic Transducers ***capture Environmental Audio, and, mixing it with the audio signal path, present the ambient sound field to the user,*** mitigating the need to remove the Headphone apparatus for normal conversation.

'829App ¶[0047];

[0111] In at least one exemplary embodiment, the ***stereo input Acoustic Transducers are ultimately connected to the audio signal path at the DSP, allowing the user to audition Environmental Audio (e.g., speech or music)*** and mitigating the need for the user to remove the Headphone apparatus to audition Environmental Audio....

Id. ¶[0111];

[0112] At least one exemplary embodiment includes a system for *first attenuating Audio Playback and then mixing the Environmental Audio input signals*, at a louder listening level, with the audio signal path using the DSP, where the system is activated by any combination of the following methods: a manual switch to activate/deactivate the system;

Id. ¶[0112].

Accordingly, a POSITA would not have understood the '829App to disclose, expressly or inherently, generating a mixed audio signal by mixing a noise reduction signal with an audio signal. *Polish* ¶56.

C. The '829App Does Not Disclose “sending a modified audio signal to the speaker, where the modified audio signal includes the mixed audio signal” (Claim 1)

Claim 1 requires “sending a modified audio signal to the speaker, where the modified audio signal includes the mixed audio signal.” The plain language of this claim requires a “modified audio signal” that may be different from the “mixed audio signal.” As discussed above, the '829App does not disclose generating the claimed “mixed audio signal.” *See* §VII.B. Nor does the '829App disclose any down-stream modifications or processing of any conceivable “mixed signal” so as to generate a “modified audio signal” that “includes the mixed audio signal.” *Polish* ¶57. Accordingly, a POSITA would not have understood the '829App to disclose,

expressly or inherently, sending a modified audio signal to the speaker, where the modified audio signal includes the mixed audio signal. *Id.* ¶58.

D. The '829App Does Not Disclose “generating the modified audio signal by mixing the ambient sound signal with the mixed audio signal” (Claim 3)

Dependent claim 3 requires “generating the modified audio signal by mixing the ambient sound signal with the mixed audio signal.” Claim 3 depends from claim 2, which requires “generating an ambient sound signal.” The plain language of claim 3 requires mixing that “ambient sound signal” with the “mixed audio signal,” and a POSITA would have understood this limitation to require a downstream modification of the mixed audio signal; that is, to generate the mixed audio signal in a first stage (or step) and then in a subsequent, second stage, mix the “ambient sound signal” with “the mixed audio signal.” This flows from the requirement that the ambient sound signal is mixed with a “mixed audio signal,” i.e., a signal that has already been mixed. This is to be contrasted with a system in which the audio signal, noise reduction signal, and ambient sound signal are mixed in a single stage. *Polish* ¶56.

As discussed in §§VII.A and VII.B, the '829App does not disclose either of the predicate steps of generating the claimed noise reduction signal or generating the claimed mixed signal. And as discussed in §VII.D, the '829App does not disclose any modification to the mixed audio signal, let alone the specific addition of an

ambient sound signal with the mixed audio signal as required by claim 3. Thus, a POSITA would not have understood the '829App to disclose the two-stage mixing required by claim 3. *Id.* ¶60.

VIII. DETAILED EXPLANATION OF GROUNDS

A. Ground 1A: *Doclo* and *Beasley* Render Obvious Claims 1-3

1. Overview of the *Doclo-Beasley* combination

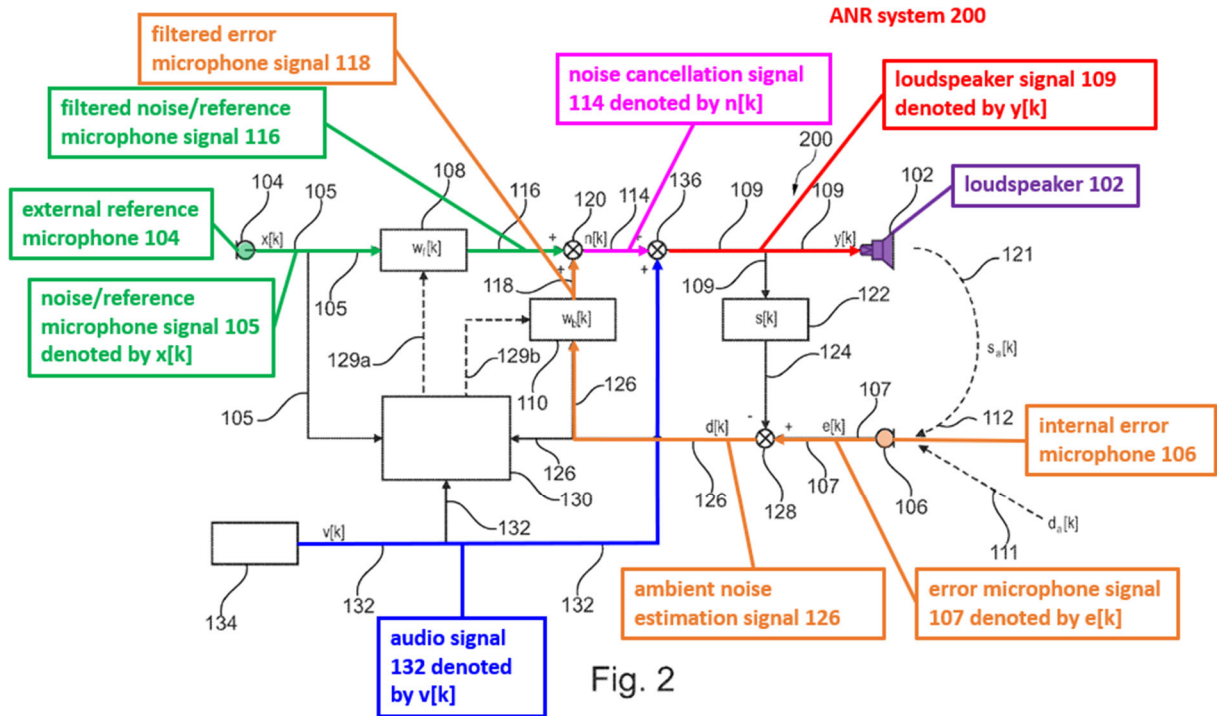
a. Overview of *Doclo*

Doclo is titled “Active noise reduction method using perceptual masking.” *Doclo*, Cover. *Doclo* discloses a system in which a noise-cancellation signal is generated based on both an incoming audio signal and ambient noise signal and takes into account the fact that the audio signal will at least partially mask the noise signal without any noise-cancellation, so that “noise reduction (or noise cancellation) may be focused in frequency regions where the noise is not masked by the audio signal,” and “[i]n this way, noise reduction efficiency may be improved.” *Doclo* ¶[0010].

Doclo discloses various embodiments of its active noise-reduction system (ANR system). *Doclo* does not repeat the description of each component common to each embodiment. *Id.* ¶¶[0055], [0060]. This petition focuses on the ANR system of Figure 2, but cites to descriptions of those same components disclosed in connection with other embodiments because a POSITA would have understood

those descriptions to apply, or at least be obvious to apply, to the embodiment of Figure 2. *Polish* ¶63.

Doclo discloses a block diagram of a combined feedforward-feedback ANR system. *Doclo* ¶¶[0056], [0060]. With reference to Figure 1, *Doclo* discloses that the ANR system includes an audio source 134, a loudspeaker 102, and a noise cancellation signal generator (which comprises the remaining elements in the figure). *Doclo* ¶[0059]. *Doclo* discloses that the remaining elements include at least one external reference microphone 104, internal error microphone 106, and filters 108 and 118. *Doclo* ¶¶[0056]-[0058]. The filters generate a filtered noise signal 116 and a filtered error signal 118, respectively, which are summed together by summing unit 120 to yield a noise-cancellation signal $n[k]$ 114. *Id.* ¶[0057]. The noise-cancellation signal 114 is summed with an incoming audio signal at 136, yielding a loudspeaker signal 109. *Id.* ¶[0058].



Doclo, FIG. 2 (annotated)

Doclo discloses that its ANR system may be applied to hearing aids. *Doclo* ¶[0124]. Indeed, it was known by the earliest alleged priority date to implement active noise-cancelling in hearing aids. *Polish* ¶66 (citing *Olsen* ¶[0013]).⁶ A POSITA would have understood that a hearing aid that applies active noise-cancelling, as taught by *Doclo*, would require a technique for providing ambient

⁶ To the extent that EX1016-1034 are cited in this Petition, it is merely to demonstrate a POSITA's knowledge and/or as evidence that a POSITA would have been motivated to make the combinations in the manner discussed in this Petition. These exhibits are not part of the unpatentability grounds.

sound to the user because that is part of the main function of a hearing aid. *Polish* ¶67. A POSITA also would have been aware that, although active noise-cancelling has certain benefits, it also has drawbacks in certain environments by making it harder for the user to be aware of dangerous events in the environment. *Id.* ¶68 (citing *Melanson*, 1:28-41, 1:58-2:2). Thus, a POSITA would have been motivated to consider ways to implement *Doclo*'s ANR system in a hearing aid that did not frustrate the main function of the hearing aid and balanced the benefits of active noise-cancelling with its drawbacks. *Id.* ¶69. As discussed further below, *Beasley* discloses one example of a technique for providing a user with ambient sound and noise-cancellation. *Id.*

b. Overview of *Beasley*

Beasley discloses improving active noise-reducing headsets by providing an ambient sound passthrough feature. *Beasley* ¶[0006]-[0014]. More particularly, *Beasley* discloses an “audio bypass module 306 ... implemented to allow background sounds originating outside the headset to more readily be heard by the user of an audio headset.” *Id.* ¶[0033]. *Beasley* discloses implementing its solution in “headset applications where it may be useful or desirable for a user to allow outside audio information such as, for example, a conversation to pass through the headset so this information can be heard by the user.” *Id.* ¶[0027]. And it may be

“implemented utilizing hardware, firmware, software, or a combination thereof, as may be desirable based on the given application.” *Id.* ¶[0033].

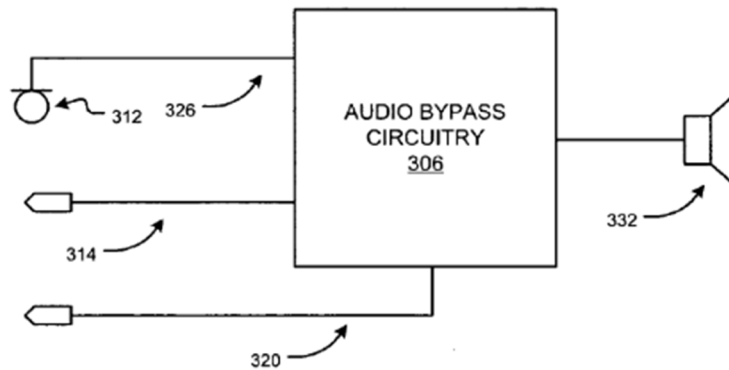


Fig. 3

Beasley, FIG. 3

With reference to Figure 9, *Beasley* discloses a **bypass module 306** with **amplifiers** that variably adjust the gain of a **noise-cancellation signal 728**, a **background audio signal 726**, and an **audio signal 314**. The signals are then mixed in **summer 730** and amplified by **driver/amplifier 732** to generate a **signal** that is provided to the **speaker 332**. *Id.* ¶[0053]. The output of **summer 730** is variably amplified by **driver/amplifier 732** prior to output from the **speaker 332**. *Id.* ¶[0051].

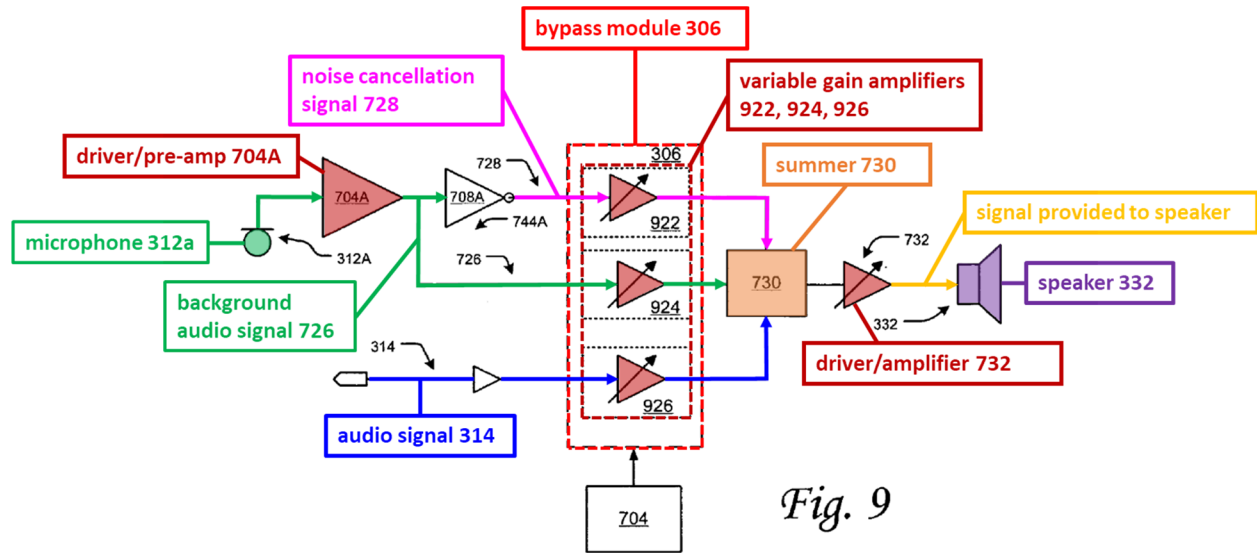


Fig. 9

Beasley, Fig. 9 (annotated)

“[W]hen the audio bypass mode is initiated, the gain of variable gain amplifiers 922 and 926 is attenuated such that noise cancellation signal 728 and audio signal 314 are attenuated and the gain of variable gain amplifier 924 is increased such that the background audio signal 726 is amplified and readily heard by the user through speaker 332.” *Id.* ¶[0053]. “Conversely, when the bypass mode is terminated, the gain of variable gain amplifier 924 is turned down such that the background audio signal 726 is no longer amplified (or is attenuated to some extent). Additionally, the gain of variable gain amplifier 926 is increased such that audio signal 314 is amplified and can be readily heard by the user via speaker 332.” *Id.* ¶[0053].

c. Motivation to combine *Doclo* and *Beasley*

A POSITA would have been motivated to apply *Beasley*'s teachings to *Doclo*'s ANR system applied to a hearing aid and would have had a reasonable expectation of success in doing so. *Polish* ¶73. *Doclo* and *Beasley* are analogous to the '315pat. because they are within the same field of endeavor of the '315pat. and/or reasonably pertinent to one or more problems addressed by the '315pat. *Id.*

As noted in §VIII.A.1.a, a POSITA would have been motivated to consider ways to implement *Doclo*'s ANR system in a hearing aid that did not frustrate the main function of the hearing aid and balanced the benefits of active noise-cancelling with its drawbacks. *Beasley* provides a system that attenuates unwanted ambient sound through noise-cancellation, but allows desired sounds—such as speech—to passthrough, allowing a user to hear desired sounds while attenuating unwanted sound. *Beasley*, ¶[0039]. A POSITA would have considered modifying *Doclo*'s hearing aid ANR system to implement *Beasley*'s teachings related to providing a bypass background audio signal and variable amplification to amount to the use of a known technique (*Beasley*'s audio bypass and variable amplification) to improve similar devices (*Doclo*'s ANR hearing aids) in the same way (to provide the user with the ability to hear the ambient environment with a noise-cancelling headset). *Polish* ¶74.

A POSITA also would have been motivated to implement *Beasley*'s teaching related to providing variable amplification of the output of *Beasley*'s summer. *Polish* ¶75. A POSITA would have understood that *Beasley*'s driver/amplifier 732 allows control of the output volume of the summed (i.e., mixed) signal. *Id.* A POSITA would have recognized that providing variable amplification of the output signal is a common feature of audio systems because it provides users control over the volume of audio output. *Id.* (citing *Arndt*, 1:13-23, *Boersma* ¶[0063]). Thus, a POSITA would have considered further modifying the *Doclo-Beasley* combination to include variable amplification of the mixed signal to amount to applying a known technique (variable amplification a signal prior to output) to a known device (the *Doclo-Beasley* combination) ready for improvement to yield predictable results (the *Doclo-Beasley* combination with variable amplification of the mixed signal prior to output). *Id.* ¶[0076].

2. Claim 1

a. [1.pre]: An earpiece comprising:

As discussed in §V, the preamble is non-limiting. Even if the preamble is limiting, the '315pat. uses the term "earpiece" to encompass a left and/or right earpiece, and *Doclo* discloses or suggests this feature. *Polish* ¶¶77-82.

Doclo discloses that its ANR system may be applied in, for example, hearing aids. *Id.* ¶¶[0124] ("[T]he herein disclosed subject matter can be *used e.g. in any*

ANR application (e.g. ... *hearing aids*) ...”); *see also id.* ¶[0099] (“*ANR can be beneficial for* several applications, such as ... *hearing instruments.*”).

A POSITA would have understood that hearing aids typically include a left and/or right earpiece in various form factors and include a processor and microphones. *Polish* ¶80 (citing *Fischer* ¶[0004]; *Niederdrank* ¶¶[0002], [0005], Figure). Thus, *Doclo*’s disclosure of applying its teachings in a “hearing aids” application discloses or suggests applying *Doclo*’s ANR system within an “earpiece.” *Id.* ¶81.

Accordingly, if the Board finds that the preamble is limiting, a POSITA would have understood *Doclo* to disclose or suggest hearing aids (“An earpiece”). *Id.* ¶82.

b. [1.1]: a first ambient microphone configured to generate a first microphone signal;

Doclo discloses or suggests this feature. *Polish* ¶¶83-87.

Doclo discloses in Figure 2 an **external reference microphone 104**, which produces a **noise signal/reference signal 105 denoted by x[k]** indicative of ambient noise 111. *Doclo* ¶¶[0056] (“The ANR system 100 consists of ... *an external reference microphone 104* ...”), [0059],[0102]-[0103], [0129], [0130]; *Polish* ¶84. The external reference microphone is “mounted outside the headset.” *Doclo* ¶[0100]; *see also id.* ¶[0022] (“For example, the reference microphone may be provided *on the outside of*, i.e. external to, a headset.”); *Polish* ¶85. This is consistent with how

the '315*pat.* describes an “ambient microphone.” '315*pat.*, 10:27-34, FIG. 5B;
Polish ¶86.

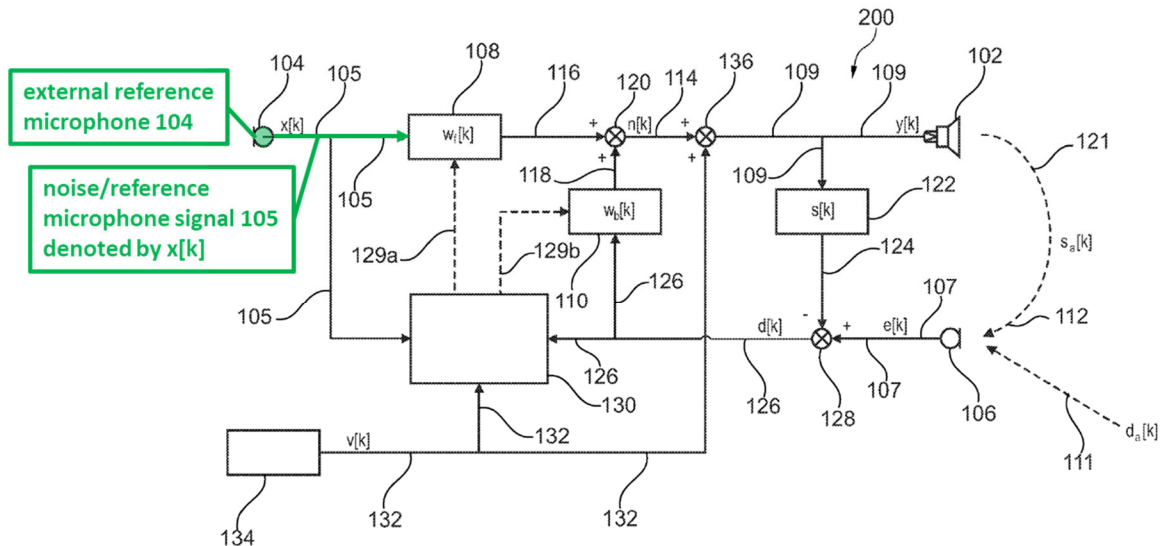


Fig. 2

Doclo, Figure 2.

Accordingly, a POSITA would have understood *Doclo* to disclose or suggest an external reference microphone (“first ambient microphone”), which is configured to generate a noise/reference microphone signal that is indicative of ambient noise (“configured to generate a first microphone signal”). *Polish* ¶87.

c. [1.2]: a second ambient microphone configured to generate a second microphone signal;

Doclo discloses or suggests this feature. *Polish* ¶¶88-93. *Doclo* discloses that its system includes reference microphone 104 and that the disclosure may be generalized for “multiple” reference microphones that produce “reference microphone signal(s).” *Doclo* ¶¶[0056] (“[T]he proposed method can be easily

generalized for ... *multiple reference ... microphones.*”), [0100]; *see also id.* ¶¶[0102], [0103]. As noted in §VIII.A.1.a, *Doclo* explains that Figure 2 includes “similar or identical elements” to Figure 1, including reference microphone 104, and that the description of common elements is not repeated for Figure 2, so a POSITA would have understood that *Doclo*’s disclosure of “multiple reference microphones” applies to the embodiment of Figure 2. *Polish* ¶90.

A POSITA would have understood *Doclo*’s “multiple microphones” disclosure to disclose or suggest a second reference microphone that generates a second signal that is indicative of ambient noise. *Polish* ¶91. Moreover, a POSITA would have understood this disclosure applies equally to *Doclo*’s hearing aid application. *Id.*; *see also id.*, *Doclo* ¶[0099], [0124].

As noted in §VIII.A.2.b, *Doclo*’s description of the “external reference microphone” is consistent with how the ’315*pat.* describes an “ambient microphone.”

Accordingly, a POSITA would have understood *Doclo* to disclose or suggest a second reference microphone (“second ambient microphone”) that is configured to generate a second reference microphone signal that is indicative of ambient noise (“configured to generate a second microphone signal”). *Polish* ¶93.

d. [1.3]: an ear canal microphone configured to generate a third microphone signal;

Doclo discloses or suggests this feature. *Polish* ¶¶94-101. *Doclo* discloses **internal error microphone 106** in Figure 2 that generates an **error microphone signal 107 denoted by $e[k]$** .

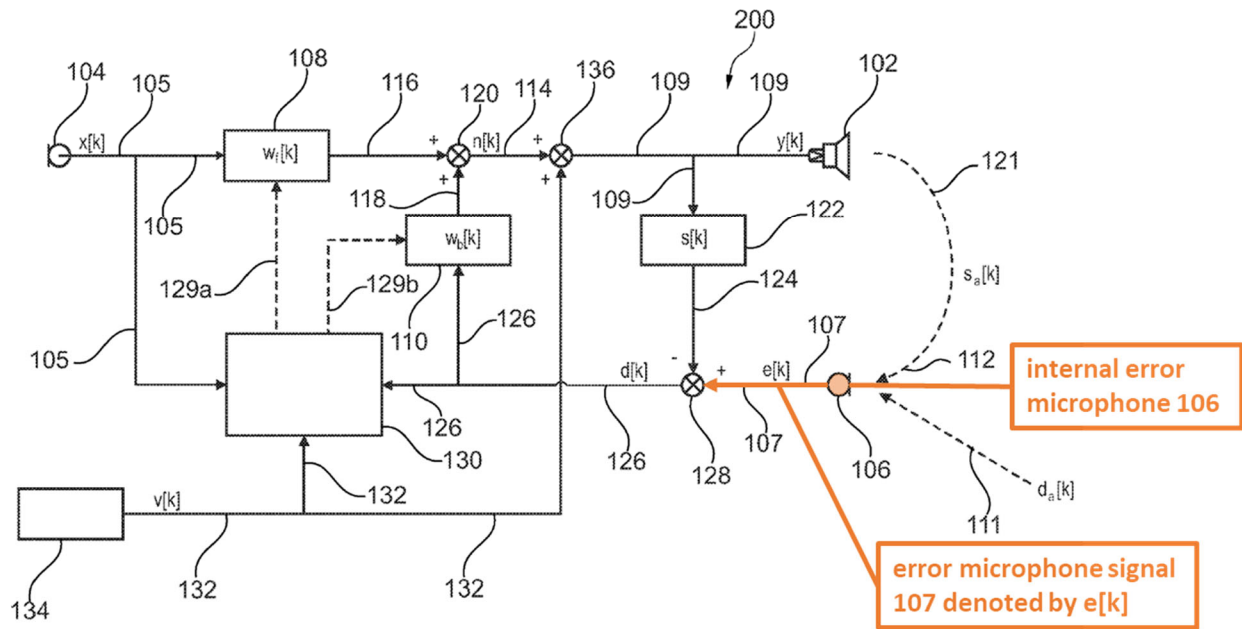


Fig. 2

Doclo, Figure 2 (annotated)

Doclo discloses that its system may be implemented in hearing aids. *Doclo* ¶¶[0099], [0124]. Further, *Doclo* discloses that the **internal error microphone 106** may be placed internal to the device in which the ANR system is implemented (e.g., a hearing aid), receives a sound identical or close to the sound received by the user's ear (i.e., ambient noise and the audio signal played by the loudspeaker), and generates an **error microphone signal 107 denoted by $e[k]$** . *Doclo* ¶¶[0023]

(“[T]he **error microphone** may be placed such that the sound which is received by the error microphone is **identical or close to the sound which is received by a user’s ear**. Hence, the error microphone receives the ambient noise as well as the sound corresponding to the audio signal.”), [0056], [0059], [0102]-[0104], [0131]-[0132].

A POSITA would have understood hearing aids include a speaker for emitting sound into the user’s ear canal. *Polish* ¶97. As noted above, *Doclo*’s “**error microphone** may be placed such that the sound which is received by the **error microphone** is **identical or close to the sound which is received by a user’s ear**.” *Doclo* ¶[0023]. A POSITA would have therefore understood that to implement *Doclo*’s internal **error microphone 106** in a hearing aid, the microphone would be in the ear canal to pick up the output of the speaker and any residual noise. At a minimum, a POSITA would have considered it obvious to place the error microphone in the ear canal in a hearing aid application because placing it there would allow the error microphone to effectively perform *Doclo*’s desired function. *Polish* ¶98. Indeed, it was known to implement hearing aids with an ear canal microphone. *Polish* ¶99 (citing *Olsen* ¶[0013], FIG. 2; *Armstrong* ¶[0011], FIG. 1).

Accordingly, a POSITA would have understood *Doclo* to disclose or suggest an error microphone in the ear canal (“ear canal microphone”), which is configured to generate a microphone signal that is indicative of ambient noise and the audio

signal played by the loudspeaker (“configured to generate a third microphone signal”). *Polish* ¶101.

e. [1.4]: a speaker;

Doclo discloses or suggests this feature. *Polish* ¶¶102-105. *Doclo* discloses **loudspeaker 102** in Figure 2.

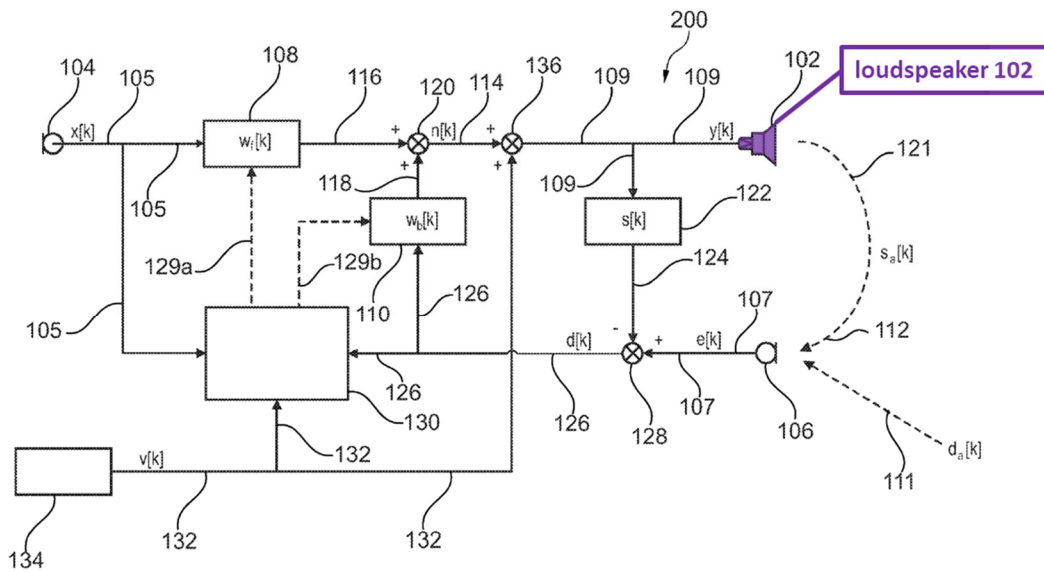


Fig. 2

Doclo, Figure 2 (annotated)

Doclo further discloses that the **loudspeaker 102** is a component of the ANR system in a hearing aid implementation. *Doclo* ¶[0124]; *see also id.* ¶¶[0029], [0056]-[0057], [0059]-[0060], [0100]-[0102], [0105], [0127].

Accordingly, a POSITA would have understood *Doclo* to disclose or suggest a loudspeaker (“a speaker”). *Polish* ¶105.

- f. [1.5]: a memory that stores instructions; [1.6]: a logic circuit, where the logic circuit is configured to execute the instructions to perform operations comprising:**

Doclo discloses or suggests these features. *Polish* ¶¶106-111. *Doclo* discloses a “computer program” which *Doclo* explains is equivalent to “a computer readable medium containing instructions for controlling a computer system to coordinate the performance of the ... method/functionality of components/units” of *Doclo*’s disclosure. *Doclo* ¶[0037]. *Doclo* discloses that the computer program is stored in the computer readable medium and further discloses implementing the computer readable medium as a memory. *Id.* ¶[0038] (“The computer program ... may be stored on a computer-readable medium (removable disk, *volatile or non-volatile memory*, embedded *memory*/processor, etc.)”).

Doclo further discloses that the computer program is executed by a processor for performing the method and functionality of the noise-cancellation signal generator its components. *Id.* ¶¶[0035] (“the computer program, when being executed by a data processor, is adapted for controlling the method”), [0036] (“the computer program, when executed by a data processor, is adapted for providing the functionality of the cancellation signal generator” and “the functionality of one or more of the units of the cancellation signal generator”); *see also id.* ¶¶[0096], [0039]; *Polish* ¶108.

A POSITA would have understood a processor is consistent with how the '315pat. describes a “logic circuit.” '315pat., 9:47-67; *Polish* ¶109.

Because *Doclo* discloses a computer program executed by a processor to coordinate the performance of its disclosed method and the functionality of the noise-cancellation signal generator, a POSITA would have understood *Doclo* to disclose or suggest the processor executing instructions to perform the claimed operations discussed below. *Polish* ¶110.

Accordingly, a POSITA would have understood *Doclo* to disclose or suggest a computer program stored as instructions in a computer readable medium such as a memory (“a memory that stores instructions”) and a processor (“logic circuit”) that executes the instructions of the computer program to perform the claimed operations discussed below (“where the logic circuit is configured to execute the instructions to perform operations comprising:”). *Id.* ¶111.

g. [1.6.1]: generating a noise-reduction signal using at least one of the first microphone signal or the second microphone signal or the third microphone signal or a combination of microphone signals;

Doclo discloses or suggests this feature. *Polish* ¶¶112-115.

As described with respect to [1.1] (*see* §VIII.A.2.b), *Doclo* discloses a noise/reference microphone signal 105 denoted by $x[k]$ indicative of ambient noise 111 that is a “first microphone signal.” As described with respect to [1.3] (*see*

§VIII.A.2.d), *Doclo* discloses an error microphone signal 107 denoted by $e[k]$ indicative of the sound received in the ear canal that is a “third microphone signal.” As detailed below, with reference to Figure 2, *Doclo* discloses generating noise-cancellation signal 114 denoted by $n[k]$ using $x[k]$ (“first microphone signal”) and $e[k]$ (“third microphone signal”).

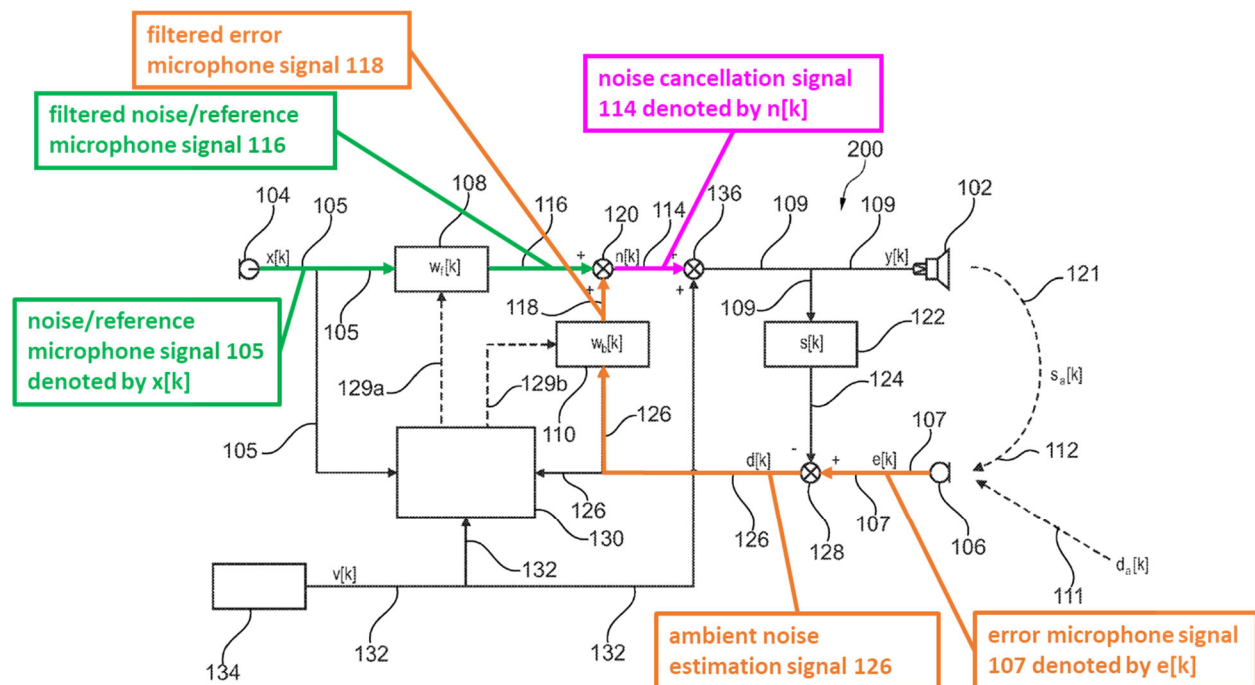


Fig. 2

Doclo, Figure 2 (annotated)

As to the “first microphone signal,” *Doclo* discloses that a feedforward filter 108 generates a filtered reference microphone signal 116 from the first microphone signal, and the filtered reference microphone signal 116 is input to summing unit 120. As to the “third microphone signal,” *Doclo* discloses that feedback filter 110 generates a filtered error microphone signal 118 from $e[k]$ 107 (“the third

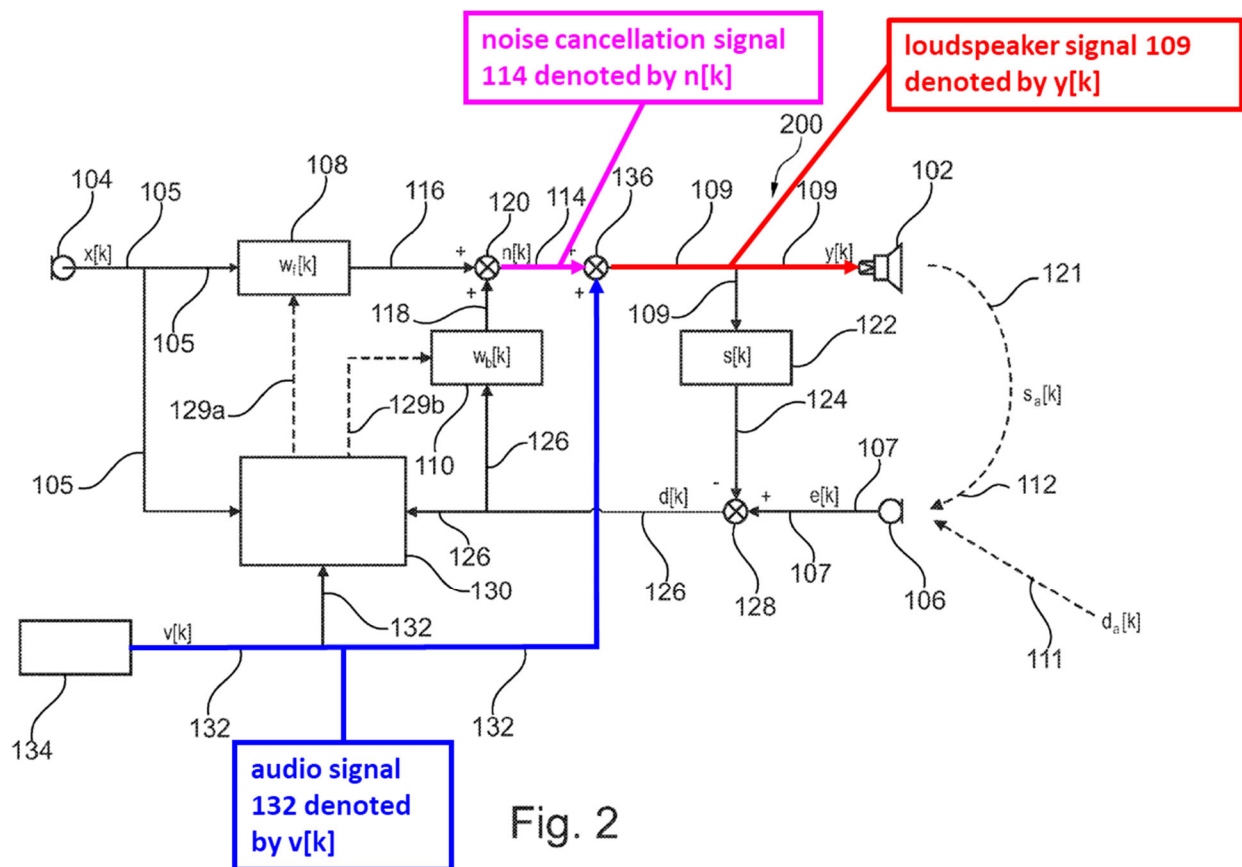
microphone signal”), and the filtered error microphone signal 118 is another input to summing unit 120. The output of summing unit 120 is noise-cancellation signal 114 denoted by $n[k]$. *Doclo* ¶[0057]. Because the noise-cancellation signal 114 is derived from filtered versions of the noise/reference microphone signal 105 and the error microphone signal 107, the noise-cancellation signal 114 is generated “using” the microphone signals 105 and 107. *Polish* ¶114.

Accordingly, a POSITA would have understood *Doclo* to disclose or suggest a processor (“logic circuit”) that executes computer program instructions to perform operations including generating a noise-cancellation signal (“generating a noise reduction signal”) using a noise/reference microphone signal (“using at least one of the first microphone signal”) and the error microphone signal (“using at least one of ... the third microphone signal”). *Id.* ¶115.

h. [1.6.2]: receiving an audio signal;

Doclo discloses or suggests this feature. *Polish* ¶¶116-118. *Doclo* discloses that its ANR system receives audio signal 132 denoted by $v[k]$ from audio source 134. *Doclo* ¶¶[0059] (“[T]he cancellation signal generator 101 has a first input 103a for receiving the audio signal 132 to be played”), [0102], [0106], [0149]. *Doclo* further discloses that the audio signal may comprise music or voice communication. *Id.* ¶[0062]; *Polish* ¶117.

¶[0058] (“Summing the outputs of these filters, which correspond to filtered noise[-]related signals 116 and 118 determine the noise cancellation signal 114 which is added to the audio signal 132 at a summing unit 136, thereby yielding the loudspeaker signal 109.”). A POSITA would have understood that *Doclo*’s “summing” is a mixing operation, at least because *Doclo* uses “summing” and “combining” interchangeably (*Doclo* ¶[0013]), and because a POSITA would have understood that summing or combining signals is how signals are “mixed” together. *Polish* ¶120.



Doclo, Figure 2 (annotated)

Accordingly, a POSITA would have understood *Doclo* to disclose or suggest a processor (“logic circuit”) that executes computer program instructions to perform operations including generating a loudspeaker signal (“generating a mixed audio signal”) by summing a noise-cancellation signal with an audio signal (“by mixing the noise reduction signal with the audio signal”). *Polish* ¶121.

j. [1.6.4]: sending a modified audio signal to the speaker, where the modified audio signal includes the mixed audio signal.

Doclo in view of *Beasley* discloses or suggests this feature. *Polish* ¶¶122-125. As detailed in §VIII.A.1.c, a POSITA would have found it obvious to modify *Doclo*’s hearing aid ANR system to incorporate *Beasley*’s teaching related to providing variable amplification of the mixed signal output.

As discussed in §VIII.A.2.i, *Doclo* discloses or suggests generating a loudspeaker signal (“generating a mixed audio signal”) by summing a noise-cancellation signal with an audio signal (“by mixing the noise reduction signal with the audio signal”). The *Doclo-Beasley* combination, therefore, discloses or suggests that the loudspeaker signal is variably amplified before being output from the speaker. A POSITA would have recognized that variably amplifying the loudspeaker signal modifies the signal. *Polish* ¶124.

Accordingly, a POSITA would have understood the *Doclo-Beasley* combination to disclose or suggest a processor (“logic circuit”) that executes

computer program instructions to perform operations including sending a variably amplified loudspeaker signal to a loudspeaker (“sending a modified audio signal to the speaker”), wherein the loudspeaker signal comprises an audio signal (“where the modified audio signal includes the mixed audio signal”). *Id.* ¶125.

3. Claim 2: The earpiece according to claim 1, wherein the operations further comprise: generating an ambient sound signal using at least one of the first microphone signal or the second microphone signal or a combination of both.

Doclo in combination with *Beasley* discloses or suggests this claim. *Polish* ¶¶126-130. As explained in §VIII.A.1.c, a POSITA would have found it obvious to modify *Doclo*’s hearing aid ANR system to incorporate *Beasley*’s teachings related to providing a bypass background audio signal.

As discussed in §VIII.A.2.b, *Doclo* discloses or suggests an external reference microphone (“first ambient microphone”) configured to generate a noise/reference microphone signal that is indicative of ambient noise (“configured to generate a first microphone signal”).

A POSITA would have understood that in the *Doclo-Beasley* combination, the *Beasley* bypass background audio signal is implemented by variably amplifying a signal from one of *Doclo*’s reference microphone signals before being mixed at summing unit 136. *Polish* ¶129. A POSITA would have understood that the variably amplified bypass background audio signal constitutes an “ambient sound signal”

within the context of the '315*pat. Id.* To note, neither the claims nor the specification limit or otherwise specify a particular method for “generating” an ambient sound signal; all that is required is “using” one of the claimed microphone signals. *Id.*

Accordingly, a POSITA would have understood the *Doclo-Beasley* combination to disclose or suggest a processor (“logic circuit”) that executes computer program instructions to perform operations including generating a variably amplified version of a bypass reference microphone signal (“generating an ambient sound signal using at least one of ... the first microphone signal”). *Id.* ¶130.

4. Claim 3: The earpiece according to claim 2, wherein the operations further comprise: generating the modified audio signal by mixing the ambient sound signal with the mixed audio signal.

The *Doclo-Beasley* combination discloses or suggests this claim. *Polish* ¶¶131-141. As detailed in §VIII.A.1.c, a POSITA would have found it obvious to modify *Doclo*’s hearing aid ANR system to incorporate *Beasley*’s teachings related to providing a bypass background audio signal.

The combination discloses or suggests mixing the variably amplified bypass background audio signal (“ambient sound signal”) at *Doclo*’s summing unit 136. *Polish* ¶133. When audio bypass mode is off, *Doclo*’s audio signal and *Doclo*’s noise-cancellation signal are mixed and then the mixed signal is variably amplified prior to being output from the speaker. When audio bypass mode is initiated, the

respective gains of *Doclo*'s audio signal and noise-cancellation signal are attenuated, and the gain of *Doclo*'s bypass reference microphone signal is amplified; then all three signals are mixed and amplified prior to being output. As explained in §VIII.A.2.j, the variably amplified loudspeaker signal is a “modified audio signal,” as claimed.

As discussed in §VII.D, a POSITA would have understood this claim to require mixing the “ambient sound signal” with the “mixed audio signal” in a downstream modification of the mixed audio signal; that is, to generate the “mixed audio signal” in a first stage (or step) and then in a subsequent, second stage, mix the “ambient sound signal” with “the mixed audio signal.” The *Doclo-Beasley* combination renders obvious this two-step mixing process in view of the knowledge of a POSITA. *Polish* ¶134.

Beasley does not disclose how its summer 730 performs the summation of three signals, instead illustrating a black box. A POSITA would have understood that first generating a “mixed audio signal” by mixing a noise-cancellation signal and an audio signal as disclosed in *Doclo* and then mixing the resulting “mixed audio signal” with an “ambient sound signal” would have amounted to choosing from a finite number of predictable solutions, with a reasonable expectation of success. *Polish* ¶135. In particular, a POSITA would have recognized that when processors mix signals, they mix two signals at a time. *Id.* ¶136. This is because processors have

an arithmetic logic unit (ALU)—the component of a processor that performs arithmetic operations such as addition—which performs operations on two operands at a time. *Id.* (citing *Lee*, 1:12-20 (“In general, single processor systems sequentially perform operations on two operands.”); *Muthusamy*, 1:59-2:26).

Thus, a POSITA would have recognized that there are three potential implementations of the summing unit in the *Doclo-Beasley* combination: (1) mixing the noise-cancellation and audio signals followed by mixing the bypass background audio signal, (2) mixing the bypass background audio signal and audio signal first, followed by mixing the noise-cancellation signal, and (3) mixing the noise-cancellation and bypass background audio signals first, followed by mixing the audio signal. *Id.* ¶137.

A POSITA reviewing the disclosures of *Doclo* and *Beasley* would have recognized that each of these approaches is a design choice that would have the same predictable result—i.e., a “modified audio signal” that includes a mix of the noise-cancellation signal, background audio, and the audio signal and desirably provides ambient sound passthrough. *Polish* ¶138. Indeed, *Beasley* expressly contemplates that “alternative configurations” may be used. *Beasley* ¶[0064]. Further, a POSITA would have had a reasonable expectation of success in mixing the noise-reduction signal with the audio signal and then mixing the resulting signal with an ambient

sound signal because this would involve performing conventional operations (amplifying and mixing signals) that were well known to a POSITA. *Polish* ¶138.

At the very least, a POSITA would have recognized that Beasley does not specify how to add the three signals, and adding the noise reduction signal and audio signal first and then adding the ambient sound signal to the result was a known technique applicable to the summation in *Beasley*, with predictable results. *Id.*

Thus, the *Doclo-Beasley* combination discloses or suggests applying *Beasley*'s teachings related to its bypass background audio signal to *Doclo*'s ANR system by mixing a variably amplified version of the bypass reference microphone signal ("ambient sound signal") with the summed noise-cancellation and audio signal ("mixed audio signal") and then variably amplifying the resulting mixed signal prior to being output from the speaker (a "modified audio signal"). *Id.* ¶139.

Accordingly, a POSITA would have understood the *Doclo-Beasley* combination to disclose or suggest a processor ("logic circuit") that executes computer program instructions to perform operations including generating a "modified audio signal" ("generating the modified audio signal") by mixing ("by mixing") a variably amplified version of a bypass background audio signal from a reference microphone ("the ambient sound signal") with a previously-generated loudspeaker signal ("with the mixed audio signal"). *Id.* ¶140.

Alternatively, to the extent Patent Owner (PO) argues that claim 3 allows single step mixing, the *Doclo-Beasley* combination renders this limitation obvious because it discloses or suggests entering audio bypass mode and mixing all three signals at summing unit 136. *Id.* ¶141. More particularly, the combination discloses or suggests that when audio bypass mode is off, the loudspeaker signal is a mix of the noise-cancellation signal and the audio signal; and when audio bypass mode is initiated, the variably amplified bypass background audio signal from a reference microphone (“ambient sound signal”) is mixed with the noise-cancellation signal and audio signal. *Id.*

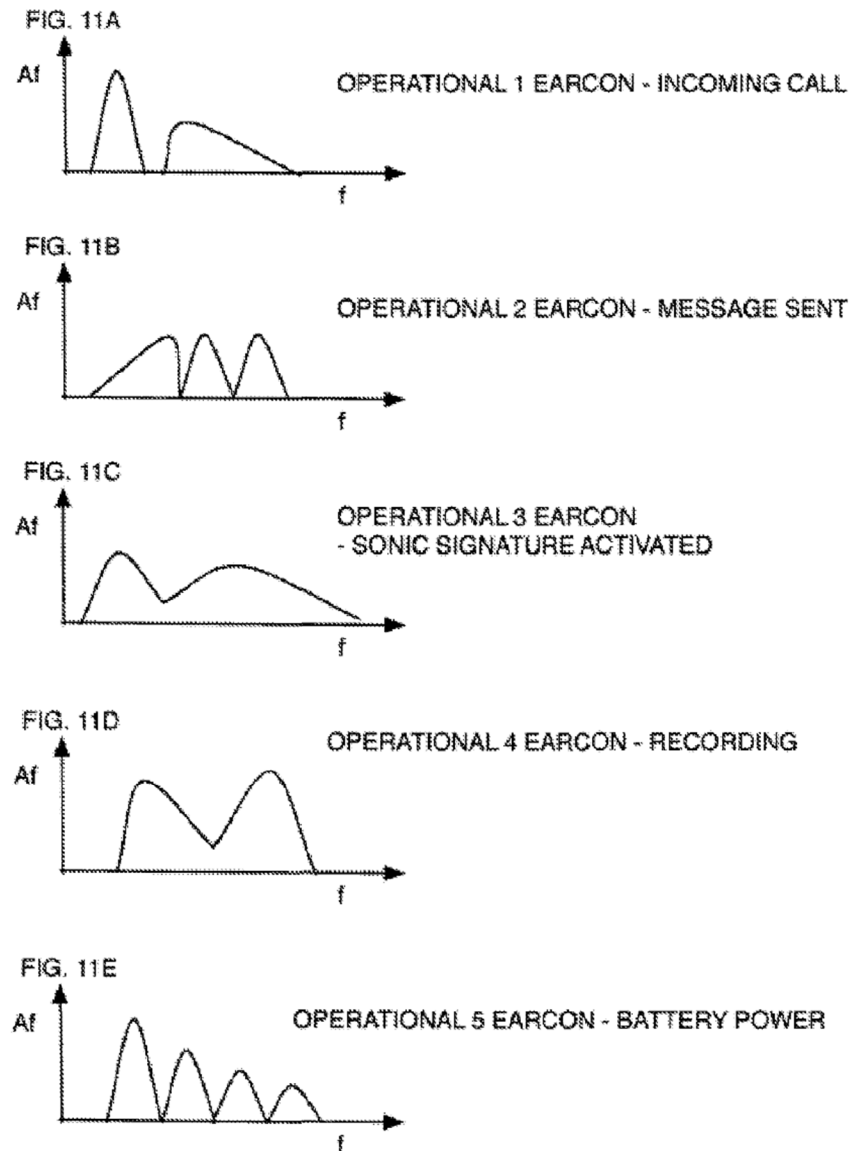
B. Ground 1B: *Doclo, Beasley, and Goldstein* Render Obvious Claims 4-8

1. Claim 4: The earpiece according to claim 1, wherein the operations further comprise: receiving an indication of an event.

The *Doclo-Beasley-Goldstein* combination discloses or suggests this claim. *Polish* ¶¶142-150.

Goldstein is analogous to the *'315pat.*, as it is within the same field of endeavor and and/or reasonably pertinent to one or more problems addressed by the *'315pat.* It discloses several examples of “operational earcons” that correspond to events such as an incoming phone call. *Goldstein* ¶[0054] (“Briefly, FIGS 11A-11E, indicate examples of operational earcons that can be emitted to indicate to a user

operational environment and status (e.g., battery life, *incoming call*, incoming call name, incoming e-mail ...”).



Goldstein, Figures 11A-E

A POSITA would have understood *Goldstein* to disclose or suggest that these earcons are emitted in response to receiving an indication that the event (e.g., an incoming call or incoming email) has occurred. *Polish* ¶144. In particular, *Goldstein*

discloses a method including the steps of “detecting an operational status of a device [and] matching the detected operational status with a related operational audio content; reproducing the related operational audio content with ... an Ear Canal Loudspeaker.” *Goldstein* ¶[0033]. In view of the exemplary “operational earcons” including, e.g., “incoming call,” a POSITA would have understood *Goldstein* to disclose or suggest a method including the step of detecting, for example, an incoming phone call or email (i.e., detecting an operational status). *Polish* ¶144. A POSITA would have understood that detecting an incoming phone call or email constitutes “receiving an indication of an event.” *Id.*

A POSITA would have been motivated to combine the teachings of *Doclo*, *Beasley*, and *Goldstein* and would have had a reasonable expectation of success in doing so. *Polish* ¶145.

Goldstein, like *Doclo* and *Beasley*, is in the same field of art and is analogous art to the *'315pat.*—i.e., they are all in the field related to a noise-cancelling audio device. See *Goldstein* ¶[0035]; *Polish* ¶145. A POSITA would have been familiar with earcons as a common user interface tool and would have been familiar with how they are implemented to provide notifications from other applications. *Polish* ¶146 (citing *Loring*, 1:13-2:18; *Blattner*, 1-4). *Goldstein* further states its disclosures are applicable to hearing aids. *Goldstein* ¶[0028]. Moreover, a POSITA would have recognized that receiving an indication of an event in a hearing aid (such as an

incoming call)—and subsequently, alerting the user of the event with an earcon—would be advantageous because it would allow the user to determine what action to take in response to the event. *Polish* ¶147. Indeed, *Doclo* expressly discloses that its ANR system is used for “voice communication” and further that “ANR can be beneficial for several applications,” including “mobile phone handsets.” *Doclo* ¶¶[0099] (“*ANR can be beneficial for several applications*, such as headsets, *mobile phone handsets*”), [0124], [0062] (“When the ANR system ... is used for listening to music or for *voice communication* ...”), [0101] (“When the ANR headset is used for listening to music or for *voice communication* ...”), [0003]-[0004]. A POSITA would have recognized that it would be advantageous to alert the ANR system—such as a hearing aid—user of an event such as an incoming call when the system is used in conjunction with a “mobile phone handset” for “voice communication.” *Polish* ¶148 (citing *Chambers* ¶[0095]).

Further, applying *Goldstein*’s teachings related to earcons to the *Doclo-Beasley* combination would have amounted to applying a known technique (receiving a notification of an event and using earcons to provide alerts) to a known device (a noise-cancelling hearing aid) ready for improvement to yield predictable results (a noise-cancelling hearing aid that receives indications of events and alerts a user of, e.g., an incoming call). A POSITA would have also had a reasonable expectation of success in making the combination because receiving indications of

events and providing earcon notifications would be a routine task that was well within the skill of a POSITA. *Id.* ¶149.

Accordingly, a POSITA would have understood the *Doclo-Beasley* combination to disclose or suggest a processor (“logic circuit”) that executes computer program instructions to perform operations including receiving an indication of an event such as an incoming phone call or incoming email (“receiving an indication of an event”). *Id.* ¶150.

2. Claim 5: The earpiece according to claim 4, wherein the event is at least one of a scheduled meeting, an incoming phone call, an email, a voice message, or a text message.

The *Doclo-Beasley-Goldstein* combination discloses or suggests this claim. *Polish* ¶¶151-154.

Goldstein discloses that the event may be an incoming call. *Goldstein* ¶[0054] (“Briefly, FIGS 11A-11E, indicate examples of operational earcons ... (e.g., battery life, *incoming call*, *incoming call name*, *incoming e-mail*, ...”). A POSITA would have been motivated to combine the teachings of *Doclo*, *Beasley*, and *Goldstein* for the reasons discussed in §VIII.B.1.

Accordingly, a POSITA would have understood the *Doclo-Beasley* combination to disclose or suggest a processor (“logic circuit”) that executes computer program instructions to perform operations including receiving an indication of an event such as an incoming phone call or an incoming email

(“wherein the event is at least one of a scheduled meeting, *an incoming phone call, an email*, a voice message, or a text message”). *Polish* ¶154.

3. Claim 6: The earpiece according to claim 5, wherein the operations further comprise: retrieving an Earcon from the memory, where the Earcon matches the event.

The *Doclo-Beasley-Goldstein* combination discloses or suggests this claim. *Polish* ¶¶155-158.

Goldstein discloses that an earcon can be fetched from memory upon insertion. *Goldstein* ¶[0055] (“When the earphone is detected as being inserted, *an earcon can be fetched at step 404 from a memory storage 405.*”). A POSITA would have understood this disclosure in *Goldstein* to disclose or suggest that earcons that match other events—such as an incoming call—are likewise retrieved from memory. *Polish* ¶156.

A POSITA would have been motivated to combine the teachings of *Doclo*, *Beasley*, and *Goldstein* for the reasons discussed in §VIII.B.1, and that, in this combination, the earcon would be retrieved from memory. *Id.* ¶157.

Accordingly, a POSITA would have understood the *Doclo-Beasley* combination to disclose or suggest a processor (“logic circuit”) that executes computer program instructions to perform operations including retrieving earcons that match incoming call or incoming email events from memory (“retrieving an Earcon from the memory, where the Earcon matches the event”). *Id.* ¶158.

4. Claim 7: The earpiece according to claim 5, wherein the operations further comprise: sending the Earcon to the speaker.

The *Doclo-Beasley-Goldstein* combination discloses or suggests this claim. *Polish* ¶¶159-162.

Goldstein discloses that an earcon can be reproduced by a loudspeaker such as an ear canal receiver (ECR) (i.e., a speaker). *Goldstein* ¶[0056] (“At step 408, the *earcon can be reproduced with the loudspeakers such as the ECR 125* as shown at filtering step 409 and sound reproduction step 410.”). A POSITA would have understood this disclosure in *Goldstein* to disclose or suggest that earcons corresponding to events such as an incoming call or an incoming email are likewise sent to a speaker for reproduction. *Polish* ¶160.

A POSITA would have been motivated to combine the teachings of *Doclo*, *Beasley*, and *Goldstein* for the reasons discussed in §VIII.B.1, and that, in this combination, the earcon would be sent to the speaker. *Id.* ¶161.

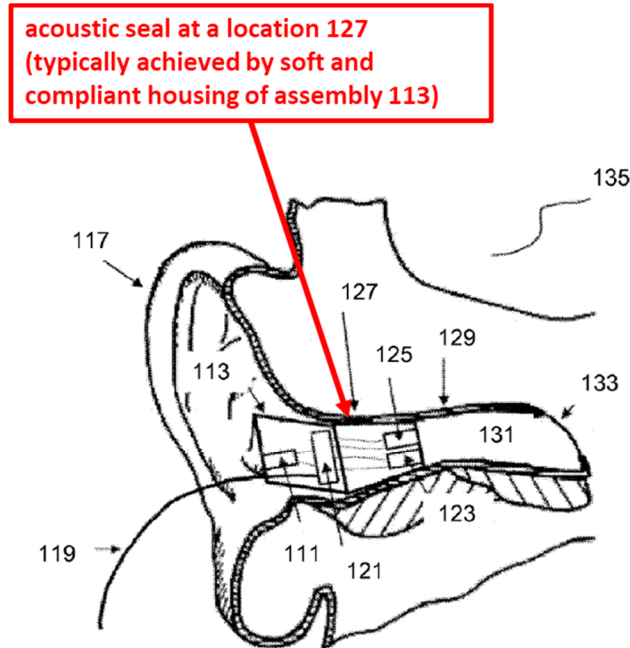
Accordingly, a POSITA would have understood the *Doclo-Beasley* combination to disclose or suggest a processor (“logic circuit”) that executes computer program instructions to perform operations including sending earcons corresponding to incoming call or incoming email events to a speaker (“sending the Earcon to the speaker”). *Id.* ¶162.

5. Claim 8: The earpiece according to claim 1, further comprising: a sealing section.

The *Doclo-Beasley-Goldstein* combination discloses or suggests this claim.

Polish ¶¶163-166.

Goldstein discloses that “[t]he earpiece 100 can partially or fully occlude the ear canal 131 to provide various degrees of acoustic isolation.” *Goldstein* ¶[0036]. In particular, “[t]he assembly is designed to be inserted into the user[']s ear canal 131, and to form an **acoustic seal with the walls of the ear canal at a location 127** between the entrance to the ear canal and the tympanic membrane (or ear drum) 133. Such a seal is typically achieved by means of a soft and compliant housing of assembly 113.” *Id.*; *see also id.* ¶[0043].



100
FIG. 1

Goldstein, Figure 1 (annotated)

A POSITA would have been motivated to combine the teachings of *Doclo*, *Beasley*, and *Goldstein* for the reasons discussed in §VIII.B.1. Additionally, a POSITA reviewing *Goldstein* would have recognized that, when applying ANR techniques in *Doclo*'s hearing aids, a sealing section would advantageously allow for “a full range bass response when reproducing sounds for the user” and “significantly reduce the sound pressure level at the user’s eardrum.” *Goldstein* ¶[0036]. And *Goldstein* discloses its disclosures are applicable to hearing aids. *Id.* ¶[0028]. A POSITA would have also found including a sealing section in *Doclo*'s

hearing aids with active noise-reduction to amount to applying a known technique (including a sealing section) to a known device (*Doclo*'s hearing aid with ANR) ready for improvement to yield predictable results (a hearing aid with a sealing section). *Polish* ¶165.

Accordingly, a POSITA would have understood the *Doclo-Beasley-Goldstein* combination to disclose or suggest including an ear sealing section in an *Doclo*'s hearing aids ("a sealing section"). *Id.* ¶166.

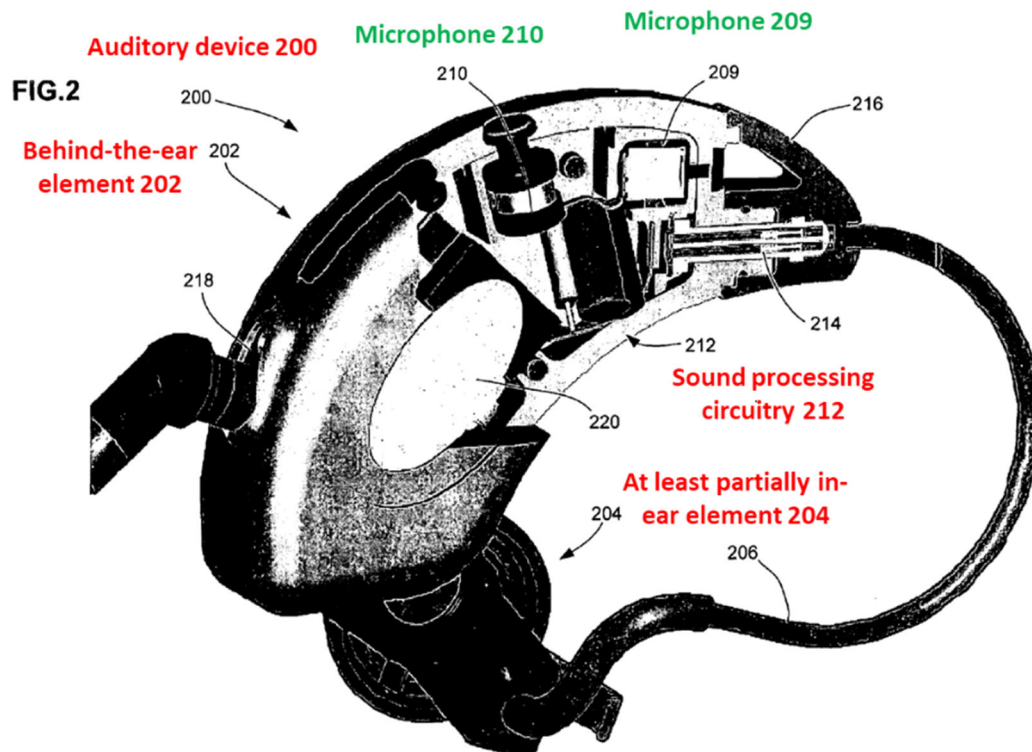
C. Ground 1C: *Doclo*, *Beasley*, and *Darbut* render obvious claims 1-3

If the Board finds that the preamble to claim 1—"a]n earpiece comprising"—limits the claim to a single earpiece that includes the claimed components, Petitioners submit that claims 1-3 nevertheless would have been obvious in view of the combination of *Doclo*, *Beasley*, and *Darbut*. *Polish* ¶¶167-172.

As discussed in §§VIII.A.2.a-VIII.A.2.f, a POSITA would have understood *Doclo*'s disclosure of applying its ANR system to hearing aids to encompass a hearing aid earpiece including at least one external microphone, an ear canal microphone, a speaker, a memory, and a processor for implementing *Doclo*'s ANR system as required by limitations [1.1], and [1.3]-[1.6.4]. *Polish* ¶168.

By the earliest alleged priority date, it was also known to include a second external microphone in a hearing aid earpiece, which enabled directional processing (also known as beamforming). *Id.* ¶169. *Darbut* is exemplary, and it is analogous to

the '315pat., as it is within the same field of endeavor and and/or reasonably pertinent to one or more problems addressed by the '315pat. *Darbut* discloses an “auditory device” such as a “hearing aid” that “includes a behind-the-ear element and an at least partially in-ear element.” *Darbut*, Abstract, ¶[0002], [0011]. In Figure 2, *Darbut* illustrates auditory device 200 includes behind-the-ear element 202 with two external microphones 209, 210. *Darbut*, [0053]. “Sound from both microphones 209, 210 is ported to a digital signal processor ... to produce a directional effect, allowing the user of the auditory device 200 to improve the signal to noise ratio which provides better detection of signal in front of the user and attenuates sounds coming from behind.” *Id.*



Darbut, Figure 2 (annotated)

In view of the known benefits of including two external microphones in an earpiece as exemplified by *Darbut* (i.e., improved signal-to-noise ratio), a POSITA would have found it obvious to incorporate *Darbut*'s teaching related to a second external microphone into *Doclo*'s ANR hearing aid earpiece because it would have amounted to the use of known technique (*Darbut*'s second external microphone) to improve similar devices (*Doclo*'s ANR hearing aid) in the same way (to provide the user of *Doclo*'s hearing aid with an improved signal to noise ratio). *Polish* ¶170.

The analysis of how the *Doclo-Beasley-Darbut* combination renders claims 1-3 obvious is the same as discussed in §§VIII.A.2-VIII.A.4 with two exceptions. First, as to element [1.2], the *Doclo-Beasley-Darbut* combination discloses or suggests two ambient microphones in a single hearing aid earpiece. *Polish* ¶171.

Second, with respect to the “ambient sound signal” required by claims 2 and 3, the *Doclo-Beasley-Darbut* combination discloses or suggests that the signals from the two external reference microphones are combined (to implement beamforming) prior to being variably amplified, thus generating a beamformed, bypass reference audio signal. This beamformed bypass reference audio signal is still an “ambient sound signal” within the meaning of the *'315pat. Id.* ¶172.

D. Ground 1D: *Doclo*, *Beasley*, *Darbut*, and *Goldstein* render obvious claims 4-8

Doclo, *Beasley*, *Darbut*, and *Goldstein* render claims 4-8 obvious for the same reasons discussed in §§VIII.B and VIII.C. *Polish* ¶173.

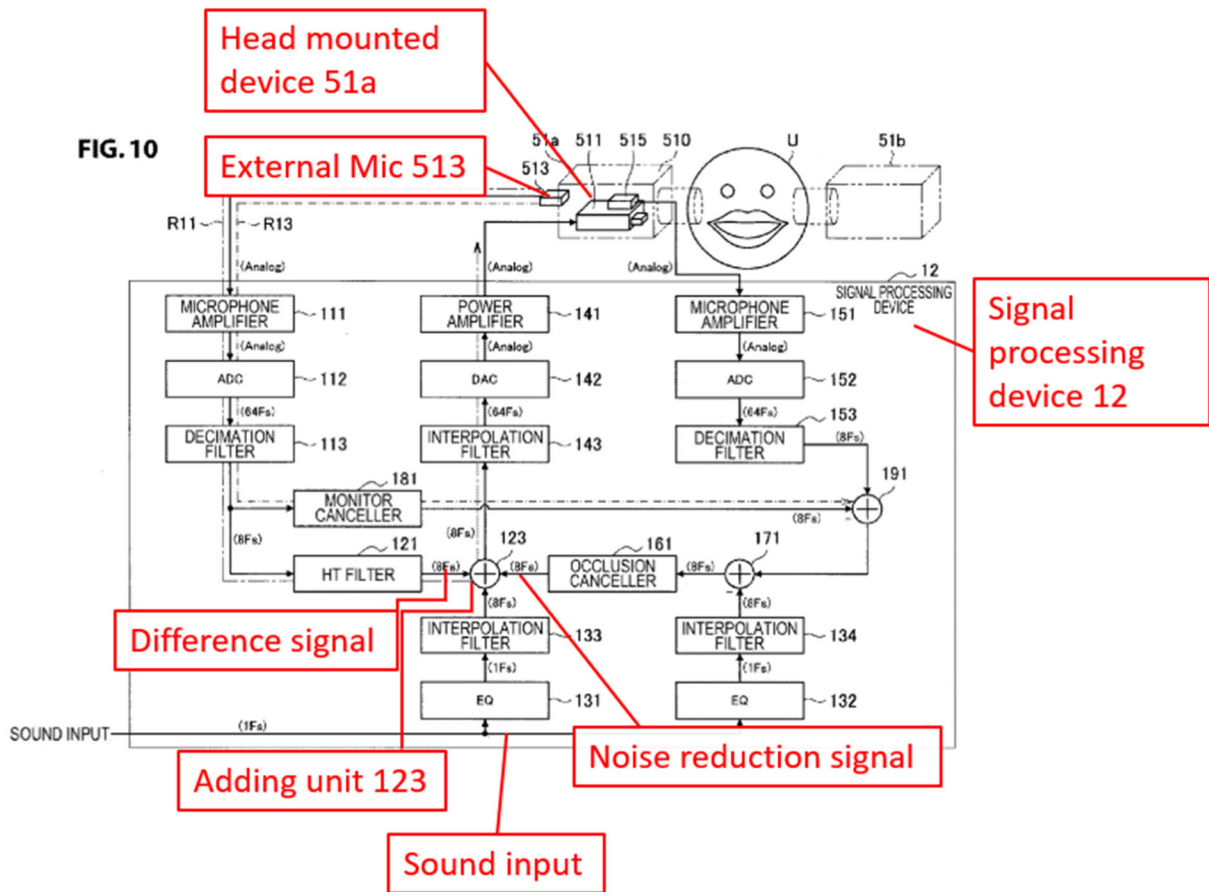
E. Ground 2A: *Asada* renders obvious claims 1-5 and 8

Asada is analogous to the '315pat., as it is within the same field of endeavor and and/or reasonably pertinent to one or more problems addressed by the '315pat. *Polish* ¶174. *Asada* explains that earphones with noise-cancelling have become widespread. *Asada* ¶[0002]. At the same time, smartphones have also become widespread and uses for earphones are no longer limited to listening to audio content, and the user's ability to listen to ambient sounds should be considered. *Id.* ¶¶[0004], [0005]. *Asada* therefore discloses a signal processing device for a head-mounted acoustic device "capable of enabling a listener to listen to ambient sounds." *Id.* ¶[0006].

Asada describes the ability to hear ambient sound and audio content as the "hear-through state" or "hear-through effect." *Asada* ¶¶[0039]-[0040]. *Asada* explains that this is important for a head-mounted devices with "high hermeticity ... such as a so-called canal type earphone." *Id.* ¶[0042]. Thus, *Asada* discloses a technique for implementing the hear-through state in an "ear canal type earphone." *Id.* ¶[0044].

Asada discloses several embodiments. This petition focuses on the embodiment of Figure 10, but *Asada*'s embodiments build on each other, and *Asada* does not repeat the entire description of each component that is common to prior embodiments. See *Asada* ¶¶[0061], [0083]-[0084], [0099], [0105]-[0106], [0128]-[0129]. Thus, for example, this Petition cites some description of the embodiments in Figures 7-9 for the purpose of explaining *Asada*'s disclosure regarding those components in the embodiment of Figure 10. *Polish* ¶176.

In Figure 10, *Asada* discloses a head-mounted device that includes an external microphone 513, and internal microphone 515, and a signal processing device 12. *Asada* ¶¶[0105]-[0119]. The signal processing device 12 may be implemented within the head-mounted device. *Id.* ¶¶[0099], [0105]-[0106], FIG. 8; *Polish* ¶177. The adding unit 123 of the signal processing device adds three signals together: a “difference signal output from the HT filter 121,” a “sound input,” and a “noise reduction signal output from the occlusion canceller 161.” *Id.* ¶[0096].



Asada FIG. 10 (annotated)

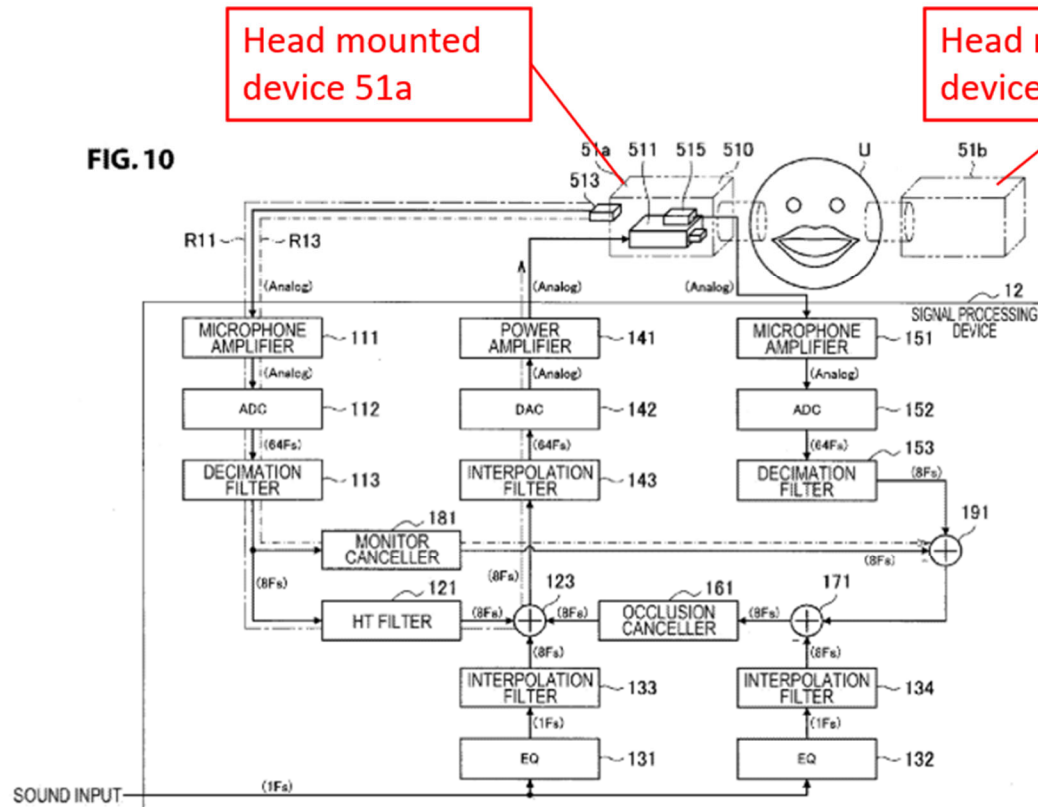
“Difference signal.” The signal from the external microphone 513 is amplified by microphone amplifier 111 and processed through decimation filter 113 and an HT filter 121, which generates the “difference signal.” *Asada* ¶¶[0069]-[0071], [0132]-[0133]. *Asada* explains that the “difference signal” is a signal that when output in the user’s ear, simulates the “hear-through effect,” i.e., “the ambient sound in a case in which the user directly hears it is simulated.” *Id.* ¶[0071]; *Polish* ¶179.

“Sound input” signal. Sound input is “audio content or a received signal in a voice call” that is processed through EQ 131 which performs an equalizing process and the interpolation filter 133 which performs up-sampling. *Asada* ¶¶[0071], [0136]; *Polish* ¶180.

“Noise-reduction signal.” The signal from the internal microphone 515 is first amplified by microphone amplifier 151. *Asada* ¶[0088]. *Asada* explains that the signal from the internal microphone 515 includes three component sounds: (1) the output from the speaker, (2) a component of the ambient sound that propagates into the ear canal; and (3) a component of the user’s voice propagating into the ear canal. *Asada* ¶[0087]. The subtraction unit 191, together with the monitor canceller 181, are “configured to suppress a component corresponding to the difference signal among components” of the signal from the internal microphone. *Id.* ¶[0107]; *Polish* ¶181.

The “subtracting unit 171 subtracts the sound input” from the output of the subtracting unit 191. *Id.* ¶¶[0090], [0116]-[0117]. Then the output of the subtracting unit 191 is input into the occlusion canceller 161 which is “an acoustic signal in which the component corresponding to a difference signal and the component corresponding to the sound input ... are suppressed.” *Id.* ¶[0117]. Then the occlusion canceller 161 “generates the noise reduction signal.” *Id.* ¶[0118]; *Polish* ¶182.

to disclose or suggest that the head-mounted devices 51a and 51b are the same with respect to the elements described in this petition. *Polish ¶185.*



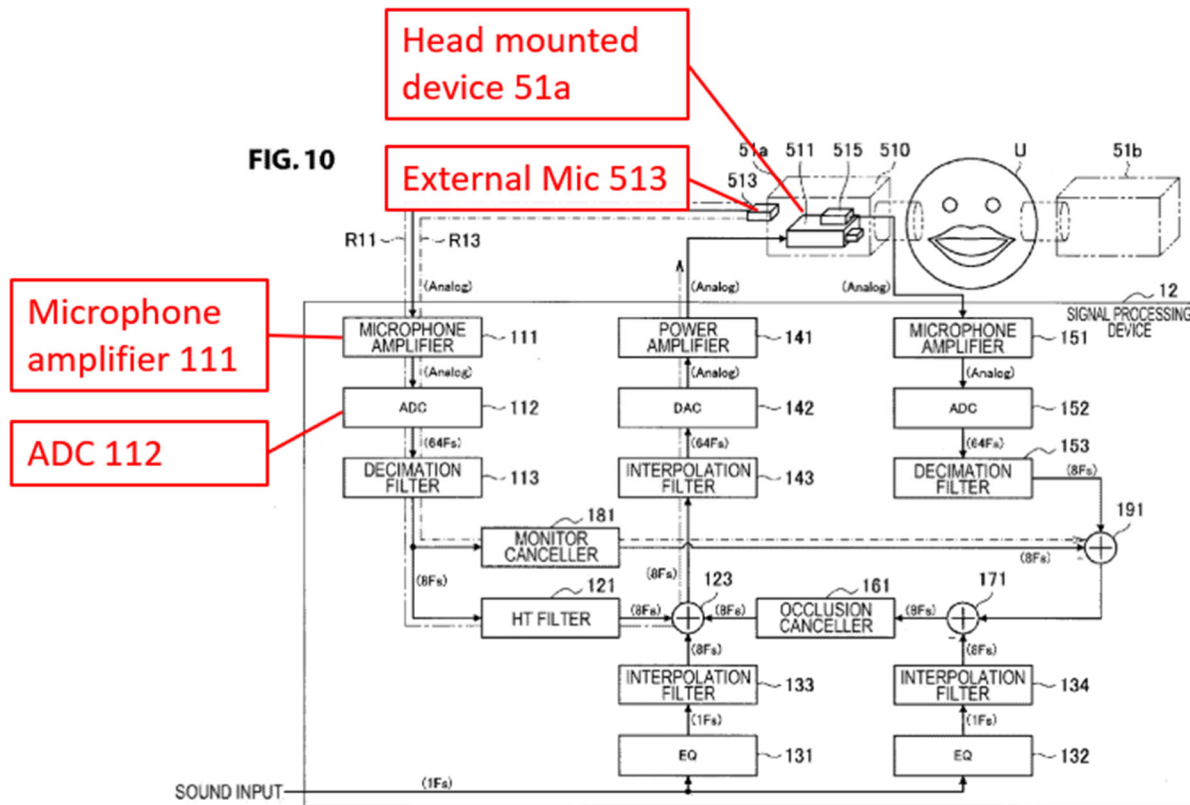
Asada FIG. 10 (annotated)

Accordingly, if the Board finds that the preamble is limiting, a POSITA would have understood *Asada* to disclose or suggest a head-mounted device implemented as an ear canal-type earphone for the left and right ears (“An earpiece”). *Polish ¶186.*

- b. [1.1] and [1.2]: a first ambient microphone configured to generate a first microphone signal; a second ambient microphone configured to generate a second microphone signal;**

Asada discloses or suggests these features. *Polish* ¶¶187-191. *Asada* discloses that the head-mounted device 51a includes an “external microphone 513” that “directly collects a sound (a so-called ambient sound).” *Asada* ¶¶[0063], [0068]. These disclosures are consistent with how the ’315*pat.* describes an “ambient microphone.” ’315*pat.*, 10:31-34; *Polish* ¶188.

Asada further discloses an “analog acoustic signal output on the basis of the sound collection result of the external microphone 513” is amplified and converted to a digital signal. *Asada* ¶[0132], FIG. 10; *Polish* ¶189.



Asada FIG. 10 (annotated)

As explained in §VIII.E.1.a, *Asada* discloses or suggests that head-mounted device 51b has the same configuration as head-mounted device 51a. Thus, a POSITA would have understood *Asada* to disclose that head-mounted device 51b also includes an external microphone 513 that outputs a signal. *Polish* ¶190.

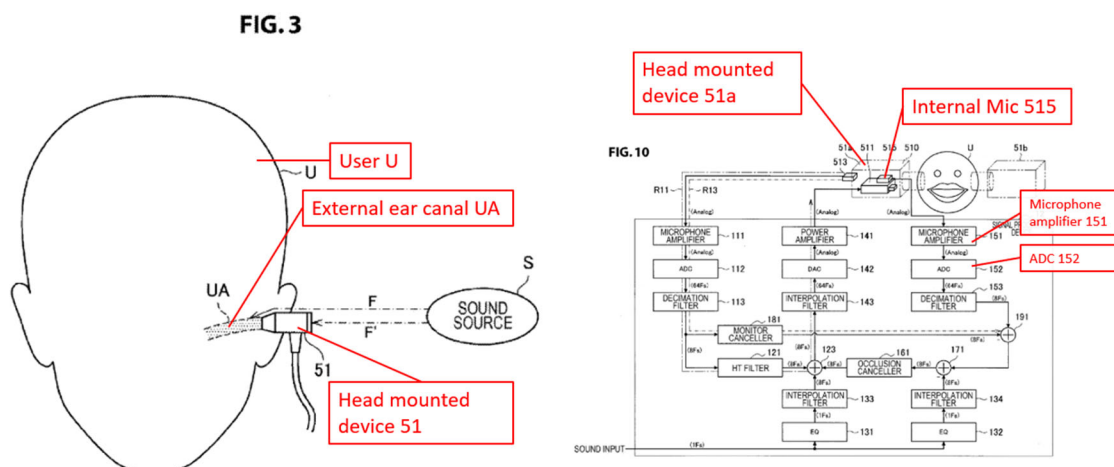
Accordingly, a POSITA would have understood *Asada* to disclose or suggest a first head-mounted device with an external microphone that collects ambient sound (“first ambient microphone”) and outputs a signal (“configured to generate a first microphone signal”), and a second head-mounted device with an external

microphone that collects ambient sound (“second ambient microphone”) and outputs a signal (“configured to generate a second microphone signal”). *Polish* ¶191.

c. [1.3]: an ear canal microphone configured to generate a third microphone signal;

Asada discloses or suggests this feature. *Polish* ¶¶192-195. *Asada* discloses that the head-mounted device 51a includes an “internal microphone 515” that is “installed in the mounting unit 510 to face the direction of the external ear canal UA” so it is “capable of collecting the sound propagating to the internal space.” *Asada* ¶¶[0085]-[0086]. This is consistent with how the *'315pat.* describes an “ear canal microphone.” *'315pat.*, 10:34-35; *Polish* ¶193.

Asada further discloses an “analog acoustic signal output on the basis of the sound collection result of the internal microphone 515” is amplified and converted into a digital signal. *Asada* ¶[0134].



Asada FIGs. 3, 10 (annotated)

Accordingly, a POSITA would have understood *Asada* to disclose or suggest a head-mounted device including an internal microphone facing the ear canal and capable of collecting the sound propagating to the internal space (“ear canal microphone”) that outputs a signal (“configured to generate a third microphone signal”). *Polish* ¶195.

d. [1.4]: a speaker;

Asada discloses or suggests this feature. *Polish* ¶¶196-197. *Asada* discloses that the head-mounted device 51a includes a speaker. *Asada* ¶[0067]. Accordingly, a POSITA would have understood *Asada* to disclose or suggest a head-mounted device including a speaker (“a speaker”). *Polish* ¶197.

e. [1.5] and [1.6]: a memory that stores instructions; a logic circuit, where the logic circuit is configured to execute the instructions to perform operations comprising:

Asada discloses or suggests these features. *Polish* ¶¶198-203. *Asada* discloses that the head-mounted device 51a includes a signal processing device housed within the head-mounted device. *Asada* ¶[0099], [105]-[106], FIG. 8; *Polish* ¶¶177, 199. *Asada* further discloses that the signal processing device includes a processor and memory and implements the components of the signal processing device. *Asada* ¶¶[0196]-[0197]. This is consistent with how a POSITA would have understood the claimed “logic circuit.” ’315pat., 10:36-38; *Polish* ¶200. For example, *Asada* states that “[t]he components of the signal processing devices 11 to 14 (particularly, the

HT filter 121, the occlusion canceller 161, the monitor canceller 181, or the like) may be implemented by the processor 901.” *Asada* ¶[0197]. A POSITA would have understood that “or the like” includes the other components of the signal processing device, such as the adding units and the decimation/interpolation filters, which are also implemented after the ADC step in the digital domain. *Polish* ¶201. Thus, *Asada*’s broad assertion that the “[t]he components of the signal processing devices 11 to 14 ... may be implemented by the processor” discloses, and at a minimum suggests, to a POSITA such an implementation. *Asada* ¶[0008] (explaining “processor” “add[s] the difference signal and the noise reduction signal to the input acoustic signal”); *Polish* ¶201.

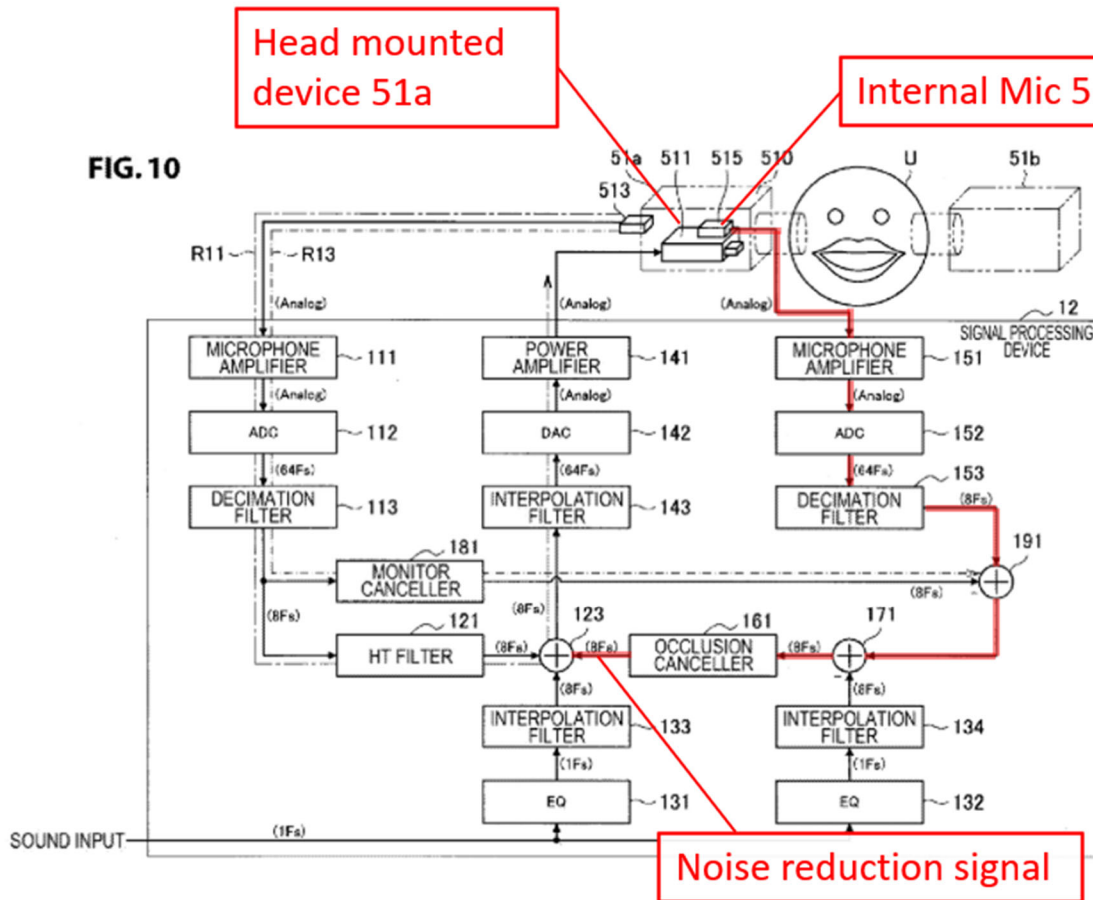
Asada discloses the memory “stores programs and data executed by the processor 901.” *Asada* ¶[0198]. *Asada* further discloses “creat[ing] a program causing hardware such as a processor, a memory, and a storage which are installed in a computer to perform functions similar to those of the components of the signal processing device.” *Id.* ¶[0207]. A POSITA would have understood that programs comprise software instructions to be executed by a processor. *Polish* ¶202 (citing *Computer Dictionary*).

Accordingly, a POSITA would have understood *Asada* to disclose or suggest a head-mounted device including a signal processing circuit with a processor (“logic circuit”) and memory that stores programs (“a memory that stores instructions”) to

be executed by the processor to perform functions of the signal processing device (“where the logic circuit is configured to execute the instructions to perform operations”). *Polish* ¶203.

f. [1.6.1]: generating a noise-reduction signal using at least one of the first microphone signal or the second microphone signal or the third microphone signal or a combination of microphone signals;

Asada discloses or suggests this feature. *Polish* ¶¶204-206. *Asada* discloses that the signal processing circuit includes an “occlusion canceller 161” that “generates [a] noise reduction signal on the basis of the acoustic signal output from the subtracting unit 171.” *Asada* ¶[0093]. The output from the subtracting unit 171 that is input to the occlusion canceller 161 is “an acoustic signal in which the component corresponding to a difference signal and the component corresponding to the sound input among the components of the acoustic signal collected by the internal microphone 515 are suppressed.” *Id.* ¶[0117]. In other words, *Asada* discloses that the occlusion canceller generates a “noise reduction signal” based on an acoustic signal in which certain components of the signal collected by the internal microphone (“third microphone signal”) are suppressed. *Polish* ¶205.



Asada FIG. 10 (annotated)

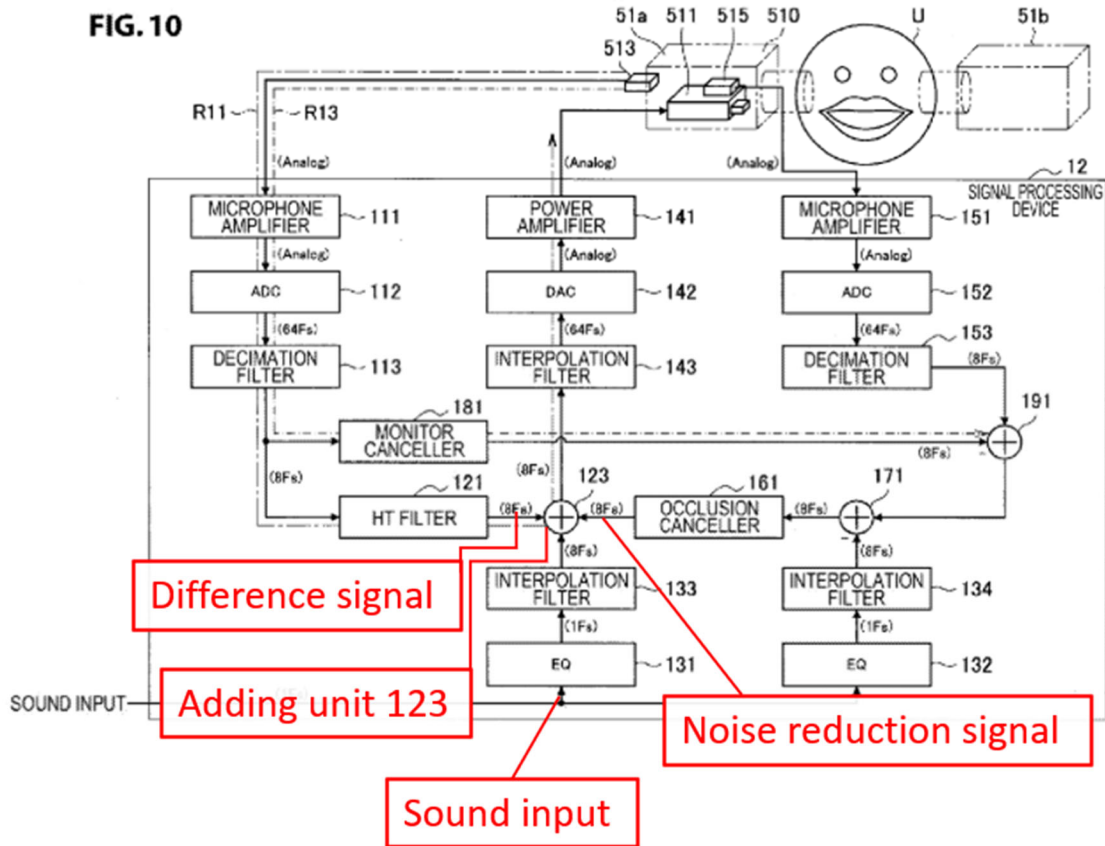
Accordingly, a POSITA would have understood *Asada* to disclose or suggest a signal processing device including a processor (“logic circuit”) executing instructions to implement the functions of the signal processing device, including generating a noise-reduction signal (“generating a noise reduction signal”) based on a signal collected by the internal microphone (“using at least one of the ... third microphone signal”). *Polish* ¶206.

The “sound input” or “input acoustic signal” are consistent with how a POSITA would have understood an “audio signal” in the context of the *'315pat.* *'315pat.*, 6:30-33, 12:30-33, 16:30-39; *Polish* ¶209.

Accordingly, a POSITA would have understood *Asada* to disclose or suggest a signal processing device including a processor (“logic circuit”) executing instructions to perform the functions of the signal processing device including an EQ 131 that receives a sound input or input acoustic signal (“receiving an audio signal”). *Polish* ¶210.

h. [1.6.3]: generating a mixed audio signal by mixing the noise-reduction signal with the audio signal; and

Asada discloses or suggests this feature. *Polish* ¶¶211-213. *Asada* discloses that the signal processing device includes an “addition unit 123” that “***adds*** ... the ***sound input*** output from the interpolation filter 133[] and the noise reduction signal output from the occlusion canceller 161.” *Asada* ¶[0137]. A POSITA would have understood that *Asada*’s adding unit 123 mixes the noise reduction signal output from the occlusion canceller and the sound input signal because mixing audio signals is accomplished by adding. *Polish* ¶212 (citing *Boersma* ¶[0062]).

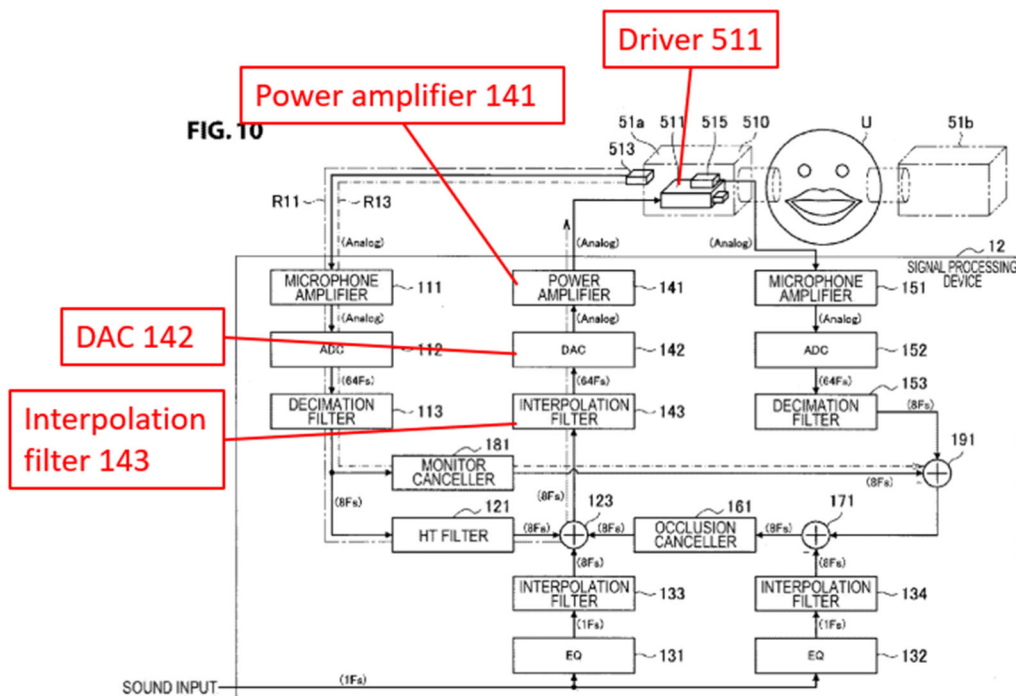


Asada, FIG. 10 (annotated)

Accordingly, a POSITA would have understood *Asada* to disclose or suggest a signal processing device including a processor (“logic circuit”) executing instructions to perform the functions of the signal processing device including an adding unit (“generating a mixed audio signal”) that adds a noise-reduction signal to the sound input (“by mixing the noise reduction signal with the audio signal”). *Polish* ¶213.

- i. [1.6.4]: sending a modified audio signal to the speaker, where the modified audio signal includes the mixed audio signal.

Asada discloses or suggests this feature. *Polish* ¶¶214-217. *Asada* discloses that “the addition result of the adding unit 123 is up-sampled to a digital signal of 64 Fs by the interpolation filter 143, converted into an analog acoustic signal by the DAC 142, and input to the power amplifier 141,” and then “the analog acoustic signal undergoes gain adjustment performed by the power amplifier 141 and then input to the driver 511.” *Asada* ¶[0138]. And then the “driver 511 drives the speaker on the basis of the inputted analog acoustic signal.” *Id.* Thus, a POSITA would have understood that the interpolation filter outputs a signal that is sent to the speaker. *Polish* ¶215.



Asada FIG. 10 (annotated)

As explained in §VIII.E.1.h, the acoustic signal output from the adding unit 123 includes the “mixed signal.” Thus, a POSITA would have understood *Asada* to disclose that the mixed signal is up-sampled by the interpolation filter 143 included in the signal processing device before it is output to the speaker. *Polish* ¶216. A POSITA would have understood that up-sampling the signal modifies it because up-sampling increases the bit-rate of the signal. *Asada* ¶¶[0129], [0137]-[0138]; *Polish* ¶216.

Accordingly, a POSITA would have understood *Asada* to disclose or suggest a signal processing device including a processor (“logic circuit”) executing instructions to perform the functions of the signal processing device including an interpolation filter that outputs an up-sampled signal to the speaker (“sending a modified audio signal to the speaker”) wherein the interpolation filter up-samples the signal output from the adding unit (“where the modified audio signal includes the mixed audio signal”). *Polish* ¶217.

2. Claim 2: The earpiece according to claim 1, wherein the operations further comprise: generating an ambient sound signal using at least one of the first microphone signal or the second microphone signal or a combination of both.

Asada discloses or suggests this claim. *Polish* ¶¶218-220. *Asada* discloses that the signal output from the external microphone 513 undergoes gain adjustment performed by the microphone amplifier 111, is converted into a digital signal

through the ADC 112, and then “[t]he decimation filter 113 down-samples the sampling rate of the digital signal output from the ADC 112 from 64 Fs to 8 Fs.” *Asada* ¶¶[0132]-[0133]. The HT filter operates on the down-sampled signal to generate a “difference signal,” which, when output to the user, simulates the ambient sound as if the user were not wearing the head-mounted device, i.e., the “hear-through effect.” *Id.* ¶¶[0071]-[0072], [0133]; *see also id.* ¶¶[0078], [0108]-[0109]; *Polish* ¶219. A POSITA would have understood *Asada*’s “difference signal” to be an “ambient sound signal” in the context of the *’315pat.* because it represents the ambient sound. *Polish* ¶219.

Accordingly, a POSITA would have understood *Asada* to disclose or suggest a signal processing device including a processor (“logic circuit”) executing instructions to perform the functions of the signal processing device including processing the signal from the external microphone to output a “difference signal” (“generating an ambient sound signal using at least one of the first microphone signal or the second microphone signal or a combination of both.”). *Id.* ¶220.

3. Claim 3: The earpiece according to claim 2, wherein the operations further comprise: generating the modified audio signal by mixing the ambient sound signal with the mixed audio signal.

Asada discloses or suggests this claim. *Polish* ¶¶221-227. As explained in §VIII.E.1.h, *Asada* discloses that the signal processing device includes an adding

unit 123 that adds the noise-reduction signal output from the occlusion canceller 161 to the sound input (“generating a mixed audio signal”).

As explained in §VIII.E.2, *Asada* discloses that the HT filter outputs a “difference signal” (“ambient sound signal.”). *Asada* explains that the adding unit 123 also adds the difference signal to the noise-reduction signal and sound input. *Asada* ¶[0137]; see also *id.* ¶¶[0075], [0096]-[0097].

As discussed in §VII.D, a POSITA would have understood this claim to require mixing the “ambient sound signal” with the “mixed signal” in a downstream modification of the mixed signal; that is, to generate the “mixed signal” in a first stage (or step) and then in a subsequent, second stage, mix the “ambient sound signal” with “the mixed signal.”

As discussed in §VIII.A.4 with respect to the *Doclo-Beasley* combination, there are three potential implementations for mixing three signals together. For the same reasons discussed there, it would have been obvious to mix the noise-reduction signal with the sound input (to generate the “mixed audio signal”) and then mix the resulting signal with the difference signal (“ambient sound signal”) to generate the “modified audio signal.” *Polish* ¶225.

At the very least, a POSITA would have recognized this approach to be a known technique applicable to the summation in *Asada*, with predictable results. *Id.*

Accordingly, a POSITA would have understood *Asada* to disclose or suggest a signal processing device including a processor (“logic circuit”) executing instructions to perform the functions of the signal processing device including “generating the modified audio signal” by mixing a difference signal (“mixing the ambient sound signal”) with *Asada*’s noise-reduction signal and sound input (“with the mixed audio signal”). *Id.* ¶226.

Alternatively, to the extent PO argues that claim 3 does not require two-step mixing as discussed in §§VII.D and VIII.A.4, *Asada* renders this limitation obvious because it discloses or suggests mixing all three signals together—the difference signal (“ambient sound signal”), the noise-reduction signal (“noise reduction signal”), and the sound input (“audio signal”). *Id.* ¶227.

- 4. Claim 4: The earpiece according to claim 1, wherein the operations further comprise: receiving an indication of an event; Claim 5: The earpiece according to claim 4, wherein the event is at least one of a scheduled meeting, an incoming phone call, an email, a voice message, or a text message.**

Asada discloses or suggests these claims. *Polish* ¶¶228-230. *Asada* discloses that “in recent years, user interfaces (UIs) that enable users to recognize notification information without checking a screen or the like when an information processing device reads out the information by voice through a speech synthesis technology have become widespread.” *Asada* ¶[0037]. *Asada* further discloses that if the hear-through state is implemented, “the user is able to check a sound output indicating

notification of content of e-mails or news while checking a surrounding situation and wearing the head mounted acoustic device even in a public place.” *Id.* ¶[0041]. “As another example, the user is also able to perform a phone call with another user by means of a so-called phone call function while checking a surrounding situation in motion.” *Id.*; *see also id.* ¶¶[0190]-[0192] (describing a feature to hear the content of an email or voice call through a signal input to the head-mounted device). A POSITA would have understood that the head-mounted device receiving a sound output of, e.g., an email to constitute “receiving an indication of an event ... wherein the event is ... an incoming phone call [or] an email.” *Polish* ¶229.

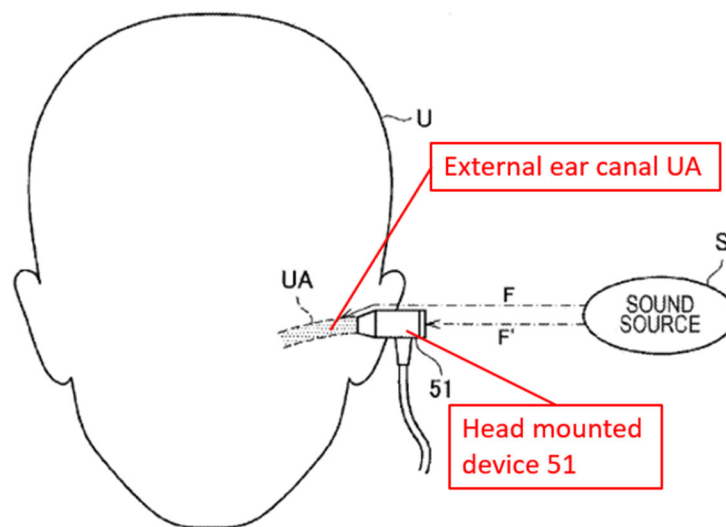
Accordingly, a POSITA would have understood *Asada* to disclose or suggest a signal processing device including a processor (“logic circuit”) executing instructions to perform the functions of the signal processing device including receiving a notification (“receiving an indication of an event”) wherein the notification corresponds to the content of email (“wherein the event is at least one of ... an email.”). *Id.* ¶230.

5. Claim 8: The earpiece according to claim 1, further comprising: a sealing section.

Asada discloses or suggests this claim. *Polish* ¶¶231-234. *Asada* illustrates the head-mounted device implemented as an ear canal earphone in Figure 3, which shows “an ear hole insertion portion having a shape insertable into the ear hole of

the user.” *Asada* ¶[0065]. *Asada* further discloses that the earphone has a “high hermeticity (in other words, a high shielding property against the external environment).” *Asada* ¶[0042]; see also *id.* ¶¶[0043]-[0044], [0080]-[0081]; *Polish* ¶232.

FIG. 3



Asada FIG. 3 (annotated)

A POSITA would have understood that for the earphone to have high hermeticity and shielding from the external environment, the ear hole insertion portion seals the ear canal. *Polish* ¶233. This is consistent with how a POSITA would have understood the “sealing section 540” in Figure 5A of the ’315pat. *Id.*

Accordingly, a POSITA would have understood *Asada* to disclose or suggest a head-mounted device implemented as an earphone with an ear hole insertion portion that has high hermeticity (“a sealing section”). *Id.* ¶234.

F. Ground 2B: *Asada* and *Goldstein* render obvious claims 4-7

- 1. Claim 4: The earpiece according to claim 1, wherein the operations further comprise: receiving an indication of an event; Claim 5: The earpiece according to claim 4, wherein the event is at least one of a scheduled meeting, an incoming phone call, an email, a voice message, or a text message.**

The *Asada-Goldstein* combination discloses or suggests these claims. *Polish* ¶¶235-240. As explained in §VIII.E.4, Petitioners submit that *Asada* alone renders these claims obvious. Separately and alternatively, these claims would have been obvious in view of the combination of *Asada* and *Goldstein*. As discussed in §VIII.B.1, *Goldstein* discloses several examples of “operational earcons” including, e.g., an “incoming e-mail” and a method for detecting the events corresponding to these operational earcons.

A POSITA would have found it obvious to incorporate *Goldstein*’s teachings into *Asada* and would have had a reasonable expectation of success in doing so. *Polish* ¶237. As discussed in §VIII.B.1, a POSITA would have been familiar with earcons as a common user interface tool and would have been aware of the advantages of using them. It was known, for example, to use earcons in the context of phone and messaging applications. *Polish* ¶¶237-238 (citing *Roberts* ¶[0010]; *Isaacs*, 1:56-2:47; *Goldstein-122* ¶[0107]). Thus, applying *Goldstein*’s teachings related to earcons to *Asada* would have amounted to applying a known technique (receiving a notification of an event and using earcons to provide alerts) to a known

device (*Asada*'s head-mounted device) ready for improvement to yield predictable results (*Asada*'s head-mounted device that receives indications of events, and alerts a user with an earcon for, e.g., an incoming call or email). *Id.* ¶239.

Accordingly, a POSITA would have understood the *Asada-Goldstein* combination to disclose or suggest a signal processing device including a processor ("logic circuit") executing instructions to implement the functions of the signal processing device, including receiving an indication of an event such as an incoming email ("receiving an indication of an event") wherein the notification corresponds to the incoming email ("wherein the event is at least one of ... an email."). *Id.* ¶240.

2. Claim 6: The earpiece according to claim 5, wherein the operations further comprise: retrieving an Earcon from the memory, where the Earcon matches the event.

The *Asada-Goldstein* combination discloses or suggests this claim. *Polish* ¶¶241-243. As discussed in §VIII.B.3, a POSITA would have understood *Goldstein* to disclose or suggest that the earcons are retrieved from memory. *Id.* ¶242. A POSITA would have been motivated to combine the teachings of *Asada* and *Goldstein* for the reasons discussed in §VIII.F.1, and that, in this combination, earcon would be pulled from memory. *Id.*

Accordingly, a POSITA would have understood the *Asad -Goldstein* combination to disclose or suggest a signal processing device including a processor ("logic circuit") executing instructions to implement the functions of the signal

processing device, including to retrieve earcons that match incoming events (e.g., incoming phone call or email) from memory (“retrieving an Earcon from the memory, where the Earcon matches the event”). *Polish* ¶243.

3. Claim 7: The earpiece according to claim 5, wherein the operations further comprise: sending the Earcon to the speaker.

The *Asada-Goldstein* combination discloses or suggests this claim. *Polish* ¶¶244-246.

As discussed in §VIII.B.4, a POSITA would have understood *Goldstein* to disclose or suggest that earcons corresponding to events such as an incoming call or an incoming email are sent to a speaker for reproduction. A POSITA would have been motivated to combine the teachings of *Asada* and *Goldstein* for the reasons discussed in §VIII.F.1, and that, in this combination, the earcon would be sent to the speaker.

Accordingly, a POSITA would have understood the *Asada-Goldstein* combination to disclose or suggest a signal processing device including a processor (“logic circuit”) executing instructions to implement the functions of the signal processing device, including sending earcons corresponding to incoming email events to a speaker (“sending the Earcon to the speaker”). *Polish* ¶246.

IX. Ground 2C: *Asada* and *Usher* Render Obvious Claims 1-5 and 8

If the Board finds that the preamble to claim 1—“[a]n earpiece comprising”—limits the claim to a single earpiece that includes the claimed components, Petitioners submit that claims 1-5 and 8 nevertheless would have been obvious in view of the combination of *Asada* and *Usher*. *Polish* ¶¶247-259. As discussed in §VIII.C, *Asada* notes that one of the problems with known earphones with high hermeticity was that they made the user less aware of their surroundings. It was also known that such earphones made it difficult to engage in conversations with others. *Polish* ¶¶248-250 (citing *Melanson*, 1:28-35; *DiCenso* ¶[0005]).

Usher is analogous to the '315pat., as it is within the same field of endeavor and and/or reasonably pertinent to one or more problems addressed by the '315pat. *Polish* ¶251. *Usher* discloses an earphone similar to *Asada* and discloses techniques “for automatically detecting when an earphone user and a second nearby user are engaged in a voice conversation, and activating a sound pass-through system such that the nearby voice source is automatically heard by the user of the sound isolating earphone.” *Usher* ¶[0019]; *Polish* ¶251. Like *Asada*, *Usher* discloses an earphone that fully occludes the ear canal and includes a processor and various microphones for implementing an ambient sound pass-through feature. *Usher* ¶¶[0019]-[0020]. Particularly relevant here, *Usher* discloses implementing two ambient microphones in the earphone and using them to implement beamforming to, for example, permit

manual capture of a sound source. *Id.* ¶¶[0020]-[0022], [0028], [0040], FIG. 1A; *Polish* ¶252. Beamforming was a known technique in devices like *Asada* and *Usher* that enables a spatially selective pass-through. *Polish* ¶255 (citing *Basu*, Abstract, Introduction, Section 2.2; *DiCenso* ¶[0032]; *Kirsch* ¶¶[0017]-[0020]). With beamforming, the user could advantageously be provided an ambient sound signal that allowed the user to hear a sound of interest (such as another person speaking) while suppressing other background noise that was not of interest. *Polish* ¶256. A POSITA would have understood that *Usher*'s teachings would improve *Asada*'s device because it would allow a user of *Asada*'s device to receive spatially selective ambient sound pass-through. *Id.* ¶256.

Therefore, a POSITA would have found it obvious to implement *Usher*'s teaching related to having multiple ambient microphones in an earpiece for beamforming into *Asada*'s device because it would have amounted to the use of a known technique (*Usher*'s teachings of multiple ambient microphones and beamforming) to improve similar devices (*Asada* and *Usher* are similarly directed to ambient sound passthrough for occluding earphones) in the same way (to provide *Asada*'s earphone with additional microphones to implement beamforming). *Id.* ¶257.

The analysis of how the *Asada-Usher* combination renders claims 1-5 and 8 obvious is the same as discussed in §§VIII.E.1-VIII.E.5 with two exceptions. First,

as to element [1.2], the *Asada-Usher* combination discloses or suggests a second external microphone 513 that operates in the same manner as the first external microphone included in the head-mounted device 51a. *Polish* ¶258.

Second, with respect to the “ambient sound signal” required by claims 2 and 3, the *Asada-Usher* combination discloses or suggests that the signals from the two external microphones 513 are combined (to implement beamforming) prior to being input to the HT filter 121, thus generating a beamformed “difference signal.” This beamformed difference signal is still an “ambient sound signal” within the meaning of the ’315pat. *Polish* ¶259.

X. Ground 2D: *Asada*, *Usher*, and *Goldstein* Render Obvious Claims 4-7

Asada, *Usher*, and *Goldstein* render claims 4-7 obvious for the same reasons discussed in §VIII.F. *Polish* ¶260.

XI. SECONDARY CONSIDERATIONS

There is no evidence in the ’315pat.’s prosecution history or elsewhere supporting secondary considerations, or evidence of nexus. *See generally* EX1004; *Polish* ¶261. Petitioners reserve the right to address any such evidence if PO raises it.

XII. THE DISCRETIONARY FACTORS FAVOR INSTITUTING TRIAL

A. 35 U.S.C. §314(a)

In June 2022, the USPTO issued updated discretionary denial guidance in view of the *Fintiv* factors and expressly noted that the PTAB will not discretionarily deny institution when, as here, Samsung presents a *Sotera* stipulation. (EX1009). Moreover, 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. (EX1035). 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. The Office did not issue any rejections during prosecution and did not consider any of the references that form the Grounds in this petition. Thus, there is no evidence that the Office previously considered the same, or substantially the same, art or arguments during prosecution.

XIII. 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 '315 patent 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.

Attached to this petition as EX1007 is a chart identifying all patents/applications that are in the same family as the '315 patent.

B. Lead and Backup Counsel

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C. Service Information

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D. Power of Attorney

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

XIV. FEES

Petitioners concurrently electronically submit 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: June 25, 2024

Respectfully submitted,

/Ali R. Sharifahmadian/
Ali R. Sharifahmadian (Reg. No. 48,202)
Counsel for Petitioners

CERTIFICATE OF COMPLIANCE

The undersigned hereby certifies that the foregoing Petition for *Inter Partes* Review contains 13,966 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.

/Ali R. Sharifahmadian/
Ali R. Sharifahmadian (Reg. No. 48,202)
Lead Counsel

CERTIFICATE OF SERVICE

I certify that on June 25, 2024, I caused a true and correct copy of the foregoing Petition for *Inter Partes* Review of U.S. Patent No. 11,659,315 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:

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