

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HARMAN INTERNATIONAL INDUSTRIES, INC.,

Petitioner,

v.

ST CASESTECH LLC

Patent Owner.

Case IPR2024-01302

U.S. Patent No. 8,150,044

PETITION FOR *INTER PARTES* REVIEW

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EXHIBIT LIST

Exhibit ("Ex.")	Description
1001	U.S. Patent No. 8,150,044 ("’044")
1002	File History of U.S. Application No. 8,150,044 ("’044FH")
1003	Declaration of Michael T. Johnson ("Johnson")
1004	U.S. Patent Application Publication No. 2001/0046304 ("Rast")
1005	European Patent Application No. 1,519,625 A2 ("Victorian")
1006	U.S. Patent Application Publication No. 2007/0038395 ("Green")
1007	U.S. Patent Application Publication No. 2009/0085873 ("Betts")
1008	U.S. Patent Application Publication No. 2006/0293882 ("Giesbrecht")
1009	U.S. Patent 4,325,142 ("Nakazawa")
1010	United States District Courts National Judicial Caseload Profile
1011	International Publication No. 2006/070229 A2 ("Jaakkola")
1012	Spoken language Processing ("SLP"), Huang, 2001, pages 500- 501
1013	Complaint, <i>Staton Techiya, LLC v. Harman International Industries, Inc.</i> , C.A. No. 23-802 (JCG) (Dist. Del.), filed July 25, 2023
1014	File History of Provisional Patent Applications No. 60/883,013
1015	Declaration of Jonathan Bradford

TABLE OF ABBREVIATIONS

Abbreviation	Description
'044	U.S. Patent No. 8,150,044 (Ex. 1001)
'044FH	File History of U.S. Application No. 11/774.965 (Ex. 1002)
IPR	<i>Inter Partes</i> Review
Petitioner	Petitioner
PO	Patent Owner
POSITA	Person of Ordinary Skill in the Art
PTAB	Patent Trial and Appeal Board
USPTO	United States Patent and Trademark Office

LIST OF CHALLENGED CLAIMS

[1.pre] An acoustic device, comprising:

[1.a] an Ambient Sound Microphone (ASM) configured to capture ambient sound;

[1.b] at least one Ear Canal Receiver (ECR) configured to deliver audio to an ear canal; and

[1.c] a processor operatively coupled to the ASM and the ECR, where the processor monitors the ambient sound for a target sound and adjusts the audio delivered to the ear canal based on the target sound, the processor generating a sound signature from the ambient sound and comparing the sound signature to a plurality of learned signature models to detect the target sound.

[2] The acoustic device of claim 1, where the acoustic device is an earpiece, wherein the target sound is at least one among an alarm, a horn, and a noise.

[3] The acoustic device of claim 1, where the acoustic device is an earpiece, wherein the processor monitors the ambient sound for spoken words associated with verbal warnings.

[4] The acoustic device of claim 1, where the acoustic device is an earpiece, further comprising a memory to store, responsive to a directive by a user of the acoustic device, at least one target sound captured by the ASM for learning.

[5] The acoustic device of claim 1, where the acoustic device is an earpiece, further comprising an audio interface operatively coupled to the processor configured to receive audio content from a media player or cell phone,

[5.a] wherein the processor selectively adjusts a volume of the audio content delivered to the ear canal when the target sound is detected.

[6] A method for personalized listening, the method comprising:

[6.a] capturing ambient sound with an Ambient Sound Microphone (ASM);

[6.b] monitoring the ambient sound for a target sound by generating a sound signature from the ambient sound and comparing the sound signature to a plurality of learned signature models to detect the target sound; and

[6.c] adjusting a delivery of audio by an Ear Canal Receiver (ECR) in an earpiece to an ear canal based on the target sound.

[7] The method of claim 6, further comprising: passing the target sound to the ECR for delivery to the ear canal.

[8] The method of claim 6, further comprising: amplifying the target sound for delivery to the ear canal.

[9] The method of claim 6, further comprising: attenuating the target sound for delivery to the ear canal.

[10] The method of claim 6, further comprising: generating an audible message for delivery to the ear canal.

[11] The method of claim 6, further comprising:

[11.a] mixing the target sound with audio content delivered to the earpiece in accordance with a priority of the target sound.

[12] The method of claim 6, further comprising: detecting and reporting from the sound signature a direction or a speed of a sound source generating the target sound.

[13] The method of claim 6, further comprising: detecting and reporting from the sound signature a spoken utterance in the ambient sound associated with verbal warnings.

[14] The method of claim 6, further comprising: identifying the target sound from the sound signature and transmitting a warning notification to other devices.

[15] The method of claim 6, wherein the target sound is at least one among an alarm, a horn, a voice, and a noise.

[16] A method for sound signature detection, the method comprising:

[16.a] capturing ambient sound with an Ambient Sound Microphone (ASM);
and

[16.b] receiving a directive to learn a sound signature within the ambient sound,

[16.c] where a voice command or an indication from a user is received and is used to initiate the steps of capturing and learning.

[17] The method of claim 16, further comprising: saving the sound signature locally on an earpiece or remotely to a server.

[18] A method for personalized listening, the method comprising:

[18.a] capturing ambient sound via an earpiece that is at least partially occluded in an ear canal;

[18.b] detecting a sound signature within the ambient sound that is associated with a target sound; and

[18.c] mixing the target sound with audio content delivered to the earpiece in accordance with a priority of the target sound and a personalized hearing level (PHL),

[18.d] where learned models are retrieved from a database, the sound signature is compared to the learned models, and the target sound is identified from the learned models in view of the comparison.

[19] The method of claim 18, further comprising: enhancing auditory queues in the target sound relative to the audio content based on a spectrum of the ambient sound captured at an ambient sounds microphone (ASM).

[20] A sound detection device comprising:

[20.a] an ambient sound microphone configured to measure an ambient sound;

[20.b] an ear canal microphone; and

[20.c] a processor configured to compare the ambient sound to at least one target sound signature, and where the processor identifies an onset of an identified target sound signature in the ambient sound,

[20.d] where the ear canal microphone is configured to emit an auditory warning when the processor identifies the onset.

[21] The sound detection device according to claim 20, where the ear canal microphone is operatively connected to an earpiece.

Pursuant to §§311-319 and §42.1,¹ Harman International Industries, Inc. (“Petitioner”) petitions for *inter partes* review (“IPR”) of claims 1-21 (“Claims”) of U.S. Patent No. 8,150,044 (Ex. 1001, “’044”), assigned to ST CasesTech, LLC (“PO”). There is a reasonable likelihood—and it is highly likely—that at least one challenged claim is unpatentable as explained herein. Petitioner requests review of the Claims and judgment finding them unpatentable under §§102/103.

I. INTRODUCTION

The ’044 purports to disclose an acoustic device, such as an earpiece, monitoring ambient sound for a target sound. ’044, 1:53-65. To detect the target sound, sound signatures for the captured ambient sound are compared to learned signature models. At the detection of target sound, the device adjusts the audio output depending on the target sound and mode. *Id.* Johnson, ¶133. The ’044 claims were allowed after the Applicant added this limitation of a processor comparing a sound signature to a learned signature model and adjusting the audio in response to detection. ’044FH, 95.

¹ Section cites reference 35 U.S.C. (pre-AIA) or 37 C.F.R. as context indicates. All emphasis/annotations added unless noted. Figure annotations herein generally quote the Claims for reference. Citations herein are exemplary and not meant to be limiting.

But the concept of comparing captured ambient sound to a learned signature model to detect a target sound and adjusting the audio accordingly was already well known in the art. For example, **Rast** (Ex. 1004) discloses a device “monitor[ing] acoustics within the environment against a set of selection criterion and upon finding a match, changes the mode of the headset.” See *e.g.*, Rast, [0012]. Johnson, ¶34.

Accordingly, Petitioner requests that the Board institute trial and find the Claims unpatentable.

II. MANDATORY NOTICES

A. Real Parties-in-Interest

Petitioner Harman International Industries, Inc. is the real party-in-interest. No other parties had access to or control over the present Petition, and no other party funded or participated in preparation of the present Petition.

B. Related Matters

The '044 is the subject of the following co-pending civil action:

Staton Techiya, LLC v. Harman International Industries, Inc., C.A. No. 23-802 (JCG) (Dist. Del.), filed July 25, 2023 (“Harman Litigation”).

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Petitioner consents to electronic service of documents to the email addresses of the counsel identified above.

III. PAYMENT OF FEES

The undersigned authorizes the Office to charge the fee required by §42.15(a) and any additional fees that might be due to Deposit Account No. 18-1945, under Order No. 111496-0012-658.

IV. REQUIREMENTS FOR *INTER PARTES* REVIEW

A. Grounds for Standing

Pursuant to §42.104(a), Petitioner certifies that the '044 is available for IPR. Petitioner and any real parties-in-interest are not barred or estopped from requesting IPR challenging the Claims on the Grounds identified herein.

B. Identification of Challenge

Pursuant to §§42.104(b)-(b)(1), Petitioner requests IPR of claims 1-21, and that the Board cancel the same as unpatentable.

1. Specific Art on Which the Challenge Is Based

Petitioner relies on the following prior art (Johnson, ¶¶54-59):

Name	Ex.	Publication/ Patent No.	Filed	Published/ Issued	Prior art under at least
Rast	1004	U.S. 2001/0046304	4/24/2001	11/29/2001	§102(b)
Victorian	1005	EP 1,519,625A2	9/13/2004	3/30/2005	§102(a)/ §102(b)
Green	1006	U.S. 2007/0038395	9/2/2004	2/15/2007	§102(e)
Betts	1007	U.S. 2009/0085873	2/1/2006	4/2/2009	§102(e)
Giesbrecht	1008	U.S. 2006/0293882	6/28/2005	12/28/2006	§102(a)/§102(b)/ §102(e)
Nakazawa	1009	U.S. 4,325,142	7/25/1980	4/13/1982	§102(b)

Rast, Victorian, Giesbrecht, and Nakazawa were filed and published and Green and Betts were filed before the '044's 12/28/2007 filing date and 12/31/2006 provisional filing date.²

2. Statutory Grounds on Which the Challenge Is Based³

Ground	Claims	Basis	References
1	1-11, 13-18	§102/103	Rast
2	2-6, 11, 17-18, 21	§103	Rast in view of Victorian
3	12	§103	Rast in view of Green
4	14	§103	Rast in view of Betts
5	19	§103	Rast in view of Giesbrecht
6	20, 21	§103	Rast in view of Victorian and Nakazawa

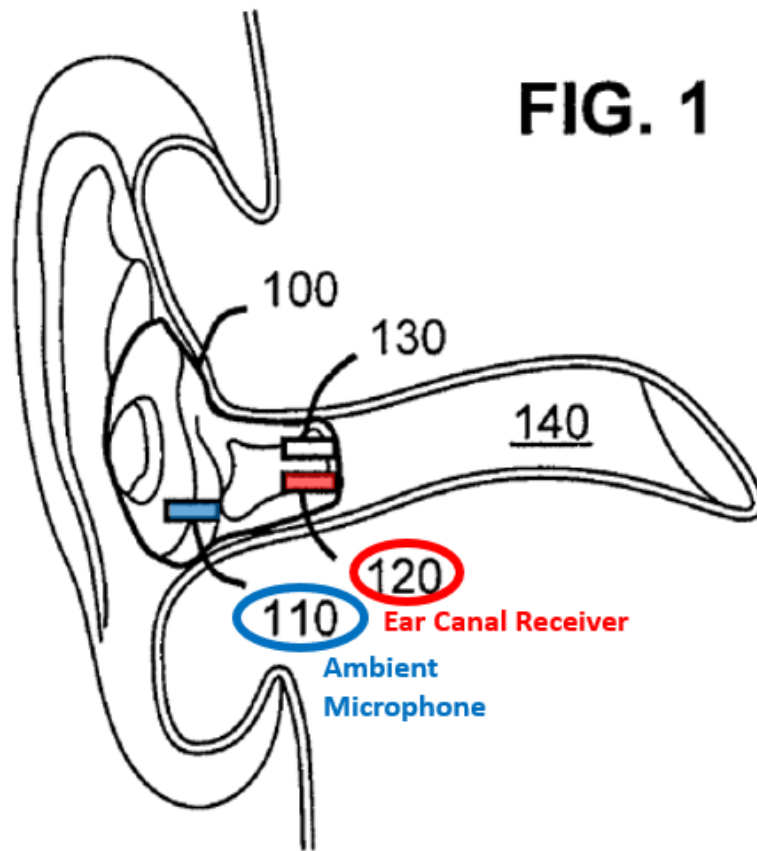
V. '044 PATENT AND PROSECUTION HISTORY

A. '044

The purported “invention” of the '044 is an acoustic device that “monitors” ambient sound for “target sounds.” '044:1-14-17. An earpiece with ear canal receiver and microphone is depicted in Fig. 1. Johnson, ¶35.

² PO has not established the '044 Claims are entitled to the 12/31/2006 filing date of the '044's earliest filed application (Provisional Application No. 60/883,013)

³ See Johnson, ¶¶1-11, 54-59.



'044, Fig. 1

Ambient sound microphone (ASM) 100 “captures ambient sound” “such as an alarm..., siren..., voice (e.g., ‘help’, ‘stop’, ‘police’. etc.), or specific noise (e.g., breaking glass, gunshot, etc.).” ’044, 3:36-40, 4:10-16. The processor detects “target sounds” within the environment based on a comparison of learned models and the “sound signature” made up of identifiable features characterizing the sound. *Id.* 5:8-22, 11:42-47. The processor adjusts audio delivered to the user through the **ear canal receiver (ECR) 120** based on the processor’s mode. *Id.* 5:38-40. The processor 206 is “operatively coupled to the **ASM** and...**ECR** to monitor target

sounds in the ambient sound.” *Id.* 1:53-58. The device “present[s] notifications based on identified target sounds, adjust[s] audio content levels with respect to ambient sound levels, and filter[s] sound” based on the mode defined by the user. *Id.* 3:46-51. Johnson, ¶36.

The ’044’s purported inventive concept is that the processor compares a sound signature to the learned models to identify the corresponding target sound. *Id.* 5:21-30. Johnson, ¶37.

B. Prosecution History

The ’044 claims priority from application No.11/966,457, filed 12/28/2007, which claims priority to provisional application No.60/883,013, filed 12/31/2006. Johnson, ¶38.

The Examiner rejected claims 1-3, 5, 7-13, 15-18, 20, and 23 under pre-AIA §102(b) as anticipated by U.S. 2005/0111683 (“Chabries”), rejected claim 6 under pre-AIA §103(a) as obvious over Chabries, and objected to claims 4, 14, 19, 21, 22, 24, and 25 as dependent upon a rejected base claim. ’044FH, 80-85. Johnson, ¶¶39-42.

Applicant amended claims 1 and 7 to add “generating a sound signature from the ambient sound and comparing the sound signature to a plurality of learned signature models to detect the target sound.” ’044FH, 95. Applicant argued Chabries does not disclose the claimed comparison and instead “examines the

constancy of the envelope of the input signature in several frequency bands.”
'044FH, 101-102. Applicant amended claims 17, 20, and 23 to include features of
claims 19, 21 and 24 and argued this put them in condition for allowance. '044FH,
97-98, 101. Johnson, ¶¶43-46.

Subsequently, claims 1, 3-18, 20-23, and 25 were allowed. '044FH, 111.
Johnson, ¶47.

VI. §325(d) AND §314(a) DISCRETION DOES NOT APPLY

A. §325(d)

Under the two-part *Advanced Bionics* framework, the Board should not
exercise discretion.

The Grounds raised by this Petition are not the same or substantially the same
as the art or arguments raised during '044's prosecution. **Rast, Victorian, Green,
Betts, Giesbrecht, and Nakazawa** were not considered during prosecution.
Johnson, ¶57.

The disclosures considered by the Examiner are not substantially the same as
any of the references relied upon in the Grounds of this Petition. For example, unlike
the art cited during prosecution, **Rast** teaches a processor coupled to a microphone
and speaker, where the processor compares captured ambient sounds to stored
sounds to detect a target sound. Rast, [0017], [0051]; see §IX. Johnson, ¶57.

Even if the art or arguments were substantially the same, the Examiner erred in a manner material to the patentability of the Claims. Because the Examiner did not issue rejections based on **Rast, Victorian, Green, Betts, Giesbrecht, and Nakazawa**, “[i]t is...difficult, if not impossible, to discern exactly why the Examiner allowed the claims of the [’044] patent, or how the Examiner might have considered the arguments presented in the Petition, had they been presented to the Examiner.” *Bowtech, Inc. v. MCP IP, LLP*, IPR2019-00379, Pap. 14, *19-20 (declining to exercise §325(d) discretion). To the extent art considered by the USPTO was substantially the same as references identified in the Grounds, the Examiner erred by not rejecting the Claims for the reasons discussed in §IX.

B. §314(a)

The PTAB should not exercise its §314(a) discretion where, as here, no schedule has been set in the Harman litigation, which was filed in July 2023, and the median time to trial in Delaware is 33 months which would set the Harman trial to about April 2026, one month after an expected FWD. (Ex.1010, 14); Ex.1013.

VII. LEVEL OF ORDINARY SKILL

For purposes of this Petition only, Petitioner assumes the Claims are entitled to the 12/31/2006 filing date of provisional application No. 60/883,013.

A person of ordinary skill in the art (“POSITA”) as of the claimed priority date of the ’044 would have had a bachelor’s degree in electrical, computer

engineering, audio engineering or the equivalent thereof, and at least two years of experience with audio devices and/or audio signal processing such as earphones, hearing aids and/or hearing protectors. More education can supplement practical experience, and vice-versa. Johnson, ¶¶12-21, 48-51.

VIII. CLAIM CONSTRUCTION

Only terms necessary to resolve the controversy need construction. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor*, 868 F.3d 1013, 1017 (Fed. Cir. 2017). Because the prior art asserted herein discloses embodiments within the Claims' indisputable scope, the Board need not construe the Claims' outer bounds. All claim terms should be construed according to their plain and ordinary meaning. Johnson, ¶¶52-53.

IX. GROUNDS OF UNPATENTABILITY

This Petition is supported by the Declaration of Michael Johnson, which describes the prior art's scope and content at the time of the '044. See Ex.1003. The prior art renders the Claims unpatentable based on the below Grounds. Johnson.

A. Ground 1: Rast (Claims 1-11, 13-18)

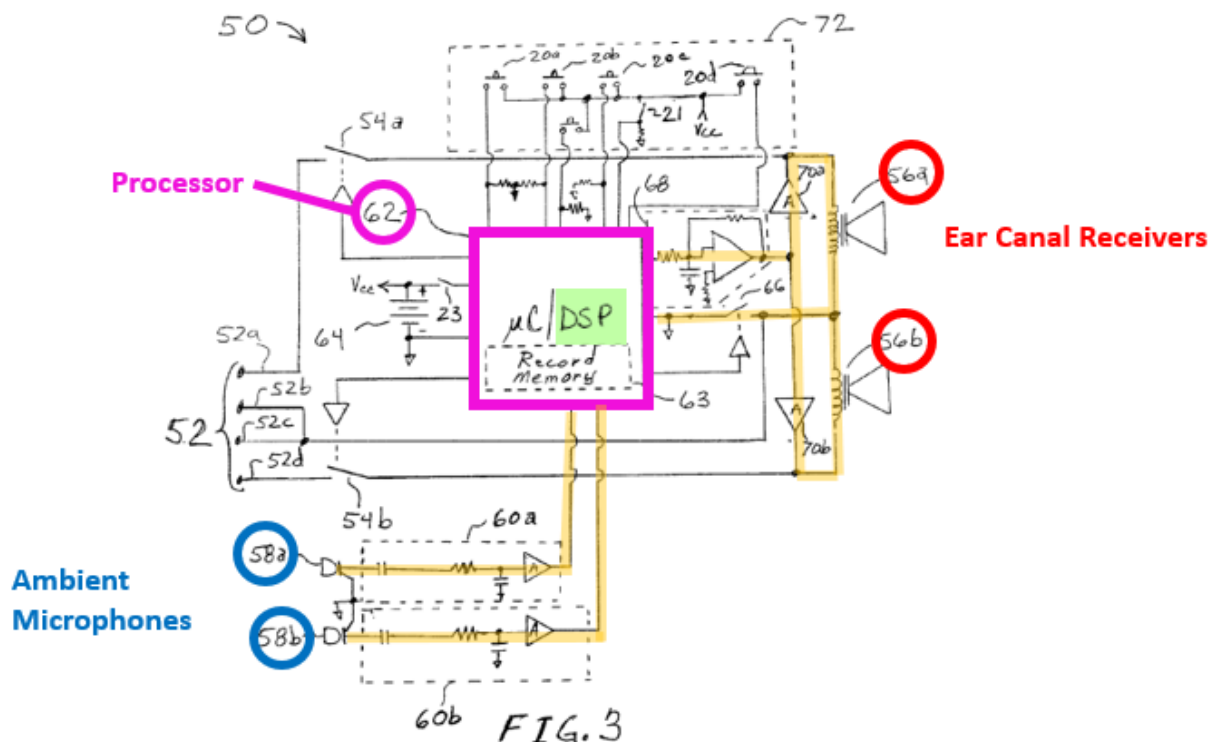
1. Overview of Rast

Rast discloses an apparatus for “sound selective acoustic isolation.” Rast, [0010]. **Ambient “[m]icrophones 58a, 58b**...convert sounds within the external acoustical environment to electrical signals,” and are “attached, or integrated, into

the exterior of each earpiece.” Rast, [0014], [0053]. **Rast’s** system “is applicable to...earbud style devices,” (inserted into the ear), “a pair of earpieces,” or a “single sided headset.” Rast, [0013], [0049]. Johnson, ¶60.

“**[S]peakers** within the earpiece” such as “**conventional audio conversion devices 56 a, 56 b**” “deliver[] environmental audio” “toward the ear canal.” Rast, [0022], [0050], [0053]. Johnson, ¶61.

DSP/microcontroller 62, connected to **microphones** and **speakers**, processes audio collected from **microphones** and outputs it to **speakers**. Rast, [0053], Fig. 3. Johnson, ¶62.



Rast, Fig. 3

The **DSP** “continually compare[s] [external environment sounds] with the sounds and sound characteristics programmed in the sound correlation unit of the headset” by “correlat[ing] the external sounds and characteristics with programmed or recorded sounds or characteristics.” Rast, [0051], [0060], Fig 5. **Rast** refers to stored information corresponding to the target sounds as “sound characterizations,” “sound characterization data,” “correlation sounds,” or “stored sound.” Rast, [0016], [0059]-[0060]. For example, stored information can be an “alarm” or “screams...[and] spoken phrases (i.e. ‘Hey!’, ‘Hello’, ‘Wearer's Name’, ‘Help’)” associated with verbal warnings. Rast, [0021], [0059], [0062]. Johnson, ¶63.

The **DSP** generates a “sound bite” including “waveforms, waveform characteristics, or characteristics of sound” from ambient sound recorded by the **microphones**. Rast, [0060]. The sound bite is saved in “memory ... [that] has the ability to store sound waveforms, sound characteristics, and sound profiles 63, to which the external sounds are to be correlated.” Rast, [0053]. The user presses “program button 88” to initiate “recording and downloading of sounds and sound characterization information for correlation with the external environment.” Rast, [0057]. Johnson, ¶64.

“Segments of sounds from the external environment are continually compared with the sounds and sound characteristics programmed in the sound correlation unit of the headset.” Rast, [0051]. The **DSP** compares the sound bite to stored sound characteristics to detect if the sound bite “matches” stored “correlation sound.” Rast, [0059-0060], Fig. 5. Johnson, ¶65.

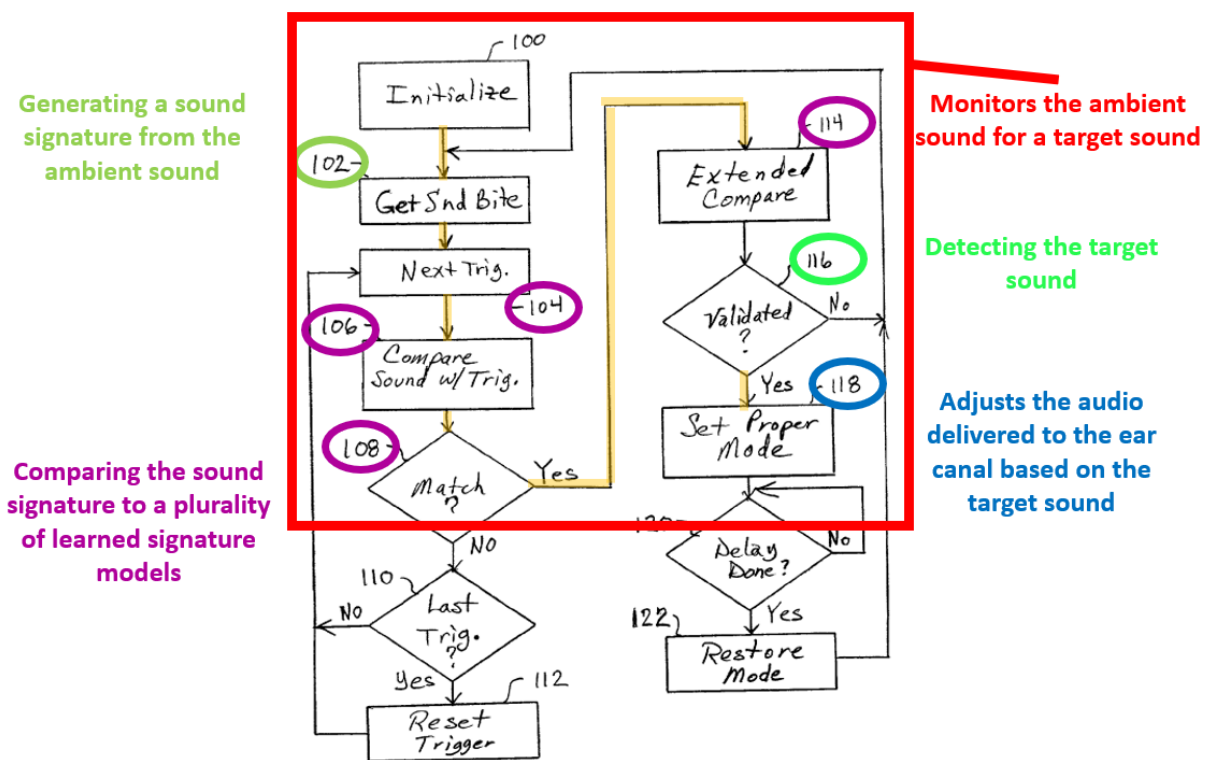


FIG. 5

Rast, Fig. 5

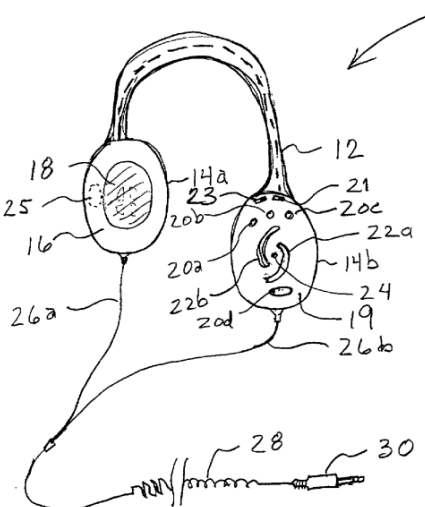
If a match is detected, the **DSP** adjusts audio delivered through the **speaker** based on the mode of the headset set by the user. Rast, [0014], [0051]. For example, while the user is listening to music, when ambient sound “correlates to a sufficiently

high degree with the stored audio parameters,” and “if the correlation sound was set for a sound that the user wished to be alerted to,” the DSP “passe[s]” the sound from the **microphones** to the listener. Rast, [0051], [0053], [0060]. Other adjustments include generating an “alert,” “attenuat[ing], or disconnect[ing]” the audio source, amplifying the **microphone** sounds, and repeating the **microphone** sounds (“echo mode”). Rast, [0051], [0059]. Johnson, ¶66.

2. Claim Chart

US 8,150,044 (“’044”)	US 2001/0046304 (“Rast”)
[1.pre] ⁴ An acoustic device, comprising:	Rast discloses an acoustic device (<i>e.g.</i>, “apparatus which is acoustically coupled to the ear(s)”). <u>E.g., Rast:</u> Rast discloses an “apparatus which is acoustically coupled to the ear(s) of a wearer to provide sound selective acoustical isolation from the environment.” Rast, [0010]. Johnson, ¶¶67-70. • Fig. 1

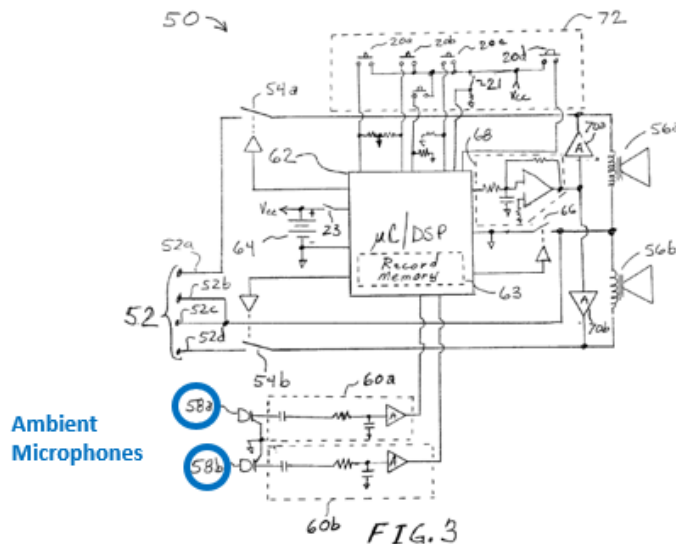
⁴ To the extent any preamble of the Challenged Claims is limiting, it is disclosed for the reasons set forth.

US 8,150,044 ("044")	US 2001/0046304 ("Rast")
	 FIG. 1 • [0010] ("[A]n apparatus for sound selective acoustic isolation.... [T]he apparatus is exemplified as an environmentally responsive apparatus which is acoustically coupled to the ear(s) of a wearer to provide sound selective acoustical isolation from the environment...typically worn by and acoustically coupled to a user...") • [0013] ("The apparatus is readily embodied within various forms of headsets....") • [0049] ("[T]he present invention is applicable to wireless headphones, communication headsets, noise abatement headsets, ... single ear headsets, earbud style devices....")
[1.a] an Ambient Sound Microphone (ASM) configured to capture ambient sound;	Rast discloses an Ambient Sound Microphone (ASM) configured to capture ambient sound (e.g., "[m]icrophones 58 a, 58 b...convert sounds within the external acoustical environment to electrical signals").

E.g., Rast:

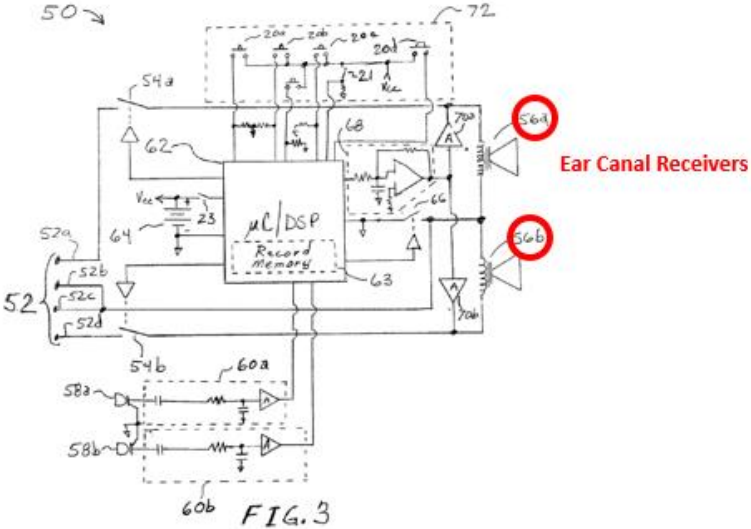
Rast discloses “[m]icrophones 58 a, 58 b...convert sounds within the external acoustical environment to electrical signals,” and are “attached, or integrated, into the exterior of each earpiece.” Rast, [0014], [0053]. The “external acoustical environment” is ambient sound. Rast, [0053]. Johnson, ¶¶71-73.

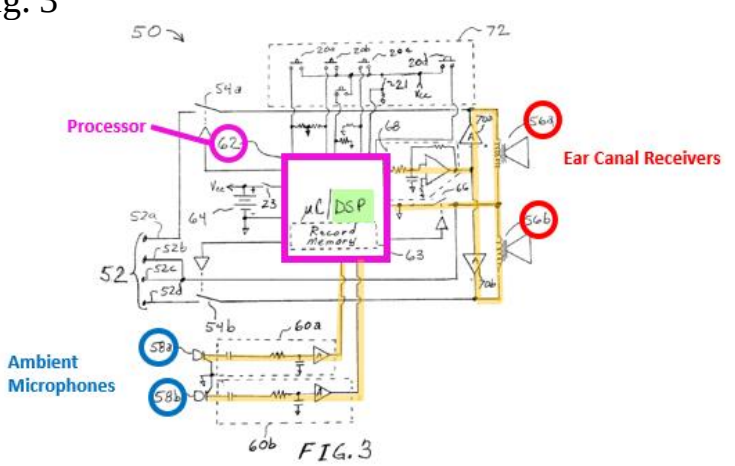
- Fig. 3



-
- [0014] (“**Sounds from the external environment are preferably registered by a microphones, with one microphone attached, or integrated, into the exterior of each earpiece. Each microphone converts the received external sound energy to an external sound signal.**”)
- [0053] (“FIG. 3 is a simplified schematic of the electronics 50 for the **environmentally responsive headphones.... Microphones 58 a, 58 b ... convert sounds within the external acoustical environment to electrical signals** which pass through the conditioning circuitry 60 a, 60 b ...”)
- See also [Abstract], [0016], [0056]

US 8,150,044 (“’044”)	US 2001/0046304 (“Rast”)
[1.b] at least one Ear Canal Receiver (ECR) configured to deliver audio to an ear canal; and	Rast discloses an Ear Canal Receiver (ECR) (<i>e.g.</i>, “speakers within the earpieces,” “conventional audio conversion devices 56 a, 56 b, such as speakers”) configured to deliver audio to an ear canal (<i>e.g.</i>, “delivers environmental audio to the wearer” “toward the ear canal”). <u>E.g., Rast:</u> Rast discloses “speakers within the earpiece” such as “conventional audio conversion devices 56 a, 56 b” that “deliver[] environmental audio” “toward the ear canal.” Rast, [0022], [0050], [0053]. A POSITA would have understood an ECR is a speaker that delivers audio to an ear canal, and does not need to be within an ear canal. Johnson, ¶¶76-77. Regardless, Rast teaches its system “is applicable to...earbud style devices,” which are inserted into the ear. Rast, [0049]; <i>see also</i> Rast, [0013]; Jaakkola, 1:28-2:5 (“Another prior art earbud headset is illustrated...wherein the earplug is inserted into the ear canal...”). Johnson, ¶¶74-77. • Fig 3.

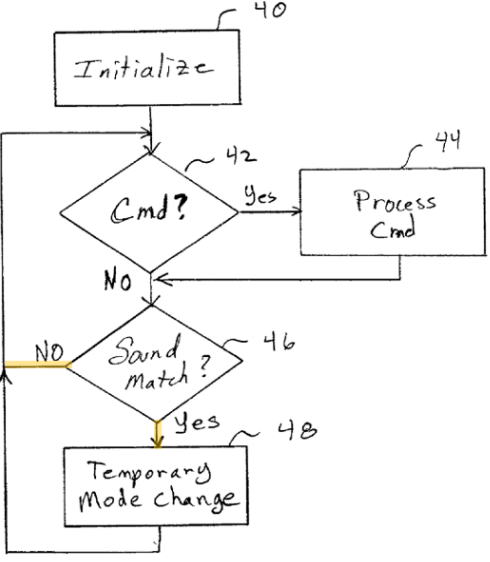
US 8,150,044 ("044")	US 2001/0046304 ("Rast")
	 • [0013] (“[T]he apparatus referred to as a headset may be configured in various mechanical configurations, such as...earbuds....”) • [0022] (“[O]ne preferred method delivers environmental audio to the wearer...by amplifying the signal from the microphone and playing it over the speakers within the earpieces.”) • [0049] (“[T]he present invention is applicable to ... earbud style devices, and so forth.”) • [0050] (“The audio collection grooves 22 a, 22 b...mimic the acoustical function of the structures surrounding the exterior of the human ear, wherein sound is redirected toward the ear canal.”) • [0053] (“Audio source connections 52 a-52 d provide an analog audio channel...to conventional audio conversion devices 56 a, 56 b, such as speakers. ... [T]he sound from the microphones is thereby selectively passed through to the listener....”) • See also [0023]

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[1.c.1] a processor operatively coupled to the ASM and the ECR,	Rast discloses a processor (e.g., "digital signal processor" ("DSP")) operatively coupled to the ASM and the ECR (e.g., "processing the audio signals from the microphones" and "outputting...the sound collected...to...earpiece speakers 56 a, 56 b"). <u>E.g., Rast:</u> See [1.a]-[1.b]. Rast further discloses DSP/microcontroller 62 is connected to the microphones (i.e., ASM) (see [1.a]) and speakers (i.e., ECR) (see [1.b]) because it processes audio collected from the microphones and outputs it to the speakers, as shown in Figure 3. Rast, [0053]. Johnson, ¶¶78-81. - Fig. 3  The diagram, labeled FIG. 3, illustrates an electronic circuit. At the center is a block labeled 'Processor' (62) which contains a 'uC/DSP' and 'Record Memory'. To the left, two 'Ambient Microphones' (58a, 58b) are connected to the processor via a network of resistors (52a, 52b, 52c, 52d) and capacitors (54a, 54b). To the right, two 'Ear Canal Receivers' (56a, 56b) are connected to the processor via a network of resistors (60a, 60b) and capacitors (64, 66, 68, 70). The entire circuit is powered by a Vcc supply (23) and includes various other components like resistors (20a, 20b, 20c, 20d) and capacitors (22a, 22b, 22c, 22d). The diagram is labeled 'FIG. 3' at the bottom. [0053] ("[A] combined digital signal processor and microcontroller.... The DSP/microcontroller 62 is capable of processing the audio signals from the microphones 58 a, 58 b and...then the DSP/microcontroller 62...output[s] via a digital-to-analog converter the sound collected from the microphones...to the separate channels of the earpiece speakers 56 a, 56 b.") [0063] ("[A]udio input is routed through the DSP/microcontroller on the way to the speakers....")

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[1.c.2] where the processor monitors the ambient sound for a target sound and adjusts the audio delivered to the ear canal based on the target sound, the processor generating a sound signature from the ambient sound and comparing the sound signature to a plurality of learned signature models to detect the target sound.	Rast discloses the processor (<i>see</i> [1.c.1]) monitors the ambient sound (<i>e.g.</i>, “[s]egments of sounds from the external environment are continually compared with the sounds and sound characteristics programmed in the sound correlation unit”) for a target sound (<i>e.g.</i>, for sound represented by “sound characterization”; “sound characterization data”; “correlation sound”; “stored sound”) and adjusts the audio delivered to the ear canal based on the target sound (<i>e.g.</i>, “sound from the microphones is...selectively passed through to the listener when it correlates to a sufficiently high degree with the stored audio parameters”; “the detected sound [is] repeated (echo mode),” “an alert [is] generated,” and/or “sounds...may be amplified” based on “the mode of the headset according to the configuration as set by the user”), the processor generating a sound signature from the ambient sound (<i>e.g.</i>, a portion of “sound being recorded from the microphones...placed in a circular buffer” is retrieved by “the processor” as a “sound bite” in the form of “waveforms, waveform characteristics, or characteristics of sound”) and comparing the sound signature to a plurality of learned signature models (<i>e.g.</i>, “the sound bite is compared” to “stored audio parameters” or “stored sounds” or “correlation sound” or “sound characteristics”) to detect the target sound (<i>e.g.</i> a “determination is made...whether the sound detected in the environment matches the correlation sound, or characteristics”). <u>E.g., Rast:</u> See [1.a], [1.c.1]. Rast further discloses the processor monitors the ambient sound for a target sound. For example, the DSP (<i>see</i> [1.c.1]) “continually compare[s] [sounds from the external environment] with the sounds and sound characteristics

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	programmed in the sound correlation unit of the headset” by “correlat[ing] the external sounds and characteristics with programmed or recorded sounds or characteristics.” Rast, [0051], [0060], Fig 5. Rast refers to the stored information corresponding to target sounds as “sound characterizations,” “sound characterization data,” “correlation sounds,” or “stored sound.” Rast, [0016], [0059]-[0060]. Johnson, ¶¶82-85. Rast further discloses the processor adjusts audio delivered to the ear canal based on the target sound. For example, while the user is listening to an audio source, such as music, when ambient sound “correlates to a sufficiently high degree with the stored audio parameters” (target sound), “if the correlation sound was set for a sound that the user wished to be alerted to,” the DSP “passe[s]” the sound from the microphones to the listener. Rast, [0051], [0053], [0060]. Rast also discloses other adjustments to the audio played to the user, including generating an “alert” such as “warning tones,” “attenuat[ing], or disconnect[ing]” the audio source, amplifying the microphone sounds, and repeating the microphone sounds (“echo mode”). Rast, [0051], [0059]. Johnson, ¶86. Rast further discloses the processor generates a sound signature from the ambient sound. For example, the DSP generates a “sound bite” including “waveforms, waveform characteristics, or characteristics of sound” from sound recorded by the microphones (<i>see</i> [1.a]) and stored in the buffer. Rast, [0060]. Johnson, ¶87. Rast further discloses the processor compares the sound signature to a plurality of learned signature models to detect the target sound. The DSP compares the sound bite (i.e., the sound signature) to the stored sound characteristics (i.e., the learned signature models) to detect if the sound bite “matches” the stored “correlation sound.” Rast, [0059]-

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	0060], Fig. 5. A POSITA would have understood Rast's stored sound characteristics are "learned signature models" because, like the '044 patent's learning mode, Rast learns sound characterization information for target sounds by, e.g., recording sounds from the environment. Rast, [0058-0060]; '044, 7:11-26; Johnson, ¶88. - Fig. 5 FIG. 5 [0051] ("Segments of sounds from the external environment are continually compared with the sounds and sound characteristics programmed in the sound correlation unit of the headset.") - Fig. 2

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	 <pre> graph TD 40[Initialize] --> 42{Cmd?} 42 -- Yes --> 44[Process Cmd] 44 --> 42 42 -- No --> 46{Sound Match?} 46 -- Yes --> 48[Temporary Mode Change] 48 --> 42 46 -- No --> 42 </pre> FIG. 2 [0053] ("Audio source connections 52 a-52 d provide an analog audio channel which is routed through a pair of switches 54 a, 54 b to conventional audio conversion devices 56 a, 56 b, such as speakers. When listening to the audio source, the switches 54 a, 54 b are in the closed position. ...It will be recognized that the sound from the microphones is thereby selectively passed through to the listener when it correlates to a sufficiently high degree with the stored audio parameters. Once correlation occurs, the environmental sounds collected from the microphones are preferably passed through to the headset wearer for a period of time....") [0058] ("The interface allows the user to program the desired functionality of the headsets, such as...the recording and downloading of sounds and sound characterization information for correlation with the external environment. ... A program button 88 allows for the activation of sound recording, or characterization.")

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	• [0059] ("Table 1...lists a series of commands...implemented within the headset. The user is preferably capable of selecting all operating parameters of the selective acoustical isolation apparatus through the user interface...The mode of selective acoustical isolation to be provided by the headset apparatus as well as the sounds can preferably be programmed....The user may also record sounds that are specific to their environment which are to be used to modify the isolation provided by the headset. ... [T]he user can select how the headset is to respond to the given sound, for instance should hearthrough be activated so that they may listen to the external environment, should the detected sound be repeated (echo mode), should an alert be generated...For example sound characterization data stored for a spoken word is different than characterization data stored for a sound, or an alarm sound...The user can also preferably select what is to be done with the audio source being received. ... The user can select if these signals are to be attenuated in response to the detection of a hearthrough match, for example, none (no attenuation), block (completely block), -10 dB (attenuate by 10 dB).... The user may then select to record a given sound, or to perform an audio "download" of sounds from an audio player device. User selection with regard to blocking selected sounds are similar in nature to the above....") • [0060] ("FIG. 5 is a flowchart of the method of correlating the external sounds and characteristics with programmed or recorded sounds or characteristics and changing the mode of the headset accordingly...The sound being recorded from the microphones is...placed in a circular

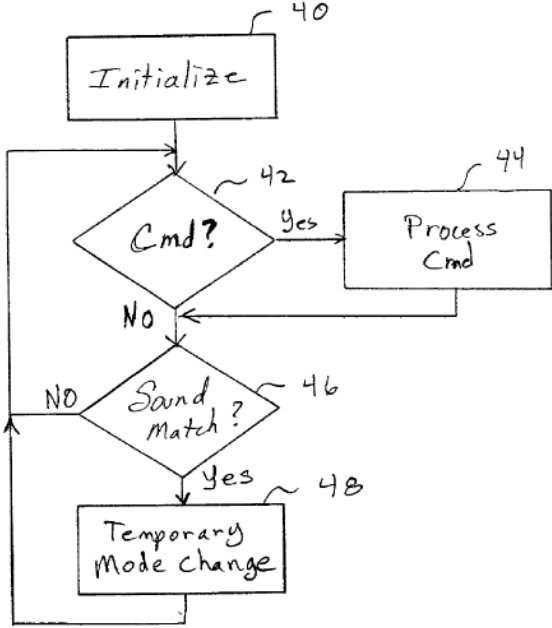
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	<i>buffer...wherein the processor is capable of operating on information from the buffer. A sound bite is retrieved from the buffer at block 102. ...[T]he sound bite may comprise waveforms, waveform characteristics, or characteristics of sound, depending on the algorithms that are being utilized for providing correlation. A pointer to the correlation sound, or trigger condition, is advanced at block 104 and the sound bite is compared at block 106. If the sound does not match this particular correlation sound (stored sound selection criterion)...[and] [i]f this is not the last correlation sound, then processing returns to block 104 which advances the correlation sound, trigger condition, to the next condition, and sound comparisons continue.... Upon the sound bite matching the correlation sound as detected at block 108, execution reaches an extended comparison routine, wherein subsequent portions, or characteristics, of the external sound are compared with subsequent portions of the stored correlation sound at block 114. A determination is made at block 116 as to whether the sound detected in the environment matches the correlation sound, or characteristics. ... If the sound is validated then block 118 is reached which sets the mode of the headset according to the configuration as set by the user. For example, if the correlation sound was set for a sound that the user wished to be alerted to then the sound being received by the microphone may be amplified and output as audio by the audio transducers in the earpiece so that the user can hear the sound.")</i> • [0061] ("<i>Upon detection of selected sounds in the external environment the incoming communication is blocked or attenuated and the external sounds are</i>

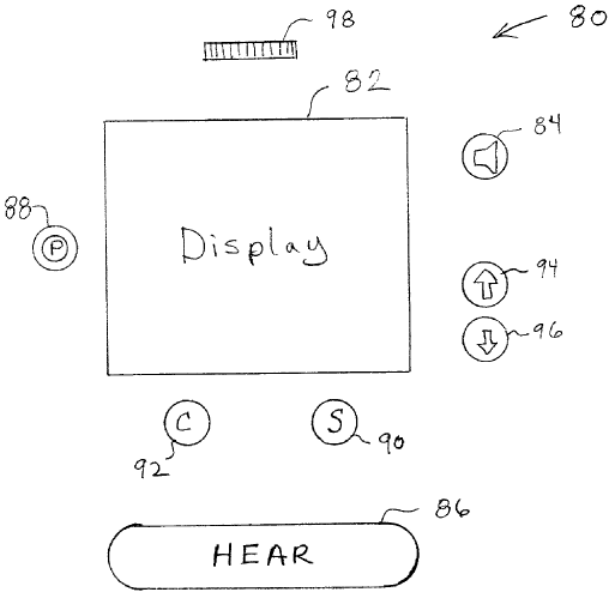
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	<i>amplified to improve the safety of the infantryman."</i>) • See also [0010], [0014], [0016]-[0018], [0030], [0051-0054], Table 1
[2] The acoustic device of claim 1, where the acoustic device is an earpiece, wherein the target sound is at least one among an alarm, a horn, and a noise.	See [1]. Rast further discloses the acoustic device is an earpiece (e.g., "earpiece[]"), wherein the target sound (e.g., sound represented by "sound characterization"; "sound characterization data"; "correlation sound"; "stored sound," see [1.c.2]) is at least one among an alarm, a horn, and a noise (e.g., "alarm"). <u>E.g., Rast:</u> See [1.c.2], [1]. Rast further discloses its apparatus as "a pair of earpieces." Rast, [0013]. Rast discloses the "sound characterization," "sound characterization data," "correlation sound" or "stored sound" includes an "alarm," such as a "smoke alarm siren" or "fire alarm." Rast, [0059], [0062]. Rast further discloses its device as a "single sided headset." Rast, [0013]. A POSITA would have understood, and at least found it obvious, when Rast's device is implemented as a single sided headset, it would embody a single earpiece with a single speaker delivering audio based on control by the DSP. Johnson, ¶92. Further, a POSITA would have understood (or at least found it obvious) when embodied in a single earpiece, the DSP (see [1.c.1]) would be included in the earpiece to advantageously make the audio device more compact, including by minimizing wiring between the microphone and speaker coupled to DSP. See Rast, Fig. 3. Johnson, ¶¶89-93. • [0013] ("The apparatus is readily embodied within various forms of headsets...A headset generally comprises a pair of <i>earpieces</i>.... [T]he apparatus

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	referred to as a headset may be configured...as...single sided headset, earbuds...") • [0059] ("The headset preferably is received by the user with a wide variety of pre-programmed sound characterizations, such as a...smoke alarm siren....These sound characterizations are configured to provide matching with a variety of devices ...For example sound characterization data stored for a spoken word is different than... [for] an alarm sound.") • [0062] ("The microphone correlates a stored sound, or set of sound characteristics, such as screams, a siren, a fire alarm, and so forth, with sounds in the environment.") • See also [0010], [0020], [0021], [0049].
[3] The acoustic device of claim 1, where the acoustic device is an earpiece, wherein the processor monitors the ambient sound for spoken words associated with verbal warnings.	See [1]. Rast further discloses the acoustic device is an earpiece (see [2]), wherein the processor (see [1.c.1]) monitors the ambient sound (e.g., "sound bites" from "sound being recorded from the microphones" are "compared" to "sound characterizations") for spoken words associated with verbal warning (e.g., "spoken phrases (i.e. 'Hey!',... 'Help')"). <u>E.g., Rast:</u> See [1.c.1]-[1.c.2], [2]. Rast further discloses the DSP compares "sound bites" taken from environmental sounds for a match with the sound characteristics set by the user (see [1.c.1], [1.c.2]). Sound characterizations to which the received sound is compared include "spoken phrases" such as "Hey!," and "Help," which are associated with verbal warnings. Rast, [0021]. Johnson, ¶¶94-97. • [0060] ("FIG. 5 is a flowchart of ...a processor main loop...The sound being recorded from the microphones is considered to be placed in a circular

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	<i>buffer,...wherein the processor is capable of operating on information from the buffer. A sound bite is retrieved from the buffer at block 102. ... [T]he sound bite is compared at block 106... A determination is made at block 116 as to whether the sound detected in the environment matches the correlation sound, or characteristics....”)</i> • [0021] (“The selection criterion provides the ability for the signal processing unit to discern a variety of environmental acoustics, which by way of example...spoken phrases (i.e. “<i>Hey!</i>” ... “<i>Help</i>”)....”) • See also [0008], [0012], [0015]-[0017], [0020], [0054], [0059], [0061]
[4] The acoustic device of claim 1, where the acoustic device is an earpiece, further comprising a memory to store, responsive to a directive by a user of the acoustic device, at least one target sound captured by the ASM for learning.	See [1]. Rast further discloses that the acoustic device is an earpiece (see [2]), further comprising a memory to store (e.g., “random access memory (RAM), [that] has the ability to store sound waveforms, sound characteristics, and sound profiles 63”; “sound characterization memory 63”) responsive to a directive by a user of the acoustic device, at least one target sound captured by the ASM for learning (e.g., “user interface 80” allows “recording...of sounds and sound characterization information for correlation with the external environment” using “program button 88”). <u>E.g., Rast:</u> See [1], [2]. Rast further discloses the earpiece includes “sound characterization memory 63” in the form of “random access memory (RAM) stor[ing] sound waveforms, sound characteristics, and sound profiles 63, to which the external sounds are to be correlated.” Rast, [0053]. The user presses “program button 88” to initiate “recording...sounds and sound characterization information

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	for correlation with the external environment,” thereby learning sound characterizations (in the form of “sound waveforms, sound characteristics, and sound profiles”). Rast, [0053], [0058]. This is consistent with how the ’044 describes learning. For example, the ’044 describes a “learning mode” in which a user “record[s] ambient sounds in the environment...[and u]pon generating a sound signature for the new target sound, it can be stored in the user defined database 504.” ’044, 7:20-26. Johnson, ¶¶98-101. • [0016] (“<i>The apparatus of the present invention is capable of retaining information about acoustic events (stored sounds) to which external acoustic events (external sounds) may be correlated.</i> For simplicity, this retained information is often referred to as “stored sounds”, or “sound characterizations”....”) • [0018] (“The sounds to be correlated may be loaded...<i>utilizing the apparatus to record sounds, or characteristics sounds, which are to be correlated.</i>”) • [0022] (“<i>[T]he user can program the headset to recognize specific sounds within their specific environment.</i> The specific sounds to be recognized (correlated)...may be contained within the headset as a prerecorded sound, or as <i>a sound that is recorded by the user from the target environment.</i>”) • [0035] (“<i>[R]ecord sounds and patterns of sound recognition</i> for which a headset mode change is to take place upon detection.”) • [0053] (“<i>[R]andom access memory (RAM)...has the ability to store sound waveforms, sound characteristics, and sound profiles 63, to which the external sounds are to be correlated...</i>[A] set of audio selection criterion which are stored in the <i>sound characterization memory 63.</i>”)

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	- Fig. 2  <pre> graph TD 40[Initialize] --> 42{Cmd?} 42 -- Yes --> 44[Process Cmd] 44 --> 42 42 -- No --> 46{Sound Match?} 46 -- Yes --> 48[Temporary Mode Change] 48 --> 42 46 -- No --> 42 </pre> FIG. 2 [0058] (“[A] user interface 80...allows the user to program the desired functionality of the headsets, such as ... both the <i>recording and downloading of sounds and sound characterization information for correlation with the external environment... A program button 88 allows for the activation of sound recording, or characterization.</i>”) - Fig. 4

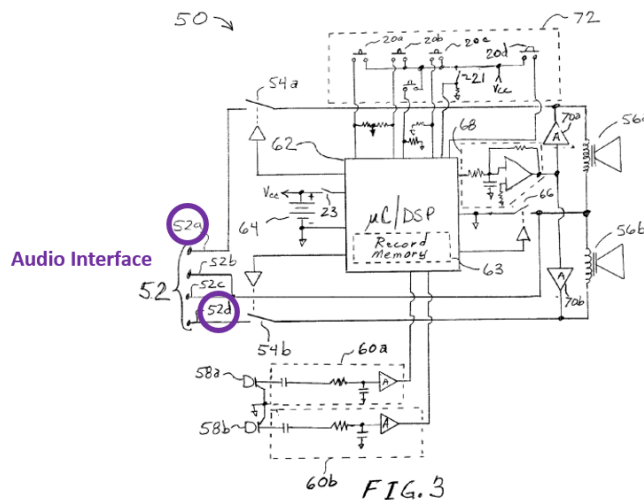
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	 FIG. 4 • • See also, [0051], [0059].
[5.a] The acoustic device of claim 1, where the acoustic device is an earpiece, further comprising an audio interface operatively coupled to the processor configured to receive audio content from a media player or cell phone,	See [1]. Rast further discloses the acoustic device is an earpiece (see [2]), further comprising an audio interface (e.g., “[a]udio source connections 52 a-52 d”) operatively coupled to the processor (e.g., “DSP” controls “switches 54 a, 54 b,” through which “an analog audio channel” from “audio source connections 52 a-52 d” are “routed”; “DSP...power may be derived from...bias voltage or signal voltage as provided on the input audio source connections 52 a-52 d”; “audio input is routed through the DSP/microcontroller on the way to the speakers”; sounds) configured to receive audio content (e.g., receiving “musical audio”) from a media player (e.g., from “audio source,” “musical audio source”; “audio player device”).

E.g., Rast:

See [1], [2]. **Rast** further discloses the earpiece comprises “[a]udio source connections 52 a-52 d” that provide a means by which the earpiece receives analog audio from a “musical audio source”—a media player—and sends the audio to the speakers, such that the wearer “listen[s] to the musical audio source.” See Rast, [0053], [0055]. A POSITA would have understood (and found it obvious) that the musical audio source is a “media player” because the audio from the musical audio source is already in a form for playback on the speaker. Johnson, ¶105. As another example, **Rast** discloses its device is connected to an “audio player device”—a media player—from which a user may select to perform “an audio ‘download’ of sounds.” Rast, [0059]. Johnson, ¶¶102-105.

Moreover, as explained in [5.b], the DSP is operatively coupled to the audio interface because the DSP controls the volume of audio received via audio source connections 52 a-52 d. Further, **Rast** discloses, when digital audio is used, “audio input is routed through the DSP/microcontroller on the way to the speakers.” Rast, [0063]. Johnson, ¶106.

- Fig. 3



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	• [0019] ("<i>[T]he unit...can be programmed with an audio stream from a source, such as the telephone, or audio from the Internet...</i>") • [0025] ("<i>The present invention may also be utilized within headsets which receive an audio channel, such as music, or communications, which is converted to sound within the earpieces to which the wearer is listening.</i>") • [0051] ("<i>[T]hen a command processing routine is entered, block 44, which interfaces with the user...Additionally, the audio source being listened to may be either attenuated...</i>") • [0053] ("<i>Audio source connections 52 a-52 d provide an analog audio channel which is routed...to...speakers. When listening to the audio source.... Power for the DSP/microcontroller...may be derived from...the input audio source connections 52 a-52 d.</i>") • [0055] ("<i>While listening to an audio source, such as music, the wearer may press button 20 d and elect to listen to the environment; pressing of button 20 d again would return the headset to listening to the musical audio source.</i>") • [0059] ("<i>The user can also preferably select what is to be done with the audio source being received...The headset may be utilized for listening to music..., wherein the headset is receiving signals that are being converted to audio by the audio conversion devices within the earpieces... The user may then select to ...perform an audio "download" of sounds from an audio player device.</i>") • [0063] ("<i>[U]tilizing the invention with a digital input source simplifies the system as audio input is routed through the DSP/microcontroller on the way to the speakers...</i>")

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[5.b] wherein the processor selectively adjusts a volume of the audio content delivered to the ear canal when the target sound is detected.	Rast discloses that the processor (<i>e.g.</i>, “DSP”) selectively adjusts a volume of the audio content delivered to the ear canal (<i>e.g.</i>, “audio volume of programmed sounds being output from the audio transducers is preferably attenuated”; “attenuating the audio amplitude of the programmed sound source” played by the speakers (<i>see</i> [1.b])) when the target sound is detected (<i>e.g.</i>, when “sound detected...matches the correlation sound”). <u>E.g., Rast:</u> See [1] and [5.a]. Rast further discloses that volume of audio playing in the speakers (<i>see</i> [1.b]) is adjusted based on the headset’s configuration, when “the sound detected in the environment matches the correlation sound” during the “processor main loop.” Rast, [0060]. For example, “if the correlation sound was set for a sound that the user wished to be alerted to” then the “audio volume of programmed sounds being output from the audio transducers is preferably attenuated...so that the wearer can easily hear the external sounds.” Rast, [0060]. A POSITA would have understood (or at least found obvious) that Rast’s DSP controls the volume of audio content. Johnson, ¶110. For example, Rast discloses the algorithm (Fig. 5)—including the attenuation of audio from the audio device—is part of a “sound discrimination program” performed in a “processor main loop.” Rast, [0060]. Johnson, ¶¶107-110. • [0060] (“FIG. 5 is a flowchart of...a processor main loop.... A determination is made at block 116 as to whether the sound detected in the environment matches the correlation sound, or characteristics.... If the sound is validated then block 118 is reached which sets the mode of the headset according to the configuration as set by the user. For example, if the

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	<i>correlation sound was set for a sound that the user wished to be alerted to then the sound being received by the microphone may be amplified and output as audio by the audio transducers in the earpiece so that the user can hear the sound. The audio volume of programmed sounds being output from the audio transducers is preferably attenuated to a given decibel level in relation to the sound detected, so that the wearer can easily hear the external sounds.... [T]he preceding flowchart is a simplified description of the sound discrimination program...")</i> • [0059] ("These sound characterizations are configured to provide matching with a variety of devices that need not produce the exact same sound ...<i>Prior to programming a sound that the user wants to be alerted to, the user may enter information about how to process the sound. For example, the user can select how the headset is to respond to the given sound, for instance should hearthrough be activated so that they may listen to the external environment, should the detected sound be repeated (echo mode), should an alert be generated... The user can select if these signals are to be attenuated in response to the detection of a hearthrough match, for example, none (no attenuation), block (completely block), -10 dB (attenuate by 10 dB), -20 dB (attenuate by 20 dB), -40 dB (attenuate by 40 dB). ... The relative volume to which hearthrough is to be configured is preferable set by the user.</i>") • [0011] ("The manual change in acoustic isolation may be coupled with attenuation of incoming audio signals, such as music programming...so that the ability of the user to hear the external environment is improved.")

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	• [0012] (“Automatic changes in acoustic isolation may be similarly coupled with <i>attenuation of the incoming audio signals...</i>”) • [0051] (“Additionally, <i>the audio source being listened to may be either attenuated, or disconnected</i>, such that the amplified external sounds from the microphones may be more clearly heard by the wearer.”) • [0058] (“[E]xternal sounds picked up by the microphones are amplified and played within the earcups, preferably in concert with <i>attenuating the audio amplitude of the programmed sound source.</i>”) • See also [0014], [0017], [0022], Fig. 5
[6.pre] A method for personalized listening, the method comprising:	Rast discloses a method for personalized listening (e.g., “method...by which the acoustic isolation of the user is modified...based on user input”). <u>E.g., Rast:</u> Rast discloses a method for isolating sounds “based on user input.” [0010]. Johnson, ¶¶111-113. • [0010] (“An apparatus and method are described by which the <i>acoustic isolation of the user is modified either manually based on user input...</i>”) • [0017] (“ “[H]earthrough” mode...routes the acoustics of the environment, <i>preferably at a user selected amplification level...</i>”) • [0018] (“[T]he sounds for which the user desires reduced acoustic isolation from the environment will be <i>unique to their particular environment...</i>”) • [0028] (“[T]o provide an <i>individual with the ability to selectively control the acoustical isolation</i>

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	<i>between themselves and their acoustic environment.”)</i> • See also [0022], [0032]
[6.a] capturing ambient sound with an Ambient Sound Microphone (ASM);	See [1.a]. Johnson, ¶¶114-116.
[6.b] monitoring the ambient sound for a target sound by generating a sound signature from the ambient sound and comparing the sound signature to a plurality of learned signature models to detect the target sound; and	See [1.c.2]. Johnson, ¶¶117-119.
[6.c] adjusting a delivery of audio by an Ear Canal Receiver (ECR) in an earpiece to an ear canal based on the target sound.	See [1.b], [1.c.2], [2]. Johnson, ¶¶120-121.
[7] The method of claim 6, further comprising: passing the target sound to the ECR	See [6]. Rast further discloses passing the target sound to the ECR for delivery to the ear canal (<i>e.g.</i>, when “the sound being received by the microphone” matches the “correlation sound,” the “sound being received by the

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for delivery to the ear canal.	microphone” is “output as audio by the audio transducers in the earpiece so that the user can hear the sound”). <u>E.g., Rast:</u> See [1.b], [1.c.2], [6]. Rast further discloses when the environmental sound received by the microphone matches a correlation sound, “the sound being received by the microphone may be amplified and output as audio by the audio transducers in the earpiece.” Rast, [0014], [0060]. Johnson, ¶¶122-126. • [0060] (“<i>If the correlation sound was set for a sound that the user wished to be alerted to then the sound being received by the microphone may be amplified and output as audio by the audio transducers in the earpiece so that the user can hear the sound.</i>”) • [0014] (“The <i>mode</i> of the headset may be changed ...”) • See also [0023], [0024], [0054]
[8] The method of claim 6, further comprising: amplifying the target sound for delivery to the ear canal.	See [6]. Rast further discloses amplifying the target sound for delivery to the ear canal (e.g., “[i]f the sound is validated,” “the sound being received by the microphone may be amplified and output as audio by the audio transducers”). <u>E.g., Rast:</u> See [6], [7], [19]. Rast further discloses, when the sound “received by the microphone” “matches the correlation sound,” “the sound being received by the microphone may be amplified and output as audio by the audio transducers in the earpiece so that the user can hear the sound.” Rast, [0060]. Johnson, ¶¶127-130.

US 8,150,044 (“’044”)	US 2001/0046304 (“Rast”)
	• [0060] (“<i>A determination is made...whether the sound detected in the environment matches the correlation sound, or characteristics....If the sound is validated ... [and] if the correlation sound was set for a sound that the user wished to be alerted to then the sound being received by the microphone may be amplified and output as audio by the audio transducers in the earpiece so that the user can hear the sound.</i>”) • [0022] (“delivers environmental audio to the wearer during a predetermined interval by <i>amplifying the signal from the microphone and playing it over the speakers within the earpieces</i>”) • [0014] (“<i>amplifying the ambient sounds</i> after extracting spurious noises”)
[9] The method of claim 6, further comprising: attenuating the target sound for delivery to the ear canal.	See [6]. Rast further discloses attenuating the target sound for delivery to the ear canal (e.g., “apply[ing] the attenuation to the given sound”). <u>E.g., Rast:</u> See [1.b], [1.c.2], [5.a]. Rast further discloses attenuating a correlation sound or sound characterization the user does not want to hear, like a “car burglar alarm.” Rast, [0014], [0059]. Johnson, ¶¶131-134. <u>E.g., Rast:</u> • [0059] (“<i>Similarly, default characteristics for how to treat sounds that are to be blocked. ... [S]ounds to be blocked may be ongoing “events”, wherein the...device continues to apply the attenuation to the given sound...The user preferably can select which of these they wish to trigger a reduction in acoustical isolation. Similarly the user can select</i>”)

US 8,150,044 ("044")	US 2001/0046304 ("Rast")
	<i>from preprogrammed sounds they wish to block, such as a car burglar alarm."</i>) • [0014] ("[T]he headset may...<i>attenuat[e] the sound by augmenting active noise cancelation with selective sound acoustical isolation</i> ("block matched sound")...") • See also [0049].
[10] The method of claim 6, further comprising: generating an audible message for delivery to the ear canal.	See [6]. Rast further discloses generating an audible message for delivery to the ear canal (e.g., "the voiced phrase is played over the earpieces to alert the wearer that the environmentally responsive functionality is active"; "the wearer may be alerted with...playback of...the correlation sound"). <u>E.g., Rast:</u> See [1.b], [1.c.2]. Rast further discloses, when the headset is put on the head of the user, a "voiced phrase" plays over the speakers to inform the user the headset is activated. Rast, [0055]. Rast further discloses that in addition to attenuating the audio being played when the environmental sounds match the sound characterization or "correlation sound," the device may also playback the correlation sound to alert the user. Rast, [0060]. For example, in the situation where the environmental sound is an audible message, like "Hello" ([0059]), then the device plays back the message "Hello" in the speakers (see [1.b]). Johnson, ¶¶135-138. • [0023] ("[P]<i>laying the recorded sound associated with the stored selection criterion</i>, or the playing of audio alert signals by themselves....") • [0051] ("[T]he wearer may...be alerted to the correlated sound... [by] <i>playing</i> of the correlated sound, or <i>the recorded correlation sound</i>.")

US 8,150,044 (“’044”)	US 2001/0046304 (“Rast”)
	• [0055] (“<i>[W]hen the headsets are placed on the wearers head...the voiced phrase is played over the earpieces to alert the wearer that the environmentally responsive functionality is active.</i>”) • [0059] (“The headset...[has] a wide variety of pre-programmed sound characterizations, such as...<i>the spoken word “Hello”</i>....”) • [0060] (“[T]he sound being received by the microphone may be...output as audio by...the earpiece so that the user can hear the sound...<i>[T]he wearer may be alerted with additional warning tones, or a playback of the sound taken from the environment or the correlation sound.</i> ”) • See also [0012], [0014], [0017], [0061].
[11] The method of claim 6, further comprising: mixing the target sound with audio content delivered to the earpiece in accordance with a priority of the target sound.	See [6]. Rast further discloses mixing (e.g., “mix[ing]”) the target sound (e.g., sound represented by “sound characterization”; “sound characterization data”; “correlation sound”; “stored sound,” see [1.c.2], including “voices, troop movements,” “artillery and gunfire”) with audio content delivered to the earpiece (e.g., “incoming communication”) in accordance with a priority of the target sound (e.g., “controlled attenuation, selective blocking”). <u>E.g., Rast:</u> Rast discloses mixing the ambient sound with an “incoming communication” when a sound correlation occurs based on the desirability of the ambient sound. Rast, [0061]. Target sounds that are desired, like “voices, [or] troop movements,” are amplified or “accentuated” (i.e., prioritized), while undesirable target sounds, like “artillery and gunfire,” are attenuated and/or blocked, based on the user’s preferences (i.e., deprioritized) before mixing the measured sound with the incoming communication. Rast, [0061]. Johnson, ¶¶139-141.

US 8,150,044 ("044")	US 2001/0046304 ("Rast")
	[0061] ("<i>The sound correlation unit being preferably configured for controlled attenuation, selective blocking, of artillery and gunfire to a predetermined decibel level</i> so that hearing is not dulled or damaged, <i>while sounds such as voices, troop movements and so forth are amplified to provide a hearing advantage to the soldier...The headset preferably mixes the incoming audio with the ambient sounds....</i> Upon detection of selected sounds in the external environment the <i>incoming communication is blocked or attenuated and the external sounds are amplified....</i> A...combat pilot...headset...provides for...<i>the accentuation of critical audio, and the blocking of select noises, such as the noise of the particular engine.</i> A second example would provide coaches...with a communication headset that allows them to <i>still hear and communicate with players, while blocking crowd noise.</i> ... [D]isc-jockeys may find that headsets...provide the benefits of a <i>studio quality sound reproduction headset while not preventing them from hearing necessary studio sounds, such as telephones, alerts, co-workers....</i> [H]eadphones to <i>listen to music...without...missing telephone calls, alarms, doorbells, or the utterances of another individual....</i>") - See also [0014], [0016], [0018], [0022], [0023]
[13] The method of claim 6, further comprising: detecting and reporting from the sound signature a spoken utterance in	See [6]. Rast further discloses detecting (e.g., "detecting") and reporting (e.g., "the wearer may be alerted with additional warning tones, or a playback of the sound taken from the environment or the correlation sound") from the sound signature a spoken utterance in the ambient sound (e.g., "sound bites" from "sound being recorded from the microphones" "compared" to "sound

US 8,150,044 (“’044”)	US 2001/0046304 (“Rast”)
the ambient sound associated with verbal warnings.	characterizations,” <i>see</i> [3]) associated with verbal warnings (e.g., “spoken phrases (i.e. ‘Hey!’,...‘Help’),” <i>see</i> [3]). <u>E.g., Rast:</u> <i>See</i> [1.a], [1.c.2], [3], [10], [12]. As explained in [3], Rast discloses sound characterizations (or “sound correlations”) can be the word “Hey!,” or “Help.” Rast, [0021], [0053]. As described in [1.c.2], when the environmental audio matches a sound correlation, like “Help,” the headset adjusts audio based on the user configuration or mode. One such configuration includes the user being “alert[ed] with additional warning tones, or a playback of the sound taken from the environment or the correlation sound.” Rast, [0060]. When the sound correlation is a verbal warning, like “Hey!” and the headset configuration is set to playback the sound correlation, then the device detects and reports the “Hey!” to the user. Johnson, ¶¶142-145. • [0021] (“The selection criterion provides the ability for the signal processing unit to discern a variety of environmental acoustics, which...comprise: ...<i>screams...spoken phrases (i.e. “Hey!”, “Hello”, “Wearer’s Name”, “Help”)....</i>”) • [0053] (“<i>When the microphone input correlates with the stored parameters</i>, such as <i>detecting</i> the word “<i>Hello!</i>”, then the DSP/microcontroller 62...switches off the input sources....”) • [0059] (“The headset...is received...with a wide variety of pre-programmed sound characterizations, such as...the spoken word “<i>Hello!</i>”....”) • [0060] (“[T]he wearer may be alerted with additional warning tones, or a playback of the sound taken from the environment or the correlation sound.”) • <i>See also</i> [0054]

US 8,150,044 (“’044”)	US 2001/0046304 (“Rast”)
[14] The method of claim 6, further comprising: identifying the target sound from the sound signature and transmitting a warning notification to other devices.	See [6]. Rast further discloses identifying the target sound from the sound signature (e.g. a “determination is made at block 116 as to whether the sound detected in the environment matches the correlation sound, or characteristics,” see [1.c.2]) and transmitting a warning notification to other devices (e.g., “a radio signal...forwarded to the squad leader”). <u>E.g., Rast:</u> See [1.c.2], [6.b]. Rast further discloses the device determines whether the environmental sound matches the correlation sound or sound characteristic. Rast, [0060]. Rast further discloses one application for its invention is “headphones for use by infantrymen on the battlefield,” in which, when “artillery and gunfire” are detected, “at the time of sound correlation, a radio signal may be forwarded to the squad leader.” Rast, [0061]. The radio signal transmitted to the squad leader is a warning notification to another device. Johnson, ¶¶146-149. To the extent that it is determined that multiple “other devices” are required, it would have been obvious to forward the “radio signal” to multiple other members of a soldier’s squad. Johnson, ¶150. For example, a POSITA would have been motivated to cause the radio signal to be sent to multiple squad members to ensure that, even if the squad leader is unavailable and/or the information is immediately relevant to other squad members, other squad members would be able to respond to the artillery and gunfire as appropriate. <i>Id.</i> • [0060] (“A determination is made at block 116 as to whether the sound detected in the environment matches the correlation sound, or characteristics.”)

US 8,150,044 (“’044”)	US 2001/0046304 (“Rast”)
	[0061] (“[H]eadphones for use by infantrymen on the battlefield...The sound correlation unit being preferably configured for controlled attenuation, selective blocking, of artillery and gunfire..., while sounds such as voices, troop movements and so forth are amplified to provide a hearing advantage to the soldier. <i>The headset itself would preferably be configured with a radio so that each infantryman may be retained in communication contact, such as with the squad leader. ... Upon detection of selected sounds in the external environment the incoming communication is blocked or attenuated and the external sounds are amplified to improve the safety of the infantryman. In addition, at the time of sound correlation, a radio signal may be forwarded to the squad leader, or otherwise utilized to signal the external event.</i>”)
[15] The method of claim 6, wherein the target sound is at least one among an alarm, a horn, a voice, and a noise.	See [6]. Rast further discloses wherein the target sound (see [1.c.2]) is at least one among an alarm, a horn, a voice, and a noise (e.g., “alarm”; see [2]). Johnson, ¶¶151-153.
[16.pre] A method for sound signature detection, the method comprising:	Rast discloses a method for sound signature detection (e.g., “method of correlating the external sounds and characteristics with programmed or recorded sounds or characteristics”). <u>E.g., Rast:</u> Rast’s device performs a method of detecting “programmed...sounds” (sound signatures) from “external sounds.” Johnson, ¶¶154-156. [0060] (“FIG. 5 is a flowchart of the <i>method of correlating the external sounds and characteristics</i>

US 8,150,044 ("044")	US 2001/0046304 ("Rast")
	<i>with programmed or recorded sounds or characteristics</i> and changing the mode of the headset accordingly.") • [0058] ("The interface allows the user to program the desired functionality of the headsets, such as operation, modes changes, as well as the selection of preprogrammed sounds, and both the recording and downloading of sounds and sound characterization information for correlation with the external environment.")
[16.a] capturing ambient sound with an Ambient Sound Microphone (ASM); and	See [1.a], [16.pre]. Johnson, ¶¶157-158.
[16.b] receiving a directive to learn a sound signature within the ambient sound,	Rast discloses receiving a directive to learn a sound signature within the ambient sound (<i>e.g.</i>, the user uses "program button 88" on "user interface 80" to initiate "recording...of sounds and sound characterization information for correlation with the external environment" which become "stored sound" in the "memory"). <u>E.g., Rast:</u> See [4], [16.pre]. Rast further discloses the user depresses program button 88 to initiate recording of ambient sound to store. Rast, [0016], [0053], [0058]. As described in [4], the resulting stored sound characteristics (sound signatures) are saved in memory, and thus learned. Johnson, ¶¶159-162. • [0016] ("The apparatus...is capable of retaining information about acoustic events (stored sounds) to which external acoustic events (external sounds) may be correlated." For simplicity, this retained

US 8,150,044 ("044")	US 2001/0046304 ("Rast")
	information is often referred to as <i>"stored sounds", or "sound characterizations"...."</i>) • [0053] ("<i>[M]emory... has the ability to store sound waveforms, sound characteristics, and sound profiles 63, to which the external sounds are to be correlated...</i>The DSP/microcontroller 62 is capable of processing the audio signals from the microphones 58 a, 58 b and correlating these signals with a set of audio selection criterion which are stored in the <i>sound characterization memory 63.</i>") • [0058] ("Referring now to FIG. 4 <i>a user interface 80</i> is shown for an environmentally responsive headset ...The interface <i>allows the user to</i> program the desired functionality of the headsets, such as...both the <i>recording and downloading of sounds and sound characterization information for correlation with the external environment...</i>A program button 88 allows for the activation of sound recording, or characterization.")
[16.c] where a voice command or an indication from a user is received and is used to initiate the steps of capturing and learning.	Rast discloses where a voice command or an indication from a user is received (e.g., "user to program" by "pressing of a button") and is used to initiate the steps of capturing and learning (e.g., to initiate "the recording...of sounds and sound characterization information for correlation with the external environment") <u>E.g., Rast:</u> See [16.pre], [16.b]. As explained in [16.b], Rast discloses the user depresses program button 88 to initiate recording sound to store, thereby learning the sound signature. Johnson, ¶¶163-166. • [0051] ("A check is made to detect <i>command entry at block 42, because the user at any time may elect to program a new sound</i> or alter the mode

US 8,150,044 ("044")	US 2001/0046304 ("Rast")
	characteristics of the headset. If a command entry is detected, <i>such as the pressing of a button</i>, then a command processing routine is entered, block 44..." • [0058] ("<i>The interface allows the user to program the desired functionality of the headsets, such as... the recording and downloading of sounds and sound characterization information for correlation with the external environment....A program button 88 allows for the activation of sound recording, or characterization. ... [T]he duration of sound recorded is selected by the user in response to the retention of the program button</i>, such that the user can select the amount of sound which is to be correlated....")
[17] The method of claim 16, further comprising: saving the sound signature locally on an earpiece or remotely to a server.	See [16]. Rast further discloses saving the sound signature locally on an earpiece (e.g., "[s]peech recognition characteristics" "are stored within the headset apparatus," which may be an "earpiece[]"). <u>E.g., Rast:</u> See [2], [4]. Rast further discloses that sound characteristics are "stored" within the headset in the "sound characterization memory 63." Rast, [0016], [0053]. As explained in [2], Rast discloses its headset implemented as an earpiece. Johnson, ¶¶167-170. • [0051] ("[A]udio is compared with all the <i>stored trigger conditions</i>, and upon meeting a first phase of correlation, the discernment process continues to check...against the <i>stored sounds and characteristics.</i>") • [0053] ("correlating...with a set of audio selection criterion which are <i>stored in the sound characterization memory 63.</i>")

US 8,150,044 (“’044”)	US 2001/0046304 (“Rast”)
	• [0054] (“<i>Speech recognition characteristics...are stored within the headset apparatus</i> and the characteristics are compared...”) • [0016] (“[T]he present invention is capable of retaining information about acoustic events (<i>stored sounds</i>) to which external acoustic events (external sounds) may be correlated. <i>For simplicity, this retained information is often referred to as “stored sounds”, or “sound characterizations”...</i>”) • See also [0019], [0049]
[18.pre] A method for personalized listening, the method comprising:	See [6.pre]. Johnson, ¶¶171-172.
[18.a] capturing ambient sound via an earpiece that is at least partially occluded in an ear canal;	Rast discloses capturing ambient sound (see [1.a], [6.a], [16.a]) via an earpiece that is at least partially occluded in an ear canal (e.g., “earbud style devices,” see [1.b]). <u>E.g., Rast:</u> See [1.a], [1.b]. Rast further discloses an earpiece including microphones. Rast, [0014], [0053]. Rast further discloses “earbud style devices,” which are earpieces at least partially in the ear canal. Rast, [0049]. Johnson, ¶¶173-176. • [0013] (“[A] headset may be configured in various mechanical configurations, such as...<i>earbuds</i>...”) • [0014] (“Sounds from the external environment are preferably registered by a microphones, with one <i>microphone attached, or integrated, into the exterior of each earpiece.</i>”) • [0049] (“[T]he present invention is applicable to...<i>earbud style devices</i>...”)

US 8,150,044 (“’044”)	US 2001/0046304 (“Rast”)
	• [0053] (“<i>Microphones 58 a, 58 b, or similar audio conversion devices, convert sounds within the external acoustical environment to electrical signals...</i>”)
[18.b] detecting a sound signature within the ambient sound that is associated with a target sound; and	Rast discloses detecting a sound signature within the ambient sound (<i>e.g.</i> , “the sound bite is compared at block 106” to “stored audio parameters” or “stored sounds” or “correlation sound” or “sound characteristics”) that is associated with a target sound (<i>e.g.</i> , “determination is made at block 116 as to whether the sound detected in the environment matches the correlation sound, or characteristics”). <i>See</i> [1.c.2]. Johnson, ¶¶177-180.
[18.c] mixing the target sound with audio content delivered to the earpiece in accordance with a priority of the target sound and a personalized hearing level (PHL),	Rast discloses mixing the target sound with audio content delivered to the earpiece in accordance with a priority of the target sound (<i>e.g.</i> , “mix[ing] the incoming audio with the ambient sounds” based on “preferabl[e] configur[ation] for controlled attenuation [and] selective blocking,” <i>see</i> [11]) and a personalized hearing level (PHL) (<i>e.g.</i> , “a volume control to allow the wearer to set the audio level played over the earpieces”).

US 8,150,044 (“’044”)	US 2001/0046304 (“Rast”)
	<u>E.g., Rast:</u> See [5.b], [6.c], [11]. As described in [11], Rast discloses “mix[ing] the incoming audio with the ambient sounds” based on “preferabl[e] configur[ation] for controlled attenuation [and] selective blocking.” Rast, [0061]. Rast further discloses the “volume” of audio provided to the user—e.g., the mixed audio—is set by the user. Rast, [0056]. This is consistent with the ’044’s disclosure, which states “[t]he PHL establishes comfortable and uncomfortable levels of hearing,” and “can also be used to properly mix the volumes of the different sounds.” ’044, 5:42-50. Johnson, ¶¶181-184. • [0056] (“[A]udio headphones are often equipped with a volume control to allow the wearer to set the audio level played over the earpieces.”) • [0059] (“The user can select if these signals are to be attenuated in response to the detection of a hearthrough match, for example, none (no attenuation), block (completely block), –10 dB (attenuate by 10 dB), –20 dB (attenuate by 20 dB), –40 dB (attenuate by 40 dB)....The relative volume to which hearthrough is to be configured is preferable set by the user.”) • [0061] (“The headset preferably mixes the incoming audio with the ambient sounds....”)
[18.d] where learned models are retrieved from a database, the sound signature is compared to the learned models, and the target sound is identified	Rast discloses where learned models are retrieved from a database (e.g., “a library of sounds may be provided, such as over the Internet, or from a CD, wherein the user can select prerecorded sound patterns, sound characterizations, and algorithms”), the sound signature is compared to the learned models, (e.g., “signal processing circuit” “compares the microphone signals against a set of stored selection criterion”) and the target sound is identified from the learned models in view of the

US 8,150,044 ("044")	US 2001/0046304 ("Rast")
from the learned models in view of the comparison.	comparison (e.g., "match" of "sound characteristics programmed."). <u>E.g., Rast:</u> See [1.c.2], [6.b], [17], [18.b]. Rast discloses sound bites (sound signatures) of environmental sounds are compared to a set of stored selection criterion of sound characteristics (learned model) to find a match. Rast, [0051]. Rast further discloses downloading the stored sounds (i.e. learned models) from a "library"—which is a database—on the Internet or a CD. Rast, [0019]. Johnson, ¶¶185-188. • [0019] ("<i>[T]he unit is configured so that it can be programmed with an audio stream from a source, such as the telephone, or audio from the Internet...To provide convenience to the user, a library of sounds may be provided, such as over the Internet, or from a CD, wherein the user can select prerecorded sound patterns, sound characterizations, and algorithms to suit their needs.</i>") • [0017] ("The signal processing unit compares the microphone signals against a set of stored selection criterion and upon finding a match alters the amount of acoustical isolation provided by the headset....") • [0051] ("[S]ounds from the external environment are continually compared with the sounds and sound characteristics programmed in the sound correlation unit of the headset.") • [0059] ("The user may then select to record a given sound, or to perform an audio "download" of sounds from an audio player device.")

B. Ground 2: Rast in view of Victorian (Claims 2-6, 11, 17-18, 21)

Claims 2-5 require “where the acoustic device is an earpiece.” As discussed for claims 2-5 in Section IX.A, **Rast discloses or at least renders obvious the acoustic device is an earpiece** (e.g., “earpiece[]”). To the extent further disclosure is required, e.g. that the entire acoustic device must be an earpiece, **Victorian discloses an acoustic device** (e.g., “audio communication system[]”) **is an earpiece** (e.g., “single ear-level device.”). Johnson, ¶189.

Victorian is directed to an “ear-level” “audio communication system[]” used as a “single ear-level device.” Victorian, [0008], [0013], [0015]; *see also* [0005], [0022]. The single ear-level device is in the form of an “earmold” that “is fully occluded to maximize audio efficiency.” Victorian, [0029], Fig. 1. Ear-level device 110 includes “ear canal microphone 440 [that] detects sound from the ear canal. Victorian, [0030]. Johnson, ¶¶189-190.

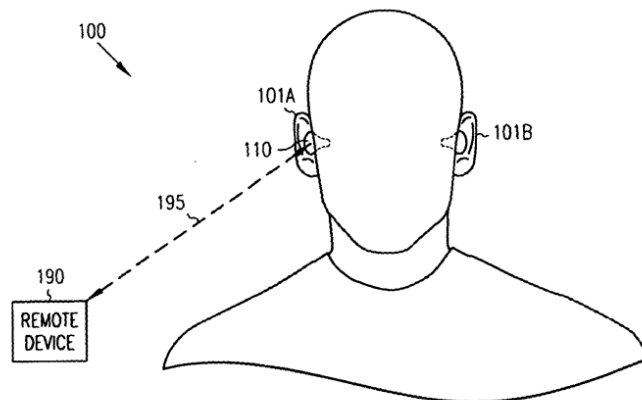


FIG. 1

Victorian, Fig. 1

Rast and **Victorian** are analogous art, in the same field as the '044, which includes acoustic devices, and are reasonably pertinent to alleged problems addressed by the '044 of “enhancing the user’s ability to hear target sounds in their environment without compromising his hearing.” ’044, 1:45-48; *e.g.*, Rast, [0012]; Victorian, [0054]. For example, **Victorian’s** device “allows a hearing impaired individual to communicate” with their environment, which is pertinent to the problem addressed by the '044, which looks to enhance a user’s awareness of their environment. ’044, 1:40-42; Victorian, [0009]. Similarly, **Rast** emphasizes “controlling acoustic isolation, so that important events are not missed.” Rast, [0009]. Johnson, ¶191.

A POSITA would have been motivated to apply **Victorian’s** teachings of a single ear-level acoustic device to **Rast’s** device for a more discrete, “not easily visible” system. Victorian, [0007]. Johnson, ¶192. **Victorian** discloses implementing acoustic devices both as a single ear-level device and a pair of ear-level devices (Victorian, [0063]), confirming a POSITA would have found it straightforward to implement devices using a pair of earpieces as a single earpiece. A POSITA would have found it straightforward to implement **Rast’s** device with a microphone, ear canal receiver and processor in a single earpiece, as **Victorian**

teaches all of these features are included in a single earpiece. See *Victorian*, Fig. 4A; Johnson, ¶192. Thus, a POSITA would have found it routine, straightforward and advantageous to apply **Victorian’s** teachings of a one-sided ear device to **Rast’s** teachings of an acoustic device, and would have known such a combination (yielding the claimed limitations) would predictably work and provide the expected functionality. Johnson, ¶192.

To the extent further disclosure is required for claims 6, 11, 17-18 and 21 for “earpiece,” it would have been obvious to apply **Victorian’s** teachings of an earpiece for those limitations for the same reasons. Johnson, ¶193.

C. Ground 3: Rast in view of Green (Claim 12)

See §IX.A.2 discussing claim 6. **Green further discloses detecting** (*e.g.*, “detect[ing]”) **and reporting** (*e.g.*, “communicat[ing]”) **from the sound signature** (*e.g.*, “acoustic signatures”) **a direction of a sound source generating the target sound** (*e.g.*, “directional information about the origin of an acoustic event” such as “vehicle movement or artillery fire”), as recited in Claim 12. Johnson, ¶194.

Green discloses an “acoustic sensor[y]” apparatus with “sensor modules” that “detect[]” events, such as “vehicle movement or artillery fire” based on their “acoustic signatures.” *Green*, [0024]. From detected sounds, the sensor module determines the direction of an acoustic event. *Id.* The sensors provide “information

regarding the direction of origin of an acoustic wavefront” which is “gathered as the acoustic wave will pass the different sensors at different times.” *Id.* Information “communicated to the module acting in control mode” by the sensor module includes “location information,” including “direction.” Green, [0046]; *see also* [0023], [0034], [0045]. Johnson, ¶¶194-197.

Rast and **Green** are analogous art, in the same field as the ’044, which includes acoustic sensory devices, and are reasonably pertinent to alleged problems addressed by the ’044 of “enhancing” the user’s awareness to their environment. *E.g.*, ’044, 1:40-42; Rast, [0023]; Green, [0002]. For example, both **Green** and **Rast** describe applications on the battlefield, which is pertinent to the ’044, which describes setting a target sound to a “gunshot.” ’044, 4:10-16, 11:47-51. **Green** describes “locat[ing] events on a battlefield,” while **Rast** describes use “by infantrymen on the battlefield.” Green, [0002], Rast, [0061]. Johnson, ¶198.

Further, a POSITA would have been motivated to apply **Green**’s teachings of acoustic location sensing to **Rast**’s acoustic device because the ability to “identify and locate certain events in an environment” benefits, e.g., to reconnaissance teams. Green, [0002]-[0003]; Johnson, ¶¶199. Identifying the location of an event decreases “risk” to a reconnaissance team. Green, [0003]. Johnson, ¶199-200.

A POSITA would have found it routine, straightforward and advantageous to apply **Green’s** teachings of direction sensing acoustic modules to **Rast’s** teachings of an acoustic device, and would have known such a combination (yielding the claimed limitations) would predictably work and provide the expected functionality. Johnson, ¶¶199-200 (citing Ex. 1012 explaining how to determine direction of arrival with microphones).

D. Ground 4: Rast in view of Betts (Claim 14)

See §IX.A.2 discussing claim 6. Claim 14 further requires “identifying the target sound from the sound signature and transmitting a warning notification to other devices.” As explained in §IX.A, **Rast** discloses and at least renders obvious this limitation. To the extent it is argued additional disclosure of notification to multiple other devices is required, **Betts discloses transmitting a warning notification to other devices** (*e.g.*, “generating a notification signal in the one or more PEDs indicating detection of the event”). Johnson, ¶¶201-203.

Betts discloses communicating notification signals to multiple personal electronic devices (“PEDS”). Betts, [0008]; *see also* [Abstract], [0021], [0035], [0044], [0103]. **Betts** describes a “sensory enhancement (SE) system” for detecting environmental events and “generating a notification signal in [] one or more [] PEDS indicating detection of the event.” Betts, Abstract, [0008]. Betts describes “means

for communicating among the plurality of PEDs” that an event has been detected.

Id. Johnson, ¶¶203-204.

Rast and **Betts** are analogous art, in the same field as the '044, which includes environmental sensor devices, and are reasonably pertinent to alleged problems addressed by the '044 of “enhancing” the user’s awareness to their environment. *E.g.*, '044, 1:40-42; Rast, [0023]; Betts, [0001]. For example, **Betts** describes using its system for “sensory enhancement to the user,” which is pertinent to the problem addressed by the '044 and **Rast** of enhancing the user’s awareness of their environment. '044, 1:45-47; Rast, [0012], Betts, [0003]. Johnson, ¶205.

A POSITA would have been motivated to apply **Betts**’s teachings of sending a notification to multiple PEDs upon detection of an acoustic event to **Rast**’s acoustic device to further advance awareness of the environment to others who may be affected by the user’s environmental conditions. Johnson, ¶206. **Rast** acknowledges the benefit of sending a notification to another device, for example, a squad leader. Rast, [0061]. **Betts** describes expanding notification functionality by providing that notification to a plurality of PEDs, in order “to provide beneficial sensory enhancement” to multiple others. Betts, [0003], [0008]. Johnson, ¶206.

Thus, a POSITA would have found it routine, straightforward and advantageous to apply **Betts**’s teachings of notifications to a plurality of devices to

Rast's teachings of an acoustic device, and would have known such a combination (yielding the claimed limitations) would predictably work and provide the expected functionality. Johnson, ¶207.

E. Ground 5: Rast in view of Giesbrecht (Claim 19)

Claim 19 requires “[t]he method of claim 18, further comprising: enhancing auditory queues in the target sound relative to the audio content based on a spectrum of the ambient sound captured at an ambient sounds microphone (ASM).” **Rast** in view of **Giesbrecht** discloses this added limitation. Johnson, ¶208.

As described in §IX.A, **Rast** discloses or at least renders obvious the method of claim 18. Johnson, ¶209.

Rast further discloses enhancing auditory queues (e.g., “voices, [or] troop movements”) **in the target sound relative to the audio content** (e.g., “amplifying the signal from the microphone” and “any incoming audio source, such as music over a wired or wireless connection, is attenuated or disconnected”) **based on the ambient sound** (e.g., based on “sounds from the external environment”) **captured at an ambient sounds microphone (ASM)** (e.g., from “external microphones,” see also [1.a], [11]). For example, **Rast** discloses “amplifying” sound characteristic such as “voices” or “troop movements,” and “attenuat[ing]” incoming audio from the audio source based on environmental sound captured by the external

microphones. Rast, [0014], [0022], [0043], [0051], [0061]; *see also* Rast, [0013], [0059], and [1.a]. Johnson, ¶¶209-210.

Giesbrecht discloses enhancing auditory queues in the target sound relative to the audio content based on a spectrum of the ambient sound (*e.g.*, “enhances the quality and intelligibility of a received speech signal by adjusting one or both of the average speech spectral shape...and the background noise spectral shape”). Giesbrecht, [0011]. For example, **Giesbrecht** discloses enhancing speech signals based on their spectrum. Giesbrecht, [0011], [0061]. **Giesbrecht** normalizes the spectrum of a speech signal to resemble the selected “target spectral shape” that represents ideal frequency for the speech signal, based on user choice of what type of speech signal to enhance. Giesbrecht, [0005], [0061]; *see also* Giesbrecht, [0010], [0011], Fig. 12. Johnson, ¶¶211-212.

Using a “spectral correction factor” (difference between the spectrum of received speech signal and the desired signal), the spectrum of input speech signal is adjusted towards the desired spectral shape. Giesbrecht, [0007], [0061]. Thus, certain speech signals are enhanced relative to the spectrum of the received signal. Giesbrecht, [0005]-[0012]. The spectrum of background noise can be similarly normalized. Giesbrecht, [0061]. Johnson, ¶213.

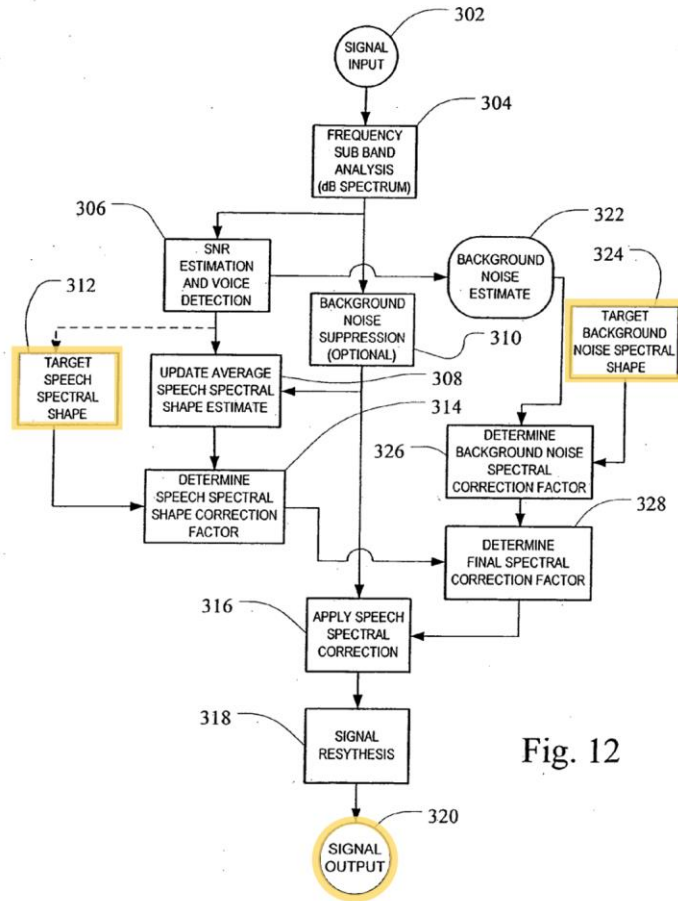


Fig. 12

Giesbrecht, Fig. 12

Rast and **Giesbrecht** are analogous art, in the same field as the '044, which includes acoustic devices for enhancement of user interaction with the environment, and are reasonably pertinent to alleged problems addressed by the '044 of users in “compromising situation[s] since they may not be aware of...their environment.” *E.g.*, '044, 1:40-42; Rast, [0012]; Giesbrecht, [0001], [0005]. For example, **Giesbrecht** describes “improv[ing] both sound quality and intelligibility” to enhance user cognition of their environment, which is reasonably pertinent to the

problem addressed by the '044 because the '044 also seeks to improve user awareness of environmental signals. '044, 1:45-47; Giesbrecht, [0002]. Johnson, ¶214.

A POSITA would have been motivated to apply **Giesbrecht's** teachings of enhancing particular speech signals relative to the spectrum of sound to **Rast's** acoustic device to enhance amplification of chosen sound characteristics. Johnson, ¶215. **Giesbrecht** describes “adjusting the spectral shape of a received speech signal can significantly improve the quality of the speech signal” (Giesbrecht, [0002]), and thus a POSITA would have been motivated to improve signal quality in **Rast's** device, using **Giesbrecht's** spectral enhancements. Johnson, ¶215. A POSITA would have understood, when **Giesbrecht's** teachings of speech enhancement are applied to **Rast's** teachings, (1) the speech signal is obtained from ambient sound (*see* [13]), and (2) detected speech would be enhanced relative to audio from the audio source because no corresponding enhancement is also made to the audio from the audio source (i.e., only the speech signal is enhanced). *Id.*

Thus, a POSITA would have found it routine, straightforward and advantageous to apply **Giesbrecht's** teachings of speech signal enhancement relative to a spectrum to **Rast's** teachings of amplifying sound characterizations, and

would have known such a combination (yielding the claimed limitations) would predictably work and provide the expected functionality. Johnson, ¶216.

F. Ground 6: Rast in view of Victorian and Nakazawa (Claims 20, 21)

1. Overview of Victorian

See §IX.B. **Victorian’s** ear-level device includes “**ear canal microphone 440**” that “detects sound from the ear canal,” and “[e]ar canal speaker 470” that plays sound to the ear canal. Victorian, [0030]; see Fig. 4A. **Victorian’s** ear-level device also includes processor 460, including “a speech recognition module.” Victorian, [0032]. Speech recognition is performed on audio from **ear canal microphone 440**. Victorian, [0052]-[0054]; see Fig. 9 (steps 910-918). Johnson, ¶217.

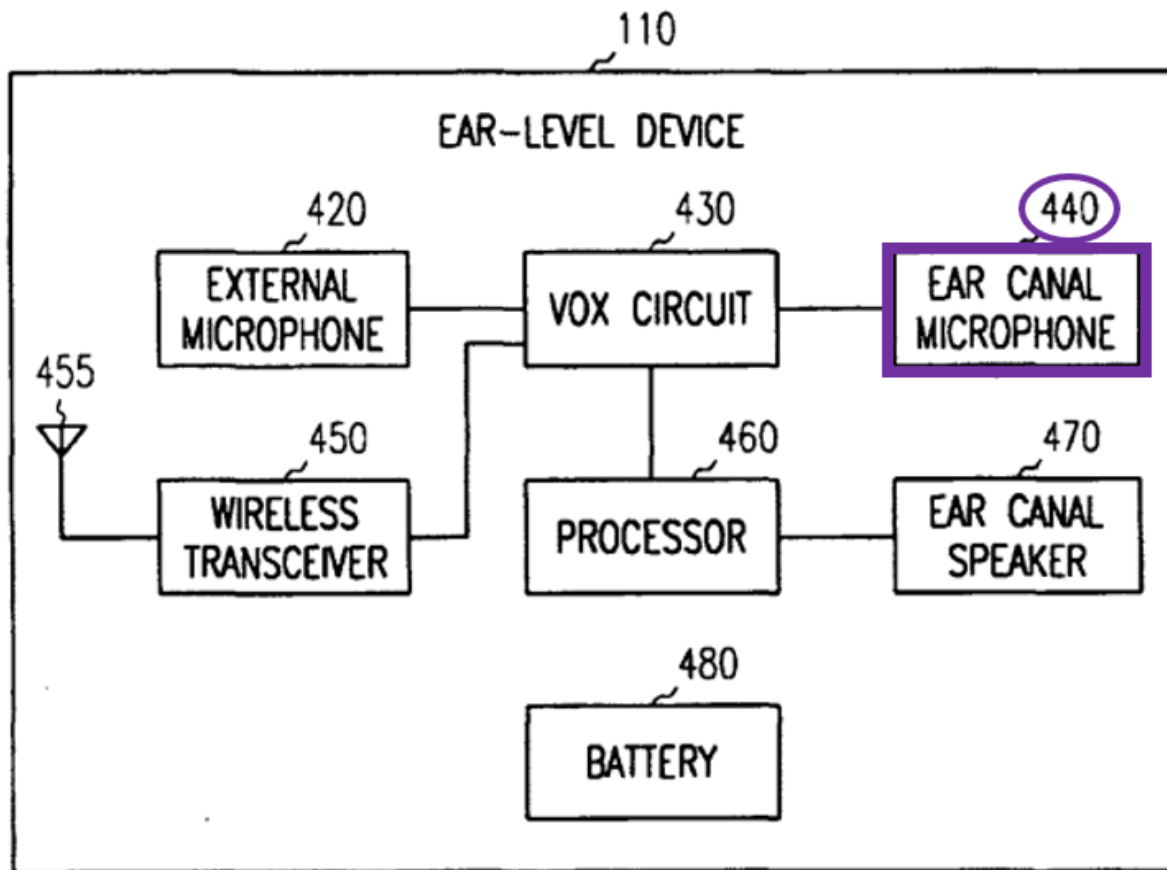
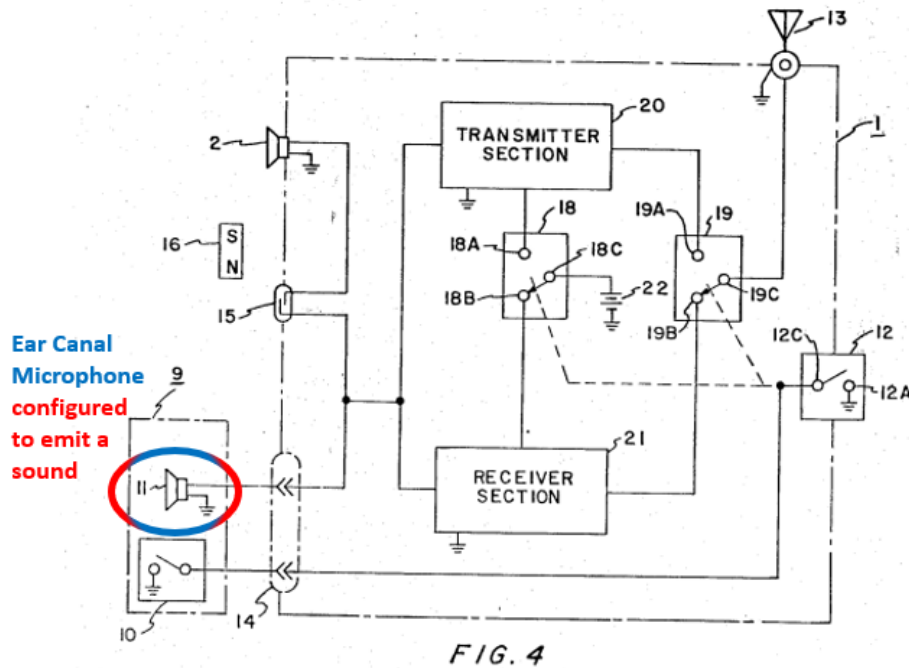


FIG. 4A

2. Overview of Nakazawa

Nakazawa describes a wearable microphone-speaker device. Nakazawa, 1:7-12, 1:22-28. Microphone-speaker 11 “output[s]...an audible sound” once a signal is received to do so. Nakazawa, 4:10-14. Johnson, ¶218.



Nakazawa, Fig. 4

3. Motivation to Apply Victorian's and Nakazawa's Teachings to Rast

Rast, Victorian, and Nakazawa are analogous art, in the same field as the '044, which includes acoustic devices, and are reasonably pertinent to alleged problems addressed by the '044 of "facilitat[ing] portable applications" of acoustic devices. E.g., '044, 4:48-52; Rast, [0061] ("The unit can be...worn"); Victorian, [0006] (describing the problems of "[w]ired" devices as "cumbersome to users who [are] physically active."); Nakazawa, 1:22-28 ("[C]arried on the person..."); see §IX.B. Johnson, ¶219.

A POSITA would have been motivated to apply **Victorian**'s teachings of an ear canal microphone to **Rast**'s device because, as **Victorian** describes, "there is a need for an ear-level communication system that is not easily visible," and an ear canal microphone is discrete. Victorian, [0007]; Johnson, ¶220. Further, **Victorian** describes the benefit of an ear canal microphone in an acoustic device like **Rast**, for "detect[ing] sound from the ear canal[,]...primarily speech of the person wearing ear-level device 110" for "communication," an application of **Rast**'s device. Victorian, [0004], [0030]; Rast [0025]. Johnson, ¶220.

A POSITA would have been motivated to apply **Nakazawa**'s teachings of a microphone-speaker that plays audible sound to **Rast**'s acoustic device (as modified by **Victorian**) because **Nakazawa** would further advance both **Rast** and **Victorian**'s goals of being small and wearable by reducing circuitry by integrating the microphone and speaker. *E.g.*, Rast, [0061]; Armstrong, [0005]; Nakazawa, 1:22-28; '044, 4:48-52. Johnson, ¶221. A POSITA would have understood, when applying **Victorian**'s teachings of an ear canal microphone to **Rast**, integrating **Rast**'s speaker with the ear canal microphone would reduce the size of the earpiece because a single transducer for both the detection and playing of audio would be used. *See, e.g.*, Nakazawa, 1:18-22 (describing the device as "small-sized"). Johnson, ¶221.

Thus, a POSITA would have found it routine, straightforward and advantageous to apply **Victorian’s** teachings of an ear canal microphone to **Rast’s** teachings of an acoustic device for noise cancellation, and would have known such a combination (yielding the claimed limitations) would predictably work and provide the expected functionality. Johnson, ¶222. Further, a POSITA would have found it routine, straightforward and advantageous to apply **Nakazawa’s** teachings of a microphone-speaker to **Rast’s** teachings of an acoustic device, as modified by **Victorian’s** ear canal microphone, and would have known such a combination (yielding the claimed limitations) would predictably work and provide the expected functionality. Johnson, ¶222.

4. Claim Chart

[20.pre] A sound detection device comprising:	See [16.pre] in §IX.A.2. Johnson, ¶¶223-226.
[20.a] an ambient sound microphone configured to measure an ambient sound;	See [1.a] in §IX.A.2. Johnson, ¶¶227-230. • See also [0016], [0056]
[20.b] an ear canal microphone; and	Victorian discloses an ear canal microphone (<i>e.g.</i> , “ear canal microphone 440”). <u>E.g., Victorian:</u> Victorian discloses an “ear canal microphone 440 detects sound from the ear canal.” Victorian, [0030]. As discussed in §IX.F, a POSITA would have been motivated to apply

Victorian's teaching of an ear canal microphone to **Rast's** audio device. Johnson, ¶¶231-234.

- Fig. 4A

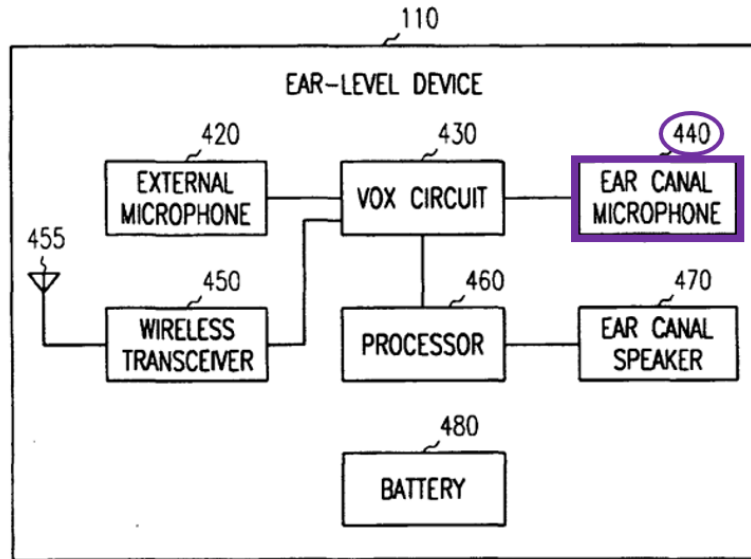


FIG. 4A

- [0030] (“Ear-level device 110 includes an external microphone 420, *an ear canal microphone 440.... Ear canal microphone 440 detects sound from the ear canal.*”)
- [0031] (“*[E]ar canal microphone 440 is capable of detecting the sound delivered to the ear canal* from ear canal speaker 470...”)

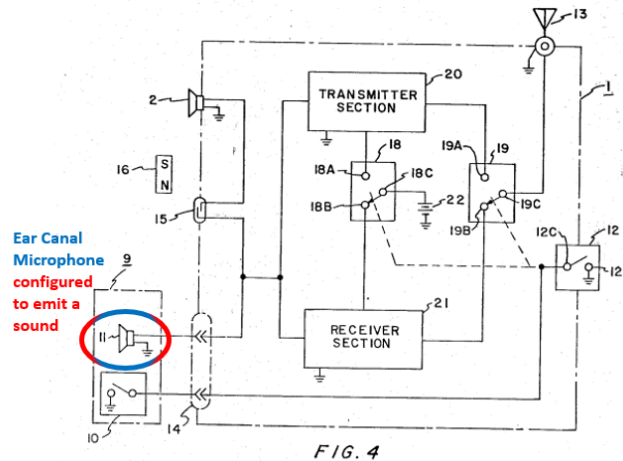
[20.c] a processor configured to compare the ambient sound to at least one target sound signature, and where the processor identifies an onset of an identified target sound

Rast discloses a processor (see [1.c.1] in §IX.A.2) **configured to compare the ambient sound to at least one target sound signature** (see [1.c.2] in §IX.A.2), and where **the processor identifies an onset of an identified target sound signature in the ambient sound** (e.g., “sounds from the external environment are continually compared with the sounds and sound characteristics programmed in the sound correlation unit” and a “determination is made...whether the sound detected in the environment matches the correlation sound, or characteristics”).

signature in the ambient sound,	<u>E.g., Rast:</u> See [1] in §IX.A.2. As described in [1.c.2], Rast discloses a DSP continually compares sounds from the external environment to stored sound characteristics and identifies when a match is made. At the first instance of a match, the mode of the headset is changed per user programming. Rast, [0051]. A POSITA would have understood, and at minimum found obvious, this is the “onset” of a sound match because the device supports a “hearthrough mode” in which the device passes through audio until the sound of interest ends. Rast, [0014]; Johnson, ¶238. In this hearthrough mode, the processor performs the “processor main loop” continually, including the comparison to the target sound and identification of a match, and continues the “hearthrough” operation until the sound of interest stops, and there is no longer a target sound match. See, e.g., Rast [0014]. Johnson, ¶¶235-238. • [0014] (“temporarily routing external sound to earpieces (a “hearthrough mode”)”) • [0051] (“Segments of sounds from the external environment are <i>continually compared</i> with the sounds and sound characteristics programmed in the sound correlation unit of the headset. ... [A] small segment of audio is compared with all the stored trigger conditions, and <i>upon meeting a first phase of correlation</i>, the discernment process continues to check further portions of the sound against the stored sounds and characteristics. <i>If the external sound correlates with the programmed sound at block 46, then the mode of operation of the headphone is changed at block 48 to that which has been programmed by the user.</i>”)
[20.d] where the ear canal microphone is configured to emit	Rast discloses a speaker is configured to emit an auditory warning (see [3], [13], [14] in §IX.A.2) when the

an auditory warning when the processor identifies the onset.	processor identifies the onset (<i>see</i> [20.c]; <i>see also</i> [1.c.2], [6.b], [18.d] in §IX.A.2). <u>E.g., Rast:</u> <i>See</i> [1.c.2], [10] in §IX.A.2. Rast further discloses its speaker provides alerts and warning tones when microphone signal matches the correlation sound, and these alert tones are played together with the hearthrough mode discussed in [20.c]. Rast, [0014], [0017], [0051]. As explained in [20.c], the match is determined at the onset of an identified target sound. Rast, [0051]; <i>see also</i> [1.c.2], [6.b], [18.d]. Johnson, ¶¶239-242. • [0014] (“<i>The mode of the headset may be changed by any of a number of mechanisms, for example, by temporarily routing external sound to earpieces (a “hearthrough mode”), ... generating an alert signal (“user alert tone”)....</i>”) • [0022] (“[O]ne preferred method delivers environmental audio to the wearer during a predetermined interval by <i>amplifying the signal from the microphone and playing it over the speakers within the earpieces.</i>”) See [20.b]. Victorian discloses an ear canal microphone (<i>e.g.</i>, “ear canal microphone 440”). Johnson, ¶243 Nakazawa discloses a microphone configured to emit sound (<i>e.g.</i> “microphone-speaker” configured to “output...an audible sound”). <u>E.g., Nakazawa:</u> Nakazawa discloses a microphone-speaker outputting audible sound. Nakazawa, 4:10-15. As discussed in §IX.F.3, a POSITA would have been motivated to apply Nakazawa’s teachings of a “microphone speaker” to Rast’s device (to which Victorian’s teachings of an ear canal microphone have been applied). Johnson, ¶¶244-245.
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- Fig. 4



- 4:10-15 (“[W]hen the radio signal is received...it is...**outputted through the internal microphone-speaker 2 as an audible sound.**”)
- See also 1:47-53, 2:33-46, 4:20-25, 4:28-59

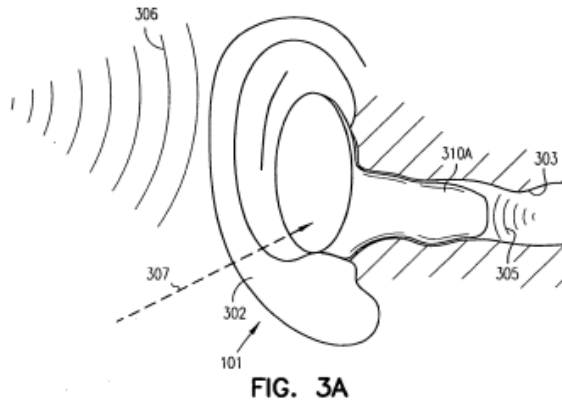
[21] The sound detection device according to claim 20, where the ear canal microphone is operatively connected to an earpiece.

See [20]. Victorian discloses the ear canal microphone (see [20.b]) **connected to an earpiece** (e.g., “ear canal microphone 440” included in “ear-level device 110,” as seen in Figs. 3A, 3B, 3C, and 4A).

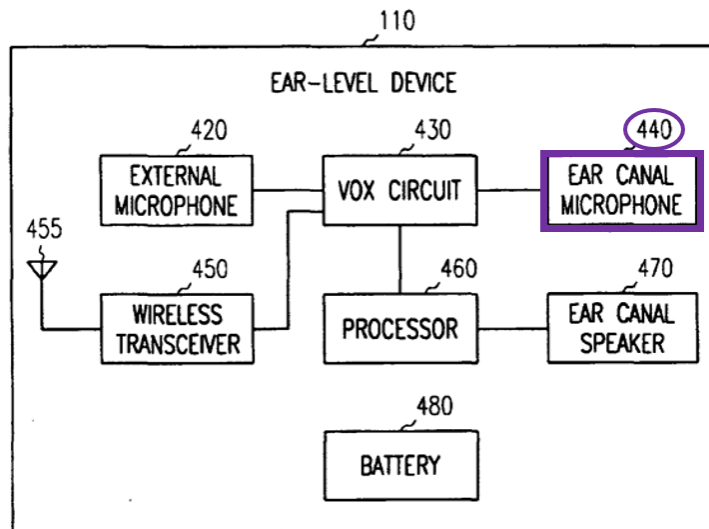
E.g., Victorian:

Victorian discloses the “[e]ar-level device 110 includes...an ear canal microphone 440,” and illustrates ear level device 110 in the form of an “in-the-ear” device 310A. Victorian, [0024], [0029], [0030]. As discussed in §IX.F, a POSITA would have been motivated to apply Victorian’s teaching of an ear canal microphone to **Rast’s** audio device. Johnson, ¶¶246-249.

- Fig. 3A



- Fig. 4A



- [0024] (“FIG. 3A is an illustration of an exemplary exterior configuration of *an in-the-ear (ITE) device 310A* used as *ear-level device 110* or one of *ear-level devices 210A and 210B*. ... ITE device 310A includes a portion inserted into ear canal 303....”)
- [0030] (“*Ear-level device 110* includes...*an ear canal microphone 440*...”)
- See also [0029].

X. SECONDARY CONSIDERATIONS

There is no evidence in the '044's prosecution history or elsewhere supporting any secondary considerations arguments, or evidence of nexus to any challenged Claim. *See generally* '044FH. Indeed, as demonstrated by the prior art referenced herein, any purported solutions to problems or unexpected results in the '044 were already well known. Johnson, ¶250. To the extent PO asserts the existence of any secondary considerations in its responses, Petitioner reserves the right to address any such evidence.

XI. CONCLUSION

Substantial, new, and noncumulative technical teachings have been presented for '044 Claims 1-21, which are anticipated and/or obvious for the reasons set forth above. Johnson, ¶¶251-257. There is a reasonable likelihood that Petitioner will prevail as to the Claims. *Inter partes* review of Claims 1-21 is accordingly requested.

Respectfully submitted,

Dated: September 1, 2024

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Name: James L. Davis, Jr.
Registration No. 57,325
Counsel for Petitioner

CERTIFICATE OF COMPLIANCE

Pursuant to §42.24(d), the undersigned certifies that the foregoing Petition for *Inter Partes* Review of U.S. Patent No. 8,150,044 contains, as measured by the word-processing system used to prepare this paper, 13,818 words. This word count does not include the items excluded by §42.24 as not counting towards the word limit.

Respectfully submitted,

Dated: September 1, 2024

/ James L. Davis, Jr /
Name: James L. Davis, Jr.
Registration No. 57,325
Counsel for Petitioner

CERTIFICATE OF SERVICE

I hereby certify that on September 1, 2024, I caused a true and correct copy of the foregoing Petition for *Inter Partes* Review of U.S. Patent No. 8,150,044 and supporting exhibits to be served via express mail on the Patent Owner at the following correspondence address of record as listed on PAIR:

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