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Paper 26
Entered: November 13, 2023

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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

v.

STATON TECHIYA LLC,
Patent Owner.

IPR2022-01078
Patent 11,057,701 B2

Before KEVIN F. TURNER, SCOTT B. HOWARD, and RUSSEL E. CASS, *Administrative Patent Judges.*

HOWARD, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

A. Background and Summary

Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. ("Petitioner") filed a Petition (Paper 3, "Pet.") requesting *inter partes* review of claims 1–9 and 11–13 of U.S. Patent No 11,057,701 B2 (Ex. 1001, "the '701 patent"). Staton Techiya, LLC ("Patent Owner") filed a Preliminary Response. Paper 7. With our authorization (Ex. 3001), Petitioner filed a Preliminary Reply (Paper 8) and Patent Owner filed a Preliminary Sur-reply (Paper 9). We instituted an *inter partes* review of claims 1–9 and 11–13 of the '701 patent on all grounds of unpatentability alleged in the Petition. Paper 10 ("Institution Decision" or "Inst. Dec.").

After institution of trial, Patent Owner filed a Response (Paper 14, "PO Resp."), Petitioner filed a Reply (Paper 17, "Pet. Reply"), and Patent Owner filed a Sur-reply (Paper 19, "PO Sur-reply").

An oral hearing was held on September 28, 2023, and the record contains a transcript of this hearing. Paper 25 ("Tr.").

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a). For the reasons that follow, we determine that Petitioner has shown by a preponderance of the evidence that all of the challenged claims are unpatentable.

B. Real Parties in Interest

Petitioner identifies Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. as the real parties in interest. Pet. 81.

Patent Owner identifies Staton Techiya, LLC as the real party in interest. Paper 18, 1 (Patent Owner's Updated Mandatory Notices).[1]

C. Related Matters

The parties identify the following district court proceeding in which the '701 patent is being asserted: *Staton Techiya, LLC v. Samsung Electronics Co., Ltd.*, No. 2:22-cv-00053 (E.D. Tex.). The parties further identify various patents and patent applications related to the '701 patent and an *inter partes* review proceeding involving one of those patents. Pet. 81 (citing Ex. 1014); Paper 5, 1. Petitioner further identifies various other *inter partes* review petitions it has filed. Pet. 82.

D. The '701 Patent

The '701 patent is directed to an earpiece that suppresses echo in an audio signal delivered to the user's eardrum, using multiple microphones. *See* Ex. 1001, code (57), 1:20–28. Figure 1 is reproduced below:

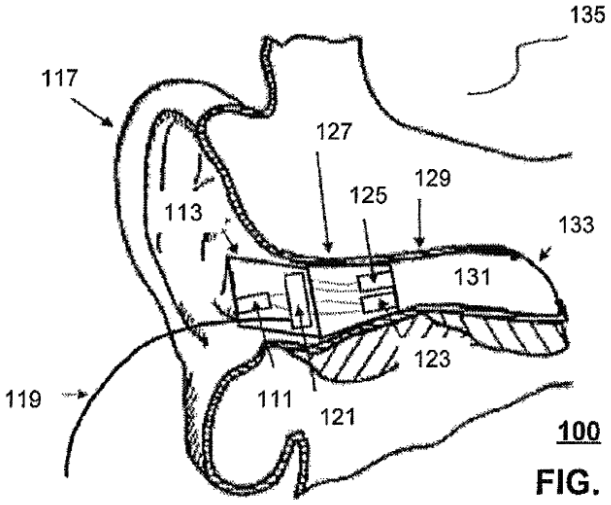


FIG. 1

[1] Patent Owner previously identified Synergy IP Corporation as the exclusive licensee of the '701 patent and a real party in interest. Paper 5, 1 (Patent Owner's Mandatory Notices). Patent Owner de-designated Synergy IP Corporation as a real party in interest in Paper 18. We make no determination whether the de-designation was appropriate.

Figure 1 is a pictorial diagram of earpiece 100 inserted into ear canal 131 of user 135. *Id.* at 4:12–13, 5:36–44. The earpiece includes processor 121 connected to ambient sound microphone 111, ear canal microphone 123, and ear canal receiver (speaker) 125. *Id.* at 5:50–54, 6:4–12. Communication path 119 permits processor 121 to communicate with other devices. *Id.* at 6:13–16.

Ambient sound microphone 111 captures ambient sound from the user's environment. Ex. 1001, 5:50–54, 6:27–34. Ear canal microphone 123 captures sound from within ear canal 131, proximate to eardrum 133, behind an acoustic seal formed between earpiece 100 and ear canal walls 129 at location 127. *Id.* at 5:50–54. Ear canal receiver 125 reproduces a sound signal to be delivered to eardrum 133, which reduces the sound pressure level at eardrum 133 and also reduces background noise, versus the sound field at the exterior entrance to ear canal 131. *Id.* at 5:64–6:3, 6:17–34.

Figure 4 is reproduced below:

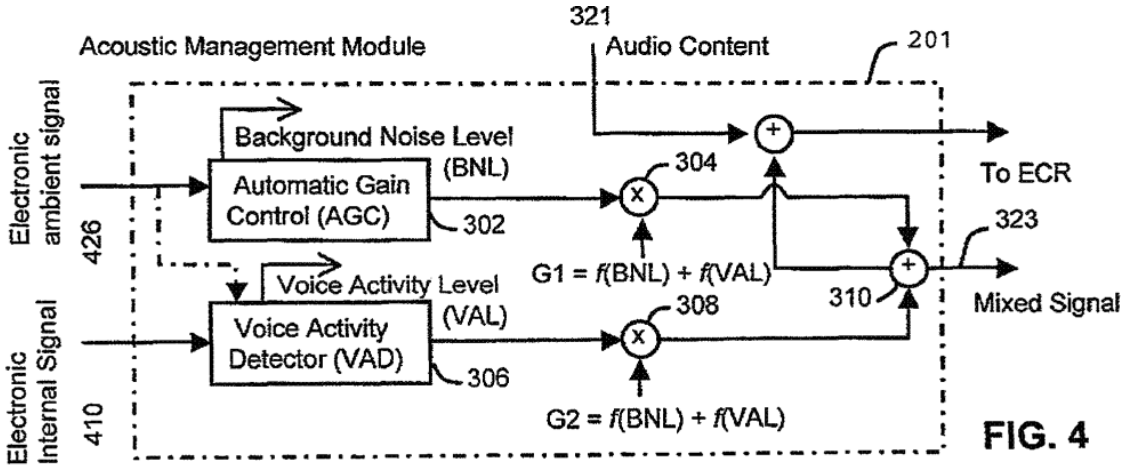


FIG. 4

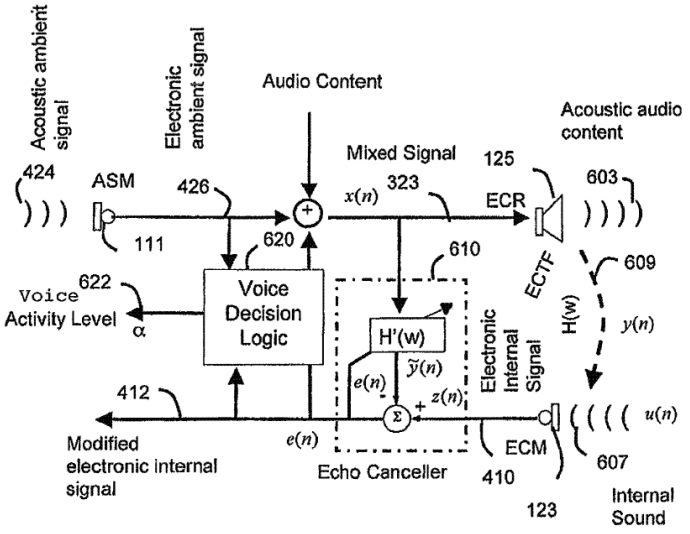
Figure 4 is a schematic of an acoustic management module implemented by processor 121 of earpiece 100. Ex. 1001, 4:18–22, 8:62–9:6. The inputs to the module are ambient signal 426 from ambient sound microphone 111, and

internal signal 410 from ear canal microphone 123. *Id.* at 8:22–28. The output of the module is mixed signal 323, which can be delivered to the user's eardrum by ear canal receiver 125. *Id.* at 8:9–14, 8:22–28, 9:25–32.

One of the problems associated with the earpiece described in the '701 patent is that it may result in echo feedback:

> In noisy ambient environments, the voice captured at the ASM 111 includes the background noise from the environment, whereas, the internal voice created in the ear canal 131 captured by the ECM 123 has less noise artifacts, since the noise is blocked due to the occlusion of the earpiece 100 in the ear. It should be noted that the background noise can enter the ear canal if the earpiece 100 is not completely sealed. In this case, when speaking, the user's voice can leak through and cause an echo feedback condition that the acoustic management module 201 mitigates.

Ex. 1001, 8:52–61. Echo reduction is described in the context of Figure 6, reproduced below.



600

FIG. 6

Figure 6 "is a block diagram of a system for in-ear canal echo suppression." *Id.* at 4:28–29, 10:13–15. Figure 6 shows an operation unit 600 which "can

include an echo suppressor 610 and a voice decision logic 620." *Id.* at 10:17–19.

> During operation, the echo suppressor 610 monitors the mixed signal 323 delivered to the ECR 125 and produces an echo estimate y(n) of an echo y(n) 609 based on the captured electronic internal signal 410 and the mixed signal 323. The echo suppressor 610, upon learning the ECTF [ear-canal microphone transfer function] by an adaptive process, can then suppress the echo y(n) 609 of the acoustic audio content 603 (e.g., output mixed signal 323) in the electronic internal signal z(n) 410. It subtracts the echo estimate y(n) from the electronic internal signal 410 to produce the modified electronic internal signal e(n) 412.
>
> The voice decision logic 620 analyzes the modified electronic signal 412 e(n) and the electronic ambient signal 426 to produce a voice activity level 622, .alpha. The voice activity level a identifies a probability that the user is speaking, for example, when the user is using the earpiece for two way voice communication. The voice activity level 622 can also indicate a degree of voicing (e.g., periodicity, amplitude)[.] When the user is speaking, voice is captured externally (such as from acoustic ambient signal 424) by the ASM 111 in the ambient environment and also by the ECM 123 in the ear canal. The voice decision logic provides the voice activity level .alpha. to the acoustic management module 201 as an input parameter for mixing the ASM 111 and ECM 123 signals.

Id. at 10:41–64.

E. Illustrative Claim

Claim 1 is independent, reproduced below, and illustrative of the claimed invention.

> 1. [1pre] A method, comprising:
>
> [1a] receiving an electronic ambient signal, where the ambient signal is produced by measurement by an ambient microphone;

> [1b(i)] receiving an electronic internal signal, where the electronic internal signal is produced by measurement of an ear canal microphone, [1b(ii)] wherein the electronic internal signal includes an echo of a spoken voice generated by a wearer of an earpiece;
>
> [1c] calculating a background noise signal using the electronic ambient signal and the electronic internal signal;
>
> [1d] producing a modified electronic internal signal by reducing the echo in the electronic internal signal;
>
> [1e] generating a voice activity level using the modified electronic signal and the background noise signal;
>
> [1f] mixing the electronic ambient signal with the modified electronic internal signal in a ratio dependent on the background noise signal to produce a mixed signal that includes a reduced echo; and
>
> [1g] sending the mixed signal to an ear canal receiver.

Ex. 1001, 12:35–54. For purposes of convenience, we use the same limitation identifications, indicated above, used by the parties.

F. Prior Art and Asserted Grounds

Petitioner asserts that claims 1–9 and 11–13 would have been unpatentable on the following grounds:

Claim(s) Challenged	35 U.S.C. §[2]	Reference(s)/Basis
1–6, 8, 9, 11–13	103(a)	Pedersen,[3] Visser[4]
1–6, 8, 9, 11–13	103(a)	Pedersen, Visser, Alves[5]
6, 7	103(a)	Pedersen, Visser, Huang[6]
6, 7	103(a)	Pedersen, Visser, Alves, Huang

Petitioner also relies on a declaration from Dr. Richard M. Stern (Ex. 1002), who was cross-examined (Ex. 2010). Patent Owner relies on a declaration from Christopher J. Struck (Ex. 2013), who was cross-examined (Ex. 1028).

II. ANALYSIS

A. Legal Standards

In *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1 (1966), the Supreme Court set out a framework for assessing obviousness under 35 U.S.C. § 103 that requires consideration of four factors: (1) the "level of ordinary skill in the pertinent art," (2) the "scope and content of the prior art," (3) the "differences between the prior art and the claims at issue," and (4) if in evidence, "secondary considerations" of non-obviousness such as

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[2] The Leahy-Smith America Invents Act ("AIA") included revisions to 35 U.S.C. §§ 102, 103 that became effective on March 16, 2013. Because the application that issued as the '701 patent is a continuation of, and claims the benefit of, the filing date of an application filed before March 16, 2013, we apply the pre-AIA versions of the statutory bases for unpatentability. *See* Ex. 1001, code (63); *see also* Pet. 8 (arguing that the '710 has an effective filing date of July 9, 2008); PO Resp. (not addressing the effective filing date of the '701 patent).

[3] EP 1,385,324 A1, published Jan. 28, 2004 (Ex. 1008).

[4] US 2007/0021958 A1, published Jan. 25, 2007 (Ex. 1009).

[5] US 2008/0037801 A1, published Feb. 14, 2008, filed Aug. 10, 2006 (Ex. 1011).

[6] US 2002/0111798 A1, published Aug. 15, 2002 (Ex. 1012).

"commercial success, long-felt but unsolved needs, failure of others, etc." *Id.* at 17–18. "While the sequence of these questions might be reordered in any particular case," *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 407 (2007), the U.S. Court of Appeals for the Federal Circuit has repeatedly emphasized that "it is error to reach a conclusion of obviousness until all those factors are considered," *WBIP v. Kohler*, 829 F.3d 1317, 1328 (Fed. Cir. 2016).[7]

B. Level of Ordinary Skill in the Art

In determining whether an invention would have been obvious at the time it was made, we consider the level of ordinary skill in the pertinent art at the time of the invention. *Graham*, 383 U.S. at 17. "The importance of resolving the level of ordinary skill in the art lies in the necessity of maintaining objectivity in the obviousness inquiry." *Ryko Mfg. Co. v. Nu-Star, Inc.*, 950 F.2d 714, 718 (Fed. Cir. 1991). The "person having ordinary skill in the art" is a hypothetical construct, from whose vantage point obviousness is assessed. *In re Rouffet*, 149 F.3d 1350, 1357 (Fed. Cir. 1998).

Factors pertinent to a determination of the level of ordinary skill in the art include "(1) the educational level of the inventor; (2) type of problems encountered in the art; (3) prior art solutions to those problems; (4) rapidity with which innovations are made; (5) sophistication of the technology; and (6) educational level of active workers in the field." *Envtl. Designs, Ltd. v. Union Oil Co. of Cal.*, 713 F.2d 693, 696–697 (Fed. Cir. 1983) (citing *Orthopedic Equip. Co. v. All Orthopedic Appliances, Inc.*, 707 F.2d 1376,

[7] Because neither party address objective evidence of non-obviousness (*see* Pet.; PO Resp.), we focus solely on the first three *Graham* factors.

1381–82 (Fed. Cir. 1983)). "Not all such factors may be present in every case, and one or more of these or other factors may predominate in a particular case." *Id.*

Petitioner argues that a person having ordinary skill in the art "would have had a bachelor's degree in electrical engineering, computer science, or a similar field and two years of experience in the design of earphones and associated signal processing. The [person having ordinary skill in the art] could have also obtained similar knowledge and experience through other means." Pet. 13 (citing Ex. 1002 ¶ 17). Patent Owner "applies the level of ordinary skill in the art that is proposed in the Petition." PO Resp. 12 (citing Pet. 13).

Because Petitioner's formulation of the level of ordinary skill in the art is consistent with the '701 patent and is not challenged by Patent Owner, we adopt it and apply it in our analysis below.

C. Claim Construction

We apply the same claim construction standard used in the federal courts, in other words, the claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b), which is articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). *See* 37 C.F.R. § 42.100(b). Under the *Phillips* standard, the "words of a claim 'are generally given their ordinary and customary meaning,'" which is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention, i.e., as of the effective filing date of the patent application." *Phillips*, 415 F.3d at 1312–13.

Petitioner argues "that no express constructions of the claims are necessary" and the terms "should be given their plain and ordinary meaning." Pet. 13–14.

Patent Owner proposes the construction of two terms, "the modified electronic signal" and "the external gain." PO Resp. 12–13. For all other terms, Patent Owner argues that they should be given their "plain and ordinary meaning as understood by a person of ordinary skill in the art at the time of the purported invention of the '701 patent." PO Resp. 13.

For the purposes of this Decision, we need not expressly construe any claim terms. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (noting that "we need only construe terms 'that are in controversy, and only to the extent necessary to resolve the controversy'" (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

D. Obviousness over Pedersen, Visser, and Alves

Petitioner argues that claims 1–6, 8, 9, and 11–13 would have been obvious over Pedersen, Visser, and Alves. *See* Pet. 14–40 and 49–68. For the reasons set forth below, Petitioner has shown by a preponderance of the evidence that claims 1–6, 8, 9, and 11–13 are unpatentable.

1. Summary of Pedersen

Pedersen is titled "A System and Method for Reducing the Effect of Background Noise" and is directed to "to enhancing speech quality in a telecommunications system, and more specifically to reducing the effect of background noise in the communication between users." Ex. 1008, code (54), ¶ 1. Figure 1 is reproduced below.

FIG 1

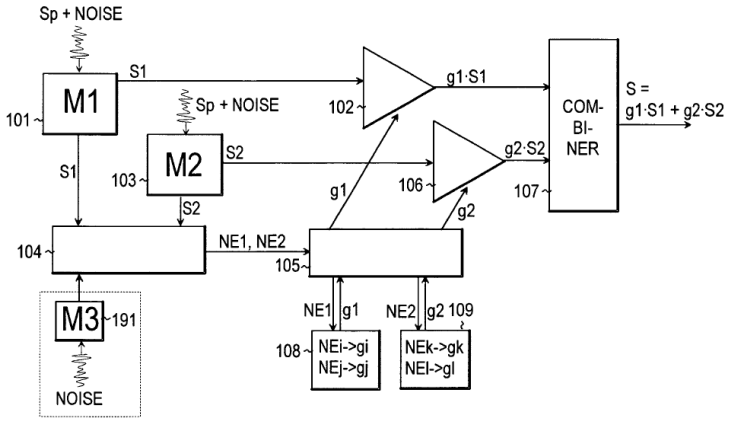


Figure 1 "illustrates one system for reducing the effect of background noise." *Id.* ¶ 15.

Figures 4A and 4B are reproduced below.

FIG. 4A

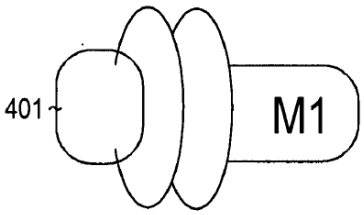
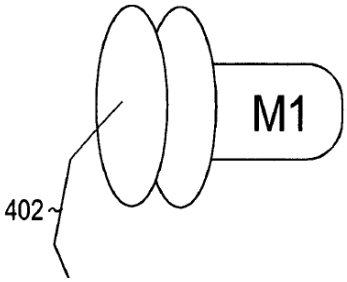


FIG 4B



Figures 4A and 4B "illustrate[] a microphone set-up" in which "[t]he first microphone M1 is located in an earplug-like element which can measure the air vibrations in the ear canal (i.e. auditory canal) of the user of the mobile device." Ex. 1008 ¶ 41. Figure 4A is an example with a wireless transmitter and Figure 4B uses a wire. *Id.* ¶¶ 41–44.

Figure 5 is reproduced below.

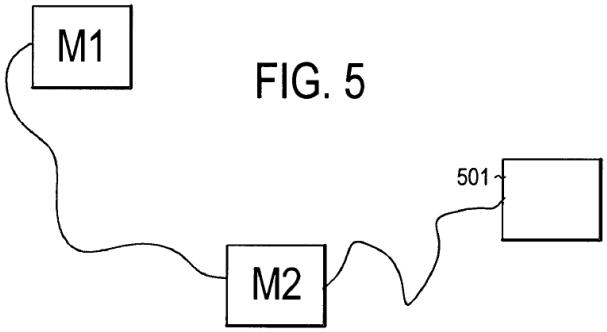


FIG. 5

Figure 5 "shows one audio data collection set-up including two microphones." Ex. 1008 ¶ 15. "Here the first and second microphones are included in a headset kit of a mobile phone." *Id.* ¶ 45. "The [headset] provides hands-free operation and may also include an answer/end button located in the second microphone M2 or somewhere else in the cable." *Id.* "The earplug including a loudspeaker may also include an earplug microphone M1, *provided that the acoustical separation of the loudspeaker and microphone can be guaranteed, or a jawbone microphone, where the acoustical separation should be a minor problem*." *Id.* (emphasis added).

2. Summary of Visser

Visser is titled "Robust Separation of Speech Signals in a Noisy Environment" and is directed to "processes and methods for separating a speech signal from a noisy acoustic environment." Ex. 1009, code (54), ¶ 2. More specifically, Visser discloses "[a] method for improving the quality of a speech signal extracted from a noisy acoustic environment." *Id.* at code (57). In one embodiment, a voice activity detector "enables a particularly robust and accurate detection of voice activity" and, when speech is detected, "the voice activity detector generates a control signal." *Id.* "[That] control signal is used to activate, adjust, or control signal separation processes or post-processing operations to improve the quality of the resulting speech signal." *Id.*

Visser Figure 2 is reproduced below.

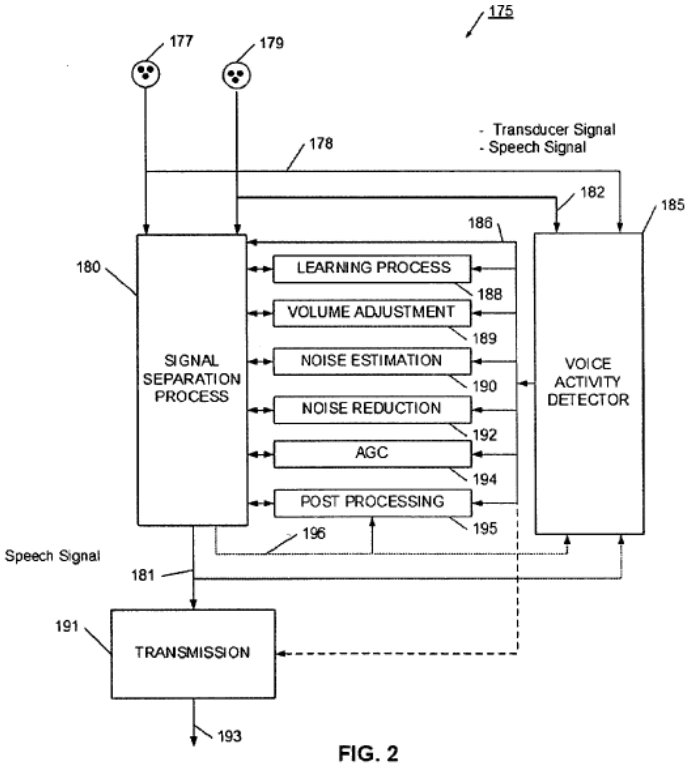


FIG. 2

Visser Figure 2 "is a block diagram of a process for separating a speech signal." Ex. 1009 ¶ 26. Communication process 175 has both a first microphone 177 and second microphone 179 that generate signals 178 and 182, respectively, that are received by the signal separation process 180. *Id.* ¶ 41. Signal separation process 180 can "be described as an independent component analysis (ICA) process." *Id.* ¶ 43.

"In one configuration, the voice activity detector 185 receives first microphone signal 178 and second microphone signal 182." Ex. 1009 ¶ 41. "When the two channel voice activity detector 185 detects speech, it generates control signal 186" which "may be . . . used to activate, control, or adjust several processes in communication process 175." *Id.* ¶¶ 41–42.

Visser Figure 8 is reproduced below.

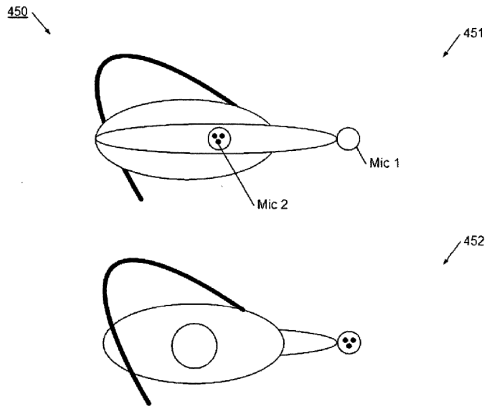


FIG. 8

Figure 8 "is a diagram of a wireless earpiece." Ex. 1009 ¶ 32. Visser describes how "[a]coustic echo problems arise[] naturally in [the] headset because the microphone(s) may be located close to the ear speaker due to space or design limitation." *Id.* ¶ 92. "As speech from the far end user is played at the ear speaker, this speech will also be picked up by the microphones(s) and echoed back to the far end user." *Id.* According to Visser, "[t]he acoustic echo can be considered as interfering noise and removed by the same processing algorithm" used by the ICA filter structure. *Id.* ¶¶ 78, 93–94.

3. Summary of Alves

Alves is titled "Dual Microphone Noise Reduction for Headset Application" and is directed "to headsets used in voice communication systems." Ex. 1011, code (54), ¶¶ 1–2. Alves describes a headset with a first microphone 28 near the user's mouth and a second microphone 34e and speaker 32 within a chamber "formed at least in part by the ear of the wearer." *Id.* ¶¶ 26, 28, Figs. 1–2. As a result of this design, "second microphone 34 will pick up sound emitted by speaker 32 [which] will appear as an echo in the output of second microphone 34." *Id.* ¶ 29.

Alves Figure 2 is reproduced below.

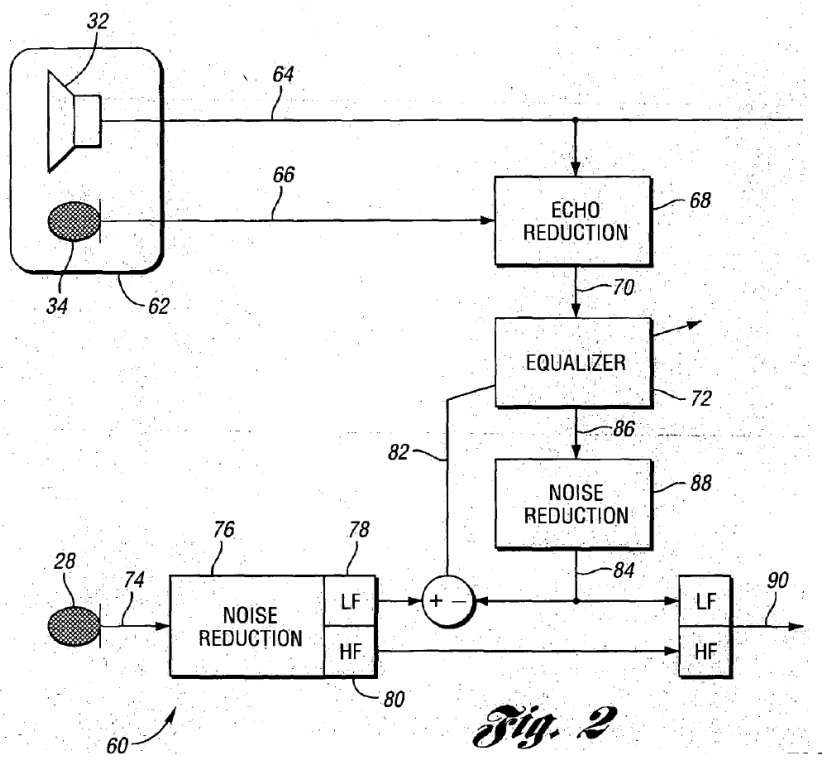


Fig. 2

Alves Figure 2 "is a block diagram for noise reduction." "Speaker 32 is driven by speaker signal 64 [and] [s]econd microphone 34 generates second microphone signal 66 which will include output from speaker 32 as well as desired source sound and residual noise that penetrates into chamber 62." *Id.* ¶ 30. "Echo reducer 68 decreases the effects of speaker output in second microphone signal 66. Echo reducer output 70 feeds adaptive equalizer 72." *Id.* Echo reducer output 70 also feeds a voice activity detector (VAD). *Id.* Fig. 6, ¶ 72 ("[A] voice active detector (VAD) improves performance in the presence of external talkers. The VAD generates control signal 124 based on the presence of spoken speech in echo reducer output 70.").

4. Analysis of Claim 1

a) Limitation 1pre: "A Method"

The preamble of claim 1 recites "[a] method, comprising." Ex. 1001, 12:35. Petitioner argues that Pedersen teaches the preamble. Pet. 14. Patent Owner does not separately address this limitation. *See* PO Resp.

We agree with Petitioner. Specifically, Pedersen both describes and claims a method. Ex. 1008, claim 14, Ex. 1002 ¶ 70.[8]

b) Limitation 1a: "Receiving an Electronic Ambient Signal, Where the Ambient Signal Is Produced by Measurement by an Ambient Microphone

Claim 1 further recites "receiving an electronic ambient signal, where the ambient signal is produced by measurement by an ambient microphone." Ex. 1001, 12:36–38. Petitioner argues Pedersen teaches or suggests this limitation. Pet. 14–17. Patent Owner does not separately address this limitation. *See* PO Resp.

We agree with Petitioner. Specifically, Pedersen Figure 5 shows two microphones, including microphone M2, and a person having ordinary skill in the art would have recognized that microphone M2 is an ambient microphone that can be implemented on a cable connecting an earplug to a mobile device. Ex. 1008 ¶¶ 16, 45, Figs. 1, 5; Ex. 1002 ¶¶ 71–72. Microphone M2 generates a signal S2 from acoustic vibrations. Ex. 1008 ¶ 16; Ex. 1002 ¶ 73.

[8] Because Patent Owner does not dispute that Pedersen teaches a method (*see* PO Resp. 13–45 (Patent Owner not disputing that Pedersen teaches a method)), we need not decide whether the preamble is limiting. *See Nidec*, 868 F.3d at 1017 (noting that "we need only construe terms 'that are in controversy'" (quoting *Vivid*, 200 F.3d at 803)).

c) Limitations 1b(i), 1(b)(ii), and 1(d)

Claim 1 further recites: "receiving an electronic internal signal, where the electronic internal signal is produced by measurement of an ear canal microphone, wherein the electronic internal signal includes an echo of a spoken voice generated by a wearer of an earpiece." Ex. 1001, 12:39–43. Claim 1 further recites "producing a modified electronic internal signal by reducing the echo in the electronic internal signal." *Id.* at 12:46–47. Petitioner argues that the combination of Pedersen and Visser teaches these limitations. Pet. 17–22, 26–40; Pet. Reply 1–15.

We agree with Petitioner. Specifically, Pedersen teaches a first microphone M1 which is used to produce an output signal S1. Ex. 1008, Fig. 1, ¶ 16; Ex. 1002 ¶ 75. Microphone M1 collects "[m]echanical vibrations or pressure variations, preferably originating from speech Sp distorted by noise," and may be "an earplug type microphone." Ex. 1008 ¶ 16; *see also* Ex. 1002 ¶ 75.

Pedersen Figures 4A and 4B[9] further illustrate a microphone which "is located in an earplug-like element which can measure the air vibrations in the ear canal (*i.e.* auditory canal) of the user of the mobile device." Ex. 1008 ¶ 41; *see also id.* at Figs. 4A, 4B. A person having ordinary skill in the art would have recognized that Pedersen's earplug microphone M1 is an "ear canal microphone" as recited in claim 1. Ex. 1002 ¶ 76.

With regard to Pedersen Figure 5, Pedersen describes an earplug that includes a loudspeaker. Ex. 1008 ¶ 45. Pedersen further describes how the earplug "may also include an earplug microphone M1, provided that the

[9] The only difference between Figures 4A and 4B is one is wireless and the other is wired. *See* Ex. 1008 ¶ 44.

acoustical separation of the loudspeaker and microphone can be guaranteed." *Id.*[10] Because the microphone produces a signal based on the measurement of sound in the ear, a person having ordinary skill in the art would have recognized that the microphone M1 produces an output signal S1 which is an electronic internal signal as recited in claim 1. Ex. 1002 ¶ 77; *see also* Ex. 1008 Fig. 1, ¶ 16. Moreover, because Pedersen describes the device in Figure 5, including the microphone, as an earplug, it is placed within the ear canal. *See* Ex. 1008 ¶ 41 (describing the earplug microphone as one that measures vibrations in the ear canal). As Patent Owner's expert Mr. Struck agreed, "the only earplug microphone that's disclosed [in Pedersen] is placed inside the wearer's ear canal." Ex. 1028, 31:10–13. Mr. Struck further testified that Pedersen does not disclose an earplug microphone that is placed anywhere besides inside the user's ear canal:

> Q. In fact, Pedersen does not disclose any embodiment where there is an earplug microphone that, when it's in use, is located anywhere other than inside the user's ear canal, isn't that right?
>
> MR. SNODGRASS: Objection to form.
>
> THE WITNESS: I believe that's true, yes.

Id. at 31:16–32:1.

A person having ordinary skill in the art would have known that placing a microphone and loudspeaker in close proximity can result in the microphone detecting an echo. Ex. 1002 ¶ 79. In fact, Pedersen recognizes that possibility of this echo by stating that one can only place the

[10] Pedersen also describes an alternative with a jawbone microphone. Ex. 1008 ¶ 45. Petitioner's arguments do not rely on that alternative. Pet. 17–20.

microphone and loudspeaker in the earplug of Pedersen Figure 5 if "the acoustical separation of the loudspeaker and microphone can be guaranteed." *See* Ex. 1008 ¶ 45; Ex. 1002 ¶ 80.

Given the small space of the user's ear, a person having ordinary skill in the art would have recognized that it would be difficult to achieve acoustical separation by physical means. Ex. 1002 ¶ 83. That is, a person having ordinary skill in the art would have recognized that given the small space, the microphone would likely pickup echo of the user's speech. *Id.* ¶¶ 81–84.

A person having ordinary skill in the art would have known that echo was not desired. *See* Ex. 1008 ¶ 45 (discussing the need for acoustical separation); Ex. 1002 ¶ 96. Accordingly, a person having ordinary skill would have looked for echo reducing circuitry so that the person wearing the earpiece would not hear any echo of his own voice. Ex. 1002 ¶ 96; *see also* Ex. 1028, 141:9–16 (Mr. Struck testifying that a signal processing solution could be used to acoustically isolate a loudspeaker and a microphone).

An example of such a system is Visser, which has two microphones and will generate an echo. *See* Ex. 1009 Figs. 1, 2, ¶ 41; Ex. 1002 ¶¶ 98–107. Visser further describes an algorithm for reducing echo. *See* Ex. 1002 ¶¶ 108–119. A person having ordinary skill in the art would have used Visser's echo reducing algorithm to acoustically isolate the microphone and loudspeaker in Pedersen's Figure 5 embodiment earplug. Ex. 1002 ¶ 120. This combination would result in the reduction of echo produced by the microphone and loudspeaker in the ear canal. Ex. 1002 ¶ 121. That echo reduced signal is shown as speech signal 181. Ex. 1002 ¶¶ 108–119.

Patent Owner makes various arguments regarding these limitations. *See* PO Resp. 13–34; PO Sur-reply 2–15. For the reasons set forth below, we disagree with them.

First, Patent Owner argues that Pedersen does not have a single embodiment that includes both an ear canal microphone and an ear canal receiver. PO Resp. 13–25; PO Sur-reply 2–10. Specifically, Patent Owner argues that Pedersen shows four embodiments (Figure 3, Figure 4A, Figure 4B, and Figure 5), none of which contain both a microphone and a loudspeaker in an ear canal. PO Resp. 14–20. Instead, Patent Owner argues, Petitioner improperly conflates the Figure 4A/4B embodiments with the Figure 5 embodiment. *Id.* at 21–24.

In support of its argument, Patent Owner argues that Petitioner is improperly asserting that microphone M1 is always an ear canal microphone. PO Resp. 22–24. For example, Patent Owner argues that Petitioner's expert Dr. Stern conceded in cross-examination that microphone M1 in the Figure 3 embodiment is not an ear canal microphone. *Id.* (citing Ex. 2010, 82:12–20, 83:19–84:3).

We disagree. Pedersen's Figure 5 embodiment clearly discloses an earplug with both a microphone and a loudspeaker, so long as acoustical separation is maintained:

> FIG. 5 illustrates another option for implementing the invention. Here the first and second microphones are included in a headset kit of a mobile phone. Typically, the headset kit includes a plug 501 which is connected to a mobile phone or a car front panel. The [headset] provides hands-free operation and may also include an answer/end button located in the second microphone M2 or somewhere else in the cable. *The earplug including a loudspeaker may also include an earplug microphone M1, provided that the acoustical separation of the loudspeaker and microphone can be guaranteed*, or a jawbone

> microphone, where the acoustical separation should be a minor problem.

Ex. 1008 ¶ 45 (emphasis added). And because, as described above, acoustical separation is maintained in the combination of Pedersen and Visser, the microphone and loudspeaker can both be placed in the ear canal.

Although Petitioner refers to Figure 4A, it is not to incorporate its features into the Figure 5 embodiment. Instead, Petitioner simply relies on Figure 4A for an understanding that an earplug is placed within the ear canal:

> When implemented as in FIGS. 4A-4B, microphone M1 101 is "located in an earplug-like element which can measure the air vibrations **in the ear canal** (*i.e.* auditory canal) of the user of the mobile device." Pedersen, ¶[0041]. POSITAs would have recognized that the headset embodiment described with respect to FIG. 5 uses an earplug similar to those in FIGS. 4A-4B, as Pedersen explicitly says that its headset uses an "earplug," and that an "earplug including a loudspeaker may also include an earplug microphone M1." *Id.*, ¶[0045].

Pet. 19.[11] Using one embodiment to explain an identical element of another embodiment does not constitute combining references. Nor is it improper.

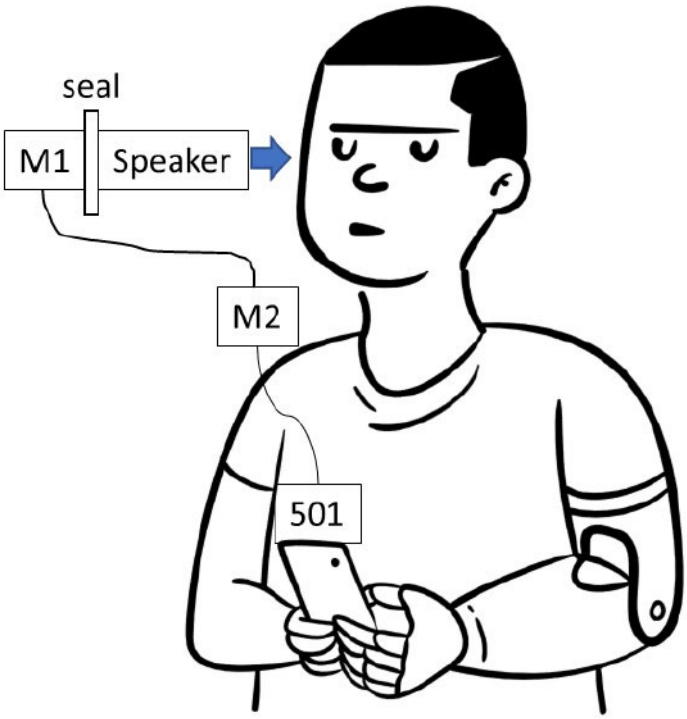
Regardless, as Patent Owner's expert Mr. Struck conceded, Pedersen's earplug microphone goes inside the ear canal. Ex. 1028, 31:10–13, 31:16–32:1. Thus, even without considering the description of Figure 4A, Petitioner has sufficiently shown that the earplug microphone identified in paragraph 45 and Figure 5 is an ear canal microphone.

We similarly do not find Patent Owner's focus on the Figure 3 embodiment availing. Although Patent Owner has clearly established that

[11] The parties use italics to denote prior art references. Here are elsewhere, the italics have been omitted.

microphone M1 of the Figure 3 embodiment is not an ear canal microphone, that is inapposite as to whether the earplug of Figure 5, which can include a microphone, is located within the ear canal. That is, microphone M1 in the mobile phone (Figure 3 embodiment) being located outside the ear says nothing about the location of microphone M1 in the earplug embodiment (Figure 5).

Second, Patent Owner argues that a person having ordinary skill in the art would understand that the only way to obtain acoustical separation is to use a physical seal in which the microphone is located outside the ear canal. PO Resp. 20; PO Sur-reply 3–10. Patent Owner illustrates such a device in a figure reproduced below.



PO Resp. 20. The figure above depicts a person holding a mobile device 501 with a wire connected to a microphone M2 located on the wire and

terminating with an ear piece with a microphone M1, a seal, and a speaker. *See* Ex. 2013 ¶ 63.

We disagree with Patent Owner's argument. Pedersen paragraph 45 describes an earplug with both a microphone and a loudspeaker. Ex. 1008 ¶ 45. As Mr. Struck testified, an earplug microphone in Pedersen goes inside the ear canal. Ex. 1028, 10–13, 31:16–32:1. That is consistent with Pedersen's other description of an earplug microphone. Ex. 1008 ¶ 41. Accordingly, the device shown above with the seal and the microphone placed outside of the ear canal is inconsistent with Mr. Struck's cross-examination testimony and Pedersen's teachings.

Third, Patent Owner, relying on Mr. Struck's testimony, argues that signal processing cannot be used to achieve acoustical separation. *See* PO Sur-reply 3 (citing Ex. 1028, 141:21–142:6). However, Mr. Struck's testimony does not support Patent Owner's argument.

Mr. Struck was cross-examined by Petitioner's counsel. Ex. 1028. Following the cross-examination, Mr. Struck was asked questions by Patent Owner's counsel and provided redirect testimony. He gave the following redirect testimony regarding acoustical separation:

> Q. What would a person of ordinary skill in the art understand to be possible solutions to acoustically isolate a loudspeaker and a microphone?
>
> A. Several possibilities exist. *A signal processing solution was discussed at length in the earlier part of my deposition here today.* But other possibilities would include sealing them and keeping the loudspeaker and the microphone on opposite sides of the seal, or a third option would be physical separation by some distance.
>
> Q. In your opinion, would a person of ordinary skill in the art have understood signal processing to be one mechanism by which two things could be acoustically separated?

> MR. MILLER: Objection. Leading.
>
> THE WITNESS: I don't think they would understand that *within the context of just this paragraph alone*, no.

Ex. 1028 141:9–142:6 (emphases added).

At first glance, the testimony appears contradictory, with Mr. Struck first testifying that signal processing can be used to achieve acoustical separation and then testifying to the opposite. The parties treated it as such in their briefing, focusing on the testimony that was favorable to them and ignoring the contrary testimony. *Compare* Pet. Reply 8 (quoting Ex. 1028, 140:11–141:16), *with* PO Sur-reply 1–2 (quoting Ex. 1028, 141:21–142:6). But the testimony is not necessarily inconsistent. *See* Tr. 10:10–26 (Petitioner explaining why testimony is not inconsistent).

In the first question, Mr. Struck was asked a broad question, and he provided a broad answer with no qualifications. That is, he identified three known ways of achieving acoustical separation including signal processing.

In the second question, he was asked a narrower (and potentially leading) question. But, importantly, his answer was qualified. That is, his answer was limited to "within the context of just this paragraph alone, no." Ex. 1028, 142:4–6. The specific paragraph he is referring to is not identified in the question or the answer. But, the last paragraph he was asked a question about was Pedersen paragraph 45. *See id.* at 140:11–142:6; *see also* Tr. 10:10–26. Even if, as Mr. Struck testified to, a person having ordinary skill in the art looking at "just [Pedersen paragraph 45] alone" might not understand that signal processing could be used for acoustical separation, that is not the issue before us. Instead, the issue before us is whether a person having ordinary skill in the art, considering both Pedersen and Visser, would understand that acoustical separation could be achieved

by signal processing. And, as Mr. Struck testified, the answer to that question is yes. *See* Ex. 1028, 141:9–20.

Fourth, Patent Owner argues that a person having ordinary skill in the art would not have modified Pedersen in view of Visser. *See* PO Resp. 25–28. Specifically, Patent Owner argues that "Petitioners' obviousness theories based on a Pedersen-Visser combination are premised on solving a problem that never would be encountered." *Id.* at 25. According to Patent Owner, the foundation of Petitioner's argument—that Pedersen teaches a mobile headset kit with a microphone and loudspeaker in the user's ear canal—"is unsound." *Id.* at 26. However, for the reasons discussed above, Pedersen explicitly teaches that combination if acoustical separation can be guaranteed.

Patent Owner also argues that Petitioner does not sufficiently explain why the ear canal microphone would capture "the same speech reproduced by the loudspeaker adjacent the microphone." PO Resp. 26 (citing Pet. 38); *see also id.* at 26–28 (explaining in detail). However, Dr. Stern testified, relying on Pedersen paragraph 45, why a person having ordinary skill in the art would have understood that placing both a microphone and loudspeaker in close proximity to each other would create an echo—the microphone could capture the speech reproduced by the loudspeaker. *See* Ex. 1002 ¶¶ 79–84, 120. Moreover, Dr. Stern's testimony is consistent with Mr. Struck's cross-examination testimony that Pedersen's Figure 5 embodiment with a microphone and loudspeaker in an ear canal would create an echo:

> Q. Well, let me ask you this. So we've talked about how the Figure 5 embodiment has a speaker in the ear canal, right?
>
> A. Yes.

> Q. And the only disclosed earplug microphone is also in the ear canal, right? You've said that already, right?
>
> A. Yes.
>
> Q. Wouldn't you agree the same issue with echo or feedback, as you just called it, as is the situation in the '701 patent?
>
> MR. SNODGRASS: Objection to form.
>
> THE WITNESS: If the microphone in the ear canal is there to pick up the user's voice, would it also pick up the sound of the loudspeaker in the ear canal, yes, it would.
>
> But as far as any leakage from the ear canal, the only additional thing it would pick up would be more of the user's voice from the outside, and some background noise.
>
> BY MR. MILLER:
>
> Q. That's just like the '701 patent, right?
>
> MR. SNODGRASS: Objection to form.
>
> THE WITNESS: It's what the – it's analogous to what the '701 patent calls echo, yes.

Ex. 1028:73:1–74:8. Accordingly, we fully credit Dr. Stern's testimony.

Fifth, in a related—if not duplicative—argument, Patent Owner argues that Pedersen does not capture an echo of the user's voice and does not reduce such an echo. PO Resp. 28–30; PO Sur-reply 10–11. Specifically, Patent Owner argues that Pedersen only teaches having a microphone and loudspeaker in an earplug if they are acoustically isolated and, therefore, there is no echo. PO Resp. 28–29. But, Patent Owner misses the thrust of Petitioner's argument. Petitioner does not argue that it uses a physical system to prevent the echo. Instead, Petitioner's argument is that an echo is created due to the location of the loudspeaker and the microphone, but that acoustical separation is achieved using signal

processing to remove the echo before it could be heard. *See*, *e.g.*, Pet. 38–39; Pet. Reply 7–9.

Patent Owner further argues that any such echo would be eliminated by solutions employed by the telephone service providers to eliminate far-end echo. PO Resp. 29–30 (citing Ex. 2013 ¶¶ 82–83). Patent Owner's argument is inapposite as it does not address the near-end echo Dr. Stern testified about. *See* Ex. 1002 ¶¶ 79–84, 120. And, as discussed above, Mr. Struck agreed with Dr. Stern that there would be near-end echo. *See* Ex. 1028, 73:1–74:8.

Sixth, Patent Owner argues that "Petitioners overlook the difference between the 'echo' of the challenged claims and the 'echo' that Visser addresses." PO Resp. 30. According to Patent Owner, "[t]he former is 'an echo of a spoken voice generated by a wearer of an earpiece.' Ex. 1001 at claim 1. The latter is an echo of the voice of the person to whom the earpiece wearer is speaking." PO Resp. 30; *see also id.* at 30–33 (explaining argument in detail); PO Sur-reply 11–14.[12] Although Patent Owner's argument may be factually correct, it is inapposite. Petitioner does not rely on Visser for a teaching that an echo would be created. Instead, as discussed above, Petitioner's argument and Dr. Stern's testimony is premised on a person having ordinary skill in the art recognizing that a design such as the one contemplated in Pedersen of an earplug with a microphone and loudspeaker would generate an echo. *See* Pet. 20–22, 38–39; Ex. 1002

[12] Patent Owner also addresses Petitioner's alternative argument that the earpiece is not limited to that worn by the user. *See* PO Resp. 33–34; PO Sur-reply 14–15. Because we do not rely on Petitioner's alternative argument, Patent Owner's counter arguments are moot.

¶¶ 79–84, 120. Because Petitioner is not relying on Visser's teaching of an echo, it does not matter how Visser's echo is generated.

Seventh, Patent Owner argues that "Petitioners erroneously equate a microphone that is located on an earplug with a microphone that detects sound in a user's ear canal." PO Sur-reply 3–8. For example, Patent Owner relies on the drawing reproduced above at page 23, which also appears as Mr. Struck's direct testimony. PO Sur-reply 4 (citing Ex. 2013 ¶ 63). According to Mr. Struck, microphone M1 is not in the ear canal:

> [T]he microphone M1 would not be positioned to capture sound in the user's ear canal. A microphone that captures sound in the same ear canal in which a loudspeaker emits sound would not be acoustically separated from the loudspeaker. Thus, a person of ordinary skill in the art would understand that if microphone M1 were to be placed on the same earplug as the loudspeaker, the microphone M1 would not be positioned to capture sound in the user's ear canal and *indeed a seal would be required between the microphone M1 and the ear canal* to ensure acoustic separation between the microphone and loudspeaker.

Ex. 2013 ¶ 63 (emphasis added); *see also* PO Sur-reply 8–10 (arguing that the microphone is not in the ear canal).

However, during his cross-examination, Mr. Struck testified that the only earplug in Pedersen is placed in an ear canal:

> Q. In Pedersen, the only earplug microphone that's disclosed is placed inside the wearer's ear canal, isn't that right?
>
> A. Are you referring to Figure 5?
>
> Q. I'm referring to the entire patent.
>
> MR. SNODGRASS: Objection to form.
>
> THE WITNESS: Could you repeat your question, please?
>
> BY MR. MILLER:
>
> Q. In Pedersen, the only -- let me start again.

> In Pedersen, the only earplug microphone that's disclosed is placed inside the wearer's ear canal, isn't that right?
>
> A. Yes.
>
> MR. SNODGRASS: Objection to form.
>
> BY MR. MILLER:
>
> Q. In fact, Pedersen does not disclose any embodiment where there is an earplug microphone that, when it's in use, is located anywhere other than inside the user's ear canal, isn't that right?
>
> MR. SNODGRASS: Objection to form.
>
> THE WITNESS: I believe that's true, yes.

Ex. 1028, 30:21–32:1. Because Pedersen states that the earplug contains both the microphone and loudspeaker, based on Mr. Struck's cross-examination testimony, they are both in the ear canal. Accordingly, we do not find Mr. Struck's direct testimony credible and give it no weight, we disagree with Patent Owner's argument, and we find Petitioner's description to be consistent with Pedersen.

d) Limitation 1c: "Calculating a Background Noise Signal Using the Electronic Ambient Signal and the Electronic Internal Signal"

Claim 1 further recites "calculating a background noise signal using the electronic ambient signal and the electronic internal signal." Ex. 1001, 12:44–45. Petitioner argues that Pedersen teaches this limitation. Pet. 22–26. Patent Owner does not separately address this limitation. *See* PO Resp.

We agree with Petitioner. Specifically, Pedersen states that it estimates "the level of background noise." Ex. 1008, code (57); *see also id.* at ¶ 9 ("The background noise is estimated . . . ."). Pedersen further describes how signals S1 and S2—the output signals from microphones M1

and M2—"are transmitted to a noise estimator 104 which includes means adapted to estimate background noise level thus producing noise estimates NE_1 and NE_2." Ex. 1008 ¶ 18; *see also* Ex. 1002 ¶ 86. Signal S1 corresponds to the claimed "electronic internal signal" and signal S2 corresponds to the claimed "electronic ambient signal." Ex. 1002 ¶ 89.

e) Limitation 1e: "Generating a Voice Activity Level Using the Modified Electronic Signal and the Background Noise Signal"

Claim 1 further recites "generating a voice activity level using the modified electronic signal and the background noise signal." Ex. 1001, 12:48–49. Petitioner argues that the combination of Pedersen, Visser, and Alves teaches this limitation. Pet. 63–58.

We agree with Petitioner. Specifically, Alves teaches an earpiece similar to Pedersen's in that it has an insertion portion consisting of a speaker 32 and an internal microphone 34 which is placed within an ear canal. Ex. 1011 ¶ 26. Alves further teaches that internal microphone 34 will pick up sound emitted by speaker 32, which will appear as an echo in the signal output internal microphone 34. Ex. 1011 ¶ 29.

Alves further teaches using a VAD. Ex. 1011, Fig. 6. Alves shows that one of the inputs to the VAD is the echo-reduced signal 70 produced from signal 66 captured by ear canal microphone 34. *Id.* Alves also describes how the VAD is used to improve the performance of the headset in the presence of external talkers:

> *Third, a voice active detector (VAD) improves performance in the presence of external talkers*. The VAD generates control signal 124 based on the presence of spoken speech in echo reducer output 70. The VAD may also be used to freeze the adaptation of subband adaptive filters $G2_i(z)$ in order to prevent updating when the wearer's voice is not present. The design and implementation of VADs is well known in the art.

> *Control signal 124 selects either the combined low frequency Y2 $_i$(k) and high frequency E3 i(k), representing noise reduced speech, when voice is detected, or the output of the comfort noise generator (CNG) when voice is not detected*.

Id. ¶ 72 (emphases added).

A person having ordinary skill in the art would have recognized the similarities between Pedersen and Alves. *See* Ex. 1002 ¶¶ 181–182. That is, both systems have a microphone and loudspeaker located in an ear canal and both discuss using comfort noise when no speech is detected. Ex. 1002 ¶¶ 181–182; Ex. 1008 ¶ 19; Ex. 1011 ¶ 72. A person having ordinary skill in the art would have used Alves's disclosure of a VAD to improve the noise reduction performance for signals captured by the ear canal microphone, which would, in turn, improve the quality of the combined output signal. Ex. 1002 ¶¶ 184–185.

Patent Owner argues Alves does not add anything to the Pedersen-Visser combination. PO Resp. 43. Specifically, Patent Owner cites to Dr. Stern's cross-examination testimony that it "refer[s] only to a 'cleaner description' of a Voice Activity Detector (VAD) and that 'in terms of functionality, I don't think that there's any advantage.'" PO Resp. 43 (citing Ex. 2010, 36:18–37:8, 37:9–38:10).

We do not agree with Patent Owner's argument. As we pointed out in the Institution Decision, it was unclear whether the input to Visser's VAD was an echo reduced signal. Inst. Dec. 38–39. However, Alves clearly shows using an echo reduced signal as the input to the VAD. Ex. 1011, Fig. 6. Accordingly, Alves adds something to the combination.

We also do not find Dr. Stern's cross-examination testimony helpful. Dr. Stern testified, both in his direct and cross-examination testimony, that he believes that the combination of Pedersen and Visser teaches

limitation 1e. *See* Ex. 1002 ¶¶ 123–142; Ex. 2010, 37:9–38:10. Because he believes that the combination of Pedersen and Visser teaches the limitation, he sees no advantage to Alves. Ex. 2010, 37:9–38:10. But, he also testified that "[t]o the extent Patent Owner incorrectly argues that Visser does not disclose that its echo-reduced speech signal 181, *i.e.*, output U_1, is used to calculate a voice activity level, such a feature is described in Alves." Ex. 1002 ¶ 178. Because Patent Owner made that argument, we rely on Dr. Stern's alternative argument, even if Dr. Stern does not believe it is necessary.[13]

Patent Owner further argues that the input to Alves's VAD is the echo reducer output while the inputs to Visser's VAD are noise signal 196 and speech signal 181. PO Resp. 43. According to Patent Owner, "Alves's disclosure of echo reducer output 70 feeding a voice activity detector in Figure 6 of Alves is inapposite; echo reducer output 70 is not part of the proposed Pedersen-Visser-Alves combination." *Id.*

Patent Owner's argument is inapposite as it relies on a bodily incorporation of Alves into Visser. "The test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference[.]" *Allied Erecting & Dismantling Co. v. Genesis Attachments, LLC*, 825 F.3d 1373, 1381 (Fed. Cir. 2016) (quoting *In re Keller*, 642 F.2d 413, 425 (CCPA 1981)). Instead, the question is whether "a skilled artisan would have been motivated to combine the teachings of the prior art references to achieve the claimed invention[.]" *Id.*

[13] As discussed below in Section II.F., because we find that the combination of Pedersen, Visser, and Alves teaches the limitation, we exercise our discretion not to determine whether the combination of Pedersen and Visser alone teaches it.

(quoting *Pfizer, Inc. v. Apotex, Inc.*, 480 F.3d 1348, 1361 (Fed. Cir. 2007)); *see also In re Mouttet*, 686 F.3d 1322, 1332 (Fed. Cir. 2012) ("It is well-established that a determination of obviousness based on teachings from multiple references does not require an actual, physical substitution of elements."); *In re Etter*, 756 F.2d 852, 859 (Fed. Cir. 1985) (en banc) (explaining that whether one reference can be incorporated in another is "basically irrelevant" since the test for obviousness is "not whether the references could be physically combined but whether the claimed inventions are rendered obvious by the teachings of the prior art as a whole").

Instead of bodily incorporating the structure from the references, we look to how the Petition describes the proposed combination. In this case, the Petitioner sets forth that in the Pedersen-Visser-Alves combination, a person having ordinary skill in the art would have used the echo reduced signal—which Petitioner maps to Visser speech signal 181 (Ex. 1002 ¶ 119; Pet. 38)—as inputs for the VAD. Pet. 67–68; Ex. 1002 ¶ 186. That satisfies the claim limitation.

Patent Owner further argues that "[if] Petitioners attempt to shift to a theory under which the VAD of Alves as well as its inputs are incorporated into a Pedersen-Visser-Alves combination, that combination would not satisfy" limitation 1e. PO Resp. 43–44. According to Patent Owner, one of the inputs to Alves's VAD is the output of an equalizer. Patent Owner further argues that Dr. Stern incorrectly identified the source of that signal under cross-examination. PO Resp. 44–45.

We fail to see the relevancy of that testimony and argument. Like the previous argument, Patent Owner's argument is premised on an improper bodily incorporation. As discussed above, Petitioner's theory, which we are persuaded by, is that a person having ordinary skill in the art would have

used Alves's VAD in combination with the echo reduced signal generated by Visser. Therefore, it does not matter what other inputs are in Alves and whether Dr. Stern correctly identified them during cross-examination.

Finally, Patent Owner argues that it "has consistently maintained that 'echo-reduced noise signal 181' does not exist in Visser. Rather, Visser discloses 'speech signal 181,' which is not echo reduced." PO Sur-reply 22 (citing PO Resp. 35). However, as discussed above in Section II.D.4.(c), we disagree with that argument and, instead, find that Petitioner has sufficiently shown that Visser signal 181 is an echo-reduced noise signal.

f) Limitation 1f: Mixing the Electronic Ambient Signal with the Modified Electronic Internal Signal in a Ratio Dependent on the Background Noise Signal to Produce a Mixed Signal that Includes a Reduced Echo

Claim 1 further recites "mixing the electronic ambient signal with the modified electronic internal signal in a ratio dependent on the background noise signal to produce a mixed signal that includes a reduced echo." Ex. 1001, 12:50–53. Petitioner argues that the combination of Pedersen and Visser teaches this limitation. Pet. 49–52. Patent Owner does not separately address this limitation. *See* PO Resp.

We agree with Petitioner. A person having ordinary skill in the art would have recognized that in Pedersen, gain controller outputs gain g1 and gain g2 are determined using noise estimates NE1 and NE2 or the combined NE. *See* Ex. 1002 ¶¶ 143–144; Ex. 1008 ¶¶ 20–21, 28. A person having ordinary skill in the art would have recognized that Pedersen's signal S1 (the claimed "electronic internal signal") and signal S2 (the claimed "electronic ambient signal") are mixed "in a ratio dependent on the background noise signal." Ex. 1002 ¶¶ 145–146; Ex. 1008 ¶ 24, Fig. 1. Additionally, a person having ordinary skill it the art would have recognized that when using the

combination of Visser and Pedersen, the echo reduced version of the wearer's speech would have been used instead. Ex. 1002 ¶¶ 147–149; Ex. 1008 ¶¶ 66, 94.

g) Limitation 1g: Sending the Mixed Signal to an Ear Canal Receiver

Claim 1 further recites limitation 1g: "sending the mixed signal to an ear canal receiver." Ex. 1001, 12:54. Petitioner argues that the combination of Pedersen and Visser teaches this limitation. Pet. 52–53.

We agree with Petitioner. Specifically, Visser teaches that after microphones 351 and 352 are used to generate sound signals, those signals are processed by a speech separation process 354. Ex. 1009, Fig. 9 ¶ 66. The speech separation process returns a clean speech signal 355, which is received by a side tone processing module 356, which "feeds an attenuated clean speech signal back to local speaker 360." Ex. 1009 ¶ 66; *see also* Ex. 1009, Fig. 6. A person having ordinary skill in the art "would have found it obvious to use Visser's teachings regarding playback of the wearer's speech into the wearer's ear in Pedersen's FIG. 5 headset." Ex. 1002 ¶ 151. That is, a person having ordinary skill in the art would have understood that after mixing the signals to create the mixed signal discussed above with respect to limitation 1f would be played back in the loudspeaker of the earplug. *See* Ex. 1002 ¶ 151.

Patent Owner disagrees with Petitioner's argument. First, Patent Owner argues that "a person of ordinary skill in the art would not have been motivated to introduce a ***fourth*** instance of a user's voice." PO Resp. 39–40; *see also* PO Sur-reply 19–20. We disagree.

Patent Owner misrepresents Petitioner's argument. Petitioner does not argue that the user's voice is played four times over the loudspeaker.

Instead, Petitioner's theory is based on eliminating the echo that would come from detecting the user's voice multiple times. *See* Pet. 20–21 (describing how the echo can be created). Because Petitioner's combination will eliminate the echo (*see* Section II.D.4.(c) (discussing reducing the echo)), it is unclear how the user's speech will be played multiple times, let alone four times as Patent Owner argues.

Second, Patent Owner argues that Dr. Stern testified that side tone processing is not on when the user is speaking:

> Q. In your proposed combinations, is the comfort noise on at all times?
>
> A. No, the comfort noise would only be on when no one is speaking.
>
> Q. Is side tone on at all times?
>
> A. Same answer, side tone would only be on when no one is speaking.

Ex. 2010, 51:20–52:1. According to Patent Owner, "[i]f side tone is enabled only when no one is speaking, then the signal that is delivered to the speaker is not a 'mixed signal' as required by claim 1." PO Resp. 40; *see also* PO Resp. 41 ("If no one is speaking, there is no echo of that voice, and the claim limitations are not satisfied."); PO Sur-reply 20–21.

We do not agree with Patent Owner's argument, as it reads too much into side tone. Although Petitioner cites Visser paragraph 66, which mentions the side tone processor, Petitioner is not relying on that paragraph for side tone. Instead, Petitioner is relying on the paragraph for the simple idea of transmitting a processed recording to a loudspeaker for playback:

> Pedersen in view of Visser discloses/suggests this feature. Stern, ¶150. Visser discloses that its clean speech signal 355, shown in FIG. 6, is reproduced by loudspeaker 360, which is incorporated into the same headset as its microphones. *Id.*,

> ¶[0066]. *See also* FIG. 8. POSITAs would have found it obvious to use Visser's teachings regarding playback of the wearer's speech into the wearer's ear in Pedersen's FIG. 5 headset. Thus, POSITAs would have found it obvious to use Visser's teachings regarding playback of the wearer's speech into the wearer's ear in Pedersen's FIG. 5 headset. Specifically, POSITAs would have been motivated to modify Pedersen such that Pedersen's combined signal S was sent to the loudspeaker in the earplug of the wearer of Pedersen's FIG. 5 headset. Visser provides the motivation for such a modification, stating that feeding clean speech signal 355 (as attenuated based on the level of noise) to local speaker 360 "provides a more natural audio feedback to the user." Visser, ¶[0066]; *see also* Stern, ¶151.

Pet. 52. Noticeably absent from this section is any reliance on sidetone.

Moreover, we do not credit expert testimony—even if elicited on cross-examination—that is inconsistent with the text of the prior art reference. We agree with Patent Owner that Dr. Stern clearly and unmistakably testified that there is no side tone processing when someone is speaking. *See* Ex. 2010, 51:20–52:1. We also acknowledge, as Patent Owner argues, that there is no errata sheet, no cross-examination, and no additional testimony indicating that there was a mistake. *See* PO Sur-reply 20. But that statement on cross-examination does not exist in a vacuum. Instead, it is one part of the record, which must be considered with the reference itself. And the reference is clear that a speech signal is sent to the side tone processor for processing and then sent for transmission. Ex. 1009 ¶ 66 ("The clean speech signal 355 is also received by a side tone processing module 356. Side tone processing module 356 feeds an attenuated clean speech signal back to local speaker 360."), Fig. 6. Indeed, this understanding that side tone is applied to speech is consistent with Dr. Stern's earlier cross-examination testimony describing what side tone is (*see* Ex. 2010, 49:24–50:1 (explaining that "side tone is an attenuated piece

of your own voice that goes to the earpiece that tells that the phone is functioning")) and Mr. Struck's cross-examination testimony (*see* Ex. 1028 (119:12–123:11)). While we have considered Dr. Stern's contrary cross-examination testimony, we find it is not sufficient to counter the clear and unambiguous teaching of the reference itself.

Because of Dr. Stern's cross-examination testimony, we have discounted the weight we give to his direct testimony on this limitation. However, in light of the clear disclosure in Visser, the combination of Dr. Stern's discounted testimony and the express disclosures in the references relied upon is sufficient for Petitioner to meet its burden of persuasion.

Third, Patent Owner argues that "a person of ordinary skill in the art would not have implemented side tone processing after (1) voice activity detection processing, [and] (2) mixing an ambient signal and a modified internal signal." PO Resp. 41; *see also id.* at 41–42 (discussing in more detail). However, Patent Owner's argument is inapposite. As discussed above, Petitioner is not relying on Visser for side tone processing, but for playing the sound in the loudspeaker. As discussed above, Petitioner has sufficiently shown why a person having ordinary skill in the art would do so.[14]

[14] Patent Owner also disagrees with Petitioner's alternate argument that the playback can be in the earplug of a person besides the user. PO Resp. 42. Because we do not rely on that theory, Patent Owner's arguments are moot.

h) Conclusion Regarding Claim 1

For the reasons set forth above, Petitioner has demonstrated by a preponderance of the evidence that the subject matter of claim 1 would have been obvious over Pedersen, Visser, and Alves.

5. Claims 2–6, 8, 9, and 11–13

Petitioner argues that the combination of Pedersen and Visser teaches all of the additional limitations set forth in dependent claims 2–6, 8, 9, and 11–13. *See* Pet. 53–63. Petitioner's arguments are supported by citations to the prior art and the testimony of Dr. Stern. *See id.* at 53–63.

Patent Owner does not address separately the additional limitations recited in claims 2–6, 8, 9, and 11–13. *See* PO Resp.

Based on our review of the evidence and arguments presented in the Petition, which are not otherwise disputed by Patent Owner, we determine that Petitioner has demonstrated by a preponderance of the evidence that the subject matter of claims 2–6, 8, 9, and 11–13 were obvious over Pedersen, Visser, and Alves. *See Incept LLC v. Palette Life Scis., Inc.*, 77 F.4th 1366, 1375 (Fed. Cir. 2023) ("Where a party 'does not raise any arguments with respect to any other claim limitation, nor does it separately argue [the] dependent claim,' '[the] dependent claim . . . stands or falls together with [the] independent claim.'" (quoting *Genentech, Inc. v. Hospira, Inc.*, 946 F.3d 1333, 1340 (Fed. Cir. 2020))).

E. Obviousness over Pedersen, Visser, Alves, and Huang

a) Summary of Huang

Huang is titled "Method and Apparatus for Robust Speech Classification" and describes "[a] speech classification technique for robust classification of varying modes of speech to enable maximum performance of multi-mode variable bit rate encoding techniques." Ex. 1012, codes (54),

(57). Huang states that "[t]he voice activity detector (204) outputs voice activity information for the current speech to speech classifier (210)." *Id.* ¶ 33.

b) Analysis of Claims 6 and 7

Petitioner argues that the combination of Pedersen, Visser, Alves, and Huang teaches the additional limitations recited in claims 6 and 7, and that a person having ordinary skill in the art would have combined the teachings with a reasonable expectation of success. *See* Pet. 68–77.

Patent Owner does not address separately the additional limitations recited in claims 6 and 7. *See* PO Resp. 45.

Based on our review of the evidence and arguments presented in the Petition, which are not separately argued by Patent Owner, we determine that Petitioner has demonstrated by a preponderance of the evidence that claims 6 and 7 would have been obvious over the combined teachings of Pedersen, Visser, Alves, and Huang. *See Incept*, 77 F.4th at 1375.

F. Other Grounds

In addition to the ground discussed above, Petitioner argues the claims are unpatentable under alternate grounds that do not include Alves. Pet. 8. Because we determine that claims 1–9 and 11–13 were obvious under grounds that include Alves, we do not address the parties' arguments regarding those alternate grounds. *See Boston Sci. Scimed, Inc. v. Cook Gp. Inc.*, 809 F. App'x 984, 990 (Fed. Cir. 2020) ("We agree that the Board need not address issues that are not necessary to the resolution of the proceeding.").

III. CONCLUSION[15]

For the foregoing reasons, we conclude that Petitioner has demonstrated by a preponderance of the evidence the unpatentability of claims 1–9 and 11–13 of the '701 patent.

In summary:

Claims	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not shown Unpatentable
1–6, 8, 9, 11–13	103(a)	Pedersen, Visser[16]		
1–6, 8, 9, 11–13	103(a)	Pedersen, Visser, Alves	1–6, 8, 9, 11–13	
6, 7	103(a)	Pedersen, Visser, Huang[17]		
6, 7	103(a)	Pedersen, Visser, Alves, Huang	6, 7	
Overall Outcome			1–9, 11–13	

[15] Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. *See* 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. § 42.8(a)(3), (b)(2).

[16] As explained above, because we determine that claims 1–6, 8, 9, and 11–13 are unpatentable as obvious over Pedersen, Visser and Alves, we decline to address those claims on this ground.

[17] As explained above, because we determine that claims 6 and 7 are unpatentable as obvious over Pedersen, Visser, Alves and Huang, we decline to address those claims on this ground.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, Petitioner has shown by a preponderance of the evidence that claims 1–9 and 10–13 of the '701 patent are unpatentable;

FURTHER ORDERED that because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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