

Filed on behalf of: Meta Platforms, Inc.

Filed: July 26, 2024

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

META PLATFORMS, INC.
Petitioner,

v.

JAWBONE INNOVATIONS, LLC,
Patent Owner.

Case No. IPR2023-01127
U.S. Patent No. 8,019,091

**SUPPLEMENTAL DECLARATION OF RICHARD M. STERN
IN SUPPORT OF PETITIONER'S REPLY TO
PATENT OWNER'S RESPONSE**

I. INTRODUCTION

1. I have been retained by Meta Platforms, Inc. (“Petitioner”) to provide my opinions concerning the validity of certain claims of U.S. Patent No. 8,019,091.

2. I have reviewed the Patent Owner’s Response and Declaration of Dr. Akbar Sayeed, as well as other materials and references cited in this Declaration.

II. DR. SAYEED MISCHARACTERIZES BOTH COMBINATIONS OF IKEDA AND PUTHUFF

3. In my original declaration, both of the proposed combinations based on Ikeda and Puthuff rely on Puthuff’s sensor as providing an acoustic signal. Specifically, I stated in my original declaration at ¶86, I quoted Puthuff’s description at 10:13-14, 5:4-7 stating “[a]t low ambient noise levels, the microphone signal is permitted to dominate as the output signal” and at 10:10-25 stating at “‘high ambient noise levels,’ the system prioritizes the output of ‘the bone conduction component of the audio signal.’” Thus, even at high acoustic noise levels, the signal that is output by Puthuff is “the bone conduction component of the audio signal,” which is an acoustic signal. Thus, the signal from Puthuff that is combined with Ikeda’s system in both combinations is an acoustic signal, not a non-acoustic signal as Dr. Sayeed states.

4. Therefore, Dr. Sayeed is incorrect to characterize both combinations of Ikeda and Puthuff as (1) replacing Ikeda’s signal-to-noise power ratio estimator and

step size output circuit with Puthuff's accelerometer alone, and (2) placing Puthuff's Fig. 1 system (except for the PD microphone) directly into Ikeda's Fig. 1 system. *See* Sayeed Decl. ¶¶64-65. Instead of simply incorporating the hardware from Puthuff into Ikeda's system, the proposed combinations combine the teachings from Puthuff and Ikeda, relying on Puthuff's acoustic signal and Ikeda's acoustic system, which are compatible with each other. I describe additional mischaracterizations below with respect to the second combination.

5. Moreover, Ikeda does not define the boundary between what is meant to be "outside" versus not "outside." For example, while Ikeda's improved noise canceler system is an acoustic system, Ikeda does not state that what it means by "outside" for its conventional noise canceler system is a non-acoustic sensor.

III. IKEDA'S "OUTSIDE" SENSOR IS NOT PUTHUFF'S SENSOR OR ALCIVAR'S SENSOR

6. A review of the following portion from Ikeda confirms that what Ikeda describes as "the outside" cannot be the same as Puthuff's sensor:

As stated above, the conventional noise canceler updates the coefficient of the adaptive filter 3 and learns the acoustic characteristic of noise in sections where the noise signal $N(z)$ is present and the desired signal component $S(z)$ is absent or negligibly small. Further, the noise canceler updates the coefficient of the adaptive filter 4 and learns a signal distortion correction filter in sections where the desired signal component $S(z)$ is present and the noise component $N(z)$ is absent or negligibly small. It is therefore necessary to detect the above sections where the desired signal component $S(z)$ is absent (or little) and the

sections where the noise signal component $N(z)$ is absent (or little) and to command the adaptive filters to perform leaning [sic] in such sections from the outside.

Ex. 1003, 3:32-45 (emphasis added). Specifically, Ikeda's description of a "conventional noise canceler" requires it to identify sections when the desired signal component $S(z)$ is absent, and when the noise signal component $N(z)$ is absent.

7. I agree with Dr. Sayeed's testimony at multiple points in his deposition (summarized below) that detecting absence of noise is not what a voice activity detector (VAD) does:

- "[A] VAD is used to detect whether voicing activity is present or absent."
Sayeed Tr. 17:4-7.
- Distinguishing "noise" from "speech or the desired signal of interest" that is detected by a VAD. *Id.* 19:3-18.
- A "VAD is not detecting when noise is absent... It's not detecting when noise is absent, no." *Id.* 21:12-19 (emphasis added).
- "[M]y voicing activity is the desired signal, then VAD is aimed at just detecting when I am speaking and not the noise. So if there is some noise in the background, VAD is not going to detect that." *Id.* 28:16-22 (emphasis added).

- “[A] VAD would be detecting physiological information related to me when I speak; whereas, you know, if someone else... speaking from outside, that voice **would be considered noise and that would not be detected by the VAD.**
Id. 21:4-11.

I agree that a VAD detects presence and absence of voicing activity, which is very different from detecting absence of noise. A VAD does not detect absence of noise, which is what is required of Ikeda’s conventional noise canceler.

8. I further agree with Dr. Sayeed’s testimony that each of a vibration sensor, accelerometer, and tissue conduction microphone (like those disclosed in Puthuff and Alcivar) is part of such a VAD that cannot detect absence of noise. *Id.* 32:16-33:4 (agreeing that a vibration sensor can be part of a VAD), 33:25-34:3 (agreeing that an accelerometer can be part of a VAD), 34:16-23 (agreeing that Alcivar’s tissue conduction microphone can be part of a VAD).

9. Thus, in my opinion, because a VAD (including Puthuff’s vibration sensor or accelerometer, or including Alcivar’s tissue conduction microphone) cannot detect the absence of noise, it cannot the same as the “outside” sensor contemplated by Ikeda. Therefore, Ikeda’s description of the “outside” sensor is not the same as Puthuff’s or Alcivar’s sensors.

10. Because the sensors in Puthuff and Alcivar are not the same as the “outside” sensor contemplated in Ikeda, the proposed prior art combinations cannot suffer from any of the same alleged deficiencies as Ikeda’s “outside” sensor. Specifically, because the Ikeda and Puthuff combinations rely on Puthuff’s audio component of the bone conduction signal (not the vibration signal itself), Puthuff’s sensor commands the filters based on its acoustic signals. It does this, for example, by indicating when there is intelligible speech and when other acoustic conditions are met.

11. In fact, Ikeda does not describe any deficiencies with the “outside” sensor. Despite including general language regarding it being sometimes “difficult” to learn from the outside, or that whether the outside provides useful information “depend[s] on the situation,” Ikeda never actually states any deficiencies with an outside sensor. Nor does Ikeda ever explain when or why it can be sometimes “difficult” to use the outside sensors, or articulate what type of situation would make them difficult to use. Ikeda only states there might be some situations where its improved VAD provides adequate performance. But a POSITA would have understood that there are situations in which such a sensor can provide adequate information, and a POSITA would not understand Ikeda to criticize, disparage, or discourage using outside sensors. Thus, the deficiencies described by Dr. Sayeed

are based on a misunderstanding of Ikeda and the prior art combinations, as discussed below.

IV. DR. SAYEED MISCHARACTERIZES IKEDA’S DESCRIPTION OF THE “OUTSIDE” SENSOR

12. A POSITA would not understand Ikeda to criticize, discredit, or otherwise discourage using any outside sensor. In fact, Ikeda does the opposite, as Ikeda specifically contemplates that the outside is able to provide sufficient information under certain situations. In particular, a POSITA would have understood Ikeda’s disclosure to describe the prior art as including a conventional noise canceler that, in certain situations, performs adequately. Specifically, a fair reading of Ikeda is that it contemplates there are some situations in which the “outside” can provide sufficient information to identify when the desired signal is absent or present, especially in view of Ikeda’s statement that it is desirable to achieve adequate performance “even when” an outside sensor cannot indicate adequate learning sections, which only occurs in certain, but not all, situations.

13. I therefore disagree with Dr. Sayeed’s characterization of Ikeda that “Ikeda contends that prior art which uses ‘outside’ sensors for obtaining information needed to adjust the adaptive filters for adequate noise is insufficient.” Sayeed Decl. ¶43, *see also* ¶¶66-84. Ikeda contends no such thing, and I disagree with Dr. Sayeed’s assumption that “outside” sensors never provide sufficient information.

Ikeda merely states that in some situations (*e.g.*, when the “outside” provides insufficient information), an improved noise canceler may be used, not that the “outside” sensor should never be used.

14. For example, Ikeda states that learning from the outside may be “difficult,” “depending on the situation.” But this does not say or imply that such outside sensors are themselves unreliable, misleading, wrong, or inaccurate. Nor does it imply that outside sensors and Ikeda’s improved noise canceler are necessarily incompatible, or mutually exclusive. To be clear, nowhere in Ikeda does it advocate a wholesale abandonment of outside sensors, and a POSITA would not be led in a direction to discard outside sensors completely.

15. It also does not state that it would be “difficult” to use outside sensors in all situations. To a POSITA, Ikeda’s use of the words “depending on the situation” would have actually suggested that it would have not been “difficult” to use outside sensors in all situations, and that there are some situations in which outside sensors would provide useful and adequate information. Therefore, it is my opinion that a POSITA would have understood from Ikeda’s disclosure that outside sensors are accurate, and could provide sufficient information, but that there are certain instances in which using outside sensors could use supplementation. A

POSITA would not have understood Ikeda to require removing or replacing outside sensors completely.

16. Ikeda therefore implies that there are situations when the outside is sufficient. As Ikeda expressly contemplates, the conventional noise canceler with “outside” learning is, in some situations, able to achieve adequate performance. Thus, a POSITA would have understood that Ikeda’s improved noise canceler supplements a system that already has an outside sensor. The improvement is to achieve adequate performance for the situations “even when” the outside sensor is insufficient, not to get rid of the outside sensor entirely.

17. Regarding Dr. Sayeed’s “false triggering” argument for the Ikeda/Puthuff combination, he states he has “seen no evidence that including Puthuff’s sensor would reduce ‘false triggering’ compared to Ikeda’s circuit.” False triggers occur when the noise in the system resembles the desired signal, or speech or voice activity. There are various reasons for this, including for example when “noise” is actually interfering speech or voice activity from someone else in the background. In general, sensors relying on physiological information to detect voicing, such as Puthuff’s vibration sensor and accelerometer, and Alcivar’s tissue conduction microphone, are significantly less responsive to that ambient background noise. They are therefore less likely to respond to that background noise, and are

less likely to result in false triggering than an acoustic-based system, including Ikeda's system. Therefore, combining Puthuff's (or Alcivar's) teachings with Ikeda's system would reduce false triggering, because the input signal already represents a cleaner signal with effectively reduced noise. A POSITA would have recognized this improvement, and would have therefore been motivated to make the combination.

V. DR. SAYEED FURTHER MISCHARACTERIZES THE SECOND COMBINATION WITH IKEDA AND PUTHUFF

18. Dr. Sayeed alleges the second combination “would not effectively cancel noise.” Sayeed Decl. ¶92. I disagree. The second combination would be very effective at operating to canceling noise. Dr. Sayeed's entire argument for the second combination of Ikeda and Puthuff is based on a fundamental misunderstanding of the proposed combination. Dr. Sayeed misunderstands the proposed combination to include Puthuff's accelerometer signal in Ikeda's signal $XA(z)$. Sayeed Decl. ¶¶94-95. He concludes that $XA(z)$ represents a combined acoustic and accelerometer environment, which due to its mixed modality, ultimately cannot cancel noise, cannot detect voicing activity, and cannot generate a VAD signal. Sayeed Decl. ¶¶94-107.

19. But this is not the proposed combination. The proposed combination relies on Puthuff's **acoustic** signal, not an accelerometer signal or a mixed modality

signal. Stern Decl. ¶¶96-97. Dr. Sayeed's analysis is therefore based on a false premise, as he assumes Puthuff's outputs an accelerometer signal, not an acoustic signal. By incorporating Puthuff's vibration sensor and transition circuit into Ikeda, the combination relies on an acoustic signal from Puthuff that represents a cleaner version of Ikeda's acoustic signal, by fading in the bone conduction component of the audio signal during times of high acoustic noise. Thus, a POSITA would have known that when Puthuff's acoustic signal is incorporated into Ikeda's system, the combination's input is simply a cleaned up acoustic version of itself.

20. Moreover, Dr. Sayeed appears to misunderstand the general principles behind the operation of adaptive filters, which would have been readily understood by a POSITA. Specifically, Dr. Sayeed contends that when $XA(z)$ is mostly accelerometer signal, $N(z)$ is close to noise, but "the subtractor would still subtract out a full $N(z)$ as received at the reference microphone and as part of $XB(z)$." Sayeed Decl. ¶98. Even setting aside Dr. Sayeed's misunderstanding that $XA(z)$ can be an accelerometer signal, Dr. Sayeed completely omits the operation of the adaptive filter in his analysis.

21. To be clear, adaptive filters (including the adaptive filters in Ikeda) manipulate the undesirable component in the reference channel that correlates with the undesirable component in the primary channel, so as to cause the output of the

adaptive filter to resemble the undesirable component in the primary channel. When the undesirable component is noise, this means that the output of the adaptive filter resembles the portion of noise in the reference channel that correlates with the noise in the primary channel.

22. This means that when the output of the adaptive filter is subtracted from the primary channel, only the portion of noise actually correlates to the noise in the primary channel is subtracted, not the “full $N(z)$ ” as Dr. Sayeed alleges. Thus, the subtraction reflects removal of the undesirable component from the primary channel, and there is no added distortion to the desired signal, as Dr. Sayeed alleges. Therefore, Ikeda’s circuit adaptive filters (which Dr. Sayeed omits in his analysis in ¶98) operate to improve (not worsen) the output signal by estimating the noise in the primary channel, so that the noise is canceled.

VI. DR. SAYEED MISCHARACTERIZES THE COMBINATION WITH IKEDA AND ALCIVAR

23. Dr. Sayeed also appears to misunderstand the proposed combination based on Ikeda with Alcivar. Specifically, Dr. Sayeed alleges that the combination is based on Alcivar’s microphone together with a layer of sound absorbing material to contend that Alcivar is limited to only addressing near-field noise. Sayeed Decl. ¶113. But this is not the proposed combination, which is based on Alcivar’s tissue conduction microphone with Ikeda’s system. Stern Decl. ¶¶145-154. Alcivar would

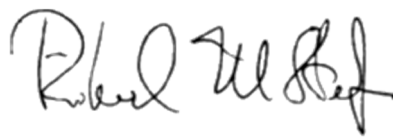
only be limited to addressing near-field noise if it is assumed that the throat microphone is insulated and is part of the rest of Alcivar's diver's mask. Without the layer of sound absorbing material, Alcivar's tissue conduction microphone would operate to provide an accurate voice activity signal, and would not be limited to detecting only near-field noise as Dr. Sayeed argues. Thus, the proposed combination does not present any of the near-field versus far-field complications that Dr. Sayeed assumes exist.

24. Even if the combination were as Dr. Sayeed alleges, there is nothing in Ikeda that limits it to addressing only far-field noise. Ikeda does not specify any limits to the types of noise that it addresses, whether far-field or near-field noise, or any other types of noise. Thus, a POSITA would not have understood that Alcivar and Ikeda necessarily address different types of noise. But even if Alcivar were limited to near-field noise, and even if Ikeda were limited to far-field noise, this difference would not have discouraged a POSITA from performing the proposed combination for the same reasons as discussed above regarding Ikeda's adaptive filters. Specifically, Ikeda's adaptive filters operate to remove the portion of the noise from the main microphone signal that is correlated with the noise in the reference microphone (and to remove the portion of the desired signal from the reference microphone signal that is correlated with the desired signal in the main

microphone signal). Ikeda's system therefore still operates to reduce the portion of noise (or desired signal), as needed.

25. Finally, contrary to Dr. Sayeed's arguments, incorporating Alcivar's microphone into Ikeda's system would have been cheaper and simpler in terms other than just hardware cost. A POSITA would have appreciated that incorporating Alcivar's microphone would have saved processing time, energy consumption, and would have provided a simpler circuit than Ikeda's system. A POSITA would have been further motivated to use Alcivar's microphone as it performs well even in high acoustic noise environments, so it presents a cheaper, simpler, and improved option.

Executed on July 26, 2024 in Buenos Aires, Argentina.

A handwritten signature in black ink, appearing to read "Richard M. Stern", written in a cursive style.

Dr. Richard M. Stern