

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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

Petitioners

v.

STATON TECHIYA, LLC,

Patent Owner

Case IPR2024-01033

U.S. Patent No. 11,750,965

**DECLARATION OF CHRIS KYRIAKAKIS, PH.D.
IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 11,750,965**

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I, Chris Kyriakakis, declare that:

I. ASSIGNMENT

1. I have been retained by Samsung Electronics Co., Ltd., Samsung Electronics America, Inc. (together “Samsung”), and Harman International Industries, Inc. (“Harman”) (collectively “Petitioners”) as an independent expert consultant in this proceeding before the United States Patent and Trademark Office (“PTO”).

2. I am being compensated at a rate of \$525/hour for my services in this proceeding, which is my regular and customary rate.

3. My compensation is in no way contingent on the nature of my findings, the presentation of my findings in testimony, or the outcome of this or any other proceeding. I have no other interest in this proceeding.

4. I have been asked to consider whether certain references disclose or suggest the features recited in the claims of U.S. Patent No. 11,750,965 (“the ’965 patent”) (Ex. 1001).¹ My opinions are set forth below.

¹ Where appropriate, I refer to exhibits I understand will be attached to the petition for *inter partes* review of the ’965 patent (the “Petition”).

II. BACKGROUND AND QUALIFICATIONS

5. I am an independent consultant. All of my opinions stated in this declaration are based on my own personal knowledge and professional judgment. In forming my opinions, I have relied on my education, experience, and knowledge regarding electrical engineering, computer science, and audio and acoustic sciences.

6. I am over 18 years of age and, if I am called upon to do so, I would be competent to testify as to the matters set forth herein. A copy of my current curriculum vitae, which details my education and professional and academic experience, as well as a list of all publications I have authored in the past ten years, is included as Ex. 1003 in this proceeding. The following provides an overview of some of my experience that is relevant to the matters set forth in this declaration.

A. Relevant Academic Experience

7. I earned my Bachelor of Science degree in Engineering and Applied Science from the California Institute of Technology (Caltech) in 1985. I received my Master of Science degree in Electrical Engineering in 1987 and my Ph.D. in Electrical Engineering in 1993, both from the University of Southern California (“USC”).

8. Since 2002, I have been a tenured Associate Professor in the Electrical Engineering Department at USC. My research interests lie at the intersection of acoustics, psychoacoustics (the science that studies human perception of sound), and

audio signal processing. My recent research has focused on the study of audio systems in challenging environments including automobiles and mobile devices, as well as algorithms for enhancing the performance of voice recognition engines. I have published nearly 100 technical papers, including several peer reviewed papers. I have published a book entitled *Immersive Audio Signal Processing*, and hold several patents in acoustic measurement of loudspeakers in rooms and cars, loudspeaker crossover optimization, and loudspeaker response correction using signal processing. My publications examine various aspects of sound measurement, how sound interacts with the acoustical elements of the environment, novel methods for surround sound recording and reproduction, and the perception of sound by human listeners.

9. A focus of my research has been the study of microphone arrays for applications in enhanced far field voice recognition. This includes methods for Direction of Arrival finding and beam forming from linear and circular microphone arrays. I have also investigated methods for noise removal and reverberation reduction from microphone signals. In addition, over the past year, I have worked on methods for echo cancellation for applications in wearable devices. Previous work includes loudspeakers and how they interact with their acoustical environment. In particular, I have researched the role of sound reflections, absorption, and diffusion in the performance of loudspeakers. I have also published several technical

papers on acoustical measurement methods in rooms and device enclosures and developed novel signal processing algorithms for optimizing sound system performance. Other topics I have researched include multichannel audio acquisition and rendering, virtual microphones and virtual speakers, hybrid headphone-loudspeaker rendering methods, and advanced signal processing techniques for optimizing sound quality from small portable devices.

B. Relevant Professional Experience

10. I am the founding Director of the USC Immersive Audio Laboratory with facilities for experimental work in room acoustics, multichannel audio, and psychoacoustics. This laboratory also serves as a unique teaching facility for my undergraduate course in Introduction to Digital Audio and my graduate course in Immersive Audio Signal Processing. Both courses have a major acoustics component that examines the interaction of sound with the acoustical environment (e.g., home, movie theater, car). The graduate course was developed through a two-year grant I received from the National Science Foundation entitled “Collaborative Learning in Engineering Using Immersive Environments,” and was the first of its kind to assess the impact of audio immersion in student learning. In addition to the courses I teach, I have also supervised and served on Ph.D. dissertation committees for more than 30 students.

11. In 2019, I joined Syng as the Chief Audio Scientist. Syng creates innovative products for next generation spatial audio and my role there includes research and development of audio algorithms for sound capture using microphone arrays to measure the acoustics of the room and loudspeaker beamforming for rendering sound in various directions.

12. From 2003 to 2018, I was the co-founder and Chief Technology Officer of Audyssey Laboratories, a USC spin-off company that develops and licenses audio technology to leading automotive, professional and consumer electronic companies around the world. A major project that I led and worked on was focused on the measurement and characterization of in-ear and over ear earbuds and headphones. This work included the development of methods for measuring earbuds and headphones using a mannequin with artificial ears and, in particular, methods for testing for proper seal prior to taking acoustical measurements. It also included the use of ear canal microphones and comparisons of the in-ear microphone response with a reference microphone in the room. A database of over 500 in-ear earbuds and headphones was created using these methods. The acoustical correction filters that were generated for each headphone were implemented as an embedded solution that could run on DSP processors in mobile devices and laptop computers.

13. I also developed audio algorithms and designed speakers. These speakers were novel acoustical designs that used a combination of unique

enclosures, and audio signal processing to optimize their performance and overcome limitations that arise from small drivers and enclosures. For example, we used signal processing technologies combined with novel acoustical design to extend the bass response of small woofers and passive radiators beyond what was previously possible in small speaker enclosures. The innovations in these designs have received awards, including Popular Science's "Best of What's New."

14. In April 2018 I was elected as Senior Member of the Institute of Electrical and Electronic Engineers (IEEE) in recognition of my contributions to the field of engineering. I am also a member of the Audio Engineering Society (AES), an association for professionals in the audio industry.

15. In 2006, I received a World Technology Network Award. This organization presents awards to innovators in several areas in which technology can foster a paradigm change. My award was for innovations in immersive audio that enable new capabilities in media and journalism. Other award recipients at that event included Vice President Al Gore, Google, and Space-X. In addition, my work has been featured in multiple news articles, including pieces by The Atlantic, the BBC World Service, the New York Times, and National Public Radio.

16. In the late 1990s and early 2000s, I was a faculty researcher and later Deputy Director of the National Science Foundation's engineering research center established at USC. I was studying the fundamental and technological limitations of

immersive audio and the role of acoustics on the performance of loudspeakers and audio systems in homes and cars. In 2003, together with one of my graduate students, I received the award for Best Paper at the Institute of Electrical and Electronics Engineers (“IEEE”) Conference on Signals, Systems and Computers.

III. MATERIALS REVIEWED

17. The opinions contained in this declaration are based on the documents I reviewed, my professional judgment, as well as my education, experience, and knowledge regarding electrical engineering, computer science, and audio and acoustic sciences.

18. In forming my opinions expressed in this declaration, I reviewed the following materials:

- the ’965 patent (Ex. 1001);
- the file history of the ’965 patent (Ex. 1004);
- U.S. Patent Pub. 20140270200A1 (“*Usher-1*”) (Ex. 1005);
- U.S. Patent Pub. 20200380945A1 (“*Woodruff-1*”) (Ex. 1006);
- U.S. Patent 11,393,486 (“*Woodruff-2*”) (Ex. 1007);
- U.S. Patent Pub. 20140126748A1 (“*Usher-2*”) (Ex. 1008);
- U.S. Patent Pub. 20110299695 (“*Nicholson*”) (Ex. 1009);
- Redline comparing the ’965 patent to its parent (Patent No. 11,277,682 (“’682*Pat*”) (Ex. 1010);

- U.S. Patent No. 11,277,682 (Ex. 1011);
- U.S. Provisional Application 60/893,617 (Ex. 1012);
- The Notice of Allowance in U.S. Application 14/109,987 (Ex. 1013);
- Redline comparing the Patent No. 11,277,682 (*'682Pat*) to Patent No. 8,625,812 (*"'812Pat"*) (Ex. 1014); and
- any other materials I refer to in this declaration in support of my opinions.

19. All of the opinions contained in this declaration are based on the documents I reviewed and my knowledge and professional judgment. My opinions have also been guided by my appreciation of how a person of ordinary skill in the art would have understood the claims and the specification of the '965 patent at the time of the alleged invention, which I have been asked to initially consider as no earlier than 9/19/2008 (the filing date of U.S. Provisional Patent Application 61/098,250), although, as I discuss, I do not believe the '965 patent is entitled to the benefit of this filing date for priority purposes. My opinions reflect how one of ordinary skill in the art would have understood the '965 patent, the prior art to the patent, and the state of the art at the time of the alleged invention.

20. Based on my experience and expertise, it is my opinion that certain references disclose and/or suggest all the features recited in claims 1-30 ("challenged claims") of the '965 patent, as I discuss in detail below.

IV. LEVEL OF ORDINARY SKILL IN THE ART

21. I have been informed and understand that, in the context of an invalidity analysis, a person having ordinary skill in the art is a hypothetical person who looks to prior art at the time of the invention. I further understand that the factors that may be considered in determining the level of ordinary skill include: (1) the problems encountered in the art; (2) the prior art solutions to the problems encountered in the art; (3) the rapidity of innovation; (4) the sophistication of the technology; and (5) the education level of active workers in the field. I understand that these factors need not all be considered for the analysis and that one or more of these factors may control.

22. I was asked to provide my opinion on the level of one of ordinary skill in the art with respect to the alleged invention of the '965 patent as of 03/07/2008. Based on my consideration of the factors above, I believe a person having ordinary skill in the art would have had a bachelor's degree in electrical engineering, computer science, audio engineering, or a similar field and at least two years of experience with hearing instruments such as earphones, hearing aids and/or hearing protectors. Persons of ordinary skill in the art could have also obtained similar knowledge and experience through other means. *Id.*, ¶ __. Note I believe that the definition of a person having ordinary skill in the art would be the same even if the '965 patent is entitled to a priority date no earlier than June 22, 2021.

23. As of 03/07/2008, I met, and in fact exceeded, the qualifications of a person of ordinary skill in the art. To be clear, all of my opinions in this declaration are from the perspective of one of ordinary skill in the art as I have defined it here during the relevant timeframe.

V. RELEVANT LEGAL STANDARDS

24. I am not an attorney and offer no legal opinions, but in the course of my work, I have had experience studying and analyzing patents and patent claims from the perspective of a person skilled in the art.

25. For the purposes of this declaration, I have been informed about certain aspects of the law that are relevant to forming my opinions. My understanding of the law is as follows.

26. Petitioners' counsel has informed me that a published nonprovisional application is entitled to claim priority to the filing date of its provisional application (as opposed to the filing date of the published non-provisional application) if (1) the provisional application discloses the portions of the published non-provisional application relied upon as prior art, and (2) at least one claim of the published non-provisional claim is supported by the provisional application, i.e., the provisional application must disclose the subject matter of the claim and enable a person of ordinary skill in the art to make and use the claim.

27. Petitioners' counsel has informed me that for the prior art to inherently disclose a claimed limitation, the prior art need not expressly disclose the limitation, so long as the claimed limitation necessarily flows from a disclosure in the prior art. I also understand that it is acceptable to examine evidence outside the prior art reference (extrinsic evidence) in determining whether a feature, while not expressly discussed in the reference, is necessarily present in that reference.

28. Petitioners' counsel has informed me that a patent claim can be considered to have been obvious to a person having ordinary skill in the art at the time the application was filed. I am informed that this means that, even if all of the requirements of a claim are not found in a single prior art reference, the claim is not patentable if the differences between the subject matter in the prior art and the subject matter in the claim would have been obvious to a person having ordinary skill in the art at the time of the invention.

29. I have been informed by Petitioners' counsel that a determination of whether a claim would have been obvious should be based upon several factors, including, among others:

- the level of ordinary skill in the art at the time the application was filed;
- the scope and content of the prior art; and
- what differences, if any, existed between the claimed invention and the prior art.

30. I have been informed by Petitioners' counsel that a single reference can render a patent claim obvious if any differences between that reference and the claims would have been obvious to a person having ordinary skill in the art. Alternatively, I understand that the teachings of two or more references may be combined in the same way as disclosed in the claims, if such a combination would have been obvious to one having ordinary skill in the art. In determining whether a combination based on either a single reference or multiple references would have been obvious, it is appropriate to consider, among other factors:

- whether the teachings of the prior art references disclose known concepts combined in familiar ways, and when combined, would yield predictable results;
- whether a person having ordinary skill in the art could implement a predictable variation, and would see the benefit of doing so;
- whether the claimed elements represent one of a limited number of known design choices, and would have a reasonable expectation of success by those skilled in the art;
- whether a person having ordinary skill would have recognized a reason to combine known elements in the manner described in the claim;
- whether there is some teaching or suggestion in the prior art to make the modification or combination of elements claimed in the patent; and

- whether the innovation applies a known technique that had been used to improve a similar device or method in a similar way.

31. I have been informed by Petitioners' counsel that one of ordinary skill in the art has ordinary creativity and is not an automaton. Petitioners' counsel has also informed me that in considering obviousness, obviousness may not be determined using the benefit of hindsight, including hindsight derived from the patent being considered.

32. I further understand that a hypothetical person of ordinary skill in the art is assumed to know and to have all relevant prior art in the field of endeavor covered by the patent at issue. I have been informed that there are two criteria for determining whether prior art is analogous and thus can be considered prior art: (1) whether the art is from the same field of endeavor, regardless of the problem addressed, and (2) if the reference is not within the field of the patentee's endeavor, whether the reference still is reasonably pertinent to the particular problem with which the patentee is involved. I have also been informed that the field of endeavor of a patent is not limited to the specific point of novelty, the narrowest possible conception of the field, or the particular focus within a given field. I have also been informed that a reference is reasonably pertinent if, even though it may be in a different field from that of the patentee's endeavor, it is one which, because of the

matter with which it deals, logically would have commended itself to a patentee's attention in considering their problem.

33. I further understand that, in making a determination as to whether the claimed invention would have been obvious to a person of ordinary skill, the Board may consider certain objective factors if they are present, such as: commercial success of products practicing the claimed invention; long-felt but unsolved need; teaching away; unexpected results; copying; and praise by others in the field. These factors are generally referred to as “secondary considerations” or “objective indicia” of nonobviousness. I understand, however, that for such objective evidence to be relevant to the obviousness of a claim, there must be a causal relationship (called a “nexus”) between the claim and the evidence and that this nexus must be based on a novel element of the claim rather than something in the prior art. I also understand that even when they are present, secondary considerations may be unable to overcome primary evidence of obviousness (such as motivation to combine with predictable results) that is sufficiently strong.

34. I have been informed by Petitioners' counsel that for a patent claim in a later-filed application to be entitled to the priority date of an earlier-filed application, the specification of the earlier-filed application must adequately support the patent claim of the later-filed application. This means that the

specification of the earlier-filed application must provide an adequate written description of the invention claimed in the later-filed application.

35. I have been informed by Petitioners' counsel that the written description requirement is met if the applicant conveys in the specification with reasonable clarity to those skilled in the art that he or she possessed the claimed invention as of the filing date of the application. An applicant shows that one is "in possession" of the invention by describing the invention, with all its claimed limitations, not merely that which makes it obvious. A description that merely renders the later-filed claim obvious is not sufficient. One may satisfy the written description requirement with words, structures, figures, diagrams, and/or formulas that fully set forth the claimed invention. Although the exact terms of the claim need not be recited verbatim in the specification, the specification must contain an equivalent description of the claimed subject matter.

36. I am also informed that the failure to include in the written description aspects of the claimed invention that would be routinely known and understood by one of ordinary skill in the art when the application was filed will not be fatal to the validity of the claim if such aspects are inherent to what was disclosed. To be inherent, the missing descriptive matter must necessarily be present in the specification such that one skilled in the art would recognize such a disclosure

VI. SUMMARY OF OPINIONS

37. This Declaration explains the conclusions I have formed based on my analysis. These conclusions are summarized below:

- Ground 1: *Usher-1*, *Woodruff-1*, and *Woodruff-2* renders obvious claims 1-4, 6-9, 11, 13-15, 19-23, 25-27, and 29.
- Ground 2: *Usher-1*, *Woodruff-1*, *Woodruff-2*, and *Usher-2* renders obvious claims 5 and 24.
- Ground 3: *Usher-1*, *Woodruff-1*, *Woodruff-2*, and *Nicholson* renders obvious claims 10, 12, 16-18, 28, and 30.

VII. OVERVIEW OF THE '965 PATENT

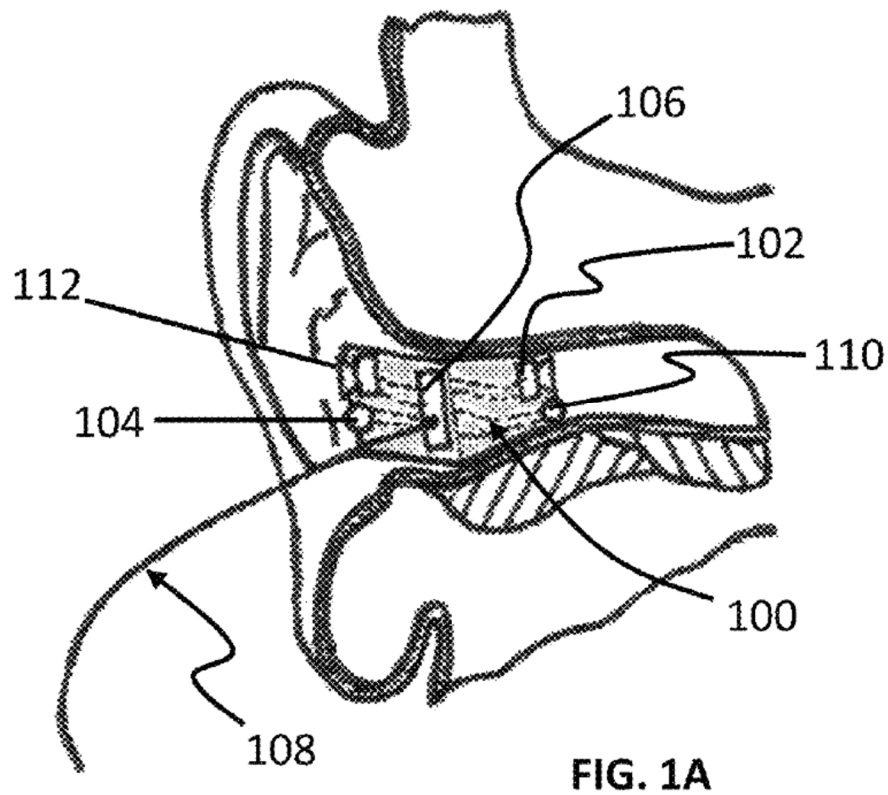
A. The Specification

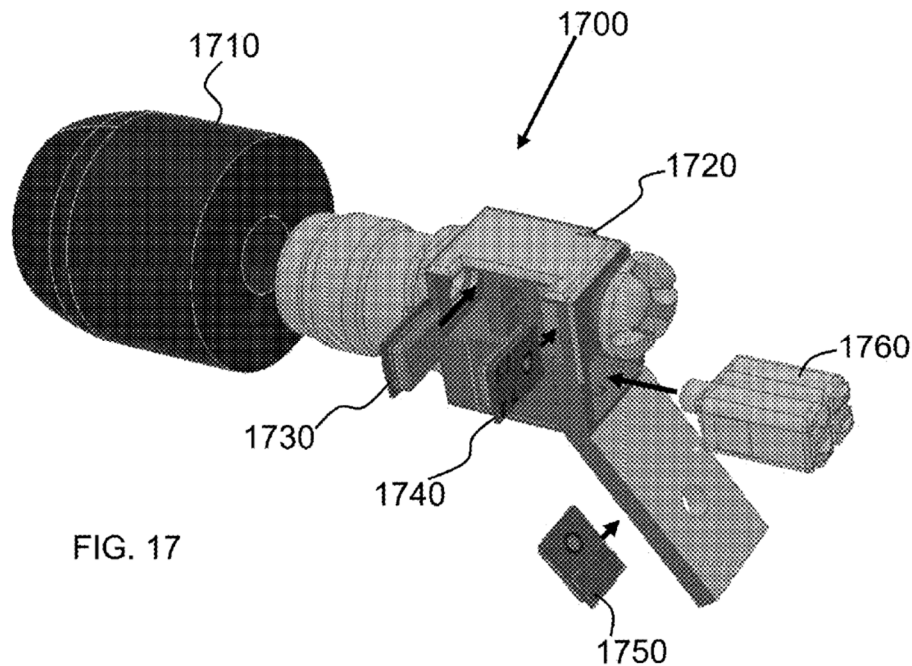
38. The '965 patent, titled "Acoustic Dampening Compensation System," discloses a system that allows acoustic detecting and/or measuring devices to compensate for the adverse effects caused by "acoustic dampening." '965 patent, 1:30-37.

39. While the '965 patent states that the apparatus/method described therein can be used for various applications, the specification focuses on earphone applications. *See e.g., id.* 39-43 ("Exemplary embodiments are directed to or can be operatively used on various wired or wireless earpieces devices (e.g., earbuds,

headphones, ear terminals, behind the ear devices or other acoustic devices as known by one of ordinary skill, and equivalents).”); Figs. 1, 7, 9-14 and 17-19.

40. The components of exemplary earphone embodiments described in the '965 patent are seen in Figs. 1A and 17:





41. The '965 patent earphone has one or more ambient sound microphones ("ASM") (e.g., Fig. 1A's ASMs 104 and Fig. 17's ASMs 1740). As can be seen, the ASMs are located outside of the wearer's ear canal and are positioned to detect ambient sound. The '965 patent explains that:

At the outer (environment-facing) surface of the earplug 100, an ambient-sound microphone 104 is located.

'965 patent, 4:7-9. The patent further explains:

FIG. 17 is a schematic exploded view of a multimicrophone earphone 1700. The earphone 1700 can include an eartip 1710, an electronic package housing 1720, a first microphone 1730 (e.g., an ECM), a second microphone 1740 (e.g., a first ASM), a third microphone 1740 (e.g. a second ASM), and a speaker 1760, where FIG. 18

illustrates 30 the earphone of FIG. 17 with components inserted.

Id., 28:24-30.

42. The '965 patent earphone also has an ear canal microphone ("ECM"), for example, Fig. 1A's ECM 110 and Fig. 17's ECM 1730.

43. The '965 patent ECM is located at the user's ear canal:

Additionally, an ear-canal microphone 110 is placed at the inner (eardrum-facing) surface of the earplug 100 and an external loudspeaker 112 is placed on the outer (environment-facing) surface of the earplug 100 for performing other functions of the headphone system not described here (such as monitoring of sound exposure and ear health conditions, headphone equalization, headphone fit testing, noise reduction, and customization).

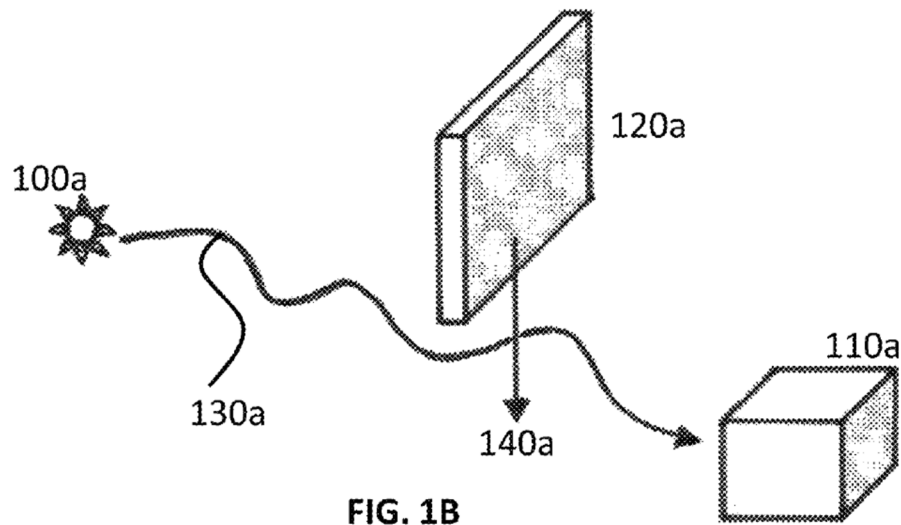
Id. 4:13-20. *See also* 28:24-30 (quoted above).

44. The '965 patent earphone also has loudspeaker (e.g., Fig. 1A's loudspeaker 102 and Fig. 17's speaker 1760). The loudspeaker is positioned to delivering audio to the wearer:

At the inner (eardrum-facing) surface of the earplug 100, an ear-canal loudspeaker receiver 102 is located for delivering an audio signal to the listener.

Id. 4:5-7. *See also* 28:24-30 (quoted above).

45. The '965 patent discloses that acoustic dampening events occur when an acoustic dampening element moves into the path of an acoustic signal/wave. *Id.* 4:21-27. Such an event is schematically illustrated in Fig. 1B:



46. As Fig. 1B illustrates, acoustic dampening element 120a moves into the path of an acoustic signal/wave 130a generated by an acoustic source 100a in ambient environment. The '965 patent states that acoustic dampening element 120a can dampen acoustic signal/wave 130a, which will affect the acoustic signal measured by microphone 110a. '965 patent, 4:21-27 ("FIG. 1B illustrates an example of an acoustic dampening element 120a, moving 140a into the path of an acoustic signal or wave 130a generated by an acoustic source 100a in ambient environment. The acoustic signal or wave 130a can be acoustically damped to some

level by acoustic damping element 120a, so that the acoustic signal measured by the microphone 110a is affected.”).

47. I note that despite boilerplate language asserting that the patent has many applications, all embodiments relate to methods allowing earphones to respond to acoustic dampening events, such as a wearer putting a hat on their head that occludes the ASM(s) detecting ambient sound. Indeed, according to the '965 patent Field Of The Invention, the subject of the patent is “acoustic compensation of acoustic dampening by headwear on detected acoustic signals.” *Id.* 1:23-26.

48. The '965 patent's. Summary Of The Invention is similar:

The microphone can be operatively and communicatively coupled to headwear, where the processor, responsive to an analysis of the change in the characteristic of the acoustic signal, can detect a presence of the headwear. The processor, from the analysis, can detect when the headwear is worn or removed, and apply the compensation filter to accommodate the headwear based on the presence of the headwear. The processor can selectively adjust the spatial sensitivity of the headwear to sound in the user's local environment The headwear can be one of a headset, earbud, earpiece or combination thereof. And, the processor actively detects when headwear is adjusted or fitted; it can be activated on a continuous or intermittent basis. In one arrangement, the compensation filter for the

headwear can be activated via voice-activation

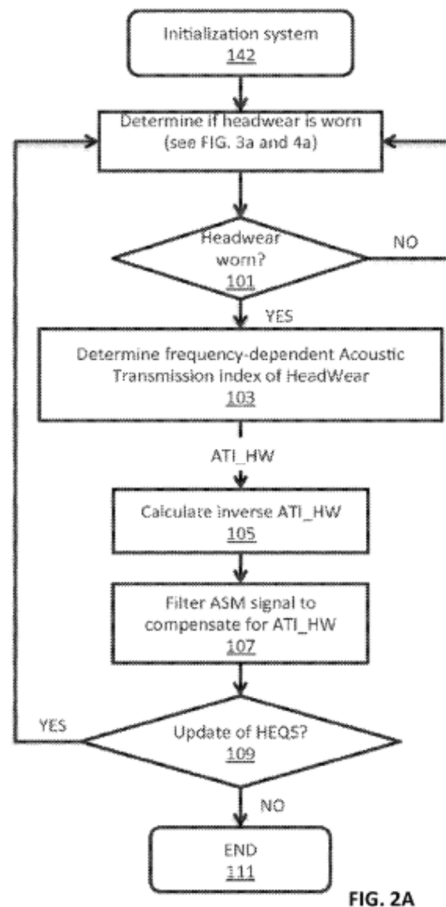
See id. 1:51-66. *See also:*

The microphone can be operatively coupled to headwear, and the processor, responsive to the change in the characteristic of the acoustic signal, detects a presence of the headwear. The headwear can be worn or removed, and apply the compensation filter to accommodate the headwear based on the presence of the headwear. The processor can apply the compensation filter to selectively adjust a spatial sensitivity of the headwear to sound in the acoustic environment. The headwear can be one of a headset, earbud, earpiece or combination thereof. The processor can actively detect when headwear is adjusted or fitted...

Id., 2:16-27.

49. I also note that the specification recites the word “headwear” 107 times. In fact, the specification refers to the technology described therein as a “headwear acoustic equalization system,” or “HEQS.” Essentially every embodiment is described as an HEQS system. *See e.g., Id.* 4:28-38; 4:55-62; 5:6-11; 5:47-51; 6:8-14; 6:42-43; 6:59-67; 7:24-28; 8:26-9:29; 9:30-10:29; 10:30-11:48; 11:49-12:47; 12:48-13:63.

50. Fig. 2A of the '965 patent is an overview of HEQS, and illustrates a method for determining whether headwear is worn, and if so, how the HEQS responds:



51. HEQS operates as follows. When HEQS determines that headwear is worn (step 101), it determines what the '965 patent refers to as the “frequency dependent acoustic transmission index of the headwear,” or “ATI_HW” (step 103). The HEQS then calculates the inverse of ATI_HW (“inverse ATI_HW”) (step 105). The signal generated by the ASM then filters with the inverse ATI_HW signal (step

107). '965 patent, 4:28-46. According to the '965 patent, this filtering “gives a modified ASM signal which approximates that the ASM signal with the headwear removed.” *Id.* 4:46-48

B. Prosecution History

52. The '965 patent was filed on June 22, 2021 as a continuation-in-part of Application 16/662,505 (“’505App”), which issued as Patent No. 11,277,682. I am informed that patent applicants file continuation-in-part applications to add additional subject matter to their patent applications. Based on my review of the continuation-in-part application, the patentee here added substantial new matter to the application, including Figs. 7-20 and all the subject matter found at 13:64-29:32.² The additions to the specification can be seen in the comparison between the '965 patent and its parent, Patent No. 11,277,682 (“’682Pat”). *See EX1010.*

53. The '682Pat, and thus the '965 patent, claims priority to the application, filed on March 7, 2008, that issued as Patent No. 8,625,812 (“’812Pat”), through a series of continuation applications. The '965 patent also claims the benefit of Provisional Application 60/893,617 (“’617Prov”).³

² I refer to this new matter as “CIP New Matter.”

³ I will refer to information found in both the original specification and the '617Priv, i.e., '965 patent, Figs. 1-6 and 1:1-13:63 as “Original Disclosure.”

54. The '965 patent was filed with 12 claims, one of which was independent. None of the originally-filed claims were directed to an earphone that detects acoustic damping events. *EX1004* at 1038-1040. Instead, as-filed claim 1 claimed a “voice pickup system” having several elements, and which recited the functionality of “detect[ing] if the user is speaking.” *Id.*.

55. On February 10, 2022, the patent owner filed preliminary amendment that amended claim 1, cancelled claims 2-11 and added claims 12-28. I have been informed that preliminary amendments change the application, such as by amending claims or adding new claims. Here, the patent owner amended claim 1 to recite “adjusting at least one of the ambient sound signal, an audio content signal, a noise signal, or a combination thereof, when it is detected that the user is speaking.” *Id.* at 898-901. In this preliminary amendment, the following new claims were added:

- New claims 16-18 (issued claims 6-8) recited “resetting the volume” of various signals “when a preset time increment has expired.”
- New claims 19-20 (issued claims 9-10) recited “determining the background noise level” by analyzing particular signals.
- New claims 21-22 (issued claims 11-12) recited “generating an anti-noise signal” by using particular signals.

- New claims 23 and 26 (issued claims 13 and 26) recited “combining the ambient sound signal and audio content signal to generate a mixed signal.”
- New claims 24 and 27 (issued claim 14 and 17) recited “generating a new mixed signal by combining the mixed signal with the anti-noise signal.”
- New claims 25 and 28 (issued as claim 15 and 18) recited “reducing the anti-noise signal and increasing the ambient sound signal prior to mixing if the user’s voice is detected.”

56. In the February 10, 2022 preliminary amendment, the patent owner asserted that the amendments were supported by Figs. 2B and 19, as well as paragraphs [0042], [0045], [0048], [0049], [0055], [0058], [0072], [0077], [0084], [0089], and [0112] *Id.* at 897.

57. I note that Fig. 19 and paragraphs [0072], [0077], [0084], [0089], and [0112] are CIP New Matter.

58. On September 29, 2022, the Examiner issued an office action rejecting all claims for non-statutory double patenting. *Id.* at 333-339.⁴ On December 12,

⁴ Application 10/123,110 is one of the parent applications in the ’965 patent’s chain of priority.

2022, the patent owner responded. In the listing of claims, minor amendments are highlighted using what I have been informed is standard PTO amendment notations. *Id.* at 319. In its Remarks, patent owner stated that “Claim 1 has been amended for grammatical issues.” *Id.* at 323. I note that as the “adjusting...” element contained an additional limitation that does not appear to me to be a grammatical issue.

59. In particular, I note that had the proper amendment notations been made, which I have been informed means that additions to the claim made by the amendment would be denoted by underlining, the patent examiner would have seen the following:

adjusting at least one of the ambient sound signal, an audio content signal, a mixed ambient and audio signal, a noise signal, or a combination thereof, when it is detected that the user is speaking.⁵

60. The Examiner issued a Notice Of Allowance on February 10, 2023. *Id.* at 282-288.

61. On February 20, 2023, patent owner filed an amendment requesting claim amendments be entered “to correct grammatical and antecedent issues.” *EX1004* at 269-273. On March 6, 2023, the Examiner entered the amendments. *EX1004* at 264-265.

⁵ All **bold**/*italics*/underline added unless noted otherwise.

62. On May 10, 2023, patent owner filed a paper adding method claims. *Id.* at 257. Patent owner also added additional apparatus claims (application claims 29-30).

63. On June 5, 2023, the Examiner issued an office action rejecting all claims for being indefinite because “it is not clear how to read ‘combination thereof’ as recited, noting that the first ASM signal, the second ASM signal, the ECM signal are the signals received from respective microphones. There are no means contemplated to combine the analog signals from each microphone.” EX1004 at 207. The Examiner indicated that all claims would be allowable if the indefiniteness issues were corrected. *Id.* at 206-207.

64. On June 7, 2023, the patent owner responded to the June 5, 2023 Office Action by making additional amendments to claims 1, 29 (issued claim 19), and 31 (issued claim 21). For example, claim 1 was amended to add “generating a first signal from at least one of the first ASM signal, or the second ASM signal.” *Id.* at 193. Claim 1 was further amended to recite that the “ambient sound signal” is generated from the “first signal or a modified first signal.” *Id.* Finally, claim 1 was amended to recite that the process of detecting if the user speaking is performed “by analyzing at least one of the first signal, or the first ASM signal, or the second ASM signal, or the ECM signal, or by analyzing the first signal and the ECM signal.” *Id.* (emphasis in original). .

65. On July 17, 2023, the patent examiner issued a Notice Of Allowance. *Id.* at 32. The Examiner also indicated that “[r]eceiving the first ASM, second ASM and ECM signals are drawn to the functions defined in fig. 2b.” *Id.* I have analyzed Fig. 2b and see neither an ear canal microphone nor any ECM signals. I have also analyzed the portion of the specification discussing Fig. 2B, which is found in the ’965 patent at 4:56-5:5, and see no discussion there for either an ear canal microphone nor any ECM signals.

66. In the July 17, 2023 Notice Of Allowance, the patent examiner indicated that the claims were deemed allowable because “[i]n the examiner’s opinion, it would not have been obvious to a person of ordinary skill in the art to implement the claimed signal processing in the prior art communication devices using a filter to compensate for an acoustic environment around a microphone.” *Id.* at 33.

C. The Claims

67. The table below includes identifiers for the ’965 patent claims and limitations, which are referenced throughout.

Claim 1	
1.pre	An earbud comprising:

1.1	a first Ambient Sound Microphone (ASM), wherein the first ASM generates a first ASM signal;
1.2	a second ASM, wherein the second ASM generates a second ASM signal;
1.3	an ear canal microphone (ECM), wherein the ECM generates an ECM signal;
1.4	a speaker;
1.5	a memory that is configured to store instructions; and
1.6	a processor that executes the instructions to perform operations, wherein the processor is coupled to the first ASM, wherein the processor is coupled to the second ASM, wherein the processor is coupled to the ECM, wherein the processor is coupled to the speaker, and the operations comprising:
1.7	receiving the first ASM signal;
1.8	receiving the second ASM signal;
1.9	receiving the ECM signal;

1.10	generating a first signal from at least one of the first ASM signal, or the second ASM signal, or both;
1.11	generating an ambient sound signal from the first signal or a modified first signal;
1.12	detecting if the user is speaking by analyzing at least one of the first signal, or the first ASM signal, or the second ASM signal, or the ECM signal, or by analyzing the first signal and the ECM signal; and
1.13	adjusting at least one of the ambient sound signal, an audio content signal, a mixed ambient sound signal and audio content signal, a noise signal or a combination thereof, when it is detected that the user is speaking.
Claim 2	
2	The earbud according to claim 1 wherein the operation of adjusting, adjusts the audio content signal by reducing its volume.
Claim 3	
3	The earbud according to claim 2 wherein the operation of adjusting also amplifies the ambient sound signal.
Claim 4	
4	The earbud according to claim 1 wherein the operation of adjusting, adjusts the ambient sound signal by increasing its volume.

Claim 5	
5	The earbud according to claim 1 wherein the operations further comprise: If the user speaking is detected, analyzing at least one of the first ASM signal, the second ASM signal, the ECM signal, or a combination thereof to detect a voice command.
Claim 6	
6	The earbud according to claim 3 wherein the operations further comprise: resetting the volume of the ambient sound signal to a preset value when a preset time increment has expired.
Claim 7	
7	The earbud according to claim 4 wherein the operations further comprise: resetting the volume of the ambient sound signal to a preset value when a preset time increment has expired.
Claim 8	
8	The earbud according to claim 3 wherein the operations further comprise: resetting the volume of the audio content signal to a preset value when a preset time increment has expired.

Claim 9	
9	The earbud according to claim 1 wherein the operations further comprise: determining the background noise level by analyzing at least one of the first ASM signal, the second ASM signal, the ECM signal, or a combination thereof.
Claim 10	
10	The earbud according to claim 1 wherein the operations further comprise: determining the background noise level by analyzing at least one of a modified first ASM signal, a modified second ASM signal, modified ECM signal, or a combination thereof.
Claim 11	
11	The earbud according to claim 9, wherein the operations further comprise: generating an anti-noise signal using at least one of the first ASM signal, the second ASM signal, the ECM signal or a combination thereof.
Claim 12	
12	The earbud according to claim 10, wherein the operations further comprise: generating an anti-noise signal using at least one of the modified first ASM signal, the modified second ASM signal, the modified ECM signal or a combination thereof.

Claim 13	
13	The earbud according to claim 11, wherein the operations further comprise: mixing the ambient sound signal and audio content signal to generate a mixed signal.
Claim 14	
14	The earbud according to claim 13, wherein the operations further comprise: generating a new mixed signal by combining the mixed signal with the anti-noise signal.
Claim 15	
15	The earbud according to claim 14, wherein the operations further comprise: reducing the anti-noise signal and increasing the ambient sound signal prior to mixing if the user's voice is detected.
Claim 16	
16	The earbud according to claim 12, wherein the operations further comprise: mixing the ambient sound signal and audio content signal to generate a mixed signal.

Claim 17	
17	The earbud according to claim 16, wherein the operations further comprise: generating a new mixed signal by combining the mixed signal with the anti-noise signal.
Claim 18	
18	The earbud according to claim 17, wherein the operations further comprise: reducing the anti-noise signal and increasing the ambient sound signal prior to mixing if the user's voice is detected.
Claim 19	
19[pre]	An earbud comprising:
19.1	a first Ambient Sound Microphone (ASM), wherein the first ASM generates a first ASM signal;
19.2	a second ASM, wherein the second ASM generates a second ASM signal;
19.3	an ear canal microphone (ECM), wherein the ECM generates an ECM signal;

19.4	a speaker;
19.5	a memory that is configured to store instructions; and
19.6	a processor that is coupled to the first ASM, wherein the processor is coupled to the second ASM, wherein the processor is coupled to the ECM, wherein the processor is coupled to the speaker,
19.7	wherein the processor receives the first ASM signal, wherein the processor receives the second ASM signal, wherein the processor receives the ECM signal,
19.8	wherein the processor generates a first signal from at least one of the first ASM signal, or the second ASM signal, or both,
19.9	wherein the processor generates an ambient sound signal from the first signal or a modified first signal,
19.10	wherein the processor detects if a user is speaking by analyzing at least one of the first signal, or the first ASM signal, or the second ASM signal, or the ECM signal, or by analyzing the first signal and the ECM signal, and
19.11	adjusts a level of the ambient sound signal sent to the speaker if the user's voice is detected.
Claim 20	
20	The earbud according to claim 19, wherein an audio content sent to the speaker is adjusted if the user's voice is detected.

Claim 21	
21[pre]	A method comprising:
21.1	receiving the first ASM signal from a first ambient sound microphone;
21.2	receiving the second ASM signal from a second ambient sound microphone;
21.3	receiving the ECM signal from an ear canal microphone;
21.4	generating a first signal from at least one of the first ASM signal, or the second ASM signal, or both;
21.5	generating an ambient sound signal from the first signal or a modified first signal;
21.6	detecting if the user is speaking by analyzing at least one of the first signal, or the first ASM signal and the second ASM signal, or the first ASM signal and the ECM signal, or the second ASM signal and the ECM signal; and
21.7	adjusting a mixed signal sent to the speaker, wherein the mixed signal is a combination of the ambient sound signal, the audio content signal, and an anti-noise signal, when it is detected that the user is speaking.

Claim 22	
22	The method according to claim 21 further comprising: adjusting the mixed signal by reducing a volume of the audio content signal.
Claim 23	
23	The method according to claim 21 further comprising: adjusting the mixed signal by increasing a volume of the ambient sound signal.
Claim 24	
24	The method according to 31 further comprising: analyzing at least one of the first ASM signal, the second ASM signal, the ECM signal, or a combination thereof to detect a voice command.
Claim 25	
25	The method according to claim 23 further comprising: resetting the volume of the ambient sound signal to a preset value when a preset time increment has expired.
Claim 26	
26	The method according to claim 22 further comprising: resetting the volume of the audio content signal to a preset value when a preset time increment has expired.

Claim 27	
27	The method according to claim 21 further comprising: generating a background noise level by analyzing at least one of the first ASM signal, the second ASM signal, the ECM signal, or a combination thereof.
Claim 28	
28	The method according to claim 21 further comprising: generating a background noise level by analyzing at least one of a modified first ASM signal, a modified second ASM signal, a modified ECM signal, or a combination thereof.
Claim 29	
29	The method according to claim 21 further comprising: generating the anti-noise signal using at least one of the first ASM signal, the second ASM signal, the ECM signal or a combination thereof.
Claim 30	
30	The method according to claim 21 further comprising: generating the anti-noise signal using at least one of the modified first ASM signal, the modified second ASM signal, the modified ECM signal or a combination thereof.

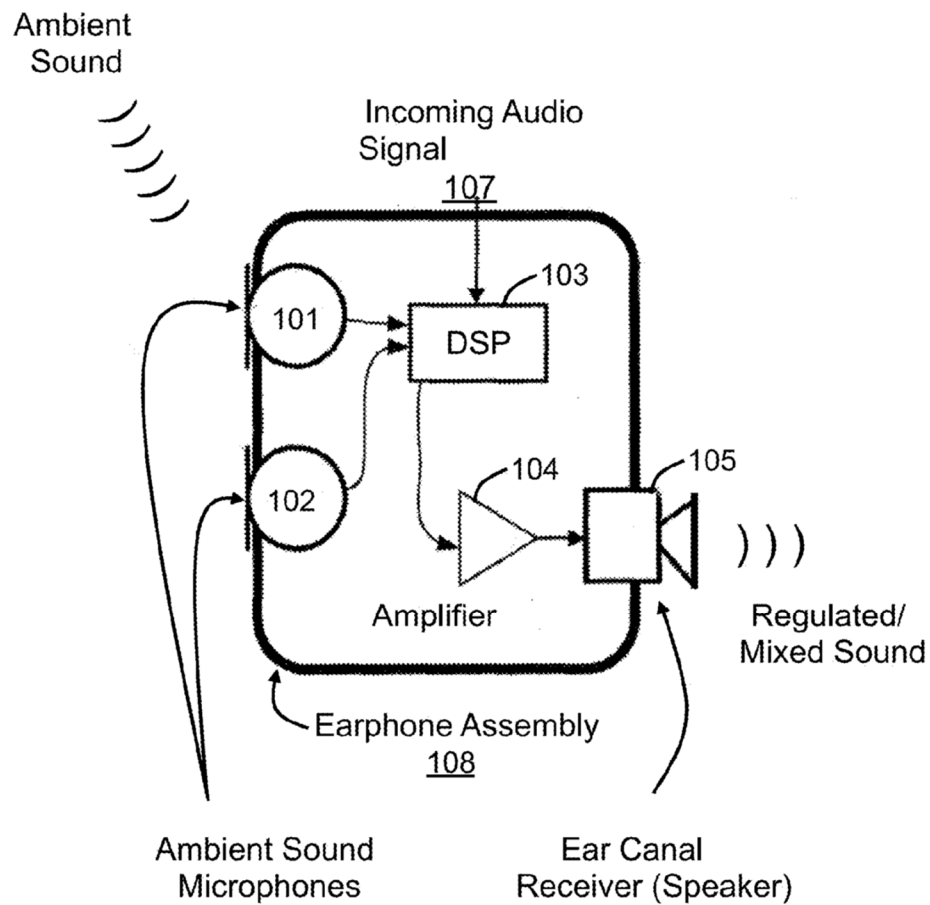
VIII. OVERVIEW OF THE PRIOR ART

68. I first note that the prior art references analyzed in the grounds below are analogous to the '965 patent because they are within the same field of endeavor and/or reasonably pertinent to one or more problems addressed by the '965 patent. Like the '965 patent, *Usher-1*, *Woodruff-1/Woodruff-2*, *Usher-2*, and *Nicholson* disclose earphone embodiments for analyzing the acoustic signals and responding to those detected signals with various functionality. *See, e.g.,* Abstracts in *Usher-1*, *Woodruff*, *Usher-2*, *Nicholson*.

A. *Usher-1*

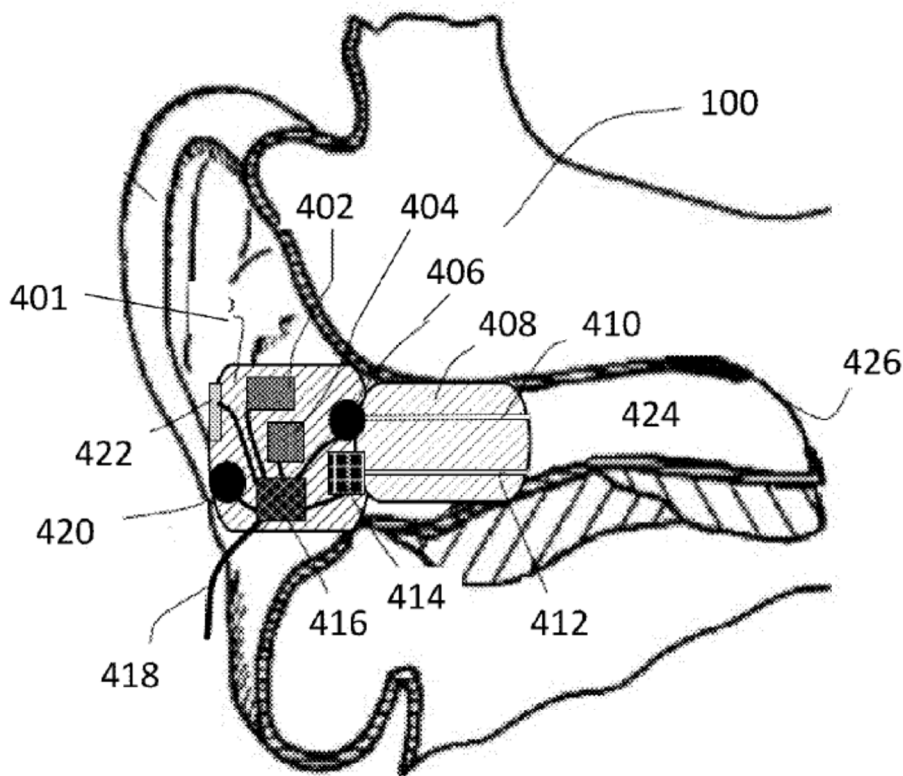
69. *Usher-1* is titled “System And Method To Detect Close Voice Sources And Automatically Enhance Situation Awareness.” *Usher-1* discloses “a method and system for automatically detecting when an earphone user and a second nearby user are engaged in a voice conversation, and activating a sound pass-through system such that the nearby voice source is automatically heard by the user of the sound isolating earphone.” *Usher-1*, ¶[0019].

70. *Usher-1* discloses that “Fig. 1A illustrates an earphone 100 that can provide sound isolation and is configured by way of electronic components to detect close voice sources and enhance situation awareness...” *Id.* ¶[0020]. Fig. 1A shows earphone 100 having ambient sound microphones 101/102, loudspeaker 105, and processor 107.



Usher-I, Fig. 1A; ¶[0052].

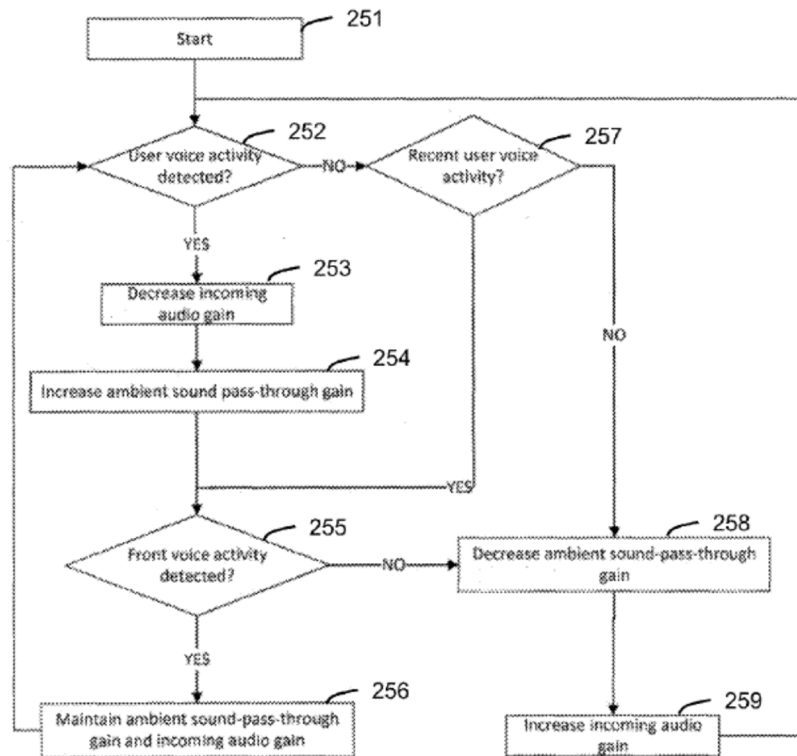
71. *Usher-I*'s Fig. 4 shows its earphone inserted into a user's ear:



400
FIG. 4

Usher-I's ¶[[0055] states that the earphone shown in Fig. 4 has “microprocessor 416, memory 404, battery 402, ECM 406, ASM 420, ECR, 414, and user interface 422.” *Id.* *Usher-I* further discloses that microprocessor 416 “is operatively coupled to memory 404, ECM 406, ASM 420, ECR 414, and user interface 420.” *Id.*

72. *Usher-I's* Fig. 2B is a flowchart showing *Usher-I's* ambient sound pass-through method:



250
FIG. 2B

See also *Usher-1*, ¶[0029].

73. *Usher-1*'s processor monitors sound from its ASMs and detects whether voice is detected. *Id.* at ¶[0030]. At 252, if voice is detected, the gain of the audio signal being played back (e.g., music) is reduced (step 253) while the gain of the signals from *Usher-1*'s ASMs is increased (step 254). *Id.*

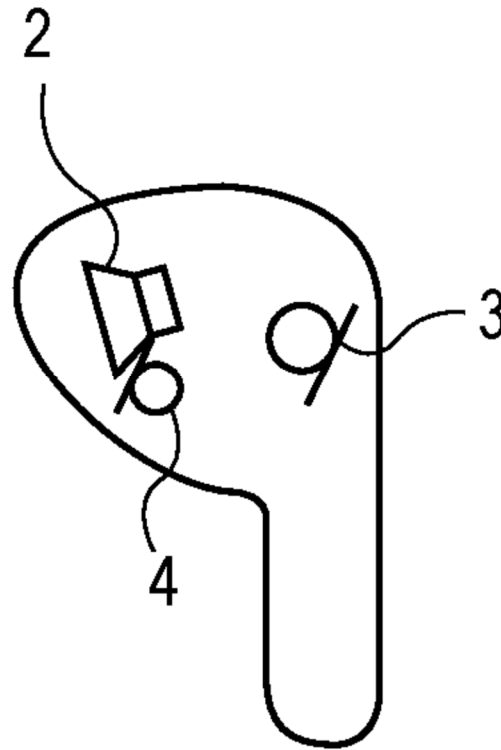
B. *Woodruff-1*

74. *Woodruff-1* is titled “Ambient Sound Enhancement And Acoustic Noise Cancellation Based On Context.” *Woodruff-1* discloses “an audio system that

has an ambient sound enhancement function, also referred to here as a transparency mode of operation, in which an against-the-ear audio device having one or more speakers converts a digitally processed version of an input audio signal into sound.” *Woodruff-1*, ¶[0004].

75. Persons of ordinary skill in the art would have understood that transparency mode for earphones entails reproducing both audio content (e.g., music) while also reproducing sound from the ambient environment. *Id.* According to *Woodruff-1*, “[r]eproduced ambient sound may be louder as compared to the user hearing the ambient sound without the device against their ear...” *Woodruff-1*, ¶[0004]. *See also id.*, ¶[0025].

76. Like *Usher-1*, *Woodruff-1* discloses an earphone (i.e., an against-the-ear audio device) having an ASM 3, and ECM 4, and a loudspeaker 2. *See Woodruff-1*, ¶[0020]. These components are shown in the portion of Fig. 1 reproduced below:



77. *Woodruff-1's* Fig. 2 details the manner in which signals generated by ASM 3 and ECM 4 are modified and processed by its signal processing circuitry to implement the disclosed transparency mode:

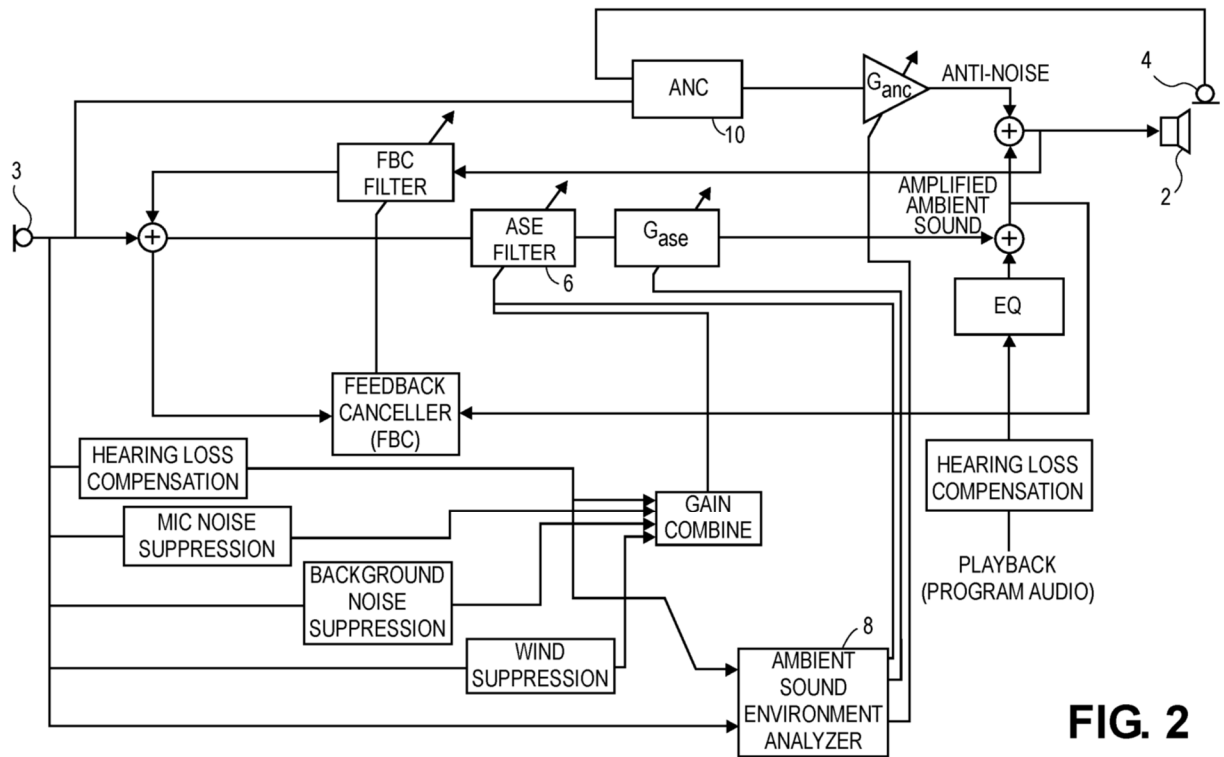


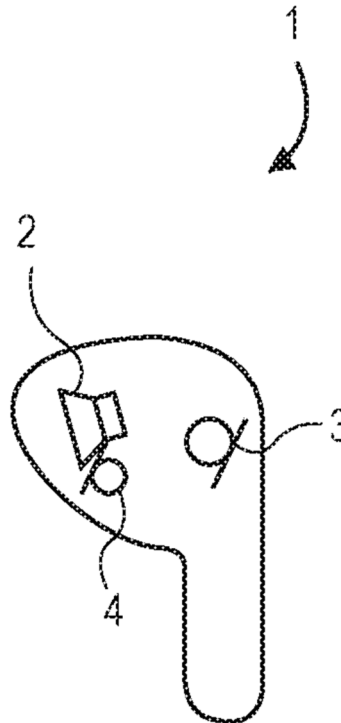
FIG. 2

78. As can be seen, ASM 3 detects ambient sound, converts the ambient sound to electrical signals, which are filtered by ASE filter 6. The signal output by ASE filter 6 are input to gain block G_{ase} , which outputs an amplified ambient sound signal. The amplified ambient sound signal is then summed with program audio, and this summed signal is then combined with an anti-noise signal. Then, the combined audio (i.e., program audio and ambient sound) are played back via speaker 2.

C. *Woodruff-2*

79. *Woodruff-2* is titled “Ambient Noise Aware Dynamic Range Control And Variable Latency For Hearing Personalization.” *Woodruff-2* discloses noise-aware dynamic range controller for an earphone device. *Woodruff-2*, 1:28-34.

80. Like *Woodruff-1*, *Woodruff-2* has an ASM 3, an ECM 4 and an in-ear speaker 2, as shown in Fig. 1:



81. *Woodruff-2*'s Fig. 3 shows a “block diagram of an audio system and related method for personalized ASE...” *Id.*, 3:7-9. The device shown *Woodruff-2*'s Fig. 3 includes what Persons of ordinary skill in the art would have understood is a feedback cancellation circuit, including a “Feedback Canceller” and “FBC filter,” just as shown in *Woodruff-1*'s Fig. 2:

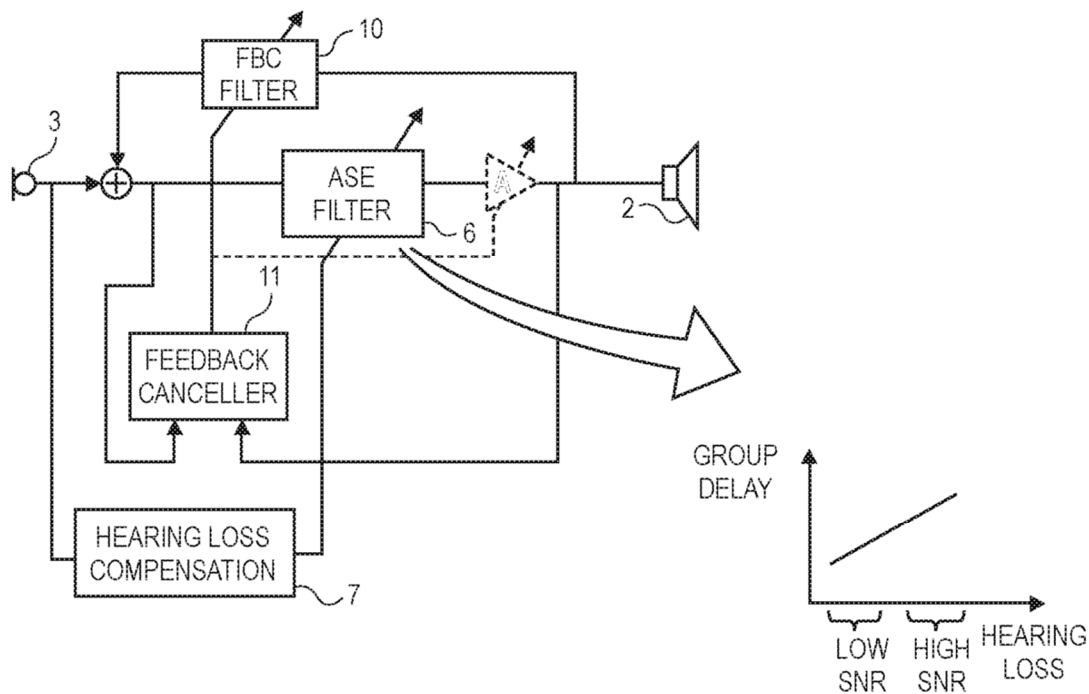
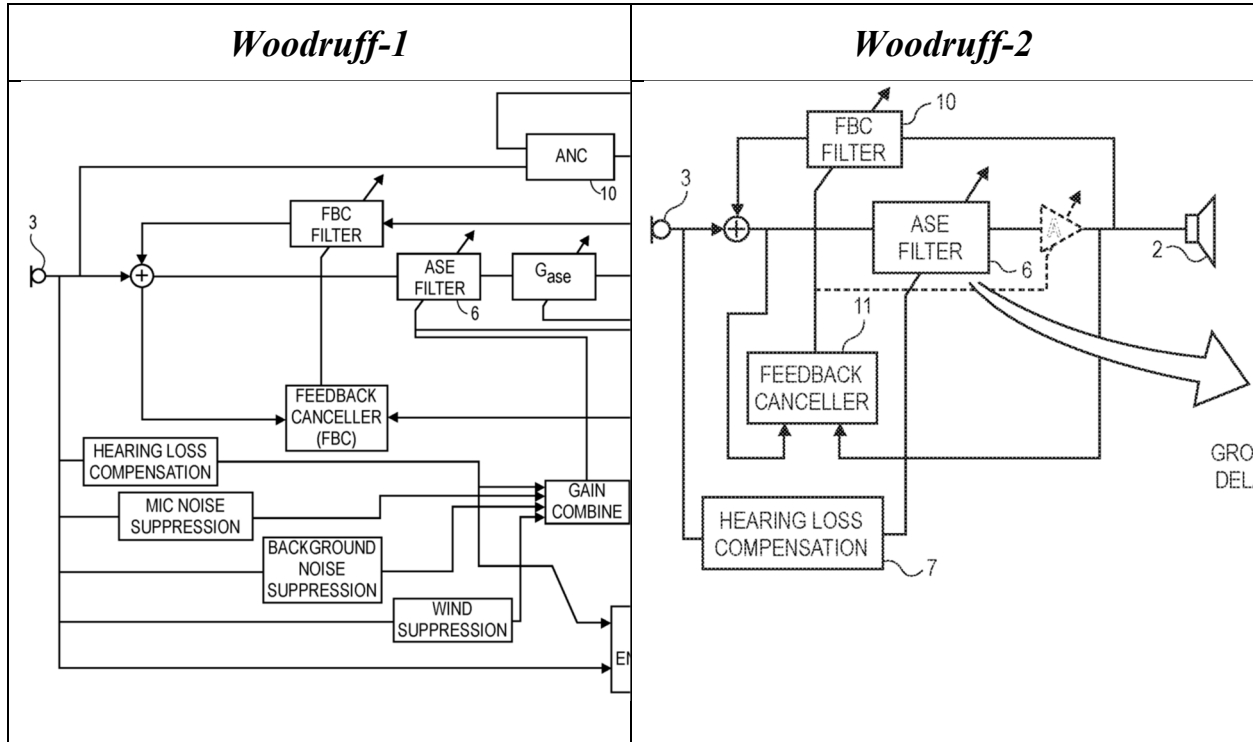


FIG. 3

82. As *Woodruff-2* states, “ASE filter 6 filters the audio signal coming from the external microphone 3.” *Woodruff-2*, 6:61-62. *Woodruff-2* further discloses that its ASE filter 6 “appl[ies] a feedforward gain” to the audio signal. *Id.*, 6:64-66. *Woodruff-2* also discloses that feedback cancellation can also be applied to the audio signal from microphone 3. *Woodruff-2* does this by filtering the output of ASE filter 6 via FBC filter 10. *Id.*, 7:21-28. Then, “[t]he output of the FBC filter 10 may be added to input audio signal coming from the external microphone 3 to result in a combined signal at the input of the ASE filter 6.” *Id.*, 7:33-36.

83. Note that Persons of ordinary skill in the art would have recognized that *Woodruff-2*’s feedback cancellation circuit shown in Fig. 3 is used in *Woodruff-1*’s

Fig. 2, which can be seen by comparing the feedback cancellation circuits of each side-by-side:



Woodruff-1, Fig. 2 (excerpt); *Woodruff-2*, Fig. 3 (excerpt).

D. *Usher-2*

84. *Usher-2* is titled System “Method And Device For Voice Operated Control.” Two of the three listed inventors are the same as listed on *Usher-1*, and *Usher-1* incorporates *Usher-2* by reference. *Usher-1*, ¶[0050]. *Usher-2* discloses “[m]ethods and devices for wearable sound processing and voice operated control...” *Usher-2*, Abstract. *Usher-2* discloses an earphone having a processor that analyze signals for information “such as voice commands.” *Usher-1*, ¶[0050].

E. *Nicholson*

85. *Nicholson* is titled “Active Noise Cancellation Decision In A Portable Audio Device.” *Nicholson* discloses “Active noise cancellation (ANC) circuitry is coupled to the input of an earpiece speaker in a portable audio device, to control the ambient acoustic noise outside of the device and that may be heard by a user of the device.” *Nicholson*, Abstract. Fig. 2 shows *Nicholson*’s components:

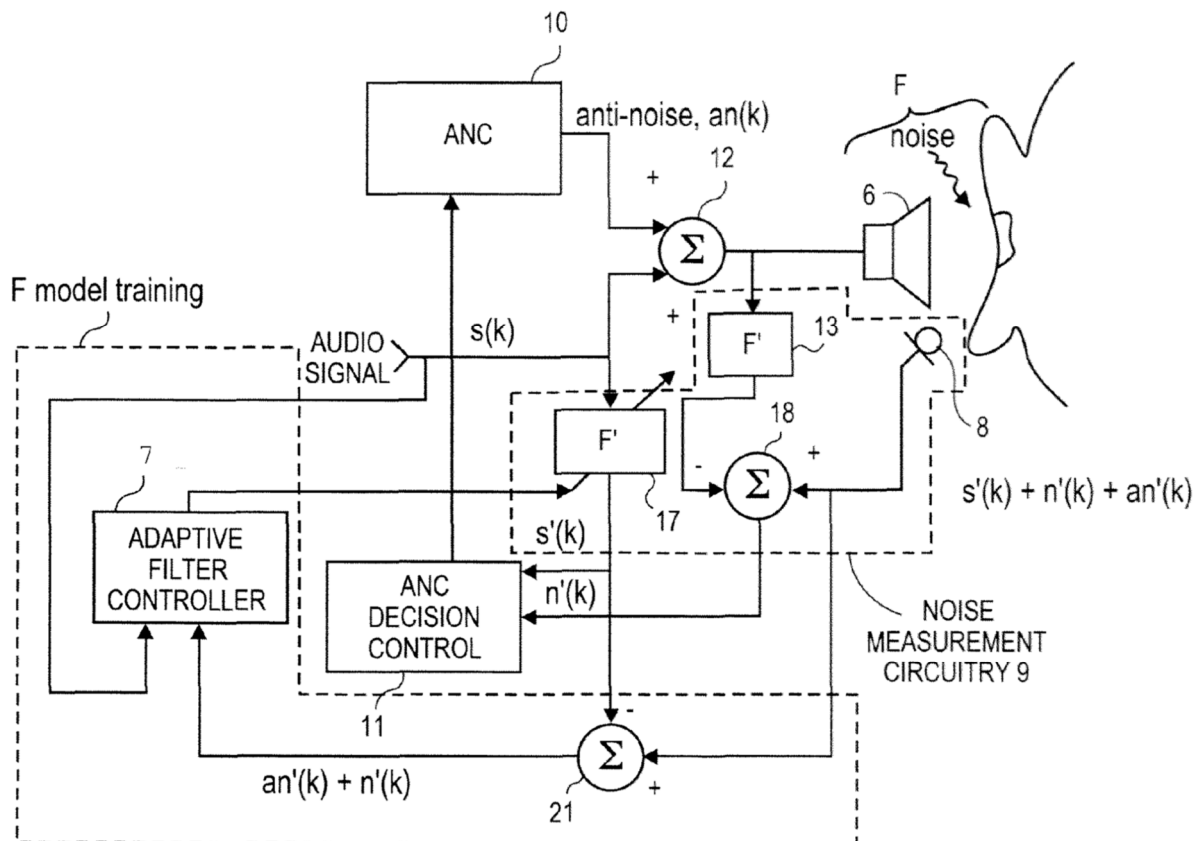


FIG. 2

86. As is seen in Fig. 2, *Nicholson* “includes an error microphone 8 that is located and oriented in such a manner as to pickup both (a) sound emitted from the

earpiece speaker 6 and (b) the ambient acoustic noise that has leaked into the cavity or region between the handset housing or shell (not shown) that is in front of the earpiece speaker 6 and the user's ear.” *Nicholson*, ¶[0027]. *Nicholson* uses various signal processing techniques, discussed in more detail below, to attenuate ambient background noise.

IX. CLAIM CONSTRUCTION

87. Here, I have given all the claim terms of the challenged claims their plain and ordinary meaning, as would have been understood by a person having ordinary skill in the art at the time of the alleged invention, having taken into consideration the language of the claims, the specification, and the prosecution history of record.

88. For purposes of this declaration, I will assume that the time of the alleged invention is March 7, 1008 (the filing date of U.S. Provisional Patent Application 60/893,617). Note that I do not believe any claim terms would be construed differently if this patent is not entitled to a priority date any earlier than June 22, 2021.

X. THE CHALLENGED CLAIMS ARE NOT ENTITLED TO THE BENEFIT OF EITHER APPLICATION 12/044,727 OR '617Prov

89. Claims 1, 19 and 21 of the '965 patent are each independent.

90. Challenged claims 2-18 depend on claim 1, challenged claim 20 depends on claim 19, and challenged claims 22-30 depend on claim 21. Each

independent claim recites limitations that are not supported by either the ultimate parent application (application 12/044,727, (“’727App”)) or the ’617Prov, and in some cases, even the specification of the ’965 patent. Thus, no claims have a priority date any earlier than June 22, 2021, the filing date of the ’965 patent.

91. As I previously discussed, the ’965 patent was filed as a continuation-in-part of the ’505App”. The ’505App claimed priority to the ’727App through a chain of continuations. All applications in the priority chain prior to the ’965 patent contain essentially the same specification, with minor changes made to the Summary Of Invention. *See EX1014*. (comparing the ’682Pat to the ’812Pat).

92. The following table summarizes the limitations that are unsupported by the Original Disclosure, or the ’965 patent itself:

Claims	Claim Element
1, 2, 8, 20, 22, and 26	“Adjusting” or “resetting” an “audio content signal.”
1, 13-18, and 21-23	“Mixing” an ambient sound signal with an audio content signal and/or an anti-noise signal.
6-8 and 25-26	Resetting volume of a signal after a “preset time increment.”
9-12, 14-15, 17-18, 21, 27- 30	“Anti-noise signal” and “Background noise level.”
1, 19, and 21	“Detecting if the user is speaking by analyzing . . . the ECM signal.”

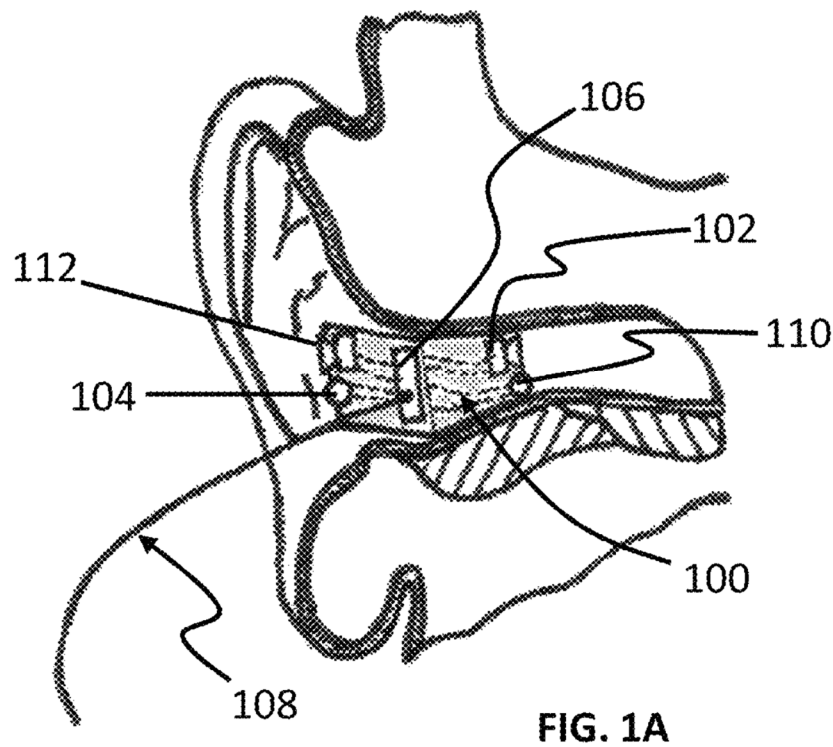
93. As I previously discussed, the applications in the '965 patent priority chain are generally directed to a “Headwear Acoustic Equalization System (HEQS)” that can be used to compensate an ASM signal during an “acoustic dampening event,” such as headwear placed over an earpiece microphone.

94. The '965 patent claim language is divorced from the priority applications. The claims do not include limitations related to “headwear” or detecting a “dampening event,” —i.e., the core concepts disclosed in the priority applications. Instead, the claims are fundamentally directed to an earbud that “adjusts” one or more signals when it is detected that the user is speaking.

A. “Adjusting” or “resetting” an “audio content signal.”

95. There is no support in the Original Disclosure for the element “adjusting ... an audio content signal,” as required by claim 1. Instead, the only support is found in the CIP New Matter added when the '965 patent was filed. As I understand the legal standard, this means that claims reciting this limitation are entitled to a priority date no earlier than 06/22/2021, the '965 patent filing date.

96. Neither the Original Disclosure nor the CIP New Matter ever use the term “audio content signal.” The Original Disclosure, however, discloses that its earphone receives “an audio signal” being input at connector 108, which is delivered to the user via loudspeaker 102. '965 patent, 4:4-13. This can be seen in the embodiment shown in Fig. 1A:



97. Persons of ordinary skill in the art would understand that the terms “audio signal” and “audio content signal” are synonyms.

98. Regardless, there is no disclosure of adjusting such an audio signal in the Original Disclosure, let alone adjusting it in response to detecting that the user is speaking. All references in the Original Disclosure to an audio signal are as follows:

4:7, 4:12-13, 8:62-63, 9:62-64, 10:12, 11:1-3, 11:17, 12:7-9, and 13:13-15.⁶ There is no mention of adjusting anywhere.

99. In contrast, the CIP New Matter discloses that its device “adjust[s] audio content.” ’965 patent, 17:64-18:4. *See also Id.*, 22:48-54. Thus, any written description support for this claim element is found only in the CIP New Matter, meaning claim 1 (and claims dependent therefrom) is not entitled to a priority date earlier than the ’965 patent filing date.

100. Claim 2 recites adjusting audio content signal “by reducing its volume.” This is not supported by any disclosure and thus not entitled to rely on its claimed priority date.

101. Claim 8, which depends (through claims 2 and 3) on claim 1 recites, in part, “resetting the volume of the audio content signal to a preset value.” Neither the term “resetting” nor any root thereof appears in the ’965 patent. There are no

⁶ Note that the Original Disclosure also refers to an “audio signal filter.” *See* ’965 patent, 7:14-18 and 8:32:38. However, the Original Disclosure only discloses applying an audio signal filter to ambient sound signals, which are not audio content signals. *Id.* The Original Disclosure also refers to a SONAR test audio signal, but there is no disclosure of adjusting such a signal, and regardless, SONAR is not “audio content.” *Id.*, 10:20-25 and 11:26-31.

synonyms either, meaning that this claim is unsupported by the '965 patent. Thus, claim 8 is not entitled to rely on the claimed priority date.

102. Claim 20 recites that “an audio content sent to the speaker is adjusted if the user's voice is detected.” Thus, claim 20 only finds written description support, if any, in the CIP New Matter, and is therefore not entitled to a priority date any earlier than the CIP filing date.

103. Claim 22 (which depends on independent claim 21) recites “adjusting the mixed signal by reducing a volume of the audio content signal.” As I discussed, only the CIP New matter discloses adjusting the audio content. However, no disclosure in '965 patent discloses “reducing the volume” of the audio content signal when it is detected that the user is speaking, meaning that claim 22 is not entitled to its claimed priority date.

104. Finally, claim 26 recites “resetting the volume of the audio content signal to a preset value...” As I discussed, “resetting” the audio content signal is not disclosed at all. Thus, claim 26 is not entitled to its claimed priority date.

B. “Mixing” an ambient sound signal with an audio content signal and/or an anti-noise signal

105. Claims 1, 13-18, and 21-23 recite limitations related to mixing an ambient sound signal with an audio content signal and/or an anti-noise signal. The

following is the specific claim language which is unsupported by the Original Disclosure:

Claim	Claim Language
1	“mixed ambient sound signal and audio content signal”
13, 16	“mixing the ambient sound signal and audio content signal to generate a mixed signal”
14, 17	“generating a new mixed signal by combining the mixed signal with the anti-noise signal”
15, 18	“prior to mixing”
21	“adjusting a mixed signal sent to the speaker, wherein the mixed signal is a combination of the ambient sound signal, the audio content signal, and an anti-noise signal”
22-23	“adjusting the mixed signal”

106. Neither the term “mix,” “mixed” nor “mixing appear anywhere in the specification of the ’965 patent. The only description that might be considered mixing ambient sound and audio content signals is found in CIP New Matter, for example at 16:29-37 (“In certain embodiments, the first user 2401 may be any type of user that may potentially desire to listen to audio content, such as from, but not limited to, a music playlist accessible via the first user device 2402, a telephone call that the first user 2401 is participating in, audio content occurring in an environment in proximity to the first user 2401, any other type of audio content, or a combination thereof.”). *See also id.*, 21:23-30.

107. I note that the CIP New Matter states that the ambient sound microphones can capture “audio content occurring in an environment that the earphone device 2415 is present in and/or is proximate to.” ’965 patent, 18:8-17. Persons of ordinary skill in the art would consider signals created from the captured “audio content occurring in an environment” to correspond to the claimed “ambient sound signal.” Persons of ordinary skill in the art would further consider signals carrying music or telephone calls to correspond to the claimed “audio content signal.”

108. Thus, when the CIP New Matter refers to “a combination thereof,” this is the only disclosure that persons of ordinary skill in the art would have considered as supporting claims reciting “mixing” an audio content signal and an ambient sound signal. Since this disclosure only appears in the CIP New Matter, claims 1, 13, 16, each of which recite mixing audio content and ambient sound signals, are not entitled to a priority date any earlier than the CIP filing date of 06/22/21.

109. Claims 14 and 17 each require “mixing” the previously mixed ambient sound and audio content signal with an anti-noise signal. Claims 15 and 18 depend, from claims 14 and 17, respectively, and recite “reducing the anti-noise signal ... prior to mixing...” As I noted above, these claims were added to the application via the February 10, 2022 preliminary amendment. As I also previously noted, there is no disclosure in either the Original Disclosure or the CIP New Matter of generating

an anti-noise signal, meaning there can be disclosure of mixing an anti-noise signal with any other signals. Thus, these claims are not entitled to rely on the filing dates of either the *'617Prov* or any of the utility applications in the '965 patent priority chain.

110. Independent claim 21 recites that the “mixed signal” is a combination of various signals and an “anti-noise signal.” Claims 22-23 recite “adjusting” components of this mixed signal. As I previously noted, these claims were added to the application in the May 10, 2023 RCE. Because there is no disclosure in either the *'617Prov*, the Original Disclosure or the CIP New Matter of an anti-noise signal, there can be disclosure of a mixed signal that includes an anti-noise signal or making any adjustments to components of such a mixed signal. Thus, claims 21-23 are not entitled to rely on the filing dates of either the *'617Prov* or any of the utility applications in the '965 patent priority chain.

C. Resetting volume of a signal after a “preset time increment.”

111. Claims 6-8 and 25-26 recite resetting the volume of either the ambient sound or the audio content signal “after a preset time increment.” As I previously noted, claims 6-8 were added to the application via the February 10, 2022 preliminary amendment, while claims 25-26 were added via the May 10, 2023 RCE. Neither the Original Disclosure nor the CIP New Matter disclose resetting either the ambient sound or audio content signals “after a present time increment.” As I

previously discussed, there is no disclosure in any of the priority applications of “resetting” audio content signals. However, while the CIP New Matter discloses adjustment of audio content signals, it provides no disclosure of exactly what it means to perform such an adjustment. This is a problem in and of itself, but even if persons of ordinary skill in the art could extrapolate some suggestion somewhere in the ’965 patent that such “adjustment” teachings includes resetting the volume, there is no disclosure at all of doing so “after a preset time increment.”

112. Thus, Claims 6-8 and 25-26 are not entitled to rely on either the filing dates of the *’617Prov* or any of the utility applications in the ’965 patent priority chain.

D. “Anti-noise signal” and “Background noise level.”

113. Claims 9-10 and 27-28 recite “generating a background noise signal.” Claims 11-12, 14-15, 17-18, 21 and 29-30 recite an “anti-noise signal.” Neither the Original Disclosure nor the CIP New Matter disclose either a background noise level or an anti-noise signal, let alone use of particular inputs used to generate such signals. While the Original Disclosure contains the word “noise,” there is no mention at all of either a “background noise level” or an “anti-noise signal.” *See* ’965 patent, 4:61-62 (“local noise sources, such as machine noise”), 5:65 (“nose bursts”), and 10:13/11:19 (“Noise signal (white noise or pink noise).”). Indeed, the patent states that “noise reduction” is “not described here.” ’965 patent, 4:13-20.

114. Thus, Claims 9-12, 14-15, 17-18, 21, 27- 30 are not entitled to rely on the filing dates of either the '617*Prov* or any of the utility applications in the '965 patent priority chain.

E. “Detecting if the user is speaking by analyzing . . . the ECM signal.”

115. Claims 1, 19, and 21 each require detecting if a user is speaking by analyzing at least one of a variety of different signals, including an ECM Signal. Neither the Original Disclosure nor the CIP new matter disclose detecting if the user is speaking by analyzing an “ECM signal,” i.e., a signal generated by an ear canal microphone. As I previously discussed, the embodiments of the '965 patent describe detecting when headwear is placed on a user's head, and enabling a compensation filter that processes the audio signals played back to the user via the earphone's loudspeaker, which is located in the user' ear canal. The '965 patent further discloses that this compensation can be voice activated. '965 patent, 2:28-29 and 1:64-66.

116. The only signals the '965 patent discloses are used to detect whether a user is speaking are ASM signals, i.e., signals generated by ambient sound microphones. One of these embodiments is described at 11:48-12:47, and it states that a “Voice test sound is generated by the HEQS user, and is simultaneously detected using one or more ambient sound microphones mounted on the same

headset.” *Id.*, 11:50-53. Another embodiment, described at 12:48-13:63, also uses only signals generated by ambient sound microphones to detect whether a user is speaking. *Id.*, 12:52-58 (“Once obtained, the ASM signal is filtered with a filter corresponding to the inverse of ATI_HW. This self-contained Voice-based headwear determination platform uses a Voice or non-voice (e.g. hand-clap) test sound created by the HEQS user, and is simultaneously recorded using one or more ambient sound microphones mounted on a headset near to or in the user's ear canal.”). *See also id.*, 28:31-36 (“FIG. 19 illustrates left 1910A and right earphones 1910B prior to insertion of a user's ears. The Earphones can have a total of at least four ASMs (1920, 1930, 1940, and 1950), which can be used in accordance with the description herein for example beam forming and voice detection and/or identification.”).

117. The only disclosure regarding ear canal microphones is that they are used to detect sound in the ear canal. '965 patent, 28:66-67 (“Microphone 2020 can be used to detect audible sound in the ear canal (ear canal microphone).). There is no suggestion that signals generated by the ECM can be used to detect whether the user is speaking. The '965 patent provides no details regarding the purpose of the ear canal microphone, other than to state that it (and an external loudspeaker) exists “for performing other functions of the headphone system not described here (such

as monitoring of sound exposure and ear health conditions, headphone equalization, headphone fit testing, noise reduction, and customization).” ’965 patent, 4:13-30.

118. In sum, there is no disclosure in any of the ’627Prov, the Original Description or the CIP New Matter of using an ECM signal to detect whether a user speaking. Thus, Claims 1, 19, and 21 are not entitled to rely on the filing dates any applications in the ’965 patent priority chain.

XI. DETAILED EXPLANATION OF GROUNDS

A. Ground 1: *Usher-1*, *Woodruff-1*, and *Woodruff-2* Render Obvious Claims 1-4, 6-9, 11, 13-15, 19-23, 25-27, and 29

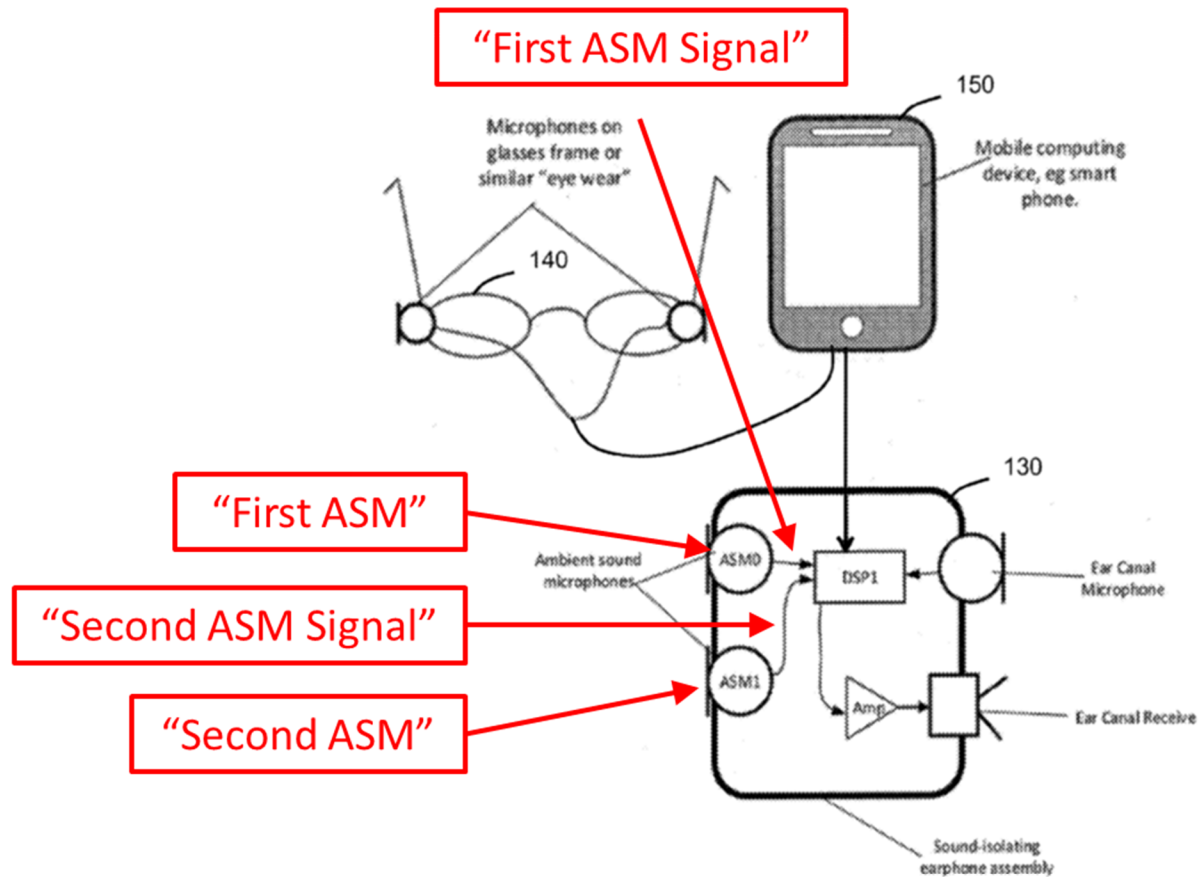
1. Claim 1

a. [1.pre]: “An earbud comprising:”

119. To the extent the preamble is limiting, *Usher-1* discloses/suggests this feature. *See Usher-1*, ¶[0002].

b. [1.1]: “a first Ambient Sound Microphone (ASM), wherein the first ASM generates a first ASM signal”

120. *Usher-1* discloses/suggests this feature. *Usher-1* discloses use of ASMs, e.g., ASM 101/ASM0 and 102/ASM1:



300
FIG. 3A

Usher-I, Fig. 3A. See also Fig. 1A. See also *Id.*, ¶[0021] (“...the earphone 100 includes a processor 103 (e.g., Digital Signal Processor DSP) operatively coupled to one or more ambient sound microphones (101/102)...”). Persons of ordinary skill in the art would have recognized that *Usher-I*’s first and second ASMs correspond to the claimed first and second ASMs.

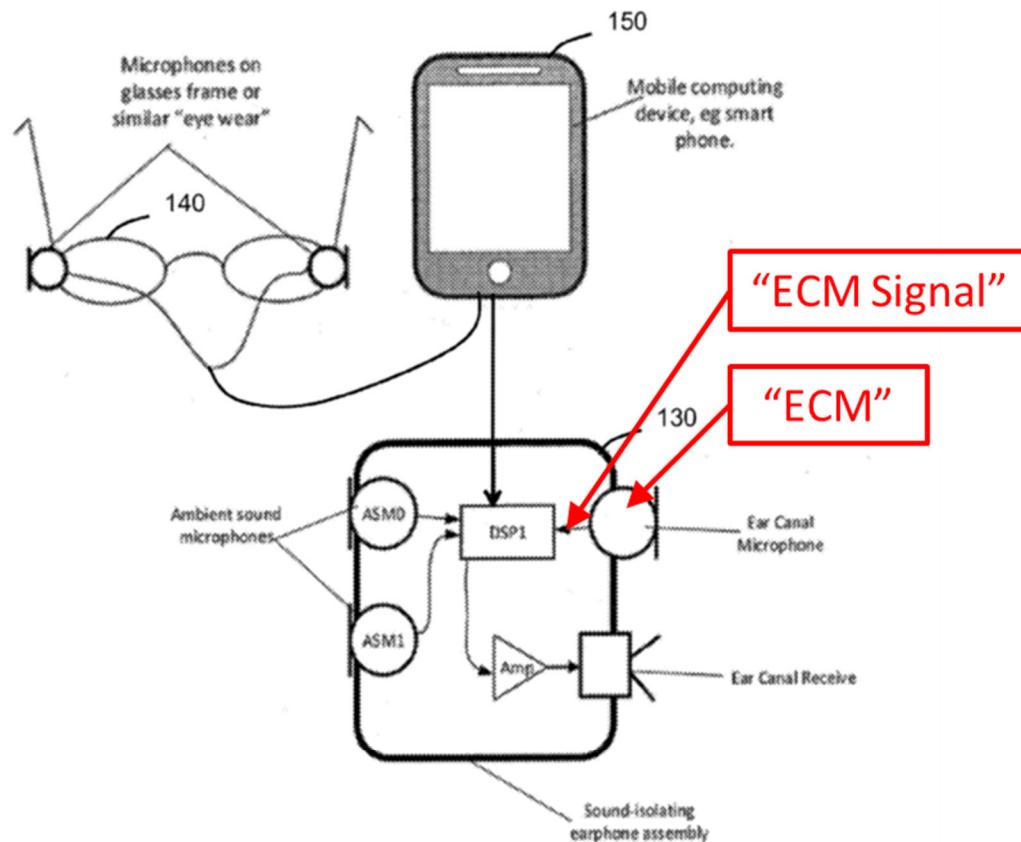
121. *Usher-I* further discloses that ASMs 101 (ASM0)/102 (ASM1) output ASM signals, which can be seen in the annotated Fig. 3A, above. *Id.*, ¶[0022] (“The two ambient sound microphone (101/102) signals...”). Persons of ordinary skill in the art would have recognized that these ASM signals correspond to the claimed first and second ASM signals.

c. [1.2]: “a second ASM, wherein the second ASM generates a second ASM signal”

122. I provided the analysis regarding this element when discussing “first ASM...” claim element in Section XI.A.1.b.

d. [1.3]: “an ear canal microphone (ECM), wherein the ECM generates an ECM signal”

123. *Usher-I* discloses/suggests this feature. *Usher-I*’s Fig. 3A shows an ECM:



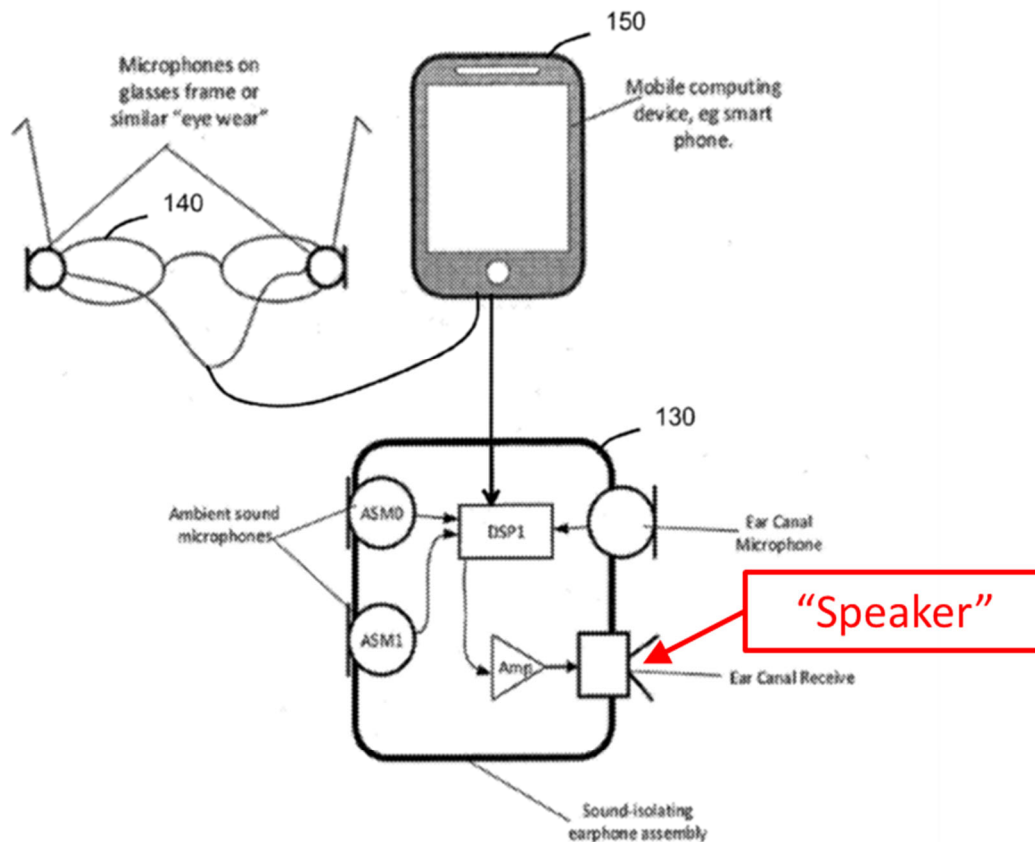
300
FIG. 3A

See also *Usher-1*, ¶[0042] (“Referring to FIG. 3A, a system 300 for close proximity detection and audio mixing in accordance with an exemplary embodiment is shown. The system 300 includes the earphone 130 (i.e., earphone 100 equipped with an optional ear canal microphone)...”). See also *Usher-1*’s Fig. 4, element 406 and ¶[0052]. Persons of ordinary skill in the art would have recognized that *Usher-1*’s ECM shown in Fig. 3A and ECM 406 correspond to the claimed ECM.

124. *Usher-1*'s ECM outputs an ECM signal. *Usher-1*, ¶[0055] (“Microprocessor 416 is operatively coupled to ... ECM 406...”); ¶[0056] (“All transducers shown [in Fig. 4] can receive or transmit audio signals...”). Persons of ordinary skill in the art would have recognized that the signal output by *Usher-1*'s ECM corresponds to the claimed “ECM signal.”

e. [1.4]: “a speaker”

125. *Usher-1* discloses/suggests this feature. *Usher-1* discloses that its earphone has a speaker, which it calls an “ear canal receiver.” *See* Fig. 1A:



300
FIG. 3A

See also Usher-1, ¶[0021] (“For such purpose, the earphone 100 includes ... an ear canal receiver 105.”); ¶[0022] (“...ear canal receiver (ECR) 105 (i.e., a loudspeaker...”); *See also* Figs. 3A, 4 (element 414) and ¶[0053].

126. Persons having ordinary skill in the art would have understood that *Usher-1*’s ear canal receiver corresponds to the claimed “speaker.”

f. [1.5]: “a memory that is configured to store instructions; and”

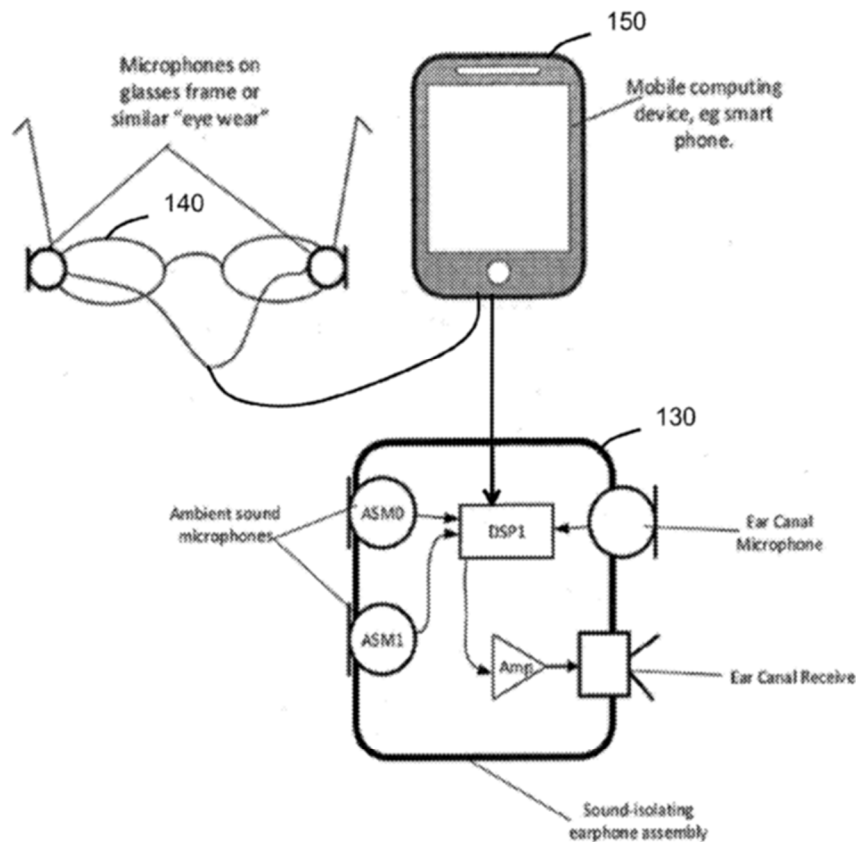
127. *Usher-I* discloses/suggests this feature. *Usher-I* discloses that its earphone has a memory.” See Figs. 4 (element 404) and 5 (element 556). See also *Usher-I*, ¶[0055] and [0058]. *Usher-I* discloses that its memory is coupled to a microprocessor. *Usher-I*, ¶[0055] (“Microprocessor 416 is operatively coupled to memory 404...”). Persons of ordinary skill in the art would have understood that *Usher-I*’s microprocessor executes instructions to implement *Usher-I*’s method, and that such instructions would be stored in its *memory*.

128. Thus, persons having ordinary skill in the art would have understood that *Usher-I*’s memory corresponds to the claimed “memory...”

g. [1.6]: “a processor that executes the instructions to perform operations, wherein the processor is coupled to the first ASM, wherein the processor is coupled to the second ASM, wherein the processor is coupled to the ECM, wherein the processor is coupled to the speaker, and the operations comprising:”

129. *Usher-I* discloses/suggests this feature. Persons of ordinary skill in the art would have understood that *Usher-I*’s processor executes instructions to perform operations, as this is how processors operate.

130. *Usher-I* discloses that its processor is coupled to its ASMs, its ECM and its speaker. See e.g., Fig. 3A:



300
FIG. 3A

See also *Usher-1*, Figs. 1A and 4. See also *Id.*, ¶[0021] and [0055].

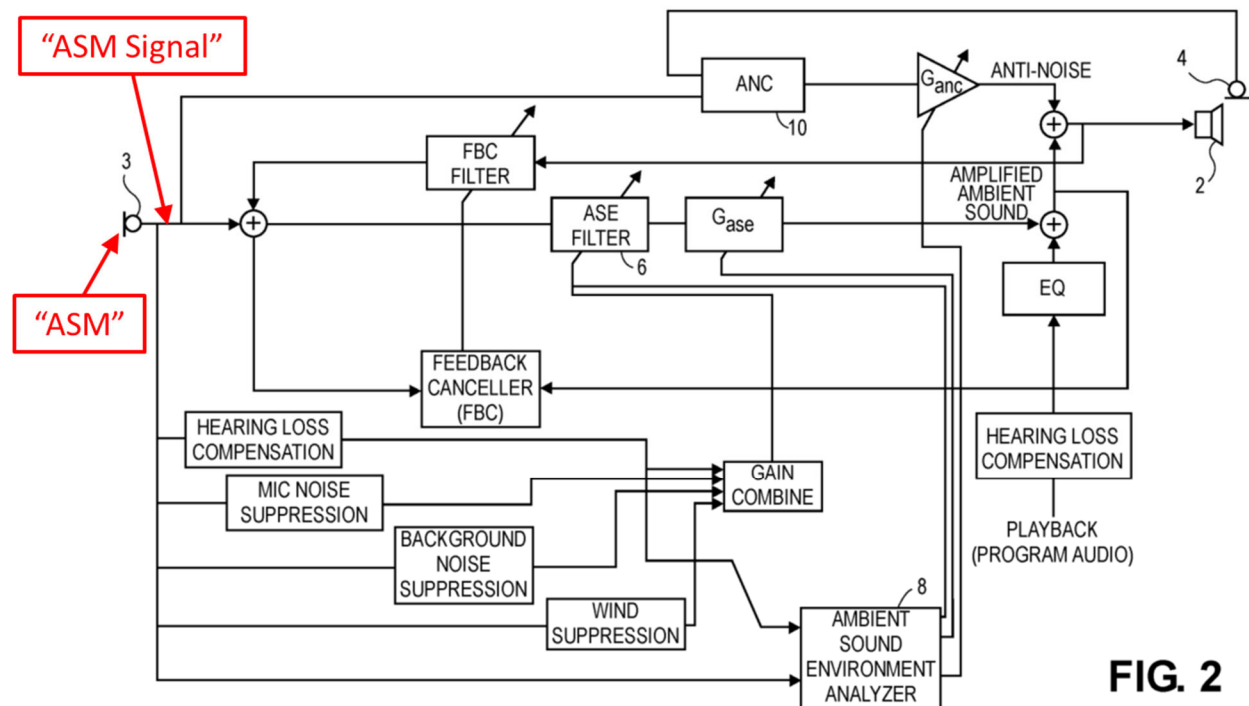
h. [1.7]: “receiving the first ASM signal”

131. *Usher-1* in view of *Woodruff-1* discloses/suggests this feature. *Usher-1* discloses that its ASMs, e.g., ASMs 101/102, are coupled to its processor. *Usher-1*, ¶[0021] (“...the earphone 100 includes a processor 103 (e.g., Digital Signal

Processor DSP) operatively coupled to one or more ambient sound microphones (101/102)...”).

132. *Usher-1* further discloses that its processor receives the ASM signals from ASMs 101/102. *Id.*, ¶[0022] (“The two ambient sound microphone (101/102) signals are directed to the processor 103...”). Persons of ordinary skill in the art would have understood that for this to happen, the processor would execute instructions to perform the operation of receiving these ASM signals. Thus, *Usher-1* discloses this element.

133. *Woodruff-1* also discloses an ASM that outputs an ASM signal. *Woodruff-1* discloses “external microphone 3,” which is shown in Fig. 2:



Woodruff-1 also discloses use of more than one ASM. See *Woodruff-1*, ¶[0024]

(“Here it should be noted that while the figures show a single microphone symbol in each instance (external microphone 3 and internal microphone 2), as producing a sound pickup channel, this does not mean that the sound pickup channel must be produced by only one microphone. In many instances, the sound pickup channel may be the result of combining multiple microphone signals, e.g., by a beamforming process performed on a multi-channel output from a microphone array.”).

134. *Woodruff-1* further discloses that Fig. 2 operates under the control of a processor. *See e.g., Woodruff-1*, ¶[0022]. Thus, *Woodruff-1* also discloses this element.⁷

i. [1.8]: “receiving the second ASM signal”

135. *See* Section XI.A.1.h.

j. [1.9]: “receiving the ECM signal”

136. *Usher-1* discloses/suggests this feature. *Usher-1* discloses that its ECM, e.g., ECM shown in Figs. 1A, 3A and 4, is coupled to its processor. *Usher-1*, ¶[0055] (“...Microprocessor 416 is operatively coupled to ... ECM 406...”). *Usher-1* further discloses that its processor receives an ECM signals from its ECM. *Id.*, ¶[0056] (“All transducers shown can receive or transmit audio signals to a processor

⁷ I will discuss the reasons why persons of ordinary skill in the art would have been motivated to combine *Woodruff-1* with *Usher-1* below.

416...”). Persons of ordinary skill in the art would have understood that for this to happen, the processor would have to execute instructions to perform the operation of receiving these ECM signals. Thus, *Usher-1* discloses this element.

k. [1.10]: “generating a first signal from at least one of the first ASM signal, or the second ASM signal, or both”

137. *Usher-1* in view of *Woodruff-1*/*Woodruff-2* discloses/suggests this feature. As I discussed, *Usher-1* discloses that the its ASMs output ASM signals. See Sections XI.A.1.b and XI.A.1.c. As I also discussed, *Usher-1* discloses that its ASM signals are sent to its processor. See Sections XI.A.1.h and XI.A.1.i. *Usher-1*, however, does not explicitly teach generating a new signal, i.e., “a first signal,” from one or both of the first and second ASM signals. Persons of ordinary skill in the art would have recognized that *Usher-1* in view of *Woodruff-1*/*Woodruff-2* discloses the generation of such a “first signal.”

138. Persons having ordinary skill in the art would have recognized that *Woodruff-1* is very similar to *Usher-1* in that both disclose what each refer to as a “pass-through” mode. *Usher-1*, ¶[0021], [0026], [0029] and [0033]-0034]; *Woodruff-1*, ¶[0045]. *Woodruff-1* discloses “an audio system that has an ambient sound enhancement function, also referred to here as a transparency mode of operation, in which an against-the-ear audio device having one or more speakers

3.” *Id.* Persons of ordinary skill in the art would have understood that *Woodruff-1*’s external microphone 3 is an ASM, and corresponds to at least one of the claimed first and second “ambient sound microphone(s), and further serves the same purpose as *Usher-1*’s ambient sound microphones 101/102. Likewise, Persons of ordinary skill in the art would have understood that the output of *Woodruff-1*’s microphone 3 corresponds to at least one of the claimed first or second “ASM signals.” *Id.* *Woodruff-1*’s Fig. 2 discloses feedback cancellation components (e.g., FBC filter and Feedback Canceller), but does not describe them in detail.

141. As I discussed in Section VIII.C, *Woodruff-2* contains essentially the same feedback cancellation components, which it does describe. In particular, *Woodruff-2*, like *Woodruff-1*, discloses use of a Feedback Canceller and an FBC Filter. As persons of ordinary skill in the art would see, the output of ASE Filter 6 (discussed in Section XI.A.1.1), has a gain applied to it (shown as amplifier A in *Woodruff-2*’s Fig. 3). The output of that amplified signal is input to FBC Filter 10.

142. *Woodruff-1* is similar, although it has additional signal processing. Specifically, the output of *Woodruff-1*’s ASE Filter 6 also has a gain applied (see gain block G_{ase}). Rather than inputting this signal directly into FBC Filter, as in *Woodruff-2*, *Woodruff-1* first combines the this signal with the program audio (e.g., music):

The ambient sound as picked up in a sound pickup channel

(e.g., a microphone signal from the external microphone 3) is filtered in a frequency-dependent transparency gain block G_{ase} , which is controlled by an ambient sound environment analyzer 8 according to the hearing profile of the user (based on input from the hearing loss compensation block.) The ambient sound content is then combined with a playback signal which contains program audio. The program audio may be music, the voice of a far end user during a phone call, or the voice of a virtual assistant program, which has not yet been converted to sound in the ambient environment.

Woodruff-1, ¶[0025] This combined signal is combined with an anti-noise signal.

Woodruff-1, ¶[0029] (“The anti-noise signal is combined with the ambient sound signal before they together drive the speaker 2 of the against the ear audio device.”).

As seen in Fig. 2, this signal is also input to FBC Filter 10.

143. *Woodruff-2* further discloses that “[t]he output of the FBC filter 10 may be added to input audio signal coming from the external microphone 3 to result in a combined signal at the input of the ASE filter 6.”⁸ *Id.*, 7:33-36. The same feature is

⁸ Persons of ordinary skill in the art would have understood that when *Woodruff-2* uses the abbreviation “ASE” as shorthand for “ambient sound enhancement.” *Woodruff-2*, 1:39-43. Given the overlapping inventors and the fact that *Woodruff-1*

shown in *Woodruff-1*'s Fig. 2. Persons of ordinary skill in the art would have recognized that the adder shown *Woodruff-1*/*Woodruff-2* adds the output of FBC filter 10 to the signal output by ASM 3 (i.e., a claimed ASM signal), and that this adder generates a new signal, which corresponds to the recited "first signal."

144. *Woodruff-2*'s Fig. 3 has been annotated to show that microphone 3 corresponds to a claimed ASM, that its output corresponds to a claimed ASM signals, and that the output of the adder corresponds to the claimed "first signal:"

and *Woodruff-2* have the same assignee and similar drawings, persons of ordinary skill in the art would have understood that "ASE" has the same meaning in both.

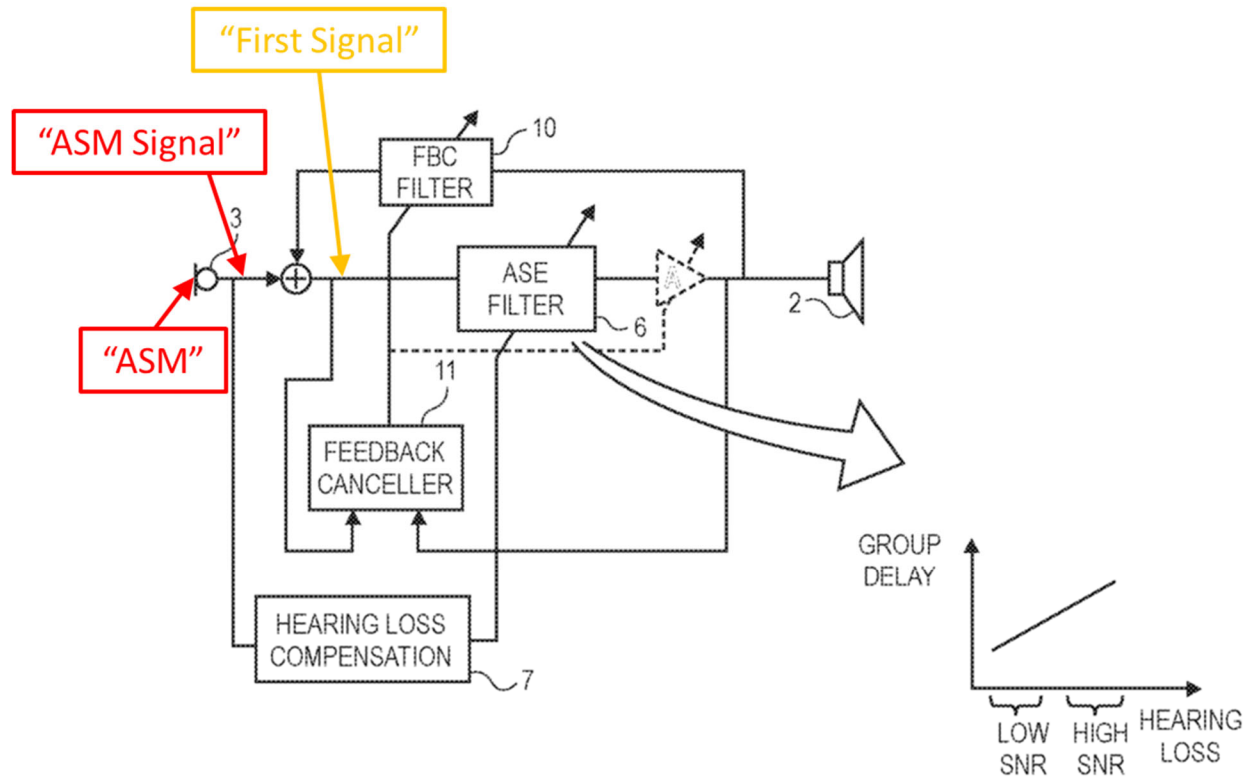
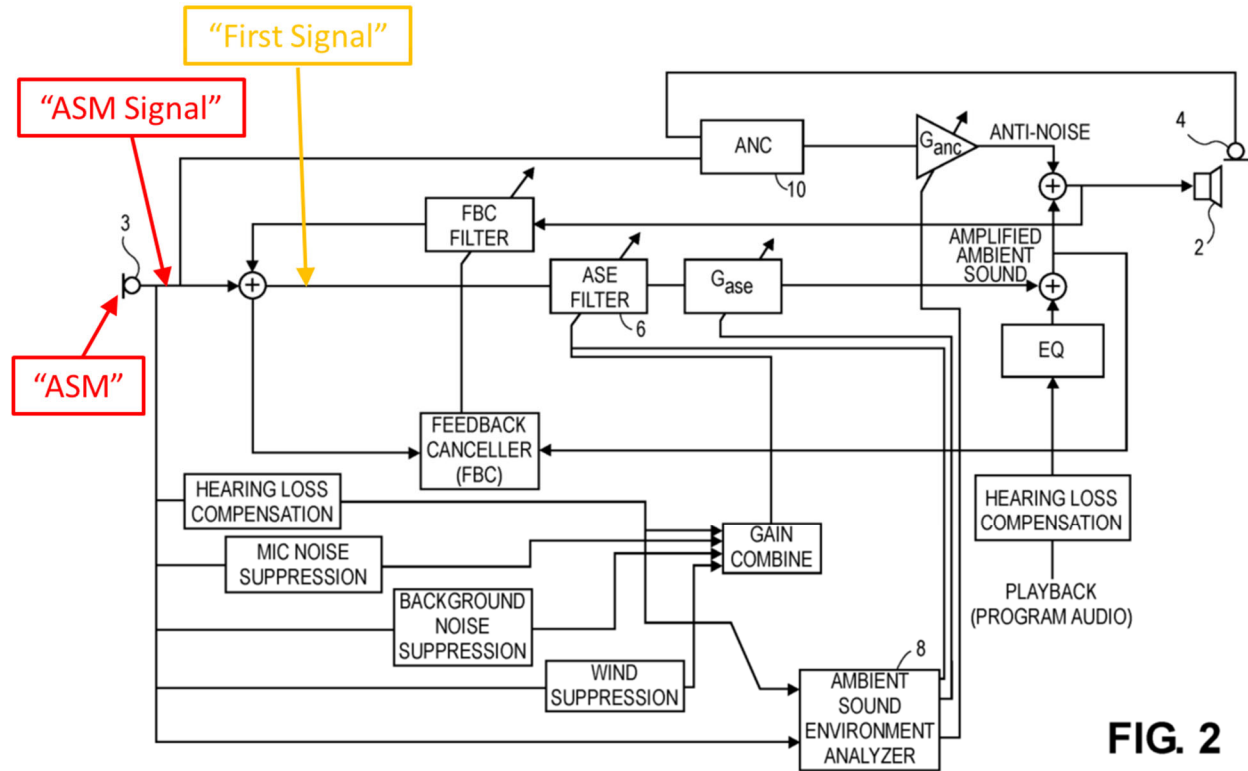


FIG. 3

This is also shown in *Woodruff-1*'s annotated Fig. 2:



145. Note that claim 1 does not specify how the “first signal” is generated or what form it takes. The language only requires that the “first signal” be generated from one or both of the recited first or second “ASM signals.” Given that the claim only requires that one of the ASM signals be used, the fact that *Woodruff-1/Woodruff-2* only explicitly disclose a first ASM microphone and hence only one ASM signal is irrelevant.

(i) Persons of ordinary skill in the art Would Have Been Motivated To Combine *Woodruff-1* and *Woodruff-2* With *Usher-1*

146. *Usher-1*, *Woodruff-1*, and *Woodruff-1* are each directed to earphone devices. *Usher-1*, $\P[0001]$, *Woodruff-1*, $\P[0002]$, *Woodruff-2*, 1:11-15. They are

structurally similar, since, as I discussed above, all three have an ASM, an ECM and in-ear speaker. Moreover, both *Usher-1* and *Woodruff-1* describe “pass-through” modes, in which the earphone can reproduce audio from the ambient environment in the user’s ear. *Usher-1*, ¶[0021], [0026], [0029] and [0033]-0034]; *Woodruff-1*, ¶[0045].

147. Persons of ordinary skill in the art would have been motivated to implement *Woodruff-1*’s signal processing for implementing such a “pass-through” mode with *Usher-1*’s earphone. First, persons of ordinary skill in the art would have recognized that *Usher-1* and *Woodruff-1* are in the same field (earphones), and would have been motivated to use *Woodruff-1*’s signal processing teachings for noise suppression. For example, a person of ordinary skill would have recognized that *Woodruff-1*’s teachings on the suppression of microphone noise, background noise, wind noise are all needed elements to improve the performance of *Usher-1*’s earphone..

148. Persons of ordinary skill in the art would have also recognized that *Woodruff-2* explains certain features of *Woodruff-1*, and that *Woodruff-2* provides further motivation for incorporating *Woodruff-1* (and hence *Woodruff-2*) into *Usher-1*. For example, *Woodruff-2* teaches that its FBC Filter attempts to remove acoustic coupling of its speaker into the ASM. *Woodruff-2*, 7:30-36. *Woodruff-2* teaches that this is particularly important when feedforward gain is applied to the ambient

audio signal. *Id.* *Woodruff-2* further teaches that its FBC Filter also helps when FBC control loop becomes unstable. *Id.*, 7:37-52. Persons of ordinary skill in the art would have understood that these conditions could result in what is known as “howling,” an unstable condition that earphone users would find at best annoying and at worst very uncomfortable, meaning that persons of ordinary skill in the art would have been motivated to reduce the possibility of it occurring.

I. [1.11]: “generating an ambient sound signal from the first signal or a modified first signal”

149. *Usher-1* in view of *Woodruff-1* and *Woodruff-2* discloses/suggests this feature. *Usher-1* does not explicitly state that it generates an “ambient sound signal” from either the “first signal or a modified first signal.” However, both *Woodruff-1* and *Woodruff-2* disclose this. As I previously discussed, both *Woodruff-1* and *Woodruff-2* disclose a signal comprised of the combination of the output from ASM microphone 3 and FBC Filter, which corresponds to the claimed “first signal.” See Section XI.A.1.k. Both *Woodruff-1* and *Woodruff-2* also disclose that this “first signal” is input to ASE Filter 6. *Woodruff-2*, 4:63-65, 5:17-29. Persons of ordinary skill in the art would have understood that the output of *Woodruff-1*/*Woodruff-2*’s ASE Filter 6 corresponds to the claimed “ambient sound signal.”

150. *Woodruff-2*’s Fig. 3 has been annotated to show that the output of ASE Filter 6 corresponds to the claimed “ambient sound signal.”

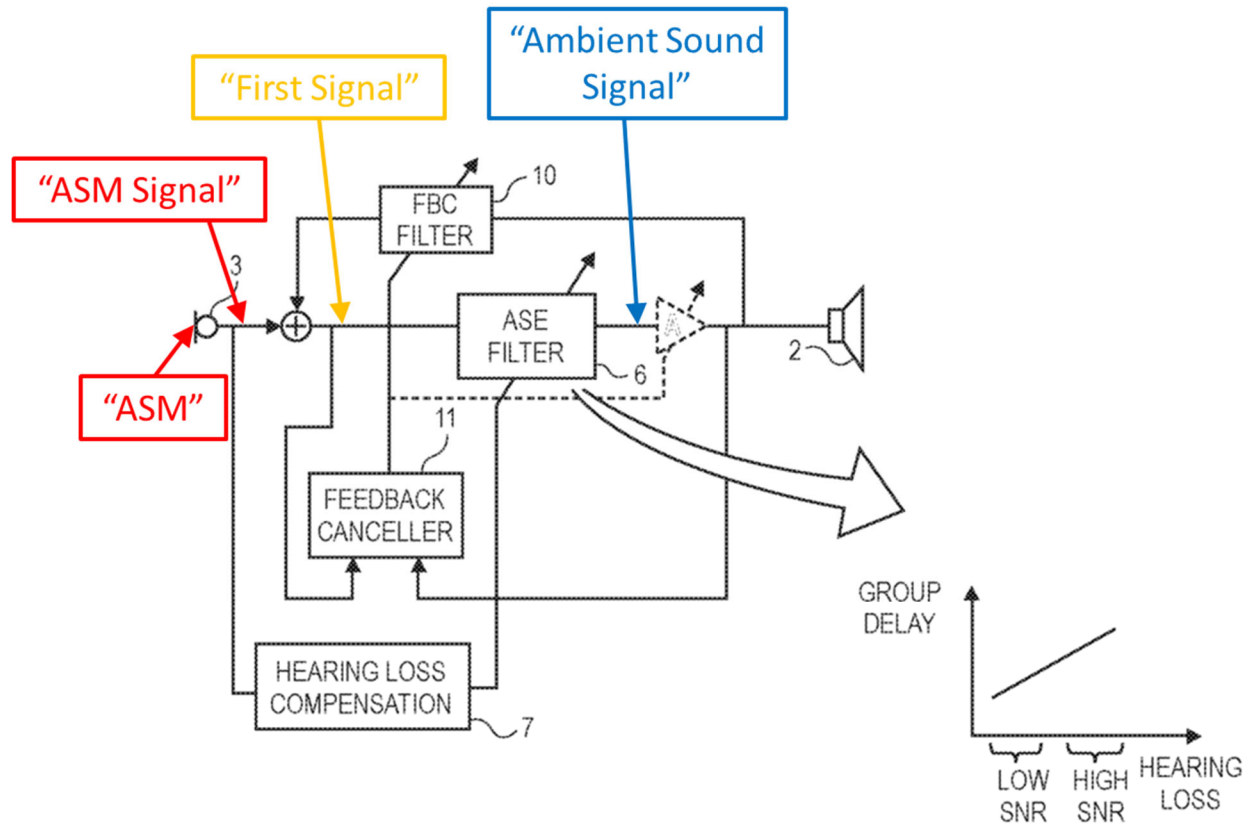
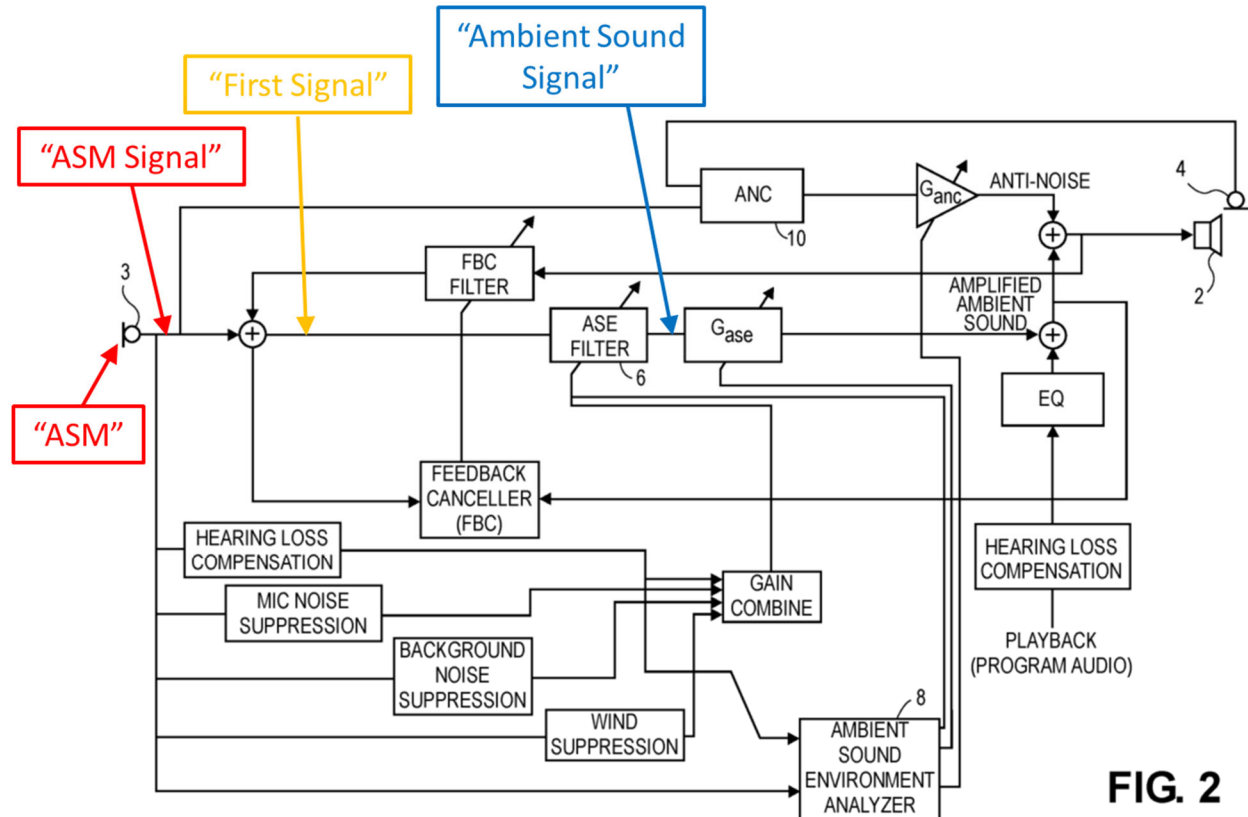


FIG. 3

See also annotated Woodruff-1's Fig. 2:



151. Note that claim 1 does not specify how the “ambient sound signal” is generated or what form it takes. All that is required is that the recited signal be generated from “the first signal or a modified first signal,” and that it relate to “ambient sound.”

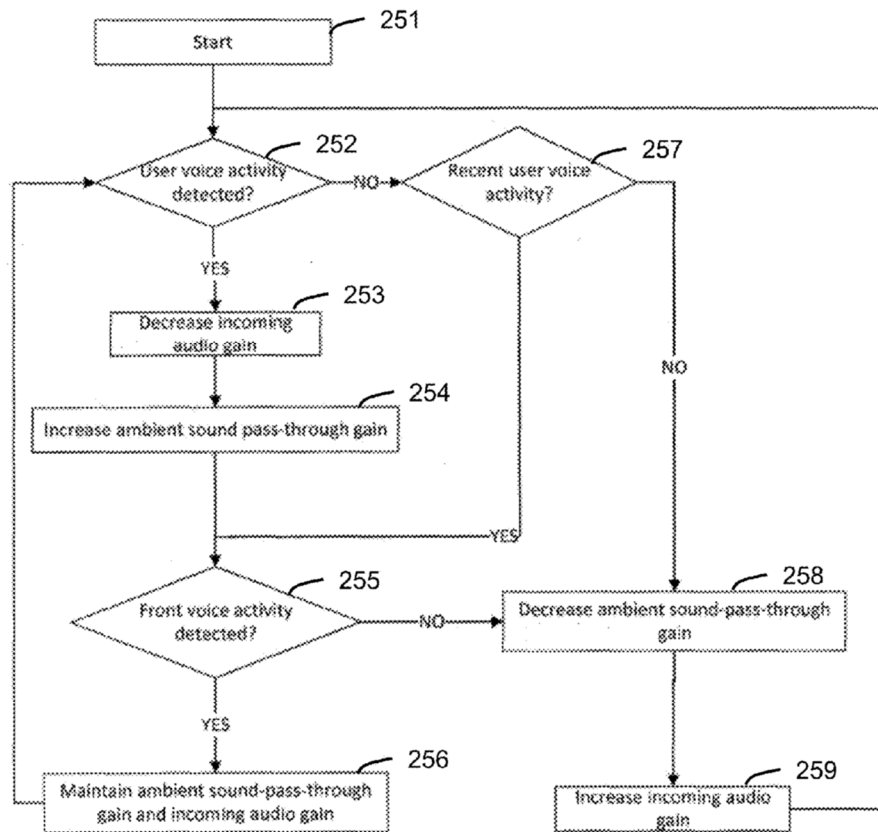
152. *Woodruff-1* discloses that the output of ASE Filter 6 is an “ambient” sound signal. *Woodruff-1* notes that ambient sound is captured by ASM 3 and then provided to ASE Filter 6. *Woodruff-1* further discloses that ASE Filter 6 shapes the ambient sound for output. *Woodruff-1*, ¶[0022] (“The ASE filter 6 may be composed of a cascade of digital filters that spectrally shape the ambient sound pickup channel for purposes of different types of noise suppression, e.g., microphone noise,

background noise, and wind.”). This signal is applied to gain block G_{ase} , which amplifies the signal for playback by speaker 2. Indeed, Fig. 2 refers to this signal as “AMPLIFIED AMBIENT SOUND.” Thus, persons of ordinary skill in the art would have recognized that the output of ASE Filter 6 is an “ambient sound signal,” just as claimed.

- m. **[1.12]: “detecting if the user is speaking by analyzing at least one of the first signal, or the first ASM signal, or the second ASM signal, or the ECM signal, or by analyzing the first signal and the ECM signal; and”**

153. *Usher-1* in view of *Woodruff-1* and *Woodruff-2* discloses/suggests this feature. This element requires determining if the user is speaking by using one of any number of signals.⁹ *Usher-1*’s Fig. 2B “illustrates a flowchart of a method 250 for controlling an ambient sound pass-through to enhance situation awareness in accordance with an exemplary embodiment.”

⁹ The list separates the recited signals with the word “or,” which I have been informed by Petitioners’ counsel means that if any one of the signals is in the prior art, the element is disclosed.



250
FIG. 2B

Usher-1, ¶[0029]. *Usher-1* further discloses that “[a]t step 252, the processor 103 monitors sound from the ambient sound microphone(s) 101/102 and determines when user voice activity is detected. The processor 103 performs voice activity detection (VAD) to analyze voice characteristics and properties and distinguish between the user’s spoken voice and environmental ambient sounds.” *Id.*, at ¶[0030].

154. Thus, *Usher-1* discloses that its device uses signals from its ASMs, (which correspond to the claimed “ASM signal(s)” to perform user voice activity

detection. Since the claim only requires detecting if the user is speaking by analyzing the first or second “ASM signal,” persons of ordinary skill in the art would have recognized *Usher-1* in view of *Woodruff-1*/*Woodruff-2* discloses this element.

- n. **[1.13]: “adjusting at least one of the ambient sound signal, an audio content signal, a mixed ambient sound signal and audio content signal, a noise signal or a combination thereof, when it is detected that the user is speaking”**

155. *Usher-1* in view of *Woodruff-1*/*Woodruff-2* discloses/suggests this feature. This element requires adjusting “at least one” of a number of recited signals when it is detected that the user is speaking.” One of the recited signals is the “audio content signal.” *Usher-1* discloses that “[i]f at step 252 user voice activity is detected, the gain of the incoming audio signal is decreased at step 253....” *Usher-1*, ¶[0030].

156. *Usher-1* discloses that the “[t]he processor 103 can also receive an incoming audio signal 107, e.g. a voice or music signal from a mobile device.” *Id.*, ¶[0022]. As I discussed in Section X.A, the ’965 patent’s “audio content signal” is a signal containing audio content. Thus, persons of ordinary skill in the art would understand that the “incoming audio signal” described in *Usher-1* corresponds to the claimed “audio content signal.” Because *Usher-1* discloses that gain is decreased when “user voice activity is detected,” *Usher-1* teaches that its “audio content signal” is “adjusted ... when it is detected that the user is speaking.”

157. This element also recites that the “ambient sound signal” is one of the signals that can be adjusted when user speech is detected. *Usher-I* discloses that “[i]f at step 252 user voice activity is detected, ...the ambient sound pass-through gain is increased at step 254.” *Usher-I*, ¶[0030]. See also *id.*, ¶[0040] (“[The processor] determines a direction and proximity of the individual with respect to the user wearing the earphone (*see id.*, FIGS. 2A and 2C), and adjusts the gain (185/187) of the ambient sound pass-through of the ambient sound microphone 101 as a function of the direction in accordance with the previous methods (see FIGS. 1B and 2B).”), ¶[0041] (“The step of adjusting the ambient sound pass-through includes increasing the gain of the ambient sound from the ambient sound microphone delivered by the internal speaker when voice activity is detected above a threshold, and/or decreasing the gain of the ambient sound from the ambient sound microphone delivered by the internal speaker when voice activity is detected below a threshold.”).

158. Note that claim 1 does not specify who the recited “user” is. If the recited “user” refers to the person wearing the earphone, *Usher-I* plainly discloses this, as discussed. If the recited “user” can be either the wearer or a person speaking to the wearer. In this case, *Woodruff-I* discloses this, as discussed in the Paragraph 157.

159. As I discussed in Section XI.A.1.k, when *Usher-1* is combined with *Woodruff-1/Woodruff-2*, the ASM signal produced by ASM microphone 101/102 is combined with the output of *Woodruff-1/Woodruff-2*'s FBC Filter 10 to produce the claimed "first signal," which in turn is filtered by ASE Filter 6 to produce the claimed "ambient sound signal." *Woodruff-1* is similar to *Usher-1*, as it also discloses that the signal output by its ASE Filter 6, corresponding to the claimed "ambient sound signal" can be adjusted when the user speaks:

But when the wearer starts talking to someone at the concert, the determined user context changes, e.g., 'wearer is talking with someone in their environment', because the system detects speech by another person in the environment and/or *speech by the wearer*, the G_{ase} block is signaled to emphasize speech frequencies (e.g., by appropriately shaping the filtering function of the Gase block.)

Woodruff-1, ¶[0042]. See also:

In yet another aspect of operating in transparency mode, the system reduces the transparency gain that it applies (in the Gase block), differently in different user contexts. For instance, when the determined context indicates that the wearer is 'talking over' ambient noise, the transparency gain is reduced more than when the wearer is passively listening to their environment.

Woodruff-1, ¶[0043]. See also

...the wearer may be at a concert when during a lull in the performance the wearer starts talking to a friend next to them (who is also at the concert.) In that case, the audio system detects a drop in the ambient noise/sound level (below a threshold) and perhaps also a contemporaneous increase in speech activity. The speech activity may be either the wearer's own voice or that of the friend nearby. In response the system may reduce its anti-noise output (e.g., raise attenuation by Ganc), and perhaps increase its transparency gain Gase that it applies to an ambient sound pickup channel, and also perhaps emphasize the speech frequency range.

Id., ¶[0044]

160. Thus, Persons of ordinary skill in the art would have recognized that both *Usher-1* and *Woodruff-1/Woodruff-2* disclose adjusting the sound from the ambient environment when it is detected that the user is speaking. Thus, persons of ordinary skill in the art would have recognized that claim 1 is obvious.

2. Claim 2: “The earbud according to claim 1 wherein the operation of adjusting, adjusts the audio content signal by reducing its volume”

161. The *Usher-1-Woodruff-1/Woodruff-2* combination discloses/suggests this claim. As I discussed in Section XI.A.1.n, *Usher-1* discloses adjusting the “audio content signal” when it is detected that the user is speaking. And while persons of ordinary skill in the art would have understood that both *Usher-1* and

Woodruff-1 will reduce the volume of the “audio content signal” when it is detected that the user is speaking, *Usher-1* explicitly says this is the case. *See*

If at step 252 user voice activity is detected, the gain of the incoming audio signal is decreased at step 253 and the ambient sound pass-through gain is increased at step 254.”

Usher-1, ¶[0030]. *See also*

The step of adjusting the mixing gain of an audio content signal includes decreasing a volume of the audio content signal delivered to the internal speaker when voice activity is detected above a threshold...

Id., ¶[0041]

162. Thus, persons of ordinary skill in the art would have recognized that claim 2 is obvious.

3. Claim 3: “The earbud according to claim 2 wherein the operation of adjusting also amplifies the ambient sound signal”

163. The *Usher-1-Woodruff-1/Woodruff-2* combination discloses/suggests this claim. *Usher-1* discloses that when it is detected that the user is speaking, the ambient sound detected by its ASM microphone(s) is amplified. *See Usher-1*, ¶[0030] (“If at step 252 user voice activity is detected, the gain of the incoming audio signal is decreased at step 253 and the ambient sound pass-through gain is increased

at step 254.”),¹⁰ ¶[0041] (“The step of adjusting the ambient sound pass-through includes increasing the gain of the ambient sound from the ambient sound microphone delivered by the internal speaker *when voice activity is detected* above a threshold”).

164. Persons of ordinary skill in the art would have understood that increasing the gain of the ambient sound would amplify the ambient sound.

165. As I discussed in Sections XI.A.1.1 and XI.A.1.n, in the *Usher-1-Woodruff-1/Woodruff-2* combination, the output of *Woodruff-1*’s ASE Filter 6 is the recited “ambient sound signal.” And *Woodruff-1*, just like *Usher-1*, discloses that the signal output from ASE Filter 6 can be amplified when the user is speaking. See *Woodruff-1*, ¶[0044] (“...the wearer may be at a concert when during a lull in the performance the wearer starts talking to a friend next to them (who is also at the concert.) In that case, the audio system detects a drop in the ambient noise/sound level (below a threshold) and perhaps also a contemporaneous increase in speech activity. The speech activity may be either the wearer’s own voice or that of the friend nearby. In response the system may reduce its anti-noise output (e.g., raise

¹⁰ Because claim 3 depends from claim 2, claim 3 requires both that the audio content signal have its volume reduced and that the ambient sound signal be amplified. *Usher-1* describes this. See *Usher-1*, ¶[0030]

attenuation by Ganc), and perhaps increase its transparency gain Gase that it applies to an ambient sound pickup channel.”). Thus claim 3 is obvious.

4. Claim 4: “The earbud according to claim 1 wherein the operation of adjusting, adjusts the ambient sound signal by increasing its volume”

166. The *Usher-1-Woodruff-1/Woodruff-2* combination discloses/suggests this claim. Claim 4 recites limitations similar to claim 3, with the difference being that claim 4 is not dependent on claim 2, and claim 4 recites increasing the volume of the ambient sound signal. As I discussed in Section XI.A.3, *Usher-1* discloses increasing the gain of the signal output by its ASM microphones 101/102. *Usher-1*, ¶[0030], [0041]. Persons of ordinary skill in the art would have understood that “increasing the gain” would result in increasing the volume of the signal having the gain applied thereto.

167. As I also discussed in Section XI.A.3, *Woodruff-1* also discloses increasing gain of the signal output from ASE Filter 6 (the recited “ambient audio signal”) when the user is speaking:

...the wearer may be at a concert when during a lull in the performance the wearer starts talking to a friend next to them (who is also at the concert.) In that case, the audio system detects a drop in the ambient noise/sound level (below a threshold) and perhaps also a contemporaneous increase in speech activity. The speech activity may be

either the wearer's own voice or that of the friend nearby.

In response the system may reduce its anti-noise output (e.g., raise attenuation by *Ganc*), and perhaps increase its transparency gain *Gase* that it applies to an ambient sound pickup channel.”

Woodruff-1, ¶[0044]

168. Since increasing the gain of this signal will increase its volume, persons of ordinary skill in the art would have understood that claim 4 is obvious.

5. Claim 6: “The earbud according to claim 3 wherein the operations further comprise: resetting the volume of the ambient sound signal to a preset value when a preset time increment has expired”

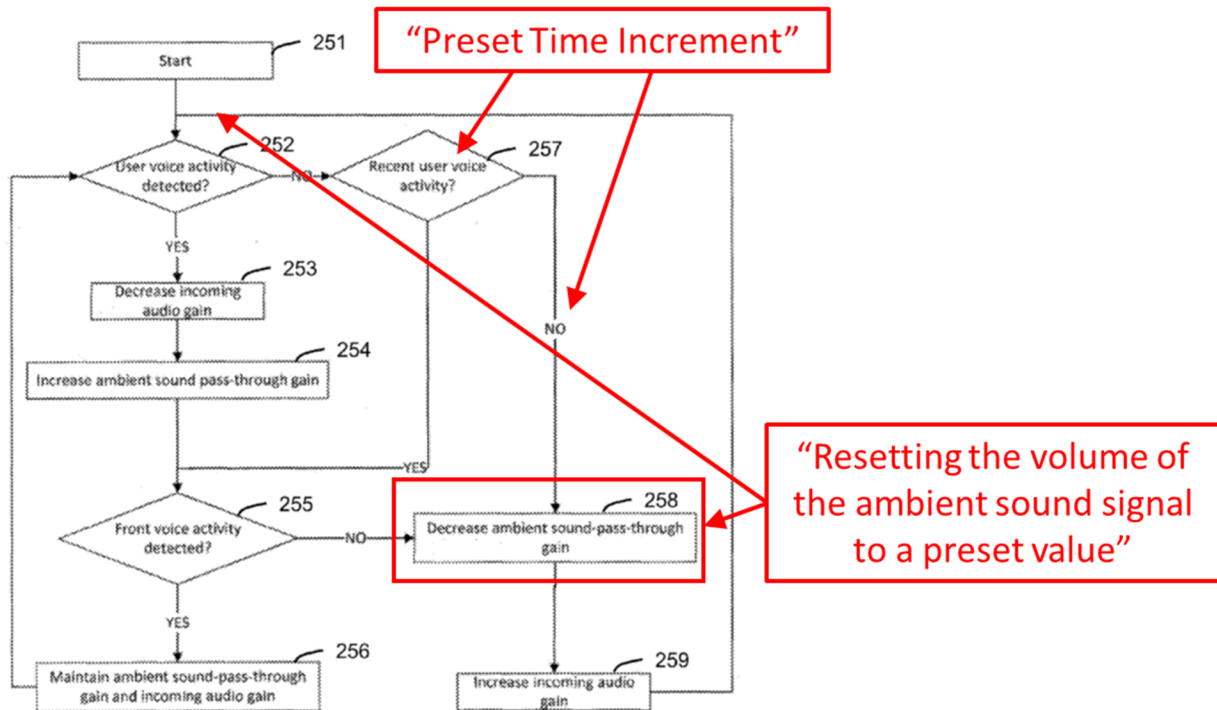
169. The *Usher-1-Woodruff-1/Woodruff-2* combination discloses/suggests this claim. *Usher-1* discloses that “[w]hen the user ceases to speak, or if no voice activity is detected, the voice activity timer is referenced to determine if there was any recent user voice activity at step 257.” *Usher-1*, ¶[0033]. *Usher-1* further discloses “two timer scenarios.” *Id.* The first is where the voice activity timer is below a “determined threshold,” which *Usher-1* states can be ten seconds. *Id.* The second is where “user voice activity is not detected at step 252 but the voice activity timer is above the determined threshold.” *Id.* In this scenario, “...the gain of the ambient sound pass-through gain is decreased at step 258...” *Id.*

170. Persons of ordinary skill in the art would have understood that *Usher-1*’s “determined threshold” corresponds to the claimed “preset time increment,”

since, as *Usher-I* discloses, it is used to determine whether “there was any recent user voice activity.” *Id.*

171. *Usher-I* discloses that when the “determined threshold” has been exceeded, “the gain of the ambient sound pass-through gain is decreased at step 258...” *Usher-I*, ¶[0033]. According to *Usher-I*, once this gain has been applied, “the method then continues back to step 252 to monitor for user voice activity.” *Id.*

172. Persons of ordinary skill in the art would have understood that this means that the gains have been set to a “preset value” since the method reverts back to its original state of monitoring for voice activity. This process is seen in *Usher-I*’s Fig. 2B (annotated):



250
FIG. 2B

173. Finally, As I discussed in Sections XI.A.1.i and XI.A.1.n, in the *Usher-1-Woodruff-1/Woodruff-2* combination, the output of *Woodruff-1*'s ASE Filter 6 is recited “ambient sound signal,” and this is the signal that is “reset,” as described in *Usher-1*.

6. **Claim 7 “The earbud according to claim 4 wherein the operations further comprise: resetting the volume of the ambient sound signal to a preset value when a preset time increment has expired”**

174. See Section XI.A.5.

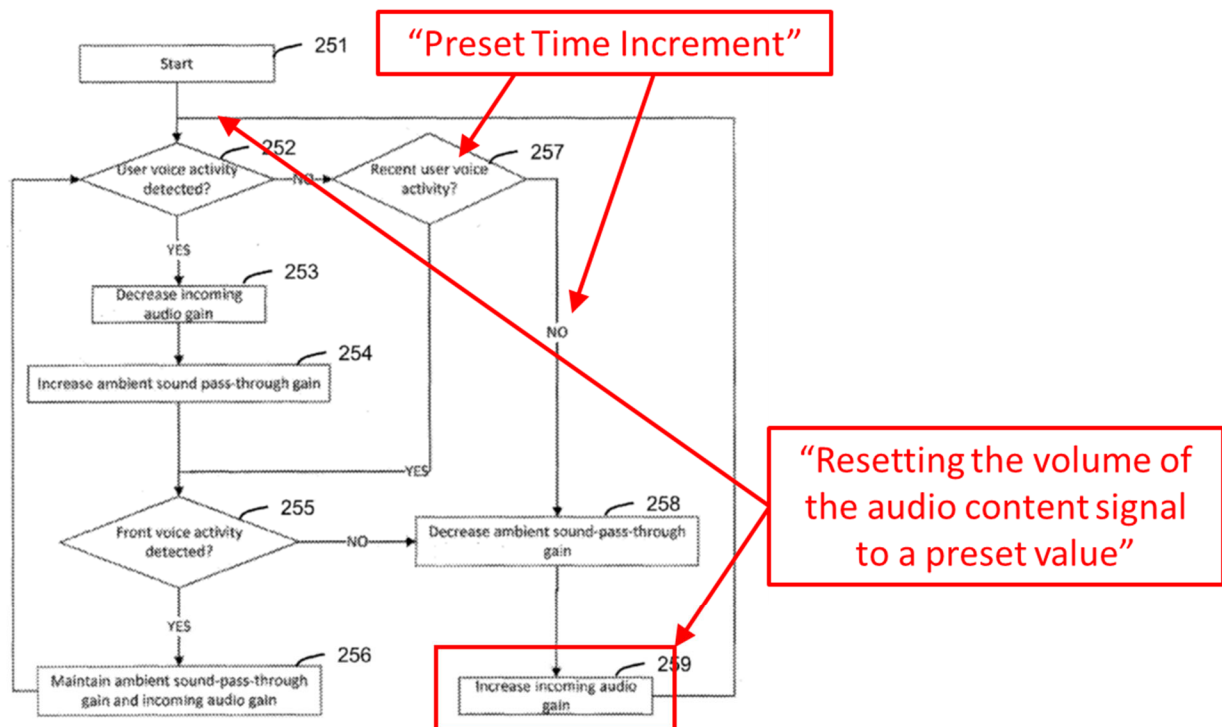
7. Claim 8: “The earbud according to claim 3 wherein the operations further comprise: resetting the volume of the audio content signal to a preset value when a preset time increment has expired”

175. The *Usher-1-Woodruff-1/Woodruff-2* combination discloses/suggests this claim. Claim 8 is similar to claim 6, with the only difference being that claim 8 requires that the volume of the “audio content signal” be reset. *Usher-1* discloses that “[w]hen the user ceases to speak, or if no voice activity is detected, the voice activity timer is referenced to determine if there was any recent user voice activity at step 257.” *Usher-1*, ¶[0033]. As I discussed in Section XI.A.5, *Usher-1* further discloses two timer scenarios, one of which is where “user voice activity is not detected at step 252 but the voice activity timer is above the determined threshold.” *Id.* In this scenario, “...the gain of the incoming audio signal is increased at step 259.” *Id.*

176. Persons of ordinary skill in the art would have understood that that *Usher-1*’s “determined threshold” corresponds to the claimed “preset time increment,” since, as *Usher-1* discloses, it is used to determine whether “there was any recent user voice activity.” *Id.*

177. *Usher-1* discloses that when the “determined threshold” has been exceeded, “the gain of the ambient sound pass-through gain is decreased at step 258, and the gain of the incoming audio signal is increased at step 259.” *Usher-1*,

¶[0033]. According to *Usher-I*, once these gains have been applied, “the method then continues back to step 252 to monitor for user voice activity.” *Id.* Persons of ordinary skill in the art would have understood that this means that the gains have been set to a “preset value” since the method reverts back to its original state of monitoring for voice activity. This process is seen in *Usher-I*’s Fig. 2B (annotated):



250
FIG. 2B

178. Thus, claim 8 is obvious.

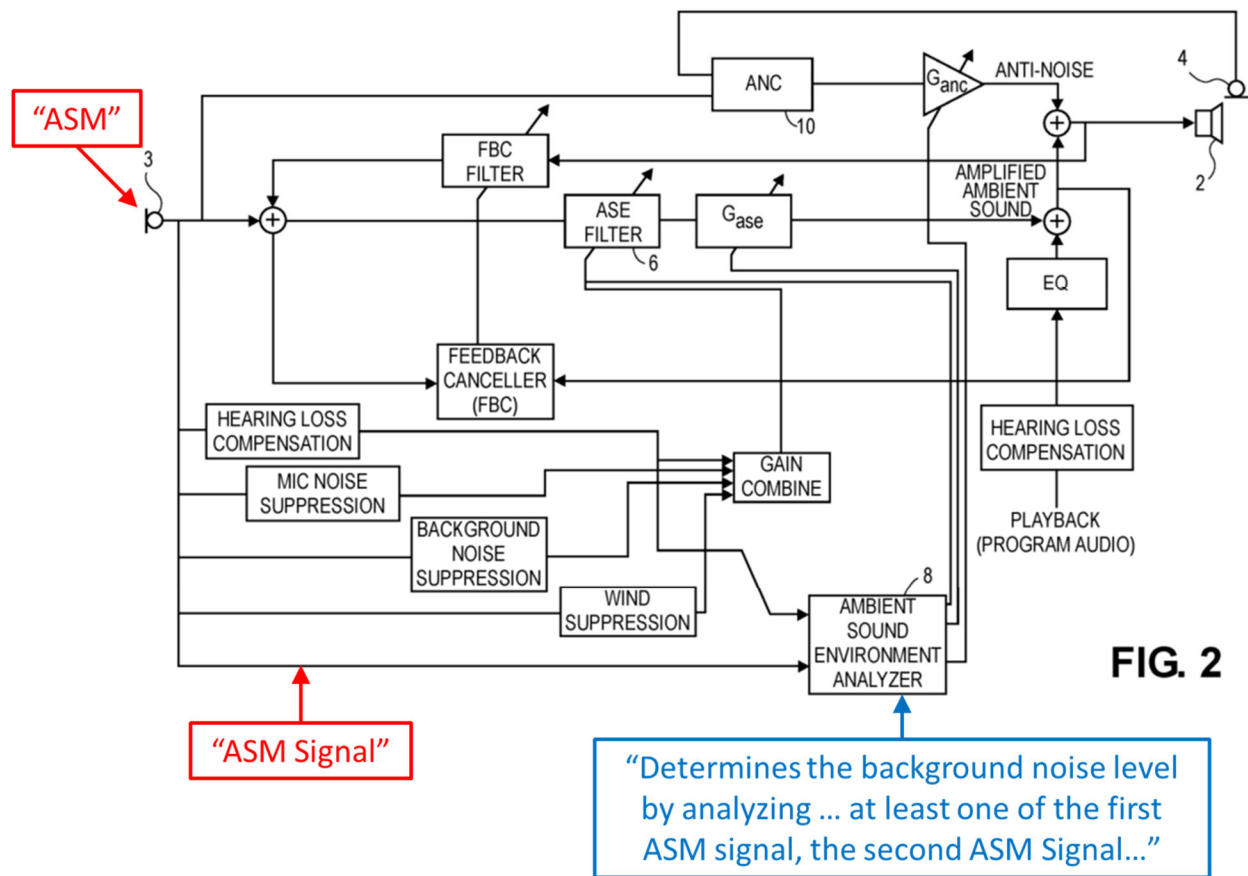
8. **Claim 9: “The earbud according to claim 1 wherein the operations further comprise: determining the background noise level by analyzing at least one of the first ASM signal, the second ASM signal, the ECM signal, or a combination thereof”**

179. The *Usher-1-Woodruff-1/Woodruff-2* combination discloses/suggests this claim. *Woodruff-1* discloses determining a “background noise level.” *Woodruff-1* discloses that “[w]hen the ambient sound enhancement function is active (the ambient sound is being reproduced, as described above), the ambient sound environment analyzer 8 may detect that the ambient sound environment changes from quiet to loud.” *Woodruff-1*, ¶[0026]. *Woodruff-1* further discloses that “[a] noise profile analyzer, an automatic sound event detector, or a sound environment detector (any of which may be based on a machine learning model) may be used for this purpose, to distinguish between a loud environment and a quiet or active talker environment,” and that “[t]he loud environment may, for example, be one where the SPL is above a threshold, such that the audio system should perform an active earplug function to reduce the SPL at the user's ears to more comfortable levels.” *Id.*

180. Persons of ordinary skill in the art would have understood that this is a determination of the “background noise level,” as *Woodruff-1* describes using a “noise profile analyzer” to distinguish between loud and quiet environments. Indeed, that *Woodruff-1* refers to a loud environment as compared to a “quiet environment

or active talker environment” demonstrates that it is calculating a “background noise level.” In fact, in paragraph [0028], *Woodruff-1* discloses that its ambient sound environment analyzer 8 computes a sound pressure level.

181. *Woodruff-1* further discloses that its ambient sound environment analyzer 8 uses the signal output by its ASM microphone to determine the background noise level. *Woodruff-1*, ¶[0028] (...the ambient sound environment analyzer 8 may simply compute SPL as derived from the signal from the external microphone 3...). As I discussed in Section XI.A.1.k, *Woodruff-1*’s microphone 3 corresponds to a claimed ASM and its output corresponds to a claimed “ASM signal.” This is shown in annotated Fig. 2:



182. Thus, the *Usher-1-Woodruff-1/Woodruff-2* combination renders claim 9 obvious.

9. **Claim 11: “The earbud according to claim 9, wherein the operations further comprise: generating an anti-noise signal using at least one of the first ASM signal, the second ASM signal, the ECM signal or a combination thereof”**

183. The *Usher-1-Woodruff-1/Woodruff-2* combination discloses/suggests this claim. Claim 11, which depends from claim 9, further requires generating an anti-noise signal using one of the ASM signals or the ECM signal. *Woodruff-1* discloses that its “ANC block 10 produces an anti-noise signal while the ambient

sound enhancement function is active.” *Woodruff-1*, ¶[0029]. *Woodruff-1* further discloses that its “ANC block 10 is shown in this example as being based on a hybrid feedforward and feedback algorithm (using input from both the external microphone 3 (also referred to as the reference microphone) and the internal microphone 4 (also referred to as the error microphone.)). *Id.* As I discussed in Section XI.A.1.k, *Woodruff-1*’s microphone 3 corresponds to a claimed ASM and its output corresponds to a claimed “ASM signal.” Persons of ordinary skill in the art would have further understood that *Woodruff-1*’s microphone 4 corresponds to the claimed “ear canal microphone,” and the output of that microphone corresponds to the claimed “ECM signal.”

184. Thus, this claim is disclosed by *Woodruff-1*, which has been seen in this annotated Fig. 2:

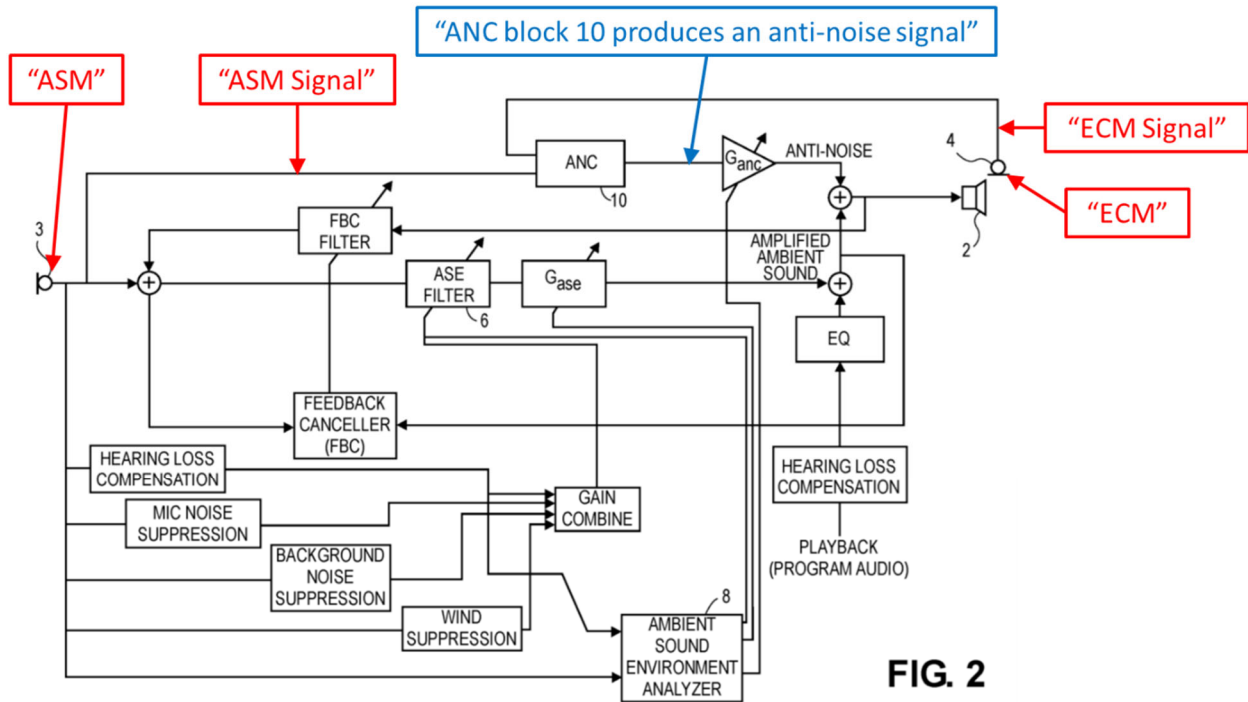


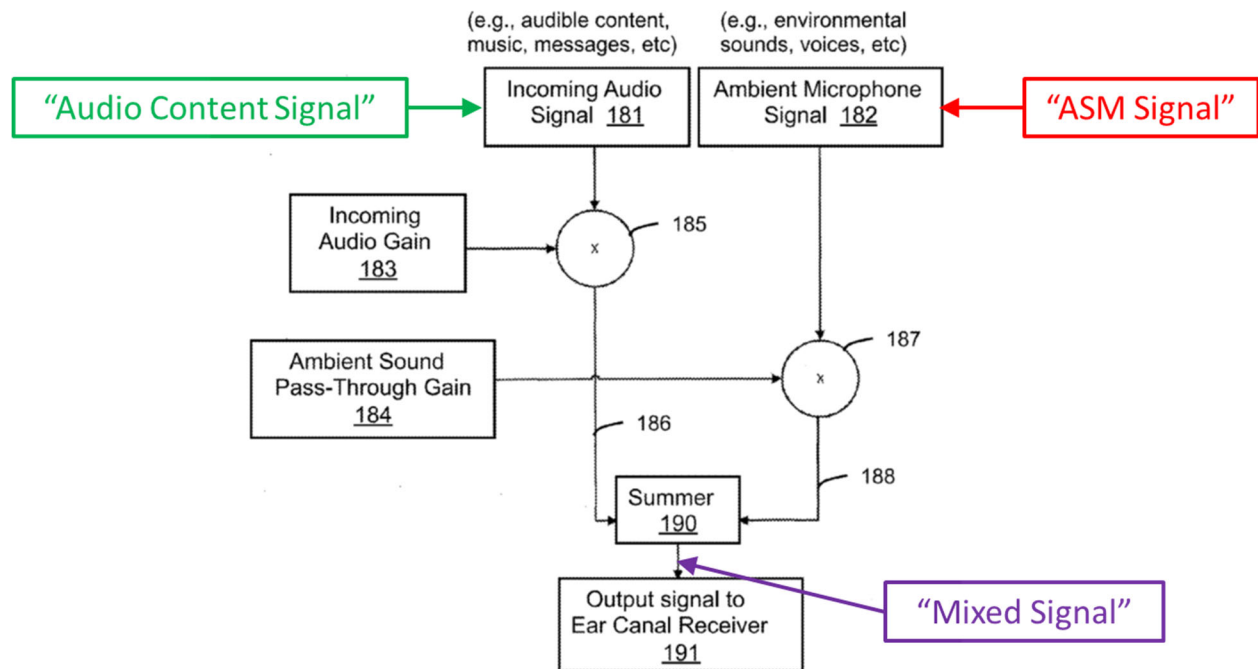
FIG. 2

185. Thus, the *Usher-1-Woodruff-1/Woodruff-2* combination renders claim 9 obvious.

10. Claim 13: “The earbud according to claim 11, wherein the operations further comprise: mixing the ambient sound signal and audio content signal to generate a mixed signal”

186. The *Usher-1-Woodruff-1/Woodruff-2* combination discloses/suggests this claim. *Usher-1* discloses mixing its incoming audio signal with signals from its ASMs 101/102. See *Usher-1*, ¶[0006] (“FIG. 1B illustrates a flowchart of a method for enhancing situation awareness of the earphone in FIG. 1A by way of mixing ambient sound signals and audible content in accordance with an exemplary embodiment.”), ¶[0022] (“Based on an analysis of the at least two ambient microphone (101/102) signals, at least one of the ambient microphone signals is

mixed with the incoming audio signal 107 and directed to the ear canal receiver (ECR) 105 (i.e., a loudspeaker in the sound isolating earphone that audibly delivers the audible signal to the user's eardrum).”). See also annotated Fig. 1B:



180
FIG. 1B

187. As I discussed in Section XI.A.1.k, *Usher-1* does not explicitly disclose the claimed “ambient sound signal,” but *Woodruff-1* does. Persons of ordinary skill in the art would have recognized that *Woodruff-1*, like *Usher-1*, discloses an “audio content signal. See *Woodruff-1*, ¶[0025] (“The ambient sound content is then combined with a playback signal which contains program audio. The program audio may be music, the voice of a far end user during a phone call, or the voice of a virtual

assistant program, which has not yet been converted to sound in the ambient environment.”). Persons of ordinary skill in the art would have also recognized that *Woodruff-1*’s “program audio” corresponds to the claimed “audio content signal.”

188. *Woodruff-1* further discloses that its “program audio is mixed with its audio content signal. *See Woodruff-1*, ¶[0025] (“The ambient sound content is then combined with a playback signal which contains program audio.”). *See also Id.*, ¶[0004]. Persons of ordinary skill in the art would have understood that *Woodruff-1*’s combined signal corresponds to the claimed “mixed signal.” This is also seen in annotated Fig. 2:¹¹

¹¹ Note that an amplified version of *Woodruff-1*’s “ambient sound signal” is what is mixed with its “audio content signal.” Persons of ordinary skill in the art would have understood that the amplified “ambient sound signal” is still the claimed “ambient sound signal” since it contains the same information.

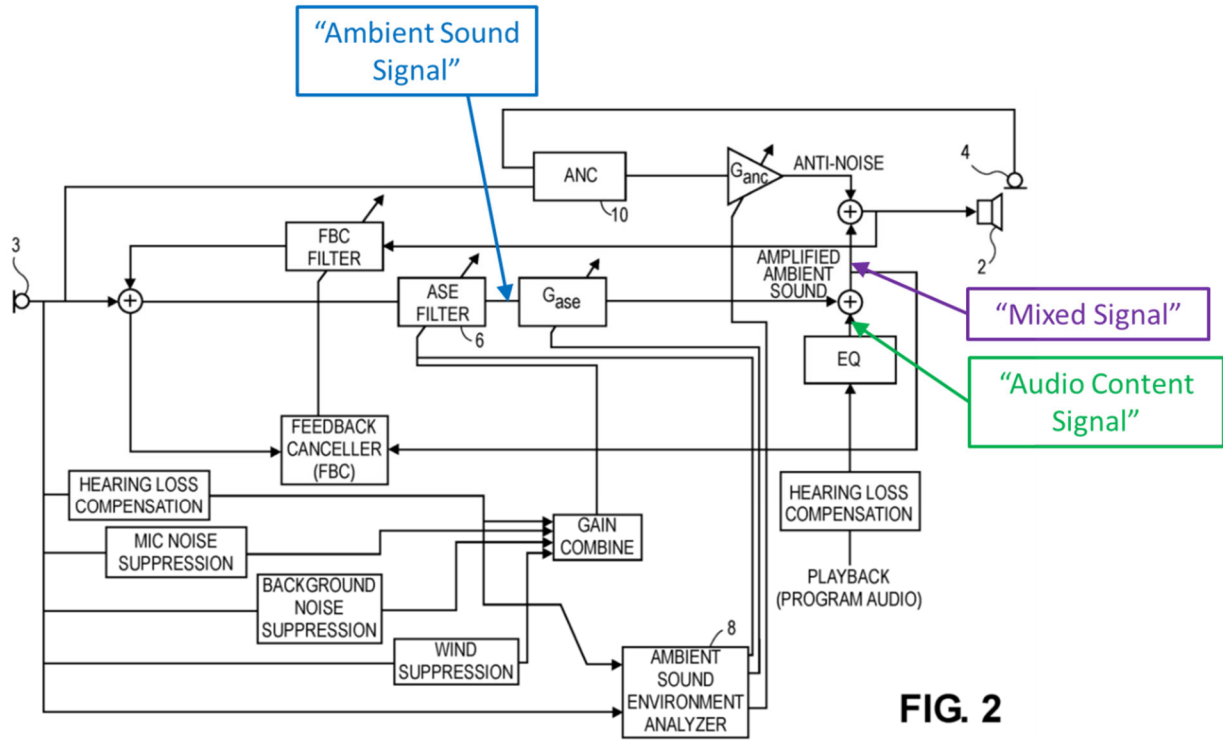


FIG. 2

189. Thus, the *Usher-1-Woodruff-1/Woodruff-2* combination renders claim 13 obvious.

11. Claim 14: “The earbud according to claim 13, wherein the operations further comprise: generating a new mixed signal by combining the mixed signal with the anti-noise signal”

190. The *Usher-1-Woodruff-1/Woodruff-2* combination discloses/suggests this claim. *Woodruff-1* discloses that the signal formed by combining its ambient sound signal with its program audio signal, (which as I discussed in Section XI.A.10, corresponds to the claimed “mixed signal”) is further combined with an anti-noise signal. This is shown in annotated Fig. 2:



As can be seen, the “mixed signal” is combined with the anti-noise, and this signal is output to speaker 4.

191. Persons of ordinary skill in the art would have understood that this combined signal corresponds to the claimed “new mixed signal.” *See*:

When the ambient sound enhancement function is active,
the input audio signal contains ambient or environmental
sound pick up from one or more microphones in the
device; in a “playback” situation, the input audio signal is
a combination signal that also contains program audio,
such as music, the voice of a far end user during a phone
call, or the voice of a virtual assistant program.

See Woodruff-1, ¶[0004]. See also:

The ANC block 10 produces an anti-noise signal while the ambient sound enhancement function is active: the anti-noise signal is combined with the ambient sound signal before they together drive the speaker 2 of the against the ear audio device.

Id., ¶[0029]

192. Thus, the *Usher-1-Woodruff-1/Woodruff-2* combination renders claim 14 obvious.

12. Claim 15: “The earbud according to claim 14, wherein the operations further comprise: reducing the anti-noise signal and increasing the ambient sound signal prior to mixing if the user's voice is detected”

193. The *Usher-1-Woodruff-1/Woodruff-2* combination discloses/suggests this claim. *Woodruff-1* discloses a situation where a user may be at a concert when due to a lull in the performance, the user starts talking. In this situation, *Woodruff-1* discloses that its device “...may reduce its anti-noise output (e.g., raise attenuation by G_{anc} , and perhaps increase its transparency gain G_{ase} that it applies to an ambient sound pickup channel” See *Woodruff-1*, ¶[0044]. See also:

Another aspect of the disclosure here is a method performed by an audio system for speech-aware sound enhancement by an against the ear audio device, where the device can produce anti-noise for acoustic noise cancellation, ANC. In such a method, ambient sound is amplified and reproduced by the against the ear audio

device in accordance with a hearing profile of the user of the against the ear audio device. The ambient sound is the sound that is in an acoustic environment of the against the ear audio device and as such may be heard by the user. While reproducing the ambient sound, the processor detects speech in the ambient sound (e.g., via voice activity detection, VAD, operating upon the external microphone signal). While reproducing the ambient sound, the against the ear device also produces anti-noise; it does that so long as no speech is detected in the ambient sound; whenever speech is detected, it reduces a level of the produced anti-noise. This enables the user to better perceive the speech in the reproduced ambient sound.

Id., ¶[0033]

194. Thus, *Woodruff-1* discloses the subject matter of claim 15, meaning that the *Usher-1-Woodruff-1/Woodruff-2* combination renders this claim obvious.

13. Claim 19

a. [19pre]: “An earbud comprising”

195. *See* Section XI.A.1.a.

b. [19.1]: “a first Ambient Sound Microphone (ASM), wherein the first ASM generates a first ASM signal

196. *See* Section XI.A.1.b.

- c. **[19.2]: “a second ASM, wherein the second ASM generates a second ASM signal”**

197. *See* Section XI.A.1.c.

- d. **[19.3]: “an ear canal microphone (ECM), wherein the ECM generates an ECM signal”**

198. *See* Section XI.A.1.d.

- e. **[19.4]: “a speaker”**

199. *See* Section XI.A.1.e.

- f. **[19.5]: “a memory that is configured to store instructions; and”**

200. *See* Section XI.A.1.f.

- g. **[19.6]: “a processor that is coupled to the first ASM, wherein the processor is coupled to the second ASM, wherein the processor is coupled to the ECM, wherein the processor is coupled to the speaker”**

201. *See* Section XI.A.1.g.

- h. **[19.7]: “wherein the processor receives the first ASM signal, wherein the processor receives the second ASM signal, wherein the processor receives the ECM signal”**

202. *See* Sections XI.A.1.h-XI.A.1.j.

- i. **[19.8]: “wherein the processor generates a first signal from at least one of the first ASM signal, or the second ASM signal, or both”**

203. *See* Section XI.A.1.k.

- j. **[19.9]: “wherein the processor generates an ambient sound signal from the first signal or a modified first signal”**

204. *See* Section XI.A.1.l.

- k. **[19.10]: “wherein the processor detects if a user is speaking by analyzing at least one of the first signal, or the first ASM signal, or the second ASM signal, or the ECM signal, or by analyzing the first signal and the ECM signal, and”**

205. *See* Section XI.A.1.m.

- l. **[19.11]: “adjusts a level of the ambient sound signal sent to the speaker if the user's voice is detected”**

206. *See* Section XI.A.1.n. I note that this element recites adjusting a “level of the ambient sound signal,” whereas element [1.13] is silent as to the “level.” Persons of ordinary skill in the art would have understood that *Woodruff-1* discloses adjusting the “level” of the “ambient sound signal” since it applies a gain using G_{ase} . Persons of ordinary skill in the art would have known that applying a gain adjusts the level of a signal. *Id.*

207. Thus, the *Usher-1-Woodruff-1/Woodruff-2* combination renders claim 19 obvious.

- 14. **Claim 20: “The earbud according to claim 19, wherein an audio content sent to the speaker is adjusted if the user's voice is detected”**

208. *See* Section XI.A.2. I note that claim 2 requires adjusting the “audio content signal” by reducing its volume if user speech is detected. Claim 19 only

recites adjustment of “audio content,” and does not require a volume reduction. Regardless, persons of ordinary skill in the art would have understood that the volume reduction *Usher-1* describes is an adjustment to “audio content,” just as claimed.

15. Claim 21

a. [21pre]: “A method comprising”

209. *Usher-1* discloses a method. *See e.g.*, Abstract. The same is true for *Woodruff-1* (e.g., ¶[0009]) and *Woodruff-1* (e.g., 2:49-56). Thus, the *Usher-1*-*Woodruff-1*/*Woodruff-2* discloses the preamble.

b. [21.1]: “receiving the first ASM signal from a first ambient sound microphone”

210. *See* Sections XI.A.1.b and XI.A.1.h.

c. [21.2]: “receiving the second ASM signal from a second ambient sound microphone”

211. *See* Sections XI.A.1.c and XI.A.1.i.

d. [21.3]: “receiving the ECM signal from an ear canal microphone”

212. *See* Sections XI.A.1.d and XI.A.1.j.

e. [21.4]: “generating a first signal from at least one of the first ASM signal, or the second ASM signal, or both”

213. *See* Section XI.A.1.k

- f. **[21.5]: “generating an ambient sound signal from the first signal or a modified first signal”**

214. See Section XI.A.1.l.

- g. **[21.6]: “detecting if the user is speaking by analyzing at least one of the first signal, or the first ASM signal and the second ASM signal, or the first ASM signal and the ECM signal, or the second ASM signal and the ECM signal; and”**

215. See Section XI.A.1.m. Note that element [21.6] requires detecting if the user is speaking by analyzing “the first and the second ASM signal,” whereas element [1.12] discussed in Section XI.A.1.m only requires analyzing one of them. Regardless, *Usher-1* discloses analyzing both. *Usher-1*, ¶[0030] “...processor 103 monitors sound from the ambient sound microphone(s) 101/102 and determines when user voice activity is detected.” *Id.*, at ¶[0030]. *Woodruff-1* also discloses this element:

While reproducing the ambient sound, the processor detects speech in the ambient sound (e.g., via voice activity detection, VAD, operating upon the external microphone signal).

Woodruff-1, ¶[0033]. See also:

The user context encompasses any one or more the following. In one aspect, the determined user context discriminates between different types of ambient sound environments in which the wearer can find themselves, e.g., a concert, a public transport arena, a loud social

gathering at a restaurant, in a coffee shop, in an office, and outdoors. The determination can be made by digitally processing a variety of input data, in real time. The input data may include an ambient sound pickup channel (from one or more microphones in the against the ear audio device or in a smartwatch being worn by the wearer, including a beamforming sound pickup channel), speech pickup via a vibration sensor, e.g., an accelerometer that is embedded in the headphone and is responding to bone conduction of the wearer's own voice, and sensor data from a variety of other types of sensors including time of day, and user location using a global positioning system or radio frequency triangulation.”).

Id., ¶[0037]

216. Thus, the *Usher-1-Woodruff-1/Woodruff-2* combination discloses this element.

- h. [21.7]: “adjusting a mixed signal sent to the speaker, wherein the mixed signal is a combination of the ambient sound signal, the audio content signal, and an anti-noise signal, when it is detected that the user is speaking”**

217. The *Usher-1-Woodruff-1/Woodruff-2* combination discloses this element. This element recites that the “mixed signal” is a “combination of the ambient sound signal, the audio content signal, and an anti-noise signal.

218. As I discussed in Section XI.A.1.n, when *Usher-1* detects that a user is speaking, “the gain of the incoming audio signal is decreased at step 253...” *Usher-1*, ¶[0030]. As I discussed in Section XI.A.1.n, *Usher-1*’s “incoming audio signal corresponds to the claimed “audio content signal.”

219. As I also discussed in Section XI.A.1.n, when *Usher-1* detects that a user is speaking, “...the ambient sound pass-through gain is increased at step 254.” *Usher-1*, ¶[0030]. See also *Id.*, ¶[0040]-[0041]. As I discussed in Section XI.A.1.k, when *Usher-1* is combined with *Woodruff-1/Woodruff-2*, the ASM signal produced by ASM microphone 101/102 is combined with the output of *Woodruff-1/Woodruff-2*’s FBC Filter 10 to produce the claimed “first signal,” which in turn is filtered by ASE Filter 6 to produce the claimed “ambient sound signal.” *Woodruff-1* is similar to *Usher-1*, as it also discloses that the signal output by its ASE Filter 6, corresponding to the claimed “ambient sound signal” can be adjusted when the user speaks. *Woodruff-1*, ¶¶[0042]-[0044]; see also *id.*, ¶¶[0033], [0049].

220. Finally, As I discussed in Section XI.A.12, *Woodruff-1* discloses that when a user starts talking, its device “...may reduce its anti-noise output (e.g., raise attenuation by G_{anc} ...” See *Woodruff-1*, ¶[0044].

221. Note that in the *Usher-1-Woodruff-1/Woodruff-2* combination, these three signals are adjusted prior to mixing. However, persons of ordinary skill in the art would have understood that the act of adjusting these three signals would result

in the claimed step of “adjusting a mixed signal sent to the speaker” because the components combined into the “mixed signal” would be adjusted when a user starts speaking, and then mixed. The resulting “mixed signal” would not be the same, i.e., would be “adjusted,” when compared to the mixed signal sent the speaker prior to the user speaking. Indeed, I see no claim language requiring that any action, e.g., application of gain, be applied to the combined signal. All that is required is that the mixed signal be adjusted.

222. That the mixed signal can be adjusted by adjusting its input signals is confirmed by claim 22, which depends on claim 21, and which recites that mixed signal is adjusted “by increasing the volume of the audio content signal.” *Id.* Any construction of limitation [21.7] requiring that the mixed signal itself be acted on would be inconsistent with the language of claim 22, which I have been informed is not how claims are normally construed.

223. The *Usher-1-Woodruff-1/Woodruff-2* combination renders this claim obvious.

16. Claim 22: “The method according to claim 21 further comprising: adjusting the mixed signal by reducing a volume of the audio content signal”

224. *See* Section XI.A.2.

17. Claim 23: “he method according to claim 21 further comprising: adjusting the mixed signal by increasing a volume of the ambient sound signal”

225. *See* Section XI.A.4.

18. Claim 25: “The method according to claim 23 further comprising: resetting the volume of the ambient sound signal to a preset value when a preset time increment has expired”

226. *See* Section XI.A.6

19. Claim 26: “The method according to claim 22 further comprising: resetting the volume of the audio content signal to a preset value when a preset time increment has expired”

227. *See* Section XI.A.7.

20. Claim 27: “The method according to claim 21 further comprising: generating a background noise level by analyzing at least one of the first ASM signal, the second ASM signal, the ECM signal, or a combination thereof”

228. *See* Section XI.A.8.

21. Claim 29: “The method according to claim 21 further comprising: generating the anti-noise signal using at least one of the first ASM signal, the second ASM signal, the ECM signal or a combination thereof”

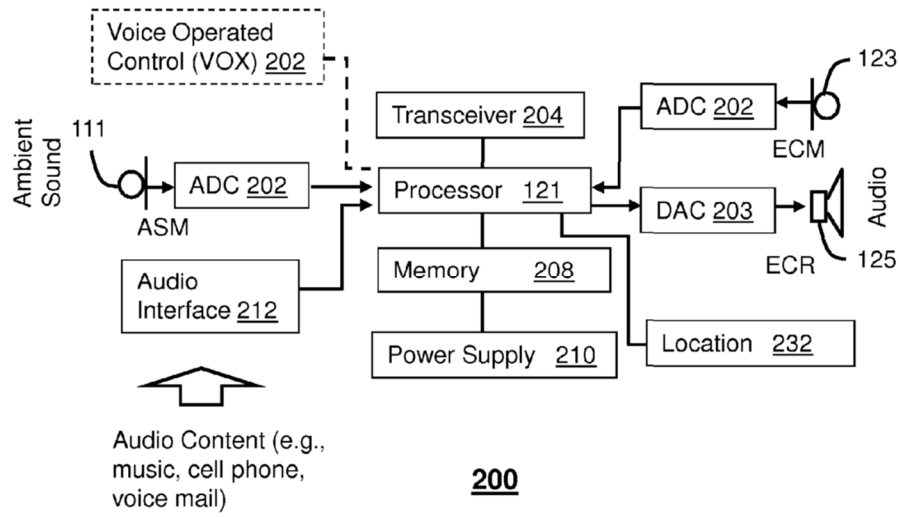
229. *See* Section XI.A.9.

B. Ground 2: *Usher-1*, *Woodruff-1*, *Woodruff-2* and *Usher-2* Render Obvious Claims 5 and 24

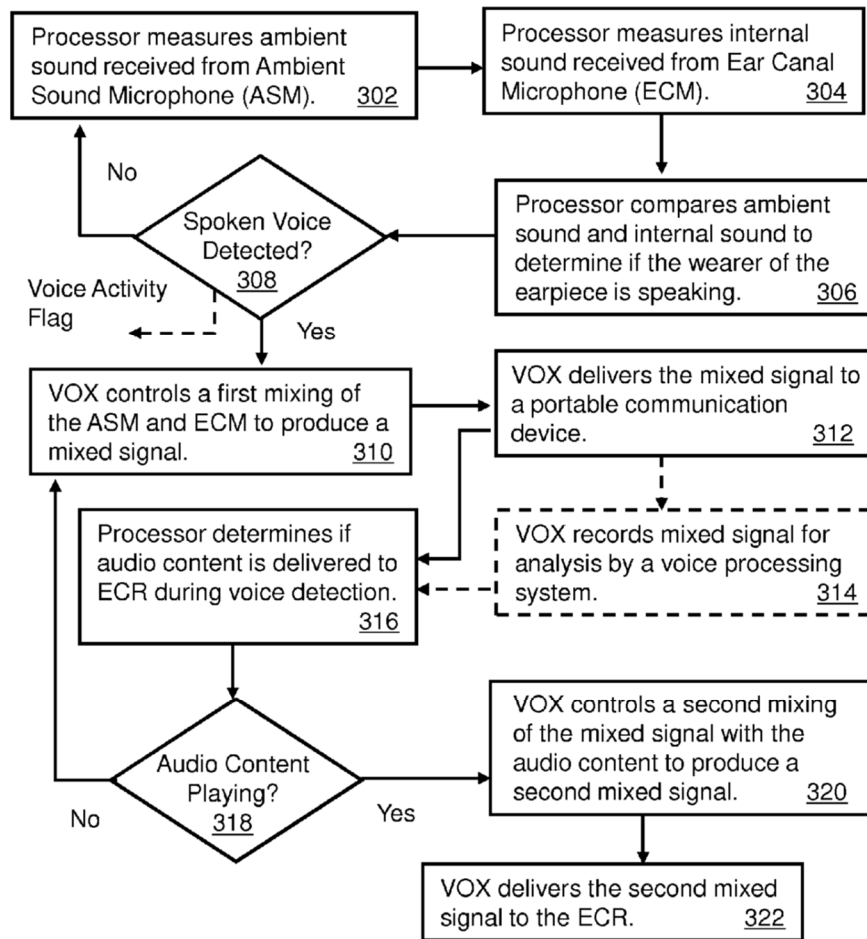
- 1. Claim 5: “The earbud according to claim 1 wherein the operations further comprise: If the user speaking is detected, analyzing at least one of the first ASM signal, the second ASM signal, the ECM signal, or a combination thereof to detect a voice command”**

230. The *Usher-1-Woodruff-1/Woodruff-2-Usher-2* combination discloses or suggests this claim. Claim 5 requires analyzing one or more ASM and/or ECM signals to detect a voice command, and requires that this analysis take place “if the user speaking is detected.” *Id.*, ¶_. As I discussed in Section XI.A.1.m, *Usher-1* discloses analyzing ASM signals to determine whether the user is speaking. *Usher-1*, ¶[0030]. *Usher-1* further discloses that its system can implement “smart” functions for “...identifying voice commands from a user...” *Id.*, ¶[0050]. *Usher-1*, however, does not explicitly disclose a device where the identification of user’s voice command is performed by the earphone itself or how such voice identification is performed.

231. *Usher-2* discloses such device. *Usher-2* discloses an earphone similar to the one described in the ’965 patent, as it has an ASM 111, and ECM 123, a processor 121 and a speaker 125. *Usher-2*, ¶¶[0030]-[0032]. See also Fig. 2:



232. *Usher-2*'s process for detecting voice commands is illustrated in Fig. 3:



300
FIG. 3

233. *Usher-2* discloses that at step 306, its processor “determines if the wearer...of the earpiece 100 is speaking.” *Usher-2*, ¶[0046]. If user speech is detected (step 308), then *Usher-2*’s voice operated control (“VOX”) 201 mixes the signals from its ASM and ECM to produce a mixed signal (step 310). *Id.*, ¶[0047]. *Usher-2* discloses that that VOX 201 can “record the mixed signal for further analysis by a voice processing system,” which, at step 314, “allows the processor

121, or voice processing system receiving the mixed signal to analyze the mixed signal for information, such as voice commands.” *Id.*, ¶[[0055].

234. Claim 5 requires that detecting voice commands by “analyzing at least one of the first ASM signal, the second ASM signal, the ECM signal, or a combination thereof.” *Usher-2* discloses detecting voice commands using a mixed signal generated by combining its ASM and ECM signals. Note also that that *Usher-2* discloses that its processor operates by executing instructions stored in memory. *Id.*, ¶[[0037]. Thus, *Usher-2* discloses claim 5

a. Persons of ordinary skill in the art Would Have Been Motivated To Combine *Usher-2* with *Usher-1-Woodruff-1/Woodruff-2*

235. As I discussed, *Usher-1* suggests that its system can implement “smart” functions for “...identifying voice commands from a user...” *Id.*, ¶[[0050]. *Usher-1*, however, does not describe how to implement voice command identification. *Usher-1*’s suggestion, however, would have motivated persons of ordinary skill in the art to look to other teachings for how to implement voice command identification, which would have led such persons to *Usher-2*’s solution. Indeed, *Usher-1* and *Usher-2* have two common inventors, and *Usher-1* incorporates *Usher-2* by reference. See Section VIII.D. Persons of ordinary skill in the art would have recognized that *Usher-2*’s voice command identification technique provided acceptable performance while implementing into *Usher-1-Woodruff-1/Woodruff-2*,

and adding *Usher-2* to *Usher-1* would have been well within the skill of an ordinary artisan.

2. **Claim 24: “The method according to 31 further comprising: analyzing at least one of the first ASM signal, the second ASM signal, the ECM signal, or a combination thereof to detect a voice command”**

236. *See* Section XI.B.1. I note that on October 23, 2023, the patent owner requested a Certificate of Correction that makes claim 24 dependent on claim 21, not non-existent claim 31. A person having ordinary skill in the art would have understood that claim 24 is obvious for the reasons described in Section XI.B.1 even if dependent on claim 21.

**C. Ground 3: *Usher-1, Woodruff-1, Woodruff-2 and Nicholson*
Render Obvious Claims 10, 12, 16-18, 28, and 30**

1. **Claim 10: “The earbud according to claim 1 wherein the operations further comprise: determining the background noise level by analyzing at least one of a modified first ASM signal, a modified second ASM signal, modified ECM signal, or a combination thereof”**

237. The *Usher-1-Woodruff-1/Woodruff-2-Nicholson* combination discloses or suggests this claim. The only difference between claim 10 and claim 9 is that claim 10 requires determining the background noise level by analyzing modified versions of the first ASM, second ASM, or ECM signals (or a combination thereof). *Woodruff-1* does not explicitly disclose use of “modified” signals to determine its

background noise signal. However, *Nicholson*, which has the same assignee as *Woodruff-1*, contains such teachings.

238. *Nicholson* discloses an ANC technique (*Nicholson*, ¶[0004]) in an earphone similar to that of the '965 patent and the prior art, as it also comprises an ECM 8 (which it calls an error microphone”), and loudspeaker 6:¹²

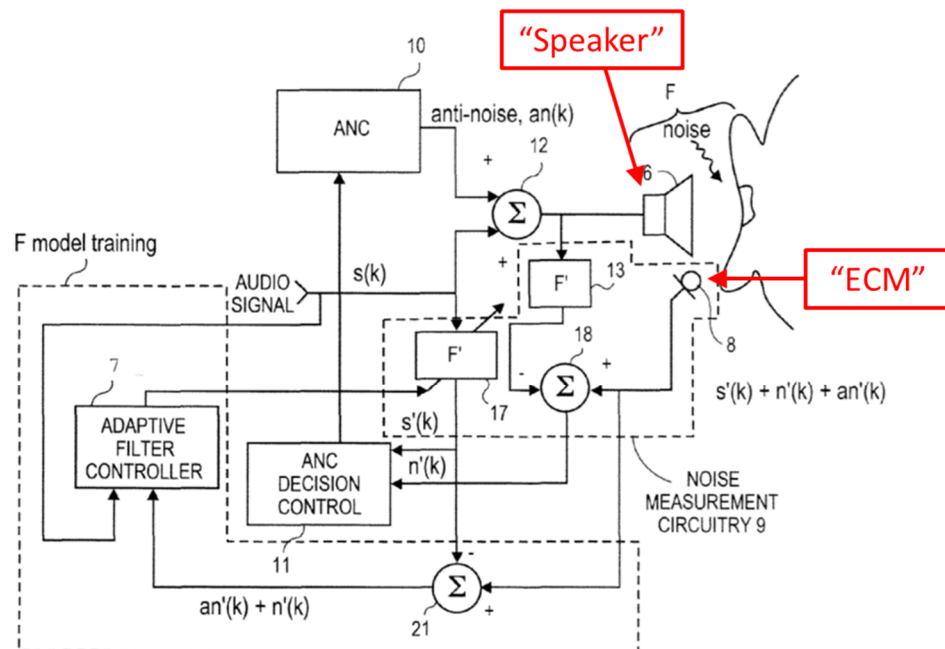


FIG. 2

Nicholson, Fig. 2.

239. *Nicholson's* earphone has ANC Decision Control 11 that “determines whether to activate or deactivate the ANC block 10, based on computed or estimated

¹² *Nicholson* also describes an embodiment having both an ECM and an ASM (reference microphone 9). See *Nicholson*, Fig. 5.

values for signal, $S'(k)$, and noise, $n'(k)$.” *Id.*, ¶[0026]. As I will be discuss, use of a decision control 11 to determine when to activate ANC block 10 will improve the functionality of the *Usher-1-Woodruff-1/Woodruff-2* combination.

240. *Nicholson* further discloses that “signal and noise estimates are computed by noise measurement circuitry 9, which includes an error microphone 8 that is located and oriented in such a manner as to pickup both (a) sound emitted from the earpiece speaker 6 and (b) the ambient acoustic noise that has leaked into the cavity or region between the handset housing or shell (not shown) that is in front of the earpiece speaker 6 and the user's ear.” *Id.*, ¶[0027].

241. *Nicholson* further discloses that its ECM 8 outputs a signal. *Id.* (“A signal picked up by the microphone...”). Persons of ordinary skill in the art would have recognized that this signal corresponds to the claimed “ECM signal.” *Nicholson* discloses that this ECM signal “is fed to a differencing unit 18 whose other input receives a signal from the output of the first filter 13.” *Nicholson*, ¶[0027]. *Nicholson* states that differencing unit 18 “provide[s] an estimate of the ambient acoustic noise $n'(k)$...” *Id.* Because differencing unit 18 modifies the signal output by ECM 8 by subtracting the signal F' , Persons of ordinary skill in the art would have understood that differencing unit 18’s output $n'(k)$ corresponds to the claimed “modified ECM signal.” This is seen in annotated Fig. 2:

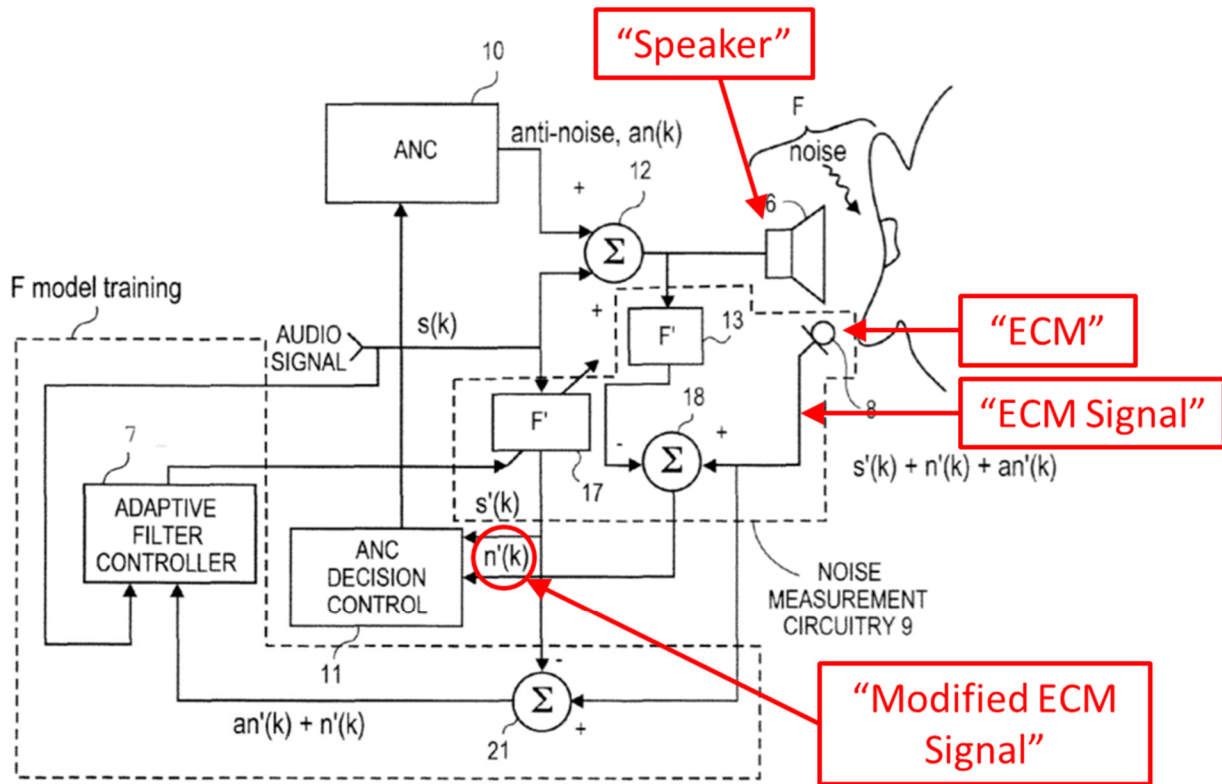


FIG. 2

242. *Nicholson's* modified ECM signal $n'(k)$ (along with “desired audio signal $s'(k)$ ”) is input to ANC Decision Control 11. *Nicholson*, ¶[0028] (“The estimated signals $s'(k)$ and $n'(k)$ are input to the ANC decision control circuitry 11, which can then determine an estimate of how much sound emitted from the earpiece speaker 6 has been corrupted by the ambient acoustic noise (e.g., SNR).”). The algorithm for *Nicholson's* decision control circuitry 11 is shown in its Fig. 3, which shows that signals $n'(k)$ and $s'(k)$ “pass through a smoothing conditioner, which in this case includes a subjective loudness weighting block 12 and an averaging block 14.” *Id.* at [0032]. *Nicholson's* loudness weighting block 12 “may be a typical

filtering operation used when measuring noise in audio systems (e.g., A-weighting, ITU-R 468).” *Id.* Next, *Nicholson’s* “averaging block 14 may implement a typical root mean square or other suitable signal averaging algorithm, e.g. ITU-T G.160...”
Id.

243. I note that signal $s'(k)$, the desired audio signal, goes through the same process (the bottom branch of the ANC Decision Control 11 of *Nicholson’s* Fig. 3). The output of averaging block 14 for the noise and the signal are input to threshold decision block 15, which “compute[s] the signal to noise ratio by essentially comparing the smoothed noise estimate $n''(k)$ to the smoothed signal estimate $s''(k)$.”

244. Persons of ordinary skill in the art would have understood that the signal output by averaging block 14, $n''(k)$, corresponds to the claimed “background noise level,” since it is a “smoothed noise estimate,” which such persons would have understood represents the “background noise level. This is seen in annotated Fig. 3:

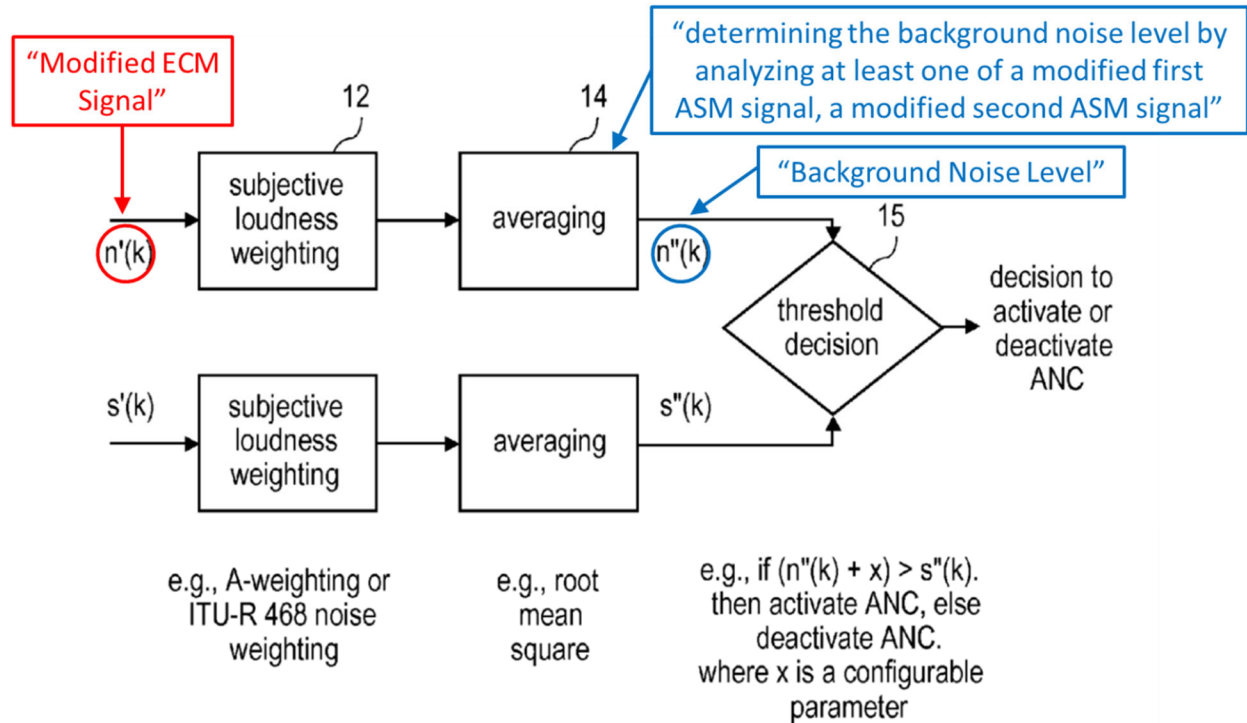


FIG. 3

245. Calculating the signal-to-noise ratio “essentially determines whether the sound being emitted from the earpiece speaker 6 has been sufficiently corrupted by the ambient acoustic noise...” *Nicholson*, ¶[0033]. In *Nicholson’s* earphone, “[i]f the SNR is below a configurable parameter or threshold, then the decision is made to not deactivate the ANC circuitry, or to activate it.” *Id.* The reason for this is that when the signal-to-noise ratio is low, “it is expected that ANC is likely to achieve some substantial reduction in the unwanted sound that the user may be hearing.” *Id.* In contrast, when the signal-to-noise ratio is high, “then this suggests that the ambient acoustic environment may be sufficiently quiet such that ANC is likely to provide no benefit to the user and hence should be deactivated or disabled,

or not activated or enabled.” *Id.* Keeping the ANC circuitry off, or deactivating it if on, “save power and avoid unwanted audio artifacts.” *Id.* Thus, Persons of ordinary skill in the art would have recognized that *Nicholson’s* will improve earphones having ANC, meaning that *Nicholson* discloses claim 10 and renders it obvious.

a. Persons of ordinary skill in the art Would Have Been Motivated To Combine *Nicholson* with *Usher-1-Woodruff-1/Woodruff-2*

246. The *Usher-1-Woodruff-1/Woodruff-2* combination discloses an earbud having acoustic noise cancellation (ANC). *See e.g., Woodruff-1*, Abstract. *See also* Sections XI.A.1.k and XI.A.8. Persons of ordinary skill in the art would have recognized that *Nicholson* sets out to improve the ANC function of earbuds, functionality also described in *Woodruff-1*. For example, *Nicholson* discloses that its method of determining when the ANC is activated helps alleviate “hiss” and reduce other artifacts of the operation of ANC circuitry. *Nicholson*, ¶[0007], [0025] (“The various embodiments of the invention make decisions on activation and deactivation of ANC in a way that helps reduce the presence of such audible artifacts and conserves power, when it has been determined that the ANC would not be of substantial benefit to the user.”). *Nicholson* further discloses that this method reduces power consumption. *Id.*

247. As I discussed in Section XI.C.1, determining the signal-to-noise ratio of the sound played in the ear canal, as described in *Nicholson*, will allow an earphone to both save power and reduce playback of ANC artifacts in situations where ambient noise is low.

248. Moreover, *Woodruff-1* discloses that its ANC block 10 uses a hybrid ANC approach, using both feedforward and feedback approaches. *Woodruff-1*, ¶[0029]. *Nicholson*'s Fig. 2 embodiment uses a feedback approach, as it uses its ECM microphone 8. *Nicholson*, ¶[0029]. Thus, persons of ordinary skill in the art would have recognized that *Nicholson*'s ANC switching could have been implemented into *Usher-1-Woodruff-1/Woodruff-2* without extensive redesign and with the expectation that the combination would work for its intended purpose.

249. Persons of ordinary skill in the art would have understood that any ANC performance improvements would provide commercial and competitive advantages and would be motivated to seek out teachings that would improve their existing technology. Persons of ordinary skill in the art searching for teachings that would improve *Usher-1-Woodruff-1/Woodruff-2*'s ANC would have been led to teachings like those in *Nicholson* because their systems are architecturally similar, as I discussed.

250. Due to the structural and conceptual similarity, persons of ordinary skill in the art would have expected that incorporating *Nicholson*'s teachings into *Usher-*

1-Woodruff-1/Woodruff-2 would have worked and would have improved the performance of the earphone.

251. Thus, claim 10 is rendered obvious by the *Usher-1-Woodruff-1/Woodruff-2-Nicholson* combination.

2. **Claim 12: “The earbud according to claim 10, wherein the operations further comprise: generating an anti-noise signal using at least one of the modified first ASM signal, the modified second ASM signal, the modified ECM signal or a combination thereof”**

252. The *Usher-1-Woodruff-1/Woodruff-2-Nicholson* combination discloses or suggests this claim. Claim 12, which depends from claim 10, requires generating an anti-noise signal “using at least one of the modified first ASM signal, the modified second ASM signal, the modified ECM signal or a combination thereof.” As I discussed in Section XI.C.1, *Nicholson* discloses that differencing unit 18 outputs a signal $n'(k)$ corresponding to the claimed “modified ECM signal.” As further discussed there, *Nicholson* discloses that its ANC circuitry 10 “generates an anti-noise signal, $a_n(k)$...” *Nicholson*, ¶[0026]. *Nicholson*’s Fig. 6 “shows a block diagram of feedback ANC.” *Id.*, ¶[0038].¹³ *Nicholson* teaches that noise measurement circuitry 9 having ECM 8 outputs a signal, to differencing unit 18,

¹³ *Nicholson* states that its Fig. 2 embodiment can be used for both feedback and feed forward ANC. *Nicholson*, ¶[0026].

which as I discussed in Section XI.C.1, modifies the signal output by ECM 8 by subtracting the signal F' therefrom, thus resulting noise estimate, $n'(k)$. As also discussed in Section XI.C.1, $n'(k)$ corresponds to the claimed “modified ECM signal,” which is input to ANC Decision Control 11. *Nicholson*, ¶[0028]. As also discussed there, *Nicholson* uses the modified ECM signal $n'(k)$ to determine whether its ANC block 10 should be enabled/disabled. *Id.*, ¶[0033]. *Nicholson* discloses that its ANC block 10 “generates an anti-noise signal, $an(k)$...” *Id.*, ¶[0026]. Because ANC Block 10’s generation of anti-noise is enabled by using *Nicholson*’s modified ECM signal $n'(k)$, persons of ordinary skill in the art would have recognized that *Nicholson* “generat[es] an anti-noise signal using ... the modified ECM signal,” just as claimed. See *Nicholson*’s Fig. 2 (annotated):

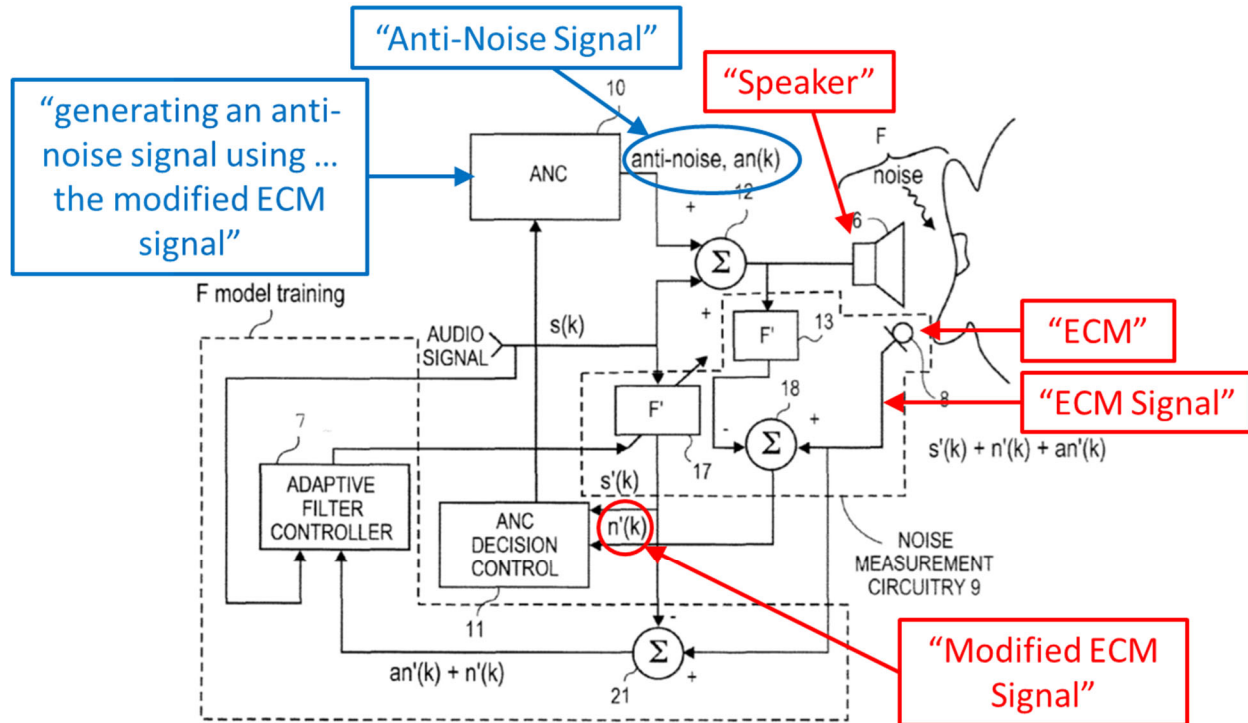


FIG. 2

253. Persons of ordinary skill in the art would have recognized that *Nicholson's* ANC decision control and ANC blocks could easily be added to Woodruff-1, and would have been motivated to do so, as I discussed in Section XI.C.1.a.

254. Alternatively, *Nicholson* discloses that “the anti-noise signal input to the mixer 12 is generated by an anti-noise digital filter 22 whose input is coupled to receive the noise estimate, $n'(k)$. *Nicholson*, ¶[0038]. Thus, Persons of ordinary skill in the art would have recognized that *Nicholson* discloses generating an anti-noise signal using a “modified ECM signal.” This can be seen in *Nicholson*’s Fig. 6 (annotated):

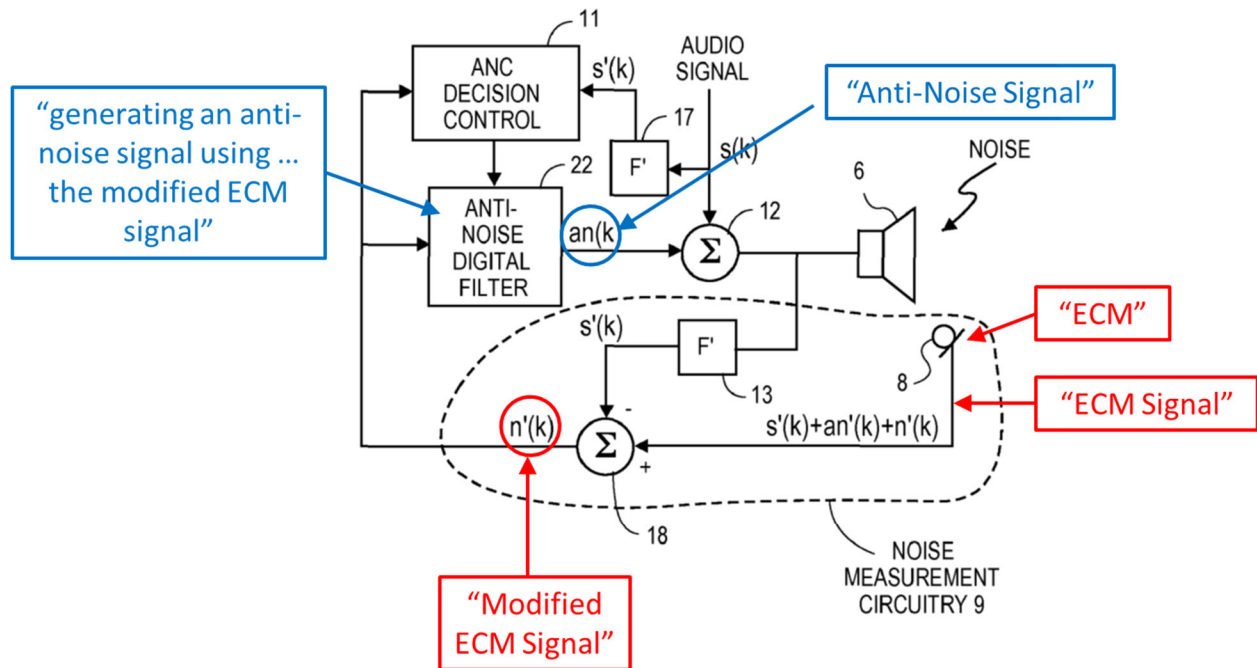


FIG. 6

255. As I discussed, in Section XI.C.1 (and XI.C.1.a), persons of ordinary skill in the art would have recognized that *Nicholson's* feedback ANC techniques could be implemented into *Woodruff-1's* hybrid ANC approach and would have been motivated to do so. Persons of ordinary skill in the art would have recognized that *Nicholson's* ANC block 10, including its ANC Decision Control 11, could be implemented *Woodruff-1's* ANC block 10 such that the *Woodruff-1-Nicholson* combined ANC block used the modified ECM signal generated by *Nicholson*. This would allow the *Usher-1-Woodruff-1/Woodruff-2* device to reduce its power consumption prevent users from hearing ANC artifacts like hiss.

256. Thus, *Nicholson* discloses claim 12, meaning the *Usher-1-Woodruff-1/Woodruff-2-Nicholson* combination renders claim 12 obvious.

3. **Claim 16: “The earbud according to claim 12, wherein the operations further comprise: mixing the ambient sound signal and audio content signal to generate a mixed signal”**

257. *See* Section XI.A.10.

4. **Claim 17: “The earbud according to claim 16, wherein the operations further comprise: generating a new mixed signal by combining the mixed signal with the anti-noise signal”**

258. *See* Section XI.A.11.

5. **Claim 18: “The earbud according to claim 17, wherein the operations further comprise: reducing the anti-noise signal and increasing the ambient sound signal prior to mixing if the user's voice is detected”**

259. *See* Section XI.A.12.

6. **Claim 28: “The method according to claim 21 further comprising: generating a background noise level by analyzing at least one of a modified first ASM signal, a modified second ASM signal, a modified ECM signal, or a combination thereof”**

260. *See* Section XI.C.1.

7. **Claim 30: “The method according to claim 21 further comprising: generating the anti-noise signal using at least one of the modified first ASM signal, the modified second ASM signal, the modified ECM signal or a combination thereof”**

261. *See* Section XI.C.2.

XII. SECONDARY CONSIDERATIONS

262. I see no evidence in the '965 patent prosecution history or elsewhere supporting any secondary considerations arguments, or evidence of nexus of such alleged evidence to the challenged claims. To the extent patent owner asserts the existence of any secondary considerations in its responses, I reserve the right to address any such evidence.

XIII. CONCLUSION

263. The findings and opinions set forth in this declaration are based on my work and examinations to date.

264. I may continue my examinations. I may also receive additional documentation and other factual evidence over the course of this IPR that will allow me to supplement and/or refine my opinions. I reserve the right to add to, alter, or delete my opinions and my declaration upon discovery of any additional information. I reserve the right to make such changes as may be deemed necessary.

265. In signing this declaration, I recognize that the declaration will be filed as evidence in an IPR before the PTAB. I also recognize that I may be subject to cross-examination in the case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

266. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Date: June 18, 2024

A handwritten signature in black ink, appearing to read 'Chris Kyriakakis', written over a horizontal line.

Chris Kyriakakis, Ph.D.