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Paper 9
Entered: January 19, 2024

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

LG ELECTRONICS INC.,
Petitioner,

v.

JAWBONE INNOVATIONS, LLC,
Patent Owner.

IPR2023-01248
Patent 8,467,543 B2

Before GEORGIANNA W. BRADEN, NORMAN H. BEAMER, and JASON M. REPKO, *Administrative Patent Judges*.

BEAMER, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314
Denying Motion For Joinder
37 C.F.R. § 42.122

I. INTRODUCTION

On July 26, 2023, LG Electronics Inc. ("Petitioner") filed a Petition ("Pet.") pursuant to 35 U.S.C. §§ 311–319 to institute an *inter partes* review of claims 1–26 of U.S. Patent No. 8,467,543 B2 ("the '543 patent"). Paper 3. On November 10, 2023, Jawbone Innovations, LLC ("Patent Owner") filed a Preliminary Response ("Prelim. Resp."). Paper 8.

On July 26, 2023, Petitioner also filed a Motion For Joinder To And Consolidation With Related *Inter Partes* Review IPR2023-00275, which Patent Owner opposed on August 28, 2023. Papers 2, 7. However, on August 8, 2023, that Proceeding was terminated due to settlement. IPR2023-00275, Paper 15. Accordingly, Petitioner's motion to join is denied as moot.

The standard for instituting an *inter partes* review is set forth in 35 U.S.C. § 314(a), which provides that an *inter partes* review may not be instituted unless the information presented in the Petition and any preliminary response shows that "there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition."

For the reasons explained below, we determine that Petitioner has established a reasonable likelihood that it would prevail with respect to at least one challenged claim. Accordingly, we institute an *inter partes* review as to the challenged claims and grounds raised in the Petition.

II. BACKGROUND

A. The '543 Patent

The '543 patent, titled "Microphone and Voice Activity Detection (VAD) Configurations for Use with Communication Systems," was filed on

March 27, 2003, issued on June 18, 2013, and lists a related provisional application filed March 27, 2002.[1] Ex. 1001, codes (54), (22), (45), (60).

The '543 patent is directed to handset and headset systems with a two-microphone array to receive acoustic signals and a Voice Activity Detector (VAD) device to provide human voicing activity information. Ex. 1001, code (57). The systems receive a control signal from the VAD to automatically select a denoising method appropriate to data of frequency subbands of the acoustic signals, which is applied to the acoustic signals to generate denoised acoustic signals when the acoustic signal includes speech and noise. *Id.* Figure 1 is reproduced below.

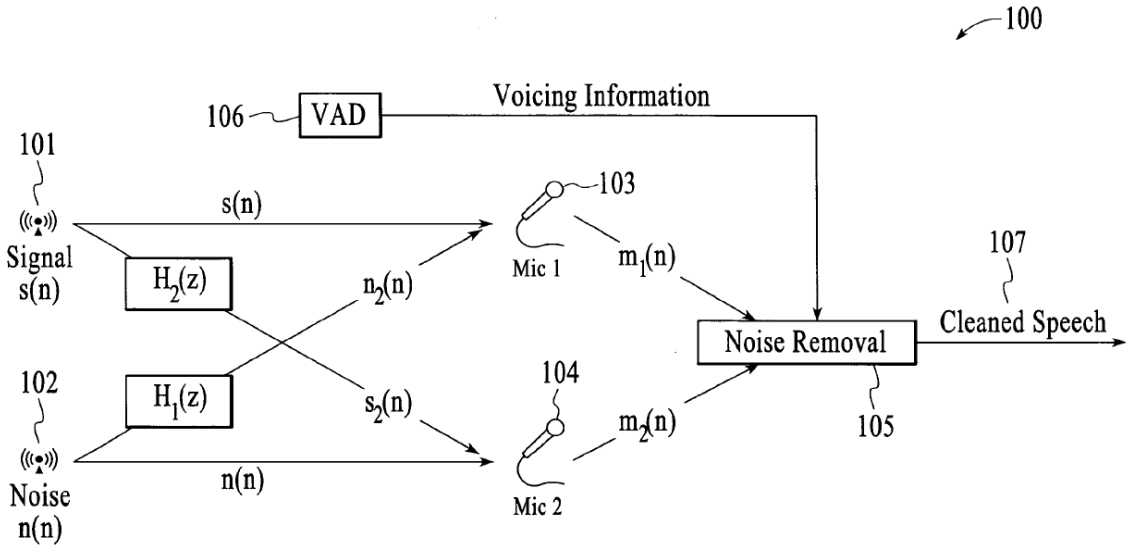


Figure 1 is a block diagram of the noise removal system. Ex. 1001, 2:23–25. Microphones Mic 1 and Mic 2 receive acoustic information from speech signal source 101 and noise source 102, and the acoustic information received at each microphone is provided to Noise Removal system 105. *Id.*

[1] It is unnecessary at this stage to determine whether the '543 patent is entitled to priority based on the application date of the provisional. *See* Pet. 12.

at 5:18–24, 14:40–54. VAD 106 detects the presence of speech by detecting vibrations of the trachea, neck, cheek, and head associated with the production of speech, and can be an electromagnetic device, such as a General Electromagnetic Sensor (GEMS), an accelerometer, or a skin-surface microphone. *Id.* at 6:9–12, 11:50–60. VAD 106 provides a signal to Noise Removal system 105 to indicate the occurrence of speech, which is used to control the method of noise removal. *Id.* at 5:33–36, 14:51–52. The system processes the acoustic information in multiple subbands in the frequency domain, by determining the noise components in the subbands when speech is absent, and subtracting those noise components from the overall acoustic signal to generate cleaned speech 107. *Id.* at 14:52–56, 16:9–12, 16:31–40.

One arrangement of the microphones is illustrated in Figure 7A reproduced below.

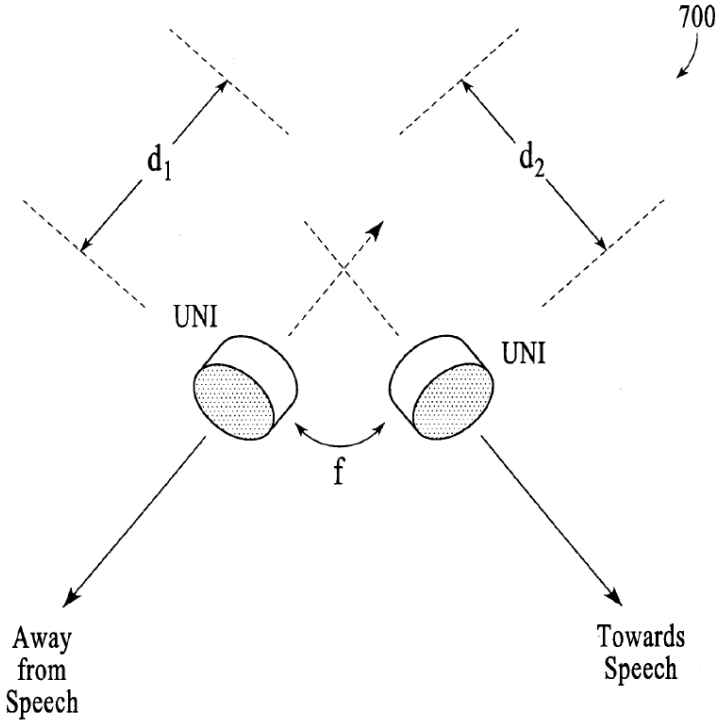


Figure 7A shows a microphone configuration using a unidirectional speech microphone and a unidirectional noise microphone, in which the speech microphone is directed toward speech and the noise microphone is directed away from speech, and the microphones are at an angle "f" of 60–135 degrees, and distances d_1 and d_2 of 0–15 cm. Ex. 1001, 3:4–6, 9:46–52. Other disclosed embodiments use a unidirectional speech microphone and an omnidirectional noise microphone, or an omnidirectional speech microphone and a unidirectional noise microphone. *Id.* at Figs. 3A, 5A, 2:34–37, 2:41–43.

The '543 Specification asserts that, compared to the prior art, the disclosed invention "make[s] all the difference in terms of noise suppression performance, including using VAD information to control adaptation of the noise suppression system to the received signals, [and] using numerous subbands to ensure adequate convergence across the spectrum of interest . . . ." Ex. 1001, 16:44–52.

B. Illustrative Claim

Independent claim 1 is reproduced below.[2]

1. A communications system, comprising:

[a] a voice detection subsystem configured to receive voice activity signals that includes information associated with human voicing activity, the voice detection subsystem configured to automatically generate control signals using the voice activity signals; and

[b] a denoising subsystem coupled to the voice detection subsystem, the denoising subsystem

[2] The bracketed letters and paragraph arrangement are added for convenience of presentation.

comprising a microphone array including a plurality of microphones,

[c] wherein a first microphone of the array is fixed at a first position relative to a mouth, wherein the first position orients a front of the first microphone towards the mouth,

[d] wherein a second microphone of the array is fixed at a second position relative to the mouth, wherein the second position orients a front of the second microphone away from the mouth such that the second position forms an angle relative to the first position, wherein the angle is greater than zero degrees,

[e] the microphone array providing acoustic signals of an environment to components of the denoising subsystem,

[f] components of the denoising subsystem automatically selecting at least one denoising method appropriate to data of at least one frequency subband of the acoustic signals using the control signals and processing the acoustic signals using the selected denoising method to generate denoised acoustic signals,

[g] wherein the denoising method includes generating a noise waveform estimate associated with noise of the acoustic signals and subtracting the noise waveform estimate from the acoustic signal when the acoustic signal includes speech and noise,

[h] wherein the voice detection subsystem is configured to receive the voice activity signals using a sensor independent from the microphone array and to output the control signals generated from the voice activity signals to the denoising system, the denoising system configured to use

> the control signals to denoise the acoustic signals from the microphone array.

Ex. 1001, 24:2–37.

C. References

Petitioner relies on the following references (Pet. 12):

- Burnett et al., US 6,377,919 Bl, filed November 4, 1999, issued April 23, 2002. Ex. 1003 ("Burnett").
- Andrea et al., US 5,825,897, filed August 18, 1997, issued October 20, 1998. Ex. 1004 ("Andrea").
- Sasaki et al., US 5,471,538, filed May 7, 1993, issued November 28, 1995. Ex. 1005 ("Sasaki").
- Hussain et al., *A New Metric for Selecting Sub-Band Processing in Adaptive Speech Enhancement Systems*, Proc. 5th European Conference on Speech Communication and Technology (Eurospeech '97), 2611–14, published September 1997. Ex. 1006 ("Hussain").
- Puthuff et al., WO 00/21194, published April 13, 2000. Ex. 1007 ("Puthuff").
- Alcivar, US 3,746,789, filed October 20, 1971, issued July 17, 1973. Ex. 1008 ("Alcivar").

Petitioner also filed the Declaration of Dr. Richard M. Stern in support of the Petition. Ex. 1002 ("Stern Decl.").

D. Asserted Challenges to Patentability

Petitioner challenges the patentability of claims 1–26 of the '543 patent on the following bases (Pet. 12):

Claim(s) Challenged	35 U.S.C. §[3]	References
1–2, 5–7	103	Burnett, Hussain
1–2, 5–13, 26	103	Burnett, Hussain, Andrea
14–25	103	Grounds 1 or 2 references, Sasaki
3	103	Grounds 1 or 2 references, Puthuff
4	103	Grounds 1 or 2 references, Alcivar

E. Real Parties in Interest

The parties identify themselves as real parties in interest. Pet. 76; Paper 6, 2.

F. Related Proceedings

The parties identify the following related proceedings: *Jawbone Innovations, LLC v. Amazon.com, Inc.,* Case No. 5:22-cv-06727-TLT (N.D. Cal.); *Jawbone Innovations, LLC v. Amazon.com, Inc.,* Case No. 2:21-cv-00435 (E.D. Tex.); *Jawbone Innovations, LLC v. Apple Inc.*, Case No. 6:21-cv-00984-ADA (W.D. Tex.); *Jawbone Innovations, LLC v. Google LLC*, Case No. 6:21-cv-00985-ADA (W.D. Tex.); *Jawbone Innovations, LLC v. Google LLC, Case No. 3:23-cv-00466 (N.D. Cal.); Jawbone Innovations, LLC v. Guangdong OPPO Mobile Telecommunications Corp., Ltd., d/b/a OPPO, Case No. 3:23-cv-00079 (E.D. Tex.);* J*awbone Innovations, LLC v. HTC Corporation*, Case No. 3:23-cv-00077 (E.D. Tex.); *Jawbone*

[3] The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) ("AIA"), included amendments to 35 U.S.C. §§ 102 and 103 that became effective after the filing of the application for the '543 patent. Therefore, we apply the pre-AIA versions of these sections.

Innovations, LLC v. LG Electronics, Inc., Case No. 2:23-cv-00078 (E.D. Tex.); *Jawbone Innovations, LLC v. Meta Platforms, Inc.*, Case No. 6:23-cv-00158 (W.D. Tex.); *Jawbone Innovations, LLC v. Panasonic Holdings Corporation*, Case No. 2:23-cv-00081 (E.D. Tex.); *Jawbone Innovations, LLC v. Samsung Electronics Co., Ltd.*, Case No. 2:21-cv-00186 (E.D. Tex.); *Jawbone Innovations, LLC v. Sony Electronics Inc.*, Case No. 2:23-cv-01161 (D.N.J.); *Jawbone Innovations, LLC v. ZTE Corporation*, Case No. 3:23-cv-00082 (E.D. Tex.); *Google LLC v. Jawbone Innovations, LLC,* IPR2022-01027; *Samsung Electronics Co., LTD. v. Jawbone Innovations, LLC,* IPR2022-00865; *Amazon.Com, Inc. v. Jawbone Innovations, LLC,* IPR2022-00275; *Sony Electronics, Inc. v. Jawbone Innovations, LLC,* IPR2023-01222. Pet. 76–77; Paper 6, 2–3.

III. ANALYSIS OF PETITIONER'S CHALLENGE

A. Legal Standards

To prevail in its challenge, Petitioner must demonstrate by a preponderance of the evidence that the claims are unpatentable. 35 U.S.C. § 316(e) (2018); 37 C.F.R. § 42.1(d) (2022). "In an IPR, the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable." *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (2012) (requiring *inter partes* review petitions to identify "with particularity . . . the evidence that supports the grounds for the challenge to each claim")). This burden of persuasion never shifts to the patent owner. *See Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof in *inter partes* review).

A patent claim is unpatentable under 35 U.S.C. § 103 if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) when in evidence, objective indicia of non-obviousness (also called secondary considerations), such as commercial success, long-felt but unsolved needs, and failure of others.[4] *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). We analyze grounds based on obviousness in accordance with the above-stated principles.

B. Level of Skill in the Art

In determining whether an invention would have been obvious at the time it was made, 35 U.S.C. § 103(a) requires us to resolve the level of ordinary skill in the pertinent art at the time of the invention. *Graham*, 383 U.S. at 17. The person of ordinary skill in the art is a hypothetical person who is presumed to have known the relevant art at the time of the invention. *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995). Factors that may be considered in determining the level of ordinary skill in the art include, but are not limited to, the types of problems encountered in the art, the

[4] The record does not include evidence or argument regarding objective indicia of nonobviousness.

sophistication of the technology, and educational level of active workers in the field. *Id.* In a given case, one or more factors may predominate. *Id.*

Petitioner asserts that a person of ordinary skill in the art at the time of the alleged invention of the '543 patent:

> [W]ould have had a minimum of a bachelor's degree in computer engineering, computer science, electrical engineering, mechanical engineering, or a similar field, and approximately three years of industry or academic experience in a field related to acoustics, speech recognition, speech detection, or signal processing. . . . Work experience can substitute for formal education and additional formal education can substitute for work experience. . . .

Pet. 13 (citing Stern Decl. ¶ 28). Patent Owner utilizes Petitioner's proposal at this stage of the proceeding. Prelim. Resp. 9.

Petitioner's proposal is consistent with the level of ordinary skill in the art reflected by the asserted prior art. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001); *GPAC*, 57 F.3d at 1579. On this record, the level of ordinary skill is neither in dispute nor dispositive of any challenge. For purposes of this Decision, we apply Petitioner's articulation.

C. Claim Construction

The Petition was accorded a filing date of July 26, 2023. Paper 4. In an *inter partes* review for a petition filed on or after November 13, 2018, a claim "shall be construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. 282(b)." 37 C.F.R. § 42.100(b). We apply the claim construction standard from *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (*en banc*).

Claim terms need only be construed to the extent necessary to resolve the controversy. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017).

The parties submit that no claim construction is necessary for present purposes. Pet. 13–14; Prelim. Resp. 9.[5]

D. Alleged Obviousness of Claims 1–2 and 5–7 over Burnett and Hussain

Petitioner challenges claims 1–2 and 5–7 as obvious over the combination of Burnett and Hussain. Pet. 14–33.

1. Burnett

Burnett, titled "System and Method for Characterizing Voiced Excitations of Speech and Acoustic Signals, Removing Acoustic Noise from Speech, and Synthesizing Speech," issued April 23, 2002, from an application filed November 4, 1999. Ex. 1003, codes (54), (45), (22). Burnett uses electromagnetic (EM) sensors to detect voiced speech to provide speech production information to enable noise removal from human speech. *Id.* at code (57). Figure 12 is reproduced below.

[5] In IPR2023-00275, we construed the terms "voice detection subsystem," "voice activity signals," and "human voicing activity" to refer to subsystems, signals, and activity, respectively, that relate to voiced speech, unvoiced speech, or a combination of voiced and unvoiced speech. IPR275, Paper 10, 13. This construction is not dispositive of any challenge in this Proceeding.

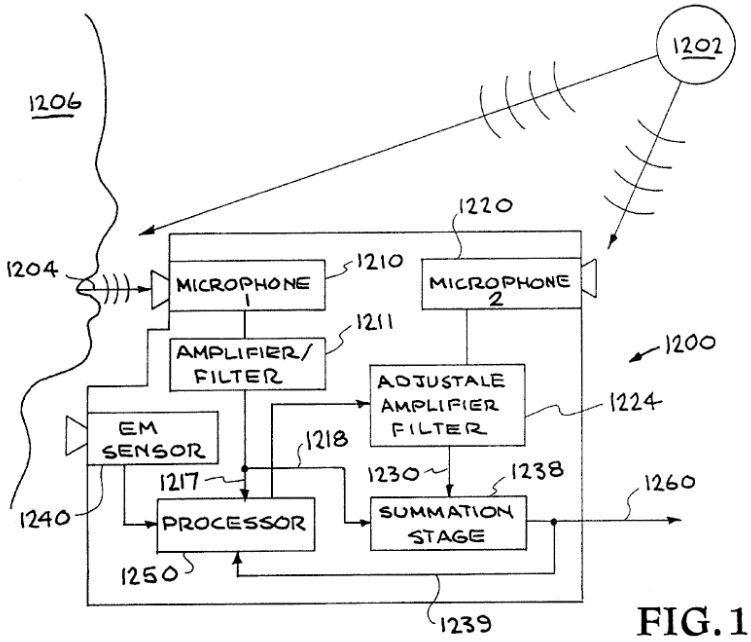


FIG. 12

Figure 12 is a diagram of a noise cancelling system, using EM sensor 1240 to determine "no-speech" time periods, and microphones 1 and 2 (elements 1210 and 1220) to receive acoustic signals, including speech 1204 and background noise 1202. Ex. 1003, 5:37–38, 17:49–61. Processor 1250 compares output signals from the two microphones 1210 and 1220 and adjusts a gain and phase of output signal 1230, using amplifier and filter circuit 1224, so as to minimize a residual signal level in all frequency bands of signal 1260 output from summation stage 1238. *Id.* at 17:61–66. In summation stage 1238 the amplified and filtered background microphone signal 1230 is set equal and opposite in sign to a speaker's microphone signal by the processor 1250, using feedback 1239 from output signal 1260. *Id.* at 17:66–18:3. The determination of the "no-speech" time periods by EM sensor 1240 is used by the circuitry to accurately remove background acoustic noise from speech. *Id.* at 18:4–13.

Burnett incorporates by reference several related patents, including Holzrichter, U.S. Patent 6,006,175 (Ex. 1009, hereafter "Holzrichter '175"), and Holzrichter U.S. Patent No. 5,729,694 (Ex. 1010, hereafter "Holzrichter '694"). Ex. 1003, 1:24–32, 11:65–12:3. Petitioner relies on disclosures in these incorporated patents for several requirements of the challenged claims. Pet. 16–17, 30–32, 39, 41–42, 44, 46, 51, 63.

2. Hussain

Hussain is a conference submission titled "A New Metric for Selecting Sub-Band Processing in Adaptive Speech Enhancement Systems." Ex. 1006. Petitioner offers evidence that Hussain was publicly available at a "Speech Communication and Technology" conference held September 22–25, 1997, and catalogued at a number of libraries prior to the earliest claimed priority date for the '543 patent. Pet. 12, 28. Patent Owner raises no issue as to the prior-art status of this reference, and we treat it as prior art pursuant to pre-AIA 35 U.S.C. § 102(b) for purposes of this Decision.

Hussain discloses an "adaptive noise cancellation scheme" that improves performance in reverberant environments by processing acoustic signals as separate sub-bands to produce a denoised signal. Ex. 1006, 10–11, 13. Figure 1 is reproduced below.

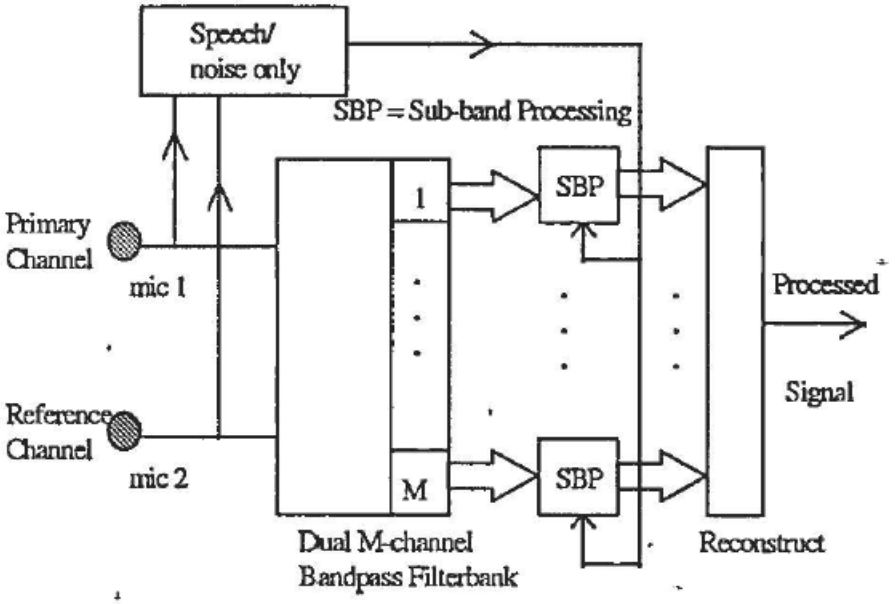


Figure 1: The MMSBA system

Figure 1 is a block diagram of a "Multi-Microphone sub-band Adaptive (MMSBA) speech enhancement system" including primary channel microphone mic 1 and reference channel microphone mic 2, a "speech/noise only" component that is an "effective voice activity detector (VAD)," and a dual M-channel bandpass filter bank. Ex. 1006, 10–11. The filter bank transforms the acoustic signals into M sub-bands in the frequency domain, which are provided to sub-band processing (SBP) circuits to perform adaptive intermittent noise cancellation, and reconstructed to provide enhanced speech output. *Id.*

3. The Combination of Burnett and Hussain

Petitioner argues that one of ordinary skill would have been motivated to combine Burnett's noise cancellation system with its EM VAD, and Hussain's sub-band processing, because of the known advantages of Hussain's ability to adaptively select the best form of processing for

individual frequency sub-bands to combat reverberation effects and improve noise cancellation, and one of ordinary skill would have reasonably expected to succeed in making such a combination. Pet. 26–27 (citing Stern Decl. ¶¶ 34, 74–78). For example, Hussain explains that sub-band processing "is capable of outperforming conventional noise cancellation schemes." Ex. 1006, 10, 12.

Patent Owner does not specifically challenge the motivation for combining Burnett and Hussain. *See generally* Prelim. Resp. At this stage, we credit the testimony of Petitioner's declarant that one of ordinary skill would have been motivated to make the combination because using adaptive noise cancellation methods on individual sub-bands rather than full-band processing is advantageous as compared to full-band processing because it provides, *inter alia*, improved performance in reverberant environments. Stern Decl. ¶ 76.

Accordingly, for purposes of this Decision, we determine that Petitioner has provided sufficiently articulated reasoning with rational underpinnings for the proffered combined teachings of Burnett and Hussain.

4. Independent Claim 1

For the "communications system" preamble of independent claim 1, Petitioner generally relies on the disclosures in Burnett of "public address systems, telephone conference systems, telephone networks" and similar communications systems. Pet. 14 (citing Ex. 1003, 14:47–50, 15:55–59; Stern Decl. ¶ 47).[6]

[6] Based on the present record, we make no determination at this stage of the proceeding that the preamble of claim 1 (or of claim 26) is limiting.

For the claim 1 requirement 1[a] of a voice detection subsystem that generates control signals,[7] Petitioner relies on EM sensor 1240 and processor 1250 of Burnett, which together generate control signals to indicate "no-speech time periods." Pet. 14–17 (citing Ex. 1003, Fig. 12, 2:62–3:9, 3:35–58, 17:49–18:17; Stern Decl. ¶¶ 49–50).

For the claim 1 requirements [1b] and [1e] of a denoising subsystem including a microphone array that provides acoustic signals, Petitioner relies on the circuitry of Figure 12 of Burnett, including microphones 1210 and 1220. Pet. 17–18 (citing Ex. 1003, Fig. 12, 12:37–39, 17:58–66; Stern Decl. ¶¶ 53–58).

For the claim 1 requirement 1[c] of a first microphone, Petitioner relies on the disclosure in Burnett of microphone 1210, which is pointed towards the mouth. Pet. 19–20 (citing Ex. 1003, Fig. 12, 17:58–61, 18:13–17; Stern Decl. ¶¶ 59–61).

For the claim 1 requirement 1[d] of a second microphone, Petitioner relies on the disclosure in Burnett of microphone 1220, which is pointed away from the mouth at an angle greater than zero degrees — *viz.*, 180 degrees. Pet. 20–21 (citing Ex. 1003, Fig. 12, 17:58–61, 18:13–17; Stern Decl. ¶¶ 62–64).

For the claim 1 requirement 1[f] of automatically selecting a denoising method appropriate to data of at least one frequency sub-band, Petitioner relies on the Hussain disclosure that noise is subtracted from the speech/noise acoustic signal by dividing the signals into multiple sub-bands and processing each sub-band by performing adaptive intermittent noise

[7] For economy of presentation, we refer to the portions of claim 1 identified by bracketed letters at Section II.B above.

cancellation using a VAD, and detecting "noise alone" periods, when differential acoustic-path transfer functions for each sub-band are determined, and "speech plus noise" periods, when the transfer functions are used to denoise the speech. Pet. 24–26 (citing Ex. 1006, Fig. 1, 10–12; Stern Decl. ¶¶ 71–73).

Patent Owner argues that the combination of Burnett and Hussain does not render obvious "components of the denoising subsystem automatically selecting at least one denoising method appropriate to data of at least one frequency subband of the acoustic signals using the control signals." Prelim. Resp. 12–16. In particular, Patent Owner argues that the VAD control signals are not used to select the denoising method, as required by claim 1. *Id.* Patent Owner explains that Hussain uses "a modified MSC [Magnitude Squared Coherence]" value to select the denoising method. *Id.* at 7–9, 14–16. Patent Owner argues that there is no support in the record for Petitioner's reliance on the VAD control signal being used for the selection. *Id.* at 13, 15–16.

Patent Owner fails to acknowledge, however, that the MSC values used to select the denoising method are calculated "during the noise alone period," and that period is determined by an "effective voice activity detector." Ex. 1006, 11. Thus, the control signal of the VAD (which indicates when the "noise alone period" occurs) is indeed used to select the denoising method. As Petitioner argues, "Hussain discloses that the decision of which method is best for each sub-band is determined, at least in part, by the output of a VAD." Pet. 25 (citing Ex. 1006, 11).

For the claim 1 requirement 1[g] of subtracting noise waveform estimates from the acoustic signals, Petitioner relies on the disclosure in

Burnett of processing acoustic signals from microphones 1210 and 1220 to generate denoised acoustic signals using adaptively adjusted amplifier and filter circuit 1224, which produces signal 1230 as a noise waveform estimate associated with noise of the acoustic signals. Pet. 22–23 (citing Ex. 1003, Fig. 12, 17:49–18:17; Stern Decl. ¶¶ 66–67). Petitioner further relies on the disclosure in Burnett that the noise estimate 1230 "is set equal and opposite in sign to a speaker's microphone signal 1218," with which it is then summed, thus subtracting the noise estimate from the acoustic signal when the acoustic signal contains speech and noise. *Id.* at 23–24 (citing Ex. 1003, Fig. 12, 11:61–12:49, 17:49–18:17; Stern Decl. ¶¶ 67–68).

For the claim 1 requirement 1[h] of using a voice activity sensor independent from the microphone array, Petitioner relies on EM sensor 1240 of Burnett. Pet. 28–29 (citing Stern Decl. ¶¶ 79–80).

Other than as discussed above, Patent Owner does not specifically respond to any other of Petitioner's arguments regarding the requirements of independent claim 1. Nonetheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378. We determine, on the current record and for purposes of this Decision, that the information presented in the Petition demonstrates a reasonable likelihood that Petitioner will prevail in establishing that claim 1 is unpatentable under 35 U.S.C. § 103(a) over the combination of Burnett and Hussain.

5. Dependent Claims 2 and 5–7

Claim 2 requires the voice detection subsystem of claim 1 to further comprise:

> at least one glottal electromagnetic micropower sensor (GEMS) including at least one antenna for receiving the voice activity signals; and
>
> at least one voice activity detector (VAD) algorithm for processing the GEMS voice activity signals and generating the control signals.

Ex. 1001, 24:38–45. For the claim 2 requirements, Petitioner relies on the EM sensor of Burnett, which is described in Burnett as a GEMS, and which also is described as including an antenna. Pet. 29–31 (citing Ex. 1003, 2:62–65, 3:7–9, 18:38–41; Stern Decl. ¶¶ 83–85).

Claim 5 requires the voice detection subsystem of claim 1 to further comprise "at least one manually activated voice activity detector (VAD) for generating the voice activity signals." Ex. 1001, 24:60–63. For the claim 5 requirement, Petitioner relies on the disclosure in Holzrichter '175 (incorporated by reference in Burnett) of "[using] a finger or other body part to actuate a button or similar sensor device to start the operation of the EM sensor system." Pet. 31 (citing Ex. 1009, 17:43–48; Stern Decl. ¶¶ 87–88).

Claim 6 adds to claim 1 the requirement of

> a portable handset that includes the microphones, wherein the portable handset includes at least one of cellular telephones, satellite telephones, portable telephones, wireline telephones, Internet telephones, wireless transceivers, wireless communication radios, personal digital assistants (PDAs), and personal computers (PCs).

Ex. 1001, 24:64–25:3. Claim 7 adds to claim 6 the requirement that "the portable handset includes at least one of the voice detection subsystem and the denoising subsystem." *Id.* at 25:4–6. For these requirements, Petitioner relies on the disclosure in Burnett that its system "can be especially useful

for telephone and conference calls . . . .," and the disclosure in incorporated Holzrichter '694 "devices [that] can be used … for a variety of user chosen speech related applications" including a "[t]elephone receiver/transmitter unit with EM sensors." Pet. 32–33 (citing Ex. 1003, 1:24–32, 15:55–56; Ex. 1010, 11:17–32; Stern Decl. ¶¶ 89–91).

Other than its arguments directed to independent claim 1, which we find unavailing on the current record, Patent Owner does not specifically respond to Petitioner's arguments regarding dependent claims 2 and 5–7. *See generally* Prelim. Resp. Nonetheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378. We determine, on the current record and for purposes of this Decision, that the information presented in the Petition demonstrates a reasonable likelihood that Petitioner will prevail in establishing that claims 2 and 5–7 are unpatentable under 35 U.S.C. § 103(a) over the combination of Burnett and Hussain.

E. Alleged Obviousness of Claims 1–2, 5–13, and 26 over Burnett, Hussain, and Andrea

Petitioner challenges claims 1–2, 5–13, and 26 as obvious over the combination of Burnett, Hussain, and Andrea. Pet. 33–52.

1. Andrea

Andrea, titled "Noise Cancellation Apparatus," issued Oct, 20, 1998, from an application filed August 18,1997. Ex. 1004, codes (54), (45), (22). Andrea describes techniques to reduce ambient noise, using signal processing circuitry to cancel background noise signals detected at a sensor microphone. *Id.* at code (57). Figure 2 is reproduced below.

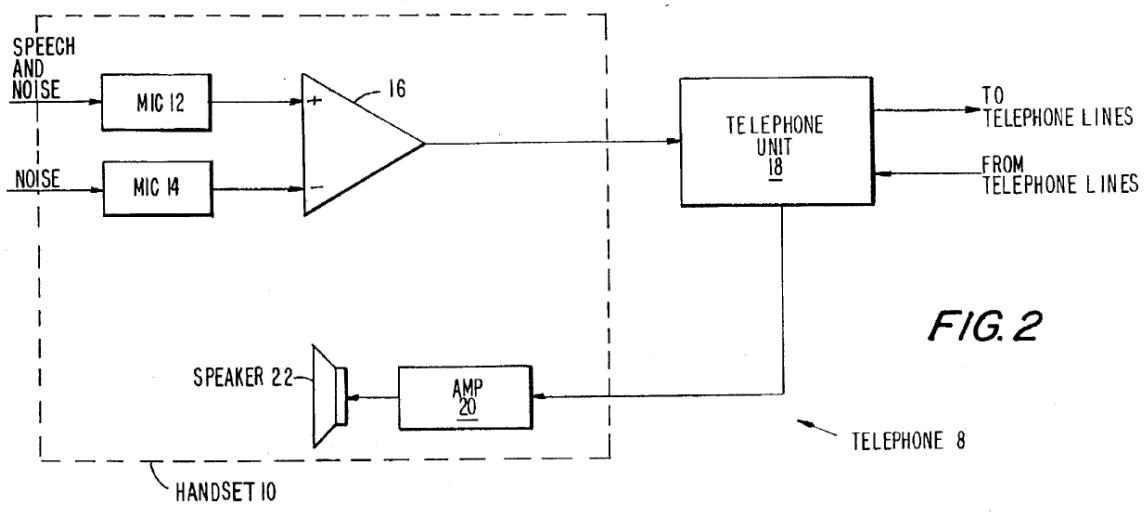


FIG. 2

Figure 2 is a block diagram of a noise cancellation apparatus, including microphone 12, which receives speech and background noise, microphone 14, which receives background noise, and operational amplifier 16, which subtracts the noise signal from microphone 14 from the speech and noise signal from microphone 12, thus supplying an electrical signal representing substantially the speech. Ex. 1004, 12:41–66.

Embodiments are disclosed for use in handsets and headsets, with the microphones positioned so that one receives speech and noise, and the other primarily receives noise. Ex. 1004, Figs. 1, 3A, 3B, 9A, 9B, 9C, 13:65–14:34, 14:49–53, 19:11–43, 19:65–20:14.

An "enhancement" of the noise cancellation system includes a "talk-thru" capability with a "VOX [voice activated transmission] circuit" that senses speech based on the microphone inputs, which allows audio transmission of voice to be heard in an earphone speaker without removal of a headset. Ex. 1004, Fig. 28, 33:44–34:61.

2. The Combination of Burnett, Hussain, and Andrea

Petitioner argues that one of ordinary skill would have been motivated to use the microphone configurations taught by Andrea in the Burnett/Hussain combination because Andrea and Burnett both address the problem of denoising speech, because Burnett's Figure 12 schematically suggests the configurations of the microphones, leading one of ordinary skill to look to Andrea for specific configuration details, including the disclosure in Andrea of the importance of positioning microphones so that they are phased properly to avoid canceling out speech, and because including Andrea in the combination would have been in accord with well-known techniques that would have led one of ordinary skill to have a reasonable expectation of success in using Andrea's microphone configurations with Burnett. Pet. 38–41 (citing Ex. 1003, Fig. 12, 15:55–57, 17:48–53; Ex. 1004, Title, Abstract, Fig. 1, 1:32–39, 7:30–35, 35:26–28; Stern Decl. ¶¶ 113–118).

Patent Owner does not specifically challenge the motivation for combining Andrea with the Burnett/Hussain combination. *See generally* Prelim. Resp. For purposes of this Decision, we determine that Petitioner has provided sufficiently articulated reasoning with rational underpinnings for the proffered combined teachings of Burnett, Hussain, and Andrea.

3. Claims 1–2 and 5–7

Petitioner challenges claims 1–2 and 5–7 as obvious over the combination of Burnett, Hussain, and Andrea as an alternative to its challenge to those claims based on the combination of Burnett and Hussain. Pet. 33.

In particular, for claim 1, Petitioner relies on the disclosure in Andrea of the two-microphone array that includes microphones 12 and 14 in Figure 2, in both handset and headset embodiments, arranged in accord with the requirements of the claim. Pet. 33–38 (citing Ex. 1004, Figs. 1, 2, 3A–3B, 9A–9B, 12:31–66, 13:65–14:29, 19:9–26, 19:35–41; Stern Decl. ¶¶ 99–109). Petitioner also relies on the handset embodiment of Andrea for its challenges to claims 6 and 7. Pet. 41–43 (citing Ex. 1004, Figs. 1, 3A–3B, 12:31–43; Stern Decl. ¶¶ 122–126).

Other than its arguments discussed above directed to independent claim 1 in the context of the Burnett/ Hussain combination, which we find unavailing on the current record, Patent Owner does not specifically respond to Petitioner's arguments regarding Petitioner's challenges to claims 1–2 and 5–7 as obvious over the combination of Burnett, Hussain, and Andrea. *See generally* Prelim. Resp. Nonetheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378. Although we have determined that the Petition demonstrates a reasonable likelihood that Petitioner will prevail in establishing that claims 1–2 and 5–7 are unpatentable over the combination of Burnett and Hussain alone, we also determine, on the current record and for purposes of this Decision, that the information presented in the Petition demonstrates a reasonable likelihood that Petitioner will prevail in establishing that claims 1–2 and 5–7 are unpatentable under 35 U.S.C. § 103(a) over the combination of Burnett, Hussain, and Andrea.

4. Claims 8–13 and 26

Claim 8 adds to claim 1 the requirement of a "portable headset that includes the microphones along with at least one speaker device." Ex. 1001,

25:7–9. Petitioner relies on the disclosure in Andrea of the headset embodiment including microphones 300 and 302 and a speaker. Pet. 43–45 (citing Ex. 1004, Figs. 9A–9E, 19:63–20:11; Stern Decl. ¶¶ 130–133).

Claim 9 adds to claim 8 the requirement that "the portable headset couples to at least one communication device selected from among cellular telephones, satellite telephones, portable telephones, wireline telephones, Internet telephones, wireless transceivers, wireless communication radios, personal digital assistants (PDAs), and personal computers (PCs)." Ex. 1001, 25:10–15. Petitioner relies on the disclosure in Andrea that the headset "can interface with computers, telephones or other equipment." Pet. 45–47 (citing Ex. 1004, Fig. 9D, 20:42–48, 26:2–10, 26:15–16; Stern Decl. ¶ 135). Petitioner also relies on disclosure in incorporated Holzrichter '694 of a "[t]elephone receiver/transmitter unit with EM sensors." *Id.* at 46 (citing Ex. 1010, 11:17–32; Stern Decl. ¶ 134).

Claim 10 adds to claim 9 the requirement that "the portable headset couples to the communication device using at least one of wireless couplings, wired couplings, and combination wireless and wired couplings." Ex. 1001, 25:16–19. Petitioner relies on the disclosure in Andrea discussed above for claim 9. Pet. 47–48 (citing Stern Decl. ¶¶ 137–139).

Claim 11 adds to claim 9 the requirement that "the communication device includes at least one of the voice detection subsystem and the denoising subsystem." Ex. 1001, 25:20–22. Petitioner argues that one of ordinary skill would have understood that, when implementing Burnett's system as a system that includes a portable headset as discussed for claim 8, one option would be to connect the headset (comprising the microphones) to

a device (e.g., phone) containing the voice detection and/or denoising subsystems. Pet. 48–49 (citing Stern Decl. ¶¶ 140–141).

Claim 12 adds to claim 8 the requirement that "the portable headset includes at least one of the voice detection subsystem and the denoising subsystem." Ex. 1001, 25:23–25. Petitioner relies on the disclosure in Andrea of a headset that includes a noise cancellation subsystem. Pet. 49–50 (citing Ex. 1004, 19:54–20:47, 22:41–52; Stern Decl. ¶¶ 142–144).

Claim 13 adds to claim 8 the requirement that "the portable headset is a portable communication device selected from among cellular telephones, satellite telephones, portable telephones, wireline telephones, Internet telephones, wireless transceivers, wireless communication radios, personal digital assistants (PDAs), and personal computers (PCs)." Ex. 1001, 25:26–31. Petitioner relies on the disclosure in Andrea of a portable headset that "can interface with computers, telephones or other equipment," and the disclosure in incorporated Holzrichter '175 of that "acoustic signals can be outputted on wireless or cable links[.]". Pet. 50–52 (citing Ex. 1004, 26:7–13; Ex. 1009, 18:49–67, Stern Decl. ¶¶ 145–148). Petitioner argues that accomplishing the coupling between the portable headset and Burnett's subsystems wirelessly means that the portable headset is at least a wireless transceiver or a wireless communication radio. *Id.*

Claim 26 essentially adds the requirements of claims 8, 9, and 11 to claim 1. Ex. 1001, 26:10–57. Petitioner refers to the arguments for those claims. Pet. 52.

Other than its arguments directed to independent claim 1, which we find unavailing on the current record, Patent Owner does not specifically respond to Petitioner's arguments regarding dependent claims 8–13 and 26.

See generally Prelim. Resp. Nonetheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378. We determine, on the current record and for purposes of this Decision, that the information presented in the Petition demonstrates a reasonable likelihood that Petitioner will prevail in establishing that claims 8–13 and 26 are unpatentable under 35 U.S.C. § 103(a) over the combination of Burnett, Hussain, and Andrea.

F. Alleged Obviousness of Claims 14–25 over Burnett, Hussain, Andrea, and Sasaki

Petitioner challenges claims 14–25 as obvious over the combination of Burnett, Hussain, Andrea, and Sasaki.[8] Pet. 52–61.

1. Sasaki

Sasaki, titled "Microphone Apparatus," was filed May 7, 1993, and issued November 28, 1995. Ex. 1005, codes (54), (22), (45). Sasaki discloses an omnidirectional microphone designed to pick up a desired signal and a unidirectional microphone pointed away from the desired signal to serve as a reference. *Id.* at code (57), Fig. 3, 3:9–14. Sasaki also discloses using two unidirectional microphones to pick up a desired signal and a reference. *Id.* at code (57), Fig. 6, 6:6–20. Petitioner cites Sasaki as evidence that it would have been obvious to use different combinations of omnidirectional and unidirectional microphones. Pet. 52–55, 58, 60–61. Petitioner argues that combining Sasaki with the Burnett/Hussain/Andrea

[8] Petitioner also challenges claims 14–25 as obvious over the combination of Burnett, Hussain, and Sasaki. Pet. 52. It is unnecessary at this stage to consider this alternative challenge.

combination is motivated by the fact that the references each are directed to removing noise from speech, that Burnett teaches the importance of shielding speech signals from the reference microphone, which problem is addressed in Sasaki, that unidirectional microphones were well known, and that the choice between using omnidirectional versus unidirectional microphones was predictable and provided reasonable expectations of success. Pet. 53–55 (citing Stern Decl. ¶¶ 159–163).

Patent Owner does not specifically challenge the motivation for combining Sasaki with the Burnett/Hussain/Andrea combination. *See generally* Prelim. Resp. For purposes of this Decision, we determine that Petitioner has provided sufficiently articulated reasoning with rational underpinnings for the proffered combined teachings of Burnett, Hussain, Andrea, and Sasaki.

2. Dependent Claims 14–25

Claim 14 adds to claim 1 the requirement that "the first microphone is a unidirectional microphone and the second microphone is a unidirectional microphone." Ex. 1001, 25:32–34. For this requirement, Petitioner relies on the disclosure in Sasaki of an embodiment with two unidirectional microphones. Pet. 52–53 (citing Ex. 1005, Fig. 6, 6:6–20; Stern Decl. ¶ 158).

Claim 15 adds to claim 14 the requirement that "the first microphone and the second microphone are separated by a distance in a range of approximately zero (0) centimeters to 15 centimeters." Ex. 1001, 25:35–38. For this requirement, Petitioner relies on the disclosure in Andrea that the microphones are in "relatively close proximity to each other," such as

within .5 inches (1.27 centimeters) of each other. Pet. 56 (citing Ex. 1004, Figs. 1, 3A–3B, 12:38–40, 19:44–50; Stern Decl. ¶¶ 165–168).

Claims 16–18 each add to claim 14 the requirement that the angle specified in claim 1 (the angle that the position of the second microphone forms relative to the position of the first microphone) is "approximately greater than zero (0) degrees and one of equal to and less than 180 degrees" for claim 16, ". . . . equal to and less than 135 degrees" for claim 17, and ". . . . equal to and greater [sic] than 90 degrees" for claim 18. Ex. 1001, 25:39–47. For these requirements, Petitioner relies on the disclosure in Burnett showing microphones at a 180-degree angle, and the disclosure in Andrea that the angle between microphones 12 and 14 in Figure 3B is "preferably … between 30° and 60°," and the angle between the microphones in Figure 9A may be up to 180°. Pet. 57–58 (citing Ex. 1004, 14:5–32; Stern Decl. ¶¶ 169–174).

Claim 19 adds to claim 1 the requirement that "the first microphone is an omnidirectional microphone and the second microphone is a unidirectional microphone," and claim 24 requires the opposite. Ex. 1001, 25:48–50, 26:3–5. Petitioner relies on the disclosures in Sasaki regarding the use of unidirectional and omnidirectional microphones. Pet. 58–61 (citing Ex. 1005, Fig. 3, 3:10–15, 8:4–14; Stern Decl. ¶¶ 175–177, 182–184).

Claims 20 and 25 add to claims 19 and 24, respectively, the requirement that "the first microphone and the second microphone are separated by a distance approximately in a range of zero (0) centimeters to 15 centimeters." Ex. 1001, 25:51–54, 26:6–9. Petitioner refers to the

arguments for claim 15, discussed above, which adds the same requirement to claim 14. Pet. 59, 61.

Claims 21–23 each add to claim 19 the requirement that the angle specified in claim 1 (the angle that the position of the second microphone forms relative to the position of the first microphone) "is approximately in a range of 30 degrees to 180 degrees" for claim 21, "is approximately in a range of 60 degrees to 180 degrees" for claim 22, and "is approximately in a range of 90 degrees to 180 degrees" for claim 23. Ex. 1001, 25:55–26:2. For these requirements, Petitioner refers to the arguments for claims 16–18, discussed above, which add the same requirements to claim 14. Pet. 59–60.

Other than its arguments directed to independent claim 1, which we find unavailing on the current record, Patent Owner does not specifically respond to Petitioner's arguments regarding dependent claims 14–25. *See generally* Prelim. Resp. Nonetheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378. We determine, on the current record and for purposes of this Decision, that the information presented in the Petition demonstrates a reasonable likelihood that Petitioner will prevail in establishing that claims 14–25 are unpatentable under 35 U.S.C. § 103(a) over the combination of Burnett, Hussain, Andrea, and Sasaki.

G. Alleged Obviousness of Claim 3 over Burnett, Hussain, Andrea, and Puthuff and of Claim 4 over Burnett, Hussain, Andrea, and Alcivar

Petitioner challenges claim 3 as obvious over the combination of Burnett, Hussain, Andrea, and Puthuff, and claim 4 over the combination of Burnett, Hussain, Andrea, and Alcivar.[9] Pet. 62–69.

Claim 3 requires the voice detection subsystem of claim 1 to further comprise:

> at least one accelerometer sensor in contact with skin for receiving the voice activity signals; and
>
> at least one voice activity detector (VAD) algorithm for processing the accelerometer sensor voice activity signals and generating the control signals.

Ex. 1001, 24:46–52. For claim 3, Petitioner relies on Puthuff, which discloses a system that includes "sens[ing] sound through bone conduction," in which a user's voice is detected in part using a "vibration sensor," which may be an "accelerometer," which "is a transducer device which senses the vibratory displacement of the bones in proximity to the ear as imparted primarily by vibrations during speech." Pet. 62–63 (citing Ex. 1007, 4:13–21, 5:1–9, 6:6–10, 8:12–19, 9:1–6; Stern Decl. ¶¶ 188–191). Petitioner argues that it would have been obvious to one of ordinary skill in the art to use the accelerometer of Puthuff as the VAD in the Burnett/Hussain/Andrea combination. Pet. 64–66 (citing Stern Decl. ¶¶ 192–198).

[9] Petitioner also challenges claim 3 as obvious over the combination of Burnett, Hussain, and Puthuff, and claim 4 over the combination of Burnett, Hussain, and Alcivar. Pet. 62, 66. It is unnecessary at this stage to consider these alternative challenges.

Claim 4 requires a "skin-surface microphone sensor in contact with skin for receiving the voice activity signals," along with a VAD algorithm to generate the control signals. Ex. 1001, 24:53–59. For claim 4, Petitioner relies on Alcivar, which discloses speech detection using a "tissue-conduction microphone" "positioned in contact with the user's neck tissue in the vicinity of the larynx" to detect "tissue vibrations due to modulation of the vocal chords [sic] (speech)." Pet. 66–67 (citing Ex. 1008, code (57), 1:5–8, 1:21–28, 1:31–33, 4:65–5:12, 5:55–67, 8:3–16). Petitioner argues that it would have been obvious to one of ordinary skill in the art to use the tissue-conduction microphone of Alcivar as the VAD in the Burnett/Hussain/Andrea combination. Pet. 67–69 (citing Stern Decl. ¶¶ 199–209).

Other than its arguments directed to independent claim 1, which we find unavailing on the current record, Patent Owner does not specifically respond to any other of Petitioner's arguments regarding claims 3 and 4. *See generally* Prelim. Resp. Nonetheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378. We determine, on the current record and for purposes of this Decision, that the information presented in the Petition demonstrates a reasonable likelihood that Petitioner will prevail in establishing that claim 3 is unpatentable under 35 U.S.C. § 103 over the combination of Burnett, Hussain, Andrea, and Puthuff, and claim 4 is unpatentable under 35 U.S.C. § 103(a) over the combination of Burnett, Hussain, Andrea, and Alcivar.

IV. CONCLUSION

After considering the evidence and arguments presented in the Petition and the Preliminary Response, Petitioner has established a reasonable likelihood of prevailing on its assertion that at least one claim of the '543 patent is unpatentable. Accordingly, we institute an *inter partes* review on all the challenged claims and all of the grounds presented in the Petition. At this stage of the proceeding, we have not made a final determination as to the patentability of these challenged claims.

V. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that Petitioner's Motion For Joinder To And Consolidation With Related *Inter Partes* Review IPR2023-00275 is denied as moot;

FURTHER ORDERED that pursuant to 35 U.S.C. § 314, *inter partes* review is instituted as to the challenged claims of the '543 patent with respect to all grounds of unpatentability presented in the Petition; and

FURTHER ORDERED that *inter partes* review is commenced on the entry date of this Order, and pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial.

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