

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

META PLATFORMS, 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. IPR2024-00349

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EXHIBIT LIST

Exhibit No.	Description of Document
2001	Declaration of Akbar M. Sayeed, Ph.D.
2002	Curriculum Vitae of Akbar M. Sayeed, Ph.D.
2003	Excerpts of MICROPHONE ARRAYS: SIGNAL PROCESSING TECHNIQUES AND APPLICATIONS, Ch. 18, Future Directions in Microphone Array Processing (Michael Brandstein & Darren Ward eds., Springer-Verlag 2001) (“Brandstein”)

I. INTRODUCTION

The Petition raises arguments that the Board already rejected while denying institution of Meta’s Petition in IPR2023-01130. *Meta Platforms, Inc. v. Jawbone Innovations, LLC*, IPR2023-01130, Paper 10 (P.T.A.B. Dec. 28, 2023) (denying Petition for failure to show that Brandstein discloses virtual microphones with “substantially similar . . . response[s] to noise.”); *see also Meta Platforms, Inc. v. Jawbone Innovations, LLC*, IPR2023-01130, Paper 12 (P.T.A.B. Feb. 22, 2024) (reaffirming decision, denying request for rehearing). This patent includes the same limitation, and Meta raises essentially the same arguments regarding Brandstein’s disclosure. Institution of this Petition should be denied for the same reasons.

In the -01130 proceeding, Meta argued that the “substantially similar . . . response[s] to noise” was rendered obvious by Brandstein’s Fig. 5.2. The Board rejected that argument, finding that the overall directivity depicted in Fig. 5.2 does not disclose the response of any component virtual microphone, and because other disclosure, including Fig. 5.3, “refutes Petitioner’s assertion [that] the virtual microphone noise responses are substantially similar.” IPR2023-01130, Paper 10 at 24.

This Petition presents the same deficiencies the Board identified in IPR2023-01130. The Board already found that Meta’s reliance on Brandstein’s Fig. 5.2 was misplaced, and that Brandstein’s other discussion, as well as Fig. 5.3, refute Meta’s

arguments that the virtual microphones of Brandstein's Griffiths-Jim beamformer ("GJBF") have substantially similar responses to noise:

We agree with Patent Owner that the record does not support Petitioner's assertion that Brandstein teaches or suggests the independent claim requirement, "wherein the first virtual microphone and the second virtual microphone are distinct virtual directional microphones with substantially similar responses to noise." Contrary to Petitioner's interpretation of Brandstein Figure 5.2, that figure does not lead to an inference that the individual microphone responses have similar responses to noise. Prelim. Resp. 12–13. In effect, Petitioner is arguing that knowing that the sum of two numbers is equal to "2" necessarily means that each number is "1", as opposed, for example, to one number being "2" and the other "0".

Moreover, as discussed above, Brandstein's description of Figure 5.1 demonstrates that the virtual microphones of Brandstein do not have "substantially similar responses to noise." Prelim. Resp. 9–11. Likewise, Figure 5. 3 of Brandstein also refutes Petitioner's assertion the virtual microphone noise responses are substantially similar. Prelim. Resp. 13.

IPR2023-01130, Paper 10 at 24-25. The Board reaffirmed its finding in denying Meta's request for rehearing, stating that:

[Figure 5.2] does not lead to an inference that the individual microphone responses have similar responses to noise. . . . Thus, Petitioner's sole basis for arguing that Brandstein teaches the noise response requirement is flawed. . . . Even if we were to agree with the construction of the noise response requirement now asserted by Petitioner in the Request, Petitioner's flawed reliance on Figure 5.2 of Brandstein still undercuts all of the unpatentability challenges raised by Petitioner, inevitably

leading to the Board's Decision Denying Institution of
Inter Partes Review.

IPR2023-01130, Paper 12 at 5-6. The Board further found that “Brandstein’s disclosure does not support Petitioner’s assertion that the virtual microphones of Brandstein have substantially similar responses to noise,” citing to Patent Owner’s declarant. *Id.* at 8-9.

If anything, Meta’s argument in this Petition (Paper 1 (“Petition” or “Pet.”)) is even more lacking. The Petition paraphrases the same arguments in IPR2023-01130, while hand-waving the requirement that the virtual microphones’ responses to noise be substantially similar and dedicating the bulk of its analysis to the “speech response” limitations instead. Pet. at 32-34. But the Petition’s heavy reliance on Brandstein’s Fig. 5.3 in the context of the *speech responses* makes Meta’s failure to address that figure in the context of Brandstein’s *noise responses* even more conspicuous. In any case, Meta fails to address that Brandstein contemplates a Griffiths-Jim beamformer in which a top path passes through speech and where “**all other signals are attenuated,**” and a bottom path that suppresses speech and where “**all other signals are passed through.**” In other words, the top path nulls out noise, and the bottom path nulls out speech. This sharply contrasts with the ’691 Patent invention where the first virtual microphone includes **both** speech and noise, such that a second virtual microphone with a substantially similar noise response may be

used to cancel the noise and is exactly the type of “conventional array[] and algorithm[], which seek to reduce noise by nulling out noise sources” that the ’691 Patent distinguishes.

The Board should further deny the Petition because Petitioner fails to identify any reason or motivation that a POSITA would have to combine the multiple papers and embodiments within Brandstein on which the Petition relies to underpin its combination and for various limitations.

II. THE ’691 PATENT

U.S. Patent No. 8,503,691 (the “’691 Patent”) (Ex. 1001) discloses and claims methods for noise suppression in dual omnidirectional microphone arrays. Unlike “conventional arrays and algorithms, which seek to reduce noise by nulling out noise sources,” the ’691 Patent uses omnidirectional microphone arrays “to form two distinct virtual directional microphones which are configured to have very similar noise responses and very dissimilar speech responses.” ’691 Patent, Abstract. While “conventional multi-microphone systems attempt to increase the [signal-to-noise ratio] of the user’s speech by ‘steering’ the nulls of the system to the strongest noise sources[, t]his approach is limited in the number of noise sources removed by the number of available nulls.” *Id.*, 1:46 -51. Counterintuitively, in the ’691 Patent, “[t]he only null formed by the DOMA is one used to remove the *speech* of the user from [the second virtual microphone]”. *Id.* at 4:67-5:2 (emphasis added). However,

the similarity of the '691 Patent's virtual microphones' noise responses allow them to be cancelled while leaving the speech response intact, "resulting in excellent noise suppression performance and minimal speech removal and distortion." *Id.* at 8:1-3; 10:25-42.

The '691 Patent discloses a noise suppression apparatus that creates two virtual microphones V_1 and V_2 based on the signals generated by two omnidirectional microphones.

$$V_1(z) = O_1(z)z^{-\gamma} - \beta O_2(z)$$

$$V_2(z) = O_2(z) - z^{-\gamma} \beta O_1(z)$$

Id. at 10:55, 11:67. In these equations, β and γ are defined as follows:

$$\beta = \frac{d_1}{d_2}$$

$$\gamma = \frac{d_2 - d_1}{c} \cdot f_s \text{ (samples)}$$

Id. at 10:58-62. "The distances d_1 and d_2 are the distances from O_1 and O_2 to the speech source," respectively, and " γ is their difference divided by c , the speed of sound, and multiplied by the sampling frequency f_s ." *Id.*, 11:1-4.

In the analog frequency domain, the equations for V_1 and V_2 are written as follows:

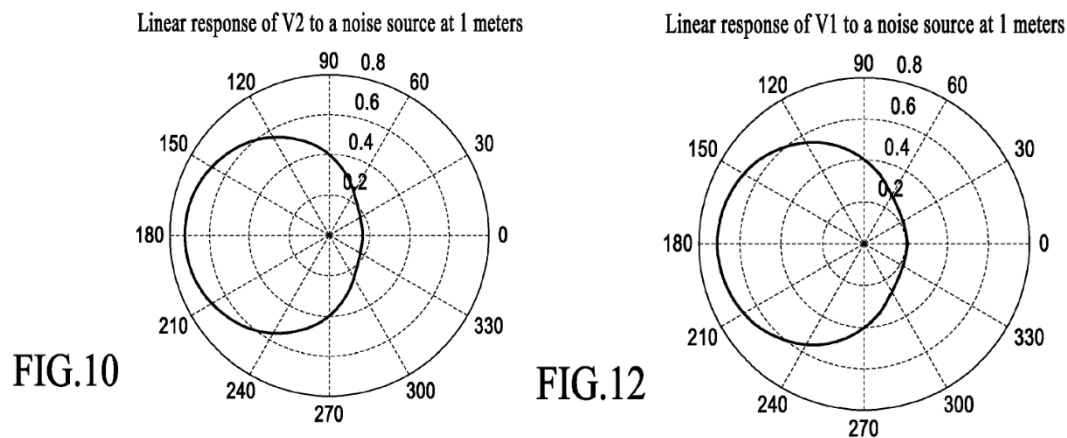
$$V_1(f) = e^{-j2\pi f\tau} O_1(f) - \beta O_2(f)$$

$$V_2(f) = -\beta e^{-j2\pi f\tau} O_1(f) + O_2(f)$$

where $z = e^{j2\pi f}$ and $\tau = \frac{d_2 - d_1}{c}$. Ex. 2001, ¶ 30.

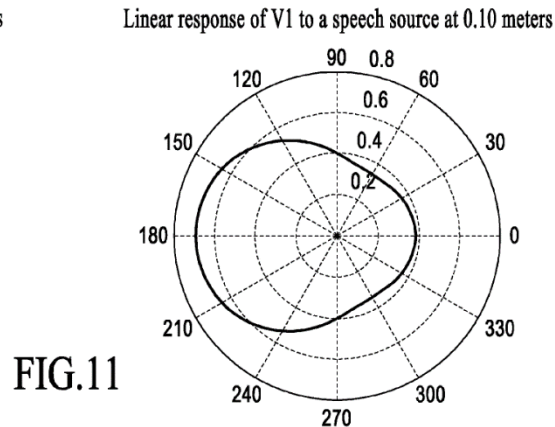
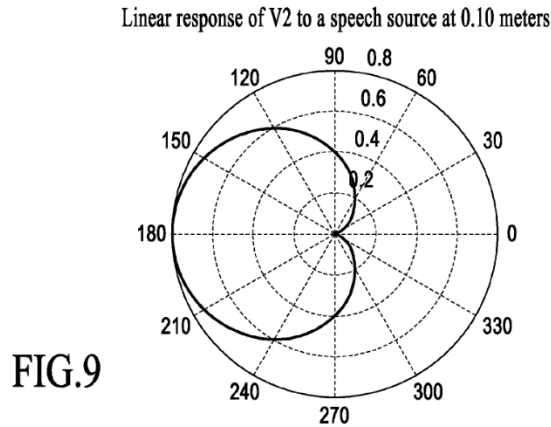
The '691 Patent discloses that the apparatus “works very well because the noise (far-field) responses of V_1 and V_2 are very similar while the speech (near-field) responses are very different.” '691 Patent at 17:5-8.

The '691 Patent discloses polar plots depicting similar noise responses which may be cancelled while leaving dissimilar speech responses intact. For instance, Figures 10 and 12 show the linear responses of virtual microphones V_2 and V_1 , respectively, to noise from a source at 1 meter:



'691 Patent, 11:25-29, 12:25-29, FIGS. 10, 12.

Figures 9 and 11 show the linear responses of virtual microphones V_2 and V_1 , respectively, to speech at a distance of 0.1 meter at an angle of zero degrees:



'691 Patent, 11:21-25, 12:20-24, FIGS. 9, 11.

Figure 9 shows a null in the linear response of virtual microphone V_2 to speech at zero degrees, “where the speech is typically expected to be located.” *Id.*, 11:21-25. As shown in Figure 10, “[t]he linear response of V_2 to noise is devoid of or includes no null, meaning all noise sources are detected.” *Id.*, 11:25-29. This configuration ensures that virtual microphone V_2 will detect all of the noise in front of the user so that it can be removed, which is an advantage over “conventional systems that can have difficulty removing noise in the direction of the mouth of the user.” *Id.*, 11:38-40. In addition, “the superior noise suppression made possible using this system more than compensates for the initially poorer SNR,” or signal to noise ratio, of the virtual microphones. *Id.*, 12:58-60.

III. THE RELEVANT ALLEGED PRIOR ART

A. Brandstein (Ex. 1005)

Microphone Arrays: Signal Processing Techniques and Applications, (Ex. 1005, “Brandstein”) is a collection of articles discussing topics in microphone

arrays. Ex. 1005 at 5. Brandstein purports to have been published in 2001. *Id.* at 4. As discussed below, *infra* Section VI.B.2, Brandstein is not a single reference, it is a collection of different papers by different authors reproduced as a collection.

Petitioner primarily relies on the paper “Robust Adaptive Beamforming” as reproduced in Brandstein as Chapter 5. *See* Brandstein at 77-89. Petitioner also relies on other papers for certain limitations and teachings for the proposed combination. *See infra* Section VI.B.2

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. Work experience could substitute for formal education, and additional formal education could substitute for work experience” (citation omitted). Pet. at 18.

VI. ARGUMENT

A. 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).

B. Ground 1: Brandstein Does Not Render Obvious Claims 1-20

1. Petitioner’s Combination Does Not Disclose or Render Obvious “the second linear response to noise [is/being] substantially similar to the first linear response to noise, and the second linear response to speech [is/being] substantially dissimilar to the first linear response to speech” as Recited in Independent Claims 1, 23, 27, 28, 29, and 41

The Petition argues that Brandstein alone discloses this limitation based on the description related to the Griffiths-Jim beamformer (GJBF) in Chapter 5. Meta does not argue that this limitation is inherent or disclosed in view of any reference other than Brandstein.

At its heart, Meta’s argument wrongly assumes that all systems that suppress noise with virtual microphones necessarily have “substantially similar” noise responses, ignoring contrary disclosure throughout Chapter 5 of Brandstein. As the Board aptly put it in rejecting this exact argument, “In effect, Petitioner is arguing that knowing that the sum of two numbers is equal to ‘2’ necessarily means that each number is ‘1’, as opposed, for example, to one number being ‘2’ and the other ‘0’.” IPR2023-01130, Paper 10 at 24. Moreover, as the Board further recognized, a simple

examination of Fig. 5.3 “refutes Petitioner’s assertion [that] the virtual microphone noise responses are substantially similar.” *Id.*

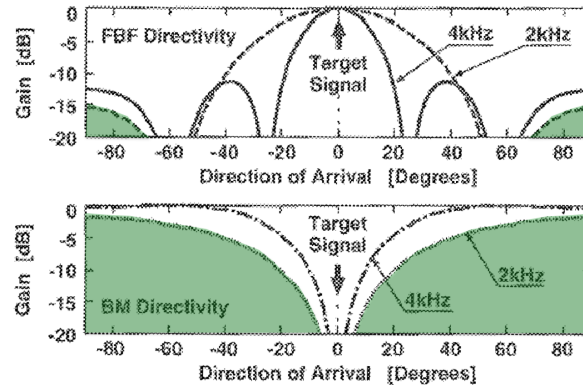


Fig. 5.3. Directivity pattern of a fixed beamformer (FBF) and a blocking matrix (BM).

Ex. 2003, ¶ 45; Ex. 1005 at 90.

The Board’s decision applies exactly to the arguments here. Among other findings, the Board found that Petitioner’s reliance on Brandstein’s Fig. 5.2, which shows the *overall* directivity of Brandstein’s GJBF, in an attempt to infer the directivity of Brandstein’s individual virtual microphones, was misplaced:

We agree with Patent Owner that the record does not support Petitioner’s assertion that Brandstein teaches or suggests the independent claim requirement, “wherein the first virtual microphone and the second virtual microphone are distinct virtual directional microphones with substantially similar responses to noise.” Contrary to Petitioner’s interpretation of Brandstein Figure 5.2, that figure does not lead to an inference that the individual microphone responses have similar responses to noise. Prelim. Resp. 12–13. In effect, Petitioner is arguing that knowing that the sum of two numbers is equal to “2” necessarily means that each number is “1”, as opposed, for example, to one number being “2” and the other “0”.

Moreover, as discussed above, Brandstein’s description of Figure 5.1 demonstrates that the virtual microphones of Brandstein do not have “substantially similar responses to noise.” Prelim. Resp. 9–11. Likewise, Figure 5.3 of Brandstein also refutes Petitioner’s assertion that the virtual microphone noise responses are substantially similar. Prelim. Resp. 13.

IPR2023-01130, Paper 10 at 24-25; *see also* Paper 12 at 5-6, 8 (reaffirming findings). Meta’s arguments rely on the same flawed interpretation of Brandstein’s Figure 5.2, and similarly fail to address Brandstein’s clear disclosure that its virtual microphones do **not** have substantially similar responses to noise that the Board noted in its earlier decision. Pet. at 32-34. Tellingly, Meta relies heavily on Brandstein’s Fig. 5.3 for the “speech response” limitations, but entirely fails to address its disclosure of very different noise responses in the context of the “noise response” limitations. Pet. at 34. Institution should be denied for the same reasons here.

At the outset, as the Board found in IPR2023-01130, even if the outputs of the GJBF’s top and bottom branches are distinct virtual microphones, the Petition fails to identify any actual disclosure where their noise responses are substantially similar – there is none. Instead, the Petition’s GJBF-based arguments assume that *any* system with a virtual microphone that nulls speech, and another that does not, automatically satisfies the claim. But the *speech response* is only half of the

limitation. Petitioner fails to show any disclosure wherein virtual microphones have *“the second linear response to noise being substantially similar to the first linear response to noise.”*

The GJBF described in Brandstein has a very different design than the patented invention, because its top path is designed to isolate speech as much as possible, instead of capturing **both** speech and noise (such that the noise may be cancelled using another virtual microphone with a substantially similar noise response). Ex. 2001, ¶ 42. Brandstein clearly states that for the top path “[t]he [fixed beamformer] is designed to form a beam in the look direction so that the target signal is passed [through] *and all other signals are attenuated,*” while for the bottom path “the [blocking matrix] forms a null in the look direction so that the target signal is suppressed *and all other signals are passed through.*” Ex. 1005 at 78 (emphasis added). In other words, the fixed beamformer (top path) passes speech through (the target signal) **and attenuates noise**, while the blocking matrix (bottom path) suppresses speech **and passes noise through**. These are exactly the type of “conventional arrays and algorithms, which seek to reduce noise by nulling out noise sources” (*i.e.*, by attenuating noise in the top path) distinguished by the ’691 Patent. ’691 Patent at 4:63-67; Ex. 2001, ¶ 41. This approach is very different than the invention of the ’691 Patent, in which the first virtual microphone passes through **both** speech and noise, such that another virtual response with a “substantially

similar” noise response may be used to cancel noise while preserving speech. A virtual microphone that attenuates noise plainly does not have a “substantially similar” noise response to one that passes noise through.

Indeed, Petitioner *admits* that “the first virtual microphone **captures the target speech signal**, while the second virtual microphone **blocks it**.” Pet. at 7 (emphasis added). Petitioner does not show any disclosure that the first virtual microphone is *also* designed to capture noise, and entirely fails to reconcile this position with the requirement for a substantially similar response to noise in both virtual microphones.

Petitioner’s purported support for this limitation amounts to unsupported conclusions that *any* GJBF meets this limitation based on the dissimilarity of speech responses without substantively addressing the requirement for substantially similar noise responses. These arguments are substantively identical to those that the Board already rejected in IPR2023-01130.

First, Petitioner argues that “[b]oth virtual microphones also have essentially the same . . . *responses to noise*, so that the noise responses cancel out in the GJBF’s final subtraction step.” Citing to Ex. 1003, ¶ 101. Pet. at 32. At the outset, Dr. Johnson’s opinions on this point are not entitled to any weight since they are conclusory and merely parrot the Petition. *Compare id. with* Pet. at 29. This argument amounts to an unsupported assumption that *all* systems in which noise is

ultimately cancelled necessarily have virtual microphones with similar noise responses. Ex. 2001, ¶ 42. It also completely ignores Brandstein's explanation that it uses a "multiple input canceller" ("MC") which "generate[s] replicas of components correlated with the interferences" that are "subtracted from a delayed output signal [] of the fixed beamformer" based on which "the target signal is enhanced and undesirable signals such as ambient noise and interferences, are suppressed." Ex. 1005 at 78-79. In other words, **instead of** using virtual microphones with substantially similar noise responses, Brandstein's GJBF attempts to isolate speech in the top path as much as possible, then uses the MC to subtract only those noise components of the bottom path that are "correlated with the interferences." *Id.*; *see also* Ex. 2001, ¶ 42. Petitioner's speculation cannot stand in the face of Brandstein's explicit teachings that it does **not** use substantially similar noise responses to cancel noise as Petitioner assumes, and its expert's conclusory assertions do not cure that deficiency.

Second, Petitioner argues that "as highlighted in red in Fig. 5.2, 'in the direction of the interference, a deep null is formed' . . . '[reflecting] that subtracting the bottom branch from the top branch cancels the interference, confirming that the virtual microphones' responses to the interference are essentially the same," citing Figure 5.2 which shows the directivity pattern for the final output of an example Griffiths-Jim beamformer:

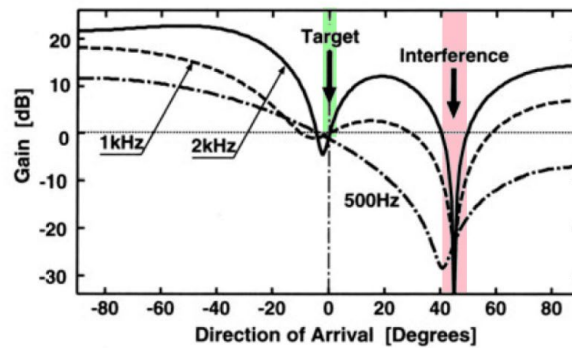


Fig. 5.2. Example directivity pattern of the Griffiths-Jim beamformer.

Pet. at 34. Figure 5.2 shows the **overall** directivity of an exemplary GJBF at three different frequencies (*i.e.*, the combination of both the top and bottom path), not the directivity of either virtual microphone individually. That directivity merely has an area of significantly reduced gain in the direction of an interference (*i.e.*, a noise source). Ex. 2001, ¶ 43. This reflects the overall result of the system in attenuating noise; it discloses nothing about the comparative responses to noise of the top or bottom path within that system (which are not even depicted in the Figure). *Id.* In any case, contrary to Petitioner’s speculation, Brandstein contemplates this result based on subtracting elements of noise (generated by a multiple input canceller by taking “replicas of components correlated with the interferences”) from an FBF signal that already has as little noise as possible, **not** based on any “substantially similar” noise response. *Id.*

Moreover, while speculating about the noise responses based on the overall output, Petitioner does not address contradictory disclosure in Figure 5.3 immediately following the cited portion. This is particularly telling since Petitioner

relies heavily on Figure. 5.3 for showing dissimilarity of speech responses in the same section. Pet. at 33-34. Unlike Figure 5.2, Figure 5.3 actually does depict the directivity of the fixed beamformer (top path) and blocking matrix (bottom path) in relation to a target signal (*i.e.*, speech). Ex. 2001, ¶ 44. A POSITA would plainly understand that their noise responses (highlighted in green) are **not** substantially similar.

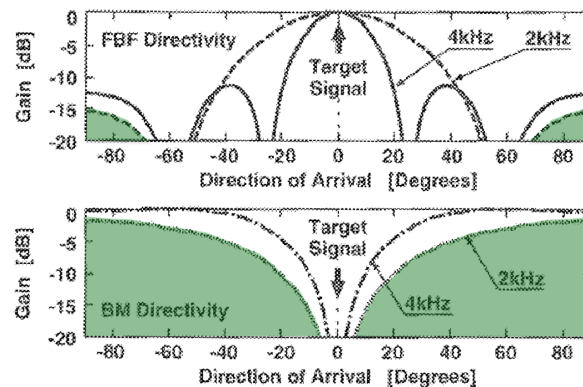


Fig. 5.3. Directivity pattern of a fixed beamformer (FBF) and a blocking matrix (BM).

Ex. 2001, ¶ 44; Ex. 1005 at 80. As Brandstein’s Chapter 5 does not disclose any equations with which to determine the responses of its top and bottom branches, Fig. 5.3 is the **only** disclosure of those responses outside the above-cited discussion that noise in the FBF (top branch) is attenuated compared to the BM (bottom branch). Ex. 2001, ¶ 46.

While Petitioner relies on an annotated version of Fig. 5.3 in the context of the “speech response” terms, it tellingly **ignores** the same figure when discussing the “noise response” limitations. *Compare* Pet. at 33 *with* Pet. at 34.

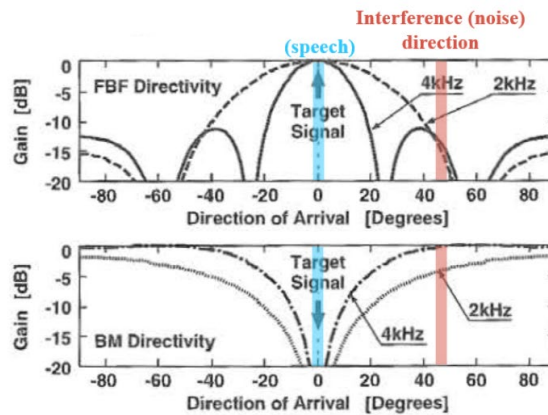


Fig. 5.3. Directivity pattern of a fixed beamformer (FBF) and a blocking matrix (BM).

EX1005, 90, Fig. 5.3 (annotated)

The sum total of Meta’s discussion of Fig. 5.3 as to noise—not noise response—is a single red line in Fig. 5.3 at approximately 40 degrees. This is, at best, mere hand waving. Meta does not even assert that responses to noise in the 40-degree direction are substantially similar; presumably because Brandstein’s disclosed gain chart would directly contradict it. *See* IPR2023-01130, Paper 10 at 24 (“Figure 5.3 of Brandstein also refutes Petitioner’s assertion [that] the virtual microphone noise responses are substantially similar” (citing Prelim. Resp. at 13)). In any case, the noise responses of the FBF and BM in Fig. 5.3 are plainly very different, as shown in Dr. Sayeed’s annotations above. Ex. 2001, ¶ 45.

Because the Petition fails to show any disclosure of “the second linear response to noise [is/being] substantially similar to the first linear response to noise, and the second linear response to speech [is/being] substantially dissimilar to the

first linear response to speech” as required by every independent claim, and should therefore be denied.

2. Petitioner Does Not Identify Any Motivation to Combine Embodiments and References Within Brandstein

Brandstein (Ex. 1005) is not a single reference. It is a collection of different papers by different authors, each reproduced as a chapter in Brandstein. Each paper is a separate reference, and contains separate embodiments, for which the Petitioner bears the burden of showing a reason or motivation to combine. *See Application of Arkley*, 455 F.2d. 586, 587-88 (C.C.P.A. 1972); *see also Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1371 (Fed. Cir. 2008) (“Thus, it is not enough that the prior art reference . . . includes multiple, distinct teachings that the artisan might somehow combine to achieve the claimed invention.”). The Petition relies on at least two different papers within Brandstein, each of which pertains to distinct embodiments. But the Petition entirely fails to articulate (or even assert) any reason or motivation for a POSITA to combine those distinct references and embodiments within those references. The Petition therefore fails as a threshold matter and must be denied on this basis.

The Petition relies on at least two different articles within the Brandstein collection: “Superdirective Microphone Arrays,” by Bitzer and Simmer, collected as Chapter 2; and “Robust Adaptive Beamforming,” by Hoshuyama and Sugiyama,

collected as Chapter 5; *see e.g.* Pet. at 5 (citing to Ex. 1005 at 87 regarding “Robust Adaptive Beamforming” by Hoshuyama and Sugiyama); Pet. at 12 (citing to Ex. 1005 at 25 regarding “Superdirective Microphone Arrays,” by Bitzer and Simmer).¹

Petitioner’s proposed combination is based on, among other things, its assertion that “[d]elaying signals based on geometry to adjust for differences in arrival times was well known,” and its assumption that a POSITA would incorporate a “near-field design” in a GSC. *See* Pet. at 11 (“When the source of the target signal is close enough to the array, instead of treating the signal’s wavefront as a plane, it is useful to use a near-field design accounting for the wave front’s spherical geometry... ”); *see also* Pet. At 14 (arguing that the ’691 Patent implementation of virtual microphones reflects “the standard near-field design”). But while the Petition primarily relies on “Robust Adaptive Beamforming” by Hoshuyama and Sugiyama,

¹ The Petition further relies on “Robust Localization in Reverberant Rooms,” by DiBiase et al, collected as Chapter 8; and “Acoustic Echo Cancellation for Beamforming Microphone Arrays,” by Walter L. Kellermann, collected as Chapter 13 for dependent claims. *See* Pet. at 44 (citing to Ex. 1005 at 159 regarding “Robust Localization in Reverberant Rooms” by DiBiase et al.); Pet. at 46 (citing to Ex. 1005 at 290 regarding “Acoustic Echo Cancellation for Beamforming Microphone Arrays” by Walter L. Kellermann).

it does not contend that article discloses the near-field design incorporated in its proposed combination. *Id.*; *see also* Pet. at 45-47. Instead, the Petition relies on the “Superdirective Microphone Arrays,” article by Bitzer and Simmer for the proposition that embodiments of *other* embodiments within Brandstein could be implemented with a near-field design. Pet. at 11-12 (citing Ex. 1005, 25). But the Petition does not even assert that a POSITA would have any reason or motivation to modify any embodiment within “Robust Adaptive Beamforming” based on the alleged “standard near-field design” discussed in “Superdirective Microphone Arrays.” At most, the Petition argues that near-field designs were “well known before the ’691 Patent.” Pet. at 11. Even if true, that would not be a sufficient basis for a POSITA to implement any particular embodiment described in “Robust Adaptive Beamforming” with a near-field design for receiving speech. *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015) (“[O]bviousness concerns whether a skilled artisan not only *could have made* but *would have been motivated to make* the combinations or modifications of prior art to arrive at the claimed invention.”).

Indeed, the Petition ***acknowledges*** that it requires a motivation to combine distinct embodiments even *within* the “Robust Adaptive Beamforming” article collected as Brandstein’s Chapter 5. Pet. at 20-21. This further underlines the Petition’s deficiency in failing to articulate ***any*** motivation to combine the Ch. 5

GJBF with various embodiments in entirely separate papers throughout the Brandstein collection. The Petition therefore fails as a threshold matter to identify a reason or motivation to combine for its proposed combination.

The Petition further omits articles within Brandstein that challenge its uncritical combination of bits and pieces throughout the collection. “Future Directions in Microphone Array Processing,” by Dirk Van Compernelle, collected as chapter 18 discusses these problems at length: “[a]fter 20 years of active research, however, we cannot claim that microphone array processing has had the success many of us hoped for, and many will wonder when the great breakthrough in microphone array processing will finally come, *if ever*. . . . However, too often the same problems that were considered too hard ten or twenty years ago are still set apart for ‘future research.’ Admitted weaknesses to proposed solutions are similar to the ones that we have been struggling with for a long time. Generally speaking we may say that many proposed solutions add to our understanding but lack robustness in order to make a bright future for themselves.” Ex. 2003 at 389. Von Compernelle goes on to explain that “[i]t is especially difficult to come up with tractable mathematical models for this complex environment. The result of this complex situation is that a lot of research effort has gone into, and continues to go into the search for optimal beamforming strategies that rely on extra assumptions and constraints. Sadly enough, this all too often leads to solutions that lack

robustness when evaluated in a variety of real-life situations . . . we should admit to ourselves that robustness has been, and still is today, one of the main issues.” *Id.* at 390.

Given the Petition’s failure to assert any reason or motivation to combine the references and embodiments within Brandstein on which it relies for its combination, and particularly in view of discussion in other articles challenging any such combination, the Petition fails as a threshold matter and must be denied.

C. Ground 2: Brandstein and McCowan Do Not Render Any Claims Obvious

Ground 2 is directed to independent Claim 28 and dependent Claims 12-14, 17-19, and 38-39, and utilizes Petitioner’s Ground 1 arguments for all limitations regarding “substantially [similar]/[dissimilar]” responses to speech and noise. The Petition only specifically relies on the addition of McCowan for limitations pertaining to “a time difference between arrival of the speech at the first virtual microphone and arrival of speech at the second virtual microphone,” “wherein the delay is raised to a power that is proportional to a sampling frequency multiplied by a quantity equal to a third distance Subtracted from a fourth distance,” and for “wherein the second microphone signal is multiplied by a ratio, wherein the ratio is a ratio of a third distance to a fourth distance, the third distance being between the first physical microphone and the speech source and the fourth distance being

between the second physical microphone and the speech source.” Pet. at 76-78 (addressing claims 12-14), and does not otherwise rely on the Ground 2 combination for the independent claims on which those claims rely. Pet. at 66-68. As discussed above, Petitioner has failed to show that Claims 1-46 are obvious under Ground 1. Petitioner’s Ground 2 arguments do not remedy this deficiency. Accordingly, the Petition does not present a reasonable likelihood of prevailing with respect to any claim as to Ground 2.

VII. CONCLUSION

As discussed above, Petitioner’s combination fails to disclose or render obvious a key limitation 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: March 28, 2023

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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 4,884 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.

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