

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD., and
SAMSUNG ELECTRONICS, AMERICA, INC.,

Petitioners

v.

STATON TECHIYA, LLC,

Patent Owner

Case IPR2024-01003

U.S. Patent No. 11,710,473

Petition for *Inter Partes* Review of

U.S. Patent No. 11,710,473

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PETITIONERS' EXHIBIT LIST

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1001	U.S. Patent 11,710,473 (“’473pat.”)
1002	Declaration of Dr. Kyriakakis (“ <i>Kyriakakis</i> ”)
1003	Curriculum Vitae of Dr. Kyriakakis
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1006	U.S. Application 17/321,892 (“’892App”)
1007	U.S. Patent 11,244,666 (“’666 patent”)
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1009	File History of U.S. Appl. No. 90/019,169, Samsung Electronics Co., Ltd. and Samsung Electronics, America, Inc., Request for <i>Ex Parte Reexamination</i> of U.S. Pat. No. 11,244,666, Date: Feb. 24, 2023
1010	Family Tree for the ’473 Patent
1011	Order on Claim Construction issued in <i>Staton Techiya, LLC et al. v. Samsung Electronics Co., Ltd. et al.</i> , 2:21-cv-00413-JRG-RSP (E.D. Tex. Dec. 17, 2023)
1012	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)
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1014	U.S. Publication 2007/0041589A1 (“ <i>Patel</i> ”)
1015	Publication WO2006/097099A1 (“ <i>Topholm</i> ”)
1016	U.S. Patent 5,027,410 (“ <i>Williamson</i> ”)

Exhibit No.	DESCRIPTION
1017	U.S. Patent 7,903,825 (“ <i>Melanson</i> ”)
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1020	U.S. Publication 2006/0182295A1 (“ <i>Dijkstra</i> ”)
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1022	U.S. Publication WO2006/036262A1 (“ <i>Engle</i> ”)
1023	U.S. Patent 4,455,677 (“ <i>Fox</i> ”)
1024	U.S. Patent 4,827,458 (“ <i>d’Arc</i> ”)
1025	EP0495653A (“ <i>Smiedt</i> ”)
1026	U.S. Patent 5,647,011 (“ <i>Garvis</i> ”)
1027	U.S. Patent 6,782,106 (“ <i>Kong</i> ”)
1028	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)
1029	Florian Mueller & Matthew Karau, <i>Transparent Hearing</i> , CHI ’02 EXTENDED ABSTRACTS ON HUM. FACTORS IN COMPUTING SYS. 730 (2002)
1030	U.S. Publication 2001/0046304A1 (“ <i>Rast</i> ”)
1031	U.S. Patent 4,947,432 (“ <i>Topholm432</i> ”)
1032	U.S. Patent 5,202,927 (“ <i>Topholm927</i> ”)
1033	E.P. Publication 1519625A2 (“ <i>Victorian</i> ”)

Exhibit No.	DESCRIPTION
1034	Excerpt from COMPUTER DICTIONARY (2d ed. 1994) (“ <i>Computer Dictionary</i> ”)
1035	Excerpt from ANDREW S. TANENBAUM, STRUCTURED COMPUTER ORGANIZATION (2006) (“ <i>Tanenbaum</i> ”)
1036	Excerpts from ROBERT OSHANA, DSP SOFTWARE DEVELOPMENT TECHNIQUES FOR EMBEDDED AND REAL-TIME SYSTEMS (2006) (“ <i>Oshana</i> ”)
1037	U.S. Patent 5,748,754 (“ <i>Maag</i> ”)
1038	Excerpt from GLEN BALLOU, HANDBOOK FOR SOUND ENGINEERS: THE NEW AUDIO CYCLOPEDIA (Glen Ballou ed., 1987) (“ <i>AudioCyclopedia</i> ”)
1039	U.S. Publication 2007/0201705 (“ <i>Dorogusker</i> ”)
1040	WIPO Publication WO2008067454A2 (“ <i>Bongiovi</i> ”)
1041	U.S. Patent 4,891,841 (“ <i>Bohn</i> ”)
1042	U.S. Publication 2008/0129520A1 (“ <i>Lee</i> ”)
1043	U.S. Publication 2007/0021148A1 (“ <i>Mahini</i> ”)
1044	U.S. Publication 2008/0165988A1 (“ <i>Terlizzi</i> ”)
1045	Excerpt from File History of U.S. Appl. No. 17/483,190
1046	U.S. Publication 2008/0089530A1 (“ <i>Bostick</i> ”)
1047	U.S. Publication 2004/0179694A1 (“ <i>Alley</i> ”)
1048	U.S. Publication 2006/0262944A1 (“ <i>Rasmussen</i> ”)
1049	U.S. Publication 2003/0165246A1 (“ <i>Kvaløy</i> ”)
1050	U.S. Publication 2007/0177743A1 (“ <i>Mertens</i> ”)

Exhibit No.	DESCRIPTION
1051	U.S. Patent 7,903,826 (“ <i>Boersma</i> ”)
1052	RESERVED
1053	RESERVED
1054	RESERVED
1055	RESERVED
1056	Exhibit A06 to Techiya’s Infringement Contentions and Claim Chart for U.S Patent 11,710,473
1057	RESERVED
1058	RESERVED

LISTING OF CHALLENGED CLAIMS

Claim 1	
1.pre	A device that can control ambient passthrough in an earpiece comprising:
1.1	a first memory that stores instructions; and
1.2	a processor that executes the instructions to perform operations, the operations comprising:
1.3	communicatively connecting to an earpiece, wherein the earpiece includes a first microphone, a second microphone, a speaker, a second memory and an earpiece processor;
1.4	sending an audio content gain value and an ambient sound gain value to the earpiece; and
1.5	sending an audio content signal to the earpiece,
1.6	wherein the earpiece processor applies the audio content gain value to the audio content signal to generate a modified audio content signal,
1.7	wherein the earpiece processor applies the ambient sound gain value to an ambient sound signal to generate a modified ambient sound signal, and
1.8	wherein the earpiece processor mixes the modified ambient sound signal with the modified audio content signal to generate a mixed signal.
Claim 2	
2.1	The device according to claim 1, wherein the earpiece processor calculates a noise level based upon a first microphone signal from the first microphone,
2.2	wherein the earpiece processor modifies the mixed signal based upon the noise level.
Claim 3	

3	The device according to claim 1, wherein the earpiece processor generates the ambient sound signal from a first microphone signal from the first microphone.
Claim 4	
4	The device according to claim 1 further including a user interface.
Claim 5	
5	The device according to claim 1, wherein the earpiece processor applies an ambient gain to a first microphone signal from the first microphone to generate the ambient sound signal.
Claim 6	
6	The device according to claim 1, wherein the device is a portable communication device.
Claim 7	
7	The device according to claim 6, where the device portable communication device is at least one of a phone, a watch, a tablet, earpiece, a laptop computer or a combination thereof.
Claim 8	
8.pre	A device that can control ambient sound passthrough comprising:
8.1	a first microphone that measures a first acoustic environment to generate a first microphone signal;
8.2	a second microphone that is positioned closer to a user's ear canal than the first microphone when the device is worn, where the second microphone generates a second microphone signal;
8.3	a speaker;
8.4	a memory that stores instructions; and
8.5	a processor that executes the instructions to perform operations, the operations comprising:
8.6	receiving an audio content signal;
8.7	modifying the audio content signal to generate a modified audio content signal;

8.8	modifying the first microphone signal to generate a modified first microphone signal;
8.9	modifying the second microphone signal to generate a modified second microphone signal;
8.10	generating an ambient sound signal from at least one of the modified first microphone signal, the modified second microphone signal or a combination thereof;
8.11	detecting an acute sound by analyzing at least one of the modified first microphone signal, the modified second microphone signal or a combination thereof;
8.12	modifying the modified audio content signal if an acute sound is detected to generate a new modified audio content signal;
8.13	generating a mixed signal by mixing the ambient sound signal with the modified audio content signal or the new modified audio content signal; and
8.14	sending the mixed signal to the speaker.
Claim 9	
9	The device according to claim 8, wherein the operations further comprise: determining if the acute sound is a user's voice by analyzing the temporal and spectral characteristics of at least one of the modified first microphone signal, the modified second microphone signal or a combination thereof.
Claim 10	
10	The device according to claim 9, wherein the operations further comprise: generating a noise signal from at least one of the modified first microphone signal, the modified second microphone signal, or both; generating a noise reduction signal.
Claim 11	
11	The device according to claim 10, wherein the operations further comprise: mixing the noise reduction signal with the mixed signal to generate a new mixed signal, and sending the new mixed signal to the speaker instead of the mixed signal.

Claim 12	
12	The device according to claim 11, wherein the operations further comprise: sending a modified ambient signal to the speaker instead of the new mixed signal if the user's voice is detected.
Claim 13	
13	The device according to claim 9, wherein the operations further comprise: sending a modified ambient signal to the speaker instead of the mixed signal if the user's voice is detected.
Claim 14	
14	The device according to claim 9, wherein the operations further comprise: detecting whether the acute sound is at least one of a warning sound, siren, voice, specific noise type, or a combination, by analyzing the spectrum of at least one of the modified first microphone signal, the modified second microphone signal, the modified ambient sound signal, or a combination.
Claim 15	
15	The device according to claim 14, wherein the operations further comprise: decreasing a volume of the modified audio content signal when a warning or siren is detected.
Claim 16	
16	The device according to claim 14, where the operations further comprise: sending a notification signal to the speaker if the acute sound is a warning sound or siren.
Claim 17	
17	The device according to claim 16, wherein the warning sound is at least one of a bell, an emergency vehicle, the sound of a security system or a combination thereof.
Claim 18	
18	The device according to claim 14, wherein if an alarm is detected it is at least one of a police siren, an ambulance siren, a car honking or a combination thereof.

Claim 19	
19	The device according to claim 8, wherein the operations further comprise: decreasing a volume of the modified audio content signal when a user's voice is detected.
Claim 20	
20	The device according to claim 8, wherein the acute sound is a voice.

I. INTRODUCTION

Samsung Electronics Co., Ltd., and Samsung Electronics America, Inc. (“Samsung” or “Petitioners”) request *inter partes* review (“IPR”) of claims 1-20 (“Challenged Claims”) of U.S. Patent No. 11,710,473 (“’473 patent”).

II. GROUNDS FOR STANDING

Petitioners certify that the ’473 patent 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

Ground	Claims	Basis
1A	1, 3-7	§103: <i>Patel</i> and <i>Topholm</i>
1B	2	§103: <i>Patel</i> , <i>Topholm</i> , and <i>Williamson</i>
2A	8, 19-20	§103: <i>Melanson</i> and <i>Rosenberg</i>
2B	9, 13-18	§103: <i>Melanson</i> , <i>Rosenberg</i> , <i>Samadani</i> , and <i>Dijkstra</i>
2C	10-12	§103: <i>Melanson</i> , <i>Rosenberg</i> , <i>Samadani</i> , <i>Dijkstra</i> , and <i>Engle</i>

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

As shown below, each reference pre-dates the earliest possible priority date to which the Challenged Claims may be entitled (January 22, 2007).²

Reference	Date	Pre-AIA Art At Least Under
U.S. 2007/0041589A1 (“ <i>Patel</i> ”)	08/17/2005 (filed) 02/22/2007 (published)	§102(e)
WO2006/097099A1 (“ <i>Topholm</i> ”)	09/21/2006 (published)	§102(a)
U.S. 5,027,410 (“ <i>Williamson</i> ”)	06/25/1991 (issued)	§102(b)
U.S. 7,903,825 (“ <i>Melanson</i> ”)	03/03/2006 (filed)	§102(e)
U.S. 2007/0189544A1 (“ <i>Rosenberg</i> ”)	08/31/2006 (prov. filed) 04/07/2007 (filed) 08/16/2007 (published)	§102(e)
U.S. 2008/0079571A1 (“ <i>Samadani</i> ”)	09/29/2006 (filed) 04/03/2008 (published)	§102(e)
U.S. 20060182295A1 (“ <i>Dijkstra</i> ”)	08/17/2006 (published)	§102(a)
WO2006/036262A1 (“ <i>Engle</i> ”)	04/06/2006 (published)	§102(a)

Rosenberg qualifies as prior art as of the date of its provisional application number 60/841,990 (“’990PROV”), which provides §112 written description and enablement support for at least one claim of *Rosenberg* and includes the invalidating portions of *Rosenberg* relied upon herein. *Kyriakakis* ¶¶135-138. For example, *Rosenberg* claim 1 is disclosed and enabled by ’990PROV Figure 2 and the

² Petitioners do not concede that the Challenged Claims are entitled to a January 22, 2007 priority date. Petitioners have filed a co-pending petition that asserts that the Challenged Claims are not entitled to priority before February 3, 2022.

corresponding description in paragraphs [0028]-[0036].³ *Id.* ¶137. The table below shows the portions of *Rosenberg* relied upon and the corresponding disclosures in the '990PROV. *Rosenberg* therefore qualifies as §102(e) prior art.

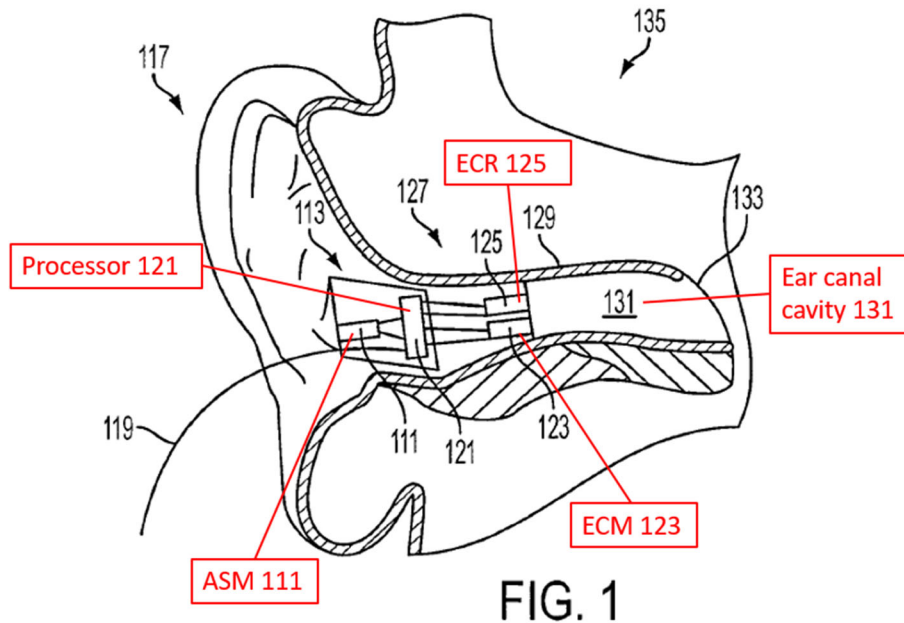
<i>Rosenberg</i>	'990PROV
[0013], [0054]-[0058], claims 19, 21	[0039]-[0043]
[0026]	[0011]
[0039]	[0024]
[0044]-[0047]	[0029]-[0032]
[0061]	[0046]

IV. OVERVIEW OF THE '473 PATENT

The '473 patent explains that due to environmental noise, “people are arming themselves with portable audio playback devices,” which has the drawback of isolating users from their environment. '473*pat.*, 1:49-2:25. The '473 patent discloses an earpiece that “detects acute sounds and allows the acute sounds to be

³ Petitioners attached '990PROV as EX1019 and added paragraph numbers for ease of reference.

reproduced in an ear canal.” *Id.*, 1:27-32, 2:29-31. Figure 1 depicts an exemplary embodiment of an earpiece:



'473pat., FIG. 1 (annotated)

As shown in Figure 1, earpiece 100 includes Ambient Sound Microphone (ASM) 111, Ear Canal Receiver (ECR) 125 or speaker, and Ear Canal Microphone (ECM) 123. *Id.*, 5:3-6. The earpiece also includes a processor 121 operatively coupled to the ASM 111, ECR 125, and ECM 123. *Id.*, 5:39-43.

The processor 121 monitors ambient sound captured by ASM 111 for acute sounds in the environment, such as an abrupt high energy sound corresponding to the on-set of a warning sound (e.g., bell, emergency vehicle, security system, etc.), siren (e.g., police car, ambulance, etc.), voice (e.g., “help”, “stop”, “police”, etc.), or specific noise type (e.g., breaking glass, gunshot, etc.). *Id.*, 5:43-50. The processor

121 can adjust the audio content and pass the acute sounds to ear canal 131 via ECR 125 responsive to detecting acute sounds. *Id.*, 7:28-47.

V. OVERVIEW OF THE PRIOR ART

The prior art references analyzed in the grounds below are analogous to the '473 patent because they are within the same field of endeavor of the '473 patent and reasonably pertinent to one or more problems addressed by the '473 patent. *Kyriakakis* ¶91. And as demonstrated below, the purported problem in the prior art identified by the '473 patent was known and solved by others before January 2007 and the '473 claims recite nothing more than an obvious combination of the prior art. *Id.*

A. Grounds 1A-B

Patel discloses a head-mounted device that includes, among other things, two microphones, a processor, and a speaker. *See Patel* ¶[0018], FIGs. 1, 4, 6, 8, 9. The head-mounted device may establish a wireless link with an external device, such as a cell phone or MP3 player, in order to send and receive audio and other control signals. *Id.* ¶¶[0018], [0028], [0060]. *Patel* further teaches that environmental sounds may be introduced into the audio signal being transmitted into the ear canal. *Id.* ¶[0028].

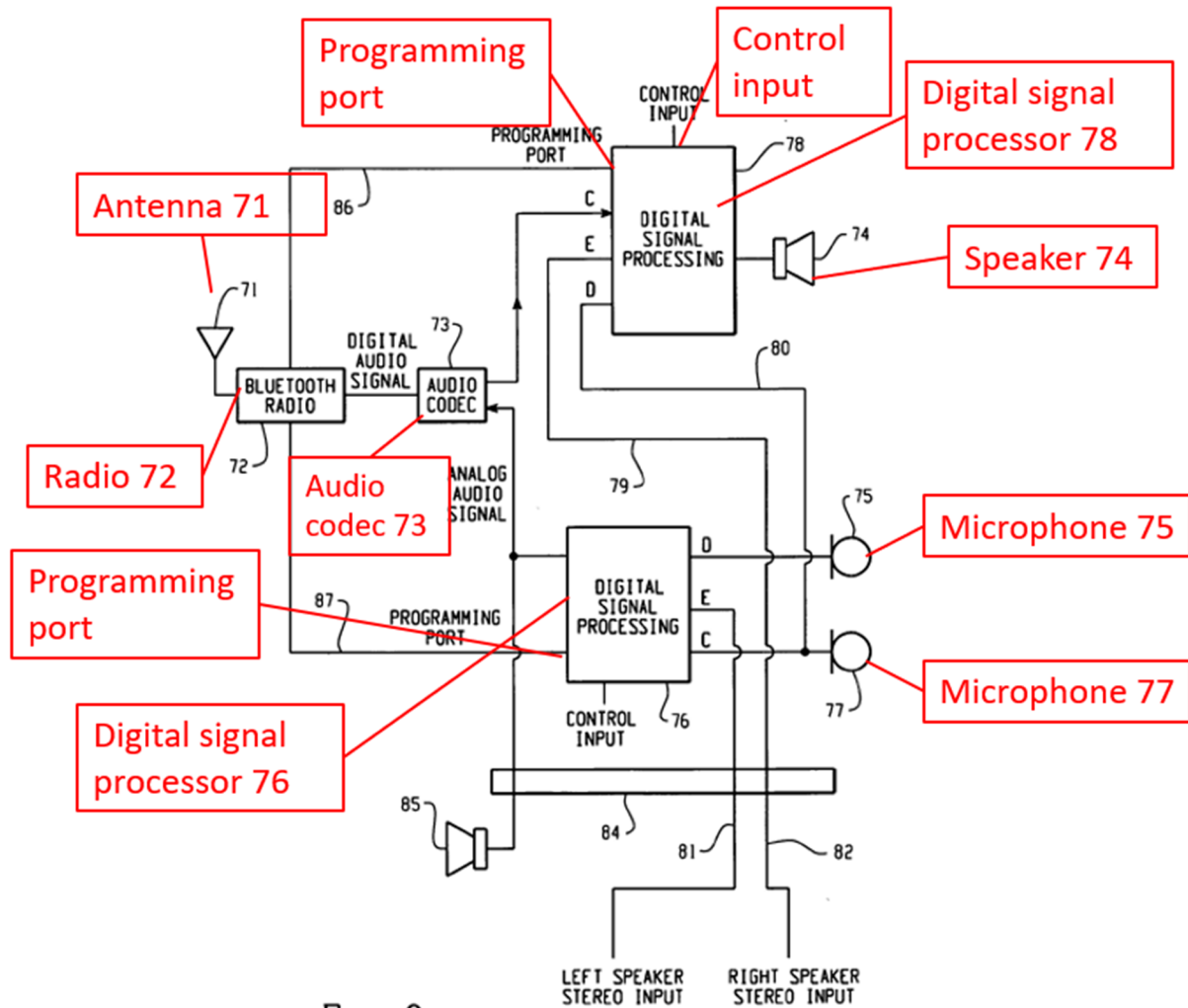


Fig. 9

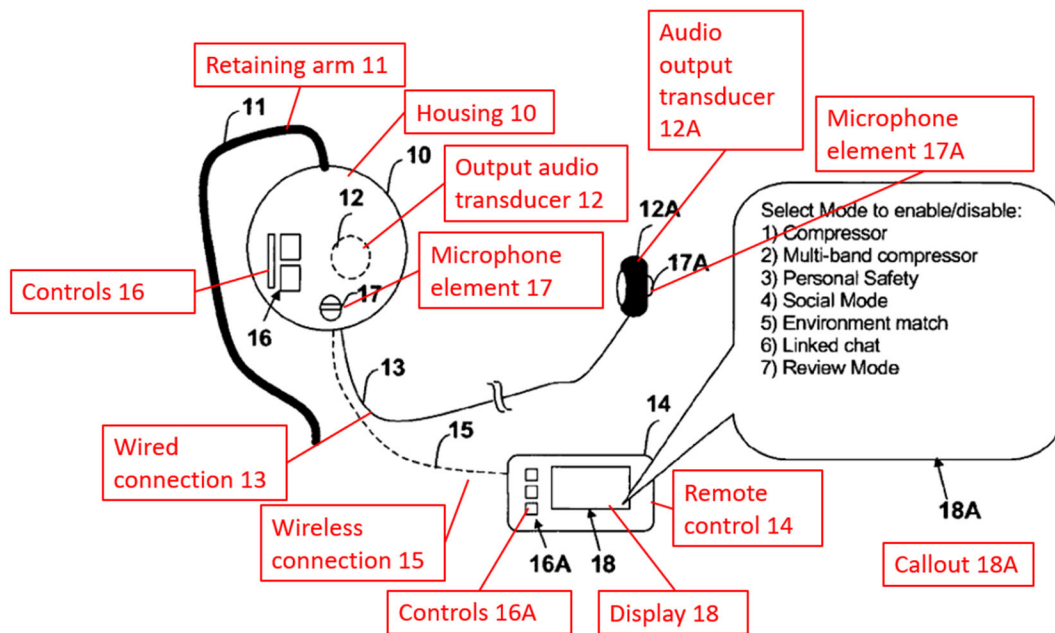
Patel, FIG. 9 (annotated)

Topholm discloses the details of a known device for remotely controlling a hearing aid. *Williamson* discloses a known-technique for analyzing a microphone signal to determine a background noise level and adapt a hearing aid filter.

B. Grounds 2A-C

Melanson discloses a “personal audio playback device that alters the gain of playback program material in response to environmental sounds.” *Melanson*,

Abstract. The personal audio playback device may be worn on the ear and includes, among other things, two microphones 17, 17A, a processor, and two output transducers. *Melanson*, 3:34-60, 4:31-48, FIGs. 1, 3.



Melanson, FIG. 1 (annotated)⁴

Rosenberg discloses processing techniques related to collecting, analyzing, and mixing ambient sound with audio content. *Samadani*, *Dijkstra*, and *Engle* disclose various known features of devices similar to *Melanson* and *Rosenberg*.

VI. LEVEL OF ORDINARY SKILL IN THE ART

A person of ordinary skill in the art at the time of the alleged invention of the '473 patent ("POSITA"), which for purposes of this proceeding is no earlier than

⁴ All emphases and annotations throughout are added unless otherwise noted.

January 22, 2007, 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 or speech processing and/or acoustic pattern recognition. *Kyriakakis* ¶19. A greater amount of education could compensate for fewer years of work experience, and vice versa. *Id.* This is the appropriate level of skill whether the claims are entitled to priority as of January 22, 2007 or February 3, 2022.

VII. CLAIM CONSTRUCTION

Petitioners are unaware of any “prior claim construction determination” related to the '473 patent. *See* 37 C.F.R. §42.100(b).

Petitioners note that, as to the parent '666 patent, the District Court in the Eastern District of Texas has construed certain claim terms (EX1011) and that, in an *ex parte* reexamination of the '666 patent (90/019,169), the examiner asserted that various claim terms should be interpreted subject to §112, ¶6 (EX1009). The claim term(s) at issue in the District Court claim construction and *ex parte* re-examination (namely, “a processor that is configured to execute ... instructions”) is not present in the '473 patent, and PO does not contend that §112 ¶6 applies. *See* EX1056.

Given the close correlation and substantial identity between the prior art references and the Challenged Claims, no express constructions of the claims are

necessary. 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).

VIII. DETAILED EXPLANATION OF GROUNDS

A. Ground 1A: *Patel* and *Topholm* Render Obvious Claims 1 and 3-7

As a threshold note, *Patel* describes various embodiments of a head-mounted device. *Kyriakakis* ¶169. A POSITA would have understood that *Patel* does not repeat the description of common components for each embodiment. *Id.* This Petition focuses on *Patel*'s embodiment in Figure 9, but also cites to the description of components and functionality of the embodiment in Figure 9 that *Patel* describes in connection with *Patel*'s other embodiments.

1. Claim 1

a. [1.pre]

To the extent the preamble is limiting, *Patel* discloses a “head-mounted device” that establishes a wireless link with an “external device.” *Patel* ¶¶[0001], [0018], [0060]; *Kyriakakis* ¶¶170-172. *Patel* discloses that the head-mounted device “could rest behind a single ear ... or it could rest within the ear canal.” *Id.* ¶[0062]; *Kyriakakis* ¶¶171-172. This is consistent with how the '473 patent describes an

⁵ Petitioners reserve all rights to raise claim construction arguments and other arguments in any parallel or future litigation concerning the '473 patent.

“earpiece.” ’473pat., 4:64-66; *Kyriakakis* ¶¶173-174 (citing *Victorian*, ¶¶[0003], [0013], FIGs. 3A-3C, 6).

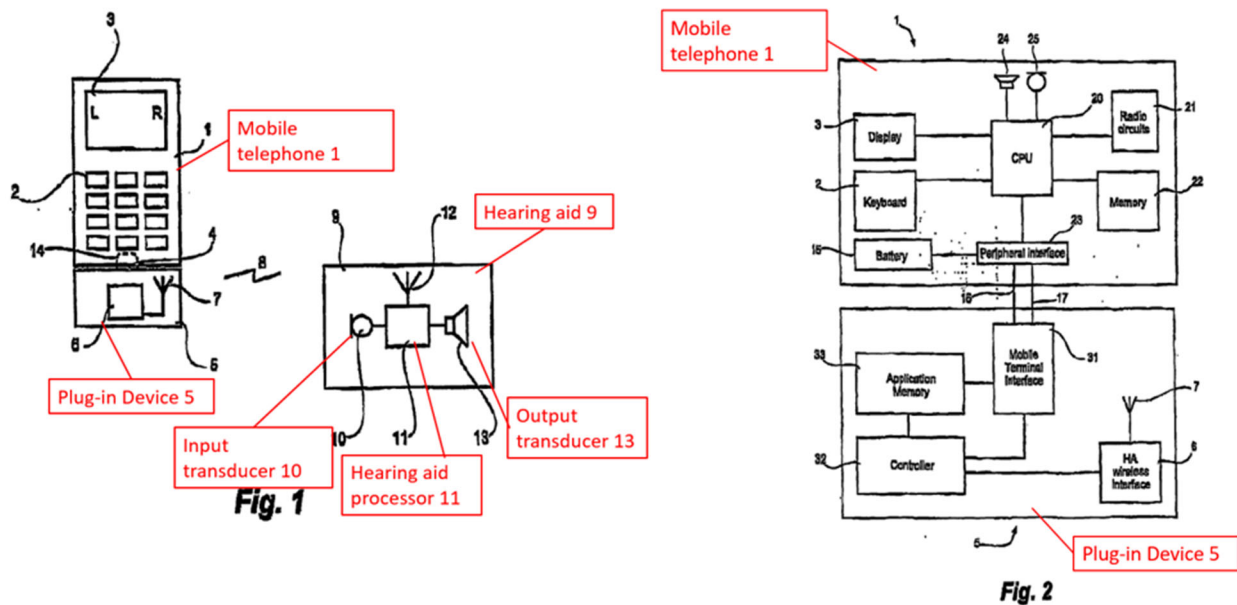
Patel further discloses that the head-mounted device includes a microphone 27 (*Patel* ¶[0026]), and that “[e]nvironmental sounds ... may be received by the microphone 27 and ... transmitted into the ear canal” (*id.* ¶[0028]). *Kyriakakis* ¶¶175-176. This feature is consistent with how the ’473 patent describes “ambient passthrough.” ’473pat., 7:28-31, 8:51-53; *Kyriakakis* ¶177.

Patel further explains that “the user may turn down or turn off the environmental sounds” via “a control signal sent by a wireless or direct link.” *Patel* ¶[0028]; *Kyriakakis* ¶¶178-179. *Patel* discloses that the “control input” may be received “via the radio 2.” *Patel* ¶[0025]. Because *Patel* discloses that the radio 2 is used for the wireless link between the head-mounted device and the external device (*id.* ¶¶[0018]-[0019]), a POSITA would have understood a “control signal” sent by a “wireless ... link” to comprise a control signal sent by the external device. *See, e.g., id.* ¶¶[0002], [0018]-[0019]; *see also id.* ¶[0032]; *Kyriakakis* ¶¶180-181.

Accordingly, a POSITA would have understood *Patel* to disclose or suggest an external device (“a device”) wirelessly linked to a head-mounted device to control the volume of environmental sounds introduced into the audio signal provided to the user (“that can control ambient passthrough”) wherein the head-mounted device rests behind a single ear or within the ear canal (“in an earpiece”). *Kyriakakis* ¶182.

b. [1.1] and [1.2]

Patel discloses or suggests an external device—such as a cell phone or MP3 player (*Patel* ¶[0018])—for controlling a head-mounted device. *Kyriakakis* ¶184. *Topholm* discloses additional implementation details related to the structure of such an external device. *Id.* ¶¶185-186. *Topholm* discloses a remote control system for a hearing aid comprising a mobile telephone and a plug-in device. *Topholm*, 2:10-20.



Topholm, FIGs. 1, 2 (annotated)

The mobile telephone comprises a CPU 20 connected to a memory 22. *Id.*, 4:6-7. The remote control functions of the mobile telephone are “controlled by the CPU 20 executing applications stored in the memory 22.” *Id.*, 4:22. A POSITA would have understood memory 22 comprises memory that stores instructions because “applications” and “software” are a series of instructions. *Kyriakakis* ¶187

(citing *Computer Dictionary*). A POSITA would have understood that CPU 20 is a processor. *Id.* (citing *Tanenbaum*, 39). Thus, a POSITA would have understood *Topholm* to disclose that the mobile telephone includes a processor for executing the instructions stored in memory to perform the remote control operations. *Id.*

A POSITA would have been motivated to combine *Patel* with *Topholm*'s teachings related to a mobile device with a memory and processor and would have had a reasonable expectation of success in doing so. *Id.* ¶188. A POSITA would have considered *Patel*'s disclosure to amount to an express suggestion to implement the teachings of *Topholm* related to an external device with a memory and processor to control the ambient passthrough in *Patel*'s head-mounted device. *Id.* A POSITA also would have considered the combination to amount to the application of a known technique (*Topholm*'s teaching of a wireless remote control system including software stored in a memory and a processor that executes the software stored in the memory) to a known device (*Patel*'s external device) ready for improvement (*Patel*'s external device is already capable of transmitting audio and control signals to a head-mounted device) to yield predictable results (*Patel*'s head-mounted device in communication with an external device including a memory and processor). *Id.*

Accordingly, a POSITA would have understood the *Patel-Topholm* combination to disclose or suggest an external device with software and applications stored in memory ("a first memory that stores instructions") and a CPU ("a

processor”) that executes the applications and software to perform operations (“that executes the instructions to perform operations”). *Id.* ¶189.

c. [1.3]

Patel discloses that the external device wirelessly links with the head-mounted device for exchanging audio and control signals. *Patel* ¶¶[0001], [0018]-[0021]; *see also id.* ¶¶[0059]-[0060], FIGs. 8-9; *Kyriakakis* ¶191. This is consistent with how a POSITA would have understood “communicatively connecting” to the head-mounted device. *Kyriakakis* ¶191. As detailed in §VIII.A.1.a, a POSITA would have understood *Patel* to disclose implementing its head-mounted device as an “earpiece.”

Patel further discloses that the head-mounted device includes two microphones (75, 77), and a speaker. *Patel* ¶[0060], FIG. 9; *see also id.* ¶[0018]; *Kyriakakis* ¶193.

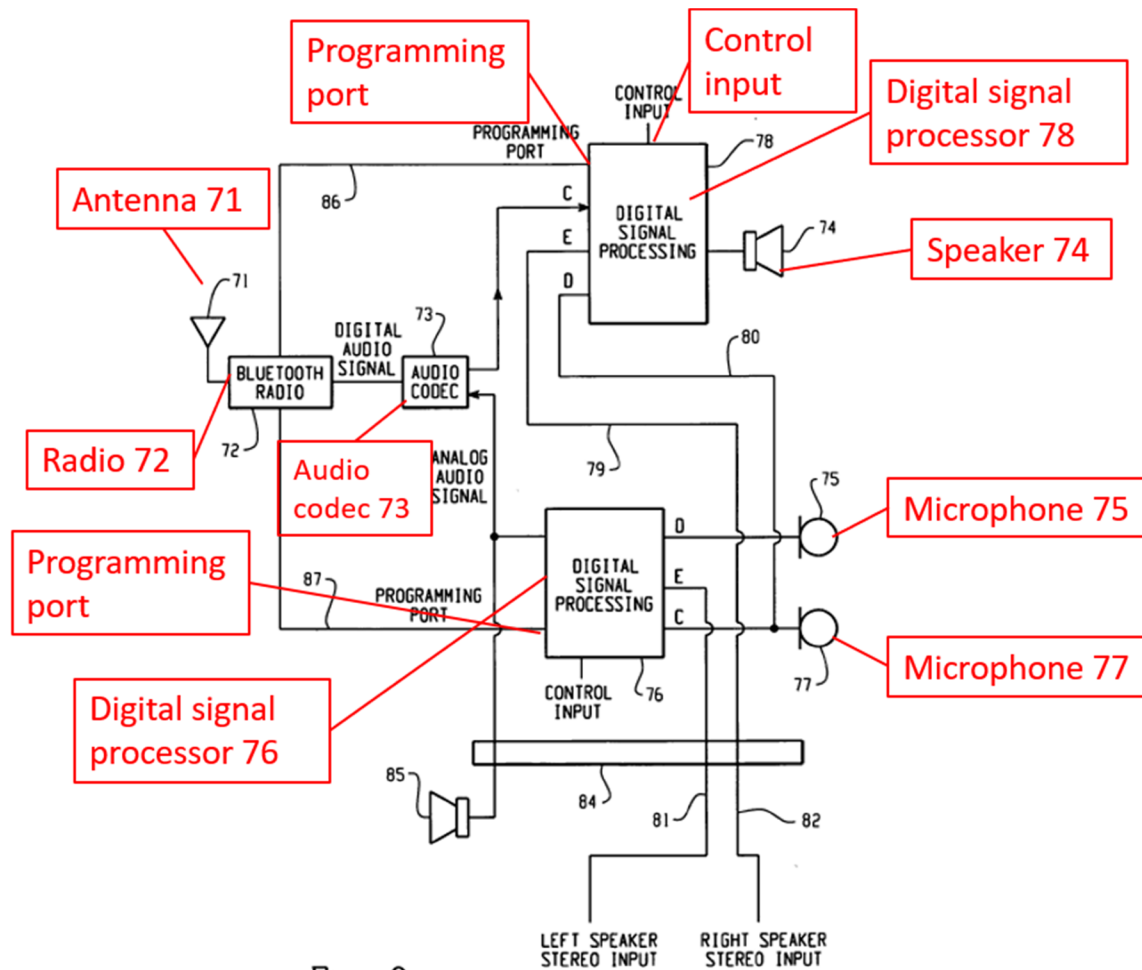


Fig. 9

Patel, FIG. 9 (annotated)

Patel further discloses that the head-mounted device includes a programmable digital signal processor. *Patel* ¶[0060], FIG. 9; *see also id.* ¶[0018]. A POSITA would have understood that a programmable digital signal processor includes a memory. *Kyriakakis* ¶195 (citing *Oshana*, xi, 124). To note, although *Patel*'s Figure 9 shows two digital signal processing blocks, *Patel* discloses that the two blocks may be implemented with "a single device," i.e., a single processor. *Patel* ¶[0030], claims 22, 28, 30; *Kyriakakis* ¶¶196-198.

Accordingly, a POSITA would have understood the *Patel-Topholm* combination to disclose or suggest that an external device with a processor executes instructions to form a wireless link with a head-mounted device (“communicatively connecting to an earpiece”) wherein the head-mounted device has two microphones (“wherein the earpiece includes a first microphone, a second microphone”), a speaker (“a speaker”), and a programmable digital signal processor (“a second memory and an earpiece processor”). *Id.* ¶199.

d. [1.5]

Patel discloses that the head-mounted device may be “configured to listen to a high fidelity external stereo audio source such as a CD player or MP3 player” via left and right side audio feeds. *Patel* ¶¶[0059]-[0060], FIGs. 8-9. This is consistent with how the ’473 patent describes this feature. ’473*pat.*, 12:28-32; *see also id.*, 3:8-10, 6:63-7:27; *Kyriakakis* ¶201.

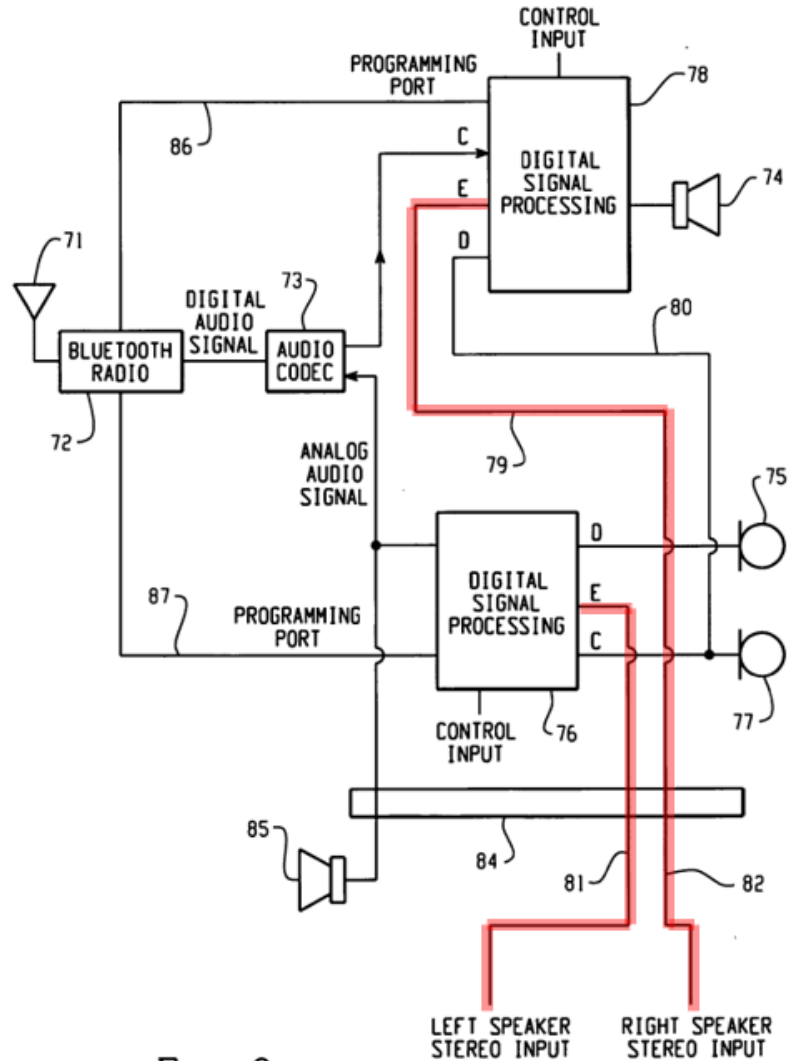


Fig. 9

Patel, FIG. 9 (annotated)

Accordingly, a POSITA would have understood the *Patel-Topholm* combination to disclose or suggest a processor located in the external device that is configured to execute instructions stored in memory to send audio signals from the external device to the head-mounted device (“sending an audio content signal to the earpiece”). *Kyriakakis* ¶202.

e. [1.4]

As explained in §VIII.A.1.d, the *Patel-Topholm* combination discloses or suggests an external device sending an audio content signal to the earpiece. The combination further discloses or suggests the same external device sending an audio content gain value and an ambient sound gain value to the earpiece. *Kyriakakis* ¶203.

**(i) [1.4.1]: sending an audio content gain value ...
to the earpiece**

Patel discloses that the head-mounted device's digital signal processing blocks “can be made to function as an audio equalizer” due to “individually adjustable filters (amplitude and bandwidth) within the processors' filter banks.” *Patel* ¶[0060]. The digital signal processing blocks 76, 78 “divide a given signal bandwidth into a number of bins” and “each bin may be capable of individual amplitude adjustment.” *Id.*

Patel further discloses that, with an external device “such as an MP3 player or other mobile device,” the equalizer settings, including amplitude and bandwidth settings, “may be transferred over the wireless link to the head-mounted device” where they are programmed via the programming ports of digital signal processing blocks 76, 78. *Id.*; *Kyriakakis* ¶¶205-206.

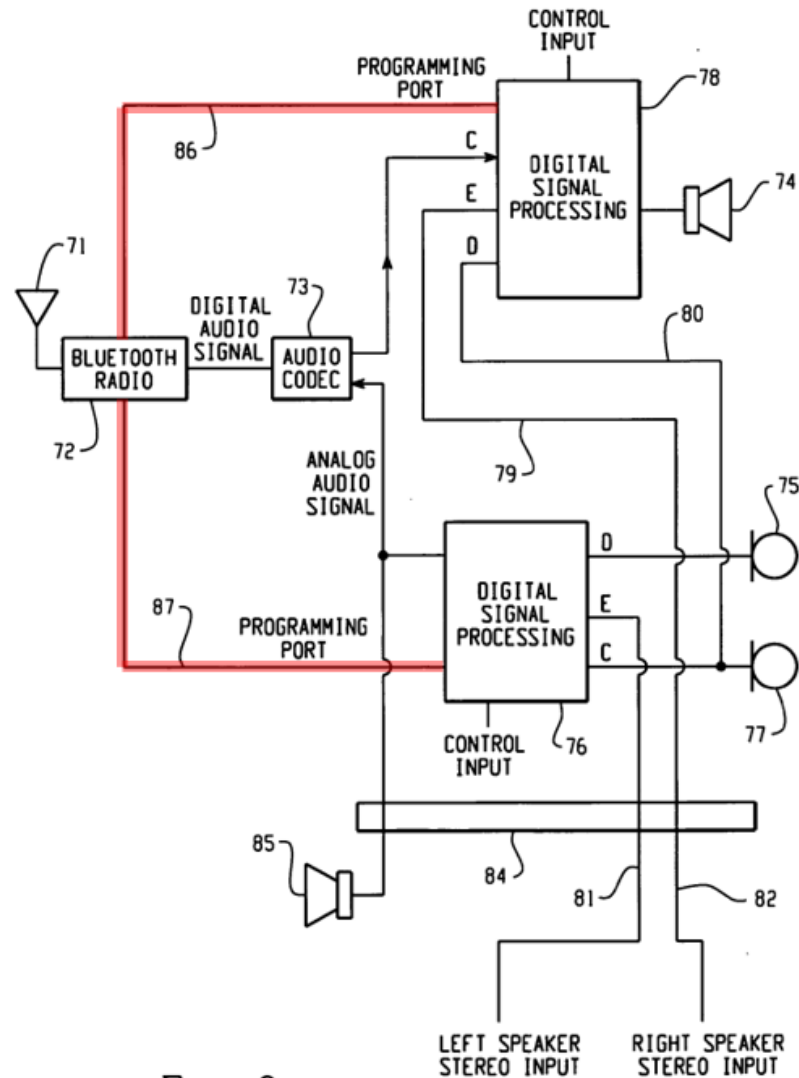


Fig. 9

Patel, FIG. 9 (annotated)

A POSITA would have understood that the amplitude setting of a filter is a gain value. *Kyriakakis* ¶207 (citing *Maag*, 1:8-2:19). Thus, transferring the amplitude and bandwidth settings for each filter within the filter bank, from an external device to the head-mounted device, comprises transmitting a gain value from the external device to the head-mounted device. *Id.* And because the filter

settings are applied to the audio content signal, a POSITA would have understood that the transmitted gain value was applied to the audio content signal (i.e., an audio content gain value). *Id.*

A POSITA would have understood *Patel* to disclose or suggest the same external device that transmits the high fidelity audio signal (“audio content signal”) also transmits the equalizer settings. *Id.* ¶208. First, *Patel* explains that both the high fidelity audio signal and the equalizer settings may be received from an MP3 player. *Patel* ¶[0060]. *Patel* also consistently identifies an MP3 player among the exemplary external devices with which the head-mounted device may communicate and does not otherwise exclude receiving both the audio signal and control signal from a single device. *Patel* ¶¶[0018], [0059], [0060]. Thus, at a minimum, *Patel* suggests a system and method involving the transmission of a high fidelity audio signal and equalizer settings from, e.g., an MP3 player or other communication device, to the head-mounted device. *Kyriakakis* ¶208.

Even if *Patel* does not itself disclose or suggest that the same external device that transmits the high fidelity audio signal also transmits the equalizer settings, *Topholm* discloses an external mobile device that transmits both control signals (e.g., for volume adjustments) (*Topholm*, 5:4-10) and digital audio (*id.*, 6:5-6) to a hearing aid from the same device. A POSITA would have considered it obvious to implement *Topholm*’s teaching in this regard in *Patel* because this would have been

more convenient to the user than having to carry two separate external devices—one to transmit music and the other to transmit the equalizer settings for the music. *Kyriakakis* ¶209. The combination would have amounted to applying a known technique (transmitting control signals and audio data) to a known device (the *Patel* head-mounted device system) ready for improvement (*Patel*’s head-mounted device is already configured to receive control signal and audio data from a remote device) to yield predictable results (a head-mounted device that can receive controls signals and audio data from the same remote device). *Id.*

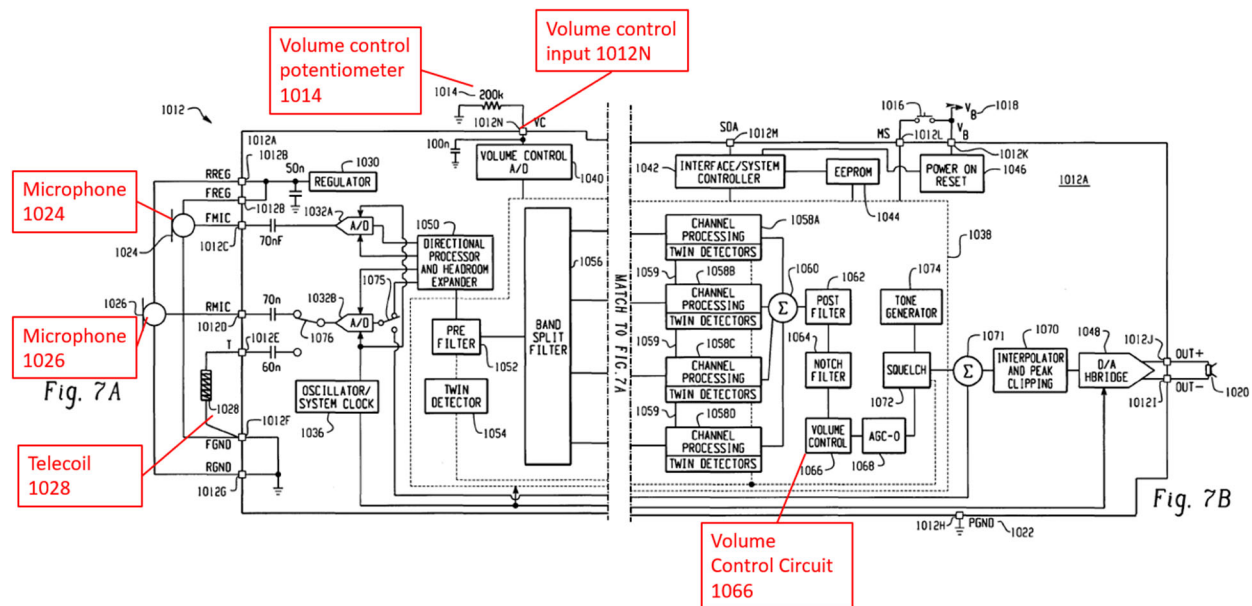
Accordingly, a POSITA would have understood the *Patel-Topholm* combination to disclose or suggest the external device with a processor executing instructions to transfer an amplitude setting for each filter within the filter bank to the head-mounted device (“sending an audio content gain value ... to the earpiece”). *Id.* ¶210.

(ii) [1.4.2]: sending ... an ambient sound gain value to the earpiece

Patel discloses that environmental sounds may be introduced by the digital signal processor into the audio signal transmitted into the ear canal and that, with a control signal sent from an external device, the user may “turn down or off” the environmental sounds. *Patel* ¶[0028]. A POSITA would have understood “turn[ing] down” the environmental sounds to refer to lowering the volume of the

environmental sounds. *Kyriakakis* ¶¶212-213.

A POSITA would have understood *Patel* to suggest that the control signal to turn down the volume of the environmental sounds includes a gain value. *Id.* ¶214. For example, *Patel* discloses a more detailed circuit diagram for an exemplary head-mounted device in Figures 7A-7B. *Patel* ¶[0033]. In relevant respect, the circuit includes a volume control potentiometer 1014 that is coupled to a volume control input 1012N and is used to set the desired volume level provided to volume control A/D 1040. *Id.* ¶[0036].



Patel, FIGS. 7A, 7B (annotated)

A POSITA would have understood that the potentiometer is a device that allows the user to adjust the volume of the audio output. *Kyriakakis* ¶215 (citing *AudioCyclopedia* at 560). *Patel* further explains that a volume control circuit 1066

“receives a digital value from the volume control A/D 1040, which indicates the desired volume level set by the user via potentiometer 1014, and uses this stored digital value to set the gain of an included amplifier circuit.” *Patel* ¶[0054]. Thus, *Patel* suggests that adjusting the volume of the microphone output involves receiving a “digital value” that is used to “set the gain of an included amplifier circuit.” This is consistent with how a POSITA would have understood a “gain value.” *Kyriakakis* ¶215.

In view of *Patel*’s disclosure with respect to the exemplary head-mounted device in Figure 7, a POSITA would have considered it obvious to implement a similar technique when using an external device to transmit a control signal to turn down environmental sounds in the embodiment of Figure 9. *Id.* ¶216. Indeed, a POSITA would have understood that a control signal to turn down the environmental sounds would include either a value to increment or decrement a gain value applied to the audio signal (e.g., a value of +0.1 or -0.1), or a gain value to replace the currently stored gain value (e.g., a value of 0.8). *Id.* ¶¶ 216-217 (citing *Dorogusker* ¶[0051]). A POSITA would have understood that *Patel*’s Figure 7 embodiment expressly suggests the latter implementation because the received digital value is used to “set the gain” of the amplifier. *Id.* ¶218. A POSITA also would have understood that the latter implementation would be advantageous because it would provide the user with the ability to implement pre-programmed volume settings,

which are convenient to users. *Id.* ¶218. Thus, a POSITA would have considered it obvious, when implementing a control signal to turn down the environmental sounds, to include a gain value to be applied to the audio signal including the environmental sounds. *Id.*

In addition, for the same reasons discussed in §VIII.A.1.e(i), the *Patel-Topholm* combination at least renders obvious transmitting the control signal to turn down environmental sounds from the same external device that transmits audio signals and equalizer settings. *Id.* ¶219.

Accordingly, a POSITA would have understood the *Patel-Topholm* combination to disclose or suggest an external device with a processor executing instructions to send a control signal including a gain value to be applied to the audio signal including the environmental sounds (“sending ... an ambient sound gain value to the earpiece”). *Id.* ¶220.

f. [1.6]

As explained in §VIII.A.1.d, a POSITA would have understood *Patel* to disclose sending an audio content gain value by sending the amplitude settings for each filter within a filter bank. *Patel* further discloses that “the audio characteristics of the left and right audio feeds 81, 82 may be ***altered by the digital signal processing blocks 76, 78.***” *Patel* ¶[0060]. And as discussed in §VIII.A.1.c, *Patel* discloses implementing the digital processing blocks with a single digital signal

processor. A POSITA would have understood that after the audio content signal is processed or “altered by the digital signal processing blocks 76, 78” it is a “modified audio content signal.” *Kyriakakis* ¶222.

Accordingly, a POSITA would have understood the *Patel-Topholm* combination to disclose or suggest that the digital signal processor of the head-mounted device (“the earpiece processor”) applies the equalizer settings provided by the user (“applies the audio content gain value”) to the audio signal (“to the audio content signal”) to alter the audio characteristics of the audio signal (“generate a modified audio content signal”). *Id.* ¶223.

g. [1.7]

As explained in §VIII.A.1.d, *Patel* discloses that the head-mounted device receives a control signal to adjust the volume of environmental sounds. More particularly, *Patel* discloses that the control signal to turn down the environmental sounds is provided “to the digital signal processor 28.” *Patel* ¶[0028]. Thus, a POSITA would have understood that it is the digital signal processor of the head-mounted device that applies the transmitted ambient sound gain value to the environmental sounds. *Kyriakakis* ¶¶225-226.

Patel explains that the environmental sounds are “audio signals from outside of the ear canal” and “may be received by the microphone 27.” *Patel* ¶[0028]. This is consistent with how a POSITA would have understood “ambient sound signal.”

Kyriakakis ¶226. A POSITA would have understood that the gain-reduced ambient sound signal constitutes a “modified ambient sound signal” because reducing the gain of the signal modifies it. *Id.* ¶227.

Accordingly, a POSITA would have understood the *Patel-Topholm* combination to disclose or suggest that the digital signal processor of the head-mounted device (“the earpiece processor”) applies the gain value included in the control signal (“applies the ambient sound gain value”) to the environmental sounds reproduced to the user (“an ambient sound signal”) such that the gain of the signal representing the environmental sounds reproduced to the user is adjusted (“generate a modified ambient sound signal”). *Id.* ¶228.

h. [1.8]

Patel discloses that the environmental sounds are introduced by the signal processor 28 into the audio signal “when the head-mounted device is in a communication mode (e.g., when a cellular call is initiated or in progress).” *Patel* ¶[0028]. As explained in §VIII.A.1.d, *Patel* discloses that the head-mounted device may receive high fidelity audio from, e.g., an MP3 player. *Patel* describes this as a “stereo mode.” *Id.* ¶[0060]. A POSITA would have understood that *Patel*’s disclosure of providing environmental sounds to the user “in a communication mode” applies to *Patel*’s “stereo mode” as well. *Kyriakakis* ¶230. This is because *Patel* broadly defines the devices that the head-mounted device may “communicate

with” as including “MP3 players,” among other devices. *Patel* ¶[0018]. Thus, a POSITA would have understood that *Patel*’s “communication mode” broadly refers to a mode in which the headset is exchanging signals with a remote device, including for purposes other than a phone call. *Kyriakakis* ¶230. Therefore, a POSITA would have understood *Patel*’s disclosure in paragraph [0028] to encompass introducing environmental sounds into a high fidelity audio signal (e.g., from an MP3 player or other communication device) provided to the user. *Id.*

A POSITA would have understood that the environmental sounds are “introduced” into the audio signal by “mixing” them with the audio signal because that is how signals are “introduced” into each other. *Id.* ¶231.

Patel discloses that the environmental sounds may be “turn[ed] down” while in a communication mode. *Patel* ¶[0028]. Thus, a POSITA would have understood *Patel* to disclose that the volume adjustment to the audio signal of the environmental sounds was made **prior to** mixing it with the audio signal from the external device such that when the processor introduces the environmental sounds into the audio signal delivered to the ear canal, it is the “modified ambient sound signal” (i.e., the turned-down environmental sound signal) that is being introduced/mixed. *Kyriakakis* ¶232. As detailed in §VIII.A.1.f, a POSITA would have understood that the “modified audio content signal” is the signal that has been processed through the processor’s programmable filter banks. Because *Patel* discloses that the

programmable filter banks adjust the “audio characteristics of the left and right audio feeds” and *Patel* **does not** disclose that the programmable filter banks adjust the audio characteristics of the microphone input environmental sounds, a POSITA would have understood *Patel* to disclose that the audio signals from the external device are processed/filtered before the environmental sound is introduced into the audio signal. *Id.* ¶233. Therefore, a POSITA would have understood *Patel* to disclose or suggest that the mix included both the “modified ambient sound signal” discussed above in §VIII.A.1.g and the “modified audio content signal” discussed above in §VIII.A.1.f. *Id.*

Accordingly, a POSITA would have understood the *Patel-Topholm* combination to disclose or suggest that, when in a communication mode, the processor of the head-mounted device (“wherein the earpiece processor”) introduces the turned-down environmental sound signal into the filtered audio signal from an external device (“mixes the modified ambient sound signal with the modified audio content signal to generate a mixed signal”). *Id.* ¶234.

2. Claims 3 and 5

As context, claims 3 and 5 add a requirement that the “ambient sound signal” is “generat[ed]” from “a first microphone signal.” Claim 5 in particular requires “appl[ying] an ambient gain” to the “first microphone signal.” *Kyriakakis* ¶236.

Patel discloses a microphone input is used to provide environmental sounds to the user. *Patel* ¶[0028]. *Patel* discloses that before the microphone input is provided to the user, the microphone input is first digitized and then “processed through a filter bank 14 to optimize the overall frequency response.” *Id.* ¶[0021], FIGs. 2, 5; *Kyriakakis* ¶237. A POSITA would have understood that the analog microphone signal that is digitized constitutes a “first microphone signal from the first microphone” because it is the digital version of an analog microphone signal from one of the microphones in the head-mounted device. *Kyriakakis* ¶238. Because the digitized microphone signal is processed through a filter bank before being provided to the user, a POSITA would have understood that the processor of the head-mounted device “generates the ambient sound signal from a first microphone signal from the first microphone.” *Id.*

A POSITA would have understood that filtering the signal to optimize the overall frequency response includes applying a gain to the signal. *Id.* ¶239 (citing *Bongiovi* at 11; *Bohn*, 6:58-60, 1:20-25, 2:27-32, 10:14-17). That is, a POSITA would have understood that a digital filter adjusts the gain of one or more frequency components of the signal by applying a gain to those frequency components. *Id.* A POSITA would have understood the gain applied to the microphone signal to constitute an “ambient gain” within the meaning of the ’473 patent because it is applied to a signal that represents environmental (i.e., ambient) sounds. *Id.* ¶240.

In view of the above, a POSITA would have understood *Patel* to disclose an embodiment in which the head-mounted device is in a communication mode and outputting an audio signal that includes both environmental sounds and, for example, stereo audio. In that embodiment, *Patel* discloses that the microphone input signal including the environmental sounds is digitized (“first microphone signal”), filtered to optimize the frequency response (“ambient sound signal”), volume-adjusted (e.g., turned down) (“modified ambient sound signal”), and then mixed with an equalized stereo audio signal (“modified audio content signal”). *Id.* ¶¶241-242.

Accordingly, a POSITA would have understood the *Patel-Topholm* combination to disclose or suggest that the processor of the head-mounted device applies a filter to the digitized microphone signal representing environmental sounds to generate a filtered microphone signal with an optimized frequency response (“wherein the earpiece processor generates the ambient sound signal from a first microphone signal from the first microphone”) and that the filter applies a gain to the digitized signal to generate a filtered microphone signal with an optimized frequency response (“wherein the earpiece processor applies an ambient gain to a first microphone signal from the first microphone to generate the ambient sound signal”). *Id.* ¶243.

3. Claim 4

Patel discloses various examples of the “external device,” including “cellular phones, PDAs, radios, MP3 players, CD players, portable game machines.” *Patel* ¶[0018]. *Patel* further discloses that the external device may be a device that “emulates a graphical equalizer” and “can be displayed on a computer screen and adjusted in real time under user control.” *Id.* ¶[0060]. This is consistent with how a POSITA would have understood a “user interface” to provide user control of a device. *Kyriakakis* ¶245.

Accordingly, a POSITA would have understood the *Patel-Topholm* combination to disclose or suggest an external device with a screen that emulates a graphical equalizer (“a user interface.”). *Id.* ¶246.

4. Claims 6 and 7

Patel discloses various examples of the “external device,” including “cellular phones, PDAs, radios, MP3 players, CD players, portable game machines.” *Patel* ¶[0018]; *see also id.* ¶[0058]. A POSITA would have understood that, in the 2007-2008 timeframe, each of these devices were implemented in a portable form factor. *Kyriakakis* ¶248 (citing *Lee* ¶¶[0005], [0035]). A POSITA would have understood that, because *Patel* describes exchanging signals with these external devices, they are “communication devices.” *Id.* Accordingly, a POSITA would have understood

the *Patel-Topholm* combination to disclose or suggest that “the device is a portable communication device.” *Id.*

Moreover, because *Patel* discloses that the external device may be a “cellular phone,” a POSITA would have understood *Patel* to disclose that the portable communication device is a “phone.” *Id.* ¶249. To be clear, as noted above in §VIII.A.1.d, *Patel* discloses that the head-mounted device may be “configured to listen to a high fidelity external stereo audio source ***such as*** a CD player or MP3 player.” *Patel* ¶[0058]. A POSITA would have understood *Patel* to disclose that the “high fidelity external stereo audio source” could be any of the exemplary “external devices” listed in paragraph [0018] even though *Patel* only lists devices “such as” a CD player or MP3 player in paragraph [0058]. *Kyriakakis* ¶249. Indeed, a POSITA would have understood that, by the earliest alleged priority date, it was well-known that cellular phones were a source of high fidelity external stereo audio and would be suitable to provide the audio feeds for the head-mounted device in Figure 9. *Id.* (citing *Mahini* ¶[0020]).

Accordingly, a POSITA would have understood the *Patel-Topholm* combination to disclose or suggest an external device, such as a cellular phone, PDA, radio, MP3 player, CD player, or portable game machine that exchanges signals with the head-mounted device (“wherein the device is a portable communication device;

where the device portable communication device is at least one of a phone”). *Id.* ¶250.

B. Ground 1B: *Patel, Topholm, and Williamson* Render Obvious Claim 2

1. Claim 2

a. [2.1]

Patel discloses that the head-mounted device may download “environment specific noise reduction algorithms (ESNRAs)” that are used to “filter environmental sounds from an audio signal(s).” *Patel* ¶[0064]. The ESNRAs may be applied to incoming audio signals from an external device or from the microphone of the head-mounted device to, for example, reduce noise from the other end of a phone call or to reduce noise in the user’s environment. *Id.* ¶¶[0066]-[0067]; *Kyriakakis* ¶¶252-254.

The ESNRA “may be automatically selected from memory by a device processor based on an analysis of the environmental noise present in the audio signal(s).” *Patel* ¶[0064]; *see also id.* ¶[0066]. A POSITA would have understood this disclosure to mean that the ESNRA is selected based on an analysis of the noise present in the digitized signal captured by the microphone of the head-mounted device (i.e., the “first microphone signal”). *Kyriakakis* ¶255. This is because *Patel* discloses using the selected ESNRA to filter noise from the environmental sounds picked up by the microphone of the head-mounted device. *Patel* ¶[0067]; *see also*

id. ¶[0068] (“In the noise reduction only mode the ESNRA function is applied to environmental signals in the user’s location.”), claims 22, 23, 32. A POSITA would have understood that analyzing the signal picked up by the microphone would have been necessary to select the appropriate ESNRA to filter the noise out of that signal because that is how the extent and type of noise is determined. *Kyriakakis* ¶255.

A POSITA looking for additional implementation details related to *Patel*’s noise analysis would have readily identified *Williamson*. *Williamson* is similar to *Patel*. *Kyriakakis* ¶256. *Williamson* discloses a “hearing aid system which is ... adaptive to the sound environment to maximize the intelligibility and quality of the audio signal provided to the user.” *Williamson*, 1:57-62. The system includes a “digital filter having filter coefficients which can be varied on a quasi-real time basis ... to best accommodate ambient signal levels and noise levels.” *Id.*, 3:36-41. “An estimate of the level of background noise is preferably made from the energy envelope of the input signal in various frequency ranges.” *Id.*, 2:67-3:1. An energy estimation algorithm “calculates the energy in a number (preferably 5) of frequency bands” and “[t]hese estimates are used to decide on the current gains or attenuations for each of the bands” of the filter. *Id.*, 8:51-59. *Williamson*’s description of estimating noise by calculating the energy envelope in a number of frequency bands is consistent with how the ’473 patent describes “calculat[ing] a noise level.” ’473*pat.*, 11:42-12:13, FIG. 8; *Kyriakakis* ¶¶257-259.

A POSITA would have been motivated to implement *Williamson*'s teachings related to estimating an ambient noise level in the *Patel-Topholm* combination for the purpose of selecting the appropriate ESNRA used to filter the environmental noise and would have had a reasonable expectation of success in doing so. *Kyriakakis* ¶260. *Patel* already discloses analyzing the environmental noise to select the appropriate ESNRA for use in the environment, and *Williamson* discloses the details of such an analysis. *Id.* In the combination, the digitized signal from *Patel*'s microphone that picks up environmental sounds ("first microphone signal") would be analyzed according to *Williamson*'s teachings to estimate a noise level, and the appropriate ESNRA would be selected according to the estimation. *Id.*

The combination amounts to applying a known technique (estimating the ambient noise level to adapt a filter) to a known device (*Patel*'s head-mounted device) ready for improvement (*Patel*'s head-mounted device analyzes environmental noise to select an ESNRA for filtering) to yield predictable results (*Patel*'s head-mounted device that analyzes the environmental noise to estimate a noise level and select an appropriate ESNRA for filtering). *Id.* ¶261.

It also amounts to the use of a known technique (estimating a noise level) to improve similar devices (both *Patel* and *Williamson* describe head-mounted devices that filter microphone signals to account for ambient noise) in the same way (to adapt a filter based on the environmental noise). *Id.* ¶262.

Accordingly, a POSITA would have understood the *Patel-Topholm-Williamson* combination to disclose or suggest the processor of the head-mounted device (“wherein the earpiece processor”) estimates a noise level of a digitized microphone signal representing environmental sounds (“calculates a noise level based upon a first microphone signal from the first microphone”) to select the appropriate ESNRA filtering to be applied to the signal. *Id.* ¶263.

b. [2.2]

As detailed in §VIII.A.1.h, the *Patel-Topholm* combination discloses or suggests generating a mixed signal by introducing environmental sounds into the audio signal delivered to the user. *Patel* discloses that the ESNRAs are used to filter noise in the user’s environment and that the filtered microphone signals may be provided to the user. *Patel* ¶[0067]; *see also id.* claims 22, 23, 32. A POSITA would have understood *Patel* to disclose that the ESNRA filter is applied to the environmental sound that is provided to the user while in a communication mode because *Patel*’s disclosure of filtering the environmental sounds provided to the user is not limited to when the head-mounted device is in a particular mode. *Kyriakakis* ¶¶265-266. *Patel* also explains that “the ESNRAs could be used to reduce noise from both the user’s location and the other party’s location at the same time” (*Patel* ¶[0067]), i.e., reduce noise in the received communication signal and in the microphone signal containing environmental sounds at the same time.

Thus, a POSITA would have understood that, in the *Patel-Topholm-Williamson* combination, the ESNRA-filtered microphone signal representing environmental sounds would be introduced into (mixed with) the audio content signal delivered to the user. *Kyriakakis* ¶267. A POSITA would have understood that this would have had the effect of modifying the mixed signal based on the noise level. *Id.* More particularly, as the ESNRA filter is adapted according to *Williamson*'s noise-level adaptation teaching, this would have the effect of modifying the mixed signal because the portion of the mix corresponding to the environmental sounds was modified. *Id.*

Accordingly, a POSITA would have understood the *Patel-Topholm-Williamson* combination to disclose or suggest the processor of the head-mounted device (“wherein the earpiece processor”) applies the ESNRA filter that was selected based on the noise level to the environmental sounds introduced into the audio signal from the external device (“modifies the mixed signal based upon the noise level”). *Id.* ¶268.

C. Ground 2A: *Melanson* and *Rosenberg* Render Obvious Claims 8, 19, and 20

1. Claim 8

a. [8.pre]

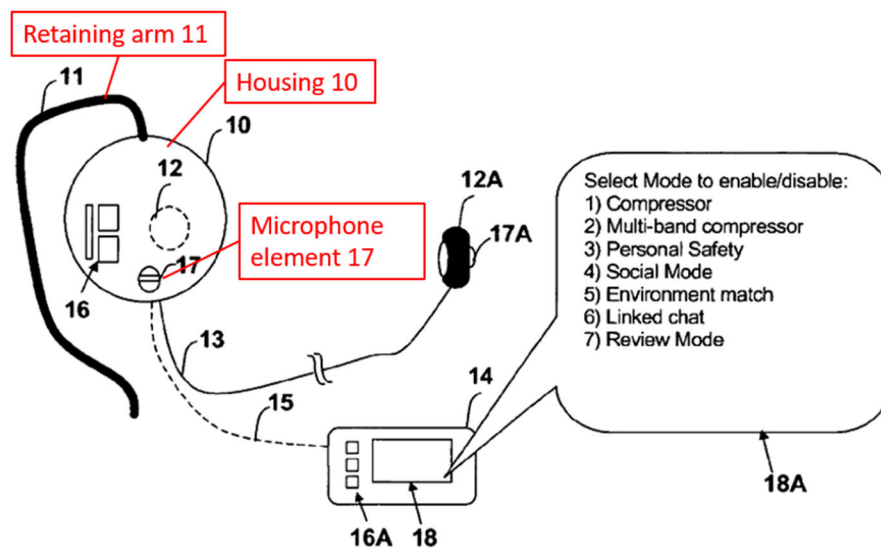
Melanson discloses a “personal audio playback device” with “one or more microphone elements” to “sense environmental (ambient) sounds.” *Melanson*, 2:17-

24. The playback device has a “Personal Safety Mode” in which, upon detection of certain sounds, “[t]he microphone input can be provided at the headphone output and/or mixed with the program audio.” *Id.*, 7:10-24; *see also id.*, 8:52-60. A POSITA would have understood that the “microphone input” corresponds to the sensed “environmental (ambient) sounds.” *Id.*, 2:19-21; *Kyriakakis* ¶¶269-270. This is consistent with how the ’473 patent describes ambient sound passthrough. *’473pat.*, 7:28-31; *Kyriakakis* ¶271.

Accordingly, a POSITA would have understood *Melanson* to disclose or suggest a playback device that outputs ambient sounds to a user upon detection of certain sounds (“[a] device that can control ambient sound passthrough”). *Kyriakakis* ¶272.

b. [8.1]

The playback device has a housing 10, a retaining arm 11 for the user’s ear, and a microphone element 17. *Melanson*, 3:34-43. The microphone element 17 “is disposed within housing 10 and ... detect[s] environmental sounds.” *Id.*, 3:40-43; *see also id.*, FIG. 1.



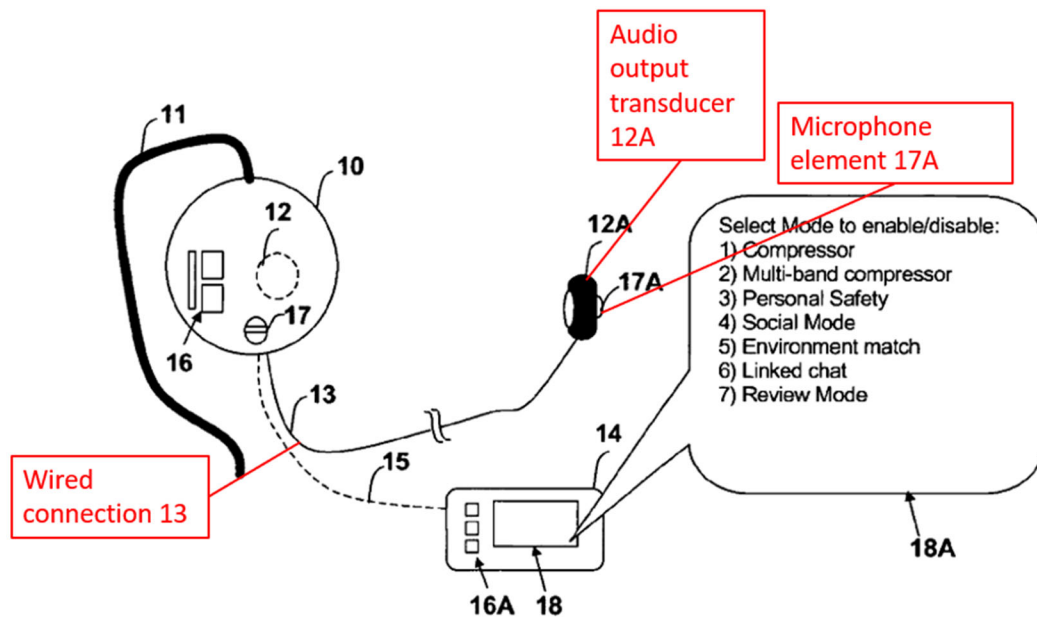
Melanson, FIG. 1 (annotated)

A processing circuit “receives a signal from the microphone elements.” *Id.*, 2:19-24; *see also id.*, 4:49-63. *Melanson*’s claims further describe the microphone as “producing an ambient measuring audio signal.” *See id.*, 9:12-13, 10:56-58, 11:32-34, 12:19-21, 12:46-49; *Kyriakakis* ¶¶273-274.

Accordingly, a POSITA would have understood *Melanson* to disclose or suggest a microphone 17 (“a first microphone”) that detects environmental sounds and produces an ambient measuring signal (“that measures a first acoustic environment to generate a first microphone signal”). *Kyriakakis* ¶¶275.

c. [8.2]

Melanson discloses that housing 10 is connected by wire 13 to a second output audio transducer 12A with “another microphone element 17A.” *Melanson*, 3:49-51, FIG. 1; *Kyriakakis* ¶¶276-277.



Melanson, FIG. 1 (annotated).

A POSITA would have understood that output transducer 12 and output transducer 12A were designed to be worn on different ears. *Kyriakakis* ¶277. And, because output transducer 12A and microphone 17A are connected by wire 13 to housing 10, output transducer 12A and microphone element 17A would be positioned on the ear opposite housing 10 and microphone element 17. *Id.* Thus, a POSITA would have understood that microphone 17A is closer to one of the user's ears than microphone element 17 when the device is worn. *Id.*

A POSITA would have further understood that each ear of the user has an ear canal. *Id.* ¶278. And, because microphone element 17A is closer to one of the user's ear canals, a POSITA would have understood that microphone element 17A "is positioned closer to a user's ear canal than the first microphone when the device is

worn.” *Id.* This is consistent with the ’473 patent’s description that the alleged invention “can be implemented in a single earpiece, ***a pair of earpieces, headphones***, or other suitable headset audio delivery devices.” ’473pat., 6:37-39; *see also id.*, 9:3-5, 10:7-10, 10:50-52, 11:21-23, 11:48-51, 12:21-24, 13:16-19; *Kyriakakis* ¶278.

This interpretation is also consistent with how similar claim language was interpreted during prosecution of U.S. Patent 11,244,666—a parent to the ’473 patent that shares a specification with the ’473 patent—where the applicant was required to amend the claims to require an ear canal microphone. *See* EX1008 at 157, 76-84, 68-75; *Kyriakakis* ¶¶279-283. In particular, the applicant distinguished the prior art by amending the limitation reciting “a second microphone configured to measure an acoustic environment closer the [*sic*] ear canal of a wearer than that measured by the first microphone” to further require that the second microphone have “a second microphone port that is configured to face toward the user when the earphone is inserted.” EX1008, 73. The applicant explained that the amendment was meant to clarify that the “second microphone” was “an ear canal microphone (ECM).” *Id.*, 73-74. No such limitation is present in claim 8 of the ’473 patent. Thus, the “second microphone” need not be an “ear canal microphone.” *Kyriakakis* ¶283.

As discussed in §VIII.C.1.b, a POSITA would have understood *Melanson* to disclose that microphone elements 17 and 17A provide one or more electrical signals corresponding to environmental sounds. *Kyriakakis* ¶284.

Accordingly, a POSITA would have understood *Melanson* to disclose or suggest a microphone element 17A (“a second microphone”) positioned on the ear opposite microphone element 17 when the device is worn (“that is positioned closer to a user’s ear canal than the first microphone when the device is worn”) and that provides an electrical signal corresponding to environmental sounds (“where the second microphone generates a second microphone signal”). *Id.* ¶285.

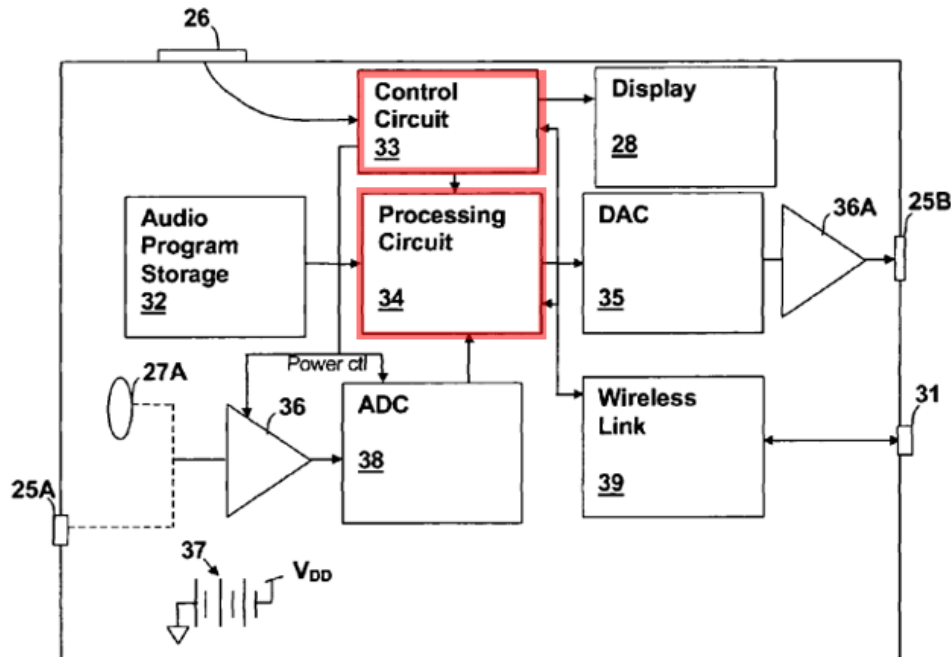
d. [8.3]

Melanson discloses that “[a]n output audio transducer 12,” i.e., a speaker, is included on housing 10. *Melanson*, 3:38-40; *see also id.*, FIG. 1; *Kyriakakis* ¶286. Accordingly, a POSITA would have understood *Melanson* to disclose or suggest an output audio transducer 12 (“a speaker”). *Kyriakakis* ¶287.

e. [8.4] and [8.5]

Melanson discloses that the playback device includes a “control circuit 33” and a “processing circuit 34” and that they may be implemented together as a single “digital signal processor with data and program memory.” *Melanson*, 5:14-24. A POSITA would have understood that “program memory” refers to memory that

stores programs comprised of software instructions. *Kyriakakis* ¶288 (citing *Computer Dictionary*).



Melanson, FIG. 3 (annotated)

A POSITA would have understood that *Melanson*'s description of Figure 3 applies to the playback device in Figure 1 because *Melanson* describes Figure 3 as pertaining to “the *above-described* consumer personal audio playback devices,” (*Melanson*, 4:31-33), referring to both devices (plural) described “above” with reference to Figures 1 and 2. *Kyriakakis* ¶289.

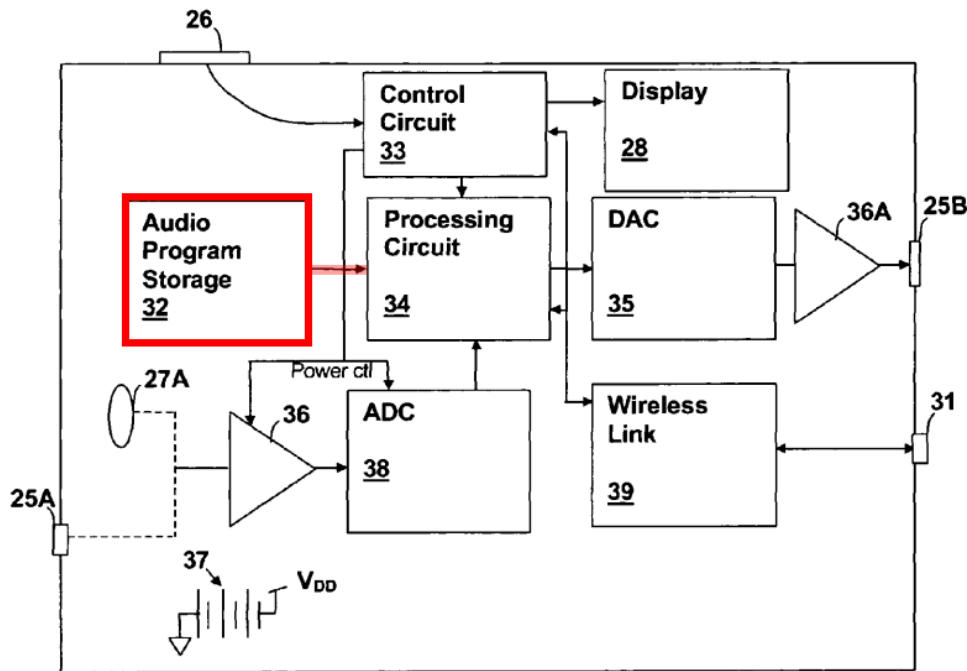
Melanson further discloses implementing “intelligent algorithms” to analyze environmental sounds and adjust the gain of headphone outputs, and that its various playback modes are implemented with “a signal processing algorithm according to

program instructions stored within a memory of processing circuit 34.” *See, e.g., Melanson*, 3:29-33, 7:5-9, 7:10-13, 7:25-31; *Kyriakakis* ¶290.

Accordingly, a POSITA would have understood *Melanson* to disclose or suggest a control circuit 33 and processing circuit 34 implemented as a digital signal processor with a program memory that executes program instructions to analyze environmental sounds and adjust the gain of the headphone outputs (“memory that stores instructions and a processor that executes the instructions to perform operations”). *Kyriakakis* ¶291.

f. [8.6]

Melanson discloses audio program storage 32 (*Melanson*, 4:33-38), and that “[p]rocessing circuit 34 performs gain control and rendering of the program information **retrieved from storage 32**” (*id.*, 4:41-48). *See also id.*, FIG. 3, 2:15-19. A POSITA would have understood that, to perform gain control and rendering of program information from storage 32, the program information is retrieved as a signal representing the program information. *Kyriakakis* ¶¶293-294. This is consistent with how the ’473 patent describes this feature. ’473*pat.*, 5:59-62.



Melanson, FIG. 3 (annotated)

Accordingly, a POSITA would have understood *Melanson* to disclose or suggest processing circuit 34 retrieving a signal representing the audio portion of video program material or computer program-generated audio sources from storage 32 (“receiving an audio content signal”). *Kyriakakis* ¶295.

g. [8.7]

Melanson discloses a “compressor mode” (*Melanson*, 5:41-64) and a “multi-band compressor mode” (*id.*, 5:65-7:9). In these modes, *Melanson* discloses adjusting the gain of the program audio (i.e., the audio content signal) based on the loudness of external sounds. *Id.*, 5:45-51, 6:4-13. A POSITA would have understood that adjusting the gain of the program audio modifies it. *Kyriakakis* ¶296.

Accordingly, a POSITA would have understood *Melanson* to disclose or suggest a compressor mode or multi-band compressor mode in which the gain of program audio is adjusted based on environmental noise levels (“modifying the audio content signal to generate a modified audio content signal”). *Id.* ¶297.

h. [8.8] and [8.9]

As explained above in §§VIII.C.1.b-VIII.C.1.c, *Melanson* discloses a processor receiving first and second microphone signals from microphone elements 17 and 17A. *Rosenberg* discloses an ambient sound responsive media player similar to *Melanson*. See *Rosenberg* ¶[0013]; *Kyriakakis* ¶¶299-300. *Rosenberg*’s system also includes “a plurality of microphone elements” (*Rosenberg* ¶[0039]), and *Rosenberg* provides additional details related to the processing of ambient microphone signals prior to detecting sounds in the signals. *Kyriakakis* ¶301. *Rosenberg* discloses performing “noise reduction, filtering, and/or other commonly known signal processing steps” on the captured ambient microphone signals. *Rosenberg* ¶[0044]. “[O]nce converted to a final digital form,” the ambient signals are temporarily stored for access by the steps of *Rosenberg*’s algorithm, including for the purpose of various sound detection processing. *Id.* ¶¶[0044]-[0045]. A POSITA would have understood that performing such common signal processing (e.g., filtering and/or noise reduction) on the ambient signals modifies the signals. *Kyriakakis* ¶303.

A POSITA would have been motivated to implement *Rosenberg*'s teachings related to performing such common signal processing steps in *Melanson*'s playback device and would have had a reasonable expectation of success in doing so. *Id.* A POSITA would have recognized, for example, that performing noise reduction and/or filtering of the ambient sound before analyzing it to detect, for example, “particular frequency patterns such as vehicle horns or loud voices,” as taught by *Melanson*, would have increased the reliability of the detection. *Id.* Therefore, a POSITA would have considered the combination to amount to the use of a known technique (performing noise reduction and/or filtering on the captured ambient sound signal prior to processing for sound/pattern detection) to improve similar devices (*Melanson* and *Rosenberg* are both directed to processing ambient sound to detect particular sounds) in the same way (to increase the reliability and accuracy of *Melanson*'s sound detection processing). *Id.* ¶304.

Accordingly, a POSITA would have understood the *Melanson-Rosenberg* combination to disclose or suggest processing *Melanson*'s first and second microphone signals by performing noise reduction and/or filtering on the signals (“modifying the first microphone signal to generate a modified first microphone signal; modifying the second microphone signal to generate a modified second microphone signal”). *Id.* ¶305.

i. [8.11]

Melanson discloses a personal safety mode in which the audio provided to the user is changed when “sudden noises” or “sudden change in volume” are detected in the microphone signals. *Melanson*, 2:34-37, 7:10-24; *see also id.*, 1:38-41; *Kyriakakis* ¶307. This is consistent with how the ’473 patent describes detecting an “acute sound.” ’473pat., 5:43-50 (“The processor 206 can monitor the ambient sound captured by the ASM 111 **for acute sounds in the environment, such as an abrupt high energy sound** corresponding to the on-set of a warning sound (e.g., bell, emergency vehicle, security system, etc.), siren (e.g., police car, ambulance, etc.), voice (e.g., ‘help’, ‘stop’, ‘police’, etc.), or specific noise type (e.g., breaking glass, gunshot, etc.).”); *see also id.*, 2:36-38, 3:2-7, 7:48-61, 9:45-49, 16:5-8; *Kyriakakis* ¶308.

As explained in §VIII.C.1.h, *Rosenberg* discloses processing the signals captured from the microphone elements before analyzing them to identify sounds. Thus, a POSITA would have understood the *Melanson-Rosenberg* combination to disclose or suggest analyzing the “modified” first and/or second microphone signals to detect the acute sound. *Kyriakakis* ¶309.

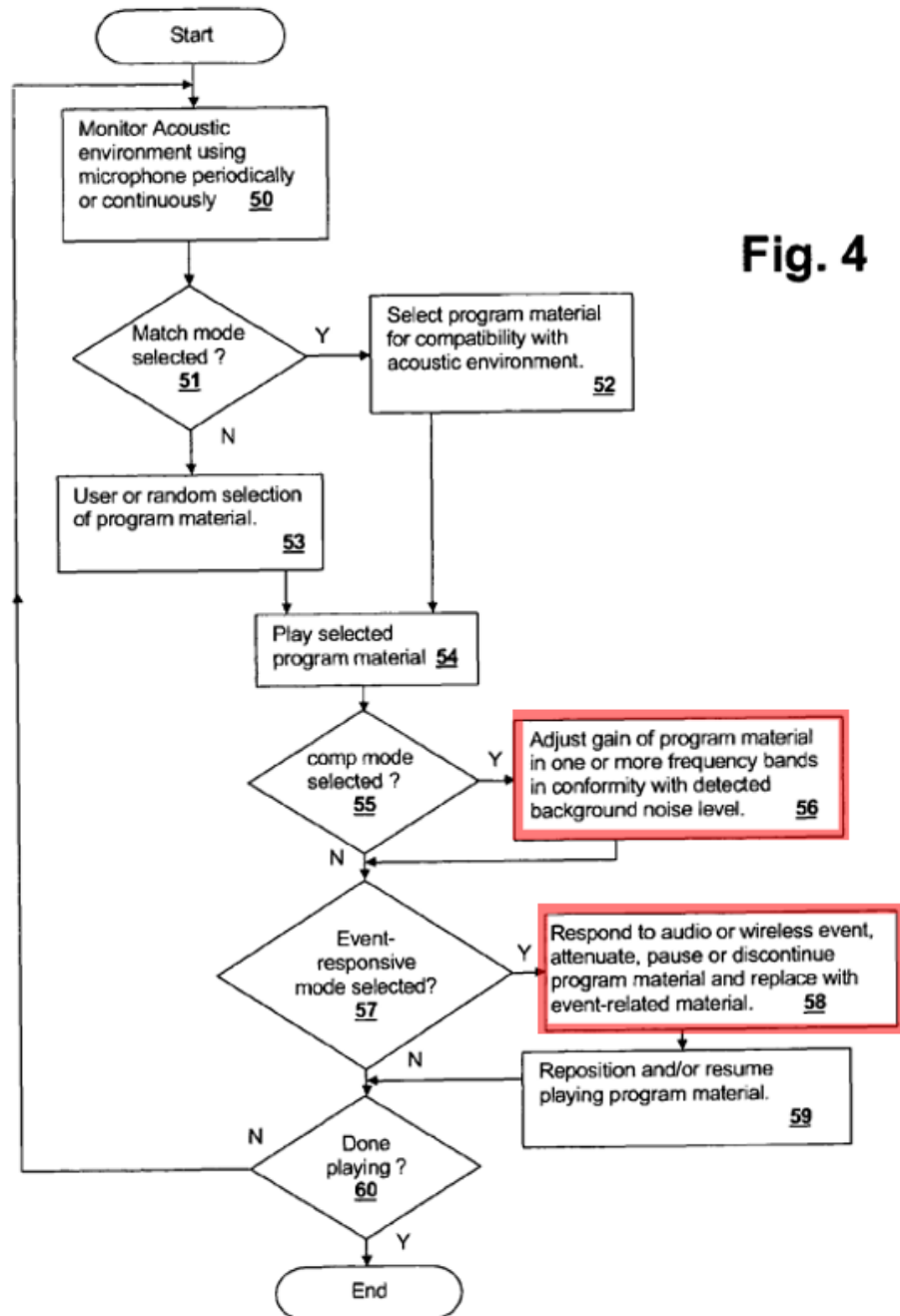
Accordingly, a POSITA would have understood the *Melanson-Rosenberg* combination to disclose or suggest detecting sudden noises or sudden changes in volume (“detecting an acute sound”) by analyzing a microphone signal that had been

processed (e.g., filtered or noise reduced) (“by analyzing at least one of the modified first microphone signal, the modified second microphone signal or a combination thereof”). *Id.* ¶310.

j. [8.12]

As explained in §VIII.C.1.g, *Melanson* discloses a “compressor mode” and “multi-band compressor mode” that modifies the audio content signal based on the background noise level. *Melanson* further discloses that its various playback modes, including the compressor modes and, for example, personal safety mode, are “not mutually exclusive” and “can be implemented simultaneously” and “selectively enabled.” *Melanson*, 8:29-39. Thus, a compressor mode and personal safety mode may be enabled together. In personal safety mode, when a sudden noise or change in volume (“acute sound”) is detected, the “processing circuit 34 either partially or completely attenuates the program material gain.” *Melanson*, 7:16-19. Thus, in addition to the compressor mode modification to the program material, a further modification is performed to the program material in accordance with the personal safety mode when an acute sound is detected. *Kyriakakis* ¶¶313-314. A POSITA would have understood that partially attenuating the program material gain modifies it. *Id.* ¶313. This two-step modification is illustrated in *Melanson*’s Figure 4, annotated below. In step 56, the compressor mode adjusts the gain of the program

material (“audio content signal”), and in steps 57 and 58, the program material is attenuated if an event is detected.



Melanson, FIG. 4 (annotated)

Accordingly, a POSITA would have understood the *Melanson-Rosenberg* combination to disclose or suggest partially attenuating the gain of the compressor-mode-modified program material (“modifying the modified audio content signal”) if a sudden noise or particular frequency pattern is detected (“if an acute sound is detected”), which yields an attenuated version of the compressor-mode-modified program material (“to generate a new modified audio content signal”). *Kyriakakis* ¶315.

k. [8.10]

Rosenberg provides additional details related to the processing of ambient microphone signals for mixing with audio content and output to the user. *See Rosenberg* ¶¶[0054]-[0058]. In particular, *Rosenberg* explains that after the ambient microphone signals are digitized and processed as explained above in §VIII.C.1.h, “the media player is operative to mix musical audio content ... with ambient audio content captured from a microphone local to the user.” *Id.* ¶[0054]; *see also id.* ¶[0013]. *Rosenberg* further notes that, in the mixed signal, “the ambient audio signal content may be filtered or otherwise processed to extract extraneous noise and/or sound content that is outside certain magnitude and/or frequency limits or thresholds.” *Id.* ¶[0054].

A POSITA would have understood *Rosenberg* to disclose or suggest that the signal processing done on the ambient sound signal for mixing (described in

Rosenberg paragraph [0054]) is *in addition* to the signal processing described in the context of capturing the ambient signals (described in *Rosenberg* paragraph [0044]). That is, a POSITA would have understood *Rosenberg* to disclose or suggest that the “modified first microphone signal” and “modified second microphone signal” generated by the processing described in paragraph [0044] are further processed before being mixed and output to the user. *Kyriakakis* ¶¶317-319.

Rosenberg explains that, after the “commonly known signal processing” is performed on the ambient signals, they are stored in a “shared memory space accessible by the steps of this program flow,” i.e., the steps of the method shown in Figure 2. *Rosenberg* ¶[0044]. A POSITA would have understood that *Rosenberg*’s teaching in paragraphs [0054] and [0055] relating to the mixing embodiment build on and modify the program flow of Figure 2 to include additional steps for implementing mixing. *Kyriakakis* ¶320. Thus, where *Rosenberg* discloses in paragraph [0055] that the ambient audio signal may be processed, a POSITA would have understood *Rosenberg* to disclose that the ambient signal is accessed in the shared memory space, processed (e.g., “to extract extraneous noise and/or sound content that is outside certain magnitude and/or frequency limits or thresholds”), and then mixed with the audio content signal. *Id.*

A POSITA would have understood that such further processing “generates an ambient sound signal from at least one of the modified first microphone signal [or]

the modified second microphone signal” because the additional processing further modifies the modified first or second microphone signal into an ambient sound signal output to the user. *Id.* ¶321.

A POSITA would have been motivated to incorporate *Rosenberg*’s teaching related to further processing the ambient sound signal prior to mixing and outputting it to the user into *Melanson* and would have had a reasonable expectation of success. *Id.* ¶322. A POSITA would have understood that such processing was advantageous because, for example, it would provide the user with an ambient sound signal with a higher signal-to-noise ratio, allowing the user to hear more of the signal that they want to hear (e.g., the voice of the person to whom they are speaking) and less of other background noise. *Id.* A POSITA would have understood that this would have advanced *Melanson*’s objective to facilitate conversations in noisy environments. *Id.*

A POSITA would have understood that the combination would have amounted to the use of a known technique (performing additional processing on the ambient sound signal prior to mixing and outputting to the user) to improve similar devices (*Melanson* and *Rosenberg* are both directed to mixing ambient sound with audio content) in the same way (to increase the signal-to-noise ratio of the ambient sound output to the user). *Id.* ¶323.

Accordingly, a POSITA would have understood the *Melanson-Rosenberg* combination to disclose or suggest performing additional processing on the ambient

sound signal (“generating an ambient sound signal from at least one of the modified first microphone signal [or] the modified second microphone signal”). *Id.* ¶324.

I. [8.13] and [8.14]

Melanson discloses that, in personal safety mode, the “microphone input can be provided at the headphone output and/or mixed with the program audio.” *Melanson*, 7:19-24. The “headphone output” refers to the output transducer (or “speaker”). *Kyriakakis* ¶326.

The *Melanson-Rosenberg* combination discloses or suggests generating an ambient sound signal for mixing and a new modified audio content signal, as explained in §§VIII.C.1.k and VIII.C.1.j, respectively. Thus, a POSITA would have understood that the *Melanson-Rosenberg* combination discloses or suggests a mixed signal that comprises the “ambient sound signal” and the “new modified audio content signal.” *Id.* ¶327.

Accordingly, a POSITA would have understood the *Melanson-Rosenberg* combination to disclose or suggest mixing an ambient sound signal with the new modified audio content signal (“generating a mixed signal by mixing the ambient sound signal with ... the new modified audio content signal”) and providing it at the headphone output (“sending the mixed signal to the speaker”). *Id.* ¶328.

2. Claim 19

Melanson discloses a “social mode” in which “speech of another person is detected and the program material is attenuated.” *Melanson*, 7:25-31. *Melanson* further states that “[a] timer can be used to restore the program material after a period ***without speech by either the user or the other person is detected.***” *Id.*, 7:34-37. Thus, a POSITA would have understood *Melanson* to disclose detecting speech of the user. *Kyriakakis* ¶329.

Rosenberg discloses mixing “if the one or more characteristic forms,” including “the unique voice of the ... user,” is present within the ambient audio signal. *Rosenberg* ¶¶[0013], [0026], [0046], [0047], [0055] [0057]; *see also id.* claims 19, 21; *Kyriakakis* ¶330. A POSITA would have been motivated to implement *Rosenberg*’s teachings in this regard in *Melanson*’s social mode and would have had a reasonable expectation of success in doing so. *Kyriakakis* ¶331. One of *Melanson*’s objectives is to facilitate conversation in noisy environments, and a POSITA would have understood that incorporating *Rosenberg*’s user-voice detection technique into *Melanson* to improve *Melanson*’s social mode would have advanced that objective by providing the user the ability to trigger social mode with his/her own voice. *Id.* And, as explained by *Rosenberg*, this would allow the “media player user to spontaneously begin [to] engage in a conversation and not talk too loud, because he or she can more easily hear himself or herself while talking.”

Rosenberg ¶[0061]. Moreover, it would have been within the skill of a POSITA to modify *Melanson* in this way, and it would not have frustrated *Melanson*'s objectives or purposes. *Kyriakakis* ¶¶332-335.

Thus, the combination would have amounted to using a known technique (modifying audio output based on user's voice detection) to improve similar devices (*Melanson* and *Rosenberg* are both directed to modifying audio output in response to detection of certain events) in the same way (to facilitate conversations with others in noisy environments). *Id.* ¶336.

As noted, *Melanson* discloses that, when "social mode" is triggered, the program material may be attenuated. *Melanson*, 7:25-31, 8:1-9, 8:52-56, FIG. 4 (Block 58). A POSITA would have understood that, where *Melanson* discloses "attenuat[ing]" the program material, it means to attenuate or decrease the gain of the program material. *Kyriakakis* ¶337; *see also Melanson*, 2:37-41 (equating "decreas[ing]" gain with "attenuat[ing]" gain). A POSITA would have further understood that attenuating the gain of the program material would cause a decrease in the volume of the program material because the gain of the program material is directly related to the output volume of the program material (higher gain means higher volume, lower gain means lower volume). *Kyriakakis* ¶338 (citing EX1045; *AudioCyclopedia*).

As explained in §VIII.C.1.j, the compressor mode may be simultaneously engaged with social mode, and the compressor mode generates a “modified audio content signal,” so when social mode is triggered, it operates to attenuate the gain of the “modified audio content signal.” *Id.* ¶339.

Accordingly, a POSITA would have understood the *Melanson-Rosenberg* combination to disclose or suggest attenuating the gain of the program material that was already processed by the compressor mode (“decreasing a volume of the modified audio content signal”) when social mode is triggered by the user’s voice (“when a user’s voice is detected.”). *Id.* ¶340.

3. Claim 20

As discussed in §VIII.C.1.i, *Melanson* discloses that detecting a sudden noise or change in volume (“acute sound”) can trigger personal safety mode. *Melanson* also discloses triggering personal safety mode upon detection of particular frequency patterns, including “loud voices.” *Melanson*, 7:10-24. A POSITA would have therefore understood *Melanson* to disclose or suggest that the sudden noise or change in volume may correspond to a “loud voice.” *Kyriakakis* ¶341.

Accordingly, a POSITA would have understood the *Melanson-Rosenberg* combination to disclose or suggest that the sudden noise or change in volume (“wherein the acute sound”) may be a loud voice (“is a voice”). *Id.* ¶342.

D. Ground 2B: *Melanson, Rosenberg, Samadani, and Dijkstra* Render Obvious Claims 9, 13-18

1. Claim 9

A POSITA would have understood that claim 9 narrows independent claim 8 in two ways: first, it requires a step for determining the type or source of the acute sound; and second, it specifically requires “determining if the acute sound is a user’s voice by analyzing the temporal and spectral characteristics of at least one of the [modified microphone signals].” In other words, when claim 9 is read together with claim 8, the claimed device must (1) detect an acute sound; and (2) determine the source or type of the acute sound (i.e., perform two-step acute sound detection), including by analyzing temporal and spectral characteristics to determine if it is the user’s voice. As explained below, both of these aspects were known in the art and would have been obvious to incorporate into *Melanson*. *Kyriakakis* ¶344.

a. Two-step acute sound detection

Melanson discloses triggering personal safety mode upon detection of a sudden change in volume **or** “particular frequency patterns” such as “vehicle horns or loud voices.” *Melanson*, 7:13-19. *Melanson* does not expressly disclose that personal safety mode is triggered by first detecting a sudden noise or change in volume (“acute sound”) **and then** detecting the particular frequency pattern (i.e., the source of the sudden noise) (i.e., two-step acute sound detection). *Kyriakakis* ¶345.

Nevertheless, a POSITA would have considered it obvious to modify *Melanson* to implement that feature. *Id.*

Samadani is similar to *Melanson* and discloses a two-step approach for triggering a notification to the user of hazards. *Kyriakakis* ¶346. *Samadani* discloses a system for a headset including microphones to monitor the external environment. *Samadani* ¶¶[0010]-[0011]. *Samadani* explains that known devices do not differentiate between hazards that are approaching the user or not. *Id.* ¶¶[0002]-[0003]. *Samadani* therefore discloses processing signals from the microphones to first detect a “signal of interest,” and then determine if a “warning condition” exists. *Id.* ¶¶[0013]-[0014]; *see also id.* ¶¶[0023]-[0026], [0031]. *Samadani* discloses that the processor of the device “may be configured to measure the energy signature over time of each external audio signal and determine whether any of the monitored external energy signatures fit within the parameters of a signal of interest. ... If an energy signature is determined to have a value that is higher than the defined threshold, the signal could be identified as a signal of interest.” *Id.* ¶[0026]. This is similar to *Melanson*’s disclosure of detecting a sudden noise or change in volume and is consistent with how the ’473 patent describes detecting an “acute sound.” *Kyriakakis* ¶¶346-348.

Samadani further discloses that “once a signal of interest is identified, processor 14 could apply one or more filters or other processes to determine if the

identified signal of interest indicates a warning condition.” *Samadani* ¶[0031]. *Samadani* explains that skilled artisans would know of ways to “to filter out various types of noise and sounds from a given audio signal” so that “background noises and other uninteresting noises could be filtered out using any known means, either before or after signals are identified as being ‘of interest.’” *Id.* ¶[0032]. *Samadani* itself discloses using “the spectral characteristics of an audio signal to filter out various unimportant signals” (*id.* ¶[0028]) and suggests that the system “could be configured to detect the specific spectral characteristics of human speech” (*id.* ¶[0034]).

Thus, a POSITA would have understood *Samadani* to disclose a two-step approach for detecting a warning condition sufficient to alter output audio signals—first identify a signal of interest (e.g., by measuring the power signature over time) and then detect the specific spectral characteristics of the signal (e.g., to determine whether the signal includes human speech). *Kyriakakis* ¶¶349-350.

A POSITA would have been motivated to implement *Samadani*’s teaching of a two-step approach for detecting a warning condition in the *Melanson-Rosenberg* combination and would have a reasonable expectation of success. *Kyriakakis* ¶351. The combination discloses or suggests *Melanson*’s personal safety mode would be triggered by detecting a sudden noise or change in volume followed by detection of a particular frequency pattern (e.g., loud voices or vehicle horn). *Id.* *Samadani* suggests that a two-step approach helps to avoid false detections of warning

conditions. *Id.* A POSITA would have understood that it was important for a device like *Melanson* to implement safeguards to avoid false detections because a user would get annoyed by frequent undesired interruptions to the program material. *Id.* Moreover, it was known that it would be advantageous to give users the flexibility to define multiple conditions for when to trigger interruptions to playback as with *Melanson*'s personal safety mode. *Id.* ¶¶352-353 (citing *Bostick* ¶[0002], [0005], [0019], [0020], [0030], [0038]; *Alley* ¶[0003], [0014], [0023], [0033]).

Thus, a POSITA also would have considered the combination to amount to applying a known technique (*Samadani*'s two-step approach to detecting a warning condition) to a known device (*Melanson*'s personal safety mode) ready for improvement (*Melanson* already discloses detecting sudden noises and particular frequency patterns) to yield predictable results (*Melanson*'s device with a personal safety mode triggered by sudden noises that are determined to have particular frequency patterns). *Id.* ¶354.

Accordingly, a POSITA would have understood the *Melanson-Rosenberg-Samadani* combination to disclose or suggest detecting sudden noise ("acute sound") and performing a separate/additional step for determining the source or type of acute sound by, for example, analyzing the frequency pattern of the sudden noise, before triggering personal safety mode. *Id.* ¶355.

b. “determining if the acute sound is a user’s voice by analyzing the temporal and spectral characteristics” of one of the modified microphone signals

Melanson discloses that with multiple microphones, the system may determine whether a sound came from the user or elsewhere and activate its playback modes accordingly. *Melanson*, 8:10-22. By the earliest alleged priority date, there were various known techniques for determining whether a sound originated with the user. *Kyriakakis* ¶¶356-359 (citing *Rasmussen*; *Kvaløy*). *Dijkstra* discloses another device similar to *Melanson* in which a microphone signal is analyzed and, depending on the analysis, a mix of audio content and ambient sounds is changed. *Id.* ¶360. More particularly, *Dijkstra* discloses a “hearing instrument” with a “classification unit” that analyzes the “frequency and/or temporal characteristics” of an earpiece microphone signal and classifies the current auditory situation into various pre-defined index values, one of which is “own voice,” i.e., the user him/herself is speaking. *Dijkstra* ¶[0037]. Based on the classification index, the ratio of mix of audio content and ambient sound is changed. *Id.*; *Kyriakakis* ¶360. A POSITA would have understood that the “frequency characteristics” of the signal are spectral characteristics because spectral characteristics refers to the frequency content of the signal. *Kyriakakis* ¶361 (citing *Mertens* ¶[0060]). Thus, a POSITA would have understood *Dijkstra* to disclose analyzing the spectral and temporal characteristics of an earpiece microphone signal and adjusting a mix of audio for playback. *Id.*

A POSITA would have been motivated to implement *Dijkstra*'s spectral and temporal characteristics analysis technique for detecting the user's own voice and would have had a reasonable expectation of success. *Id.* ¶362. As noted above, *Melanson* discloses that determining whether a sound originates from the user or elsewhere is useful to help determine which of its various modes to trigger, and a POSITA would have understood that *Dijkstra*'s frequency and temporal characteristics analysis was a suitable solution for that. *Id.* Moreover, a POSITA would have understood that analyzing the temporal and spectral characteristics of the microphone signal as taught by *Dijkstra* would provide a robust method of detecting the user's voice. *Id.* The combination would have been predictable because *Melanson*'s device already has the signal processing capability for analyzing the spectral and temporal characteristics of an earpiece microphone signal, as evidenced by *Melanson*'s ability to detect sudden noises and particular frequency patterns. *Id.*

Thus, a POSITA would have considered the combination to amount to applying a known technique (detecting the user's own voice by analyzing spectral and temporal characteristics of the signal) to a known device (*Melanson*) ready for improvement (*Melanson* already discloses the ability to analyze the frequency and temporal characteristics of signals) to yield predictable results (a device capable of analyzing the frequency and temporal characteristics of a sudden noise to determine if it is the user's voice). *Id.* ¶363. That *Melanson* discloses a different technique for

determining whether a sound was the user's voice is of no moment. *Intel Corp. v. PACT XPP Schweiz AG*, 61 F.4th 1373, 1380-81 (Fed. Cir. 2023).

A POSITA also would have considered the combination to amount to the simple substitution of one known element (*Melanson's* directional technique for detecting whether the sound came from the user) for another (*Dijkstra's* frequency and temporal characteristics analysis) to obtain predictable results (*Melanson's* device that distinguishes between when the user is speaking or someone else by analyzing the frequency and temporal characteristics of the signal). *Kyriakakis* ¶364.

As discussed in §VIII.C.1.i, the *Melanson-Rosenberg* combination discloses or suggests detecting the acute sound by analyzing one of the first or second modified microphone signals. *Id.* ¶365

Accordingly, a POSITA would have understood the *Melanson-Rosenberg-Samadani-Dijkstra* combination to disclose or suggest analyzing the sudden noise or change in volume to determine if it is the user's voice ("determining if the acute sound is a user's voice") by analyzing the frequency and temporal characteristics of the processed microphone signal ("by analyzing the temporal and spectral characteristics of at least one of the modified first microphone signal, the modified second microphone signal or a combination thereof"). *Id.* ¶366.

2. Claim 13

The *Melanson-Rosenberg* combination discloses or suggests implementing *Melanson*'s social mode so that it is activated upon detection of the user's voice and outputting a mixed signal including an "ambient sound signal," as explained in §§VIII.C.2, VIII.C.1.k, and VIII.C.1.l.

Melanson discloses that, when social mode is activated, the microphone input can be provided "and/or" mixed. *Melanson*, 7:19-22; *Kyriakakis* ¶¶368-369. Thus, in social mode, the microphone input can be provided *instead of* the program content. *Kyriakakis* ¶369.

Rosenberg discloses an embodiment in which the audio content and ambient sounds are cross-faded—the volume of ambient sound is increased while audio content is decreased to substantially zero. *Rosenberg* ¶[0058]; *Kyriakakis* ¶370. A POSITA would have understood that adjusting the volume of the ambient sound signal "modifies" the ambient signal. *Kyriakakis* ¶371. A POSITA would have further understood that, after the cross-fade, the ambient sound signal is output to the speaker instead of the audio content. Thus, a POSITA would have understood *Rosenberg* to disclose outputting a volume-adjusted ambient sound signal to the speaker instead of the audio content signal. *Id.*

A POSITA would have been motivated to implement *Rosenberg*'s teaching related to cross-fading in *Melanson* and would have had a reasonable expectation of

success in doing so. *Id.* ¶372. For example, a POSITA would have recognized that the cross-fade would provide a more pleasant user experience, and implementing such a cross-fade would have been well within the skill of an ordinary artisan. *Id.*

Thus, a POSITA would have considered the combination to amount to the use of a known technique (*Rosenberg*'s cross fade to output the ambient sound instead of the audio content) to improve similar devices (*Melanson* and *Rosenberg* both disclose outputting ambient sound instead of audio content upon detection of an event) in the same way (to provide the user with a more pleasant listening experience). *Id.* ¶373.

Accordingly, a POSITA would have understood the *Melanson-Rosenberg-Samadani-Dijkstra* combination to disclose or suggest cross-fading the ambient sound signal in and the program material out ("sending a modified ambient signal to the speaker instead of the mixed signal") if the user's voice is detected ("if the user's voice is detected"). *Id.* ¶374.

3. Claim 14

Claim 14 is similar to claim 9 except that claim 14 requires detecting whether the acute sound is one of various other sound types "by analyzing the spectrum" of one of the modified microphone signals. *Kyriakakis* ¶375.

As explained in §VIII.D.1.a, the *Melanson-Rosenberg-Samadani* combination discloses or suggests *Melanson*'s personal safety mode modified to be

triggered by detecting a sudden noise or change in volume followed by detection of a particular frequency pattern (e.g., loud voices or vehicle horn). A POSITA would have understood that detecting a particular frequency pattern involves analyzing the “spectrum” of the signal because the “spectrum” of the signal refers to the frequency content of the signal. *Kyriakakis* ¶376 (citing *Mertens* ¶[0060]). Thus, detecting frequency patterns requires analyzing the spectrum, i.e., frequency content, of the signal for patterns. *Id.*

As discussed in §VIII.C.1.i, the *Melanson-Rosenberg* combination discloses or suggests detecting the acute sound by analyzing one of the first or second modified microphone signals. *Kyriakakis* ¶377.

Accordingly, a POSITA would have understood the *Melanson-Rosenberg-Samadani-Dijkstra* combination to disclose or suggest analyzing the sudden noise or change in volume to determine if it is loud voices or a vehicle horn (“detecting whether the acute sound is at least one of a warning sound, siren, voice, specific noise type, or a combination”) by analyzing the frequency patterns of the processed microphone signal (“by analyzing the spectrum of at least one of the modified first microphone signal, the modified second microphone signal, the modified ambient sound signal, or a combination”). *Kyriakakis* ¶378.

4. Claim 15

Melanson discloses that, in personal safety mode, detection of a vehicle horn will partially or completely attenuate the program material gain. *Melanson*, 7:10-24; *see also id.*, 1:38-41. *Melanson*'s disclosure of detecting vehicle horns is consistent with how the '473 patent describes detecting a warning sound. *See '473pat.*, 9:15-16; *Kyriakakis* ¶380. As detailed in §VIII.C.1.j, a POSITA would have understood that attenuating the gain of the program material would decrease the volume of the program material. *Kyriakakis* ¶381.

Accordingly, a POSITA would have understood the *Melanson-Rosenberg-Samadani-Dijkstra* combination to disclose or suggest attenuating the gain of the program material (“decreasing a volume of the modified audio content signal”) when a vehicle horn is detected (“when a warning ... is detected”). *Kyriakakis* ¶382.

5. Claim 16

As explained in §VIII.D.4, *Melanson* discloses that, in personal safety mode, if a vehicle horn is detected (“if the acute sound is a warning sound”), the output of the playback device will be adjusted. As explained in §VIII.D.1.a, *Samadani* discloses a system similar to *Melanson*. *Samadani* discloses outputting an alert signal to the user's headphones when a warning condition is detected, including by mixing the alert signal into the audio output. *Samadani* ¶¶[0016], [0022]; *see also id.* ¶¶[0017]-[0018]; *Kyriakakis* ¶384.

A POSITA would have been motivated to implement *Samadani*'s teachings related to sending an alert signal in *Melanson*'s personal audio playback device and would have had a reasonable expectation of success in doing so. *Kyriakakis* ¶385. Both *Melanson* and *Samadani* are concerned with ensuring that users are aware of hazards in the environment, and a POSITA would have recognized that implementing *Samadani*'s alert signal technique would have advanced that objective. Thus, a POSITA would have considered the combination to amount to the use of a known technique (*Samadani*'s alarm signal) to improve similar devices (*Melanson* and *Samadani* both disclose adjusting the output of a headset to make users aware of hazards in the environment) in the same way (to provide an additional signal to the user to make them aware of the hazards in the environment). *Id.*

Accordingly, a POSITA would have understood the *Melanson-Rosenberg-Samadani-Dijkstra* combination to disclose or suggest sending an alert signal to the speaker ("sending a notification signal to the speaker") if a vehicle horn is detected ("if the acute sound is a warning sound or siren"). *Id.* ¶386.

6. Claim 17

As detailed in §VIII.C.1.i, *Melanson* discloses or suggests detecting particular frequency patterns, including vehicle horns and sirens. *Samadani* expressly discloses "identify[ing] ... **emergency vehicle** sirens." *Samadani* ¶[0035].

A POSITA would have been motivated to combine *Samadani*'s teachings related to detecting an emergency vehicle siren into the *Melanson-Rosenberg-Samadani-Dijkstra* combination and would have had a reasonable expectation of success in doing so. *Kyriakakis* ¶¶387-388. A POSITA would have understood that it would have advanced *Melanson*'s objectives for notifying the user of important events in the environment. *Id.* Therefore, a POSITA would have considered the combination to amount to the use of a known technique (detecting emergency vehicle sirens) to improve similar devices (*Melanson* and *Samadani* are both directed to adjusting the output of a media device in response to detecting particular sounds) in the same way (to make users aware of hazards in the environment). *Id.*

Accordingly, a POSITA would have understood the *Melanson-Rosenberg-Samadani-Dijkstra* combination to disclose or suggest detecting an acute sound that is an emergency vehicle siren ("wherein the warning sound is at least one of a bell, an emergency vehicle, the sound of a security system or a combination thereof"). *Id.* ¶389.

7. Claim 18

As discussed in §VIII.C.1.i, *Melanson* discloses detecting particular frequency patterns, including vehicle horns. A POSITA would have understood that detecting a vehicle horn is the same thing as detecting a car honking. *Kyriakakis* ¶391. This is consistent with the '473 patent insofar as the '473 patent discloses

detecting “car horns” (’473pat., 9:15-16), and does not separately disclose or otherwise distinguish that from detecting “car honking.” *Kyriakakis* ¶391. Thus, a POSITA would have understood *Melanson* to disclose detecting a car honking, and thus also detecting an “alarm” in the context of claim 18. *Id.*

Accordingly, a POSITA would have understood the *Melanson-Rosenberg-Samadani-Dijkstra* combination to disclose or suggest detecting a vehicle horn (“if an alarm is detected, it is at least one of ... a car honking ...”). *Id.* ¶392.

E. Ground 2C: *Melanson, Rosenberg, Samadani, Dijkstra, and Engle* Render Obvious Claims 10-12

1. Claim 10

Melanson discloses “subtractive noise-cancellation as a selectable operating mode.” *Melanson*, 3:24-27. *Melanson* leaves the details for implementing noise-cancellation to the knowledge of a POSITA. A POSITA looking for additional details for how to implement noise cancellation would have readily identified *Engle*. *Kyriakakis* ¶394.

Engle discloses headphones with active noise cancellation. *Engle*, 1:4-5. *Engle* discloses using custom noise reduction filters that vary based on the environment in which the headphones are worn. *See id.*, 2:11-19, 16:5-18:2, 18:3-19:16, 19:17-20:21, FIGs. 4-5; *Kyriakakis* ¶¶395-396. In particular, *Engle* discloses “the ambient noise received by the microphone” is digitized and passed through a set of filters, and then “the filtered signal in time domain is inverted by an inverter,”

and then the inverted signal is converted to analog and summed with the audio program materials. *Engle*, 20:4-13.

A POSITA would have understood that *Engle*'s filtered signal is a "noise signal" because it represents the noise to be cancelled. *Kyriakakis* ¶397. A POSITA would have understood that the inverted, filtered signal is a "noise-reduction signal" because when it is mixed with another signal, it will have the effect of reducing certain noise in that signal. *Id.* ¶397.

A POSITA would have been motivated to modify the *Melanson-Rosenberg-Samadani-Dijkstra* combination to include *Engle*'s teachings related to generating a noise reduction signal and would have had a reasonable expectation of success in doing so. *Id.* ¶398. A POSITA would have appreciated that *Melanson* and *Engle* disclose devices with very similar functionality. *Id.* ¶399. Similar to *Melanson*, *Engle* describes headphones that can detect an ambient sound, adjust the output of the media player based on the ambient audio signal, and provides for active noise cancellation. *Engle*, 1:4-5, 4:1-5. *Engle* provides additional implementation details suitable for *Melanson*'s noise cancellation mode. *Kyriakakis* ¶400. Moreover, a POSITA would have recognized that *Engle*'s noise reduction technique based on programmable filters would improve *Melanson*'s personal audio playback device by making *Melanson*'s device more flexible and usable in various environments. *Id.*

As explained in §VIII.C.1.h, the *Melanson-Rosenberg* combination discloses

or suggests that the microphone signals are processed upon capture prior to additional processing.

Accordingly, a POSITA would have understood the *Melanson-Rosenberg-Samadani-Dijkstra-Engle* combination to disclose or suggest that the captured and processed microphone signal is filtered (“generating a noise signal from at least one of the modified first microphone signal, the modified second microphone signal, or both”) and that the filtered microphone signal is then inverted (“generating a noise reduction signal”). *Id.* ¶402.

2. Claim 11

As noted above in §VIII.E.1, *Melanson* discloses “subtractive noise-cancellation” as an operating mode. *Melanson*, 3:24-27. *Melanson* also discloses that each of the modes may be “selectively enabled.” *Id.*, 8:33-39. Thus, a POSITA would have understood *Melanson* to disclose that the disclosed modes may be enabled and triggered in any order. *Kyriakakis* ¶403. Therefore, a POSITA would have understood *Melanson* to suggest a scenario in which personal safety mode is triggered first and noise-cancellation mode is triggered second. *Id.* In that scenario, a POSITA would have understood that triggering the noise-cancellation mode would cause a noise-reduction signal to be mixed with the mixed signal comprising the ambient and program audio created by personal safety mode. *Id.*

Accordingly, a POSITA would have understood the *Melanson-Rosenberg-Samadani-Dijkstra-Engle* combination to disclose or suggest triggering the subtractive noise-cancellation mode after the personal safety mode is triggered (“mixing the noise reduction signal with the mixed signal to generate a new mixed signal, and sending the new mixed signal to the speaker instead of the mixed signal”) *Id.* ¶404.

3. Claim 12

Melanson in combination with *Rosenberg*, *Samadani*, *Dijkstra*, and *Engle* discloses or suggests this claim for the reasons discussed in §VIII.D.2. *Kyriakakis* ¶405.

IX. SECONDARY CONSIDERATIONS

There is no evidence in the ’473 patent’s prosecution history or elsewhere supporting any secondary considerations arguments, or evidence of nexus of such alleged evidence to the Challenged Claims. *See generally* EX1004; *Kyriakakis* ¶407.

X. 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, Petitioners present a *Sotera* stipulation. (EX1013).

B. 35 U.S.C. §325(d)

The examiner did not issue any rejections under Sections 102 or 103 during prosecution and there is no evidence that the examiner considered any of the Grounds presented in this Petition. Neither *Patel* nor *Topholm* were before the examiner and they are not cumulative of *Boersma*, which the examiner identified as the closest prior art of record. In addition, *Williamson*, *Samadani*, *Dijkstra*, and *Engle* were not disclosed to the examiner during prosecution.

Melanson and *Rosenberg* were both before the examiner during prosecution of the '473 patent, along with over a hundred other references, but neither reference was substantively discussed. Thus, *Becton* factor (c) strongly favors not exercising discretion to deny this Petition. *SolarEdge Techs. LTD v. SMA Solar*, IPR2020-00021, Paper 8 at 12 (PTAB Apr. 10, 2020).

More particularly, while *Melanson* and *Rosenberg* were disclosed to the examiner during prosecution, they are presented in a different light here supported by expert evidence. Thus, Petitioners' challenges are based on additional evidence and arguments that the Office did not consider or, if they were considered, as to which the Office clearly erred. More particularly, the Office erred in not recognizing that *Melanson* discloses a device that can control ambient sound passthrough including the claimed first and second microphones, as well as a memory and processor that performs most of the claimed operations, including detecting an acute

sound and mixing ambient sound with audio content for output to the user. The Office further erred in not recognizing that *Rosenberg* teaches how ambient sound signals are commonly processed in an ambient sound responsive media player very similar to *Melanson*, including in response to detection of the user's voice. The Office further erred in not recognizing that a POSITA would have been motivated to combine *Melanson* and *Rosenberg* for the reasons discussed in §VIII.C.

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

A. Real Parties-in-Interest

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

1. Related Matters

To the best of Petitioners' knowledge, the '473 patent has only been involved in the following district court litigation:

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

Attached to this Petition as EX1010 is a chart identifying all patents/applications that are in the same family as the '473 patent.

B. Lead and Backup Counsel

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C. Service Information

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

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D. Power of Attorney

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

XII. FEES

Petitioners concurrently electronically 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 12, 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 of U.S. Patent No. 11,710,473 contains 13,949 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 12, 2024, I caused a true and correct copy of the foregoing Petition for *Inter Partes* Review of U.S. Patent No. 11,710,473 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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