

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

AMAZON.COM, INC.,

Petitioner,

v.

JAWBONE INNOVATIONS, LLC,

Patent Owner.

Patent No. 8,503,691

Filing Date: June 13, 2008

Issue Date: August 6, 2013

Inventor: Gregory C. Burnett

Title: VIRTUAL MICROPHONE ARRAYS USING DUAL
OMNIDIRECTIONAL MICROPHONE ARRAY (DOMA)

PATENT OWNER'S PRELIMINARY RESPONSE

Case No. IPR2023-00561

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I. INTRODUCTION

On February 3, 2023, Amazon.com, Inc. (“Amazon” or “Petitioner”) filed a Petition requesting *inter partes* review of claims 23-28 and 41-46 (“Challenged Claims”) of U.S. Patent No. 8,503,691 (the “’691 Patent”) (Ex. 1001). Paper 2 (“Petition” or “Pet.”). The Declaration of Jeffrey S. Vipperman, Ph.D. (Ex. 1003) accompanied the Petition. On February 15, 2023, the Board issued a Notice of Filing Date Accorded for the Petition and set the time for filing patent owner’s preliminary response. Paper 5.

The Board should deny Amazon’s Petition because (1) Amazon’s Petition is based almost entirely on hindsight and its motivation to modify the art to arrive at the claims is based on incorrect factual assumptions—Amazon’s assumptions are ***directly contradicted*** by the art to which it cites; (2) Amazon’s prior art references fail to disclose or render obvious the key limitations and concepts of the Challenged Claims; more specifically, “the second linear response to noise is substantially similar to the first linear response to noise and the second linear response to speech is substantially dissimilar to the first linear response to speech” limitation which is present in each Challenged Claim; and (3) Amazon’s motivations to combine Kanamori and McCowan are pure speculation.

II. THE '691 PATENT

The '691 Patent discloses and claims apparatuses for implementing “dual omnidirectional microphone array noise suppression.” '691 Patent, Abstract. The prior art was concerned with “nulling out noise sources” to reduce noise. *Id.* By contrast, the '691 Patent forms a null to remove *speech* from its noise signal. *Id.*; *see also id.*, 4:61-5:2. This highly effective removal of speech from the noise signal enables the invention to effectively remove noise from its speech signal. *Id.*, Abstract.

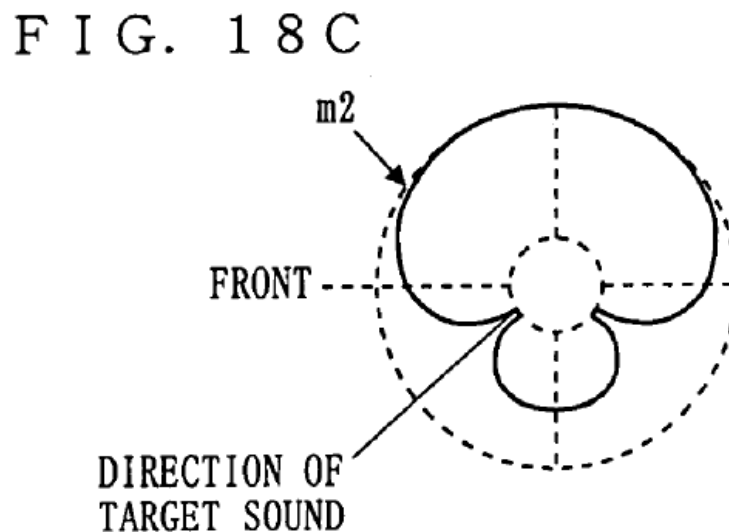
The '691 Patent uses at least two physical microphones to generate virtual microphones which have similar noise responses and dissimilar speech responses. *Id.*, Abstract; 3:40-52. In embodiments, one of the signals will have a null in the direction of speech, which results in a “clean” noise signal. *Id.*, 3:62-67, 4:67-5:2, 11:21-40. With speech removed from the noise signal, the noise signal can then, in turn, be used to effectively remove noise from the speech. *Id.*, 13:6-14.

III. THE ALLEGED PRIOR ART

A. Kanamori (U.S. Patent Application Publication No. 2004/0185804)

Kanamori is directed to “a microphone device and an audio player which detects a desired sound coming from a specific direction with noise being suppressed.” Ex. 1005 at [0002]. Kanamori’s system comprises “a microphone device which detects a target sound coming from a direction of the target sound”

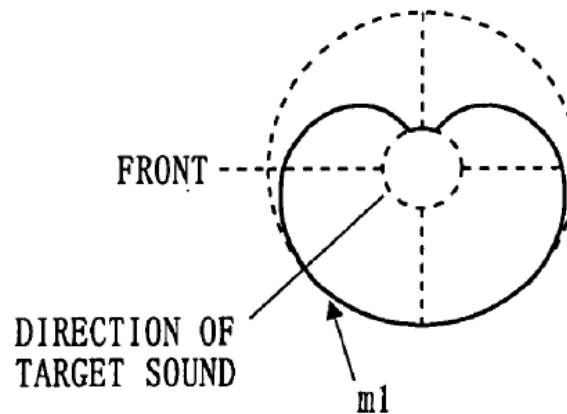
which includes “a signal generating section, a determining section, an adaptive filter section, a subtracting section, and a noise suppressing section.” Kanamori’s “signal generating section” generates both a “main signal . . . with a sensitivity in the direction of the target sound and a noise reference signal . . . with a sensitivity higher in another direction than in the direction of the target sound.” *Id.* at [0019]. Kanamori’s noise reference signal includes signals from both the target sound and noise, requiring an “adaptive filter section” to generate “a signal indicative of a signal component of the target sound included in the noise reference signal.” *Id.* Consistent with that approach, Kanamori’s noise reference signal (“m2”) includes multiple nulls:



Id. at Fig. 18C; *see also id.* at Figs. 1, 8, 10-12, 16B, 17B-C, 19, and 20. Kanamori similarly contemplates a main signal (m1) with a different directivity pattern than its

noise reference in the direction away from speech, generally including at least one null directed away from a speech source:

F I G. 1 8 B



Id. at Fig. 18B; *see also id.* at Figs. 1, 8, 10-12, 14-15, and 20.

Kanamori discusses at least 11 separate embodiments of its system, variously comprising up to six microphones. *Id.* at [0193].

B. McCowan (Iain A. McCowan et al., *Near-Field Adaptive Beamformer for Robust Speech Recognition*, Digital Signal Processing, Vol. 12, Issue 1 (2002), 87-106)

The McCowan paper discusses a near-field adaptive beamformer (“hereinafter “NFAB”) “implemented using the standard generalized sidelobe canceler (GSC) system structure.” Ex. 1006 at 87. Specifically, McCowan contemplates “a fixed near-field superdirective beamformer” (hereinafter “NFSD”) used with “a near-field compensation unit” and “a standard generalized sidelobe canceling blocking matrix and adaptive filters.” *Id.* at 90-91. McCowan’s

experimental system used an eleven-microphone array split into four sub-arrays associated with different frequency ranges. *Id.* at 96.

McCowan’s NFSD comprises an “upper path,” while “[t]he blocking matrix and adaptive filters essentially implement a conventional (nonsuperdirective) beamformer that adaptively focuses on the major sources of noise” comprising a “lower path.” *Id.* at 98. McCowan’s upper path NFSD includes at least four nulls, while its lower path NFAB includes at least two nulls, and many more at higher frequencies:

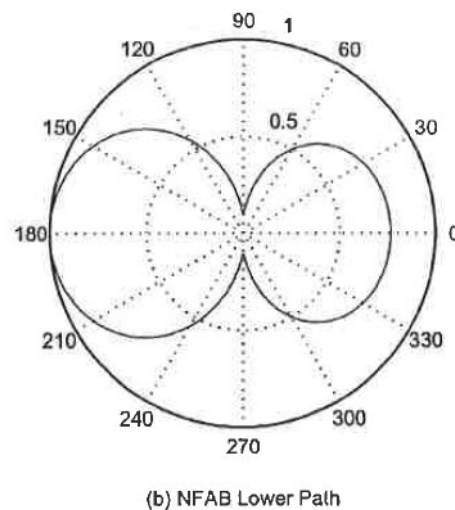
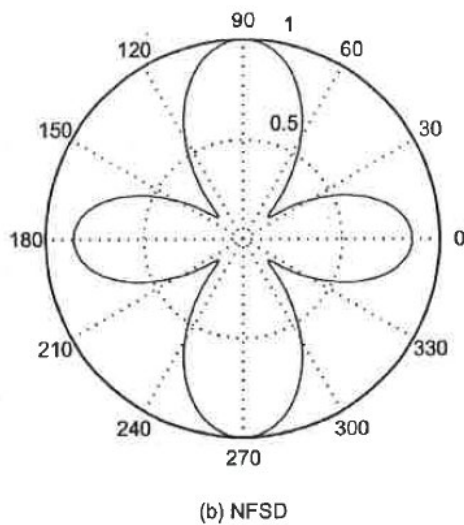


FIG. 6. Upper path directivity pattern at 300 Hz. FIG. 7. Lower path directivity pattern at 300 Hz.

Id. at 98-99. The “overall beamformer directivity pattern” of McCowan’s NFAB also includes four nulls. *Id.* at 100.

McCowan contemplates that the discussed beamformers will be applied in near-field environments, and specifically notes that it employs “a spherical

propagation model in its formulation, *rather than assuming a far-field model.*” *Id.* at 88 (emphasis added).

IV. CLAIM CONSTRUCTION

For the purposes of this Preliminary Response only, Patent Owner believes that claim construction is not required to resolve any issues.

V. LEVEL OF ORDINARY SKILL IN THE ART

For the purposes of this Preliminary Response only, Patent Owner utilizes Petitioner’s proposed level of skill in the art—“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.” Pet. at 4, 5.

VI. LEGAL STANDARD

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 skill in the art, and (4) where in evidence, so called secondary considerations. *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17–18 (1966). A claim is only unpatentable under 35 U.S.C. § 103 if “the differences between the subject matter sought to be patented 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) (quoting 35 U.S.C. § 103).

“An invention is not obvious simply because all of the claimed limitations were known in the prior art at the time of the invention. Instead, we ask ‘whether there is a reason, suggestion, or motivation in the prior art that would lead one of ordinary skill in the art to combine the references, and that would also suggest a reasonable likelihood of success.’” *Forest Lab ’ys, LLC v. Sigmapharm Lab ’ys, LLC*, 918 F.3d 928, 934 (Fed. Cir. 2019). “Of course, concluding that the references are within the scope and content of the prior art to be considered for obviousness does not end the inquiry. *Graham* makes clear that the obviousness inquiry requires a determination whether the claimed invention would have been obvious to a skilled artisan.” *Apple Inc. v. Samsung Elecs. Co.*, 839 F.3d 1034, 1050 n.14 (Fed. Cir. 2016).

VII. ARGUMENT

A. Kanamori and McCowan Do Not Render Obvious Claims 23-28 and 41-46

1. Dr. Vipperman’s Analysis is Based Entirely on Hindsight

Amazon’s Petition is based almost entirely on hindsight and speculation cloaked in an expert declaration. The claims of the ’691 Patent identify specific

combinations of microphones, virtual microphones, linear responses to speech and noise and locations/absences of nulls. The claimed combinations do not exist in the prior art. More specifically, the prior art does not disclose or depict any responses to either speech or noise which are all explicitly required by the Challenged Claims. Amazon relies instead on “simulations” purportedly run by its expert Dr. Vipperman in 2022 to arrive at the claims. This type of analysis constitutes impermissible hindsight, and the Petition should be denied.

Amazon relies on Dr. Vipperman’s “simulations” in numerous places throughout the Petition. Pet. at 19, 22, 26, 27, 37, 38, and 40–42. Neither Amazon in its Petition nor Dr. Vipperman in his Declaration identify how these simulations were performed. Dr. Vipperman does not disclose any source code for running his simulations, or even what system could be used to run these simulations. Dr. Vipperman also fails to identify all of the inputs to the alleged simulations. At this stage, without the tools necessary to evaluate Dr. Vipperman’s simulations, the Board should reject Dr. Vipperman’s analysis based on the alleged simulations and, because the Petition relies on Dr. Vipperman’s analysis to support all “response” limitations, the Board should deny the Petition in its entirety.

Dr. Vipperman’s simulations also suffer from a fatal flaw—reliance on a “1000 Hz signal” as an input for both noise and speech. Pet. at 22. (referencing “a 1000 Hz signal located 0.1 m (speech))” *Id.* However, 1000 Hz is not a valid speech

signal. Instead, a speech signal should be well below 1000 Hz and potentially in the 100 Hz to 300 Hz range. McCowan, for example, states “the main objective of the proposed technique is to produce an adaptive beamformer that exhibits good *low frequency* performance for *near-field* speech sources.” Ex. 1006 at 97. McCowan further states “[l]ow frequency performance is critical for speech processing applications, as significant speech energy is located **below 1 kHz**.” *Id.* at 88 (emphasis added). Moreover, the claims of the ’691 Patent specify “wherein the speech is human speech.” ’691 Patent at Claim 23. Therefore, Dr. Vipperman should not have used 1 kHz as the speech input for his simulations as a POSITA would not have been motivated to analyze 1 kHz speech inputs. Without simulations at the proper frequencies, Amazon cannot show that Kanamori or McCowan teach explicitly or render obvious that “the second linear response to noise is **substantially similar** to the first linear response to noise and the second linear response to speech is **substantially dissimilar** to the first linear response to speech.”

Accordingly, the Petition should be denied in its entirety.

2. Amazon’s Combination Does Not Disclose or Render Obvious “the second linear response to noise is substantially similar to the first linear response to noise and the second linear response to speech is substantially dissimilar to the first linear response to speech” as Required by Claims 23-28 and 41-46

Claim 23 and its dependent Claims (24-26), Claims 27 and 28, and Claim 41 and its dependent Claims (42-46) require “the second linear response to noise is substantially similar to the first linear response to noise and the second linear response to speech is substantially dissimilar to the first linear response to speech.”¹

Amazon admits that Kanamori does not disclose this limitation but argues that it would be obvious over Kanamori in view of McCowan. Pet. at 25-39, 52-53, 54-63, and 67-71. In particular, Amazon argues that “[i]t would have been obvious to modify Kanamori’s Figure 17A to implement McCowan’s near-field compensation for when the speech source is in the near field.” *Id.* at 26.

¹ Claim 28 requires the similar limitation “the second linear response to noise being substantially the first linear response to noise, and the second linear response to speech being substantially dissimilar to the first linear response to speech.” Amazon does not suggest this phrase’s meaning is different than “the second linear response to noise being substantially similar to the first linear response to noise, and the second linear response to speech being substantially dissimilar to the first linear response to speech” and cites to arguments relating to Claim 23. Pet. at 60.

As discussed below, a POSITA would not have been motivated to modify Kanamori to include McCowan's near-field compensation. Moreover, even assuming that a POSITA was motivated to make such a modification, Amazon has not shown that the resulting combination would disclose or render obvious "the second linear response to noise being substantially similar to the first linear response to noise, and the second linear response to speech being substantially dissimilar to the first linear response to speech."

The claims require comparing the linear responses "across a plurality of frequencies for a speech source." '691 Patent, cl. 1, 29. Amazon attempts to show that the first and second linear responses are substantially dissimilar regarding a 1000 Hz signal. Pet. at 41-42 ("Dr. Vipperman also simulated and plotted m1's and m2's linear responses, respectively, *to a 1000 Hz signal* originating 0.1 m (speech) from the microphone array, assuming a speech direction of 0°" (emphasis added)). However, Amazon makes no effort to show that the responses are dissimilar with respect to any other frequency. *See id.*

Accordingly, Amazon has not shown that its combination discloses or renders obvious this limitation. The Board should, therefore, deny the Petition.

3. Amazon Does Not Show That a POSITA Would Be Motivated to Combine Kanamori with McCowan

Amazon argues that the claims are rendered obvious over a combination of Kanamori with McCowan’s “near-field compensation.” Pet. at 26. Amazon’s obviousness arguments are predicated on the idea that “[i]t would have been obvious to implement Kanamori’s microphone device in a device intended to receive near-field speech, such as a headset.” Pet. at 28. Amazon provides no support for its contention.

In arriving at an obviousness determination, the Board must sufficiently explain and support the conclusions that the prior art references disclose all of the elements recited in the Challenged Claims and a relevant skilled artisan not only could have made but would have been motivated to combine all the prior art references in the way the patent claims. *Pers. Web Techs., LLC v. Apple, Inc.*, 848 F.3d 987, 994 (Fed. Cir. 2017). That is, even if all the claim elements are found across a number of references, an obviousness determination must consider whether a POSITA would have been motivated to combine those references. *Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1368 (Fed. Cir. 2016); *Los Angeles Biomedical Rsch. Inst. at Harbor-UCLA Med. Ctr. v. Eli Lilly and Co.*, 849 F.3d 1049, 1067 (Fed. Cir. 2017) (vacating and remanding an obviousness determination, in part, because the Board did not make factual findings as to whether

there was an apparent reason to combine all three prior art references to achieve the claimed invention and whether a POSITA would have had a reasonable expectation of success from such a combination). This combination determination, as supported by an articulated motivation to combine, requires a plausible rationale as to why those prior art references would have worked together. *Broadcom Corp. v. Emulex Corp.*, 732 F.3d 1325, 1335 (Fed. Cir. 2013). Absent some articulated rationale, a “common sense” finding is no different than the conclusory statement “would have been obvious.” *In re Van Os*, 844 F.3d 1359, 1361 (Fed. Cir. 2017). Of additional importance, “knowledge of a problem and motivation to solve it are entirely different from motivation to combine particular references.” *Innogenetics, N.V. v. Abbott Lab’ys*, 512 F.3d 1363, 1373 (Fed. Cir. 2008).

Amazon’s argument that a POSITA would have used Kanamori to implement a headset is entirely based on scattered statements throughout Kanamori discussing “loudspeakers or calling.” Pet. at 10, 21-22; Pet. at 28 (citing Pet. at 21-22). Nothing in Kanamori discusses the use of headsets; instead, the reference to “loudspeakers” indicates that “calling” refers to conference-room type speakerphones. Indeed, the only exemplary distances between an audio source and microphone in Kanamori are far greater than would be found in a headset. *E.g.*, Ex. 1005, Fig. 9 (showing 50cm between “talker” and microphone). Kanamori further discusses that the invention should be used in areas where reflected waves may be generated by the physical

structure of embodiment devices, “such as a box to which the microphone unit is mounted or a substance that surrounds the microphone device.” *Id.*, [0084].

Amazon’s expert provides no stronger basis to combine the two references. Indeed, Dr. Vipperman merely parrots Amazon’s attorney argument. *See* Ex. 1003, ¶ 69.

Implementing McCowan’s “near-field compensation” would render Kanamori useless for its intended purpose: providing a microphone device that operates well “in a noisy environment or a reflective sound field . . . such as being used for loudspeakers or calling.” *E.g.*, Ex. 1005, [0115]. Including McCowan’s near-field compensation would render the device useless for anything other than a headset or other near-field-only device. And Kanamori is intended to provide a microphone device that provides good far-field receptions, such as a “video recorder” or “loudspeaker.” *Id.*, [0115], [0151], [0188]. A POSITA would not be motivated to destroy the objective of the prior art. *Trivascular, Inc. v. Samuels*, 812 F.3d 1056, 1068 (Fed. Cir. 2016); *Chemours Co. FC, LLC v. Daikin Indus., Ltd.*, No. 2020-1289, 2021 WL 3085514, at *4-*5 (Fed. Cir. July 22, 2021).

The Petition should, therefore, be denied.

VIII. CONCLUSION

As discussed above, Amazon's combination fails to disclose key limitations of each claim of the '691 Patent, and therefore, does not anticipate or render obvious any claims. The Board should, therefore, deny the Petition.

Respectfully submitted,

Dated: May 15, 2023

By: /Peter Lambrianakos /
Peter Lambrianakos (Reg. No. 58,279)
Lead Counsel for Patent Owner
FABRICANT LLP
411 Theodore Fremd Avenue,
Suite 206 South
Rye, New York 10580
Tel. 212-257-5797
Fax. 212-257-5796
Email: plambrianakos@fabricantllp.com

CERTIFICATE OF WORD COUNT

The undersigned hereby certifies that the portions of the above-captioned PATENT OWNER'S PRELIMINARY RESPONSE specified in 37 C.F.R. § 42.24 has 2,846 words in compliance with the 14,000 word limit set forth in 37 C.F.R. § 42.24. This word count was prepared using Microsoft Word for Office 365.

Respectfully submitted,

May 15, 2023

By: /Peter Lambrianakos /
Peter Lambrianakos (Reg. No. 58,279)
Lead Counsel for Patent Owner
FABRICANT LLP
411 Theodore Fremd Avenue,
Suite 206 South
Rye, New York 10580
Tel. 212-257-5797
Fax. 212-257-5796
Email: plambrianakos@fabricantllp.com

CERTIFICATE OF SERVICE

A copy of the foregoing Patent Owner's Preliminary Response has been served on Petitioner's counsel of record as follows:

Colin B. Heideman
Email: 2cbh@knobbe.com
Email: BoxSEAZN2L1925LP12@knobbe.com
Nathan D. Reeves
Email: 2ndr@knobbe.com
Logan P. Young
Email: 2lpy@knobbe.com
KNOBBE, MARTENS, OLSON & BEAR, LLP
925 Fourth Avenue, Suite 2500
Seattle, WA 98104

Joseph R. Re
Email: 2jrr@knobbe.com
KNOBBE, MARTENS, OLSON & BEAR, LLP
925 Fourth Avenue, Suite 2500
Seattle, WA 98104

Attorneys for Amazon.com, Inc.

May 15, 2023

By: /Peter Lambrianakos /
Peter Lambrianakos (Reg. No. 58,279)
Lead Counsel for Patent Owner
FABRICANT LLP
411 Theodore Fremd Avenue,
Suite 206 South
Rye, New York 10580
Telephone: 212-257-5797
Fax: 212-257-5796