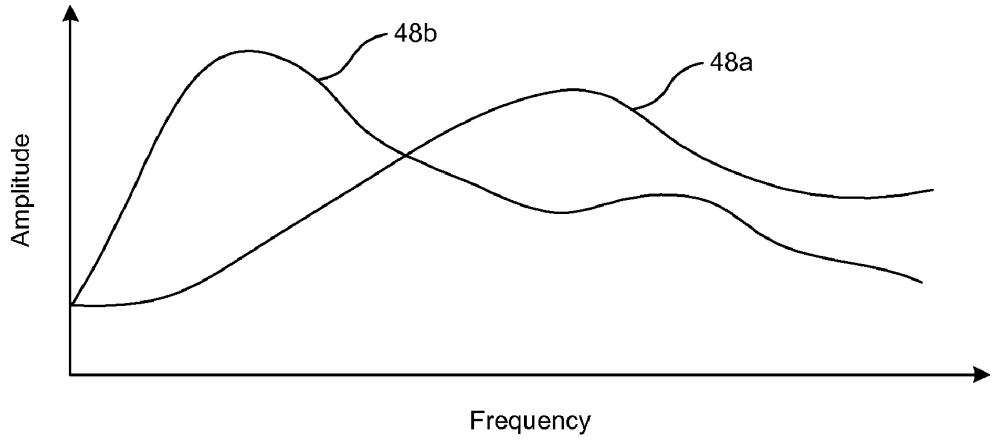

48b
48a
Amplitude
Frequency

FIG. 9

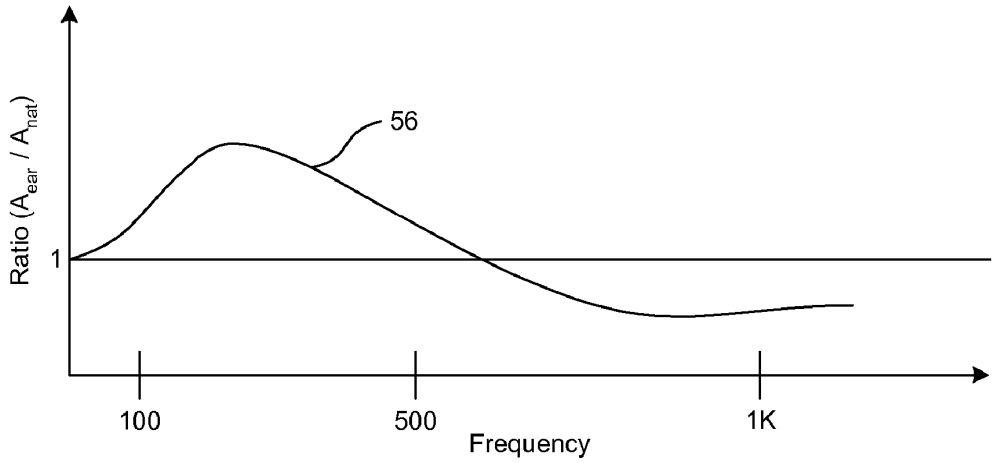

56
Ratio (A_{ear} / A_{nat})
1
100
500
1K
Frequency

FIG. 10

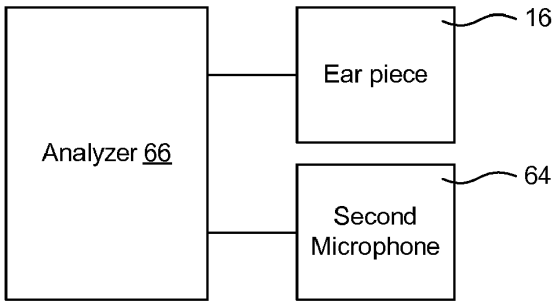


FIG. 12

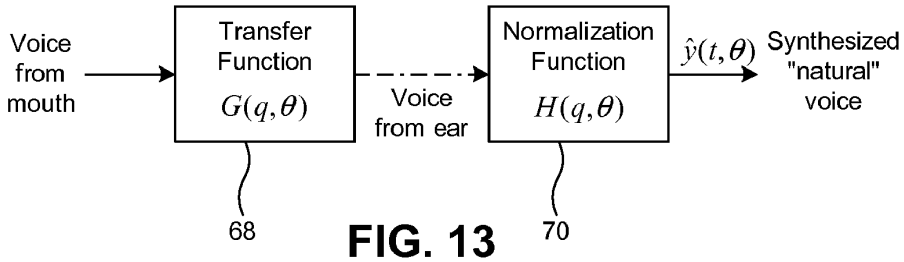


FIG. 13

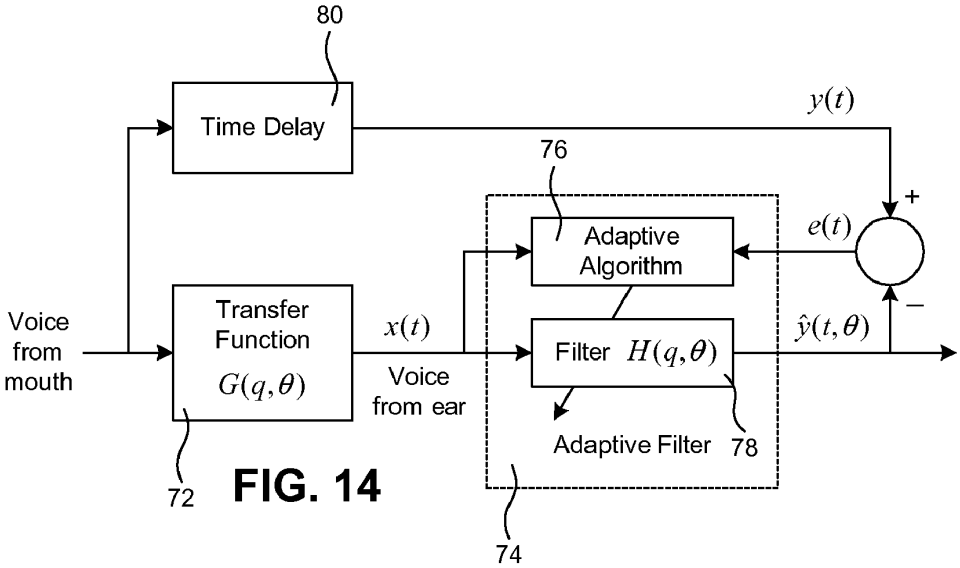


FIG. 14

EAR SENSOR ASSEMBLY FOR SPEECH PROCESSING

RELATED APPLICATION DATA

This application claims the benefit of U.S. Provisional Patent Application No. 60/804,679, the disclosure of which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

The present disclosure generally relates to an ear sensor assembly having at least a microphone that can be placed with respect to an ear. Among other applications, the ear sensor has particular application for speech processing.

BACKGROUND

Speech processing is a term that broadly describes the study of speech signals and the processing methods applied to these signals. Various categories of speech processing exist. One category is speaker recognition, which is also referred to in the art as voice recognition. Speaker recognition is the task of recognizing the identity of a person from his or her voice.

Another category of speech processing is speech recognition. Some forms of speech recognition, such as found in dictation systems, attempt to convert a signal output by a microphone used to capture the user's speech into a sequence of words (e.g., text). Other forms of speech recognition, such as found in some voice activated telephones, attempt to recognize patterns in the signal and carry out an associated command. For instance, if the user were to say "call home," the device processing the speech would not "understand" what was said by converting the speech to text, but would match the speech to a command function.

As will be appreciated, the quality of a signal from the microphone used to detect a user's speech will greatly affect the quality of automated speech processing carried out by a host device (e.g., a computer executing speech recognition software). Signals from the environment surrounding the user that are detected by the microphone can greatly diminish the accuracy of speech processing. An article titled "Speech Recognition" downloaded from the WIKIPEDIA website on the Internet under the heading "Speech Recognition" on Jun. 3, 2006 reports that the typical achievable recognition rate as of 2005 for large-vocabulary, speaker-independent speech recognition systems is only about 80% to 90% for a clear environment, and can be as low as 50% for scenarios with background noise.

Accordingly, there is a need in the art for an improved apparatus for detecting user speech for purposes of speech processing, as well as associated methods of speech signal detection and signal processing.

SUMMARY

According to one aspect of the disclosure, a remote speech recognition apparatus includes a microphone positionable with respect to an ear canal to detect sound signals in or near the ear canal and to generate a corresponding output signal; a seal for substantially blocking ambient sound signals from reaching the microphone; and an interface to convey the output signal to a remote speech recognition apparatus.

According to one embodiment, the remote speech recognition apparatus further includes a housing that retains the microphone and the seal.

According to one embodiment of the remote speech recognition apparatus, the interface includes a set of conductors.

According to one embodiment of the remote speech recognition apparatus, the interface includes a wireless interface adapter.

According to one embodiment of the remote speech recognition apparatus, the microphone is fluidly coupled to the ear canal via a channel disposed in the ear piece.

According to one embodiment of the remote speech recognition apparatus, the channel is defined by a tube.

According to one embodiment of the remote speech recognition apparatus, the channel is generally linear and, when the ear piece is placed with respect to the ear, the channel is generally arranged along a longitudinal axis of the ear canal.

According to one embodiment, the remote speech recognition apparatus further includes a housing that retains the microphone and the seal, the channel disposed within the housing.

According to one embodiment of the remote speech recognition apparatus, the seal includes at least one annular resilient member that, when the ear piece is placed with respect to the ear, engages the ear at an opening of the ear canal.

According to one embodiment of the remote speech recognition apparatus, the output signal from the microphone corresponds to a portion of speech and has a different spectral response than a spectral response of the same speech as detected from the mouth of a user.

According to one embodiment, the remote speech recognition apparatus further includes a host that executes speech recognition software to process the output signal.

According to one embodiment of the remote speech recognition apparatus, the software has greater than 90% accuracy using a raw form of the output signal as an input to the software.

According to another aspect of the invention, a sound processing apparatus includes a microphone positionable with respect to an ear canal to detect sound signals from the ear canal and to generate a corresponding output signal, wherein the output signal from the microphone corresponds to a portion of speech and has a different spectral response than a spectral response of the same speech from the mouth of a user; and a circuit that normalizes the output signal from the microphone by applying a normalization function to the output signal from the microphone, the normalized signal having a spectral response that is closer to the spectral response of the speech from the mouth of the user than the spectral response of the output signal from the microphone.

According to one embodiment of the sound processing apparatus, the microphone and the circuit are contained within a housing that is retained by the ear of the user.

According to one embodiment of the sound processing apparatus, the microphone is contained within an ear piece that is retained by the ear of the user and the circuit forms a part of a separate device that is interfaced with the ear piece.

According to one embodiment of the sound processing apparatus, the normalization function is an inverse of a transfer function that is based on a ratio of a spectral response of a speech sample detected from the mouth of a sampled individual to a spectral response of the speech sample detected from the ear of the sampled individual.

According to one embodiment of the sound processing apparatus, the transfer function is a composite function that is combination of plural spectral response ratios taken from plural individuals.

According to one embodiment of the sound processing apparatus, the transfer function is a combination of a series of

ratio values of the spectral response of the speech detected from the ear to the spectral response of the speech detected from the mouth for each of plural time frames of the speech sample.

According to one embodiment of the sound processing apparatus, the time frames are about 10 milliseconds to about 30 milliseconds long.

According to one embodiment of the sound processing apparatus, the transfer function is user dependent and the speech sample is generated by the user of the sound processing apparatus.

According to one embodiment of the sound processing apparatus, the transfer function is user independent and the speech sample is generated by at least one speaker different than the user of the sound processing apparatus.

According to one embodiment of the sound processing apparatus, the normalization function is an inverse of a transfer function that is based on a ratio of a time domain response of a speech sample detected from the mouth of a sampled individual to a time domain response of the speech sample detected from the ear of the sampled individual.

According to one embodiment of the sound processing apparatus, the normalization function is adaptively established by an adaptive filter that models a difference between a sound signal from the ear and a corresponding sound signal from the mouth.

According to one embodiment of the sound processing apparatus, the normalization function is based on a transformation matrix that is selected to decorrelate a current value of the output signal from the microphone from a past history of output signal values.

According to one embodiment of the sound processing apparatus, the normalization function is based on a transformed version of an input vector that models the difference between the sound signal from the ear and the corresponding sound signal from the mouth.

According to one embodiment of the sound processing apparatus, the normalization function is based on a non-transformed version of an input vector that models the difference between the sound signal from the ear and the corresponding sound signal from the mouth.

According to one embodiment of the sound processing apparatus, the normalization function is established by sampling speech data from an ear and a mouth of a user for a period of time and adaptively generating the normalization function over the period of time.

According to one embodiment of the sound processing apparatus, the adaptive updating of the normalization function is stopped after the period of time.

According to one embodiment, the sound processing apparatus, further includes a host that executes speech recognition software to process the normalized output signal.

According to one embodiment, the sound processing apparatus, further includes a communications device that transmits the normalized output signal to a remote destination.

BRIEF DESCRIPTION OF DRAWINGS

These and further features will be apparent with reference to the following description and drawings, wherein:

FIG. **1** is a schematic block diagram of a sound signal processing system that includes an ear piece;

FIG. **2** is a schematic block diagram of a telecommunications system that includes an ear piece;

FIG. **3** is a schematic view of an ear;

FIG. **4** is a cross-sectional view of the ear having an ear piece disposed with respect thereto;

FIG. **5** is a schematic diagram of an exemplary embodiment of an ear piece;

FIG. **6** is a schematic diagram of another exemplary embodiment of an ear piece;

FIG. **7** is a schematic diagram of yet another exemplary embodiment of an ear piece;

FIG. **8** is a flow chart depicting a method of generating a transfer function used to normalize a microphone output signal;

FIG. **9** is a graph having plots of the user's "natural" speech and the speech as detected by the ear piece;

FIG. **10** is a graph having a plot of the transfer function;

FIG. **11** is a flow chart depicting a method of normalizing a microphone output signal using the transfer function;

FIG. **12** a schematic block diagram of an exemplary assembly for generating a transfer function and a normalization function;

FIG. **13** is a diagram that depicts a batch estimation method for generating a transfer function and applying a normalization function that is based on the transfer function to a microphone output signal; and

FIG. **14** is a diagram that depicts an adaptive estimation method for generating a transfer function and applying a normalization function that is based on the transfer function to a microphone output signal.

DESCRIPTION

I. Introduction

In the description that follows, like components have been given the same reference numerals, regardless of whether they are shown in different embodiments. To illustrate various embodiments in a clear and concise manner, the drawings may not necessarily be to scale and certain features may be shown in somewhat schematic form. Features that are described and/or illustrated with respect to one embodiment may be used in the same way or in a similar way in one or more other embodiments and/or in combination with or instead of the features of the other embodiments.

Disclosed herein are various embodiments of an ear piece assembly that may be used with, for example, a host device that executes speech processing software. As will be discussed below, other possible uses for the ear piece assembly exist. For example, the ear piece set assembly that can be used with a communication system that allows a user to carry on a conversation with a remotely located person.

In one embodiment, the ear piece assembly includes a microphone that is positionable with respect to an ear canal to detect signals associated with the ear canal, a seal for blocking ambient signals and a wired or wireless connection to a remote apparatus. These components may be supported by a housing so that the ear piece assembly is retained by the ear of the user and allows for hands free use of the ear piece. The microphone is arranged to detect air pressure changes occurring within the ear, which may be described as sounds in the ear canal and/or emanating from (e.g., coming out of) the ear canal. Thus, the microphone may be used to accurately and reliably detect the speech of the user.

The user's speech that may be detected at the ear is typically muted (e.g., muffled) relative to the "natural" sound of the speech that emanates from the user's mouth. The applicants have unexpectedly found, however, that the signal output by the microphone using the ear piece described herein can be accurately processed using speech recognition software included with MICROSOFT's XP operating system at an accuracy rate of about 97%. Even with these results, one

embodiment of the ear piece may include a circuit to normalize the signal output by the microphone so that the signal more accurately represents the "natural" sound of the user's voice. This embodiment may improve speech recognition results and/or may find application for voice communications.

Without intending to be bound by theory, the disclosed ear piece assembly allows a user to speak more quietly (e.g., such as at a whisper or near whisper) than is needed for adequate functioning of conventional headsets. This allows for more private conversations and less disruption to others.

The disclosed ear piece assembly does not rely on the detection of sound that has emanated directly from the user's mouth. Therefore, there is a reduced need to repeatedly adjust the position of the ear piece that would otherwise distract the user and require the use of the user's hands. Also, the size and arrangement of the ear piece is small, resulting in a more cosmetically appealing device. Such a device can be used unobtrusively. For example, the device would not be noticed as much by others when used in public, or by a person being observed by others, such as, for example, a television news anchor or a secret service agent.

It is noted that the term air pressure changes is used in its broadest sense and includes, for example, sound waves (whether audible to the user or not), pressure fluctuations, vibrations, resonations and the like. In addition, the term air pressure changes, as used herein, includes vibrations conducted by the bones and tissue of the user that are carried to ear. These conducted vibrations can vibrate the anatomical parts of the ear and/or the housing and lead to sound detection by the microphone. The air pressure changes may be caused by one or more factors, including vibrations of the ear drum, vibrations of bone within the ear, vibrations of other anatomical structures within the ear and vibrations conducted by the bones and/or tissue of the user to the ear and which invoke an air pressure change in and/or emanating from the ear.

As a result, the ear piece assembly (also referred to herein as an ear sensor assembly) can be used to detect a person's speech and output a corresponding signal. It is also noted that the term speech is used in its broadest sense and includes spoken words and utterances, as well as other vocalizations produced by the user, including, for example, grunts, whistles, singing, coughs, "clicking" sounds made by movement of the lips or tongue, and the like. To facilitate the description herein, the event of sensing or detecting by the microphone will be referred to as detecting and that which is detected will be referred to as a change within the ear, or simply an air pressure change. The ear piece assembly monitors changes within and/or emanating from the human ear which occur instantaneously, or nearly instantaneously, in response to the speech of the person to provide a substantially real-time speech detection system. Other uses for the ear piece assembly include, for example, a thought detection system, a movement and/or voluntary physical action detection system, a speech processing system, a medical diagnostic system and so forth. Collectively, these systems will be referred to as sound processing systems. Examples of various communication systems and/or sound processing systems in which the ear piece assembly described herein can be used are found in co-owned U.S. Pat. Nos. 6,024,700, 6,503,197, 6,647,368 and 6,671,379, the disclosures of which are herein incorporated by reference in their entireties.

II. Apparatus

Turning now to the figures, FIG. **1** is a block diagram that illustrates a sound signal processing system **10** for processing signals representative of sounds detected in association with the ear canal of a user. The system **10** includes a host device **12**, such as a computer, mobile telephone, personal digital assistant (PDA) or the like. The host **12** may be connected in a larger system and may be used to control another device (e.g., a wheel chair, machinery, etc.) or provide input to a logical operation (e.g., a software program executed by the host **12** or another device). The host **12** may be any device capable of executing logical instructions including, in particular, processing software **14** that acts upon a signal generated and output by an ear piece **16**. In a preferred embodiment, the processing software **14** is speaker-independent speech recognition software. However, any other signal processing or speech processing software may be executed by the host to act upon the signal output by the ear piece **16**.

In another example, the host **12** can be a medical diagnostic system where detected sounds corresponding to the user's heart beat, breathing and/or gastrointestinal system are converted into visual and/or data forms for use by medical professionals. In another example, the sound processing apparatus **12** can be a control system where sounds corresponding to voluntary actions of the user are converted into control instructions for a device, such as a computer, wheelchair, item of machinery, etc. In this embodiment, the sounds can correspond to thoughts of the user as set forth in co-owned U.S. Pat. No. 6,024,700, movements of the user as set forth in co-owned U.S. Pat. No. 6,503,197, or spoken or other vocally generated sounds.

As indicated, the sound signal processing system **10** includes an ear piece assembly, generally referred to by reference numeral **16**. With additional reference to FIGS. **5-7**, the ear piece **16** can include a microphone **18** and a seal **20** that are supported by a housing **22**. The physical arrangement and detailed operation of the ear piece **16** will be described more fully below. The microphone **18** is used to detect sounds in, near and/or emanating from the ear of the user (collectively referred to as air pressure changes of the ear) that result from, for example, speech of the user. The microphone **18** converts those detections into an electrical signal that is input to the host **12**.

An interface may couple the ear piece **16** to the host **12** or some other device. In the embodiments of FIGS. **1**, **2**, **5** and **6**, the interface is an appropriate set of conductors **24**. The conductors can include a wire or wires coupling the microphone **18** to the host **12**. In other embodiments, the interface that couples the ear piece **16** to the host **12** or some other device may be wireless. For instance, in the embodiment of FIG. **7**, the ear piece **16** includes a wireless adapter **26**, such as a Bluetooth adapter. The host **12** may have a coordinating wireless adapter (not shown) to exchange signals with the wireless adapter **26** and receive the signal output by the microphone **18**.

As indicated, the ear piece **16** can be used with other systems and devices other than the host device **12**. For example, as shown in FIG. **2**, the ear piece **16** may form part of a communications system **28** for establishing duplexed (two-way) audio communication between two or more individuals. The system **28** includes a communication device **30**, such as a telephone. In the illustrated embodiment, the communication device **30** is a wireless telephone, such as mobile or cellular telephone. The device **30** can establish communication with a communications network (not shown), or backbone network, that enables a user of the device **30** to carry on a conversation with a remotely located person using a remotely located communication device (e.g., another telephone) as is known in the art. It will be appreciated that the communication device **30** and/or any remote communication

device (not shown) can be other types of devices, including hardwired (land line) telephones, radios, personal digital assistants (PDAs), portable or stationary computers, voice over internet protocol (VoIP) devices, etc. Also, the communications network can be a network of any type, such as telephone systems, the Internet, a WAN, or a LAN.

For use in the communications system **28**, the ear piece **16** may include the microphone **18** and a speaker **32** as shown in FIG. **7**. The speaker **32** may be used to output sounds to the user. These sounds can include sounds generated in response to signals received by the communication device **30** over the communications network. In this way, the ear piece **16** and communication device **30** can be used as a bi-directional communication apparatus.

Referring to FIGS. **3** and **4**, an external view and a cross-sectional view of an ear **100** are respectively illustrated. FIG. **4** also schematically shows the ear piece **16** disposed with respect to the ear. The ear piece **16** also is shown in cross-section in FIG. **4**. According to Henry Gray's famous text "Anatomy", the human ear is divided into three parts, including the external ear **102**, the middle ear (or tympanum) **104** and the internal ear (or labyrinth) **106**. The middle ear **104** and the internal ear **106** will not be described in great detail herein. The external ear **102** includes an expanded portion, or a pinna **108** (also referred to as an auricle), and an ear canal **110** (also referred to as a meatus or auditory canal). The pinna **108** serves to collect vibrations of the air surrounding the person's head. The ear canal **110** conducts those vibrations to the tympanum, or eardrum **112**.

The pinna **108** has a generally ovoid form with a larger end directed upward and having an outer surface that is irregularly concave and directed slightly forward. The pinna **108** has a number of eminences and depressions. Typically, the ear **100** has a prominent and curved rim, or helix **114**. Generally parallel to the helix **114** is another curved prominence, or antihelix **116**. The antihelix **116** bifurcates to form a triangular depression, or a fossa of the antihelix **118** (also referred to as a fossa triangularis). A narrow, curved depression located between the helix **114** and antihelix **116** is referred to as fossa of the helix, or scapha **120**. The antihelix **116** also curves around a deep, capacious cavity, or the concha **122** (the concha **122** being divided by the commencement of the helix **114**, or crus helicis, into an upper part, termed the cymba conchae, and a lower part, termed the cavum conchae). The concha **122** leads inward to an opening of the ear canal **110**. In front of the concha **122** and projecting backward (usually over the opening of the ear canal **110**) is a pointed eminence, or tragus **124**. Opposite the tragus **124** is a tubercle, or antitragus **126**. A notch-like depression, or incisura intertragica **128**, is disposed between the tragus **124** and antitragus **126**. A lobule **130** is present under the tragus **124** and antitragus **126**.

The ear canal **110** is an oval cylindrical passage extending from a bottom of the concha **122** to the ear drum **112**. The ear canal **110** is about an inch and a half in length when measured from the tragus **124** to the ear drum **112**. When measured from the bottom of the concha **122** to the ear drum **112**, the ear canal is about an inch long. The ear canal **110** forms a gradual "S-shaped" curve and is directed, at first, inward, forward and slightly upward (i.e., pars externa). The ear canal **110** then passes inward and backward (i.e., pars media) and then passes inward, forward and slightly downward (i.e., pars interna).

It is not certain what physical, chemical or neural mechanism causes or generates the changes in air pressure in or near the ear or sounds to come from the ear in response to various actions of the user. However, due to the connection of the oral cavity to the ear via the eustachian tube, speech and movements of the mouth may cause a change in air pressure or an airflow to or from the ear leading to a detectable air pressure change that can be detected by the microphone **18**. Regardless of the exact physical, chemical or neural mechanism, empirical testing has confirmed that the user's speech generates pressure changes in, near or from the ear of the person. Consequently, the air pressure changes can be monitored in or near the ear and used to detect the speech of a user.

In this document, various forms of the terms "changes in air pressure", "changes within the ear", and sounds "emanating" or "coming from" the ear are used their broadest sense to characterize the parameter being measured. Changes in air pressure may alternatively be characterized as sound waves or as signals. These sound waves (or vibrations) may propagate through mediums other than air, such as bone and tissue. As is well known by those skilled in the art, as a sound wave spreads out from its source its intensity falls off (the energy per unit area decreases with the inverse square of the distance), but the total energy is constant.

FIG. **4** illustrates the ear piece **16** inserted at least partially into the ear **100** of a person (i.e., at least within the cavity defined by the pinna **108**, if not deeper within the ear **100** such as within the concha **122**, at the opening of the ear canal **110** or slightly into the ear canal **110**). In a preferred embodiment, the seal **20** engages the ear canal **110** at the opening of the ear canal **110**. In this arrangement, the ear piece **16** may be retained by the ear **100**. Also, the seal **20** may work with the surrounding tissue to seal off sound signals from the user's environment to reduce the detection of or interference from ambient sounds (e.g., people talking, machinery, animals, wind, etc.). The sealing may also assist in minimizing disruption to the signals from the ear before they reach the microphone **18**. In the illustrated embodiment, the microphone **18** is retained by the housing in a position outside the ear canal **110**. However, the microphone **18** may be positioned, relative to the ear **100**, close to the opening of the ear canal **110** or in the ear canal **110**.

With additional reference to FIG. **5**, components of an embodiment of the ear piece **16** are schematically illustrated. As indicated, the ear piece **16** includes a housing **22**, which may have unitary or multipart construction.

The housing **22** can take on a number of different physical configurations. For example, the housing **22** can resemble the housing design of a hearing aid, and particularly a digital hearing aid, for similar insertion, or partial insertion, into the ear **100**. Alternatively, the housing **22** can resemble a miniature earphone as used with personal audio/music players. Such ear phones are commonly referred to as "ear buds". The ear piece **16** can be retained by insertion into the ear **100** as shown or by a member disposed over or hanging from the ear and/or by a headset assembly.

The housing **22** can be made from any suitable material, such as plastic, rubber or a gel-like material. In a preferred embodiment, the housing **22**, or portions thereof, is made of relatively rigid plastic, but alternative embodiments can includes making the housing from pliable material, sound absorbing (or sound proofing) material and/or include sound insulating material such as foam. The housing **22** defines a hollow cavity (or cavities) in which the operative components of the ear piece **16** are placed. Voids in the cavity can be unfilled or filled with foam or other material. In another arrangement, the inside surfaces of the housing **22** can be shaped to conform to the components contained therein so that the volume of any unoccupied cavities surrounding the various components is minimized.

The seal **20** may be made from rubber or gel-like material. In the illustrated embodiment, the seal **20** includes two stacked annular members **34***a* and **34***b* that are integrally

formed with one another or securely joined, such as with adhesive. The annular member **34***b* is slightly smaller than the annular member **34***a* and is positioned for deeper insertion into the ear canal than the annular member **34***a*. The housing **22** may include a hub **36** that retains the seal **20**. For instance, at least one of the annular members **34**, such as the annular member **34***a* in the illustrated embodiment, is arranged to conform to an annular indentation of the hub **36** to form an interference fit therewith.

The ear piece **16** can be custom designed for the individual user so as to form a close and comfortable fit with the ear of the individual. Alternatively, the ear piece **16** can have a standard, or "stock", design for all individuals. Stock design ear pieces **16** may be fabricated in a number of sizes. As one skilled in the art will appreciate, alternative physical configurations for the ear piece **16** are possible.

Sounds from the ear canal **110** may be conveyed to the microphone **18** through an air medium via a channel **40** or passageway of the ear piece **16**. The channel **40** may terminate at an opening of the ear piece **16** that fluidly communicates with the ear canal. The opening may be referred to as a port **38**. The channel **40**, in the illustrated embodiments, is defined by a tube. However, the channel **40** may be defined by the construction of the housing **22** and/or seal **20**. For example, a bore or hole in these components may allow fluid coupling of the microphone **18** and the ear canal **110**.

The foregoing arrangement allows detection of air pressure changes of the ear, such as sounds emanating from the ear. In particular, sound waves present at the port **38** are communicated to the microphone **18**. This arrangement reduces the detection of sound waves other than those present at the port **38** by minimizing a conveyance path to the microphone **18** for such sound waves. Additional isolation of the microphone **18** can be accomplished by encapsulating the microphone **18** in a suitable polymer that conforms to the exterior surfaces of the body of the microphone **18**.

When used with the host **12**, the ear piece **16** can be used to generate a signal indicative of the user's speech that may be processed with great accuracy by speech recognition software, even in noisy environments or when the user speaks at a whisper. Without intending to be bound by theory, the unexpected speech recognition accuracy described above is directly attributable to the arrangement of the ear piece **16** having a seal **20** and a direct channel **40** to convey sounds from the ear canal **110** to the microphone **18**. In addition, the accuracy is achieved even though the signal generated by the microphone **18** in response to user speech and input to the host over the interface **24** is uncorrected for the differences in spectral characteristics between the user's voice detected from the ear canal **110** and the same speech detected from the user's mouth.

As will be appreciated, the voice signal from the microphone **18** is relatively strong due to sealing of the ear canal with the earpiece **16**. The illustrated approach to sealing the ear canal is to use the seal **20**, which resembles a rubber cup. The sealing is made to pick up as much sound as possible from the ear and, as indicated above, may be made to specifically exclude as many external sounds as possible or not be specifically made to exclude external sounds. In either case, the voice signal detected by the microphone **18** is changed from its natural form, or the speech that one may expect to hear from the user's mouth. The differences are most likely due to the anatomical structures conveying the sound to the ear and/or the enclosed spaces of the ear canal **110** and channel **40**. In the signal detected by the microphone **18**, high frequencies are suppressed and there is a prominence of low frequency components relative to the "normal" voice for the same speech.

With additional reference to FIG. **6**, the ear piece **16** may include a circuit **42** to conform the speech detected by the microphone **18** to be more closely representative of the "normal" speech of the user. The circuit **42** may be implemented in hardware, such as an application specific integrated circuit (ASIC), a set of filters (e.g., band pass filters), a digital signal processor, etc. Alternatively, the functions of the circuit **42** may be implemented in software, firmware or a combination of hardware and software. In one embodiment, the functions of the circuit **42** are carried out by the host **12** or the communication device **30**.

The circuit **42** may adapt (e.g., normalize) the output signal of the microphone **18** using a predetermined transfer function. One exemplary technique for generating the transfer function will be described with respect to FIG. **8** and one exemplary technique for normalizing the output signal of the microphone **18** using the transfer function will be described with respect to FIG. **11**. The flow charts of FIGS. **8** and **11** may be thought of as depicting steps of a method or methods. Although FIGS. **8** and **11** show a specific order of executing functional logic blocks, the order of execution of the blocks may be changed relative to the order shown. Also, two or more blocks shown in succession may be executed concurrently or with partial concurrence. Certain blocks also may be omitted.

The method of transfer function generation represented by FIG. **8** may be carried out to create a transfer function specific to the user. However, the applicants have determined that a single transfer function may be developed that works suitably well for many possible users, if not almost all users. Thus, in a preferred embodiment, the predetermined transfer function applied by the circuit **42** is a generic transfer function that is developed for multiple users.

Referring to FIG. **8**, the method of personalized or generic transfer function generation may begin in blocks **44***a* and **44***b*. In block **44***a*, the "natural" speech of a person is detected with a microphone (not shown) that outputs a first signal. The natural speech is detected, for example, using a microphone positioned with respect to the speaker's mouth. The same speech is detected at the same time in block **44***b* with the microphone **18** of the ear piece. For purposes of transfer function generation, the output of the microphone **18** is considered a second signal and is representative of the speech as detected from the ear canal.

Next, in blocks **46***a* and **46***b*, the first signal and the second signal are respectively converted from the time domain to the frequency domain. For example, the Fourier transform of the first and second signals may be taken.

With additional reference to FIG. **9**, the spectral response of the first signal (the spectral response for the output from the microphone used to detect the "natural" speech) is shown as plot **48***a* and the spectral response of the second signal (the spectral response for the output from the microphone **18**) is shown as plot **48***b*. The plots **48***a* and **48***b* are exemplary plots to illustrate the steps of the method and may not be accurate representations of actual spectral responses of the signals obtained in blocks **44***a* and **44***b*.

In block **50**, a ratio between the amplitude of the spectral response for the voice detected from the ear canal **110** in block **44***b* (A_{ear}) to the spectral response for the "natural" voice detected from the mouth in block **44***a* (A_{nat}) may be obtained. A time frame approach to determine the ratio may be used to incrementally compare the spectral responses over a desired frequency range. For instance, the first and second

signals may be broken into time frames, where each time frame is about 20 milliseconds long to about 30 milliseconds long. In another embodiment, each time frame may be about 10 milliseconds long to about 30 milliseconds long. In this duration of time, it is rare for the frequency of the detected speech to change by a large amount. By operation of block **50**, the amplitude of the spectral response for the first signal may be compared to the amplitude of the spectral response for the second signal for a particular time frame to obtain a ratio of the two responses for a particular frequency (the frequency of the speech signal during the time frame or, for example, an average of the frequency during the time frame).

Next, in block **52**, a determination may be made to determine if the ratio of block **50** has been ascertained for each time frame. If there are more time frames to analyze, a positive determination may be made in block **52** and the logical flow may return to block **50**. If all of the time frames have been analyzed, a negative determination may be made in block **52** and the logical flow may proceed to block **54**. However, if ratios for all frequencies of interest over a frequency range of interest have not been ascertained, the process through block **52** may be repeated with another speech sample to obtain a satisfactory number of ratio values.

In block **54**, the ratios for all of the time frames may be combined to generate the transfer function. With additional reference to FIG. **10**, illustrated is a plot **56** of the transfer function. The plot **56** is exemplary to illustrate the steps of the method and may not be an accurate representation of an actual transfer function. If multiple time frames generated a ratio for the same frequency, the corresponding ratios may be averaged or addressed in another mathematically relevant manner. In one embodiment, the transfer function may be the result of combining the results from multiple speech samples from a single person and/or combining results from multiple persons. It may be observed that the transfer function is a generally smooth curve that does not include spikes of steep slopes. As a result, the transfer function may be expressed as a relatively simple polynomial and the circuit **42** that uses the transfer function to normalize the output signal of the microphone **18** need not be overly complex.

With reference now to FIG. **11**, the signal output by the microphone **18** may be normalized. In block **58**, the microphone **18** may detect the user's voice from the user's ear and output a corresponding electrical signal. The electrical signal is input to the circuit **42**. In block **60**, the circuit **42** processes the circuit by applying the inverse of the transfer function to the signal to change the content of the signal to more accurately represent the user's "natural" form of the same speech. By applying the inverse of the transfer function, high frequency components may be boosted and low frequency components may be attenuated. Thereafter, the circuit **42** may output a normalized signal representative of the user's speech in block **62**.

In the exemplary approach of normalizing the detected speech, an inverse of the transfer function is applied to the output signal of the microphone **18**. In this case, the inverse of the transfer function may be considered a normalization function. It will be appreciated that other transfer functions may be established and that, in some embodiments, the normalization function may be the same as the transfer function or may be some other function of the transfer function. Additional exemplary techniques for deriving the transfer function and the normalization function will be described in greater detail below.

The circuit **42** also may be used to decrease sensitivity to ambient sounds. For example, the circuit **42** may include filters to remove wind noise, office equipment noise (e.g., as generated by computer fans and air conditions), road noise, background conversations (e.g., the "din" experienced at restaurants and crowded places), music, and so forth. The circuit **42** also may compensate for known anomalies of the microphone **18**.

Referring now to FIG. **7**, the ear piece **16** may be used in conjunction with the communications device **30** to support fully duplexed conversations with a remotely located person. For this application, or other applications involving the host **12**, the ear piece **16** may include the speaker **32**. The speaker **32** may be connected to the interface (e.g., wireless adapter **26** or the conductors **24**) to receive a signal that the speaker **32** converts into an audible output. Similarly, the microphone **18** may be connected to the interface via the circuit **42** (if present) to deliver a signal corresponding to detected speech to the communication device **30** or the host **12**.

In the illustrated embodiment, both the speaker **32** and the microphone **18** are fluidly coupled to the ear canal **110** via the channel **40**. In one embodiment, the channel **40** branches to each of the microphone **18** and the speaker **32** using, for example, a "T" or "Y" connector. In other embodiments, the microphone **18** and the speaker **32** may be coupled to the ear canal **110** with separate channels or via separate ports (e.g., the microphone **18** via port **38** and the speaker **32** via a supplemental port).

As will be appreciated, the ear piece **16** may have other configurations. For instance, the ear piece **16** may include the feedback suppression features of the ear pieces disclosed in co-owned U.S. Provisional Patent Application No. 60/734,598 and U.S. patent application Ser. No. 11/557,775 that claims the benefit of this provisional patent application, the disclosures of which are herein incorporated by reference in their entireties. In some embodiments, the fluid coupling of the microphone **18** and/or speaker **32** may be achieved using an acoustically transmissive material instead of or in addition to an air medium. In yet other embodiments, the ear piece **16** may include another microphone for detecting sounds generated from sources external to the ear canal **110**. Externally detected sounds may be processed in the manner described in the above-identified patents and applications, or in any other suitable manner.

In one arrangement, the host **12** may manage a speech recognition system for a facility at which the user may be present. For instance, the host **12** may serve as a user interactive terminal for a gas station, a store, a sporting venue, an airport and so forth. The user may ask questions of the host (e.g., in a supermarket, "where is the milk located" or in an airport, "which direction to my gate") and the host may respond in a suitable manner for the recognized speech. The host **12** may seek information from the user, responses to which may be received orally from the user via the ear piece **16** and interpreted by the host **12** using speech recognition. In one embodiment, the ear piece **16** may communicate with the host **12** through the communication device **30** (e.g., by establishment of a wireless interface between the host **12** and the communication device **30**).

III. Microphone Signal Normalization

A. Overview

As previously described, the voice signal that is detected by the microphone **18** may be changed from a natural form of the same speech that is detectable with a microphone positioned with respect to the speaker's mouth. To make the speech detected with the microphone **18** sound more like the natural speech, speech equalization may be used to model the differ-

ences between the detected speech and a natural version of the speech. As will be described in greater detail, the model may be structured as an inverse filter or a deconvolution filter. For consistency with modeling terminology and for purposes of this description, the speaker may be referred to as a "system" that is "modeled". Following this terminology, speech that is detected from the speaker's mouth may be considered as the input signal x(t) to the system and the speech that is detected from the speaker's ear may be considered as the output signal y(t) to the system. Similarly, the model may use the voice from the ear as the input signal x(t) to estimate the future output $\hat{y}(t,\theta)$, the future output being a synthesized version of the speech from the speaker's mouth, and which may be as close as possible to the natural speech. But modeling system behavior to generate an accurate mathematical expression that represents the system is a challenging task. The following sections describe various embodiments of modeling the system that address these challenges.

The prior section describes an exemplary technique for normalizing the signal that is output by the microphone **18**. This section will describe additional techniques for normalizing the signal that is output by the microphone **18** to equalize the speech represented by that signal, thereby synthesizing a natural voice output. In particular, this section describes techniques for mathematically modeling the differences between natural speech of a user and speech detected at an ear of the user.

With additional reference to FIG. **12**, an exemplary assembly for generating a transfer function and/or a normalization function is illustrated. The assembly may include the ear piece **16** that is positioned with respect to the ear of a speaker (e.g., a person who speaks) as described above to detect speech that is spoken by the speaker. A second microphone **64** is positioned with respect to the speaker's mouth to simultaneously detect speech from the speaker's mouth. The ear piece **16** may retain the second microphone **64**, or the second microphone **64** may be retained separately from the ear piece **16**. The microphone **18** of the ear piece **16** and the second microphone **64** may be coupled to an analyzer **66** that analyzes the respective output signals from the microphones **18**, **64** to establish the transfer function and/or the normalization function. The analyzer **66** may be embodied as hardware and/or software. For instance, the analyzer **66** may be present as part of the host **12** (FIG. **1**).

Once the transfer function and/or the normalization function are determined, the transfer function and/or the normalization function may be embodied into the circuit **42** for normalization of the signal from the microphone **18**. For instance, the transfer function and/or the normalization may be made part of firmware present as part of the circuit **42** that resides in the earpiece **16**. In another implementation where the circuit **42** includes a processing device and a memory of the host **12** or of the communications device **30**, the transfer function and/or the normalization function may be stored so as to be available to an executable normalization function that is embodied as software and executed by the processing device.

In many system modeling approaches, a dynamic system having an input x(t) and an output y(t) is estimated in discrete time with observation data represented by equations 1 and 2.

$$x^t=(x(1),x(2),\ldots x(t)) \quad \text{Eq. 1}$$

$$y^t=(y(1),y(2),\ldots y(t)) \quad \text{Eq. 2}$$

An analysis may then be made for a connection between past observations (x^{t-1},y^{t-1}) and a future output y(t) as represented by equation 3, where $G(x^{t-1},y^{t-1})$ is a general (linear and/or nonlinear) function of past observances, and v(t) is a disturbance that is uncorrelated with the input signal.

$$y(t)=G(x^{t-1},y^{t-1})+v(t) \quad \text{Eq. 3}$$

It follows that a mathematical model for $G(x^{t-1},y^{t-1})$ may be used to predict future output y(t) of the system, which may be expressed using equation 4, where $\hat{y}(t,\theta)$ is a model estimate of the future output y(t), and θ is a common parameter vector that includes some, if not all, parameters (linear and/or nonlinear) of the model.

$$\hat{y}(t,\theta)=G(x^{t-1},y^{t-1},\theta) \quad \text{Eq. 4}$$

To make the speech detected by the microphone **18** sound as close as possible to the natural version of the same speech, it may be desirable to make the model be an inverse of the system. Therefore, in one embodiment, the system may be denoted by $G(q,\theta)$, which may be considered a simplified version of the notation for $G(x^{t-1},y^{t-1},\theta)$. Also, the model may be denoted by $H(q,\theta)$, where $H(q,\theta)$ is the inverse of $G(q,\theta)$ and q is a forward time shift operator.

If the system given by $G(x^{t-1},y^{t-1},\theta)$ is substantially time-invariant for a certain time frame, such as about ten milliseconds to about thirty milliseconds, then vector θ and future output $\hat{y}(t,\theta)$ may be estimated by analyzing one or more sets of speech samples. The analysis of collected speech data to establish a fixed transfer function and/or a fixed normalization function will be referred to as batch estimation. The fixed transfer function and/or the fixed normalization function may be used as a predetermined function for application to future output signals from the microphone **18** (e.g., when the second microphone **64** is not present). Under batch estimation, a single historical data set that is collected within a window of time is used in each iteration of the estimation.

For time-invariant systems and for time-varying systems, the vector θ and future output $\hat{y}(t,\theta)$ may be estimated by analyzing speech data as the speech data is received. The analysis of speech data in this manner will be referred to as adaptive analysis, which is used to establish and revise an adaptive filter that applies a dynamic normalization function to generate a normalized output signal based on input from the microphone **18**. Under adaptive analysis, a new data sample may be available for each iteration time of the estimation. The continual revision of the adaptive filter may be implemented in the presence of the second microphone **64** so that the dynamic normalization function is applied to ongoing output signals from the microphone **18**. In one embodiment, the adaptive analysis may be used for a relatively short period of time (e.g., about thirty seconds to about five minutes) to establish a predetermined normalization function. Then, the second microphone **64** may be removed, the adaptive component of the filter may be turned off and the predetermined normalization function may be applied to future output signals from the microphone **18**.

B. Batch Estimation

For batch estimation, a set of discrete input data values for the system may be given by equation 5 and a set of discrete output data values for the system may be given by equation 6, in which N is the number of data points.

$$x^N=(x(1),x(2),\ldots x(N)) \quad \text{Eq. 5}$$

$$y^N=(y(1),y(2),\ldots y(N)) \quad \text{Eq. 6}$$

A transfer function of the system may be given by $G(q,\theta)$. For a speech system, the transfer function $G(q,\theta)$ is substantially time-invariant for a relatively short period time (e.g.,

about ten milliseconds to about thirty milliseconds). In this case, the data set (x^N,y^N) may be divided into plural data sets that each have N_1 data points when N_1 is less than N. In one example, if the input and the output are sampled at about eight kilohertz (kHz) and G(q,θ) is time-invariant for a period of about ten milliseconds, then each data set may have eighty data points (or N_1 equals eighty).

With additional reference to FIG. **13**, an exemplary batch estimation method for generating a transfer function and applying a normalization function that is based on the transfer function to the microphone **18** output signal is shown. Process block **68** uses the natural voice signal as detected with respect to the mouth of the speaker as the input signal x(t) and the voice signal as detected from the ear canal as the output signal y(t) to estimate the transfer function G(q,θ). Therefore, process block **68** may be considered a logical operation to analyze the signals to generate a transfer function for the speech system.

Using the voice detected from the ear canal as an input signal, process block **70** represents using the inverse of the transfer function G(q,θ) to synthesize the output signal $\hat{y}(t,\theta)$. The inverse of the transfer function G(q,θ) is the model H(q,θ), which as also referred to as the normalization function. In this regard, process block **70** applies the normalization function H(q,θ) to the voice signal that is detected from the ear canal. Therefore, process block **70** may be considered a logical operation to apply the model of the speech system to the signal that is output by the microphone **18**.

Establishment of the transfer function and/or the normalization function under batch estimation may be carried out in a user-independent manner or a user-specific manner. As indicated, the transfer functions of multiple people may resemble one another. Under this observation, a composite transfer function may be established by averaging or otherwise combining the respective transfer functions from multiple persons. Each person's transfer function may be established by having the individual speak while the microphone **18** detects sound from the ear and the second microphone **64** detects sound from the speaker's mouth. The signals from the respective microphones may be compared to generate the transfer function for the speaker, which are then combined to generate the composite transfer function. In one embodiment, this composite transfer function may be used to normalize the speech signal detected from the ear of any individual user of the microphone **18** so that the normalized signal closely resembles the "natural" speech of the individual user.

In another embodiment, the step of estimating the transfer function may be made for the specific user as part of a user-specific training process for the ear piece **16**. For example, the user may speak while the microphone **18** detects sound from the ear and the second microphone **64** detects sound from the user's mouth. The signals from the respective microphones may be compared to generate the transfer function for the user. Thereafter, the user may speak so that the speech is detected only by the microphone **18** and the inverse of the transfer function that was established for the user may be applied to the detected signal to normalize the detected signal.

1. Batch Estimation Using Frequency Response

An exemplary technique of determining the transfer function using the frequency responses of the signal output by the microphone **18** and the signal output by the second microphone **64** that is arranged with respect to the speakers' mouth is described above in connection with FIG. **8**. In this technique, a ratio of the frequency response of the signal from the microphone **18** to the frequency response of the signal from the microphone **64** is established. In one approach, the ratio is established by using data sets that each have N_1 data points and that each have a time frame over which the transfer function of the system is assumed to be substantially time-invariant. Then, the estimated ratio for each time frame is combined for the available time frames until N data points are addressed, where N_1 is less than N. The ratio may be computed in accordance with equation 7, where j is the square root of negative one ($j=\sqrt{-1}$).

$$\text{Ratio}\ (jw) = \frac{A_{ear}(jw)}{A_{mat}(jw)} \qquad \text{Eq. 7}$$

2. Batch Estimation Using Time Domain Response

The transfer function may be established using time domain signals rather than the frequency domain signals described in the preceding section. The time domain signal may be the value (e.g., amplitude) of the output signals from the respective microphones **18**, **64**. When time domain response is used, a ratio may be calculated to serve as the transfer function G(q,θ). Any suitable filter structure may be used, an example of which is a linear regression model. Under a linear regression model, equations 8 through 10 may be established, where M is a dimension of the parameter vector θ, N_1 is less than N, the superscript −1 denotes an inverse, and the superscript T denotes a transpose.

$$X(t)=[x(t),\ldots,x(t-M+1)]^T \qquad \text{Eq. 8}$$

$$\tilde{X}=[X(1),X(2),\ldots,X(N_1)]^T \qquad \text{Eq. 9}$$

$$Y=[y(1),y(2),\ldots,y(N_1)]^T \qquad \text{Eq. 10}$$

The ratio used as the transfer function may be expressed using equation 11. One exemplary technique for computing $\tilde{X}^{-1}$ for equation 11 is to use a pseudo-inverse algorithm, such as the Moore-Penrose algorithm.

$$\text{Ratio}(\theta)=\tilde{X}^{-1}Y \qquad \text{Eq. 11}$$

C. Adaptive Estimation

With additional reference to FIG. **14**, an adaptive estimation method for generating a transfer function and applying a normalization function that is based on the transfer function to the microphone **18** output signal is illustrated. For adaptive estimation, a new data sample established from the input signal and the output signal may be available for each estimation time. Also, the speech system may be time varying such that recent data at time t is more representative of the speech system than old data. The input signal may be expressed by equation 12 and the output signal may be expressed by equation 13.

$$x'=(x(1),x(2),\ldots,x(t)) \qquad \text{Eq. 12}$$

$$y'=(y(1),y(2),\ldots,y(t)) \qquad \text{Eq. 13}$$

Under at least these circumstances, an adaptive estimation technique may be used to produce a synthesized "natural" voice output, also referred to as the future output $\hat{y}(t,\theta)$. The technique, as illustrated by FIG. **14**, includes a process block **72** for generating the transfer function G(q,θ). The technique also includes a process block **74** to apply an adaptive filter to the signal output by the microphone **18**. The adaptive filter process block **74** may include an adaptive algorithm process

block **76** and a model or filter process block **78** that applies the normalization function H(q,θ).

The adaptive algorithm may be used to track time varying statistics of the voice from the ear (e.g., as represented by input signal x(t) to the model). A delayed version of the voice from the mouth (e.g., as represented by y(t)) may be combined with the synthesized output $\hat{y}(t,\theta)$ to generate an estimated error e(t) that is input to the adaptive algorithm of process block **76**. A time delay process block **80** may be used to delay the voice from the mouth. In response to these inputs (the voice from the ear and the estimated error), the adaptive algorithm may adjust the vector θ from the normalization function H(q,θ) to adjust the estimation of the synthesized output $\hat{y}(t,\theta)$. The model used to represent the speech system may be a linear regression model, or any suitable filter structure. The linear regression model may include, for example, a finite impulse response (FIR) filter. In the exemplary techniques described below, a linear regression model will be used.

The adaptive filter may recursively adjust the vector θ of the model so that the normalization function H(q,θ) functions as an inverse of the transfer function G(q,θ) even as the transfer function G(q,θ) changes over time. Since the model parameters of the adaptive filter may be automatically adjusted for each new data sample at time t, the adaptive filter may automatically adjust its normalization function based on data samples attained from any individual speaker. Therefore, an individual's use of the adaptive estimation method may result in automatic training of the speech system to establish a transfer function and a normalization function that are appropriate for the individual at a time instance t.

1. Adaptive Estimation

Example 1

A first example of adaptive estimation is described in this section. Equations 14a and 14b express a general adaptive algorithm, where $\hat{\theta}(t)$ is an estimate of θ at time t, M is the dimension of the parameter vector θ, μ(t) is an adaptive gain, V(t,θ) is a first order differential of a criterion that minimizes the error e(t), and R(t,θ) is a second order differential of a criterion that minimizes the error e(t). The superscript −1 denotes an inverse and the superscript T denotes a transpose.

$$\hat{\theta}(t)=[\hat{\theta}_1(t),\ldots,\hat{\theta}_M(t)]^T \quad \text{Eq. 14a}$$

$$\hat{\theta}(t)=\hat{\theta}(t-1)+\mu(t)R^{-1}(t,\theta)V(t,\theta) \quad \text{Eq. 14b}$$

If H(q,θ) is a linear regression model, then a transformed version of the input vector X(t) at time t may be Z(t) as expressed in equation 15, where T(q,η) is a square transformation matrix (e.g., an M-by-M matrix) that is parameterized by a vector η.

$$Z(t)=[z_1(t),\ldots z_M(t)]^T=T(q,\eta)[x(t),\ldots x(t-M+1)]^T \quad \text{Eq. 15}$$

Also, the synthesized output $\hat{y}(t,\theta)$ may be represented by equation 16 and the estimation error may be represented in equation 17.

$$\hat{y}(t,\theta)=\hat{\theta}^T(t-1)Z(t) \quad \text{Eq. 16}$$

$$e(t,\theta)=y(t)-\hat{\theta}^T(t-1)Z(t) \quad \text{Eq. 17}$$

Various criteria may be used to establish a basis by which the algorithm estimates the parameters for the vector θ. In one embodiment a least-squares error criterion is used such that equation 18 results.

$$V(t,\theta)=Z(t)e(t,\theta) \quad \text{Eq. 18}$$

In one embodiment to reduce mathematical complexity, R(t,θ) may be made to equal a square identity matrix I by ignoring the second order differential of the criterion. In this embodiment, equation 19 results, where I is an M-by-M identity matrix. Also, a gain μ(t) may be selected in accordance with equation 20, where μ is greater than zero and less than two (e.g., 0<μ<2).

$$\hat{\theta}(t)=\hat{\theta}(t-1)+\mu(t)Z(t)e(t,\theta) \quad \text{Eq. 19}$$

$$\mu(t)=\frac{\mu}{Z^T(t)Z(t)} \quad \text{Eq. 20}$$

From the foregoing, the adaptive filter may be implemented in accordance with equations 21 through 25 where the estimated output $\hat{y}(t,\theta)$ is a function of a transformed version of the input vector X(t). Driving the adaptive filter will be the transformation matrix T(q,η). Selection of the transformation matrix T(q,η) will be described in greater detail below.

$$X(t)=[x(t),\ \ldots\ ,x(t-M+1)]^T \quad \text{Eq. 21}$$

$$Z(t)=T(q,\eta)X(t) \quad \text{Eq. 22}$$

$$\hat{y}(t,\theta)=\hat{\theta}^T(t-1)Z(t) \quad \text{Eq. 23}$$

$$e(t,\theta)=y(t)-\hat{\theta}^T(t-1)Z(t) \quad \text{Eq. 24}$$

$$\hat{\theta}(t)=\hat{\theta}(t-1)+\frac{\mu}{Z^T(t)Z(t)}Z(t)e(t,\theta), \quad \text{Eq. 25}$$

where $0<\mu<2$

It may be shown that the adaptive filter implemented in accordance with equations 21 through 25 is stable. For instance, if it is assumed that $\epsilon(t)=\hat{\theta}(t)-\theta_0$, where θ_0 is the true parameter vector of an inverse of the system's transfer function G(q,θ) , then i) $y(t)=\theta_0{}^TZ(t)$ if the disturbance v(t) is assumed to be negligible, and ii) a difference equation given by equation 26 results, where Γ is a matrix.

$$\varepsilon(t)=\left[I-\frac{\mu Z(t)Z^T(t)}{Z^T(t)Z(t)}\right]\varepsilon(t-1)=\Gamma\varepsilon(t-1) \quad \text{Eq. 26}$$

The matrix Γ may have Eigen values of [1−μ, 1, . . . 1]. Also, since 0<μ<2, then |1−μ|<1 and a conclusion that the implementation of the adaptive filter is stable may be reached.

2. Adaptive Estimation

Example 2

A second example of adaptive estimation is described in this section. The second example is similar to the first example, but where the estimated output $\hat{y}(t,\theta)$ may be a function of a non-transformed version of the input vector X(t). If the same general adaptive estimation technique set forth in the first example is used, but it assumed that the normalization function H(q,θ) is a linear regression model and that R(t,θ)=I, then another set of equations to implement the adaptive filter may be established. The equations are set forth in equations 27 through 31. Driving the adaptive filter will be the transformation matrix T(q,η). Selection of the transformation matrix T(q,η) will be described in greater detail below.

$$X(t) = [x(t), \ldots, x(t-M+1)]^T \quad \text{Eq. 27}$$

$$Z(t) = T(q, \eta)X(t) \quad \text{Eq. 28}$$

$$\hat{y}(t, \theta) = \hat{\theta}^T(t-1)X(t) \quad \text{Eq. 29}$$

$$e(t, \theta) = y(t) - \hat{\theta}^T(t-1)X(t) \quad \text{Eq. 30}$$

$$\hat{\theta}(t) = \hat{\theta}(t-1) + \frac{\mu}{Z^T(t)X(t)}Z(t)e(t, \theta) \quad \text{Eq. 31}$$

It may be shown that the adaptive filter implemented in accordance with equations 27 through 31 is stable. For instance, using the same technique for analyzing stability as was used for the first example, the difference equation of equation 32 may be derived.

$$\varepsilon(t) = \left[I - \frac{\mu Z(t)X^T(t)}{Z^T(t)X(t)}\right]\varepsilon(t-1) = \Pi\varepsilon(t-1) \quad \text{Eq. 32}$$

The matrix Π may have Eigen values of [1−μ, 1, . . . 1]. Also, since 0<μ<2, then |1−μ|<1 and a conclusion that the implementation of the adaptive filter is stable may be reached.

3. Selection of Transformation Matrix for Adaptive Estimation

As indicated, the adaptive estimation techniques described herein may be driven by the transformation matrix T(q,η). With appropriate selection of the transformation matrix T(q, η), the adaptive filter may achieve relatively fast convergence with relatively low mathematical complexity. One possible transformation matrix is an identity matrix. While an identity matrix may have relatively low mathematical complexity, the first and second example implementations become normalized least means square (LMS) algorithms when an identity matrix is selected as the transformation matrix. But normalized LMS algorithms are known to converge slowly when the input signal is highly correlated, as is the case with a signal representing speech. Therefore, a faster converging transformation matrix may be desirable.

In one embodiment, the transformation matrix T(q,η) is selected to decorrelate in the input signal so that the transformation matrix T(q,η) will "whiten" the input signal before being used by the adaptive algorithm to update the parameter vector $\hat{\theta}(t)$. Decorrelating the input may serve to reduce the correlation (e.g., relationship) between the current input value (e.g., x(t)) from the past history of input values.

In one embodiment, the transformation matrix T(q,η) may be represented as set forth in equation 33, where $\eta(t)=[\eta_1(t), \ldots \eta_P(t)]$ is the parameter vector η at time t and represents the coefficients of a decorrelating filter, and q is a backward time shift operator (also referred to as a time delay).

$$T(q, \eta) = \begin{bmatrix} 1 & \eta_1(t) & \cdots & \eta_P(t) & 0 & 0 & \cdots & 0 \\ q^{-1} & q^{-2}\eta_1(t) & \cdots & q^{-P-1}\eta_P(t) & 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots & \vdots & \vdots & \ddots & \vdots \\ q^{-M+1} & q^{-M}\eta_1(t) & \cdots & q^{-M-P+1}\eta_P(t) & 0 & 0 & \cdots & 0 \end{bmatrix} \quad \text{Eq. 33}$$

In one embodiment, the coefficients of the decorrelating filter may be computed by a Levinson-Durbin algorithm. The selection of the transformation matrix T(q,η) in the foregoing manner may result in an implementation of the first example or the second example that has faster convergence than if a normalized LMS algorithm is selected.

IV. Conclusion

Although particular embodiments have been described in detail, it is understood that the invention as defined by the appended claims is not limited correspondingly in scope, but includes all changes, modifications and equivalents.

What is claimed is:

1. A sound processing apparatus, comprising:

a microphone positionable with respect to an ear canal to detect sound signals from the ear canal and to generate a corresponding output signal, wherein the output signal from the microphone corresponds to a portion of speech and has a different spectral response than a spectral response of the same speech from the mouth of a user; and

a circuit that normalizes the output signal from the microphone by applying a normalization function to the output signal from the microphone, the normalized signal having a spectral response that is closer to the spectral response of the speech from the mouth of the user than the spectral response of the output signal from the microphone;

wherein the normalization function is an inverse of a transfer function that is based on a ratio of a spectral response of a speech sample detected from the mouth of a sampled individual to a spectral response of the speech sample detected from the ear of the sampled individual.

2. The sound processing apparatus of claim **1**, wherein the microphone and the circuit are contained within a housing that is retained by the ear of the user.

3. The sound processing apparatus of claim **1**, wherein the microphone is contained within an ear piece that is retained by the ear of the user and the circuit forms part of a separate device that is interfaced with the ear piece.

4. The sound processing apparatus of claim **1**, wherein the transfer function is a composite function that is combination of plural spectral response ratios taken from plural individuals.

5. The sound processing apparatus of claim **1**, wherein the transfer function is a combination of a series of ratio values of the spectral response of the speech detected from the ear to the spectral response of the speech detected from the mouth for each of plural time frames of the speech sample.

6. The sound processing apparatus of claim **5**, wherein the time frames are about 10 milliseconds to about 30 milliseconds long.

7. The sound processing apparatus of claim **1**, wherein the transfer function is user dependent and the speech sample is generated by the user of the sound processing apparatus.

8. The sound processing apparatus of claim **1**, wherein the transfer function is user independent and the speech sample is generated by at least one speaker different than the user of the sound processing apparatus.

9. A sound processing apparatus, comprising:

a microphone positionable with respect to an ear canal to detect sound signals from the ear canal and to generate a corresponding output signal, wherein the output signal from the microphone corresponds to a portion of speech and has a different spectral response than a spectral response of the same speech from the mouth of a user; and

a circuit that normalizes the output signal from the microphone by applying a normalization function to the output signal from the microphone, the normalized signal having a spectral response that is closer to the spectral response of the speech from the mouth of the user than the spectral response of the output signal from the microphone;

wherein the normalization function is an inverse of a transfer function that is based on a ratio of a time domain response of a speech sample detected from the mouth of a sampled individual to a time domain response of the speech sample detected from the ear of the sampled individual.

10. A sound processing apparatus, comprising:

a microphone positionable with respect to an ear canal to detect sound signals from the ear canal and to generate a corresponding output signal, wherein the output signal from the microphone corresponds to a portion of speech and has a different spectral response than a spectral response of the same speech from the mouth of a user; and

a circuit that normalizes the output signal from the microphone by applying a normalization function to the output signal from the microphone, the normalized signal having a spectral response that is closer to the spectral response of the speech from the mouth of the user than the spectral response of the output signal from the microphone;

wherein the normalization function is adaptively established by an adaptive filter that models a difference between a sound signal from the ear and a corresponding sound signal from the mouth;

wherein the normalization function is based on a transformation matrix that is selected to decorrelate a current value of the output signal from the microphone from a past history of output signal values.

11. A sound processing apparatus, comprising:

a microphone positionable with respect to an ear canal to detect sound signals from the ear canal and to generate a corresponding output signal, wherein the output signal from the microphone corresponds to a portion of speech and has a different spectral response than a spectral response of the same speech from the mouth of a user; and

a circuit that normalizes the output signal from the microphone by applying a normalization function to the output signal from the microphone, the normalized signal having a spectral response that is closer to the spectral response of the speech from the mouth of the user than the spectral response of the output signal from the microphone;

wherein the normalization function is adaptively established by an adaptive filter that models a difference between a sound signal from the ear and a corresponding sound signal from the mouth;

wherein the normalization function is based on a transformed version of an input vector that models the difference between the sound signal from the ear and the corresponding sound signal from the mouth.

12. A sound processing apparatus, comprising:

a microphone positionable with respect to an ear canal to detect sound signals from the ear canal and to generate a corresponding output signal, wherein the output signal from the microphone corresponds to a portion of speech and has a different spectral response than a spectral response of the same speech from the mouth of a user; and

a circuit that normalizes the output signal from the microphone by applying a normalization function to the output signal from the microphone, the normalized signal having a spectral response that is closer to the spectral response of the speech from the mouth of the user than the spectral response of the output signal from the microphone;

wherein the normalization function is adaptively established by an adaptive filter that models a difference between a sound signal from the ear and a corresponding sound signal from the mouth;

wherein the normalization function is based on a non-transformed version of an input vector that models the difference between the sound signal from the ear and the corresponding sound signal from the mouth.

13. A sound processing apparatus, comprising:

a microphone positionable with respect to an ear canal to detect sound signals from the ear canal and to generate a corresponding output signal, wherein the output signal from the microphone corresponds to a portion of speech and has a different spectral response than a spectral response of the same speech from the mouth of a user; and

a circuit that normalizes the output signal from the microphone by applying a normalization function to the output signal from the microphone, the normalized signal having a spectral response that is closer to the spectral response of the speech from the mouth of the user than the spectral response of the output signal from the microphone;

wherein the normalization function is adaptively established by an adaptive filter that models a difference between a sound signal from the ear and a corresponding sound signal from the mouth;

wherein the normalization function is established by sampling speech data from an ear and a mouth of a user for a period of time and adaptively generating the normalization function over the period of time.

14. The sound processing apparatus of claim **13**, wherein the adaptive updating of the normalization function is stopped after the period of time.

15. The sound processing apparatus of claim **1**, further comprising a host that executes speech recognition software to process the normalized output signal.

16. The sound processing apparatus of claim **1**, further comprising a communications device that transmits the normalized output signal to a remote destination.

* * * * *

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ELECTRONIC PAYMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
90/019,169	02/24/2023 05:27:37 PM ET	0027071.00133

Title of Invention

METHOD AND DEVICE FOR ACUTE SOUND DETECTION AND REPRODUCTION

Application Information

APPLICATION TYPE	Utility / ex parte reexam	PATENT #	11244666
CONFIRMATION #	7859	FILED BY	Sandra Tartisel
PATENT CENTER #	61645467	AUTHORIZED BY	Ali Sharifahmadian
CUSTOMER #	150139	FILING DATE	-
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	Steven Wayne Goldstein

Payment Information

PAYMENT METHOD	PAYMENT TRANSACTION ID	PAYMENT AUTHORIZED BY
CARD / 0128	E20232NH28569013	Sandra Tartisel

PRE-AUTHORIZED ACCOUNT	PRE-AUTHORIZED CATEGORY
502387	37 CFR 1.16 (National application filing, search, and examination fees); 37 CFR 1.17 (Patent application and reexamination processing fees); 37 CFR 1.19 (Document supply fees); 37 CFR 1.20 (Post Issuance fees); 37 CFR 1.21 (Miscellaneous fees and charges)

FEE CODE	DESCRIPTION	ITEM PRICE($)	QUANTITY	ITEM TOTAL($)
1812	REQUEST FOR EX PARTE REEXAM-NON-STREAMLINED	12600.00	1	12600.00
			TOTAL AMOUNT:	$12,600.00

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Exhibit PA-C

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 640 972 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
29.03.2006 Bulletin 2006/13

(21) Application number: **05028366.2**

(22) Date of filing: **23.12.2005**

(51) Int Cl.:
G10L 21/02 *(2006.01)* ***H04R 25/00*** *(2006.01)*
H04R 3/00 *(2006.01)* ***H04R 1/10*** *(2006.01)*

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

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(54) System and method for separation of a users voice from ambient sound

(57) The invention relates to a system for separation of a user's voice from ambient sound, comprising a device (10) to be wom at the user's ear or at least partly in the user's ear canal (12) comprising a first microphone (M1) oriented outwardly towards the environment and a second microphone (M2) oriented inwardly towards the user's ear canal, and an audio signal processing unit (24, 26) for processing audio signals from the first and second microphone by a blind source separation algorithm adapted to separate the user's voice from ambient sound.

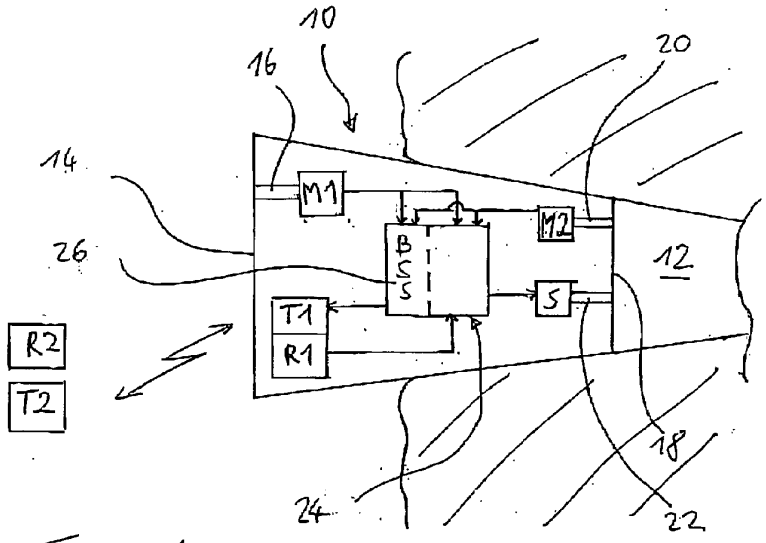


Fig. 1

EP 1 640 972 A1

Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The present invention relates to a system and a method for separation of a user's voice from ambient sound by using at least one device to be worn at the user's ear or at least partly in the user's ear canal.

[0002] For communication purposes, in particular for wireless electronic communication between or from persons exposed to a noisy environment, such as workers in industrial plants, policemen, soldiers, firemen, etc., it is desirable to have a sound pick-up system which is capable at least to some extent to separate the user's voice from ambient noise, or generally ambient sound, in order to improve the intelligibility of the person's speech to the listener, who may be one of the other persons exposed to the noisy environment or who may be a remote person.

[0003] A common approach to achieve such separation of a person's voice is the use of a boom microphone, i.e. a microphone which is placed close to the mouth, carried by a headset, helmet or any other device worn by the person. Such microphone selectively emphasizes the near field around the mouth.

[0004] Other approaches are vibration pick-up devices which are in direct contact with the throat, picking up the vibrations of the vocal chord, or which are in direct contact with the meatus wall or the outer ear canal, picking up the vibrations of the head tissue (i.e. "bone conduction" microphones) or which are in direct contact with the cheek-bone.

[0005] Devices of these types are either fairly sensitive to acoustic noise masking the speech or certain speech sounds are poorly transmitted, especially the high frequency consonant sounds necessary for good intelligibility. Furthermore, for industrial applications boom microphones have the drawbacks that they limit the freedom of movement of the user and that, when combined with a hearing protection device, they will affect the stability and hence the attenuation of the hearing protection device. Bone-conduction microphones have the drawbacks that they have a very limited audio bandwidth which limits the intelligibility of the speech and that they often have to be pressed fairly hard which causes discomfort to the user.

[0006] US 6,661,901 B1 relates to an active hearing protection system comprising an earplug with an outer microphone for picking up ambient sound and an inner microphone which is sealed with respect to ambient sound but is open towards the inner part of the user's ear canal. In an operation mode in which separation of the user's voice from ambient noise is desired only the inner microphone is activated while the outer microphone is not, with the signal from the inner microphone being processed by an electronics unit integrated within the earplug in order to make the user's voice highly natural and intelligible, either for the user himself or his external communication partners.

[0007] Another approach is based on a so-called "blind source separation" (BSS) algorithm in order to separate a person's voice from background noise by corresponding audio signal processing. In this respect, US 2003/0055535 A1 relates to the use of a BSS algorithm for separating the voice of an operator of a vehicle wheel alignment system with a voice audio interface from background noise by using a microphone array in order to avoid the necessity to use a headset. US 2005/0060142 A1 relates in a more general manner to the use of two spaced-apart microphones operated with a BSS algorithm for voice separation from background noise in audio applications.

[0008] It is an object of the invention to provide for a system and a method for separation of a person's voice from ambient sound wherein good intelligibility of speech is achieved while nevertheless discomfort to the person is to be avoided as far as possible.

[0009] According to the invention this object is achieved by a system as defined in claims 1 and 25, and by corresponding methods as defined in claims 28 and 29, respectively.

[0010] The invention is beneficial in that, by using a first microphone and a second microphone, wherein according to the solution of claims 1 and 28 the first microphone is oriented outwardly towards the environment and the second microphone oriented inwardly towards the user's ear canal and according to the solution of claims 25 and 29 the first microphone is located at the right ear and the second microphone is located at the left ear, and by processing the audio signals from the first and second microphone by a blind source separation algorithm, good separation of the user's voice from ambient sound with resulting high intelligibility of the user's speech is achieved without the need for additional restrictions regarding the location of the microphones, so that in particular the need for a boom microphone or a bone-conduction microphone can be avoided. In particular, by orienting the first microphone towards the environment and orienting the second microphone towards the user's ear canal or by locating the first microphone at the right ear and the second microphone at the left ear these two microphones pick up sufficiently differently mixed signals of the ambient sound and the user's voice so that a BSS algorithm will work efficiently.

[0011] Generally, blind source separation (also referred to as "independent component analysis" (ICA)) is a technique for separating mixed source signals (components) which are presumably statistically independent from each other. In its simplified form, blind source separation applies an "un-mixing" matrix of weights to the mixed signals, for example, multiplying the matrix with the mixed signals, to produce separated signals. The weights are assigned initial values, and then adjusted to maximize joint entropy of the signals in order to minimize information redundancy. This weight-adjusting and entropy-increasing process is repeated until the information redundancy of the signals is reduced to a minimum. Because this technique does not require information on the

source of each signal, it is referred to as "blind source separation". An introduction to blind source separation is found, for example, in US 2005/0060142 A1.

[0012] In the most simple cage, BSS is applied to two different mixtures of two (acoustic) sources, wherein the two different mixtures are obtained by using two spaced apart microphones. Mixing of the two sources can be represented by a matrix A, with the BSS algorithm corresponding mathematically to finding the inverse matrix of A without knowing anything about the matrix nor about the sources, except that they are statistically independent. In the case of a person's voice mixed with background noise the latter assumption usually is valid. The mixtures of the two sources could be different with respect to amplitude and/or phase of the two sources. In other words, by picking up sound signals with two differently oriented microphones the signal of each of these microphones will correspond to a mixture which is different with regard to the difference in amplitude and/or phase of the two acoustic sources (i.e. user's voice on the one hand and ambient noise on the other hand). By orienting one of the microphones outwardly towards the environment and the other microphone inwardly to the ear canal, a particularly large difference between the two mixtures can be obtained in a simple and particularly comfortable manner, i.e. no boom microphones or bone-cunduction microphones which would cause discomfort to the user need to be used.

[0013] According to one embodiment, the two microphones are part of a hearing protection device. With such a configuration, the microphones can be arranged such that the ambient sound reaching the inwardly oriented microphone is attenuated by the hearing protection device relative to ambient sound reaching the outwardly oriented microphone. Although such hearing protection device could be an earmuff, according to a preferred embodiment the hearing protection device is an earplug comprising a shell which is to be inserted at least partially into the user's ear canal. According to one embodiment, the shell is a customized hard shell having an elasticity from shore D85 to D65 and having an outer shape according to the measured inner shape of the user's outer ear and ear canal. According to an alternative embodiment, the shell is a generic soft shell capable of adapting to the shape of the user's outer ear and ear canal.

[0014] Preferably, the inwardly oriented microphone is located at or is open to the inner part of the shell which is to be inserted into the ear canal, with the inwardly oriented microphone preferably being located at the inner end of the shell or within a channel of the shell open to the inner end of the shell.

[0015] Preferably, the outwardly oriented microphone is located at or is open to the outer part of the shell which is not to be inserted into the ear canal, with the outwardly oriented microphone preferably being located at the outer end of the shell or within a channel of the shell open to the outer end of the shell.

[0016] If the hearing protection device is an earmuff, the first microphone is located at or is open to the outer side of the earmuff and the second microphone is located at or is open to the inner side of the earmuff.

[0017] In all embodiments, the device preferably comprises a speaker adapted to provide an external audio signal to the user's ear. Thereby bidirectional communication with the user is achieved. Preferably the speaker is located at or is open to a portion of the device which is to be worn within the user's ear canal, whereby the speaker is brought acoustically close to the user's ear drum so that good intelligibility of the sound provided by the speaker is achieved even in noisy environments.

[0018] Usually the device will be binaural, i.e. it will comprise one unit for the right ear and another unit for the left ear. The speaker and the microphones may be integrated in the same unit, i.e. in at least one of the units, or the speaker may be part of the unit for one ear and the microphones may be part of the unit for the other ear.

[0019] According to one embodiment, the device may be adapted to be worn completely within the user's ear canal, whereby the device can be more or less completely hidden from the views of other persons. According to other embodiments, the device may be any other kind of a wired or wireless headset.

[0020] Preferably the audio signal processing unit is integrated within the device. In an alternative embodiment, the audio signal processing unit may be adapted to be worn behind the user's ear or somewhere at the user's body. In this case, although the device becomes more handy, more space, and hence also more power, is available for the audio signal processing unit, which may reduce the costs an/or may improve the performance of the blind source separation. In such case, the audio signal processing unit may be connected to the microphone either by wires, which is the most simple solution, or via a wireless link, for example, a radio frequency link such as Bluetooth link, an inductive link or an infrared link, which solution would result in enhanced wearing comfort for the user.

[0021] As a further alternative, the audio signal processing unit could be designed to be located remote from the user and is connected to the microphones via a radio frequency link such as Bluetooth link. In this case, there would be even less restrictions regarding the size and power consumption of the audio signal processing unit, which might result in reduced costs and/or increased performance of the blind source separation.

[0022] In all embodiments, the system preferably comprises a radio frequency transmitter for transmitting the processed audio signal output of the audio signal processing unit to a remote radio frequency receiver in order to provide the user's voice to another person. According to one embodiment, the radio frequency transmitter is integrated within the audio signal processing unit, i.e. the radio frequency transmitter may be either integrated within the device or it may be adapted to be worn behind the use's ear or at the user's body or it could be even located remote from the user. However, in an

alternative embodiment, the radio frequency transmitter could be remote from the audio signal processing unit, in which case the processed audio signal output of the audio signal processing unit would be provided to a radio frequency transmitter by wires or via a radio frequency link, an inductive link or an infrared link. In this case the location of the audio signal processing unit and the radio frequency transmitter can be optimized independently form each other.

[0023] In all embodiments, the blind source separation algorithm preferably works in the frequency domain, i.e. the algorithm is simultaneously carried out in different frequency bands/bins and the outcomes of these bands/bins are combined in an appropriate way.

[0024] In all embodiments, the blind source separation algorithm preferably works with the assumption that the sources are statistically independent, i.e. that the user's voice is independent of the ambient sound.

[0025] In the following, examples of the invention will be explained in detail by reference to the attached drawings.

Fig. 1 shows a schematic view of a first embodiment of a hearing protection earplug system according to the invention inserted into a person's ear canal with a block diagram of the most relevant electronic components;

Fig. 2 shows a schematic view of a modified embodiment of a hearing protection earplug according to the invention;

Figs. 3 and 4 show further modified embodiments of a system according to the invention;

Fig. 5 shows a modification of the embodiment of Fig. 1; and

Fig. 6 shows a modification of the embodiment of Fig. 5.

[0026] The system of Fig. 1 comprises a hearing protection earplug 10 which may have a hard shell with an elasticity from shore D85 to shore D65, which is customized, i.e. it has an outer shape according to the individual measured inner shape of the user's outer ear and ear canal. The hard shell may be manufactured by layer-by-layer laser sintering of a powder material, for example, polyamide powder, or by laser stereo-lithography or photo-polymerization. An overview regarding such additive layer-by-layer build-up processes for manufacturing customized shells of hearing devices can be found, for example, in US 2003/0133583 A1 or US 6,533,062 B1. The inner shape of the person's ear canal and outer ear can be measured, for example, by taking an impression which then undergoes laser scanning or by direct laser scanning of the ear.

[0027] Preferably the hard shell is designed such that it provides for an acoustic attenuation, averaged over the audible frequency range, of at least 10 dB when inserted into the user's ear canal.

[0028] Rather than having a customized hard shell, earplug 10 may have a generic soft shell which adapts to the shape of the users outer ear and ear canal due to its elasticity.

[0029] In Fig. 1 the earplug 10 is shown to be inserted with its inner end portion into a user's ear canal 12. The earplug 10 comprises an outer microphone M1, which is located at the outer part of the earplug 10 and which is open to the outer end 14 of the earplug 10 via a sound channel 16, and an inner microphone M2, which is located at the inner part of the earplug 10 and which is open to the inner end 18 of the earplug 10 via a sound channel 20. The earplug 10 further comprises a speaker S which is likewise located at the inner part of the earplug 10 and is open to the inner end 18 via a sound channel 22. The earplug 10 also includes a digital audio signal processing unit 24 comprising a digital signal processor as well as a radio frequency transmitter unit T1 and a radio frequency receiver unit R1. The audio signal processing unit 24 functionally includes a unit 26 for applying a blind source separation algorithm to the audio signals provided by the microphones M1 and M2. It is evident to the skilled person that the earplug 10 includes additional electrical components, such as amplifiers and analogue-to-digital converters for the audio signals provided by the microphones M1 and M2, a digital-to-analogue converter and an amplifier for the audio signal to be transformed into sound by the speaker S, program and data memory components for the audio signal processing unit 24, a battery for power supply, a demodulator, a modulator, an antenna, etc., which are not shown in Fig. 1 for the sake of simplicity.

[0030] The transmitter T1 of the earplug 10 is adapted to transmit audio signals from the earplug 10 to a remote receiver R2 via a radio link, while the receiver R1 of the earplug 10 is adapted to receive audio signals from a remote transmitter T2. The audio signals received by the receiver R1 are demodulated and then undergo signal processing in the audio signal processing unit 24 as input to the speaker S in order to provide remote audio signals to the user. Such remote audio signals could be the speech of another person picked up by a microphone whose output is sent to the remote transmitter T2 by wires or via, for example, a mobile telephone or mobile radio device.

[0031] The audio signals provided by the microphones M1 and M2 are passed as input to the blind source separation unit 26, in which a processed audio signal output for the transmitter T1 is produced, with the processed audio signal output consisting completely or at least essentially of the user's voice which has been separated from the ambient sound by action of the blind source separation algorithm carried out in the BSS unit 26. Such BSS signal processing utilizes the fact that the sound

mixtures picked up by the microphone M1 which is oriented towards the environment and M2 which is oriented towards the ear canal 12, respectively, consist - due to the different orientation of the microphones M1 and M2 - of essentially different mixtures of the ambient sound and the user's voice, which are different regarding amplitude ratio of these two signal contributions or sources (i.e. ambient sound on the one hand and user's voice on the other hand) and regarding phase difference of these two signal contributions of the mixture.

[0032] The output signal of the BSS unit 26 is transmitted via the transmitter T1 to the remote receiver R2 which usually will be connected to a remote speaker for presenting the user's voice to another person. The remote speaker and the remote microphone connected to the remote transmitter T2 could be part of an earpiece or an earplug worn by another person, which may be similar or identical to the earplug 10. Thereby in-the-ear hearing protection devices with integrated communication function can be achieved. Such a system could be used by any persons who need to communicate in a noisy environment, such as workers, soldiers, firemen, etc. However, the remote receiver R2 also might serve for communication via a mobile telephone or a mobile radio device.

[0033] In general, the remote receiver R2 / transmitter T2 could be a part of an interface of a standard wireless communication device, such as a mobile telephone device or a mobile radio device Preferably, the wireless link between the transmitter T1 / receiver R1 and the remote receiver R2 / remote transmitter T2 is a Bluetooth link. The remote receiver R2 / transmitter T2 then could be a part of the Bluetooth interface of a standard wireless communication device, such as a mobile telephone device or a mobile radio device.

[0034] According to Fig. 1, the audio signal produced by the microphones M1 and M2, which is used as input to the BSS unit 26, in addition could undergo other audio signal processing within the audio signal processing unit 24, for example, in order to provide the ambient sound picked up by the microphone M1 to the speaker S for enabling perception of desired ambient sounds during times when the noise level is low so that the hearing protection function provided by the earplug 10 is not needed, or to provide for an in-situ measurement of the actual acoustic attenuation provided by the earplug 10 when inserted into the user's ear canal 12 by comparing the sound levels measured by the microphones M1 and M2.

[0035] In Fig. 2 a modified embodiment is shown, wherein the transmitter T1 and the receiver R1 have been removed from the earplug 10 and now are located in an external unit 28 which is connected by wires 30 to the earplug 10 and which is to be worn at an appropriate location at the user's body, for example behind the user's ear or somewhere within or below the user's clothing, for example, within a helmet. The external unit 28 may include further electrical components removed from the earplug 10, for example, the power supply battery.

[0036] In Fig. 3 a further modified embodiment is shown, wherein not only the transmitter T1 and the receiver R1 (and the power supply battery) but in addition also the audio signal processing unit 24 including the BSS unit 26 has been removed from the earplug 10 and is connected via corresponding wires to the microphones M1 and M2 and the speaker S, respectively.

[0037] In Fig. 4 a still further modified embodiment is shown, wherein the wire connection 30 between the earplug 10 and the external unit 28 has been replaced by a bidirectional wireless link 32, which is established by a transmitter T3 and a receiver R3 located in the earplug 10 and a corresponding receiver R4 and transmitter T4 located in the external unit 28. The wireless link 32 could be a radio frequency link, an inductive link or an infrared link. If it is an inductive link, the external unit 28 would have to be located relatively close to the earplug 10, for example at a distance of not more than 20 cm. With an RF link, the distance could be larger; in this case it would be even be possible to locate the external unit 28 at a position remote from the user's body, for example, within a distance of a few meters. Preferably the wireless link 32 of the embodiment of Fig. 4 is a Bluetooth link.

[0038] Although in the embodiments shown is Figs. 1 to 4 the speaker S is shown as being integrated in the same earplug 10 as the microphones M1 and M2, in other embodiments the speaker S may be provided at an earplug other than the earplug at which the microphones M1 and M2 are provided.

[0039] Fig. 5 shows a modified version of the embodiment of Fig. 1, wherein the inwardly oriented second microphone M2 is not part of the earplug 10 — as shown in Fig. 1 — but rather is provided at the earplug 11 for the other ear. The second microphone M2 is located at the inner part of the earplug 11 and is open to the inner end 18 of the earplug 11 via a sound channel 20. In addition, the earplug 11 further comprises a speaker S which is likewise located at the inner part of the earplug 11 and is open to the inner end 18 via a sound channel 22. The microphone M2 and the speaker S of the earplug 11 are connected to the audio signal processing unit 24 located in the earplug 10 via a wire connection 40 which be integrated in a mechanical connection (not shown) between the earplugs 10 and 11 which may be provided for preventing loss of the earplugs 10, 11.

[0040] According to a modification of the embodiment of Fig. 5, the outwardly oriented first microphone M1 may be provided at the earplug 11, while the inwardly oriented second microphone M2 may be provided at the earplug 10 as in Fig. 1.

[0041] An alternative modification of the embodiment of Fig. 5 is shown in Fig. 6, wherein both the first microphone M1 of the earplug 10 and the second microphone M2 of the earplug 11 are outwardly oriented. In this case the differences in the sound mixtures picked up by the microphone M1 of the earplug 10 and the microphone M2 of the earplug 11 are due to the different location of

the microphone M1 at one ear and the microphone M2 at the other ear (for example, a disturbing noise source usually will be located closer to one of the two ears and hence will contribute more strongly and with different phase to the signal picked up by the microphone located at that ear than to that located at the other ear).

[0042] According to a modification of the embodiment of Fig. 6 both microphones M1 and M2 could be inwardly oriented rather than outwardly oriented.

[0043] While Figs. 5 and 6 and the above-discussed variants thereof are modifications of the embodiment of Fig. 1, according to which both the audio signal processing unit 24 and the transmitter T1 / receiver R1 are part of the earplug 10, it is to be understood that the embodiments of Figs. 2 to 4 may be analogously modified, i.e. by providing the second microphone M2 at the earplug 11 rather than at the earplug 10.

[0044] While the examples discussed so far relate to an application of the communication system to hearing protection earplugs, the invention also may be applied to earmuffs serving as a hearing protection device or generally to any kind of headset, i.e. also to hearing devices which do not provide for a hearing protection function. For example, the headset may consist of a device with a customized or a generic shell which is designed such that it can be worn completely in the ear canal 12 (i.e. as a "CIC device") and which serves exclusively communication purposes, for example, for security persons, policemen, firemen, etc., i.e. for persons who are exposed to a noisy environment, with the noise level, however, being below a threshold value which would require the use of hearing protection devices. Such CIC device generally could have the construction of the earplug of Fig. 1, however, without considerable acoustic attenuation provided due to the material and the design of the shell, and would be reduced in size so that it can be worn completely within the ear canal 12.

[0045] In general, the device need not be designed as an earplug but it may rather be any kind of headset.

Claims

1. A system for separation of a user's voice from ambient sound, comprising a device (10) to be worn at the user's ear or at least partly in the user's ear canal (12) comprising a first microphone (M1) oriented outwardly towards the environment and a second microphone (M2) oriented inwardly towards the user's ear canal, and an audio signal processing unit (24, 26) for processing audio signals from the first and second microphone by a blind source separation algorithm adapted to separate the user's voice from ambient sound.

2. The system of claim 1, wherein the device (10) is designed as a hearing protection device.

3. The system of claim 2, wherein the hearing protection device (10) is designed to provide for an acoustic attenuation, averaged over the audible frequency range, of at least 10 dB.

4. The system of claim 3, wherein the microphones (M1, M2) are arranged such that ambient sound reaching the second microphone (M2) is attenuated by the hearing protection device (10) relative to ambient sound reaching the first microphone (M1).

5. The system of one of claims 2 to 4, wherein the hearing protection device is an earplug (10) comprising a shell which is to be inserted at least partially into the user's ear canal (12).

6. The system of claim 5, wherein the shell is a hard shell having an elasticity from Shore D 85 to Shore D 65 and having an outer shape according to the measured inner shape of the user's outer ear and ear canal (12).

7. The system of one of claims 5 and 6, wherein the second microphone (M2) is located at or is open to the inner part of the shell which is to be inserted into the ear canal (12).

8. The system of claim 7, wherein the second microphone (M2) is located at the inner end of the shell or within a channel (20) of the shell open to the inner end of the shell.

9. The system of one of claims 5 to 8, wherein the first microphone (M1) is located at or is open to the outer part of the shell which is not to be inserted into the ear canal (12).

10. The system of claim 9, wherein the second microphone (M2) is located at the outer end of the shell or within a channel (16) of the shell open to the outer end of the shell.

11. The system of one of claims 1 to 4, wherein the hearing protection device is an earmuff and wherein the first microphone is located at or is open to the outer side of the earmuff and the second microphone is located at or is open to the inner side of the earmuff.

12. The system of one of the preceding claims, wherein the device comprises a speaker (S) adapted to provide an external audio signal to the user's ear.

13. The system of claim 12, wherein the speaker (S) is located at or within a channel open to that end of the device which is to be worn within the user's ear canal.

14. The system of one of the preceding claims, wherein the device is adapted to be worn completely within

the user's ear canal.

15. The system of one of the preceding claims, wherein the audio signal processing unit (24, 26) is integrated within the device (10).

16. The system of one of claims 1 to 14, wherein the audio signal processing unit (24, 26) is adapted to be worn behind the user' s ear or at the user's body.

17. The system of claim 16, wherein the audio signal processing unit (24, 26) is connected to the microphones (M1, M2) by wires (30) or via a radio frequency link (32) such as a Bluetooth link, an inductive link or an infrared link.

18. The system of one of claims 1 to 14, wherein the audio signal processing unit (24, 26) is designed to be located remote from the user and is connected to the microphones (M1, M2) via a radio frequency link (32) such as a Bluetooth link.

19. The system of one of the preceding claims, wherein the system comprises a radio frequency transmitter (T1) for transmitting the processed audio signal output of the audio signal processing unit (24, 26) to a remote radio frequency receiver (R2) in order to provide the user's voice to another person.

20. The system of claim 19, wherein the remote radio frequency receiver (R2) is part of a Bluetooth interface of a mobile telephone or a mobile radio system.

21. The system of claim 19 or 20, wherein the radio frequency transmitter (T1) is integrated with the audio signal processing unit (24, 26).

22. The system of claim 19 or 20, wherein the radio frequency transmitter (T1) is remote from the audio signal processing unit (24, 26) and wherein the processed audio signal output of the audio signal processing unit is provided to the radio frequency transmitter by wires (30) or via an inductive link.

23. The system of claim 12, wherein the system comprises a radio frequency receiver (R1) for receiving the external audio signal from a remote radio frequency transmitter (T2).

24. The system of claim 23, wherein the remote radio frequency transmitter (T2) is part of a Bluetooth interface of a mobile telephone or a mobile radio system.

25. A system for separation of a user's voice from ambient sound, comprising: a first device (10) to be worn at the user's right ear or at least partly in the user's right ear canal (12), a second device (11) to be worn at the user's left ear or at least partly in the user's left ear canal (12), the first device comprising a first microphone (M1) and the second device comprising a second microphone (M2), and an audio signal processing unit (24, 26) for processing audio signals from the first and second microphone by a blind source separation algorithm adapted to separate the user's voice from ambient sound.

26. The system of claim 25, wherein one of the first microphone (M1) and second microphone (M2) is oriented outwardly towards the environment and the other one of the first microphone and second microphone is oriented inwardly towards the user's ear canal (12).

27. The system of one of claims 25 and 26, wherein the audio signal processing unit (24, 26) is located in one of the first device (10) and the second device (11) or is adapted to be worn behind the user's ear or at the user's body or is designed to be located remote from the user and is connected to the microphones via a radio frequency link (32) such as a Bluetooth link.

28. A method for separation of a user's voice from ambient sound, comprising:

providing the user with a device (10) to be worn at a user's ear or at least partly in the user's ear canal (12) and comprising a first microphone (M1) oriented towards the environment and a second microphone (M2) oriented towards the user's ear canal (12),
picking up sound by the first microphone to create a first audio signal and by the second microphone to create a second audio signal, and
processing the first and second audio signals by a blind source separation algorithm in order to produce a processed audio signal wherein the user's voice is separated from ambient sound.

29. A method for separation of a user's voice from ambient sound, comprising:

providing the user with a first device (10) to be worn at the user's right ear or at least partly in the user's right ear canal (12) and a second device (11) to be worn at the user's left ear or at least partly in the user's left ear canal (12), the first device comprising a first microphone (M1) and the second device comprising a second microphone (M2),
picking up sound by the first microphone to create a first audio signal and by the second microphone to create a second audio signal, and
processing the first and second audio signals by a blind source separation algorithm in order to

produce a processed audio signal wherein the user's voice is separated from ambient sound.

30. The method of one of claims 28 and 29, wherein the blind source separation algorithm works in the frequency domain.

31. The method of one of claims 28 to 30, wherein the processed audio signal is provided to another person via a wireless link such as a Bluetooth link.

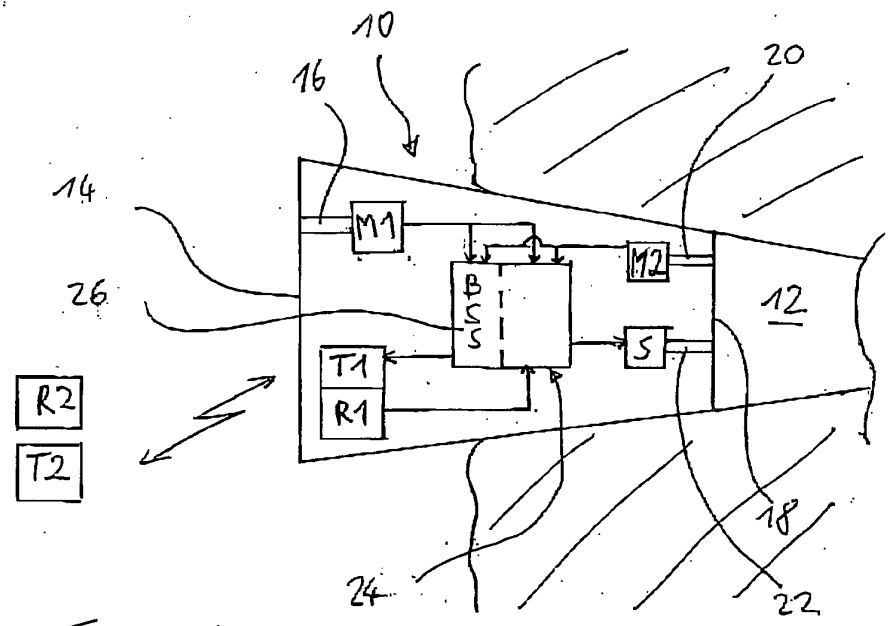

10
16
20
14
M1
M2
26
BSS
12
S
T1
R1
R2
T2
18
24
22

Fig. 1

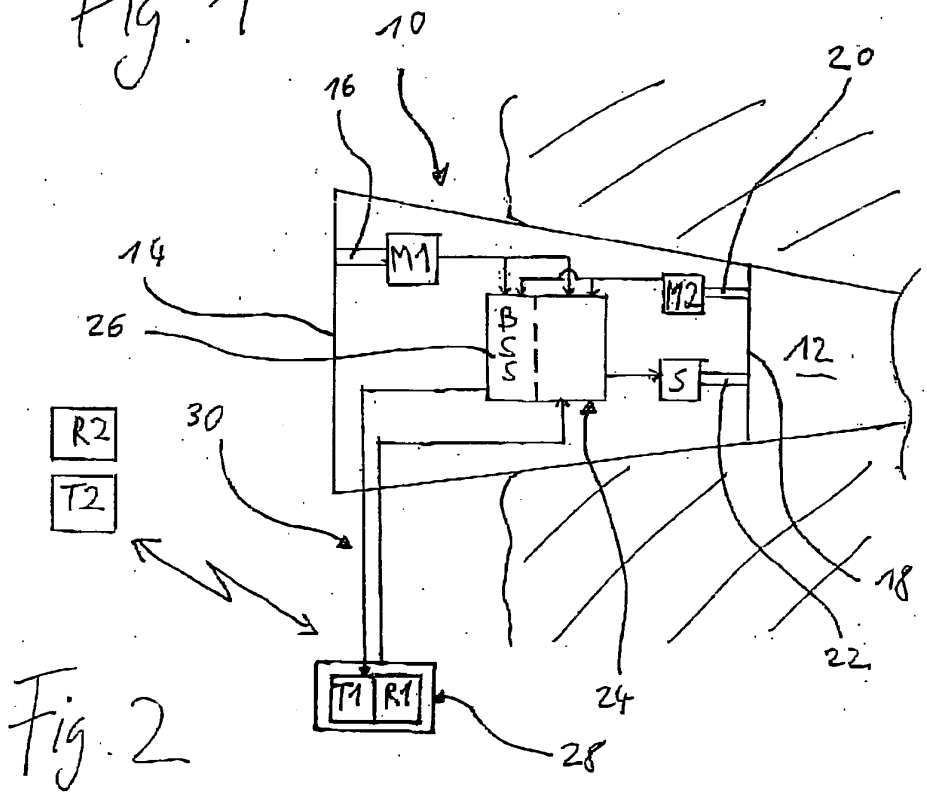

10
16
20
14
M1
M2
26
BSS
12
S
R2
30
T2
18
22
T1
R1
24
28

Fig. 2

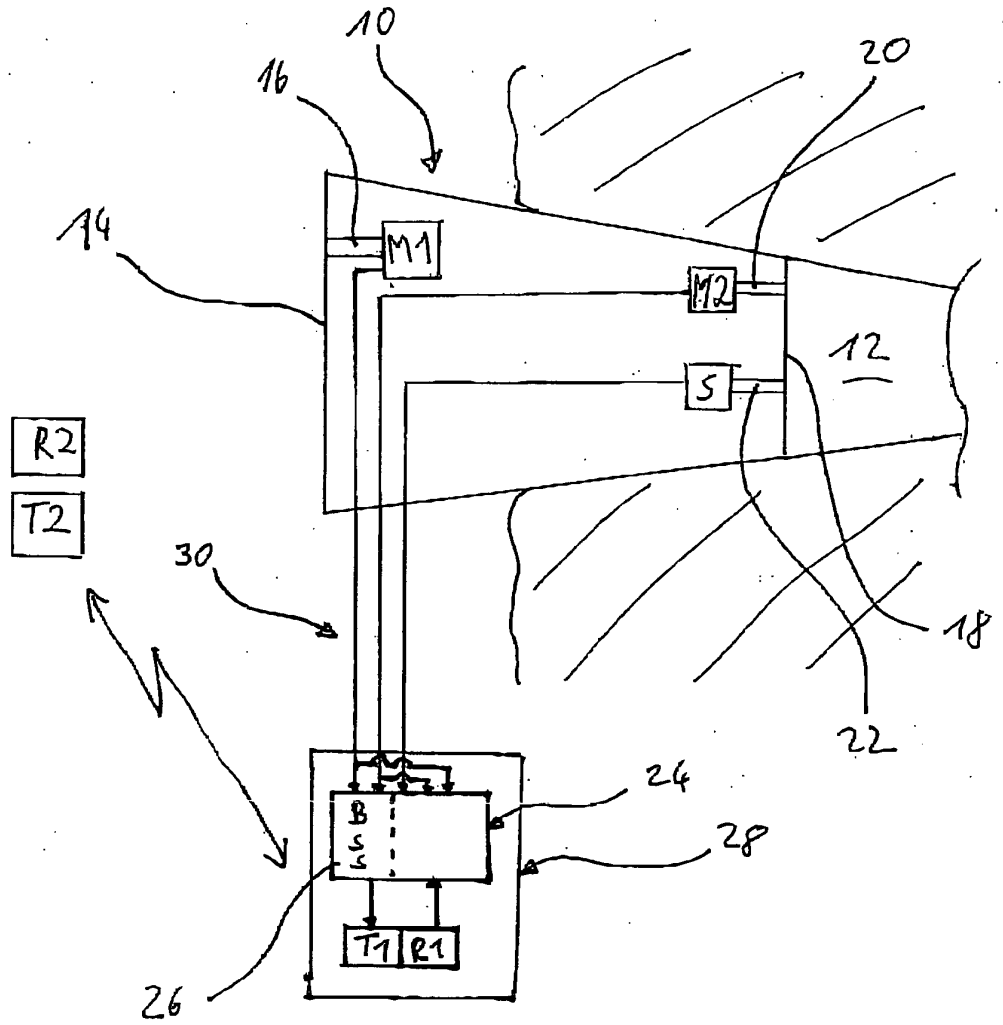


Fig. 3

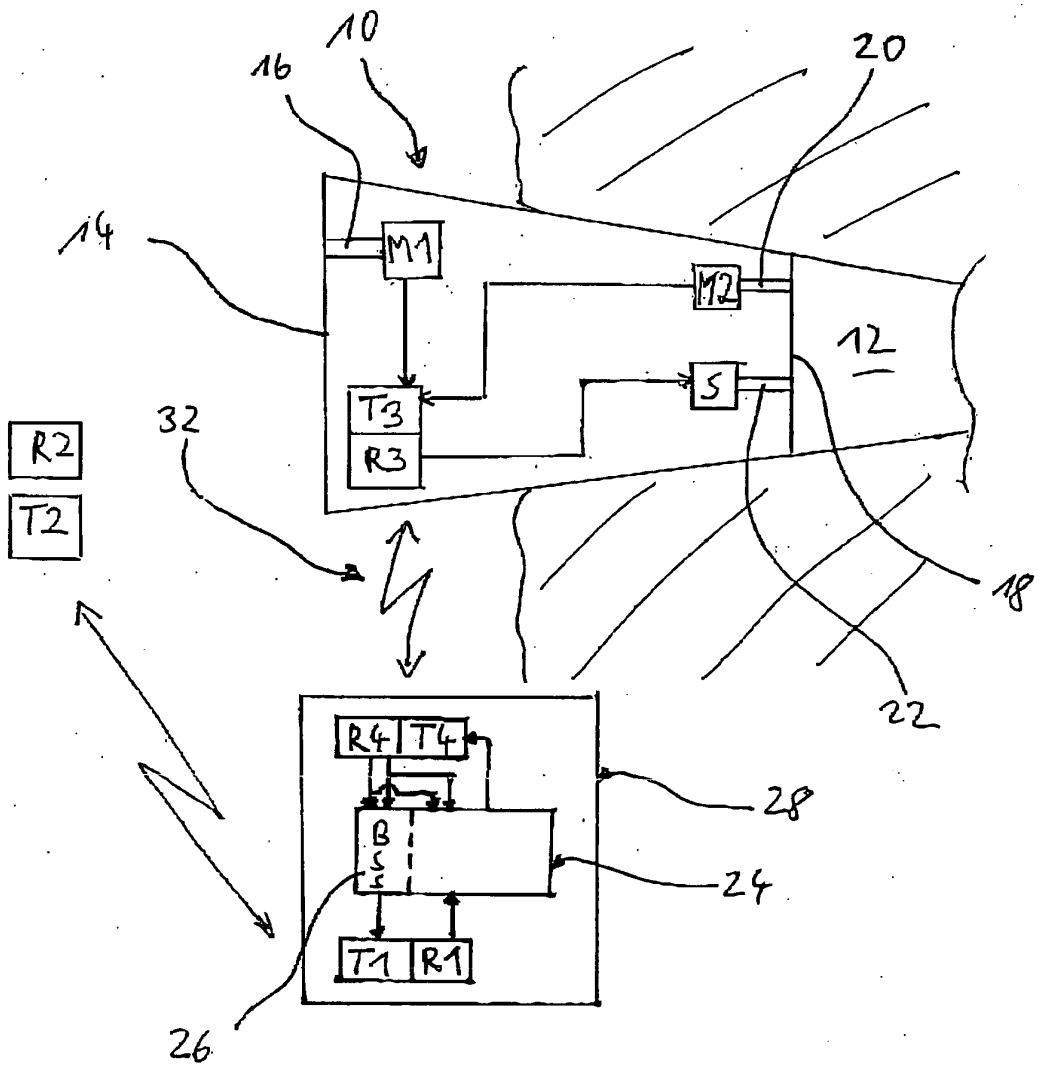


Fig. 4

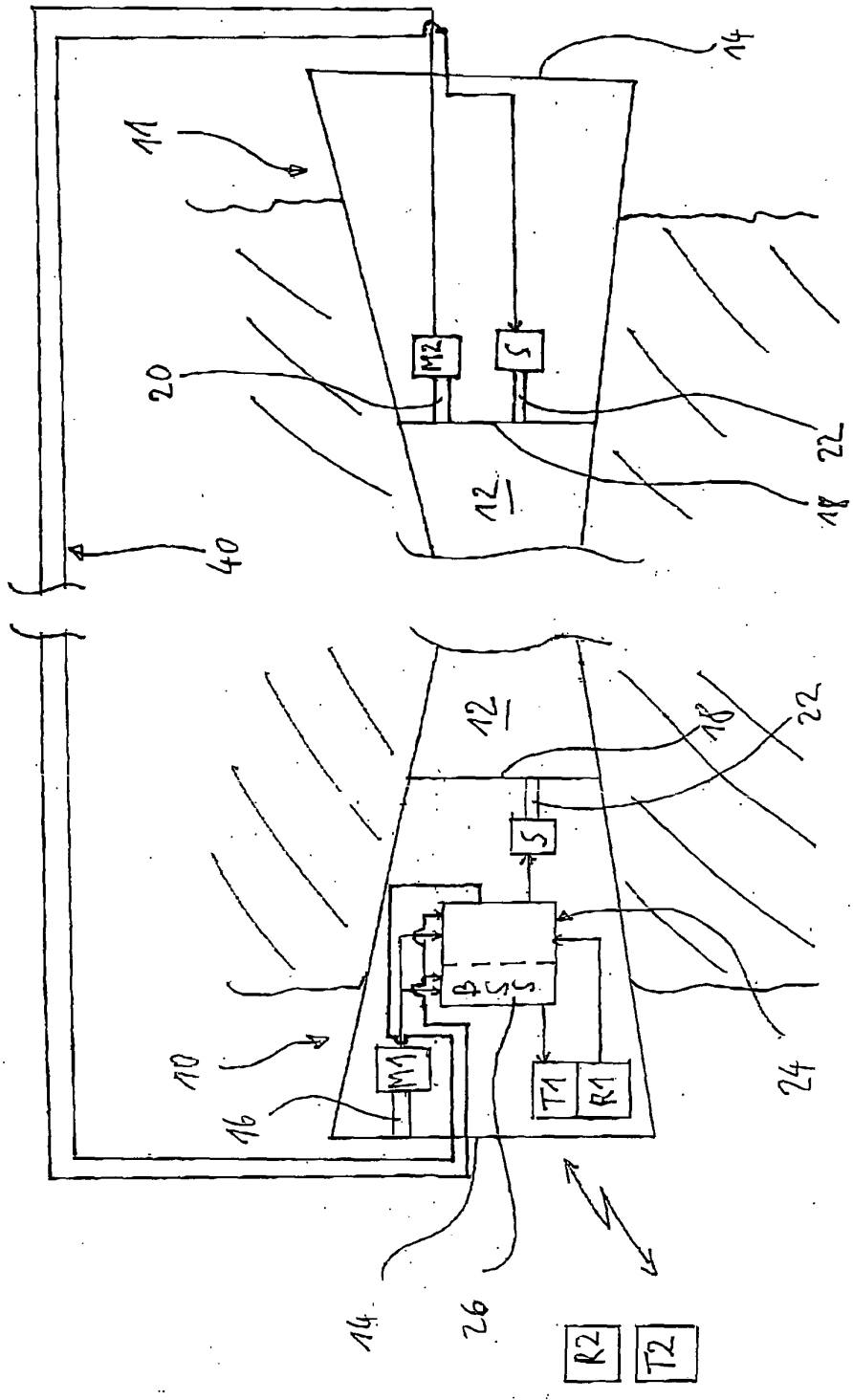


Fig. 5

Exhibit PA-C

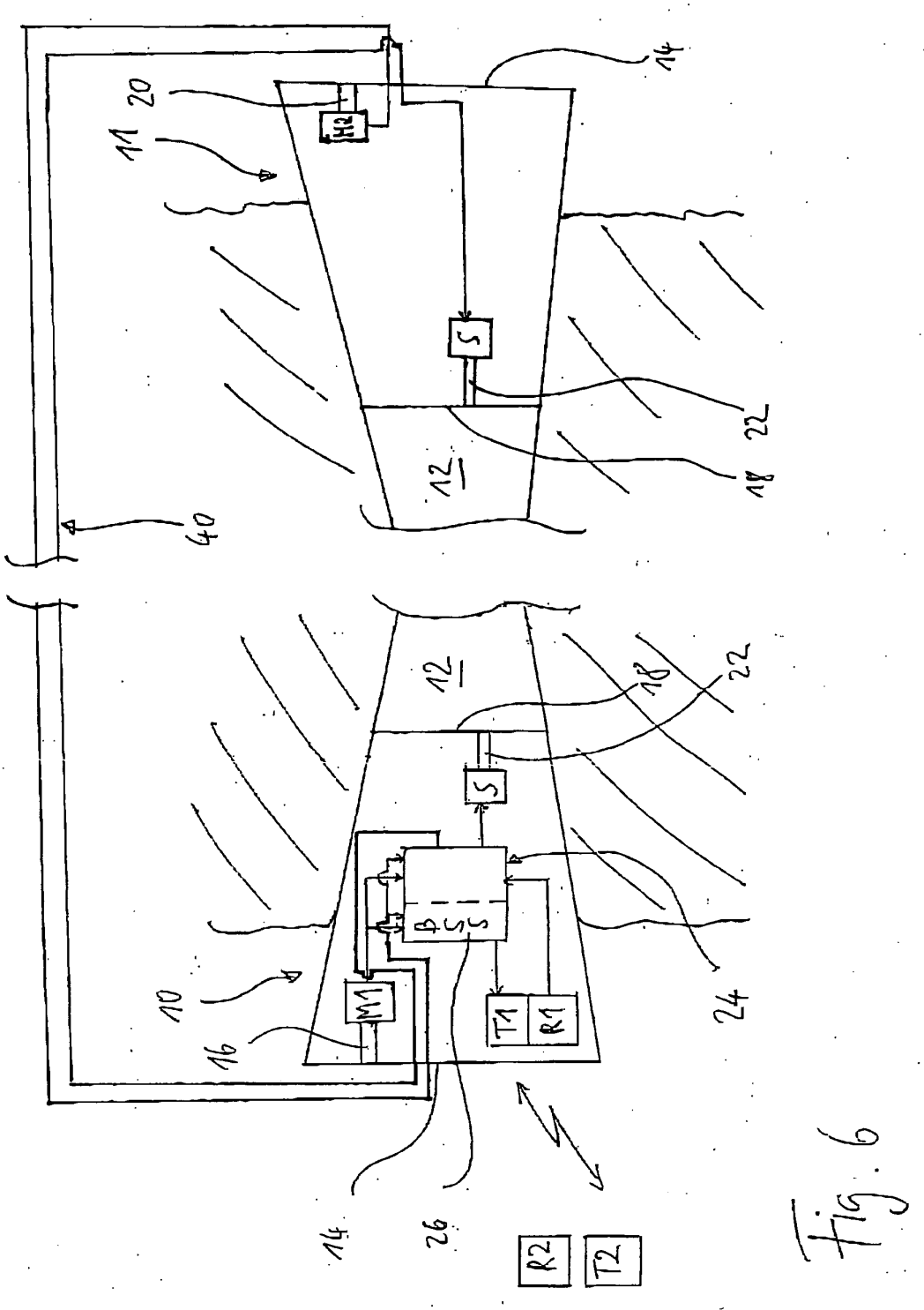


Fig. 6

Exhibit PA-C

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 02 8366

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
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X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

Exhibit PA-C

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 05 02 8366

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03-02-2006

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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

Exhibit PA-H

US007903826B2

(12) **United States Patent**
Boersma

(10) **Patent No.: US 7,903,826 B2**
(45) **Date of Patent: Mar. 8, 2011**

(54) **HEADSET WITH AMBIENT SOUND**

(75) Inventor: **Johan Boersma**, Emmen (NL)

(73) Assignee: **Sony Ericsson Mobile Communications AB**, Lund (SE)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1369 days.

(21) Appl. No.: **11/370,349**

(22) Filed: **Mar. 8, 2006**

(65) **Prior Publication Data**

US 2007/0223717 A1 Sep. 27, 2007

(51) **Int. Cl.**
H03G 3/20 (2006.01)

(52) **U.S. Cl.** **381/57**; 381/74

(58) **Field of Classification Search** 381/71.6, 381/74, 72, 317, 309–311, 313, 370, 375, 381/119, 56, 57, 58; 455/569, 575, 550, 455/556, 557; 379/430, 433, 428, 434, 79
See application file for complete search history.

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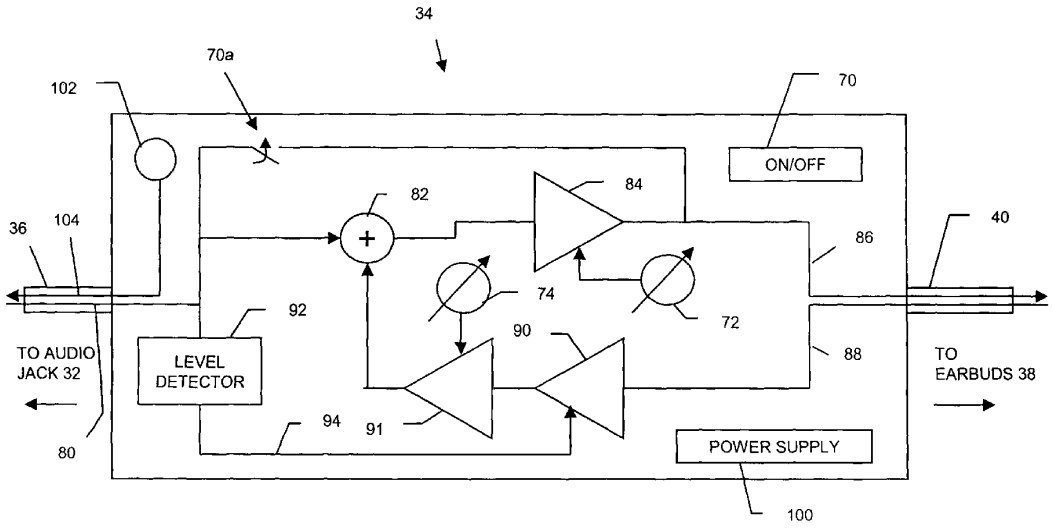
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Primary Examiner — Vivian Chin
Assistant Examiner — Lun-See Lao
(74) *Attorney, Agent, or Firm* — Renner, Otto, Boisselle & Sklar, LLP

(57) **ABSTRACT**

A headset that includes an input that receives an audio signal from an electronic equipment, and at least one earpiece having an electro-acoustic speaker for converting electrical signals to audible sound. The headset further includes at least one microphone that receives ambient sound and converts the ambient sound to an ambient sound signal. In addition, the headset includes a processing circuit formed as an integral unit with the input and the at least one earpiece. The processing circuit includes circuitry that combines the audio signal from the electronic equipment with the ambient sound signal from the at least one microphone and provides the combined signals to the at least one earpiece such that the electro-acoustic speaker reproduces the ambient sound in combination with audio from the audio signal.

17 Claims, 5 Drawing Sheets



U.S. Patent Mar. 8, 2011 Sheet 1 of 5 US 7,903,826 B2

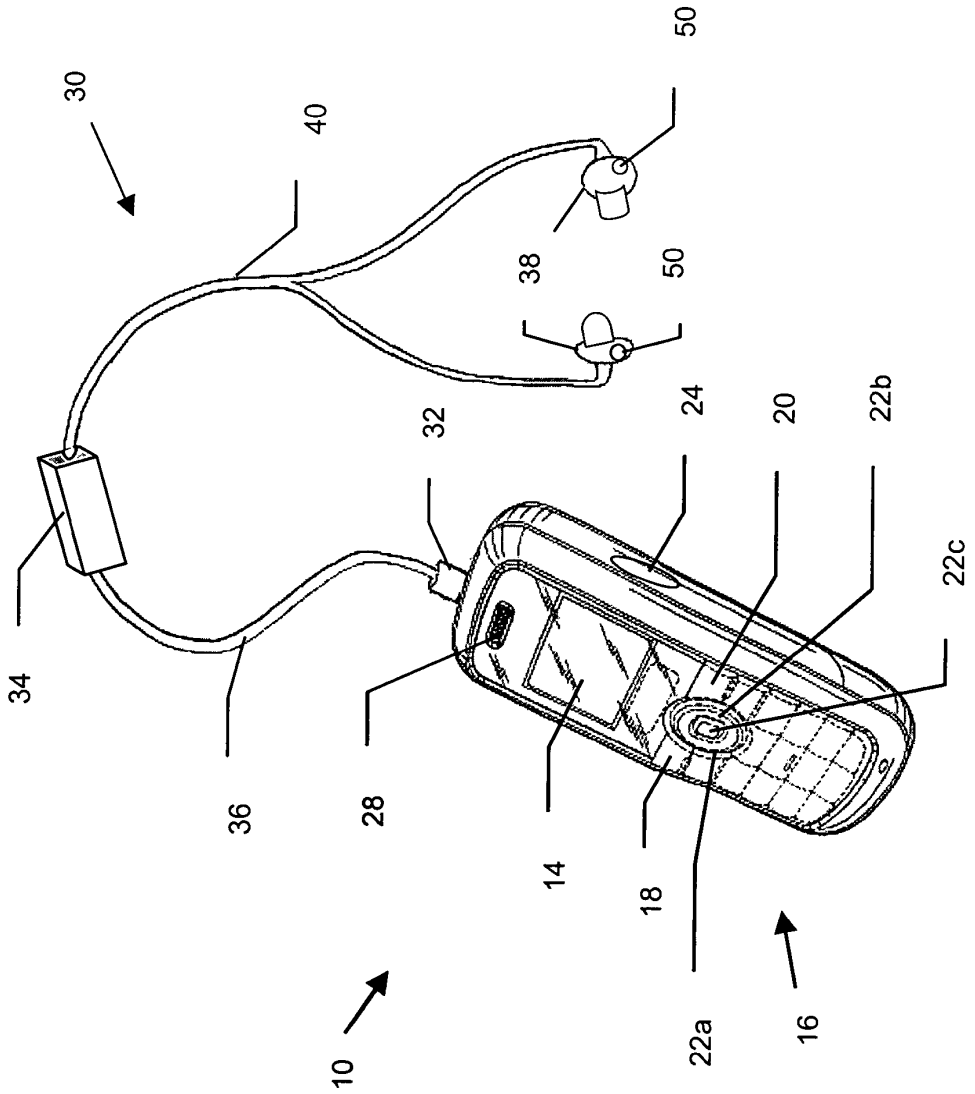


FIG. 1

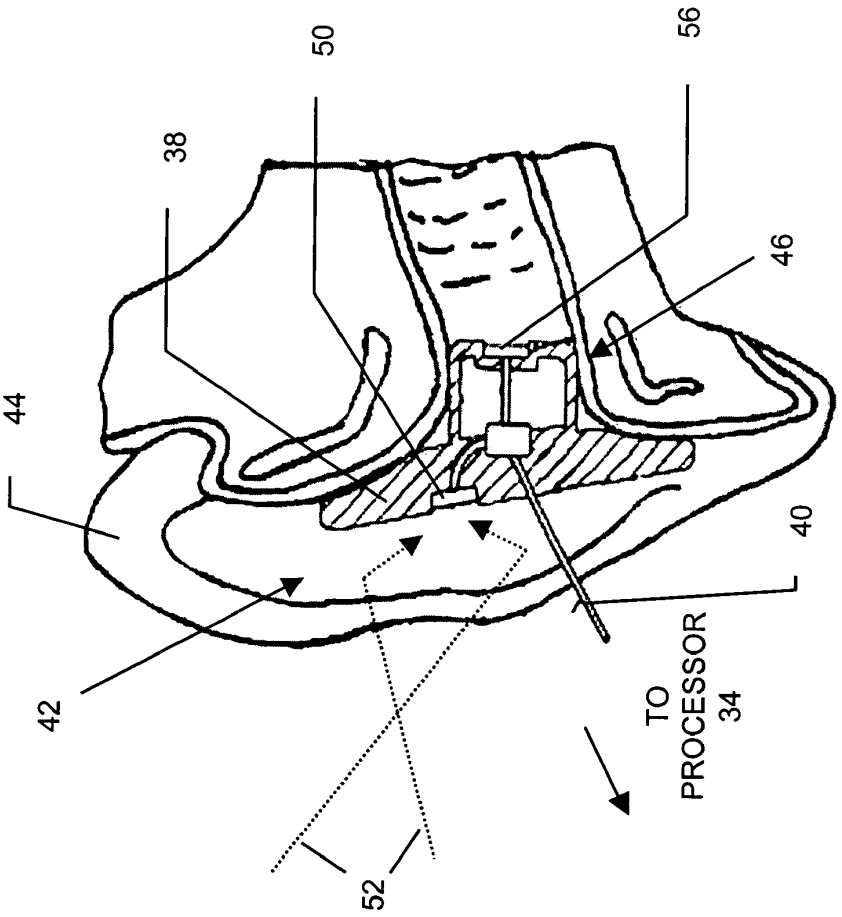


FIG. 2

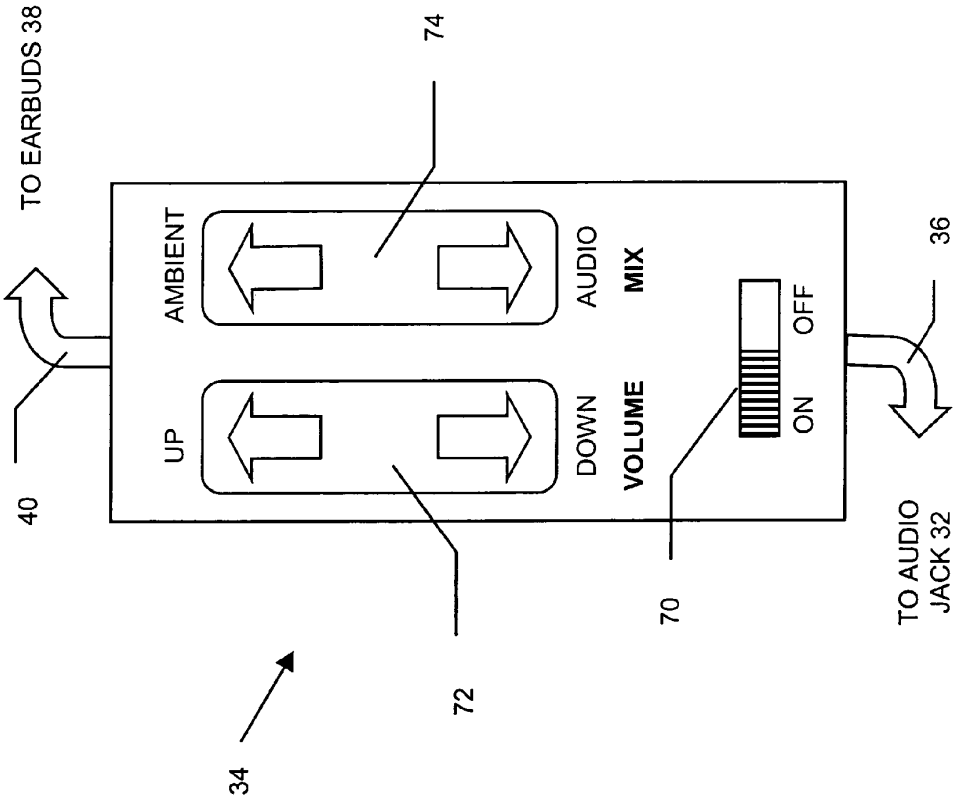

TO EARBUDS 38
74
AMBIENT
AUDIO
MIX
36
UP
DOWN
VOLUME
ON
OFF
40
70
TO AUDIO JACK 32
72
34

FIG. 3

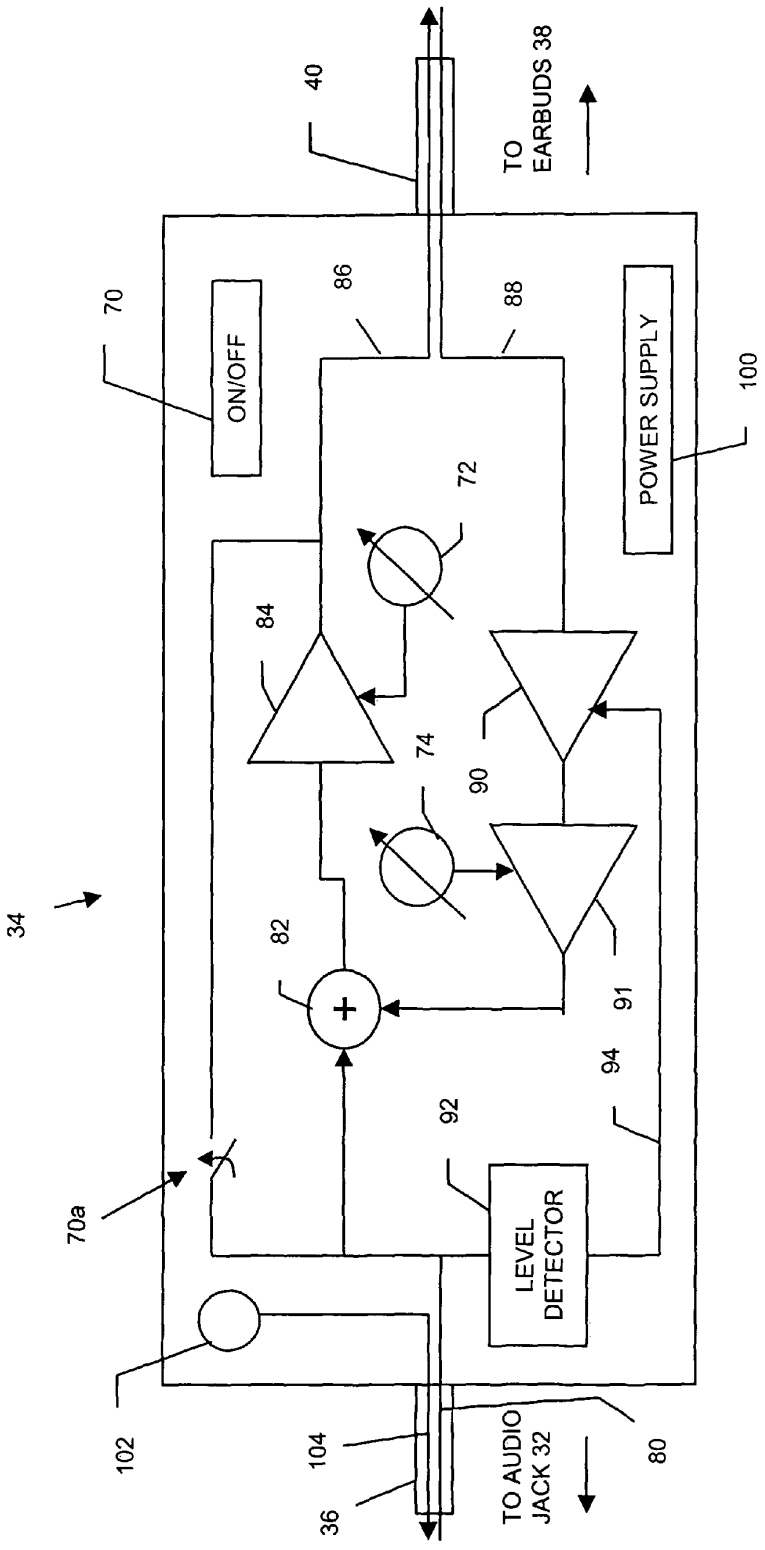

40
TO EARBUDS 38
70
ON/OFF
86
88
POWER SUPPLY
100
72
84
74
90
34
82
91
94
92
70a
LEVEL DETECTOR
102
104
36
TO AUDIO JACK 32
80

FIG. 4

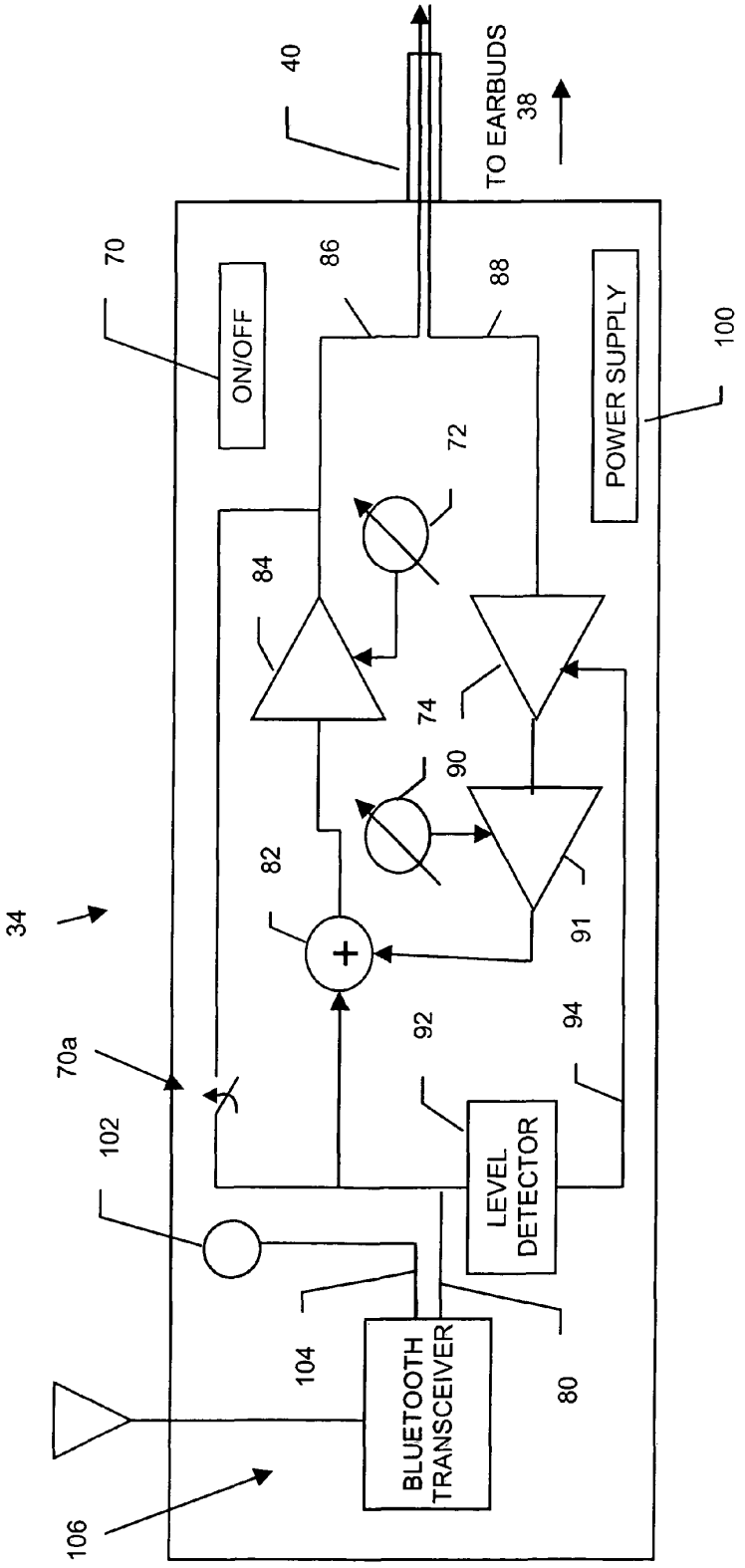

40
TO EARBUDS
38
70
ON/OFF
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88
POWER SUPPLY
100
72
84
74
90
82
34
91
92
94
70a
102
LEVEL
DETECTOR
104
BLUETOOTH
TRANSCEIVER
80
106

FIG. 5

HEADSET WITH AMBIENT SOUND

TECHNICAL FIELD OF THE INVENTION

The present invention relates generally to electronic equipment, and more particularly to a headset for electronic equipment.

DESCRIPTION OF THE RELATED ART

Electronic equipment such as portable electronic devices have been popular for decades yet continue to increase in popularity. Many modern portable electronic devices are intended or suitable for recording or playback of acoustic and/or video signals. For example, portable CD or DVD players, MPEG players, MP-3 players, etc., provide a vast variety of forms of personal entertainment. Whether audio and/or video entertainment, there are numerous portable electronic devices to satisfy any user's tastes.

Similarly, portable electronic devices in the form of mobile phones, pagers, communicators, e.g., electronic organizers, personal digital assistants (PDAs), smartphones or the like are also becoming increasingly popular. Such devices allow a user to communicate with others, store and manipulate data, create text, etc., many times within the same device.

Depending on the particular application(s), oftentimes a headset is used in combination with the portable electronic device. The headset typically includes one or more loudspeakers formed in respective earpiece housings that are either placed within the ear (in-ear headphones) or over the ear (over-the-ear headphones). A headset allows the user of a mobile phone to engage in hands free discussion, for example. In the case of media players, a headset allows a user to enjoy a private listening experience without bothering others.

Conventional headsets, however, do possess disadvantages. The earpieces alone or in combination with the music or other audio reproduced by the headset can completely block out all other sounds from the environment. Typically, the higher the volume of the audio being reproduced, the less likely that outside environmental sounds will be recognized by the user. While there are times the user may desire isolation of this type, there also are times when the user's inability to hear these ambient sounds can be undesirable or even dangerous. For example, a user wearing a headset while in traffic may be unable to hear police or emergency equipment sirens, thereby creating a potentially dangerous situation. In a social situation, a user wearing a headset still may desire to hear sound from his/her surroundings.

Headsets in the past have attempted to maintain ambient sound in addition to the audio reproduced by the headsets. Such headsets have included headsets with one or more microphones designed to pick up ambient sounds. The ambient sounds are then combined with the audio signal and reproduced by the headsets.

Nevertheless, the aforementioned attempts have fallen short insofar as providing a user with comfortable and convenient reproduction of ambient sound together with the desired audio. For example, conventional headsets have been limited with respect to their ability to be used with a variety of types of electronic equipment. Moreover, conventional headsets have not provided the user with sufficient control as to the combining of the ambient sound with the reproduced audio. Still further, conventional headsets have restricted the user's ability to receive and appreciate the spatial characteristics of the ambient sound.

SUMMARY

In view of the aforementioned shortcomings associated with conventional headsets, there is a strong need in the art for a headset suitable for use with a variety of types of electronic equipment. Additionally, there is a strong need in the art for a headset that provides a user with the ability to control the manner in which the ambient sound is combined with the reproduced audio. Still further, there is a strong need in the art for a headset that preserves the spatial characteristics of the ambient sound.

According to an aspect of the invention, a headset for reproducing audio is provided. The headset includes an input that receives an audio signal from an electronic equipment, and at least one earpiece having an electro-acoustic speaker for converting electrical signals to audible sound. The headset further includes at least one microphone that receives ambient sound and converts the ambient sound to an ambient sound signal. In addition, the headset includes a processing circuit formed as an integral unit with the input and the at least one earpiece. The processing circuit includes circuitry that combines the audio signal from the electronic equipment with the ambient sound signal from the at least one microphone and provides the combined signals to the at least one earpiece such that the electro-acoustic speaker reproduces the ambient sound in combination with audio from the audio signal.

According to a particular aspect, the input includes an electrical connector configured to connect directly to the electronic equipment.

In accordance with another aspect, the electrical connector includes an audio plug type connector.

According to still another aspect, the processing circuitry is coupled to the electrical connector via a first audio cable and to the at least one earpiece via a second audio cable, all of which are part of the integral unit.

In still another aspect, the electronic equipment is a mobile telephone.

Regarding another aspect, the input comprises a low-power wireless interface that communicates with an interface included in the electronic equipment.

According to still another aspect, the low-power wireless interface is a Bluetooth interface.

With yet another aspect, the electronic equipment is a mobile telephone.

Regarding a further aspect, the headset includes a pair of earpieces each including an electro-acoustic speaker for reproducing audio from the audio signal and the ambient sound.

In accordance with another aspect, the headset includes a pair of microphones each included in a respective one of the pair of earpieces.

According to another aspect, the at least one earpiece is an earbud-style earpiece.

In accordance with yet another aspect, the earbud-style earpiece includes the at least one microphone.

In yet another aspect, the earbud-style earpiece is configured to be inserted into an ear of a user with the microphone positioned within a cavity formed by the auricle of the ear.

As for still another aspect, a headset for reproducing audio is again provided. The headset includes an input that receives an audio signal from an electronic equipment, at least one earpiece having an electro-acoustic speaker for converting electrical signals to audible sound, and at least one microphone that receives ambient sound and converts the ambient sound to an ambient sound signal. The headset further includes a processing circuit, the processing circuit including circuitry that combines the audio signal from the electronic

equipment with the ambient sound signal from the at least one microphone and provides the combined signals to the at least one earpiece such that the electro-acoustic speaker reproduces the ambient sound in combination with audio from the audio signal. The at least one earpiece includes the at least one microphone, and the earpiece is configured to be inserted into an ear of a user with the microphone positioned within a cavity formed by the auricle of the ear.

According to another aspect, the headset includes a pair of earpieces each including a respective electro-acoustic speaker and corresponding microphone, the respective electro-acoustic speaker reproducing the ambient sound received by the corresponding microphone.

In accordance with still another aspect, the processing circuit includes mixture circuitry adjustable by a user to adjust a ratio by which the processing circuit combines the audio signal and the ambient sound signal.

With still another aspect, the processing circuit includes volume adjust circuitry adjustable by the user to adjust the volume of the combined signals independently of the ratio.

As for still another aspect, the processing circuit includes gain control circuitry that compensates for changes in amplitude of the input signal such that the ratio remains constant.

Regarding another aspect, the processing circuit includes bypass circuitry allowing the input signal to pass to the at least one earpiece substantially without modification.

According to another aspect, the processing circuit is formed as an integral unit with the input and the at least one earpiece.

In accordance with another aspect of the invention, a headset for reproducing audio is provided that includes an input that receives an audio signal from an electronic equipment and at least one earpiece having an electro-acoustic speaker for converting electrical signals to audible sound. The headset also includes at least one microphone that receives ambient sound and converts the ambient sound to an ambient sound signal and a processing circuit. The processing circuit includes circuitry that combines the audio signal from the electronic equipment with the ambient sound signal from the at least one microphone and provides the combined signals to the at least one earpiece such that the electro-acoustic speaker reproduces the ambient sound in combination with audio from the audio signal. The processing circuit also includes mixture circuitry adjustable by a user to adjust a ratio by which the processing circuit combines the audio signal and the ambient sound signal.

According to another aspect, the processing circuit includes volume adjust circuitry adjustable by the user to adjust the volume of the combined signals independently of the ratio.

As for another aspect, the processing circuit includes gain control circuitry that compensates for changes in amplitude of the input signal such that the ratio remains constant.

In accordance with still another aspect, the processing circuit includes bypass circuitry allowing the input signal to pass to the at least one earpiece substantially without modification.

Regarding yet another aspect, the at least one earpiece includes the at least one microphone, and the earpiece is configured to be inserted into an ear of a user with the microphone positioned within a cavity formed by the auricle of the ear.

According to another aspect, the processing circuit is formed as an integral unit with the input and the at least one earpiece.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described and particularly pointed out in the claims. The following description and the annexed drawings set forth in detail certain illustrative embodiments of the invention. These embodiments are indicative, however, of but a few of the various ways in which the principles of the invention may be employed. Other objects, advantages and novel features of the invention will become apparent from the following detailed description of the invention when considered in conjunction with the drawings.

It should be emphasized that the term "comprises/comprising" when used in this specification is taken to specify the presence of stated features, integers, steps or components but does not preclude the presence or addition of one or more other features, integers, steps, components or groups thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an environmental view of a mobile phone and headset in accordance with an embodiment of the present invention;

FIG. **2** is a cross-sectional view of an earbud including a microphone positioned so as to be located within the cavity of the auricle in accordance with an embodiment of the present invention;

FIG. **3** is front view of a processor of a headset in accordance with an embodiment of the present invention;

FIG. **4** is a simplified circuit diagram of the processor of FIG. **3** in accordance with an embodiment of the present invention; and

FIG. **5** is a simplified circuit diagram of a processor in accordance with another embodiment of the present invention.

DETAILED DESCRIPTION OF EMBODIMENTS

The present invention will now be described with reference to the drawings, wherein like reference numerals are provided for like elements throughout.

The term "electronic equipment" as referred to herein includes personal portable electronics, including, but not limited to, media players of various formats such as digital music players (e.g., CD, MP3, AC-3, .wma, etc.), video players (e.g., DVD, MPEG, .wmv, etc.), picture players (e.g., JPEG, etc.). Electronic equipment includes traditional media players such as CD and DVD players, as well as the increasingly popular "flash memory" and "hard drive" type media players, referring to the type of memory used to store various media files. Electronic equipment includes dedicated media players as well as multi-functional devices that include media players. Such multi-functional devices include portable radio communication equipment. The term "portable radio communication equipment", also referred to herein as a "mobile radio terminal", includes all equipment such as mobile phones, pagers, communicators, e.g., electronic organizers, personal digital assistants (PDAs), smartphones or the like. In the present application, the invention is described primarily in the context of a mobile phone. However, it will be appreciated that the invention is not intended to be limited to a mobile phone and can be any type of electronic equipment. Moreover, although the invention is described primarily in the context of listening to music via an electronic equipment such as a mobile telephone, it will be appreciated that the invention more generally has application with any type of electronic equipment for which sound is reproduced.

Referring initially to FIG. **1**, an electronic equipment **10** is shown in accordance with the present invention. In the exemplary embodiment described herein, the electronic equipment is a mobile phone **10**. The mobile phone **10** is shown as having

a "brick" or "block" design type housing, but it will be appreciated that other type housings such as clamshell or slide-type housings may be utilized without departing from the scope of the invention.

The mobile phone **10** includes a display **14** and keypad **16**. As is conventional, the display **14** displays information to a user such as operating state, time, phone numbers, contact information, various navigational menus, etc., which enable the user to utilize the various features of the mobile phone **10**. Similarly, the keypad **16** may be conventional in that it provides for a variety of user input operations. For example, the keypad **16** typically includes alphanumeric keys for allowing entry of alphanumeric information such as telephone numbers, phone lists, contact information, notes, etc. In addition, the keypad **16** typically includes special function keys such as a "call send" key **18** for initiating or answering a call, and a "call end" key **20** for ending, or "hanging up" a call. Special function keys may also include menu navigation keys **22***a*, **22***b* and **22***c*, for example, for navigating through a menu displayed on the display **14** to select different phone functions, profiles, settings, etc., as is conventional. Other keys included in the keypad **16** may include a volume key **24**, on/off power key **26**, as well as various other keys such as a web browser launch key, camera key, etc.

In the particular embodiment of FIG. **1**, the mobile phone **10** includes the display **14** and separate keypad **16**. In an alternative embodiment, the display **14** may comprise a touchscreen which itself includes one or more keys. In yet another embodiment, the display **14** may comprise a touchscreen that includes all or substantially all of the keys used to operate the phone **10** so as to include a very limited keypad **16** or no keypad **16** at all. As will be appreciated, the particular form and function of the keys included in the keypad **16** or touchscreen/display **14** are not germane to the invention in its broadest sense.

The mobile phone **10** is a multi-functional device that is capable of carrying out various functions in addition to traditional mobile phone functions. For example, the mobile phone **10** in accordance with the present invention also functions as a media player. More specifically, the mobile phone **10** is capable of playing different types of media objects such as audio files (e.g., MP3, .wma, AC-3), video files (e.g., MPEG, .wmv, etc.), still images (e.g., .pdf, JPEG, .bmp, etc.). The media objects are typically stored in non-volatile memory within the mobile phone **10**. The mobile phone **10** reproduces audio files through a speaker **28** or an accessory such as a stereo headset **30** in accordance with the present invention. The stereo headset **30** may be plugged into or otherwise connected to an audio output of the mobile phone **10** via an appropriate connector.

For reasons that will be explained more fully below, the headset **30** overcomes the aforementioned shortcomings associated with conventional headsets used with electronic equipment having an audio output. For example, the headset **30** is suitable for use with a variety of types of electronic equipment. The headset **30** does not necessarily rely on processing circuitry and/or controls within the electronic equipment **10** to provide a user with the ability to listen to reproduced audio yet still be able to hear ambient sound. Moreover, the headset **30** provides a user with the ability to control the manner in which the ambient sound is combined with the reproduced audio. The user has the ability to control the respective levels of the reproduced audio and ambient sound, thereby allowing the user to adjust the listening experience to his or her preference. Still further, the headset **30** preserves the spatial characteristics of the ambient sound. As a result, the user continues to be able to derive aspects such as the direction from which the ambient sound originates. These features increase the safety and improve the listening experience of the user compared to conventional headsets.

The headset **30** in the exemplary embodiment includes an input **32** for receiving an audio signal from the mobile phone **10**. The input **32** may include a conventional audio jack/plug or any other type of suitable electrical connector. Preferably the audio signal is a stereo signal including audio for left and right channels, although one will appreciate that the audio signal may be a signal other than stereo (e.g., mono, multi-channel, etc.).

The headset **30** further includes a processor **34** that receives the audio signal from the input **32** via an audio cable **36**. In addition, the headset **30** includes a pair of earpieces **38** coupled to the processor **34** via an audio cable **40**. Each of the earpieces **38** is conventional in that the earpieces **38** each include an electro-acoustic loudspeaker (not shown) within the earpiece housing for converting electrical signals into audio sound. The processor **34** provides the left and right channel stereo signals from the output of the mobile phone **10** to the respective earpieces **38**.

In the exemplary embodiment, the earpieces **38** are each "in-the-ear" type earpieces such as an earbud **38** as is shown in FIG. **2**. As referred to herein, an "in-the-ear" type earpiece **38** is a type that a user wears generally within the cavity **42** formed by the auricle **44** of the ear. Earbuds **38** fit snuggly within the cavity **42** and/or the opening **46** to the ear canal. In contrast, an "outside-the-ear" type earpiece is an earpiece that a user wears generally outside or on top of the cavity **42** formed by the auricle **44**.

Continuing to refer to FIGS. **1** and **2**, each earpiece **38** includes a microphone **50** for picking up ambient sound. The microphone **50** is positioned within the earpiece housing such that when the earpiece **38** is worn by the user, the microphone **50** is located within and exposed to the cavity **42** formed by the auricle **44**. Thus, as represented by arrows **52** in FIG. **2**, ambient sound waves collected by the auricle **44** are focused generally towards the microphone **50**. As a result, the microphone **50** picks up ambient sound while preserving the spatial characteristics of the sound. That is to say, the same way a human is able to detect the direction from which sounds originate based on the spacing and direction of the ears, the microphones **50** pick up the same ambient sound. In contrast, microphones located in over-the-ear type earpieces lose such spatial characteristics. While the microphones continue to remain spaced apart, the characteristics associated with the direction of the ears is lost due to not being placed within the cavity formed by the auricle **44**.

FIG. **2** further illustrates how each earpiece **38** includes an aforementioned loudspeaker **56**. The loudspeaker **56** can be of any conventional type (e.g., piezoelectric element, etc.). As is shown in FIG. **2**, the loudspeaker **56** receives audio signals from the processor **34** via the audio cable **40**. Conversely, the microphone **50** receives the ambient sound and converts such sound into an ambient sound signal that is provided to the processor **34** via the audio cable **40**.

As will be explained in more detail below with respect to FIGS. **3** and **4**, the processor **34** functions to combine the audio signal received from the mobile phone **10** with the ambient sound signal provided by the respective microphones **50**. The processor **34** then provides the combined signals to the loudspeaker **56** in each earpiece **38**. In such manner, each earpiece **38** is capable of reproducing the audio signal from the mobile phone **10** together with the ambient sound picked up by the corresponding microphone **50**. The spatial characteristics of the ambient sound are therefore preserved.

Referring again briefly to FIG. **1**, the headset **30** in the preferred embodiment is an integral, or self-contained unit. Specifically, the input **32**, processor **34** and earpieces **38** are fixedly connected to one another via audio cables **36**, **40**. Thus, the headset **30** represents a self-contained accessory that is not necessarily dependent upon a particular electronic equipment or any other accessory and/or attachment. The headset **30** includes its own processor **34** that obtains the ambient sound and combines the ambient sound with the audio from the electronic equipment to provide the desired listening experience.

Turning to FIG. **3**, shown is an exemplary embodiment of the processor **30**. As will be explained in more detail below with respect to FIG. **4**, the processor **30** includes an on/off switch **70** that allows the user to turn the processor **34** on and off. In the on position, the headset **30** functions to pick up the ambient sound and combine the ambient sound with the audio signal from the mobile telephone **10** so that both may be heard by the user. In the off position, the processor **34** essentially routes the audio signal from the mobile telephone directly to the earpieces **58** as in a conventional headset. The on/off switch **70** is shown as a slide switch, but it will be appreciated that virtually any type of suitable switch may be utilized without departing from the scope of the invention.

The processor **34** also includes a volume control switch **72** and mix switch **74**. The volume control switch **72** allows the user to control the volume of the audio reproduced by the headset **30** directly without having to adjust the output volume of the mobile phone **10**. The mix switch **74** allows the user to adjust a ratio by which the processor **34** combines the audio signal from the mobile telephone **10** and the ambient sound signal from the microphones **50**. By controlling the mix, the user can choose whether the earpieces **38** provide more or less of the ambient sound in relation to the audio signal. Depending on the situation, the user may choose to block most or all of the environmental sounds (e.g., in a crowded train) by substantially reducing the amount of ambient sound provided to the loudspeakers **56**. The user may choose to retain the ambient sound at a lower level in situations where it is desirable to maintain some contact with the environment, albeit at a reduced level (e.g., while in traffic). Still further, the user may choose to retain the ambient sound at a higher level under circumstances where it is desirable to retain complete contact with the environment (e.g., in one's living room).

The switches **72** and **74** as shown in FIG. **3** are membrane switches that serve to adjust the volume and mix up or down as a function of the particular arrow that is pressed. However, those having ordinary skill in the art will readily appreciate that virtually any other type suitable switch could also be used without departing from the scope of the invention. For example, switch **72** and/or switch **74** could be replaced with a rotary switch, slide switch, etc. As will also be appreciated, the switches **72** and/or **74** together with any or all of the circuitry described herein may be analog circuitry, digital circuitry, or any combination thereof. While the invention is described herein primarily in the context of an analog design, it will be readily appreciated that the circuitry could alternately be implemented via digital design or a combination thereof.

FIG. **4** is a schematic illustration of the processor **34**. The processor **34** is simplified so as to represent a single channel. Those having ordinary skill in the art, however, will appreciate that a stereo embodiment for handling left and right channel stereo signals provided to respective earpieces **38** involves simply a duplication of the circuit shown in FIG. **4**.

The mobile phone **10** provides an audio signal to the processor **34** via line **80** within the audio cable **36**. The audio signal on line **36** is input to an adder **82** included in the processor **34**. The output of the adder **82** is input to an adjustable gain amplifier **84** that amplifies the output of the adder **82**. The output of the amplifier is provided to the earpieces **38** via line **86** within the audio cable **40**.

Ambient sound picked up by the microphones **50** is input to the processor **34** as an ambient sound signal on line **88** from the audio cable **40**. The ambient sound signal on line **88** is input to an adjustable gain amplifier **90** so as to amplify the ambient sound signal. The amplifier **90** outputs the ambient sound signal into an adjustable gain amplifier **91** whose gain is controlled using a level control switch in the form of the aforementioned mix switch **74**. The mix switch **74**, in this embodiment preferably a rheostat, controls the level of the amplified ambient sound signal from the amplifier **91** that is provided to another input of the adder **82**.

Accordingly, the adder **82** functions to combine the ambient sound signal with the audio signal from the mobile phone **10**. By way of adjusting the mix switch **74**, the user can control the relative amplitude or ratio of the ambient sound signal to the audio signal as represented by the output of the adder **82**. Therefore, the user can control the degree to which the ambient sound is represented in comparison to the audio signal.

The volume switch **72**, also preferably a rheostat in this embodiment, functions to adjust the gain of the amplifier **84**. Accordingly, the user may control the gain of the amplifier **84** which amplifies the combined audio and ambient sound signals. As a result, the user may control the overall volume of the sound reproduced by the headset.

In a preferred embodiment, the processor **34** may further includes an optional level detector circuit **92** that serves to detect the level of the audio signal received on line **80** from the mobile phone **10**. The level detector circuit **92** is designed to output a gain control signal on line **94** that is proportional to the level of the audio signal on line **80**. The gain control signal on line **94** serves to adjust the gain of the adjustable gain amplifier **90**. As a result, the processor **34** automatically adjusts the level of the ambient sound signal in proportion to changes in the level of the received audio signal. In this manner, even if the user adjusts the audio output volume of the mobile phone **10** or other electronic equipment, the mix ratio of the audio signal and the ambient sound signal will remain substantially constant. Although not shown, the level detector **92** preferably includes a low-pass filter for smoothing the response of the amplifier **90** (e.g., to avoid sudden changes in the level of the ambient sound due to sudden quiet/loud periods in the audio signal).

The processor **34** includes the aforementioned switch **70** which serves to turn power from a power supply **100** on and off to the remaining circuitry. The power supply **100** preferably is self contained, such as a battery. Alternatively, the processor **34** may be designed to receive power from the electronic equipment itself. The switch **70** also may include as a part thereof an optional switch **70***a*. The switch **70***a* is normally open during operation (switch **70** is on) so as to remain effectively an open circuit. When the switch **70** is off, switch **70***a* becomes closed. As a result, the audio signal on line **80** bypasses the circuitry within the processor **34** and is output directly to the earpieces **38** on line **86**.

Still further, the processor **34** may include a microphone **102** for picking up the voice of the user during hands-free communication with the mobile phone **10** using the headset **30**. The microphone **102** provides a voice signal to the mobile phone **10** via line **104** using conventional techniques.

FIG. **5** illustrates an alternative embodiment of the processor **34**. In this embodiment, the input **32** is replaced by a low-power wireless interface such as a Bluetooth transceiver **106**. The Bluetooth transceiver **106** can be programmed to carry out conventional communications between the headset **30** and the similarly equipped mobile phone **10** or other electronic equipment. In such embodiment, there is no need for an audio cable **36**.

Furthermore, the embodiments described herein can be modified without departing from the scope of the invention. For example, while the processor **34** is shown as being part of a housing connected in-line between the earpieces **38** and the input **32**, the processor **34** may instead be housed within part of the jack forming the input **32** and/or within the housing of the earpiece(s) **38**. Alternatively, in a Bluetooth embodiment the processor **34** may be incorporated within a small housing designed to fit behind the ear of the user similar to known Bluetooth headsets.

Although the invention has been shown and described with respect to certain preferred embodiments, it is obvious that equivalents and modifications will occur to others skilled in the art upon the reading and understanding of the specification. The present invention includes all such equivalents and modifications, and is limited only by the scope of the following claims.

The invention claimed is:

1. A headset for reproducing audio, comprising:

an input that receives an audio signal from an electronic equipment;

at least one earpiece having an electro-acoustic speaker for converting electrical signals to audible sound;

at least one microphone that receives ambient sound and converts the ambient sound to an ambient sound signal; and

a processing circuit formed as an integral unit with the input and the at least one earpiece, the processing circuit including circuitry that combines the audio signal from the electronic equipment with the ambient sound signal from the at least one microphone and provides the combined signals to the at least one earpiece such that the electro-acoustic speaker reproduces the ambient sound in combination with audio from the audio signal, wherein the processing circuit comprises mixture circuitry adjustable by a user to adjust a ratio by which the processing circuit combines the audio signal and the ambient sound signal, and the processing circuit comprises gain control circuitry that compensates for changes in amplitude of the input signal such that the ratio remains constant, and

wherein the at least one earpiece includes the at least one microphone, and the earpiece is configured to be inserted into an ear of a user with the microphone positioned within a cavity formed by the auricle of the ear.

2. The headset of claim **1**, wherein the input comprises an electrical connector configured to connect directly to the electronic equipment.

3. The headset of claim **2**, wherein the electrical connector comprises an audio plug type connector.

4. The headset of claim **2**, wherein the processing circuitry is coupled to the electrical connector via a first audio cable and to the at least one earpiece via a second audio cable, all of which are part of the integral unit.

5. The headset of claim **2**, wherein the electronic equipment is a mobile telephone.

6. The headset of claim **1**, wherein the input comprises a low-power wireless interface that communicates with an interface included in the electronic equipment.

7. The headset of claim **6**, wherein the low-power wireless interface is a Bluetooth interface.

8. The headset of claim **6**, wherein the electronic equipment is a mobile telephone.

9. The headset of claim **1**, wherein the headset comprises a pair of earpieces each including an electro-acoustic speaker for reproducing audio from the audio signal and the ambient sound.

10. The headset of claim **9**, wherein the headset comprises a pair of microphones each included in a respective one of the pair of earpieces.

11. The headset of claim **1**, wherein the at least one earpiece is an earbud-style earpiece.

12. The headset of claim **1**, further comprising a level detector circuit to detect the level of the audio signal received from the electronic equipment and output a gain control signal to adjust the level of the ambient sound signal in proportion to changes in the level of the received audio signal.

13. A headset for reproducing audio, comprising:

an input that receives an audio signal from an electronic equipment;

at least one earpiece having an electro-acoustic speaker for converting electrical signals to audible sound;

at least one microphone that receives ambient sound and converts the ambient sound to an ambient sound signal; and

a processing circuit, the processing circuit including circuitry that combines the audio signal from the electronic equipment with the ambient sound signal from the at least one microphone and provides the combined signals to the at least one earpiece such that the electro-acoustic speaker reproduces the ambient sound in combination with audio from the audio signal, wherein the processing circuit comprises mixture circuitry adjustable by a user to adjust a ratio by which the processing circuit combines the audio signal and the ambient sound signal, and the processing circuit comprises gain control circuitry that compensates for changes in amplitude of the input signal such that the ratio remains constant, and

wherein the at least one earpiece includes the at least one microphone, and the earpiece is configured to be inserted into an ear of a user with the microphone positioned within a cavity formed by the auricle of the ear.

14. The headset of claim **13**, wherein the headset comprises a pair of earpieces each including a respective electro-acoustic speaker and corresponding microphone, the respective electro-acoustic speaker reproducing the ambient sound received by the corresponding microphone.

15. The headset of claim **13**, wherein the processing circuit comprises bypass circuitry allowing the input signal to pass to the at least one earpiece substantially without modification.

16. The headset of claim **13**, wherein the processing circuit is formed as an integral unit with the input and the at least one earpiece.

17. The headset of claim **13**, further comprising a level detector circuit to detect the level of the audio signal received from the electronic equipment and output a gain control signal to adjust the level of the ambient sound signal in proportion to changes in the level of the received audio signal.

* * * * *

Exhibit PA-M



(12) **United States Patent**
Jorgensen et al.

(10) **Patent No.: US 7,953,241 B2**
(45) **Date of Patent: May 31, 2011**

(54) **MICROPHONE ASSEMBLY**

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(73) Assignee: **Sonion Nederland B.V.**, Amsterdam (NL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1104 days.

(21) Appl. No.: **09/893,997**

(22) Filed: **Jun. 29, 2001**

(65) **Prior Publication Data**

US 2002/0009206 A1 Jan. 24, 2002

(51) **Int. Cl.**
H04R 25/00 (2006.01)

(52) **U.S. Cl.** **381/356**; 381/355; 381/322

(58) **Field of Classification Search** 381/312, 381/313, 314, 322, 328, 355–361, 91, 92, 381/122, 324
See application file for complete search history.

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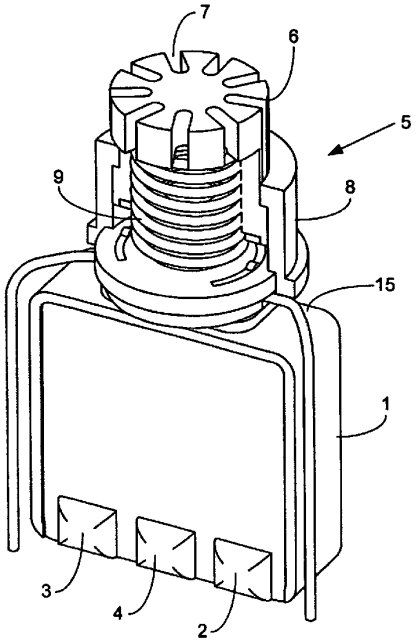
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Primary Examiner — Huyen D Le
(74) *Attorney, Agent, or Firm* — Harness, Dickey & Pierce, P.L.C.

(57) **ABSTRACT**

A microphone assembly for mounting in an electronic communication device, and wherein the microphone assembly comprises one or more sound inlet port(s) with channels (**7**), and one or more microphone(s) inside a housing (**1**). One or more controlling means (**5**) are an integrated part of the microphone assembly, said controlling means comprising a sound inlet part (**6**) composing a button and being surrounded by a second casing part (**8**), the button being loaded by a spring (**9**). The housing (**1**) comprises a terminal (**2**) for grounding the microphone, a terminal (**3**) connected to e.g. a battery, and a terminal (**4**) for signalling out.

35 Claims, 4 Drawing Sheets



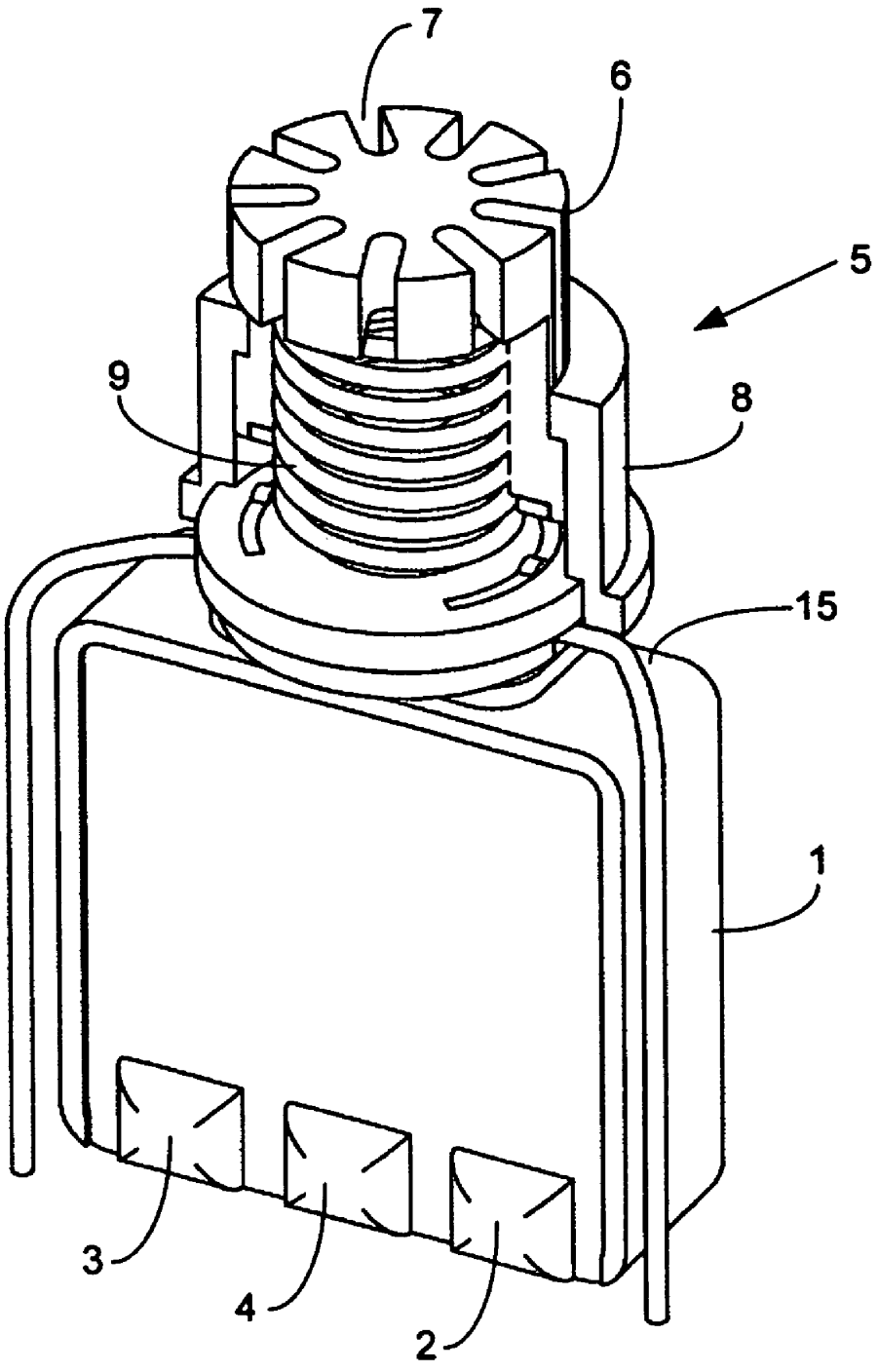


Fig. 1

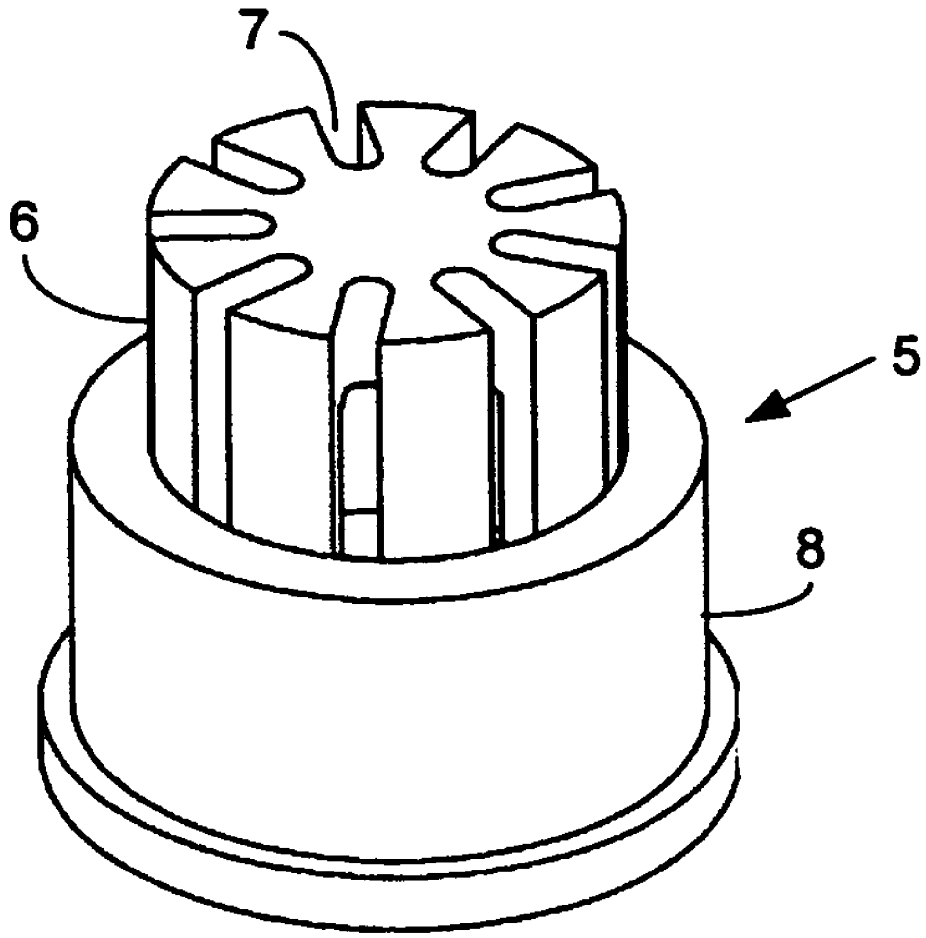


Fig. 2

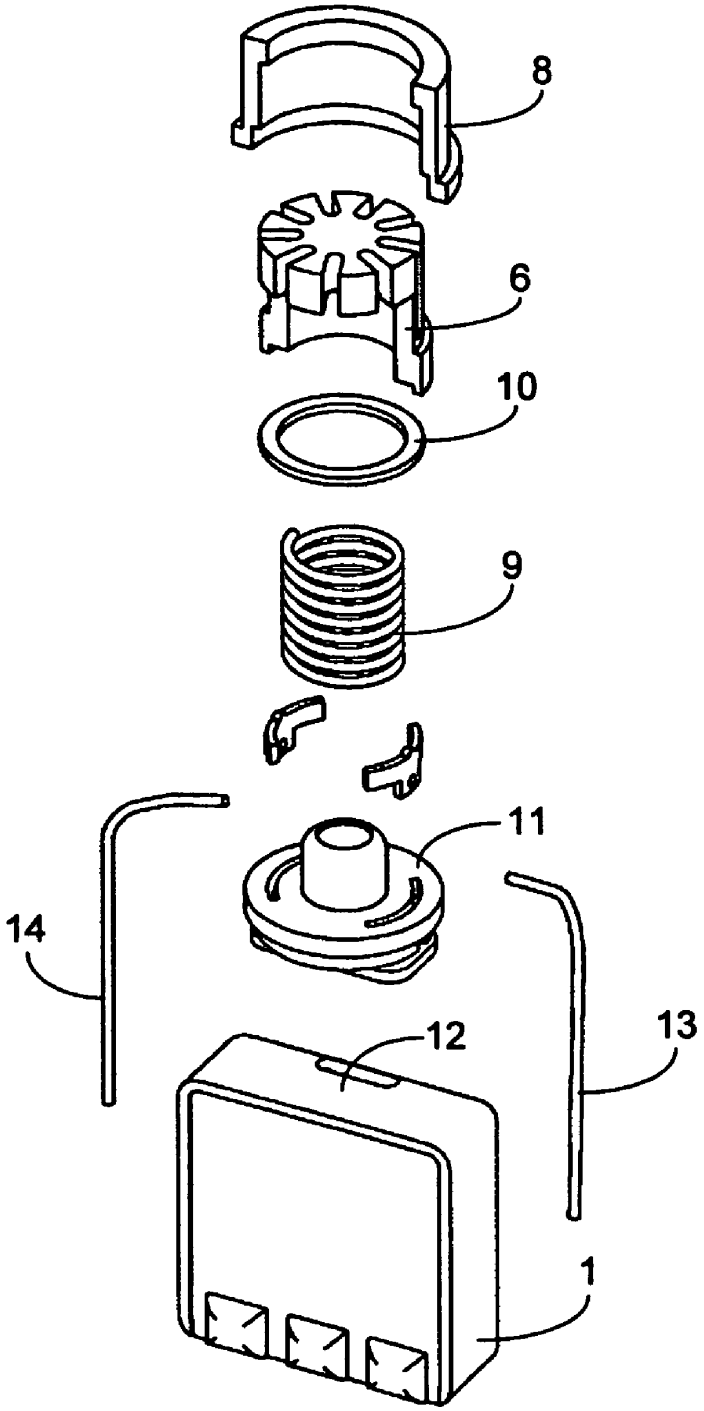


Fig. 3

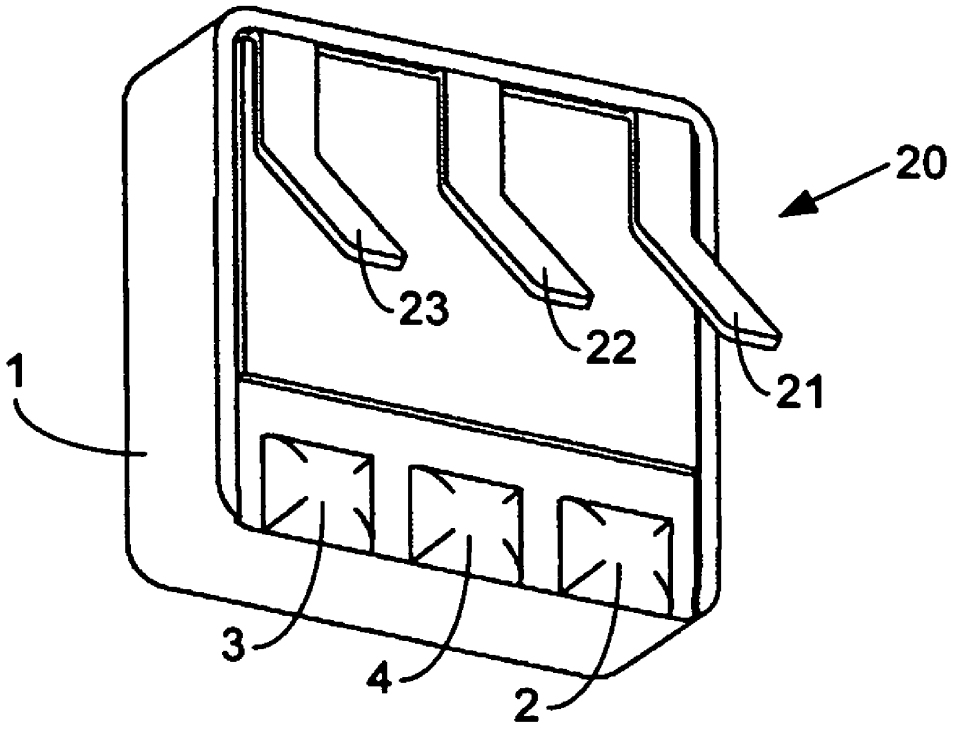


Fig. 4

MICROPHONE ASSEMBLY

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority under 35 U.S.C. §§119 on Provisional Application No. 60/215,068 filed on Jun. 30, 2000.

FIELD OF THE INVENTION

The present invention relates to a microphone assembly for use in electronic communication devices. The microphone assembly has at least one sound inlet port, at least one microphone and at least one controlling means, such as a switch, being an integrated part of the microphone assembly.

BACKGROUND OF THE INVENTION

In nearly all parts of the electronic industry there is a constant striving toward developing smaller electronic communication devices. This development demands a continuous reduction in size for all components commonly utilised in the electronic communication devices.

For example, in the hearing aid industry, the advent of in-the-canal (ITC) type of hearing aids and completely-in-the-canal (CIC) type of hearing aids is only rendered possible because of constantly reductions in the size of the hearing aids. Many users or potential users find it cosmetically attractive to wear an aid that may be completely contained within the ear canal, since this renders the aid invisible, at least in a majority of everyday situations.

Furthermore, hearing aids of the ITC and CIC types provide acoustical benefits compared to a behind-the-ear (BTE) type of instrument. One benefit is improved directional hearing due to a major part of the outer ear being left unblocked by the ITC and CIC hearing aids, thereby preserving the natural directional properties of the outer ear.

A further example is the mobile phones, where the size of the mobile phones has been drastically reduced in recent years, even though they provide an increasing number of features.

Hearing aids as well as mobile phones and headsets are usually provided with one or several controlling means, such as push buttons, switches, etc., which may be located on a face part of the housing. The controlling means may be adapted to provide a number of functions, such as turning the electronic communication device or a part thereof, such as the microphone assembly, on/off, controlling a gain, changing between a number of predetermined programs, and, in the example of hearing aids, changing between a microphone signal and a telecoil signal, etc.

Further, many electronic communication devices are provided with connection means so as to facilitate data communication between an external programming system and a processor or memory device within the electronic communication device.

In a hearing aid for example, the size of utilised components, including the microphone, are constantly reduced so that the available area of faceplate is constantly reduced. Thereby, faceplate area occupied by the controlling and connection means of the hearing aid is an increasing problem for the further miniaturisation of ITC and CIC types of hearing aids.

As the user of the hearing aid must be able to operate the controlling means of the hearing aid this limits the possible reduction in physical dimensions of the hearing aid controlling means.

A number of different functions of the electronic communication devices may be implemented by the present microphone assembly, such as turning a battery supply on/off, adjusting a volume control or trimmer, selecting different states and/or pre-set programs of the electronic communication device, such as selecting between a microphone and a telecoil input signal in a hearing aid, etc., may be provided the present electronic communication device.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an electronic communication device with a microphone assembly that minimises the faceplate area required by the controlling and connection means to solve the above-mentioned disadvantages.

According to a first aspect of the invention, the above-mentioned and other objects are fulfilled by a microphone assembly for mounting in an electronic communication device, the microphone assembly comprising one or more sound inlet port(s), one or more microphone(s) and one or more controlling means, said controlling means being an integrated part of the microphone assembly. The controlling means may be positioned next to the sound inlet port on the same surface part as the sound inlet port or, alternatively, the sound inlet port and the controlling means may be positioned at different surface parts of the microphone assembly.

The combination of the microphone assembly and the sound inlet port with the controlling means, the assembly of e.g. a hearing aid is eased as only one element comprising the controlling means and the sound inlet port has to be fitted into the hearing aid faceplate.

In a preferred embodiment of the present invention the controlling means forms part of the one or more sound inlet port(s). Hereby, the space requirements are heavily reduced as only one element is to be positioned on a surface part of the microphone assembly.

The one or more microphone(s) may comprise a directional microphone having at least two sound inlet spouts each being connected to a sound inlet port, and/or comprise an omni-directional microphone having at least one sound inlet spout connected to a sound inlet port.

In an embodiment, one of the at least two inlet spouts of the directional microphone may merge with the at least one inlet spout of the omni-directional microphone into a combined spout. Thus, the total number of spouts may be reduced from three spouts to two spouts.

By combining a directional and an omni-directional microphone in one assembly, the user has the possibility to change between at least two modes; one directional mode if the user only wants to hear sound from one preferred direction (e.g. telephone conversation), and one omni-directional mode if the user wants to hear sound from a plurality of directions (e.g. in the traffic).

Each sound inlet port and/or each microphone may comprise controlling means for controlling the operation of the whole electronic communication device and/or the operation of the microphone.

The sound inlet spouts of the one or more directional microphones and/or omni-directional microphones may be combined with one or more spouts of external microphones outside the assembly.

Thus, two, three or more microphones may be mounted in one assembly, so that is possible to have a plurality of combined microphones in e.g. a housing of a hearing aid. Combining the microphones may reduce the number of sound

inlets and controlling means. However, the number of controlling means may depend on how many operations there have to be controlled.

For example can two microphones with the same frequency response be combined and used in directional applications. The controlling means may also be combined.

The controlling means may be positioned so as to facilitate operation of the at least one controlling means by applying a predetermined force to an integrated part of the microphone assembly. The predetermined force may be any force, such as force applied by the user of the electronic communication device, such as shear stress or normal stress, such as torque, etc.

The at least one controlling means may comprise one or more switches, such as a push button, a turning knob, such as a switch responsive to a force applied to tragus, etc. The switch may be adapted to e.g. electrically connect and disconnect two externally accessible switch terminals or switch between an on-state and an off-state of the microphone assembly.

For example in a headset, the possibility of turning the microphone assembly off at the microphone itself may be very convenient to the headset user.

Furthermore, at least one of the controlling means may be a volume control, so as to regulate e.g. the volume of the sound reaching the user of a hearing aid or so as to regulate the volume of an incoming call in a mobile telephone.

Still further, the controlling means may be adapted to provide at least one control signal adapted to control operations of the electronic communication device. The control signal may further be adapted to control operations of the microphone assembly and other components of the assembly, such as the one or more microphone(s).

The control signal may, for example, be adapted to power the electronic communication device down and/or to activate the electronic communication device.

The controlling means and control signal may be adapted to control the calibration of the one or more microphone(s).

In a preferred embodiment, the switch is a push button comprising at least a first and a second part positioned so that at least a part of the first part is surrounded by at least a part of the second part and the first part further being adapted to be moved relative to the second part. By activating the push button all or at least some of the above-mentioned functionalities may be achieved.

The electronic communication device may comprise a number of predetermined programs and the one or more controlling means may then be adapted to provide a control signal to switch the electronic communication device between the number of predetermined programs. The predetermined programs may be stored in any memory, such as an electronic memory, such as an EEPROM, etc. The memory may be positioned in the microphone assembly or more preferably in the electronic communication device.

In a hearing aid, for example, the predetermined programs may be any listening programs so as to allow the user to select a listening program specifically designed to the current acoustical environment, i.e. to select one program for use in the traffic and another program for telephone conversations etc.

Another example is in a mobile phone, where the predetermined programs may comprise any programming of the mobile phone, such as for example adapting a dial tone according to the situation: discrete when in meetings, louder in the traffic, etc.

In order to minimise noise in the controlling means, the controlling means may be adapted to control the switch, the volume control, etc, so that the controlled operation, i. e. the switching, the volume level, etc., is performed smoothly. For example, if the switch, the volume control, etc., induce a change in capacity between two parts, the change may be read by a circuit adapted to read the change(s) in capacitance between the two parts, so that the control operation become smooth without inducing unnecessary noise in the controlling means.

The assembly may further comprise a connector comprising one or more connection means, the connector and the one or more connection means may form an integrated part of the microphone assembly. Preferably, the connection means protrudes from a surface part of the assembly.

Having the connector forming part of the microphone assembly saves space as only the connection means may protrude from a surface part of the microphone. Hereby, the addition of for example an add-on adapter comprising the connector is unnecessary, which makes it possible to manufacture the present microphone assembly with a width 1-2 mm less than the width of a conventional microphone and an add-on adapter. Accordingly, the present microphone assembly makes it possible to save a substantially area of the face part of the hearing aid.

The electronic communication device may comprise one or more processing means having a programming port, and wherein a number of connection means in a first end is connected to the programming port of the processing means and in a second end is adapted to form operative connection to an external programming system so that at least one communication channel is formed between the programming port and the external programming system.

The processing means may not only program the whole electronic communication device, but also the microphone(s) or other components of the device. Preferably, the processing means forms an integrated part of the microphone assembly and/or the one or more microphone(s). Alternatively or additionally, the processing means may be located outside the assembly.

The processing means and the controlling means may not only be adapted to program, but also to calibrate the one or more microphones. Thus, as the assembly may comprise two or more microphones, it may also comprise two or more processing means.

The microphone assembly may comprise processing means for each of the microphones or for just some of them. The processing means may comprise any processor, such as a general purpose or a proprietary Digital Signal Processor (DSP), and the communication channel may be provided by means of a cable, by means of infra red radiation (IR), by radio frequencies (RF), or by any other communication means.

One communication channel may comprise a channel for transmission of data signals between the processing means and the external programming system. Furthermore, communication channels may be provided for the transmission of a clock signal, a battery voltage, or to provide for grounding of the electronic communication device. Still further, the data signals may be communicated asynchronously or synchronously between the external programming system and the processor.

The external programming system may for example be a programming system adapted to communicate and program a hearing aid processor to adjust the hearing aid to optimally compensate a hearing loss of the patient involved.

The one or more connection means may be adapted to provide contact to a power source, such as a battery, for the microphone assembly. The assembly may comprise more than one battery.

For example in a hearing aid, the battery terminals have hitherto been cast in the faceplate. This is a complicated process where the battery terminals must be provided in the mould adding costs and complexity to the manufacturing process. By adapting the battery connector to provide these battery terminals forming part of the microphone assembly therefore reduces the overall costs and complexity of the hearing aid manufacturing.

Furthermore, the microphone assembly may contain one or more moisture and/or contamination filter(s) forming part of the controlling means. Typically, a moisture filter is provided as a narrow-mesh net positioned just above the sound inlet. By combining the moisture filter with the controlling means the difficult positioning of the tiny net is avoided so that the time and cost in assembling the microphone assembly is reduced.

Still further, the microphone assembly may comprise one or more damping grid(s) for controlling the frequency response of the microphone(s). The damping grid may form part of the controlling means and may, for example, form part of the moisture filter. Depending upon the size of the grid and particularly upon the size of the openings in the grid, the frequency response of the microphone(s) may be controlled. Having, for example, smaller holes in the grid will result in a more significant damping of the peak signal of the microphone(s).

According to a second aspect of the invention the microphone assembly may comprise a connector comprising one or more connection means, and wherein the connector and the connection means form an integrated part of the microphone assembly. The one or more connection means may protrude from a surface part of the microphone assembly or be located inside the one or more microphone(s).

The one or more connection means may be adapted to provide contact to a power source, such as a battery, for the microphone assembly.

The electronic communication device may comprise one or more processing means having a programming port, and wherein a number of connection means in a first end is connected to the programming port of the processing means and in a second end is adapted to form operative connection to an external programming system so that at least one communication channel is formed between the programming port and the external programming system.

The microphone assembly according to the second aspect may comprise any features and elements mentioned in connection with the microphone assembly according to the first aspect.

The microphone assembly according to the first and/or second aspect may be mounted in any communication device, such as mobile phones/terminals, headsets, assisting listening devices, or hearing aids. The assembly may be used to other devices than electronic communication devices, such as audio recording devices.

According to a third aspect of the invention, a method for controlling an electronic communication device comprising a microphone assembly according to the first aspect, wherein one or more of the controlling means is positioned in a frame of the electronic communication device so as to facilitate operation of the controlling means by a user of the electronic communication device, the method comprising the steps of:

applying a predetermined force to an integrated part of the microphone assembly,

detecting a control signal in response to the applied force, and

operating the processing means of the electronic communication device according to the detected control signal, whereby the electronic communication device is operated according to the operation of the controlling means.

BRIEF DESCRIPTION OF THE DRAWINGS

In the following, a preferred embodiment of a microphone assembly will be described with reference to the drawings, wherein

FIG. **1** shows a microphone assembly according to a preferred embodiment of the present invention,

FIG. **2** shows the sound inlet port and the switch,

FIG. **3** is an exploded view of the microphone assembly, and

FIG. **4** shows a microphone assembly and a connector having three connection means.

DETAILED DESCRIPTION OF THE DRAWINGS

With reference to FIG. **1**, a microphone assembly according to a preferred embodiment of the present invention is shown. In this preferred embodiment the controlling means is a push button.

In the microphone housing **1** three terminals are provided: a terminal **2** for grounding the microphone, a terminal **3** connected to e.g. the battery voltage or a regulated supply, and a terminal **4** for signal out (i.e. sound out).

The sound inlet port **5** is positioned on top of the microphone on a surface part **15** of the microphone, and comprises a first sound inlet part **6** having a form so as to allow the sound to proceed to a sound inlet aperture (see FIG. **3**) in the microphone housing **1**. The sound inlet part may for example be provided with a number of channels **7** allowing the sound to proceed to the sound inlet aperture. The sound inlet port **5** further comprises a second casing part **8** surrounding at least part of the first sound inlet part **6**. The first sound inlet part **6** may be movable relative to the second casing part **8**, and the second casing part may further surround a spring **9**. The spring may be fabricated of a metal, such as copper, such as steel, etc, or of a suitable plastic material.

FIG. **2** shows the controlling means corresponding to the sound inlet port **5** comprising the first sound inlet part **6** having sound channels **7** and the second casing part **8**. By controlling the size and/or amount of the channels **7**, the damping of the microphone signal may be controlled. Hereby, no external damping grid need to be applied, resulting in a cost effective and less complex design of the microphone.

Furthermore, if, for example, the first sound inlet part **6** is performed in a conductive material, preferably a material having a low conductivity, then movement of the first sound inlet part **6** in relation to the microphone housing **1** and/or a switch contact would induce a change in capacitance. Hereby, a smooth operation of the controlling means is obtained. The change in capacitance may be read by a reasonable simple IC, not shown.

In FIG. **3**, an exploded view of the microphone assembly is shown. The microphone assembly comprises a second casing part **8**, a first sound inlet part **6**, a contact plate **10**, a spring **9**, and a sound inlet spout **11** positioned above a sound inlet aperture **12** in the microphone housing **1**. Two wires **13**, **14** are in a first end connected to the sound inlet spout, and when the

parts constituting the microphone assembly are assembled, the depression of the first sound inlet part connects/disconnects the wires **13** and **14**.

The connection/disconnection of the wires **13** and **14** may provide a simple connection/disconnection of the hearing aid battery (not shown), so that the hearing aid is turned on/off accordingly.

In a further example, the connection/disconnection of the wires **13** and **14** may trigger a control signal to be sent. A second end of the wire **13** may for example be grounded whereas a second end of the wire **14** may be connected to a processor, such as a DSP. The processor may then read the control signal provided by the wire **14**. The control signal may for example be logic "0" or low as long as the push button is not depressed, i.e. the wires **13** and **14** are not connected. When the push button is depressed, the wires **13** and **14** are connected providing a pulse in the control signal as the control signal is changed to logic "1" or high. Now, the processor may respond either to a rising edge of the pulse, or to a falling edge of the pulse. Alternatively, the processor may be adapted to respond to the logic level of the control signal.

The processor may then be adapted to, for example, change between prestored programs when the rising edge of a pulse is sensed, or the gain of the hearing aid may be lowered in proportion to the sensed duration of a particular logic state of the control signal.

FIG. **4** shows a microphone assembly according to the second aspect of the invention. In the microphone housing **1**, three terminals **2**, **3** and **4** are provided as in FIG. **1**.

Furthermore, a connector **20** having three connection means **21**, **22** and **23** are provided. These terminals **21**, **22** and **23** are in a first end connected to a programming port (not shown) of a processor and are in a second end adapted to form operative connection to an external programming system (not shown) so that a communication channels with signals DATA, CLOCK and GND are formed between the programming port and the external programming system.

The communication channels may be provided by means of a cable, by means of infra red radiation (IR), by radio frequencies (RF), or by any other communication means.

Alternatively, four connection means may be provided in the present microphone assembly so that a conductor for the providing the battery voltage is included. In another alternative the clock signal may be omitted and asynchronous data transmission between the processor and the programming system provided.

In this preferred embodiment the external programming system is a programming system adapted to adjust each individual hearing aid according to the hearing loss of the patient involved.

Alternatively or concurrently, two connection means, such as flat springs, may be adapted to provide contact to a power source, such as a battery, for the hearing aid.

The invention claimed is:

1. A microphone assembly including a casing mounted in an electronic communication device, the microphone assembly comprising:

one or more sound inlet ports,

one or more microphones within the casing,

one or more channels for allowing sound to pass through the one or more sound inlet ports to the one or more microphones, and

one or more electrical controlling devices within the casing that can be operated by a user for selectively controlling the operation of the assembly,

wherein the one or more sound inlet ports, the one or more microphones and the one or more electrical controlling devices are combined to form an integrated microphone assembly, and

wherein the one or more electrical controlling devices form part of the one or more sound inlet ports and can be operated by the user without affecting a configuration of any of the one or more sound inlet ports, any of the one or more channels and any path the sound will follow from the one or more sound inlet ports to the one or more microphones.

2. A microphone assembly according to claim **1**, wherein the one or more microphones comprises a directional microphone having a sound inlet spout connected to a sound inlet port.

3. A microphone assembly according to claim **1**, wherein the one or more microphones comprises an omni-directional microphone having at least one sound inlet spout connected to a sound inlet port.

4. A microphone assembly according to claim **1**, wherein each sound inlet port or each microphone comprises electrical controlling devices.

5. A microphone assembly according to claim **1**, wherein the electrical controlling devices is positioned so as to facilitate operation by applying a force to the integrated microphone assembly.

6. A microphone assembly according to claim **5**, wherein the operations of the electronic communication device comprises powering the electronic communication device down and/or activating the electronic communication device.

7. A microphone assembly according to claim **1**, wherein the electrical controlling device comprises a switch.

8. A microphone assembly according to claim **7**, wherein at least one of the electrical controlling device is adapted to switch between an on-state and an off-state of the microphone assembly.

9. A microphone assembly according to claim **1**, wherein the controlling means is adapted to provide at least one control signal.

10. A microphone assembly according to claim **9**, wherein the at least one control signal is adapted to control operations of the electronic communication device.

11. A microphone assembly according to claim **9**, wherein the at least one control signal is further adapted to control operations of the microphone assembly.

12. A microphone assembly according to claim **9**, wherein the electronic communication device comprises a number of predetermined programs and wherein the one or more controlling means is adapted to provide a control signal to switch the electronic communication device between the number of predetermined programs.

13. A microphone assembly according to claim **1**, wherein the electrical controlling device is adapted to control calibration of the one or more microphones.

14. A microphone assembly according to claim **1**, wherein the microphone assembly further comprises a connector comprising one or more connection means, the connector and the connection means form an integrated part of the microphone assembly.

15. A microphone assembly according to claim **14**, wherein the electronic communication device comprises one or more processing means having a programming port, and wherein a number of connection means, in a first end, is connected to the programming port of the processing means and, in a second end, is adapted to form operative connection to an external programming system so that at least one com-

munication channel is formed between the programming port and the external programming system.

16. A microphone assembly according to claim **15**, wherein the processing means is adapted to program the electronic communication device and/or the one or more microphone(s).

17. A microphone assembly according to claim **15**, wherein the processing means forms an integrated part of the microphone assembly or the one or more microphone(s).

18. A microphone assembly according to claim **15**, and comprising processing means for each of the microphone.

19. A microphone assembly according to claim **15**, wherein the processing means comprises a Digital Signal Processor.

20. A microphone assembly according to claim **15**, wherein the at least one communication channel is provided by means of a cable, by means of infra red radiation (IR), or by radio frequencies (RF).

21. A microphone assembly according to claim **15**, wherein the at least one communication channel comprises a channel for transmission of data signals between the processing means and the external programming system.

22. A method for controlling an electronic communication device comprising a microphone assembly according to claim **15**, wherein one or more of the controlling means is positioned in a frame of the electronic communication device so as to facilitate operation of the controlling means by a user of the electronic communication device, the method comprising the steps of: applying a predetermined force to an integrated part of the microphone assembly, detecting a control signal in response to the applied force, and operating the processing means of the electronic communication device according to the detected control signal, whereby the electronic communication device is operated according to the operation of the controlling means.

23. A microphone assembly according to claim **14**, wherein at least one connection means is adapted to provide contact to a power source for the microphone assembly.

24. A microphone assembly according to claim **23**, wherein the power source is a battery.

25. A hearing aid, a mobile phone and/or a headset comprising a microphone assembly according to claim **1**.

26. The microphone assembly according to claim **1**, wherein the electrical controlling device includes a user operable actuator having a generally rounded outer configuration.

27. A microphone assembly for mounting in an electronic communication device, the microphone assembly comprising:

a microphone housing;

a sound inlet port for passing sound to the microphone housing;

a channel for allowing sound to pass through the sound inlet port to a microphone, and

wherein an electrical controlling device forming at least part of the sound inlet port, the electrical controlling device being operable by a user for selectively controlling operation of the microphone assembly and without affecting any path the sound will follow from the sound inlet port to the microphone housing.

28. The microphone assembly set forth in claim **27**, wherein the electrical controlling device is disposed at least partly within the sound inlet port.

29. The microphone assembly set forth in claim **27**, wherein the electrical controlling device includes a first part and a second part, the first part of the electrical controlling device being movable relative to both the second part of the electrical controlling device and the microphone housing.

30. The microphone assembly set forth in claim **29**, wherein the first part of the electrical controlling device includes channels for allowing sound to pass through the sound inlet port to the microphone housing.

31. The microphone assembly set forth in claim **30**, wherein the first part of the electrical controlling device includes a push button.

32. The microphone assembly set forth in claim **27**, wherein the electrical controlling device includes channels that extend at least partly into the sound inlet port for allowing sound to pass through the sound inlet port to the microphone housing.

33. The microphone assembly set forth in claim **27**, wherein the microphone housing includes an outer surface and an inlet formed in the outer surface, the sound inlet port being disposed adjacent the outer surface of the microphone housing generally over the inlet for passing sound to the microphone housing.

34. The microphone assembly set forth in claim **27**, wherein the electrical controlling device includes an actuator having a generally rounded outer configuration.

35. A microphone assembly for mounting in an electronic communication device, the microphone assembly having a sound inlet port, and an electrical controlling device that can be operated by a user for selectively controlling the operation of the assembly and without affecting any path a sound will follow from the sound inlet port to the assembly, said sound inlet port and said electrical controlling device being combined to form an integrated microphone assembly, wherein the electrical controlling device forms part of the sound inlet port, and wherein the electrical controlling device includes a user operable actuator having a generally rounded outer configuration.

* * * * *

Exhibit PA-S

US 20030035551A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2003/0035551 A1**

Light et al. (43) **Pub. Date: Feb. 20, 2003**

(54) **AMBIENT-AWARE HEADSET**

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(21) Appl. No.: **09/933,626**

(22) Filed: **Aug. 20, 2001**

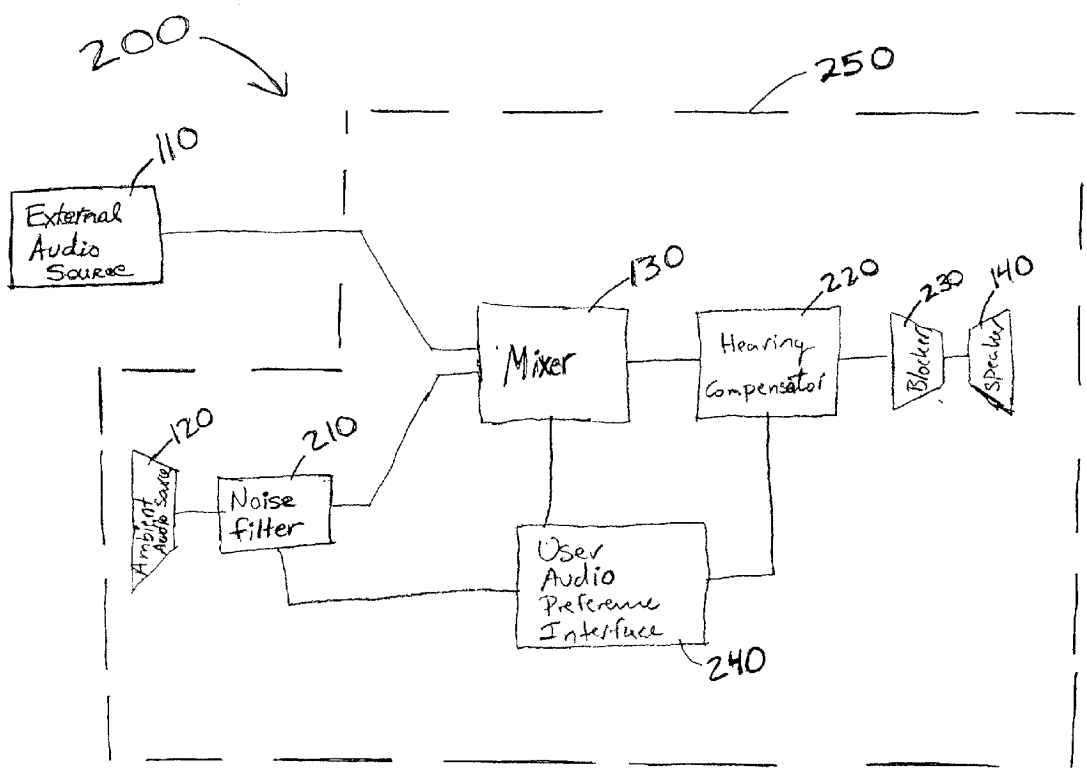
Publication Classification

(51) **Int. Cl.**[7] **A61F 11/06**; G10K 11/16; H03B 29/00

(52) **U.S. Cl.** **381/71.6**; 381/74; 381/94.8

(57) **ABSTRACT**

An ambient-aware headset is described. A mixer coupled to an external audio source receives an external audio signal. The mixer is also coupled to an ambient audio source to receive an ambient audio signal. The mixer mixes the external audio signal and the ambient audio signal according to a specified relationship. A speaker coupled to the mixer emits the external audio signal and the ambient audio signal into an ear canal of a user after the external audio signal and the ambient audio signal have been mixed by the mixer.



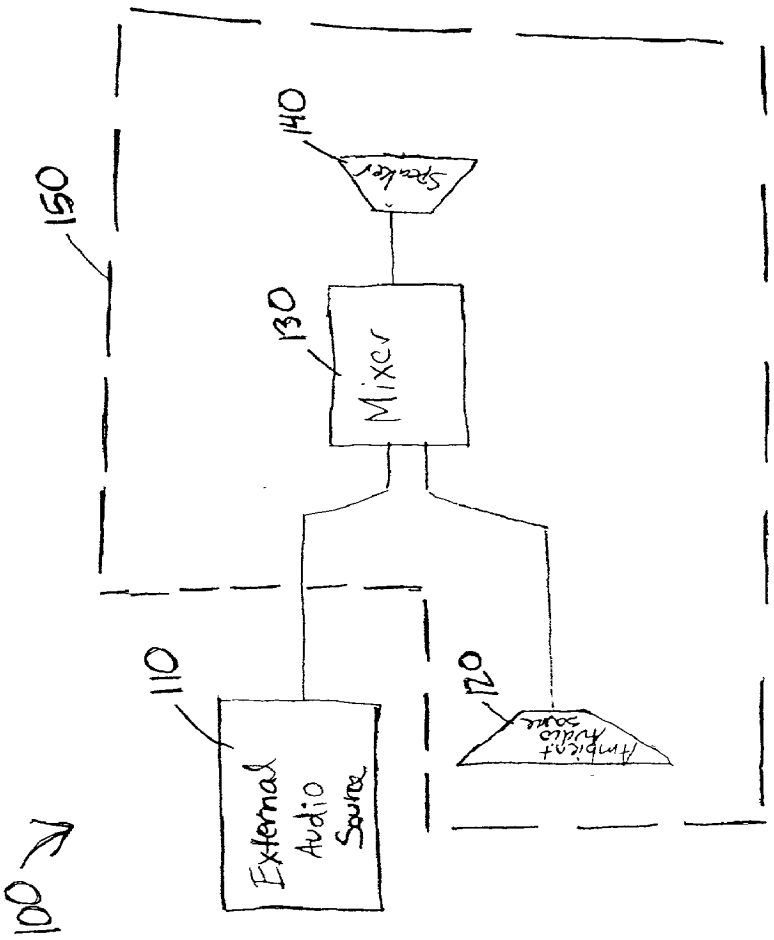

140
Speaker
150
130
Mixer
110
External Audio Source
120
Ambient Audio Source
100

Figure 1

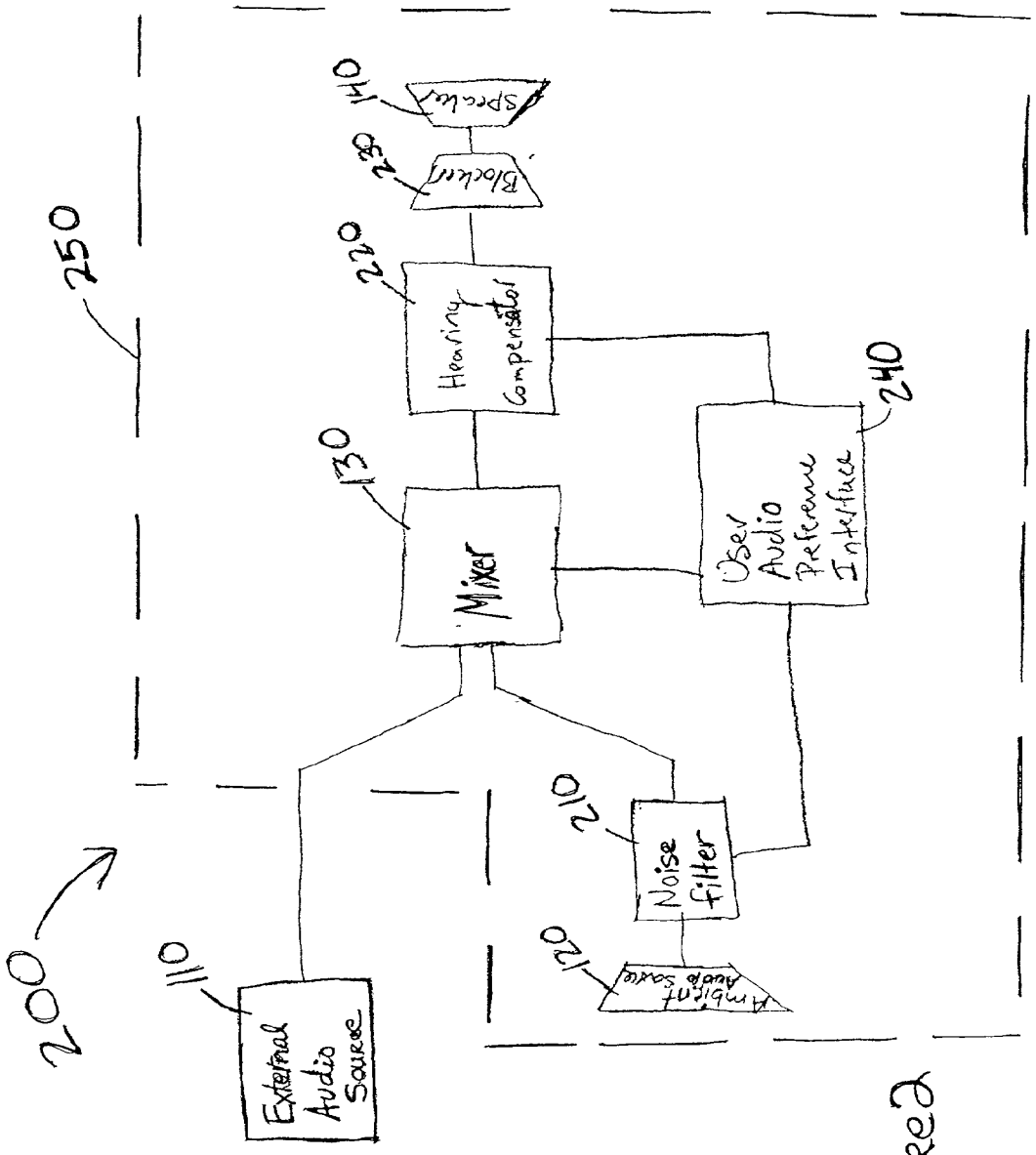

250
140
Speaker
230
Blocker
220
Hearing Compensator
240
User Audio Preference Interface
130
Mixer
200
210
Noise filter
110
External Audio Source
120
Ambient Audio Source

Figure 2

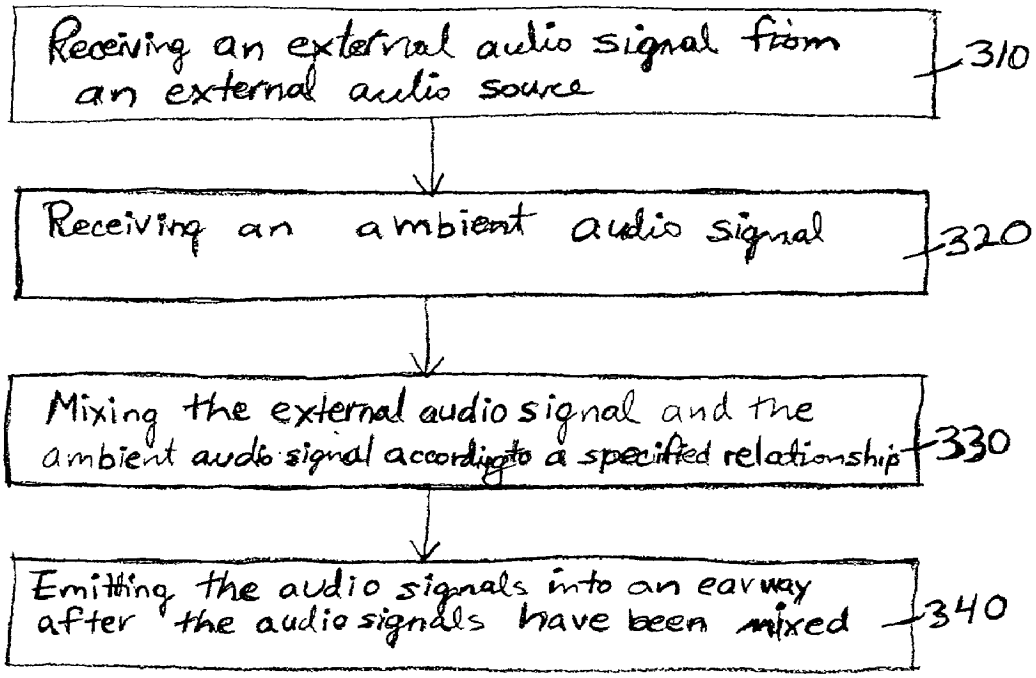

Receiving an external audio signal from an external audio source
310
Receiving an ambient audio signal
320
Mixing the external audio signal and the ambient audio signal according to a specified relationship
330
Emitting the audio signals into an earway after the audio signals have been mixed
340

Figure 3

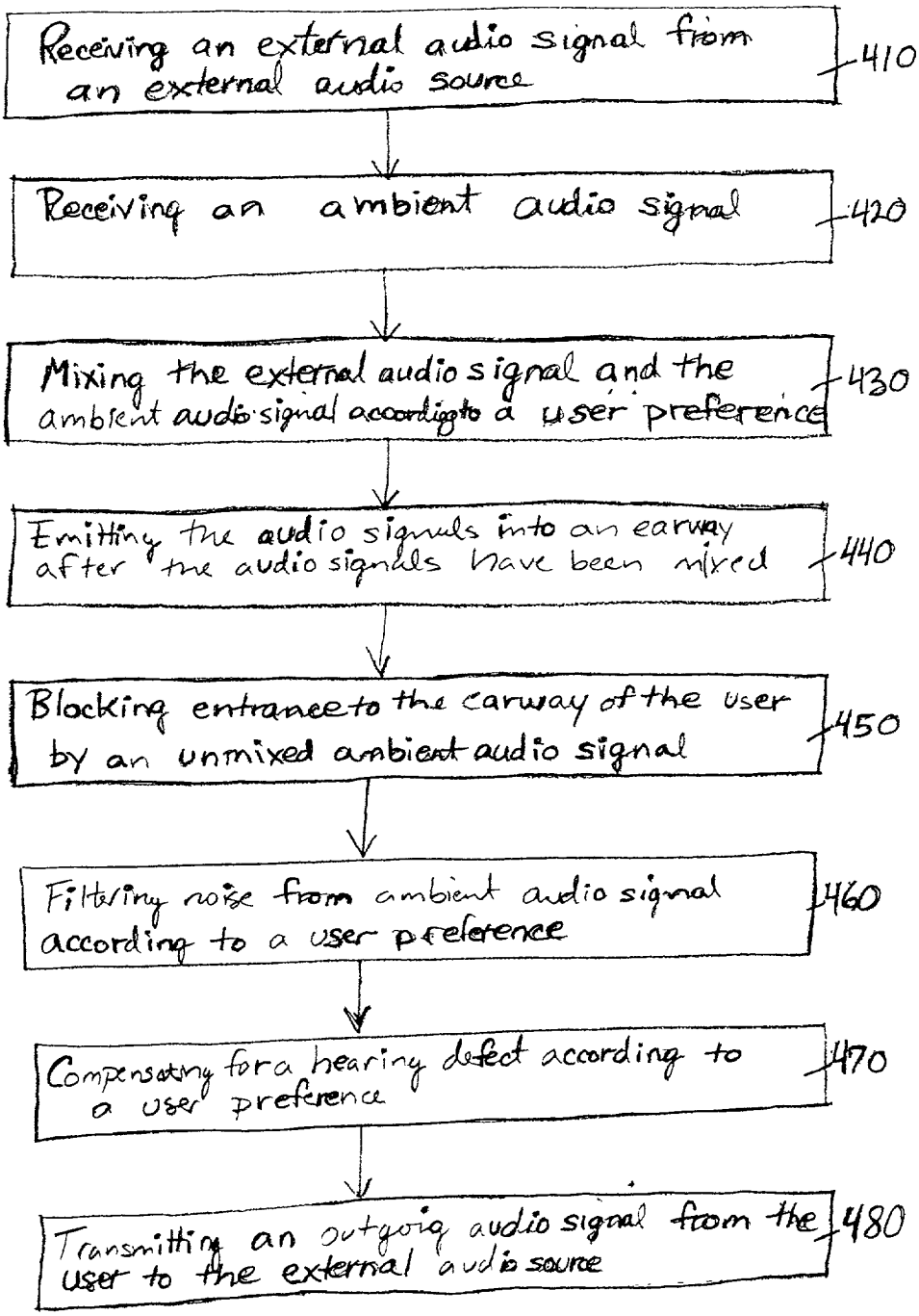

Receiving an external audio signal from an external audio source
410
Receiving an ambient audio signal
420
Mixing the external audio signal and the ambient audio signal according to a user preference
430
Emitting the audio signals into an earway after the audio signals have been mixed
440
Blocking entrance to the earway of the user by an unmixed ambient audio signal
450
Filtering noise from ambient audio signal according to a user preference
460
Compensating for a hearing defect according to a user preference
470
Transmitting an outgoing audio signal from the user to the external audio source
480

Figure 4

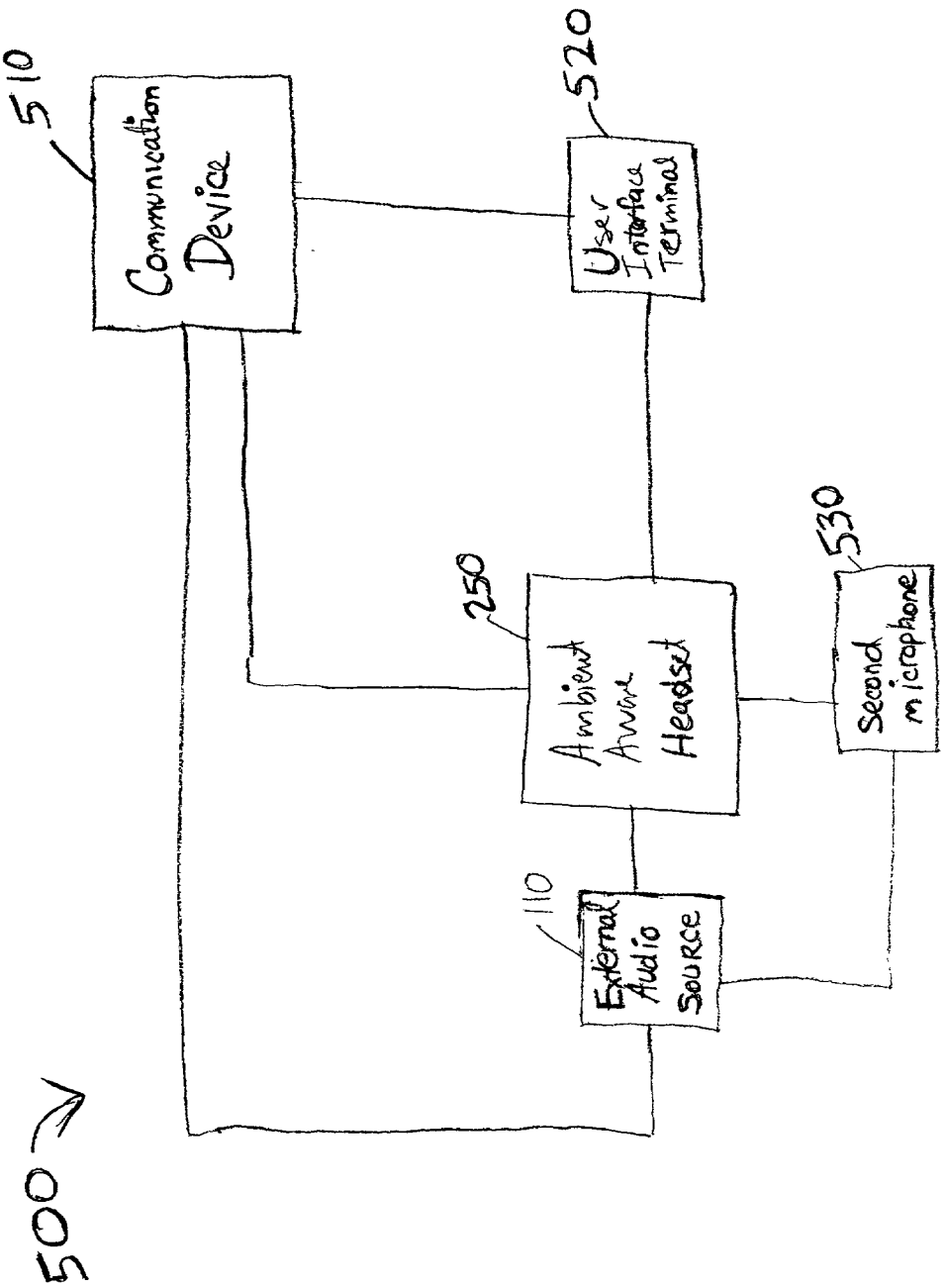

500
510
Communication Device
520
User Interface Terminal
250
Ambient Aware Headset
530
Second microphone
110
External Audio Source

Figure 5

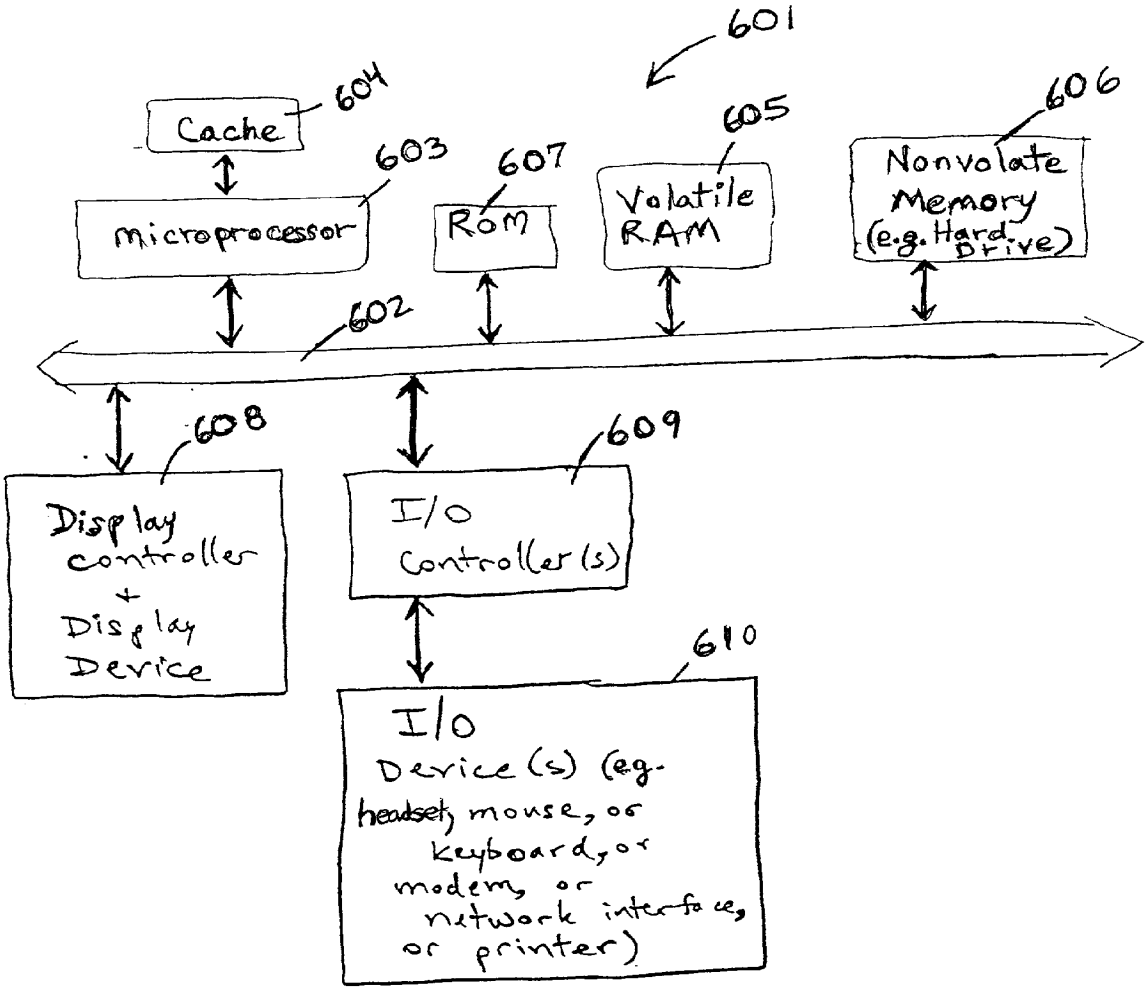

601
Cache
604
603
microprocessor
607
ROM
605
Volatile RAM
606
Nonvolate Memory (e.g. Hard Drive)
602
608
609
Display controller + Display Device
I/O Controller(s)
610
I/O Device(s) (eg. headset, mouse, or keyboard, or modem, or network interface, or printer)

Figure 6

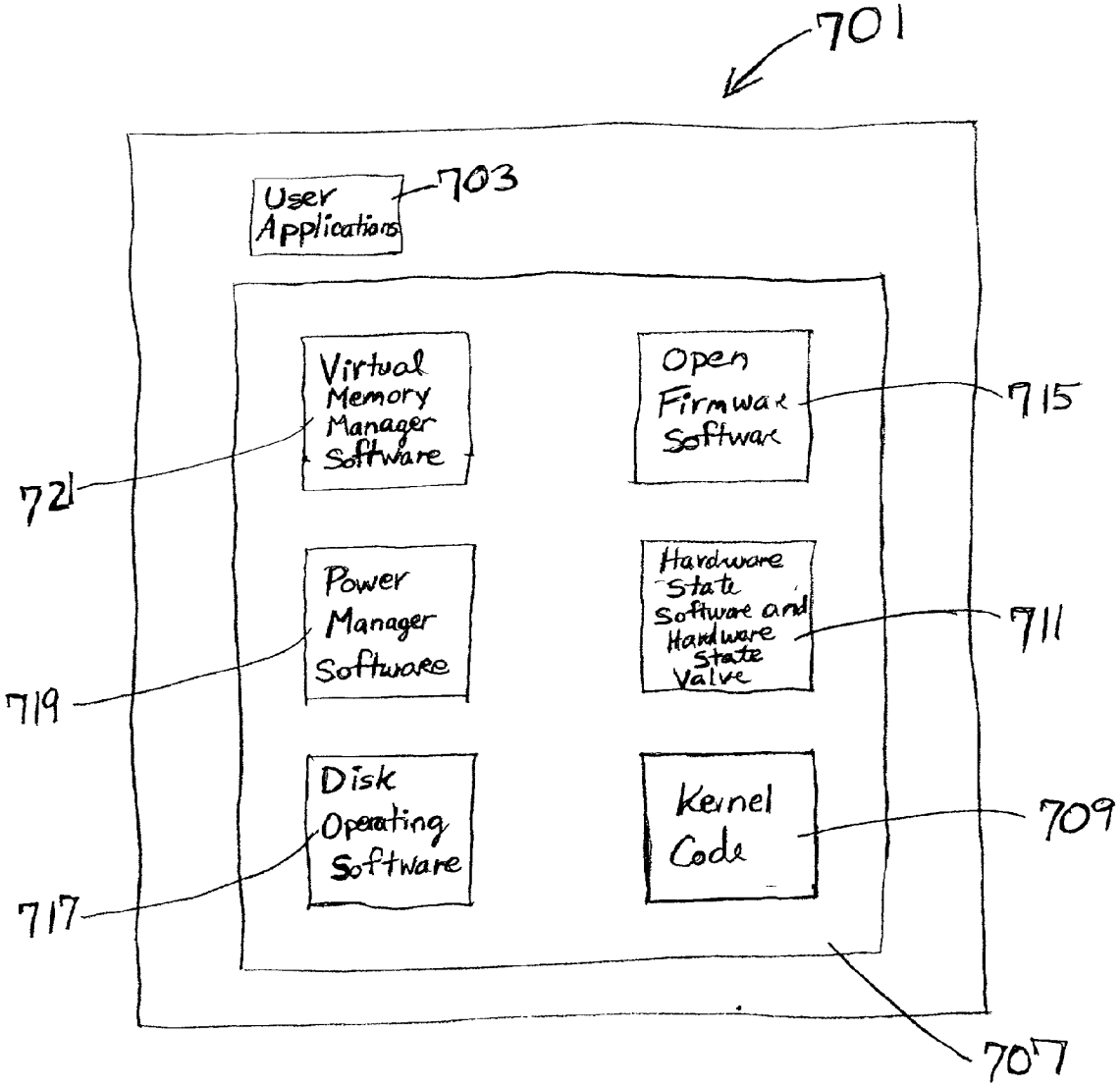

701
User Applications
703
Virtual Memory Manager Software
721
Open Firmware Software
715
Power Manager Software
719
Hardware State Software and Hardware State Valve
711
Disk Operating Software
717
Kernel Code
709
707

Figure 7

AMBIENT-AWARE HEADSET

FIELD OF THE INVENTION

[0001] The field of the invention relates generally to a headset and specifically to a headset having a mixer to process ambient sound.

BACKGROUND

[0002] Headsets and earphones are becoming increasingly popular with the mushrooming in the number and type of portable electronic devices. A headset eliminates the need of the headset wearer to hold a speaker, such as a telephone "receiver" to his ear in order to hear the audio sound or voice being emitted by the speaker. The wearer can thus listen to audio emitted from an electronic device while keeping one or both hands free to do other things.

[0003] One problem, however, with conventional headsets is that they do not restrict outside or "ambient" noise from being heard by the headset wearer. In an attempt to solve this problem, various types of "noise cancellation" headphones have been produced. Noise cancellation headphones generate "anti-noise" waves to "cancel" ambient noise, such as airplane cabin noise. Such headphones can allow the wearer to simultaneously listen to another audio source, such as a personal CD player, through the headphones and also to adjust ambient noise reduction. However, noise cancellation headphones should not be used in certain situations because of the potential dangers of the headset wearer not hearing ambient noise adequately, such as in the case of driving an automobile. If, on the other hand, the headset wearer opts to reduce the level of ambient noise reduction so that he may better hear ambient noise, then, the headset may not filter ambient sounds sufficiently for such purposes as carrying on a wireless telephone conversation. Thus, using a state of the art headset, the headset wearer is limited in how and where he can use his headset.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] **FIG. 1** is a simplified block diagram of one embodiment of an ambient-aware headset according to the present invention.

[0005] **FIG. 2** is a block diagram of another embodiment of an ambient-aware headset.

[0006] **FIG. 3** is a flow diagram of one embodiment of a method for mixing an external audio signal and an ambient audio signal according to a specified relationship.

[0007] **FIG. 4** is a flow diagram of another embodiment of a method for mixing an external audio signal and an ambient audio signal according to a specified relationship.

[0008] **FIG. 5** is a diagram of a system-level overview of an embodiment of the invention.

[0009] **FIG. 6** is a diagram of an operating environment suitable for practicing the invention.

[0010] **FIG. 7** is a diagram of a computer-readable media, which may be used within an operating environment, such as the environment of **FIG. 6**, according to one embodiment of the present invention.

DETAILED DESCRIPTION

[0011] An ambient-aware headset is described. In the following description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the invention. However, it will be apparent to one with ordinary skill in the art that these specific details need not be used to practice the present invention. In other instances, well-known structures and devices are shown in block diagram form in order to avoid unnecessarily obscuring the present invention.

[0012] A mixer coupled to an external audio source receives an external audio signal. The mixer is also coupled to an ambient audio source to receive an ambient audio signal. The mixer mixes the external audio signal and the ambient audio signal according to a specified relationship. A speaker coupled to the mixer emits the external audio signal and the ambient audio signal into an ear canal of a user after the external audio signal and the ambient audio signal have been mixed by the mixer. An ear canal is a narrow tube like passage through which sound enters the ear. Use of an ambient aware headset may enable a headset wearer to interact more seamlessly between physical space and cyberspace. The headset will allow the headset wearer to select the degree to which he will participate in an activity in physical space as opposed to an activity in cyberspace.

[0013] The term "headset" means a device consisting of one or more earphones with a headband for holding them over the ears and sometimes with a mouthpiece attached. It will be appreciated by one skilled in the art that there is no particular physical configuration for the headset described herein. Rather, any configuration which enables the headset wearer to hear an incoming audio signal is contemplated. Such configurations are not limited to those having a headband; a single earpiece inserted directly into the ear of the wearer is also contemplated. The term "user" is used interchangeably with the terms "wearer" and "headset wearer."

[0014] The term "ambient" means of the surrounding area or environment. Thus, "ambient sound" refers to sounds or noises audible within the area surrounding the headset wearer. Ambient sound includes voices and background noise, but the term is not so limited.

[0015] **FIG. 1** is a simplified block diagram of one embodiment of an ambient-aware headset according to the present invention. It will be appreciated that the headset may operate in the context of network environment, such as the environment of **FIG. 5**. In one embodiment, headset **150** is comprised of mixer **130**, ambient audio source **120** and speaker **140**. External audio source **110** is coupled to mixer **130**. External audio source may be a telephone, a audio playing device or a personal electronic device, but the invention is not so limited. Ambient audio source **120** is also coupled to mixer **130**. Ambient audio source **120** may be a microphone to capture ambient sound, but the invention is not so limited. Mixer **130** mixes an external audio signal generated by external audio source **110** and an ambient audio signal communicated ambient audio source **120** to mixer **130** according to a specified relationship. In one embodiment, the specified relationship is determined by a preference input by the user. In another embodiment, mixer **130** further comprises a digital signal processor (DSP) to process the ambient audio signal and external audio signal digitally. Mixer **130** is further coupled to speaker **140**. Speaker **140** emits the external audio signal and the ambient audio signal into an ear canal of a user after the external audio signal and the ambient audio signal have been mixed

by the mixer **130**. In one embodiment, ambient audio source **120**, mixer **130**, and speaker **140** are an integrated assembly.

[**0016**] **FIG. 2** is a block diagram of another embodiment of an ambient-aware headset. In one embodiment, headset **250** is composed of mixer **130**, ambient audio source **120**, noise filter **210**, hearing compensator **220**, blocker **230**, speaker **140** and user audio preference interface (UAPI) **240**. Noise filter **210** is coupled to ambient audio source **120** to filter noise from the ambient audio signal. In one embodiment, the noise is filtered according to an audio preference asserted by the user. The audio preference may be asserted by the user at a user audio preference interface (UAPI) **240**. In another embodiment, the UAPI **240** is coupled to the mixer **130** to receive an audio preference from the user, the audio preference being used to determine the specified relationship according to which the external audio signal and the ambient audio signal are mixed by mixer **130**. Hearing compensator **220** is coupled to mixer **130**. Hearing compensator **220** compensates for a hearing defect of the user. In one embodiment, the hearing defect is compensated for according to an audio preference asserted by the user. The audio preference may be asserted by the user at the UAPI **240**. Blocker **230** is coupled to speaker **140**. Blocker **230** prevents entrance of the ambient audio signal that was not mixed by the mixer from entering the ear canal of the user. In one embodiment, blocker **230** is a component of speaker **140**.

[**0017**] In one embodiment where the mixer **130** further comprises a digital signal processor to process the ambient audio signal and the external audio signal digitally, the DSP may have a noise filter to filter noise coupled to the ambient audio source **120** to filter noise from the ambient audio signal and/or a hearing compensator coupled to the mixer **130** to compensate for a hearing defect of the user.

[**0018**] In one embodiment, the headset further comprises a second microphone coupled to the external audio source for transmitting an outgoing audio signal from the user to the external audio source. For example, the headset may have a microphone for capturing the speech of the headset wearer in a wireless telephone conversation.

[**0019**] **FIG. 3** is a flow diagram of one embodiment of a method for mixing an external audio signal and an ambient audio signal according to a specified relationship. At block **310**, an external audio signal is received from an external audio source. At block **320**, an ambient audio signal is received. At block **330**, the external audio signal and ambient audio signal are mixed according to a specified relationship. In one embodiment, the specified relationship is predetermined by a preference input by a user. At block **340**, the external audio signal and the ambient audio signal are emitted into the ear canal of a user after the external audio signal and the ambient audio signal have been mixed according to the specified relationship.

[**0020**] **FIG. 4** is a flow diagram of another embodiment of a method for mixing an external audio signal and an ambient audio signal according to a specified relationship. At block **410**, an external audio signal is received from an external audio source. At block **420**, an ambient audio signal is received. At block **430**, the external audio signal and ambient audio signal are mixed according to a specified relationship. In one embodiment, the specified relationship is predetermined by a preference input by a user. At block **440**, the external audio signal and the ambient audio signal are emitted into the ear canal of the user after the external audio signal and the ambient audio signal have been mixed according to the specified relationship. At block **450**, entrance to the ear canal of the user by the ambient audio signal that has not been mixed according to the specified relationship is blocked. At block **460**, noise is filtered from the ambient audio signal. In one embodiment, the filtering is performed according to a preference input by the user. This preference may be pre-defined by the user. At block **470**, compensation is made for a hearing defect of the user. In one embodiment, the compensation is performed according to a preference input by the user. In another embodiment, the compensation is performed according to a preference input by a medical professional. At block **480**, an outgoing audio signal is transmitted from the user to the external audio source.

[**0021**] In one embodiment, the mixing further comprises mixing in digital form using a digital signal processor (DSP). In another embodiment, the noise filtering is performed by a DSP. In yet another embodiment, the hearing compensation is performed by the DSP.

[**0022**] It will be appreciated that the preferences used to modify the audio system before it enters the ear canal may be pre-defined by the headset wearer or any other person.

[**0023**] **FIG. 5** is a diagram of a system-level overview of an embodiment of the invention. Ambient-aware headset **250** is coupled to external audio source **110** to receive an external audio signal. Ambient-aware headset **250** also receives an ambient audio signal. Ambient-aware headset **250** is also coupled to second microphone **530** to transmit an outgoing audio signal from the headset wearer to external audio source **110**. Communication device **510** is communicatively coupled to external audio source **110** and ambient-aware headset **250** to communicate audio data. Communication device **510** may be a wireless telephone transmission tower or a wireless audio data transmission tower, but the invention is not so limited. Communication device **510** and ambient-aware headset **250** may also be communicatively coupled to user interface terminal **520**. User interface terminal **520** may store or relay audio data between communication device **510** and ambient-aware headset **250**. User interface terminal **520** may be a personal computer, but the invention is not so limited.

[**0024**] In one embodiment, a user wearing headset **250** carries on a wireless telephone conversation in which the incoming voice is received at headset **250** via external audio source **110** where external audio source **110** is a wireless phone. The user's voice is captured by second microphone **530** and communicated to external audio source **110**. External audio source **110** communicates incoming and outgoing voice streams with communication device **510**.

[**0025**] **FIG. 6** shows one example of a typical computer system which may be used with the present invention. Note that while **FIG. 6** illustrates various components of a computer system, it is not intended to represent any particular architecture or manner of interconnecting the components as such details are not germane to the present invention. It will also be appreciated that network computers and other data processing systems which have fewer components or perhaps more components may also be used with the present invention.

[**0026**] As shown in **FIG. 6**, the computer system **601**, which is a form of a data processing system, includes a bus

602 which is coupled to a microprocessor 603 and a ROM 607 and volatile RAM 605 and a non-volatile memory 606. The microprocessor 603 is coupled to cache memory 604 as shown in the example of FIG. 6. The bus 602 interconnects these various components together and also interconnects these components 603, 604, 605, and 606 to a display controller and display device 608 and to peripheral devices such as input/output (I/O) devices which may be ambient-aware headsets, mice, keyboards, modems, network interfaces, printers and other devices which are well known in the art. Typically, the input/output devices 610 are coupled to the system through input/output controllers 609. The volatile RAM 605 is typically implemented as dynamic RAM (DRAM) which requires power continually in order to refresh or maintain the data in the memory. The non-volatile memory 606 is typically a magnetic hard drive or a magnetic optical drive or an optical drive or a DVD RAM or other types of memory systems which maintain data even after power is removed from the system. Typically, the non-volatile memory will also be a random access memory although this is not required. While FIG. 6 shows that the non-volatile memory 606 is a local device coupled directly to the rest of the components in the data processing system, it will be appreciated that the present invention may utilize a non-volatile memory which is remote from the system, such as a network storage device which is coupled to the data processing system through a network interface such as a modem or Ethernet interface. The bus 602 may include one or more buses connected to each other through various bridges, controllers and/or adapters as is well known in the art. In one embodiment the I/O controller 609 includes a USB (Universal Serial Bus) adapter for controlling USB peripherals.

[0027] It will be apparent from this description that aspects of the present invention may be embodied, at least in part, in machine-executable instructions, e.g. software. That is, the techniques may be carried out in a computer system or other data processing system in response to its processor, such as a microprocessor, executing sequences of instructions contained in a memory, such as ROM 607, volatile RAM 605, non-volatile memory 606, cache 604 or a remote storage device. In various embodiments, hardwired circuitry may be used in combination with software instructions to implement the present invention. Thus, the techniques are not limited to any specific combination of hardware circuitry and software nor to any particular source for the instructions executed by the data processing system. In addition, throughout this description, various functions and operations are described as being performed by or caused by software code to simplify description. However, those skilled in the art will recognize what is meant by such expressions is that the functions result from execution of the code by a processor, such as the microprocessor 603.

[0028] FIG. 7 shows an example of a computer readable media, which may be used with the data processing system according to one embodiment of the present invention. The computer readable media contains data and executable software which when executed in the data processing system such as a digital processing system cause the system to perform the various methods of the present invention. As noted above, this executable software and data may be stored in various places including for example the ROM 607, the volatile RAM 605, the non-volatile memory 606 and/or the cache 604. Portions of this software and/or data may be stored in any one of these storage devices. The media 701 for example may be primarily the volatile RAM 605 and the non-volatile memory 606 in one embodiment. The user applications 703 represent software applications, which are executing on the computer system, such as a word processing application or a spreadsheet application, an Internet web browser application, or an ambient-aware headset application, such as a headset interface application. The operating system 707 includes the Open Firmware software 715 which may be stored in the ROM 607 and loaded into RAM 605 at boot up. The hardware state software and hardware state value 711 is the software which generates the hardware state value. The kernel code 709 represents the kernel of the operating system and performs numerous tasks. The virtual memory manager software 721 controls the virtual memory process. This typically involves maintaining a map of page data which represents the state of data in all the virtual memory which includes the physical RAM such as volatile RAM 605 and a portion of the non-volatile memory 606 which has been designated as part of the virtual memory of the system. The virtual memory manager software will be performing conventional virtual memory processes as is known in the art. The power manager software 719 performs the various power managing operations such as notifying applications and the system and drivers of changes to the power consumption state of the system. The software may also monitor the state of a computer battery to determine whether sufficient power exists to continue to operate and displays alerts to the user indicating the status of the battery and the power status of the system. The disk operating system software 717 performs the conventional functions of a disk operating system. This typically includes controlling the operation of a hard disk drive which in many examples is the non-volatile memory 606 which serves as a virtual memory for the volatile RAM 605.

[0029] It will be further appreciated that the instructions represented by the blocks in FIGS. 3 and 4 are not required to be performed in the order illustrated, and that all the processing represented by the blocks may not be necessary to practice the invention.

[0030] In the foregoing specification, the invention has been described with reference to specific exemplary embodiments thereof. It will be evident that various modifications may be made thereto without departing from the broader spirit and scope of the invention as set forth in the following claims. The specification and drawings are, accordingly, to be regarded in an illustrative sense rather than a restrictive sense.

What is claimed is:

1. An apparatus comprising:

a mixer coupled to an external audio source to receive an external audio signal;

the mixer coupled to an ambient audio source to receive an ambient audio signal;

the mixer to mix the external audio signal and the ambient audio signal according to a specified relationship; and

a speaker coupled to the mixer to emit the external audio signal and the ambient audio signal into an ear canal of a user after the external audio signal and the ambient audio signal have been mixed by the mixer.

2. The apparatus of claim 1, wherein the ambient audio source, the mixer, and the speaker are an integrated assembly.

3. The apparatus of claim 1, further comprising a blocker coupled to the speaker to prevent entrance of the ambient audio signal that has not been mixed by the mixer from entering the ear canal of the user.

4. The apparatus of claim 1, further comprising a user audio preference interface (UAPI) coupled to the mixer to receive an audio preference from the user, the audio preference being used to determine the specified relationship.

5. The apparatus of claim 1, further comprising a noise filter coupled to the ambient audio source to filter noise from the ambient audio signal.

6. The apparatus of claim 1, further comprising a hearing compensator coupled to the mixer to compensate for a hearing defect of the user.

7. The apparatus of claim 1, the mixer further comprises a digital signal processor (DSP) to process the ambient audio signal and the external audio signal digitally.

8. The apparatus of claim 1, wherein the external audio source is selected from the group consisting of:

a telephone;

an audio playing device; and

a personal electronic device.

9. The apparatus of claim 1, wherein the ambient audio source is a microphone to capture ambient sound.

10. The apparatus of claim 1, further comprising a second microphone coupled to the external audio source for transmitting an outgoing audio signal from the user to the external audio source.

11. A method comprising:

receiving an external audio signal from an external audio source;

receiving an ambient audio signal;

mixing the external audio signal and the ambient audio signal according to a specified relationship; and

emitting the external audio signal and the ambient audio signal into an ear canal of a user after the external audio signal and the ambient audio signal have been mixed according to the specified relationship.

12. The method of claim 11, further comprising blocking entrance to the ear canal of the user by the ambient audio signal that has not been mixed according to the specified relationship.

13. The method of claim 11, wherein the specified relationship is predetermined by a preference input by the user.

14. The method of claim 11, further comprising filtering noise from the ambient audio signal.

15. The method of claim 14, wherein the filtering is performed according to a preference input by the user.

16. The method of claim 11, further comprising compensating for a hearing defect of the user.

17. The method of claim 16, wherein the compensating is performed according to a preference input by the user.

18. The method of claim 16, wherein the compensating is performed according to a preference input by a medical professional.

19. The method of claim 11, further comprising transmitting an outgoing audio signal from the user to the external audio source.

20. A system comprising:

an ambient-aware headset to receive an external audio signal from an external audio source, receive an ambient audio signal from an ambient audio source, mix the external audio signal and the ambient audio signal according to a specified relationship, and emit the external audio signal and the ambient audio signal into an ear canal of a user after the external audio signal and the ambient audio signal have been mixed according to the specified relationship; and

the external audio source communicatively coupled to the headset to receive the external audio signal from a communication apparatus and to provide the external audio signal to the headset.

21. The system of claim 20, further comprising a microphone communicatively coupled to the external audio source and the headset to transmit an outgoing audio signal from the user to the external audio source, the external audio source communicating the outgoing audio signal to the communication apparatus.

22. The system of claim 20, further comprising a user interface terminal communicatively coupled to the communication apparatus and the headset to store audio data and to relay the audio data between the communication apparatus and the headset.

23. A system comprising:

a processing unit:

a memory coupled to the processing unit through a bus; and

an ambient-aware headset interface process executed from the memory by the processing unit to receive an audio data signal from a communication apparatus and to provide the audio data signal to an ambient-aware headset; the headset receiving the audio data signal, receiving an ambient audio signal, mixing the audio data signal and the ambient audio signal according to a specified relationship, and emitting the audio data signal and the ambient audio signal into an ear canal of a user after the audio data signal and the ambient audio signal have been mixed according to the specified relationship

24. The system of claim 23, wherein the communication apparatus is selected from the group comprising:

a wireless telephone signal transmission tower; and

a wireless audio data signal transmission tower.

25. The system of claim 23, further comprising a microphone communicatively coupled to the headset to transmit an outgoing audio signal from the user to the communication device.

26. A machine-readable medium having stored thereon a plurality of instructions, which if executed by a machine, cause the machine to perform a method comprising:

receiving an external audio signal from an external audio source;

receiving an ambient audio signal;

mixing the external audio signal and the ambient audio signal according to a specified relationship; and

emitting the external audio signal and the ambient audio signal into an ear canal of a user after the external audio signal and the ambient audio signal have been mixed according to the specified relationship.

27. The machine-readable medium of claim 26, wherein the method further comprises blocking entrance to the ear canal of the user by the ambient audio signal that has not been mixed according to the specified relationship.

28. The machine-readable medium of claim 26, wherein the method further comprises at least one of the group consisting of:

filtering noise from the ambient audio signal; and

compensating for a hearing defect of the user.

29. The machine-readable medium of claim 26, wherein the specified relationship is predefined by the user.

* * * * *

Exhibit PAT-F

11472-27-1_PRS-118US3

What is Claimed:

1. An earphone comprising a sound passthrough feature:

an Ambient Sound Microphone (ASM) configured to measure an ambient sound from a first port in the earphone, forming a first microphone signal;

an ear canal microphone (ECM) configured to measure sound from a second port in the earphone, forming a second microphone signal;

a partially occluding element, configured to at least partially occlude an ear canal when the earphone is inserted into an ear canal;

a loudspeaker configured to play audio; and

a processor operatively coupled to the ASM, ECM, and loudspeaker, the processor being configured to:

receive an audio content signal;

retrieve from a first computer readable memory a mixing level;

mixing the first microphone signal with the audio content signal to form a first mixed signal;

retrieving from a second computer readable memory a safe listening level;

modifying the first mixed signal using the safe listening level to form a safe mixed signal; and

sending the safe mixed signal to the loudspeaker.

2. The earphone according to claim 1, where the safe listening level is set by a user by adjusting a volume control.

3. The earphone according to claim 2, where the mixing level is set to a minimum value when none of the first microphone signal is to be mixed with the audio content signal.

4. The earphone according to claim 3, where the mixing level is set to maximum when none of the audio content is to be mixed with the first microphone signal.

5. The earphone according to claim 4, where the processor is further configured to:

detect a warning signal in the first microphone signal.

6. The earphone according to claim 5, where the processor is further configured to:

bypassing the mixing of the first microphone signal with the audio content when a warning signal is detected and sending the first microphone signal to the loudspeaker without the audio content.

7. The earphone according to claim 5, where the processor is further configured to:

setting the mixing level to maximum when a warning signal is detected.

8. The earphone according to claim 3, where the first and second ports are on the same side of the partially occluding element.

9. The earphone according to claim 3, where the first and second ports are on opposite sides of the partially occluding element.

10. A method for sound passthrough the method comprising:

measuring an ambient sound external to an ear at least partially occluded by an earphone, where the ambient sound is measured by a first microphone having a first port, and where the measured ambient sound is converted into a first microphone signal by the first microphone;

measuring a second sound, where the second sound is measured from a second microphone having a second port, where the measured second sound is converted into a second microphone signal by the second microphone;

receiving an audio content signal;

retrieving a mixing level from a first computer readable memory;

mixing the audio content signal with the first microphone signal to form a mixed signal, where the amplitude levels of the audio content signal and the first microphone signal are modified in the formation of the mixed signal based upon the mixing level;

retrieving a safe threshold level from a second computer readable memory;

adjusting the mixed signal to play from a loudspeaker at a max sound pressure level less than or equal to the safe threshold level forming a safe mixed signal; and

sending the safe mixed signal to the loudspeaker.

11. The method according to claim 10, where the safe threshold level is set by a user.

12. The method according to claim 11, where the mixing level is set to a minimum value when none of the first microphone signal is to be mixed with the audio content signal to form the mixed signal.

13. The method according to claim 12, where the mixing level is set to maximum when none of the audio content signa is to be mixed with the first microphone signal to form the mixed signal.

14. The method according to claim 13, further comprising:

detecting a warning signal in the first microphone signal.

15. The method according to claim 14, further comprising:

bypassing the step of mixing of the first microphone signal with the audio content signal when a warning signal is detecting and sending the first microphone signal to the loudspeaker without the audio content signal.

16. The earphone according to claim 14, further comprising:

setting the mixing level to maximum when a warning signal is detected.

17. The method according to claim 14, where the second port is closer to a distal end of the earphone than the first port.

Exhibit PAT-F

Electronic Acknowledgement Receipt

EFS ID:	37613660
Application Number:	16669490
International Application Number:	
Confirmation Number:	7747
Title of Invention:	METHOD AND DEVICE FOR ACUTE SOUND DETECTION AND REPRODUCTION
First Named Inventor/Applicant Name:	Steven Wayne Goldstein
Customer Number:	150139
Filer:	John Patrick Keady
Filer Authorized By:	
Attorney Docket Number:	11472-27-1_PRS-118US3
Receipt Date:	30-OCT-2019
Filing Date:	
Time Stamp:	23:03:16
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$785
RAM confirmation Number	E20190TN05266195
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The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

Exhibit PAT-F

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	WebADS.pdf	145832 7e2c6e1d3801b96398acbfa8dce52dd4ea21025c	no	8
Warnings:					
Information:					
2	Oath or Declaration filed	16193568_oath.pdf	235474 bbbeb76b4162219294a43c491ef4a6ec0d192a86	no	3
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3	Abstract	CONT_16193568_abstract.pdf	99806 5caca5f31baff465e39f9270bb213281b2f9af1c	no	1
Warnings:					
Information:					
4	Claims	CONT_16193568_claims.pdf	145702 29ff4cd4930625cc9236860d261865ae70b75401	no	3
Warnings:					
Information:					
5	Drawings-only black and white line drawings	CONT_16193568_drawings.pdf	238228 92704a13796de10ca64e680387ed14a65233299c	no	9
Warnings:					
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6	Specification	CONT_16193568_spec.pdf	335920 3894c8cb8309a326b1c81a9e245511f2c21718f8	no	18
Warnings:					
Information:					

Exhibit PAT-F

7	Fee Worksheet (SB06)	fee-info.pdf	35025 fbc7d77a66e09b4489422c17765909d6754a5996	no	2
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			Total Files Size (in bytes):	1235987	

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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

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Exhibit PAT-F

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
16/669,490	10/30/2019	2654	785	11472-27-1_PRS-118US3	17	2

CONFIRMATION NO. 7747

150139
Akerman LLP
777 South Flagler Drive
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West Palm Beach, FL 33401

FILING RECEIPT

OC000000112772280

Date Mailed: 11/20/2019

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

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Assignment For Published Patent Application

Staton Techiya LLC, Delray Beach, FL

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 16/193,568 11/16/2018
which is a CON of 14/574,589 12/18/2014 PAT 10134377
which is a CON of 12/017,878 01/22/2008 PAT 8917894
which claims benefit of 60/885,917 01/22/2007

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Exhibit PAT-F

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 11/18/2019
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/669,490**
Projected Publication Date: 02/27/2020
Non-Publication Request: No
Early Publication Request: No
**** SMALL ENTITY ****
Title

METHOD AND DEVICE FOR ACUTE SOUND DETECTION AND REPRODUCTION

Preliminary Class

381

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative,

this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

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Exhibit PAT-F

Electronic Acknowledgement Receipt

EFS ID:	38178817
Application Number:	16669490
International Application Number:	
Confirmation Number:	7747
Title of Invention:	METHOD AND DEVICE FOR ACUTE SOUND DETECTION AND REPRODUCTION
First Named Inventor/Applicant Name:	Steven Wayne Goldstein
Customer Number:	150139
Filer:	John Patrick Keady
Filer Authorized By:	
Attorney Docket Number:	11472-27-1_PRS-118US3
Receipt Date:	01-JAN-2020
Filing Date:	30-OCT-2019
Time Stamp:	11:09:15
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Preliminary Amendment	16669490_JPK_preliminary_amend.pdf	150808 60fa7c26b1804ff644d76f5811199b9bee1cd44c	no	4

Warnings:

Exhibit PAT-F

Information:	
Total Files Size (in bytes):	150808

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Exhibit PAT-F

PATENT
11472-27-1_PRS-118US3

IN THE U.S. PATENT AND TRADEMARK OFFICE

Applicant:	Staton Techiya LLC	Conf.: 7747
Appl. No.:	16/669,490	Art Unit: 2688
Filed:	10-30-2019	Examiner: SNIEZEK, ANDREW L
For:	METHOD AND DEVICE FOR ACUTE SOUND DETECTION AND REPRODUCTION	

PRELIMINARY AMENDMENT UNDER 37 CFR § 1.104

Commissioner of Patents
P.O. Box 1450
Alexandria, VA 22313-1450

DUE DATE: Before first Office Action

Sir:

This preliminary amendment under 37 CFR § 1.104 seeks to replace the previously filed, 10-30-2019, claims with the claims herein for examination. Therefore please cancel the originally filed claims 1-17 and replace with the attached new claims 1-20.

Support for the new claims can be found at least in Figure 2 (123, 125, 111) [col. 5, ll. 19-31] , Figure 9 (902, 904, 906, 940, 944) [col. 12, ll. 13-30] and Figure 10 (972) [col. 12, ll. 62-64].

If the Examiner has any questions concerning this application, the Examiner is requested to contact the John P. Keady (571-606-1291) in the Washington DC metro area.

Very truly yours,

By /John P. Keady/
John P. Keady, PhD, Esq.
Reg. No. 56,389

Exhibit PAT-F

Listing of Claims replacing prior filed claims:

1.(new) An earpiece configured to pass through sound from an ambient sound microphone comprising:

a housing, where the housing has a tip end and an ambient environment end;

a processor;

a first microphone configured to measure a first acoustic environment closer to the tip end than the ambient environment end, generating a first microphone signal;

a second microphone configured to measure a second acoustic environment closer to the ambient environment end than the tip end, generating a second microphone signal; and

a speaker configured to play an audio content signal, where the processor is coupled to the first microphone, the second microphone and the speaker, and where the processor is configured, if the earpiece has been placed into pass-through mode, to:

modify the first microphone signal to generate a first modified signal;

modify the second microphone signal to generate a second modified signal;

mix the first modified signal, the audio content signal and the second modified signal to generate a mixed signal; and

send the mixed signal to the speaker.

2.(new) The earpiece according to claim 1, where the earpiece is placed into pass-through mode when the processor detects an acute sound by examining the temporal or spectral characteristics of a portion of the second microphone signal and the examined portion exceeds a threshold value.

3.(new) The earpiece according to claim 2, where the first microphone is an ear canal microphone.

4.(new) The earpiece according to claim 3, where the second microphone is an ambient sound microphone.

5.(new) The earpiece according to claim 4, where the first modified signal is configured to reduce the noise in the first acoustic environment.

6.(new) The earpiece according to claim 5, where noise is defined as the sound in the first acoustic environment that is not a result of playing the audio content and playing the second modified signal.

7.(new) The earpiece according to claim 6, where the processor is configured to modify the audio content signal prior to generating the mixed signal so that the mixed signal is generated by mixing the first modified signal, the second modified signal and the modified audio content signal.

8.(new) The earpiece according to claim 7, further including:
a safe level check system.

9.(new) The earpiece according to claim 8, where the safe level check system checks if the mixed signal would exceed a safe threshold level if played by the speaker.

10.(new) The earpiece according to claim 9, where the safe level check system reduces the amplitude of the mixed signal if the mixed signal would exceed a safe threshold level if played by the speaker.

11.(new) The earpiece according to claim 7, where the modified audio signal is a zero signal.

12.(new) The earpiece according to claim 1, where the earpiece has been placed into pass-through mode by a user operated mode selection.

13.(new) The earpiece according to claim 12, where the first microphone is an ear canal microphone.

14.(new) The earpiece according to claim 13, where the second microphone is an ambient sound microphone.

15.(new) The earpiece according to claim 14, further including:
a second ambient sound microphone generating a third microphone signal.

16.(new) The earpiece according to claim 15, where the processor is configured to examine the second and third microphone signals to determine the presence of a user's voice.

17.(new) The earpiece according to claim 16, further including
a tip, attached to the tip end of the housing.

18.(new) The earpiece according to claim 4, further including
a tip, attached to the tip end of the housing.

19.(new) The earpiece according to claim 18, where the tip is configured to acoustically seal an ear canal when inserted therein.

20.(new) The earpiece according to claim 19, where the tip provides at least 10dB acoustic isolation from 500Hz to 4000Hz.

Exhibit PAT-F

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16669490
Filing Date	2019-10-30
First Named Inventor	Steven Wayne Goldstein
Art Unit	2688
Examiner Name	Andrew L. Sniezek
Attorney Docket Number	11472-27-2_PRS-118US3

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5721783		1998-02-24	Anderson	
	2	5867581		1999-02-02	Obara	
	3	6415034		2002-07-02	Hietanen	
	4	6754359		2004-06-22	Svean et al.	
	5	7006650		2006-02-28	Wild	
	6	7929713		2011-04-19	Victorian	
	7	8077892		2011-12-13	Dijkstra	
	8	8098832		2012-01-17	Lin	

Exhibit PAT-F

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

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First Named Inventor	Steven Wayne Goldstein
Art Unit	2688
Examiner Name	Andrew L. Sniezek
Attorney Docket Number	11472-27-2_PRS-118US3

	9	8213629		2012-07-03	Goldstein et al.	
	10	8229127		2012-07-24	Jorgensen	
	11	8774433		2014-07-08	Goldstein	
	12	9055377		2015-06-09	Kinsbergen	
	13	9137611		2015-09-15	Unno	
	14	9232322		2016-01-05	Fang	
	15	9357314		2016-05-31	Goorevich	
	16	9613622		2017-04-04	Melanson	
	17	10134377		2018-11-20	Goldstein et al.	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16669490
Filing Date	2019-10-30
First Named Inventor	Steven Wayne Goldstein
Art Unit	2688
Examiner Name	Andrew L. Sniezek
Attorney Docket Number	11472-27-2_PRS-118US3

	1	20010046304		2001-11-29	Rast	
	2	20050058313		2005-03-17	Victorian et al.	
	3	20060002574		2006-01-05	Shennib et al.	
	4	20060045282		2006-03-02	Reber	
	5	20060083388		2006-04-20	Rothchild	
	6	20060222194		2006-10-05	Bramslow et al.	
	7	20060262938		2006-11-23	Gauger Jr. et al.	
	8	20070116310		2007-05-24	Ludvigsen	
	9	20070189544		2007-08-16	Rosenberg	
	10	20080159547		2008-07-03	Schuler et al.	
	11	20080181442		2008-07-31	Goldstein et al.	

EFS Web 2.1.18

Exhibit PAT-F

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16669490
	Filing Date	2019-10-30
	First Named Inventor	Steven Wayne Goldstein
	Art Unit	2688
	Examiner Name	Andrew L. Sniezek
	Attorney Docket Number	11472-27-2_PRS-118US3

	12	20080240458		2008-10-02	Goldstein et al.	
	13	20080260191		2008-10-23	Victorian et al.	
	14	20110195676		2011-08-11	Victorian et al.	
	15	20120020485		2012-01-26	Visser et al.	
	16	20160021469		2016-01-21	Victorian et al.	
	17	20050058301		2005-03-17	Brown	

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Exhibit PAT-F

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Application Number	16669490
	Filing Date	2019-10-30
	First Named Inventor	Steven Wayne Goldstein
	Art Unit	2688
	Examiner Name	Andrew L. Sniezek
	Attorney Docket Number	11472-27-2_PRS-118US3

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EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

Exhibit PAT-F

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16669490
Filing Date	2019-10-30
First Named Inventor	Steven Wayne Goldstein
Art Unit	2688
Examiner Name	Andrew L. Sniezek
Attorney Docket Number	11472-27-2_PRS-118US3

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Peter A. Chiabotti/	Date (YYYY-MM-DD)	2020-02-28
Name/Print	Peter A. Chiabotti	Registration Number	54603

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Exhibit PAT-F

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The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

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Exhibit PAT-F

Electronic Acknowledgement Receipt

EFS ID:	38729609
Application Number:	16669490
International Application Number:	
Confirmation Number:	7747
Title of Invention:	METHOD AND DEVICE FOR ACUTE SOUND DETECTION AND REPRODUCTION
First Named Inventor/Applicant Name:	Steven Wayne Goldstein
Customer Number:	150139
Filer:	Peter Allen Chiabotti/Angela Martin
Filer Authorized By:	Peter Allen Chiabotti
Attorney Docket Number:	11472-27-1_PRS-118US3
Receipt Date:	28-FEB-2020
Filing Date:	30-OCT-2019
Time Stamp:	17:08:51
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	11472-27-2_IDS.PDF	1051729 3f6e646b240dde99aa8b29b6dab852c1cd86a584	no	7

Warnings:

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Information:					
2	Power of Attorney	11472-27-2_POA-Executed.PDF	68755 f58120e904276d6eba18a5c4a5aa2ce720df5f06	no	1
Warnings:					
Information:					
3	Assignee showing of ownership per 37 CFR 3.73	11472-27-2_CFR_Statement.PDF	131392 14ecac52924965773343d9cb1c15d6f3d4260116	no	3
Warnings:					
Information:					
		Total Files Size (in bytes):	1251876		

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New Applications Under 35 U.S.C. 111

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New International Application Filed with the USPTO as a Receiving Office

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Exhibit PAT-F

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UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/669,490	10/30/2019	Steven Wayne Goldstein	11472-27-2_PRS-118US3	7747

150139 7590 04/09/2020

Akerman LLP
777 South Flagler Drive
Suite 1100 West Tower
West Palm Beach, FL 33401

EXAMINER	
SNIEZEK, ANDREW L	

ART UNIT	PAPER NUMBER
2688	

NOTIFICATION DATE	DELIVERY MODE
04/09/2020	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

ip@akerman.com
jp.keady@techiya.co
personics_docketing@cardinal-ip.com

PTOL-90A (Rev. 04/07)

Exhibit PAT-F

Office Action Summary	Application No. 16/669,490	Applicant(s) Goldstein et al.	
	Examiner ANDREW SNIEZEK	Art Unit 2688	AIA (FITF) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 10/30/19.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b) ☑ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1-20 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☑ Claim(s) 1-10,12-14 and 18-20 is/are allowed.

7) ☑ Claim(s) 11 and 15-17 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☑ The drawing(s) filed on 10/30/19 is/are: a)☐ accepted or b)☑ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☑ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

Information Disclosure Statement

2. The information disclosure statement filed 2/28/20 has been considered.

Drawings

3. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, having a second ambient sound microphone in a single earpiece as set forth in claim 15 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner,

the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

4. The following is a quotation of 35 U.S.C. 112(b):

> (b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claim 11 is rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

The term “the modified audio signal” set forth in claim 11 lacks a clear and positive antecedent basis.

6. The following is a quotation of the first paragraph of 35 U.S.C. 112(a):

> (a) IN GENERAL.—The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor or joint inventor of carrying out the invention.

The following is a quotation of the first paragraph of pre-AIA 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

7. Claims 15-17 are rejected under 35 U.S.C. 112(a) or 35 U.S.C. 112 (pre-AIA), first paragraph, as failing to comply with the enablement requirement. The claim(s)

contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Claim 15 sets for an earpiece that includes a second ambient sound microphone, which is not enable by the specification as provided. It is noted that the claimed earpiece is not the same as a headphone including to earpieces as disclosed. Although the specification provides support for a headphone having two separate earpieces, with each earpiece including an ambient sound microphone as depicted for example in figure 5; the specification does not support a single earpiece including a second ambient sound microphone as set forth in claim 15. The limitations of claims 16-17 inherit the features of claim 15.

Allowable Subject Matter

8. Claims 1-10, 12-14 and 18-20 are allowed.

9. Claim 11 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

10. The following is a statement of reasons for the indication of allowable subject matter: The claimed earpiece that includes a first microphone, a second microphone, speaker and processor used in combination to modify each of the first and second microphone signals producing modified signal that are then mixed with an audio content signal when the earpiece has been placed in a pass-through mode in order to send the mixed signal to the speaker as set forth is neither taught by nor an obvious variation of the art of record. The limitations of claims 2-14 and 18-20 depend upon those features of claim 1. .

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Boersma being the closet art to the claimed invention teaches an arrangement that modifies an ambient detected audio signal and combined with an audio content signal which is then provided to a speaker when switched to an on position so both ambient sound and audio content can be heard; however does not teach the use of an additional microphone and modified signals mixed as presently set forth. Svean et al. and Gilman teach the use of a second microphone located adjacent the ear to monitor sound levels at the ear. Goldstein et al. ('894, '377 and '334) are patent obtained by parent applications to the present invention.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to ANDREW SNIEZEK whose telephone number is (571)272-7563. The examiner can normally be reached on Monday-Friday 7:00 AM-3:30 PM EST.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steven Lim can be reached on 571-270-1210. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for

published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/ANDREW L SNIEZEK/
Primary Examiner, Art Unit 2688

/A.L.S/
Primary Examiner, Art Unit 2688
4/6/20

Exhibit PAT-F

Notice of References Cited	Application/Control No. 16/669,490	Applicant(s)/Patent Under Reexamination Goldstein et al.	
	Examiner ANDREW SNIEZEK	Art Unit 2688	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20070223717-A1	09-2007	Boersma; Johan	H04M1/6058	381/74
*	B	US-6754359-B1	06-2004	Svean; Jarle	H04R1/1083	381/313
*	C	US-4596902-A	06-1986	Gilman; Samuel	H04R25/505	381/320
*	D	US-8917894-B2	12-2014	Goldstein; Steven Wayne	H04R1/1016	381/328
*	E	US-10134377-B2	11-2018	Goldstein; Steven Wayne	G10K11/17827	1/1
*	F	US-10535334-B2	01-2020	Goldstein; Steven Wayne	H04R3/002	1/1
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16669490
Filing Date	2019-10-30
First Named Inventor	Steven Wayne Goldstein
Art Unit	2688
Examiner Name	Andrew L. Sniezek
Attorney Docket Number	11472-27-2_PRS-118US3

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5721783		1998-02-24	Anderson	
	2	5867581		1999-02-02	Obara	
	3	6415034		2002-07-02	Hietanen	
	4	6754359		2004-06-22	Svean et al.	
	5	7006650		2006-02-28	Wild	
	6	7929713		2011-04-19	Victorian	
	7	8077892		2011-12-13	Dijkstra	
	8	8098832		2012-01-17	Lin	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.L.S/

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Attorney Docket Number	11472-27-2_PRS-118US3

	9	8213629		2012-07-03	Goldstein et al.	
	10	8229127		2012-07-24	Jorgensen	
	11	8774433		2014-07-08	Goldstein	
	12	9055377		2015-06-09	Kinsbergen	
	13	9137611		2015-09-15	Unno	
	14	9232322		2016-01-05	Fang	
	15	9357314		2016-05-31	Goorevich	
	16	9613622		2017-04-04	Melanson	
	17	10134377		2018-11-20	Goldstein et al.	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear

EFS Web 2.1.18

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.L.S/

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First Named Inventor	Steven Wayne Goldstein
Art Unit	2688
Examiner Name	Andrew L. Sniezek
Attorney Docket Number	11472-27-2_PRS-118US3

	1	20010046304		2001-11-29	Rast	
	2	20050058313		2005-03-17	Victorian et al.	
	3	20060002574		2006-01-05	Shennib et al.	
	4	20060045282		2006-03-02	Reber	
	5	20060083388		2006-04-20	Rothchild	
	6	20060222194		2006-10-05	Bramslow et al.	
	7	20060262938		2006-11-23	Gauger Jr. et al.	
	8	20070116310		2007-05-24	Ludvigsen	
	9	20070189544		2007-08-16	Rosenberg	
	10	20080159547		2008-07-03	Schuler et al.	
	11	20080181442		2008-07-31	Goldstein et al.	

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.L.S/

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First Named Inventor	Steven Wayne Goldstein
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Examiner Name	Andrew L. Sniezek
Attorney Docket Number	11472-27-2_PRS-118US3

	12	20080240458		2008-10-02	Goldstein et al.	
	13	20080260191		2008-10-23	Victorian et al.	
	14	20110195676		2011-08-11	Victorian et al.	
	15	20120020485		2012-01-26	Visser et al.	
	16	20160021469		2016-01-21	Victorian et al.	
	17	20050058301		2005-03-17	Brown	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.L.S/

EFS Web 2.1.18

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Application Number	16669490
	Filing Date	2019-10-30
	First Named Inventor	Steven Wayne Goldstein
	Art Unit	2688
	Examiner Name	Andrew L. Sniezek
	Attorney Docket Number	11472-27-2_PRS-118US3

	1		

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EXAMINER SIGNATURE

Examiner Signature	/ANDREW L SNIEZEK/ (04/03/2020)	Date Considered	04/03/2020

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.L.S/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16669490
Filing Date	2019-10-30
First Named Inventor	Steven Wayne Goldstein
Art Unit	2688
Examiner Name	Andrew L. Sniezek
Attorney Docket Number	11472-27-2_PRS-118US3

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Peter A. Chiabotti/	Date (YYYY-MM-DD)	2020-02-28
Name/Print	Peter A. Chiabotti	Registration Number	54603

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.L.S/

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.L.S/

Exhibit PAT-F

Electronic Acknowledgement Receipt

EFS ID:	39523848
Application Number:	16669490
International Application Number:	
Confirmation Number:	7747
Title of Invention:	METHOD AND DEVICE FOR ACUTE SOUND DETECTION AND REPRODUCTION
First Named Inventor/Applicant Name:	Steven Wayne Goldstein
Customer Number:	150139
Filer:	John Patrick Keady
Filer Authorized By:	
Attorney Docket Number:	11472-27-2_PRS-118US3
Receipt Date:	22-MAY-2020
Filing Date:	30-OCT-2019
Time Stamp:	17:49:41
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Applicant Arguments/Remarks Made in an Amendment	16669490-RESPONSE_JPK.pdf	263256 b64ea5fe5371c3e0489deb4cffdf0e10dbffc cd6	no	6

Warnings:

Exhibit PAT-F

Information:	
Total Files Size (in bytes):	263256

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Exhibit PAT-F

PATENT
11472-27-2_PRS-118US3

IN THE U.S. PATENT AND TRADEMARK OFFICE

Applicant:	Staton Techiya LLC	Conf.: 7747
Appl. No.:	16/669,490	Art Unit: 2688
Filed:	10-30-2019	Examiner: SNIEZEK, ANDREW L
For:	METHOD AND DEVICE FOR ACUTE SOUND DETECTION AND REPRODUCTION	

RESPONSE TO OFFICE ACTION

Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

Date: May 22, 2020

Sir:

These remarks are filed in response to the Non Final Office Action dated 9 Apr. 2020. Please amend the above-identified patent application as follows:

- **Amendments to the Claims** begin on page 2 of this paper; and
- **Remarks/Arguments** begin on page 5 of this paper.

AMENDMENTS TO THE CLAIMS

The following listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1.(previously presented) An earpiece configured to pass through sound from an ambient sound microphone comprising:

a housing, where the housing has a tip end and an ambient environment end;

a processor;

a first microphone configured to measure a first acoustic environment closer to the tip end than the ambient environment end, generating a first microphone signal;

a second microphone configured to measure a second acoustic environment closer to the ambient environment end than the tip end, generating a second microphone signal; and

a speaker configured to play an audio content signal, where the processor is coupled to the first microphone, the second microphone and the speaker, and where the processor is configured, if the earpiece has been placed into pass-through mode, to:

modify the first microphone signal to generate a first modified signal;

modify the second microphone signal to generate a second modified signal;

mix the first modified signal, the audio content signal and the second modified signal to generate a mixed signal; and

send the mixed signal to the speaker.

2.(previously presented) The earpiece according to claim 1, where the earpiece is placed into pass-through mode when the processor detects an acute sound by examining the temporal or spectral characteristics of a portion of the second microphone signal and the examined portion exceeds a threshold value.

3.(previously presented) The earpiece according to claim 2, where the first microphone is an ear canal microphone.

4.(previously presented) The earpiece according to claim 3, where the second microphone is an ambient sound microphone.

5.(previously presented) The earpiece according to claim 4, where the first modified signal is configured to reduce the noise in the first acoustic environment.

6.(previously presented) The earpiece according to claim 5, where noise is defined as the sound in the first acoustic environment that is not a result of playing the audio content and playing the second modified signal.

7.(previously presented) The earpiece according to claim 6, where the processor is configured to modify the audio content signal prior to generating the mixed signal so that the mixed signal is generated by mixing the first modified signal, the second modified signal and the modified audio content signal.

8.(previously presented) The earpiece according to claim 7, further including:
a safe level check system.

9.(previously presented) The earpiece according to claim 8, where the safe level check system checks if the mixed signal would exceed a safe threshold level if played by the speaker.

10.(previously presented) The earpiece according to claim 9, where the safe level check system reduces the amplitude of the mixed signal if the mixed signal would exceed a safe threshold level if played by the speaker.

11.(currently amended) The earpiece according to claim 7, where ~~the~~a modified audio signal is a zero signal.

12.(previously presented) The earpiece according to claim 1, where the earpiece has been placed into pass-through mode by a user operated mode selection.

13.(previously presented) The earpiece according to claim 12, where the first microphone is an ear canal microphone.

14.(previously presented) The earpiece according to claim 13, where the second microphone is an ambient sound microphone.

15.(cancelled)

16.(cancelled)

17.(cancelled)

18.(previously presented) The earpiece according to claim 4, further including a tip, attached to the tip end of the housing.

19.(previously presented) The earpiece according to claim 18, where the tip is configured to acoustically seal an ear canal when inserted therein.

20.(previously presented) The earpiece according to claim 19, where the tip provides at least 10dB acoustic isolation from 500Hz to 4000Hz.

REMARKS

The following remarks are made in response to the non-final Office Action dated 2 Apr. 2020 ("Office Action").

At the time of the Office Action, the Examiner noted that claims 1-20 were pending. The Examiner has rejected claims 11, 15-17, and the drawings related to the claim 15 rejection of multiple ambient sound microphones on an earpiece.

In the interest of expedited prosecution Applicant has cancelled claims 15-17 and amended claim 11.

In view of the arguments set forth below, claims 1-14 and 18-20 are allowable, and the Examiner is respectfully requested to withdraw the rejections and issue a Notice of Allowance.

I. Allowable Subject Matter

Applicant appreciates the indication of allowance of claims 1-10, 12-14, and 18-20, and the indication of allowance of claim 11 if amended, which it has been as discussed below.

Applicant therefore respectfully requests the additional allowance of claim 11.

II. Drawing Objection

The Examiner has objected to the drawings under 37 CFR 1.83(a), stating "...The drawings must show every feature of the invention specified in the claims. Therefore, having a second ambient sound microphone in a single earpiece as set forth in claim 15 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered..." (Office Action (OA) #3)

Note that in the interest of expedited prosecution Applicant has cancelled claims 15-17.

Thus, the Examiner is respectfully requested to withdraw the drawing objection.

III. Claim Rejection under 35 USC § 112

The Examiner has rejected claim 11under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly

claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

Applicant directs the Examiner's attention to amended claim 11 addressing the Examiner's rejection.

Additionally the Examiner has rejected claim 15-17 under 112(a) as failing to comply with the enablement requirement. In particular the Examiner has stated "… Claim 15 sets for an earpiece that includes a second ambient sound microphone, which is not enable by the specification as provided. …"(OA, #7)

Note that in the interest of expedited prosecution Applicant has cancelled claims 15-17.

Thus, the Examiner is respectfully requested to withdraw the rejection of 35 USC § 112.

IV. Conclusion

For at least the reasons given above, claims 1-14 and 18-20 are allowable, and the Examiner is respectfully requested to withdraw all rejections and issue a Notice of Allowance. Should the Examiner believe that anything further is necessary, the Examiner is respectfully requested to contact the undersigned representative at the telephone number listed below.

Respectfully submitted,

TECHIYA LLC

/John P. Keady/
John P. Keady
Reg. No. 56,389
571-606-1291

Exhibit PAT-F

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

150139 7590 06/12/2020

Akerman LLP
777 South Flagler Drive
Suite 1100 West Tower
West Palm Beach, FL 33401

EXAMINER	
SNIEZEK, ANDREW L	
ART UNIT	**PAPER NUMBER**
2688	

DATE MAILED: 06/12/2020

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/669,490	10/30/2019	Steven Wayne Goldstein	11472-27-2_PRS-118US3	7747

TITLE OF INVENTION: METHOD AND DEVICE FOR ACUTE SOUND DETECTION AND REPRODUCTION

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$500	$0.00	$0.00	$500	09/14/2020

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PTOL-85 (Rev. 02/11)

Exhibit PAT-F

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

150139 7590 06/12/2020

Akerman LLP
777 South Flagler Drive
Suite 1100 West Tower
West Palm Beach, FL 33401

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/669,490	10/30/2019	Steven Wayne Goldstein	11472-27-2_PRS-118US3	7747

TITLE OF INVENTION: METHOD AND DEVICE FOR ACUTE SOUND DETECTION AND REPRODUCTION

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$500	$0.00	$0.00	$500	09/14/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
SNIEZEK, ANDREW L	2688	381-056000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1_____
2_____
3_____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ❑Issue Fee ❑Publication Fee (if required) ❑Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

Exhibit PAT-F

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/669,490	10/30/2019	Steven Wayne Goldstein	11472-27-2_PRS-118US3	7747

150139 7590 06/12/2020

Akerman LLP
777 South Flagler Drive
Suite 1100 West Tower
West Palm Beach, FL 33401

EXAMINER	
SNIEZEK, ANDREW L	
ART UNIT	**PAPER NUMBER**
2688	

DATE MAILED: 06/12/2020

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Exhibit PAT-F

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Exhibit PAT-F

Notice of Allowability	**Application No.** 16/669,490	**Applicant(s)** Goldstein et al.	
	Examiner ANDREW SNIEZEK	**Art Unit** 2688	**AIA (FITF) Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to the amendment filed 5/22/20.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 1-14 and 18-20 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information , please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☑ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/ANDREW L SNIEZEK/
Primary Examiner, Art Unit 2688

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

Allowable Subject Matter

2. Claims 1-10, 11, 12-14 and 18-20 are allowed.

Examiner's Comments

3. Claims 1-10, 11, 12-14 and 18-20 have been renumbered as claims 1-10, 14, 15-17 and 11-13 respectively. Also, the drawing objections have been overcome by the amendment filed 5/22/20.

Conclusion

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to ANDREW SNIEZEK whose telephone number is (571)272-7563. The examiner can normally be reached on Monday-Friday 7:00 AM-3:30 PM EST.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steven Lim can be reached on 571-270-1210. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for

published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/ANDREW L SNIEZEK/
Primary Examiner, Art Unit 2688

/A.L.S/
Primary Examiner, Art Unit 2688
6/5/20

Issue Fee Transmittal Form

Application Number	Filing Date	First Named Inventor	Atty. Docket No.	Confirmation No.
16669490	30-Oct-2019	Steven Goldstein	11472-27-2_PRS-118US3	7747

TITLE OF INVENTION :

METHOD AND DEVICE FOR ACUTE SOUND DETECTION AND REPRODUCTION

Entity Status	Application Type	Art Unit	Class - Subclass	EXAMINER
Small	Utility under 35 USC 111(a)	2688	056000	ANDREW SNIEZEK

Issue Fee Due	Publication Due	Total Fee(s) Due	Date Due	Prev. Paid Fee
$500	$0	$500	14-Sep-2020	$0

1.Change of Correspondence Address and/or Indication Of Fee Address (37 CFR 1.33 & 1.363)

Current Correspondence Address:	Current Indicated Fee Address :
150139 Akerman LLP 777 South Flagler Drive Suite 1100 West Tower West Palm Beach FL 33401 UNITED STATES 5616535000 ip@akerman.com	
☐ Change of correspondence address requested, system generated AIA/122-EFS form attached	☒ Fee Address indication requested, system generated SB/47-EFS form attached

2.Entity Status

Change in Entity Status

○ Applicant certifying micro entity status; system generated Micro Entity certification form attached. See 37 CFR 1.29.
Note: Absent a valid certification of micro entity status, issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment. If this box is checked, you will be prompted to choose a micro entity status on the gross income basis (37 CFR 1.29(a)) or the institution of higher education basis (37 CFR 1.29(d)), and make the applicable certification online.

◉ Applicant asserting small entity status. See 37 CFR 1.27.
Note: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

○ Applicant changing to regular undiscounted fee status.
Note: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

Doc Code: IFEE Exhibit PAT-F PTOL/85B-EFS

Document Description: Issue Fee Payment (PTO-85B)

3.The Following Fee(s) Are Submitted:

☒ Issue Fee

☐ I authorize USPTO to apply my previously paid issue fee to the current fees due

☐ Publication Fee

☐ The Director is hereby authorized to apply my previously paid issue fee to the current fee due and to charge deficient fees to Deposit Account Number _____

☐ Advance Order - # of copies _____

☒ If i**n addition to** the payment of the issue fee amount submitted with this form, there are any discrepancies in any amount(s) due, the Director is authorized to charge any deficiency, or credit any overpayment, to Deposit Account Number 500931 . The **issue fee must be submitted** with this form. **If payment of the issue fee does not accompany this form, checking this box and providing a deposit account number will NOT be effective to satisfy full payment of the fee(s) due.**

4.Firm and/or Attorney Names To Be Printed

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1. Akerman LLP
2. Peter A. Chiabotti
3. Mammen (Roy) P. Zachariah, Jr.

5.Assignee Name(s) and Residence Data To Be Printed

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Name	City	State	Country	Category
Staton Techiya LLC	Delray Beach	FLORIDA	united states	other

6.Signature

I certify, in accordance with 37 CFR 1.4(d)(4) that I am an attorney or agent registered to practice before the Patent and Trademark Office who has filed and has been granted power of attorney in this application. I also certify that this Fee(s) Transmittal form is being transmitted to the USPTO via EFS-WEB on the date indicated below.

Signature	/Peter A. Chiabotti/	**Date**	09-14-2020
Name	Peter Allen Chiabotti	**Registration Number**	54603

WEB IFEE 1.0

Exhibit PAT-F

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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/669,490	10/20/2020	10810989	11472-27-2_PRS-118US3	7747

150139 7590 09/30/2020

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777 South Flagler Drive
Suite 1100 West Tower
West Palm Beach, FL 33401

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Staton Techiya LLC, Delray Beach, FL
Steven Wayne Goldstein, Delray Beach, FL;
John Usher, Beer, UNITED KINGDOM;
Marc Andre Boillot, Plantation, FL;

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IR103 (Rev. 10/09)

Exhibit PAT-G



(12) **United States Patent**
Goldstein et al.

(10) **Patent No.: US 8,917,894 B2**
(45) **Date of Patent: Dec. 23, 2014**

(54) **METHOD AND DEVICE FOR ACUTE SOUND DETECTION AND REPRODUCTION**

(75) Inventors: **Steven Wayne Goldstein**, Delray Beach, FL (US); **Marc Andre Boillot**, Plantation, FL (US); **John Usher**, Montreal (CA)

(73) Assignee: **Personics Holdings, LLC.**, Boca Raton, FL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1636 days.

(21) Appl. No.: **12/017,878**

(22) Filed: **Jan. 22, 2008**

(65) **Prior Publication Data**

US 2008/0181419 A1 Jul. 31, 2008

Related U.S. Application Data

(60) Provisional application No. 60/885,917, filed on Jan. 22, 2007.

(51) **Int. Cl.**
H04R 25/00 (2006.01)
H04R 3/00 (2006.01)

(52) **U.S. Cl.**
CPC ***H04R 3/002*** (2013.01); *H04R 2499/11* (2013.01)
USPC **381/328**; 381/312; 381/313; 381/314; 381/315; 381/320; 381/23.1; 381/350

(58) **Field of Classification Search**
USPC 381/81, 123, 80, 328, 313–315, 320, 381/322, 323
See application file for complete search history.

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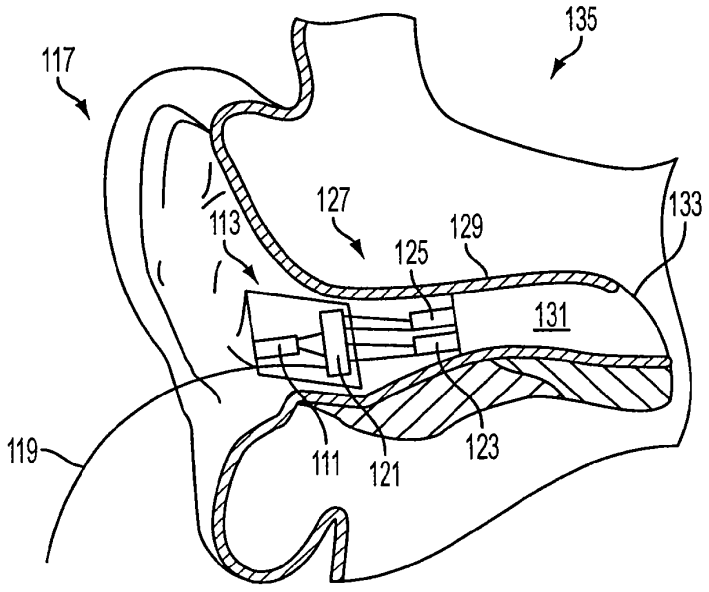
* cited by examiner

Primary Examiner — David Vu
Assistant Examiner — Cuong B Nguyen
(74) *Attorney, Agent, or Firm* — Pablo Meles

(57) **ABSTRACT**

Earpieces and methods for acute sound detection and reproduction are provided. A method can include measuring an ambient sound level external to an ear canal at least partially occluded by the earpiece, monitoring a change in the ambient sound level for detecting an acute sound, estimating a proximity of the acute sound, and reproducing the acute sound within the ear canal responsive to detecting the acute sound and the proximity.

38 Claims, 9 Drawing Sheets



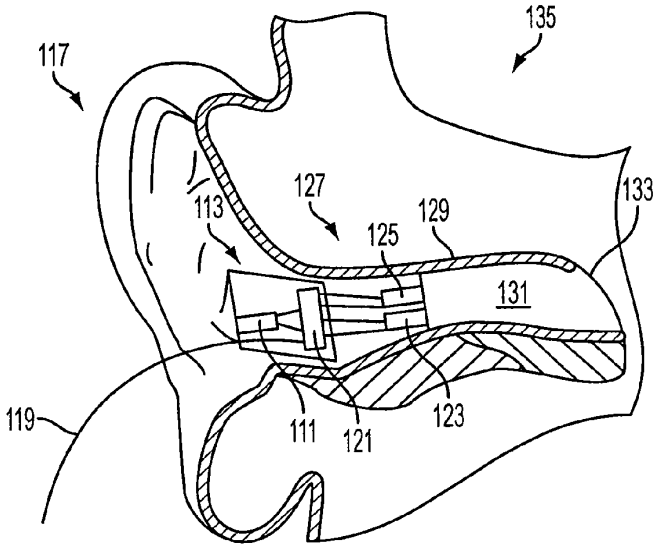


FIG. 1 100

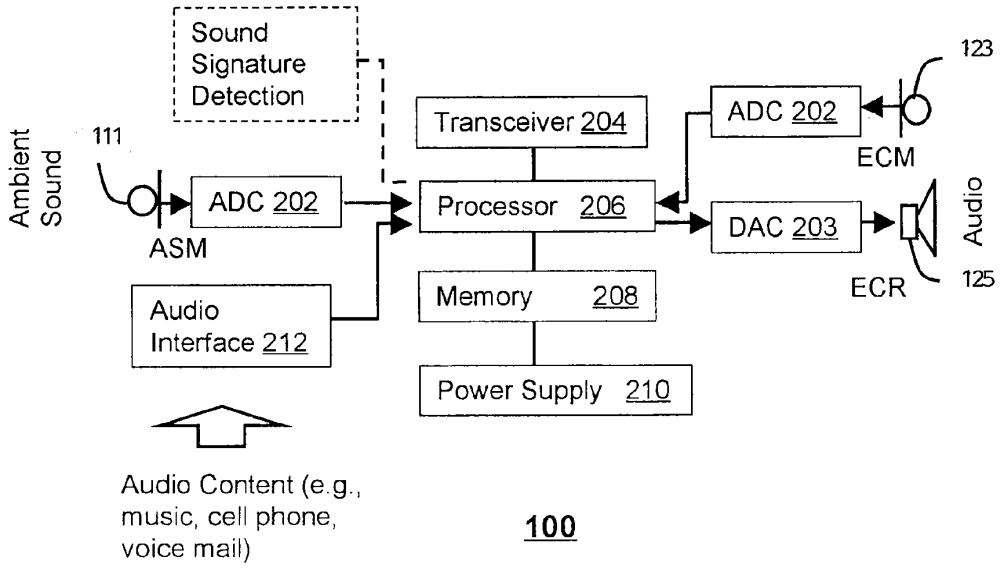


FIG. 2

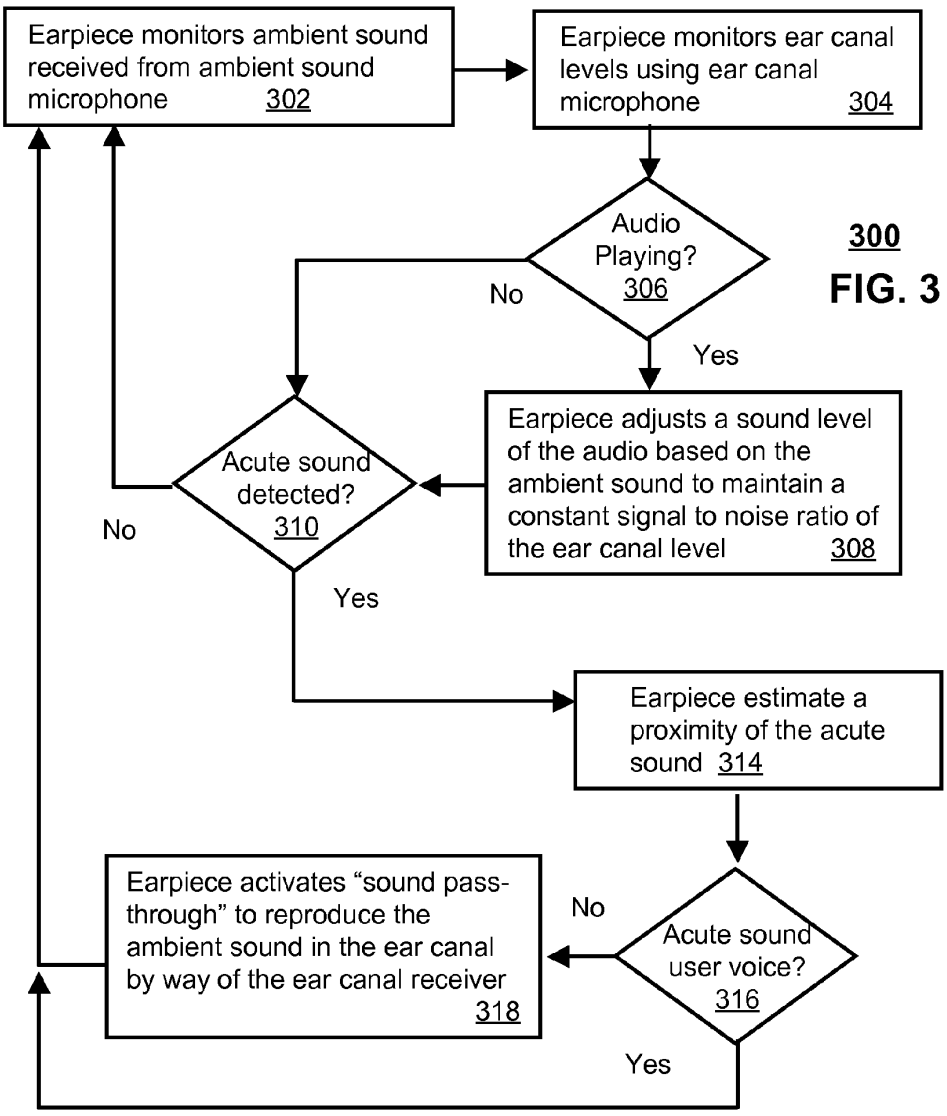

Earpiece monitors ambient sound received from ambient sound microphone 302
Earpiece monitors ear canal levels using ear canal microphone 304
Audio Playing? 306
No
Yes
300
Earpiece adjusts a sound level of the audio based on the ambient sound to maintain a constant signal to noise ratio of the ear canal level 308
Acute sound detected? 310
No
Yes
Earpiece estimate a proximity of the acute sound 314
Acute sound user voice? 316
No
Yes
Earpiece activates "sound pass-through" to reproduce the ambient sound in the ear canal by way of the ear canal receiver 318

FIG. 3

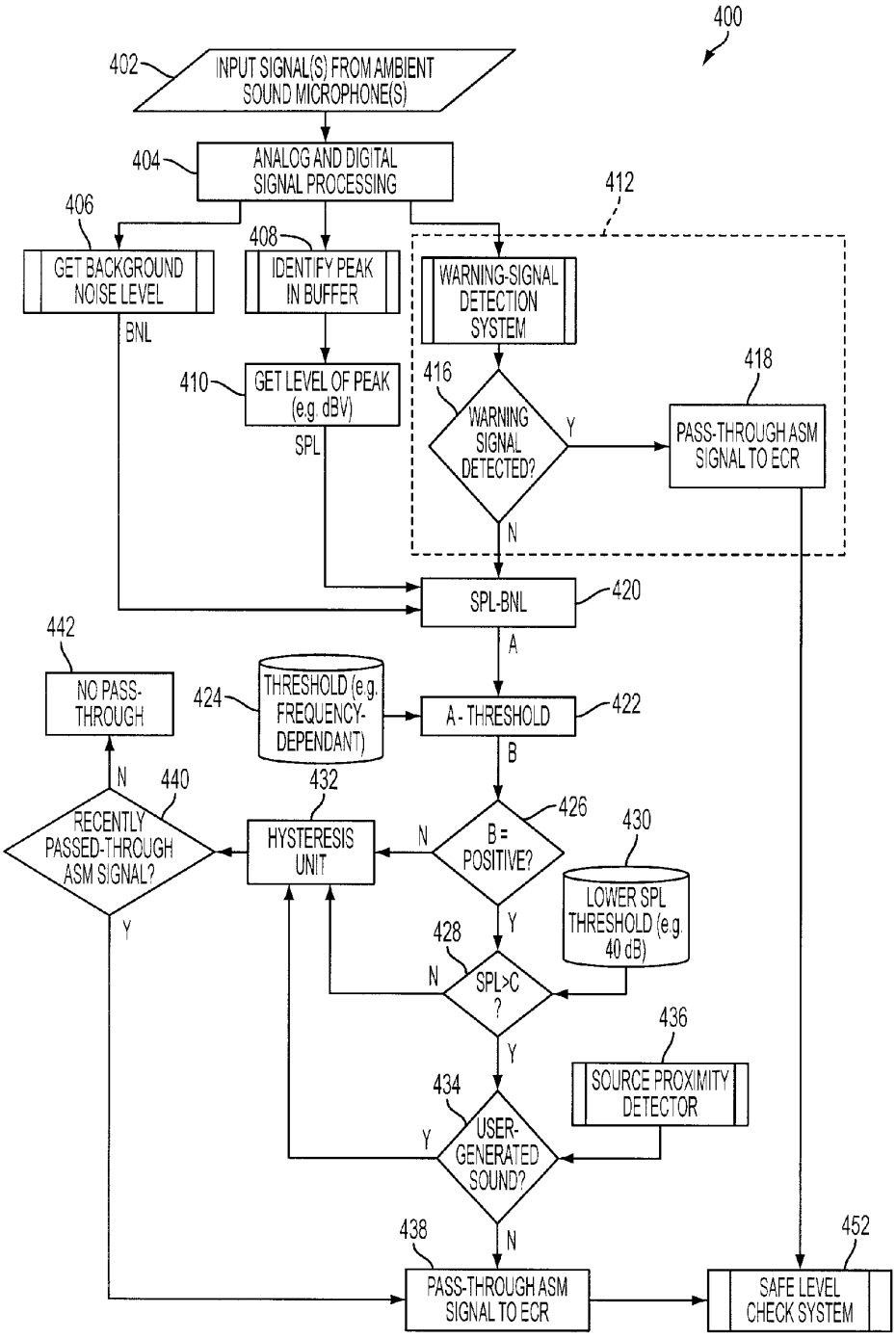

400
402
INPUT SIGNAL(S) FROM AMBIENT SOUND MICROPHONE(S)
404
ANALOG AND DIGITAL SIGNAL PROCESSING
406
GET BACKGROUND NOISE LEVEL
408
IDENTIFY PEAK IN BUFFER
412
WARNING-SIGNAL DETECTION SYSTEM
BNL
410
GET LEVEL OF PEAK (e.g. dBV)
SPL
416
WARNING SIGNAL DETECTED?
Y
418
PASS-THROUGH ASM SIGNAL TO ECR
N
SPL-BNL
420
A
442
NO PASS-THROUGH
424
THRESHOLD (e.g. FREQUENCY-DEPENDANT)
A - THRESHOLD
422
B
N
440
RECENTLY PASSED-THROUGH ASM SIGNAL?
432
HYSTERESIS UNIT
N
426
B = POSITIVE?
430
LOWER SPL THRESHOLD (e.g. 40 dB)
Y
428
N
SPL>C ?
Y
436
SOURCE PROXIMITY DETECTOR
434
Y
USER-GENERATED SOUND?
N
438
452
PASS-THROUGH ASM SIGNAL TO ECR
SAFE LEVEL CHECK SYSTEM

FIG. 4

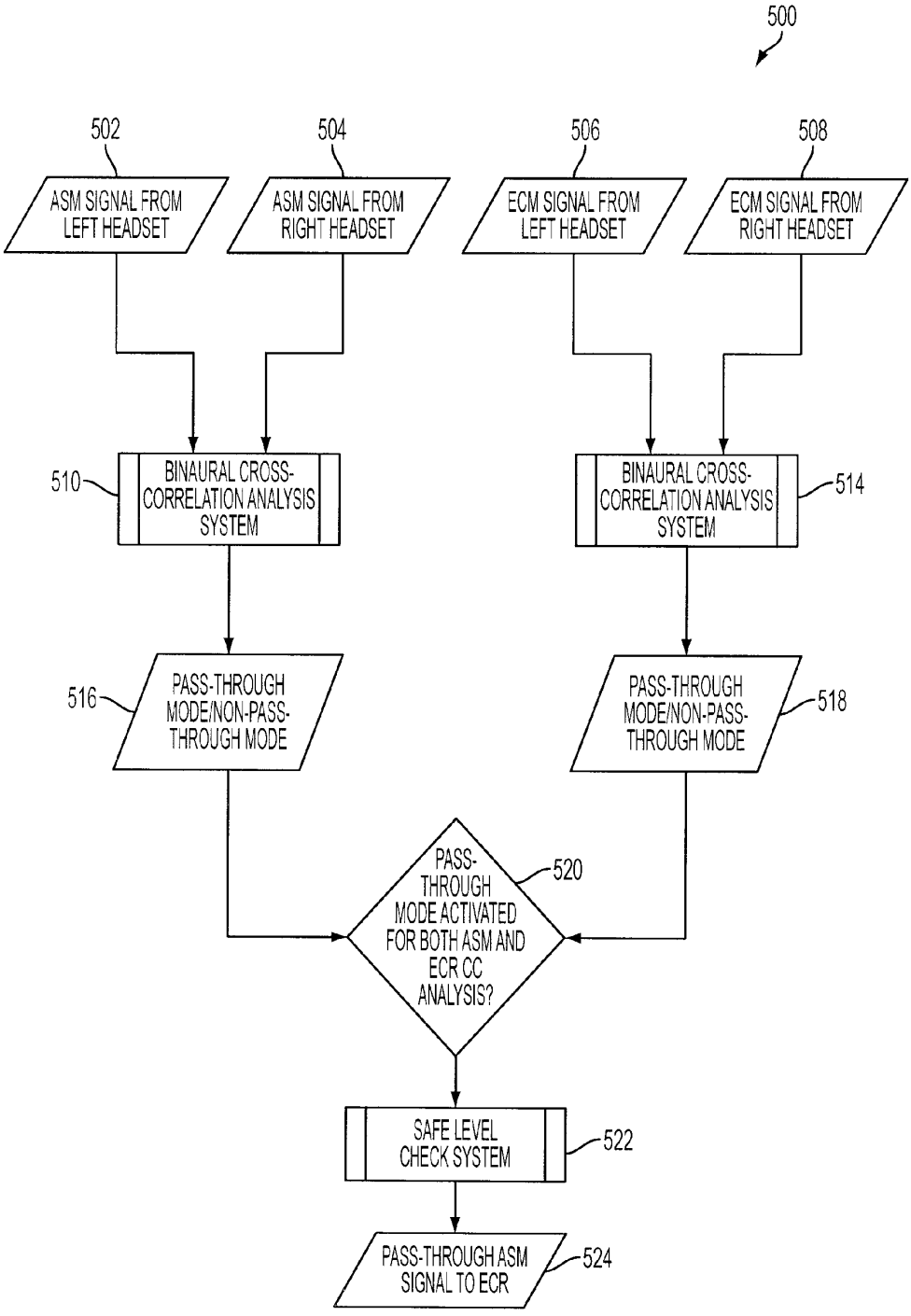

500
502
504
506
508
ASM SIGNAL FROM LEFT HEADSET
ASM SIGNAL FROM RIGHT HEADSET
ECM SIGNAL FROM LEFT HEADSET
ECM SIGNAL FROM RIGHT HEADSET
510
BINAURAL CROSS-CORRELATION ANALYSIS SYSTEM
514
BINAURAL CROSS-CORRELATION ANALYSIS SYSTEM
516
PASS-THROUGH MODE/NON-PASS-THROUGH MODE
518
PASS-THROUGH MODE/NON-PASS-THROUGH MODE
520
PASS-THROUGH MODE ACTIVATED FOR BOTH ASM AND ECR CC ANALYSIS?
522
SAFE LEVEL CHECK SYSTEM
524
PASS-THROUGH ASM SIGNAL TO ECR

FIG. 5

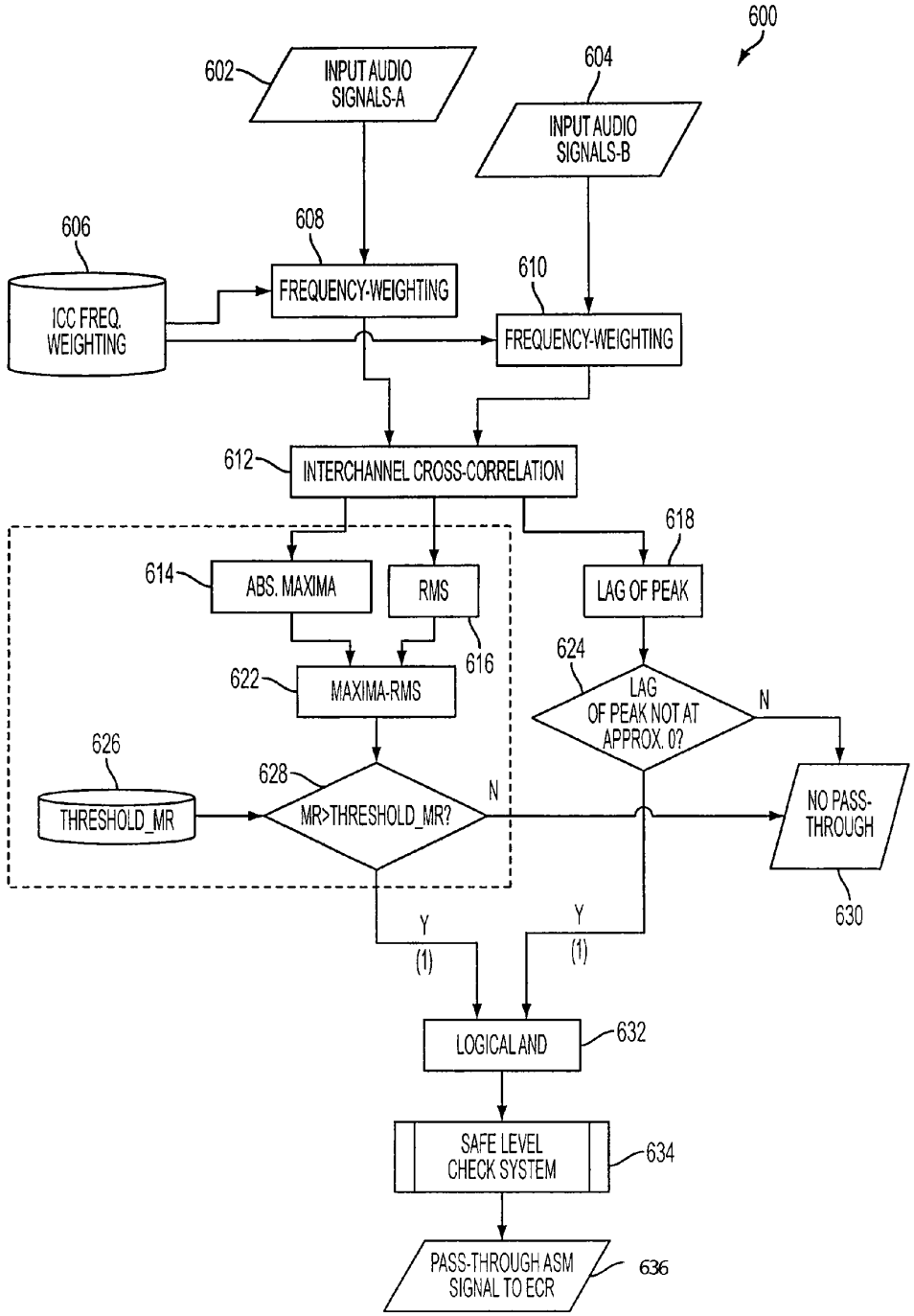

600
602
INPUT AUDIO SIGNALS-A
604
INPUT AUDIO SIGNALS-B
606
ICC FREQ. WEIGHTING
608
FREQUENCY-WEIGHTING
610
FREQUENCY-WEIGHTING
612
INTERCHANNEL CROSS-CORRELATION
614
ABS. MAXIMA
RMS
616
618
LAG OF PEAK
622
MAXIMA-RMS
624
LAG OF PEAK NOT AT APPROX. 0?
N
626
THRESHOLD_MR
628
MR>THRESHOLD_MR?
N
NO PASS-THROUGH
630
Y
(1)
Y
(1)
LOGICAL AND
632
SAFE LEVEL CHECK SYSTEM
634
PASS-THROUGH ASM SIGNAL TO ECR
636

FIG. 6

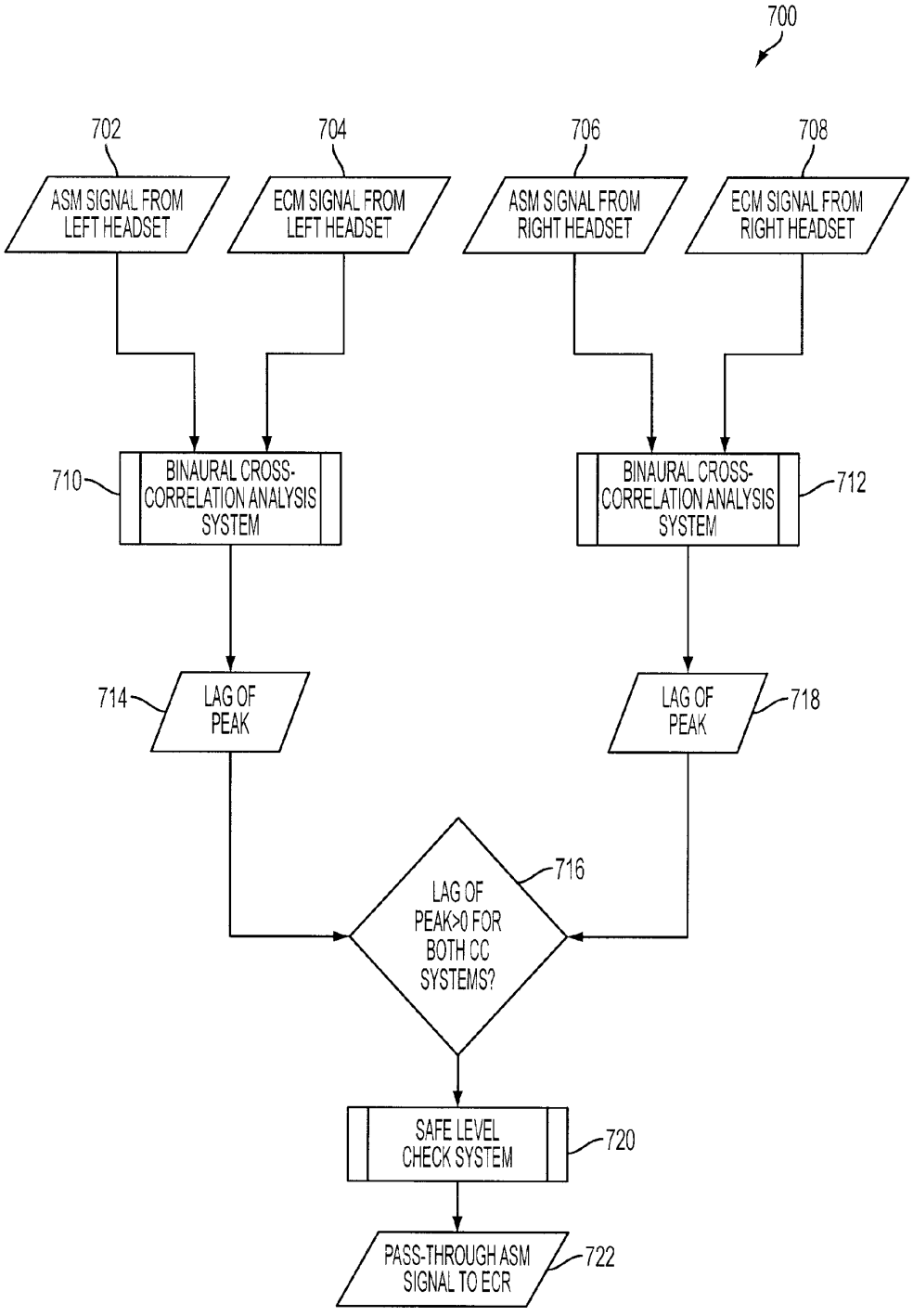

700
702
704
706
708
ASM SIGNAL FROM LEFT HEADSET
ECM SIGNAL FROM LEFT HEADSET
ASM SIGNAL FROM RIGHT HEADSET
ECM SIGNAL FROM RIGHT HEADSET
710
BINAURAL CROSS-CORRELATION ANALYSIS SYSTEM
712
BINAURAL CROSS-CORRELATION ANALYSIS SYSTEM
714
LAG OF PEAK
718
LAG OF PEAK
716
LAG OF PEAK>0 FOR BOTH CC SYSTEMS?
720
SAFE LEVEL CHECK SYSTEM
722
PASS-THROUGH ASM SIGNAL TO ECR

FIG. 7

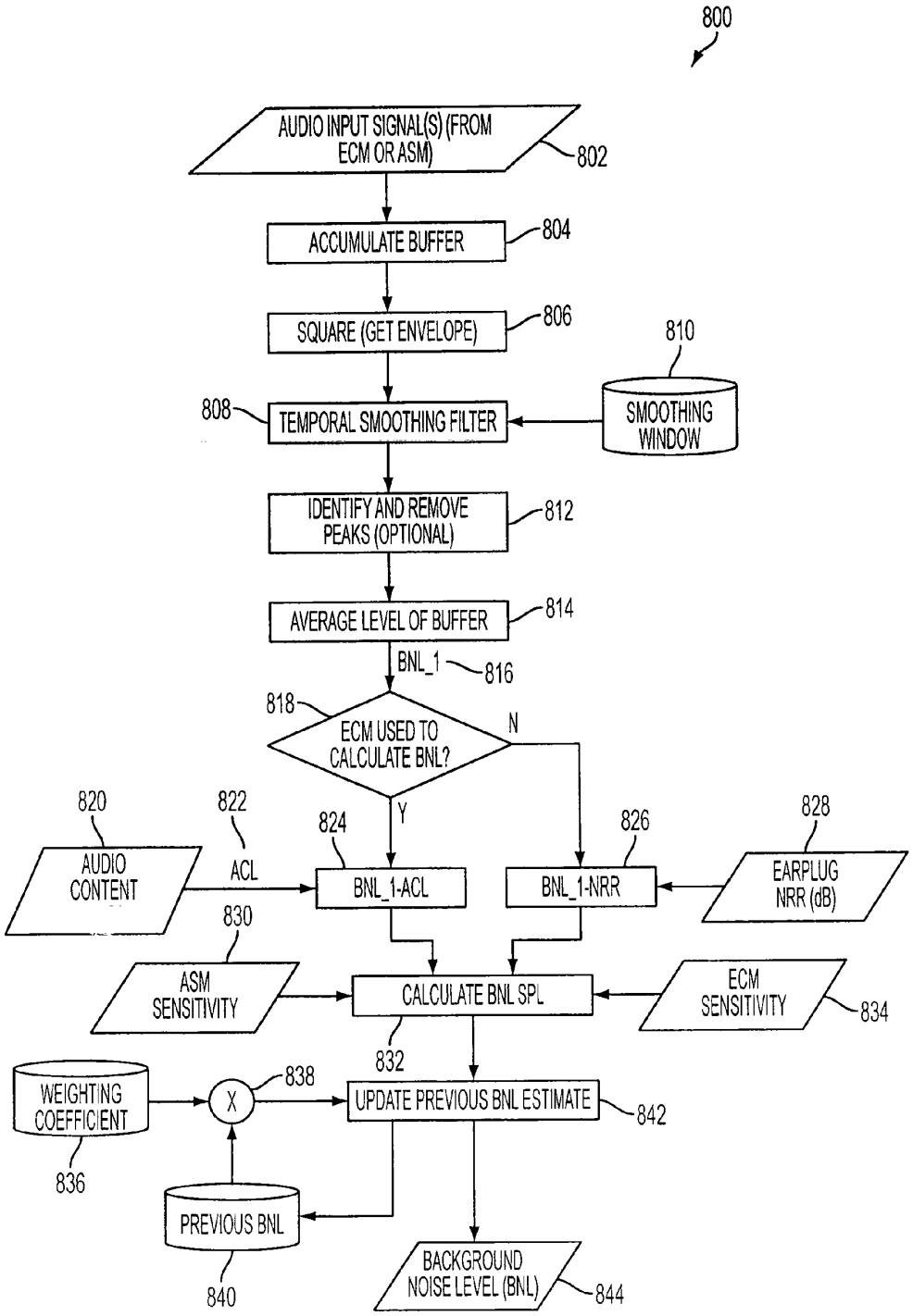

800
AUDIO INPUT SIGNAL(S) (FROM ECM OR ASM)
802
ACCUMULATE BUFFER
804
SQUARE (GET ENVELOPE)
806
810
SMOOTHING WINDOW
808
TEMPORAL SMOOTHING FILTER
IDENTIFY AND REMOVE PEAKS (OPTIONAL)
812
AVERAGE LEVEL OF BUFFER
814
BNL_1
816
818
ECM USED TO CALCULATE BNL?
N
Y
820
AUDIO CONTENT
822
ACL
824
BNL_1-ACL
826
BNL_1-NRR
828
EARPLUG NRR (dB)
830
ASM SENSITIVITY
CALCULATE BNL SPL
ECM SENSITIVITY
834
832
WEIGHTING COEFFICIENT
838
X
UPDATE PREVIOUS BNL ESTIMATE
842
836
PREVIOUS BNL
840
BACKGROUND NOISE LEVEL (BNL)
844

FIG. 8

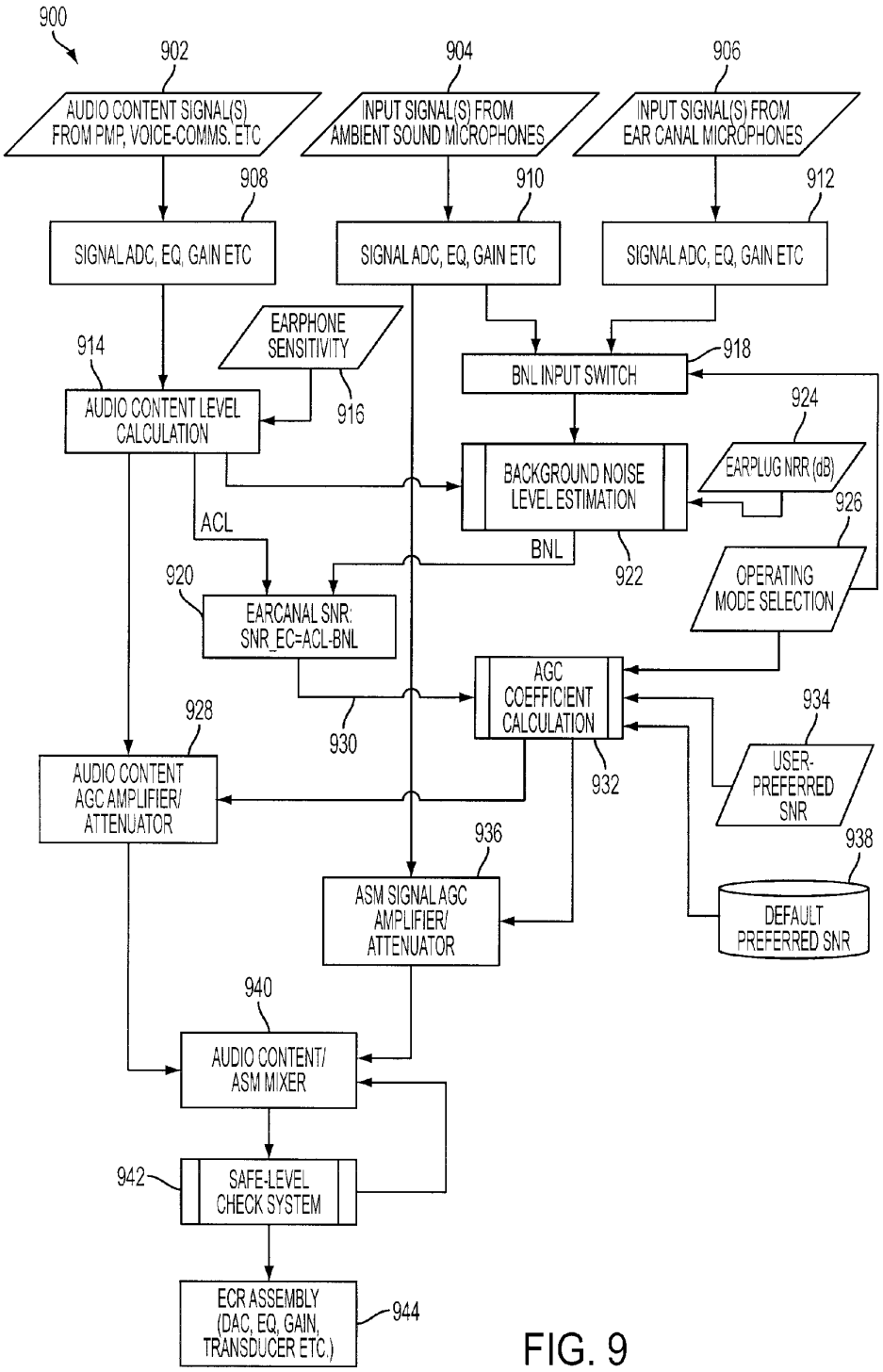

900
902
AUDIO CONTENT SIGNAL(S) FROM PMP, VOICE-COMMS, ETC
904
INPUT SIGNAL(S) FROM AMBIENT SOUND MICROPHONES
906
INPUT SIGNAL(S) FROM EAR CANAL MICROPHONES
908
SIGNAL ADC, EQ, GAIN ETC
910
SIGNAL ADC, EQ, GAIN ETC
912
SIGNAL ADC, EQ, GAIN ETC
914
AUDIO CONTENT LEVEL CALCULATION
EARPHONE SENSITIVITY
916
BNL INPUT SWITCH
918
924
EARPLUG NRR (dB)
BACKGROUND NOISE LEVEL ESTIMATION
926
ACL
BNL
922
920
EARCANAL SNR: SNR_EC=ACL-BNL
OPERATING MODE SELECTION
AGC COEFFICIENT CALCULATION
934
928
930
932
AUDIO CONTENT AGC AMPLIFIER/ ATTENUATOR
USER-PREFERRED SNR
936
938
ASM SIGNAL AGC AMPLIFIER/ ATTENUATOR
DEFAULT PREFERRED SNR
940
AUDIO CONTENT/ ASM MIXER
942
SAFE-LEVEL CHECK SYSTEM
ECR ASSEMBLY (DAC, EQ, GAIN, TRANSDUCER ETC.)
944

FIG. 9

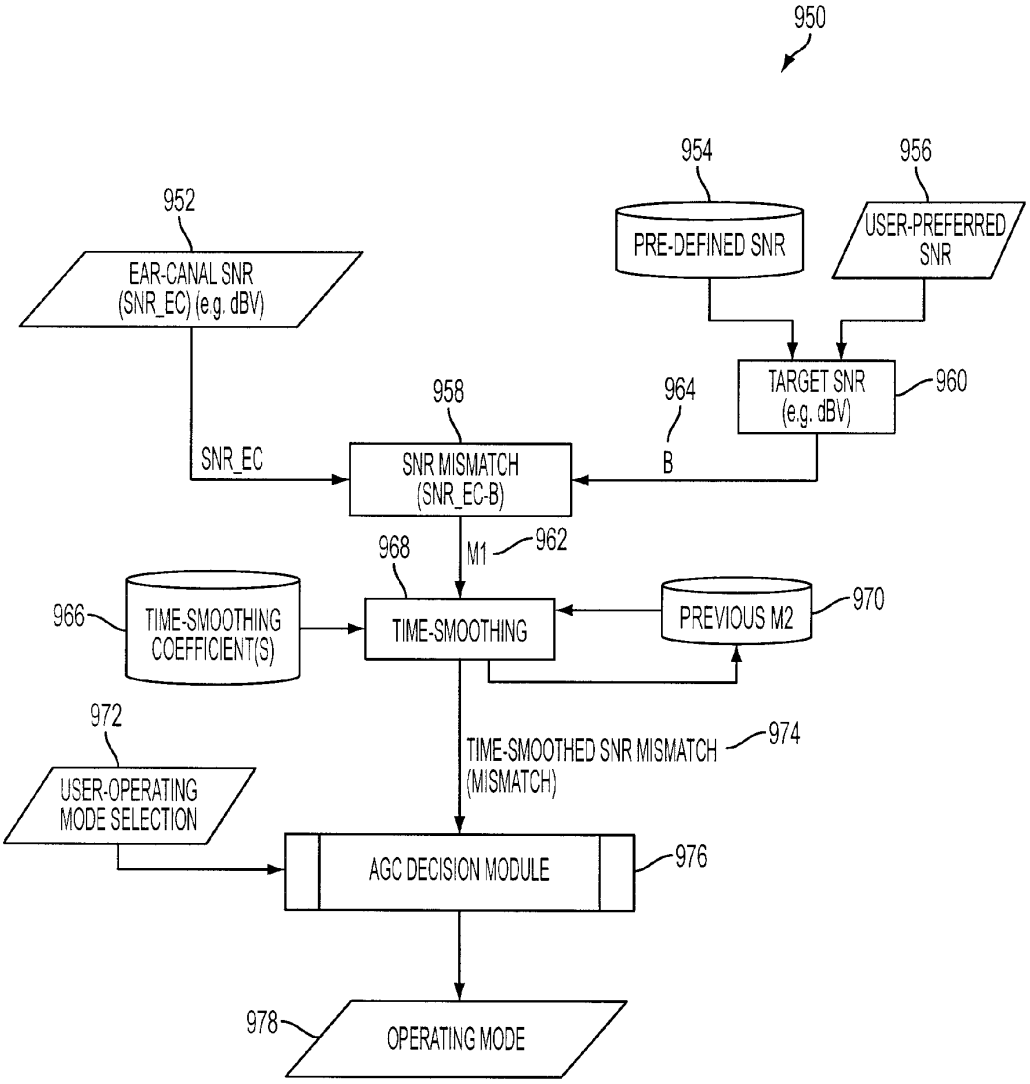

950
954
956
952
PRE-DEFINED SNR
USER-PREFERRED SNR
EAR-CANAL SNR (SNR_EC) (e.g. dBV)
TARGET SNR (e.g. dBV)
960
958
964
SNR_EC
SNR MISMATCH (SNR_EC-B)
B
968
M1
962
966
TIME-SMOOTHING COEFFICIENT(S)
TIME-SMOOTHING
PREVIOUS M2
970
972
TIME-SMOOTHED SNR MISMATCH (MISMATCH)
974
USER-OPERATING MODE SELECTION
AGC DECISION MODULE
976
978
OPERATING MODE

FIG. 10

METHOD AND DEVICE FOR ACUTE SOUND DETECTION AND REPRODUCTION

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a Non-Provisional and claims the priority benefit of Provisional Application No. 60/885,917 filed on Jan. 22, 2007, the entire disclosure of which is incorporated herein by reference.

FIELD

The present invention relates to a device that monitors sound directed to an occluded ear, and more particularly, though not exclusively, to an earpiece and method of operating an earpiece that detects acute sounds and allows the acute sounds to be reproduced in an ear canal of the occluded ear.

BACKGROUND

Since the advent of industrialization over two centuries ago, the human auditory system has been increasingly stressed to tolerate high noise levels to which it had hitherto been unexposed. Recently, human knowledge of the causes of hearing damage have been researched intensively and models for predicting hearing loss have been developed and verified with empirical data from decades of scientific research. Yet it can be strongly argued that the danger of permanent hearing damage is more present in our daily lives than ever, and that sound levels from personal audio systems in particular (i.e. from portable audio devices), live sound events, and the urban environment are a ubiquitous threat to healthy auditory functioning across the global population.

Environmental noise is constantly presented in industrialized societies given the ubiquity of external sound intrusions. Examples include people talking on their cell phones, blaring music in health clubs, or the constant hum of air conditioning systems in schools and office buildings. Excess noise exposure can also induce auditory fatigue, possibly comprising a person's listening abilities. On a daily basis, people are exposed to various environmental sounds and noises within their environment, such as the sounds from traffic, construction, and industry.

To combat the undesired cacophony of annoying sounds, people are arming themselves with portable audio playback devices to drown out intrusive noise. The majority of devices providing the person with audio content do so using insert (or in-ear) earbuds. These earbuds deliver sound directly to the ear canal at high sound levels over the background noise even though the earbuds generally provide little to no ambient sound isolation. Moreover, when people wear earbuds (or headphones) to listen to music, or engage in a call using a telephone, they can effectively impair their auditory judgment and their ability to discriminate between sounds. With such devices, the person is immersed in the audio experience and generally less likely to hear warning sounds within their environment. In some cases, the user may even turn up the volume to hear their personal audio over environmental noises. It also puts them at high sound exposure risk which can potentially cause long term hearing damage.

With earbuds, personal audio reproduction levels can reach in excess of 100 dB. This is enough to exceed recommended daily sound exposure levels in less than a minute and to cause permanent acoustic trauma. Furthermore, rising population densities have continually increased sound levels in society. According to researchers, 40% of the European community is continuously exposed to transportation noise of 55 dBA and 20% are exposed to greater than 65 dBA. This level of 65 dBA is considered by the World Health Organization to be intrusive or annoying, and as mentioned, can lead to users of personal audio devices increasing reproduction levels to compensate for ambient noise.

A need therefore exists for enhancing the user's ability to listen in the environment without harming his or her hearing faculties.

SUMMARY

Embodiments in accordance with the present invention provide a method and device for acute sound detection and reproduction.

In a first embodiment, an earpiece can include an Ambient Sound Microphone (ASM) to capture ambient sound, at least one Ear Canal Receiver (ECR) to deliver audio to an ear canal; and a processor operatively coupled to the ASM and the at least one ECR. The processor can monitor a change in the ambient sound level to detect an acute sound from the change. The acute sound can be reproduced within the ear canal via the ECR responsive to detecting the acute sound.

The processor can pass (transmit) sound from the ASM directly to the ECR to produce sound within the ear canal at a same sound pressure level (SPL) as the acute sound measured at an entrance to the ear canal. In one arrangement, the processor can maintain an approximately constant ratio between an audio content level (ACL) and an internal ambient sound level (iASL) measured within the ear canal. In one arrangement, the processor can measure an external ambient sound level (xASL) of the ambient sound with the ASM and subtract an attenuation level of the earpiece from the xASL to estimate the internal ambient sound level (iASL) within the ear canal.

The earpiece can further include an Ear Canal Microphone (ECM) to measure an ear canal sound level (ECL) within the ear canal. In this configuration, the processor can estimate the internal ambient sound level (iASL) within the ear canal by subtracting an estimated audio content sound level (ACL) from the ECL. For instance, the processor can measure a voltage level of the audio content sent to the ECR, and apply a transfer function of the ECR to convert the voltage level to the ACL. The processor can be located external to the earpiece on a portable computing device.

In a second embodiment, an earpiece can comprise an Ambient Sound Microphone (ASM) to capture ambient sound, at least one Ear Canal Receiver (ECR) to deliver audio to an ear canal, an audio interface operatively coupled to the processor to receive audio content, and a processor operatively coupled to the ASM and the at least one ECR. The processor can monitor a change in the ambient sound level to detect an acute sound from the change, adjust an audio content level (ACL) of the audio content delivered to the ear canal, and reproduce the acute sound within the ear canal via the ECR responsive to detecting the acute sound and based on the ACL.

The audio interface can receive the audio content from at least one among a portable music player, a cell phone, and a portable communication device. During operation, the processor can maintain an approximately constant ratio between an audio content level (ACL) and an internal ambient sound level (iASL) measured within the ear canal. In one arrangement, the processor can mute the audio content and pass the acute sound to the ECR for reproducing the acute sound within the ear canal. In another arrangement, the processor can amplify the acute sound with respect to the audio content level (ACL).

In a third embodiment, a method for acute sound detection and reproduction can include the steps of measuring an ambient sound level (xASL) of ambient sound external to an ear canal at least partially occluded by the earpiece, monitoring a change in the xASL for detecting an acute sound, and reproducing the acute sound within the ear canal responsive to detecting the acute sound. The reproducing can include enhancing the acute sound over the ambient sound. The step of reproducing can produce sound within the ear canal at a same sound pressure level (SPL) as the acute sound measured at an entrance to the ear canal.

The method can further include receiving audio content from an audio interface that is directed to the ear canal, and maintaining an approximately constant ratio between a level of the audio content (ACL) and a level of an internal ambient sound level (iASL) measured within the ear canal. The ACL can be determined by measuring a voltage level of the audio content sent to the ECR, and applying a transfer function of the ECR to convert the voltage level to the ACL. The method can further include measuring an Ear Canal Level (ECL) within the ear canal, and subtracting the ACL from the ECL to estimate the iASL. The iASL can be estimated by subtracting an attenuation level of the earpiece from the xASL.

In a fourth embodiment, a method for acute sound detection and reproduction suitable for use with an earpiece can include the steps of measuring an external ambient sound level (xASL) in an ear canal at least partially occluded by the earpiece, monitoring a change in the xASL for detecting an acute sound, estimating a proximity of the acute sound, and reproducing the acute sound within the ear canal responsive to detecting the acute sound based on the proximity. The step of estimating a proximity can include performing a cross correlation analysis between at least two microphones, identifying a peak in the cross correlation and an associated time lag, and determining the direction from the associated time lag. The method can further include identifying whether the acute sound is a vocal signal produced by a user operating the earpiece or a sound source external from the user.

In a fifth embodiment, a method for acute sound detection and reproduction suitable for use with an earpiece can include measuring an external ambient sound level (xASL) due to ambient sound outside of an ear canal at least partially occluded by the earpiece, measuring an internal ambient sound level (iASL) due to residual ambient sound within the ear canal at least partially occluded by the earpiece, monitoring a high frequency change between the xASL and the iASL with respect to a low frequency change between the xASL and the iASL for detecting an acute sound, and reproducing the xASL within the ear canal responsive to detecting the high frequency change. The method can further include determining a proximity of a sound source producing the acute sound.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a pictorial diagram of an earpiece in accordance with an exemplary embodiment;

FIG. **2** is a block diagram of the earpiece in accordance with an exemplary embodiment;

FIG. **3** is a flowchart of a method for acute sound detection in accordance with an exemplary embodiment;

FIG. **4** is a more detailed approach to the method of FIG. **3** in accordance with an exemplary embodiment;

FIG. **5** is a flowchart of a method for acute sound source proximity in accordance with an exemplary embodiment;

FIG. **6** is a flowchart of a method for binaural analysis in accordance with an exemplary embodiment;

FIG. **7** is a flowchart of a method for logic control in accordance with an exemplary embodiment;

FIG. **8** is a flowchart of a method for estimating background noise level in accordance with an exemplary embodiment;

FIG. **9** is a flowchart of a method for maintaining constant audio content level (ACL) to internal ambient sound level (iASL) in accordance with an exemplary embodiment; and

FIG. **10** is a flowchart of a method for adjusting audio content gain in accordance with an exemplary embodiment.

DETAILED DESCRIPTION

The following description of at least one exemplary embodiment is merely illustrative in nature and is in no way intended to limit the invention, its application, or uses.

Processes, techniques, apparatus, and materials as known by one of ordinary skill in the relevant art may not be discussed in detail but are intended to be part of the enabling description where appropriate, for example the fabrication and use of transducers. Additionally in at least one exemplary embodiment the sampling rate of the transducers can be varied to pick up pulses of sound, for example less than 50 milliseconds.

In all of the examples illustrated and discussed herein, any specific values, for example the sound pressure level change, should be interpreted to be illustrative only and non-limiting. Thus, other examples of the exemplary embodiments could have different values.

Note that similar reference numerals and letters refer to similar items in the following figures, and thus once an item is defined in one figure, it may not be discussed for following figures.

Note that herein when referring to correcting or preventing an error or damage (e.g., hearing damage), a reduction of the damage or error and/or a correction of the damage or error are intended.

At least one exemplary embodiment of the invention is directed to an earpiece for ambient sound monitoring and warning detection. Reference is made to FIG. **1** in which an earpiece device, generally indicated as earpiece **100**, is constructed in accordance with at least one exemplary embodiment of the invention. As illustrated, earpiece **100** depicts an electro-acoustical assembly **113** for an in-the-ear acoustic assembly, as it would typically be placed in the ear canal **131** of a user **135**. The earpiece **100** can be an in the ear earpiece, behind the ear earpiece, receiver in the ear, open-fit device, or any other suitable earpiece type. The earpiece **100** can be partially or fully occluded in the ear canal, and is suitable for use with users having healthy or abnormal auditory functioning.

Earpiece **100** includes an Ambient Sound Microphone (ASM) **111** to capture ambient sound, an Ear Canal Receiver (ECR) **125** to deliver audio to an ear canal **131**, and an Ear Canal Microphone (ECM) **123** to assess a sound exposure level within the ear canal. The earpiece **100** can partially or fully occlude the ear canal **131** to provide various degrees of acoustic isolation. The assembly is designed to be inserted into the user's ear canal **131**, and to form an acoustic seal with the walls **129** of the ear canal at a location **127** between the entrance **117** to the ear canal and the tympanic membrane (or ear drum) **133**. Such a seal is typically achieved by means of a soft and compliant housing of assembly **113**. Such a seal is pertinent to the performance of the system in that it creates a closed cavity **131** of approximately 5 cc between the in-ear assembly **113** and the tympanic membrane **133**. As a result of this seal, the ECR (speaker) **125** is able to generate a full range

bass response when reproducing sounds for the user. This seal also serves to significantly reduce the sound pressure level at the user's eardrum **133** resulting from the sound field at the entrance to the ear canal. This seal is also the basis for the sound isolating performance of the electro-acoustic assembly **113**.

Located adjacent to the ECR **125**, is the ECM **123**, which is acoustically coupled to the (closed) ear canal cavity **131**. One of its functions is that of measuring the sound pressure level in the ear canal cavity **131** as a part of testing the hearing acuity of the user as well as confirming the integrity of the acoustic seal and the working condition of itself and the ECR. The ASM **111** is housed in an assembly **113** and monitors sound pressure at the entrance to the occluded or partially occluded ear canal. All transducers shown can receive or transmit audio signals to a processor **121** that undertakes audio signal processing and provides a transceiver for audio via the wired or wireless communication path **119**.

Referring to FIG. **2**, a block diagram of the earpiece **100** in accordance with an exemplary embodiment is shown. As illustrated, the earpiece **100** can include a processor **206** operatively coupled to the ASM **111**, ECR **125**, and ECM **123** via one or more Analog to Digital Converters (ADC) **202** and Digital to Analog Converters (DAC) **203**. The processor **206** can monitor the ambient sound captured by the ASM **111** for acute sounds in the environment, such as an abrupt high energy sound corresponding to the on-set of a warning sound (e.g., bell, emergency vehicle, security system, etc.), siren (e.g., police car, ambulance, etc.), voice (e.g., "help", "stop", "police", etc.), or specific noise type (e.g., breaking glass, gunshot, etc.). The processor **206** can utilize computing technologies such as a microprocessor, Application Specific Integrated Chip (ASIC), and/or digital signal processor (DSP) with associated storage memory **208** such as Flash, ROM, RAM, SRAM, DRAM or other like technologies for controlling operations of the earpiece device **100**. The memory **208** can store program instructions for execution on the processor **206** as well as captured audio processing data.

The earpiece **100** can include an audio interface **212** operatively coupled to the processor **206** to receive audio content, for example from a media player or cell phone, and deliver the audio content to the processor **206**. The processor **206** responsive to detecting acute sounds can adjust the audio content and pass the acute sounds directly to the ear canal. For instance, the processor can lower a volume of the audio content responsive to detecting an acute sound for transmitting the acute sound to the ear canal. The processor **206** can also actively monitor the sound exposure level inside the ear canal and adjust the audio to within a safe and subjectively optimized listening level range.

The earpiece **100** can further include a transceiver **204** that can support singly or in combination any number of wireless access technologies including without limitation Bluetooth™, Wireless Fidelity (WiFi), Worldwide Interoperability for Microwave Access (WiMAX), and/or other short or long range communication protocols. The transceiver **204** can also provide support for dynamic downloading over-the-air to the earpiece **100**. It should be noted also that next generation access technologies can also be applied to the present disclosure.

The power supply **210** can utilize common power management technologies such as replaceable batteries, supply regulation technologies, and charging system technologies for supplying energy to the components of the earpiece **100** and to facilitate portable applications. A motor (not shown) can be a single supply motor driver coupled to the power supply **210** to improve sensory input via haptic vibration. As an example, the processor **206** can direct the motor to vibrate responsive to an action, such as a detection of a warning sound or an incoming voice call.

The earpiece **100** can further represent a single operational device or a family of devices configured in a master-slave arrangement, for example, a mobile device and an earpiece. In the latter embodiment, the components of the earpiece **100** can be reused in different form factors for the master and slave devices.

FIG. **3** is a flowchart of a method **300** for acute sound detection and reproduction in accordance with an exemplary embodiment. The method **300** can be practiced with more or less than the number of steps shown and is not limited to the order shown. To describe the method **300**, reference will be made to components of FIG. **2**, although it is understood that the method **300** can be implemented in any other manner using other suitable components. The method **300** can be implemented in a single earpiece, a pair of earpieces, headphones, or other suitable headset audio delivery devices.

The method **300** can start in a state wherein the earpiece **100** has been inserted and powered on. As shown in step **302**, the earpiece **100** can monitor the environment for ambient sounds received at the ASM **111**. Ambient sounds correspond to sounds within the environment such as the sound of traffic noise, street noise, conversation babble, or any other acoustic sound. Ambient sounds can also correspond to industrial sounds present in an industrial setting, such as factory noise, lifting vehicles, automobiles, and robots to name a few.

Although the earpiece **100** when inserted in the ear can partially occlude the ear canal, the earpiece **100** may not completely attenuate the ambient sound. During the monitoring of ambient sounds in the environment, the earpiece **100** also monitors ear canal levels via the ECM **123** as shown in step **304**. The passive aspect of the physical earpiece **100**, due to the mechanical and sealing properties, can provide upwards of a 22-26 dB noise reduction. However, portions of ambient sounds higher than 26 dB can still pass through the earpiece **100** into the ear canal. For instance, high energy low frequency sounds are not completely attenuated. Accordingly, residual sound may be resident in the ear canal and heard by the user.

Sound within the ear canal **131** can also be provided via the audio interface **212**. The audio interface **212** can receive the audio content from at least one among a portable music player, a cell phone, and a portable communication device. The audio interface **212** responsive to user input can direct sound to the ECR **125**. For instance, a user can elect to play music through the earpiece **100** which can be audibly presented to the ear canal **131** for listening. The user can also elect to receive voice communications (e.g., cell phone, voice mail, messaging) via the earpiece **100**. For instance, the user can receive audio content for voice mail or a phone call directed to the ear canal via the ECR **125**. As shown in step **304**, the earpiece **100** an monitor ear canal levels due to ambient sound and user selected sound via the ECM **123**.

If at step **306**, audio is playing (e.g., music, cell phone, etc.), the earpiece **100** adjusts a sound level of the audio based on the ambient sound to maintain a constant signal to noise ratio with respect to the ear canal level at step **308**. For instance, the processor **206** can selectively amplify or attenuate audio content received from the audio interface **212** before it is delivered to the ECR **125**. The processor **206** estimates a background noise level from the ambient sound received at the ASM **111**, and adjusts the audio level of delivered audio content (e.g., music, cell phone audio) to maintain a constant signal (e.g., audio content) to noise level (e.g., ambient sound). By way of example, if the background noise level

increases due to traffic sounds, the earpiece **100** automatically increases the volume of the audio content. Similarly, if the background noise level decreases, the earpiece **100** automatically decreases the volume of the audio content. The processor **206** can track variations on the ambient sound level to adjust the audio content level.

If at step **310**, an acute sound is detected within the ambient sound, the earpiece **100** activates "sound pass-through" to reproduce the ambient sound in the ear canal by way of the ECR **125**. The processor **206** permits the ambient sound to pass through the ECR **125** to the ear canal **131** directly for example by replicating the ambient sound external to the ear canal within the ear canal. This is important if the acute sound corresponds to an on-set for a warning sound such as a bell, a car, or an object. In such regard, the ambient sound containing the acute sound is presented directly to the ear canal in an original form. Although, the earpiece **100** inherently provides attenuation due to the physical and mechanical aspects of the earpiece and its sealing properties, the processor **206** can reproduce the ambient sound within the ear canal **131** at an original amplitude level and frequency content to provide "transparency". For instance, the processor **206** measures and applies a transfer function of the ear canal to the passed ambient sound signal to provide an accurate reproduction of the ambient sound within the ear canal.

In one embodiment, the earpiece **100** looks for temporal and spectral characteristics in the ambient sound for detecting acute sounds. For instance, as will be explained ahead, the processor **206** looks for an abrupt change in the Sound Pressure Level (SPL) of an ambient sound across a small time period. The processor **206** can also detect abrupt magnitude changes across frequency sub-bands (e.g. filter-bank, FFT, etc.). Notably, the processor **206** can search for on-sets (e.g., fast rising amplitude wave-front) of an acute sound or other abrupt feature characteristics without initially attempting to initially identify or recognize the sound source. That is, the processor **206** is actively listening for a presence of acute sounds before identifying the type of sound source.

Even though the earplug inherently provides a certain attenuation level (e.g., noise reduction rating), the processor **206** in view of the ear canal level (ECL) and ambient sound level (ASL) can reproduce the ambient sound within the ear canal to allow the user to make an informed decision with regard to the acute sound. The ECL corresponds to all sounds within the ear canal and includes the internal ambient sound level (iASL) resulting from residual ambient sounds through the earpiece and the audio content level (ACL) resulting from the audio delivered via the audio interface **212**. Briefly, xASL is the external ambient sound external to the ear canal and the earpiece (e.g., ambient sound outside the ear canal). iASL is the residual ambient sound that remains internal in the ear canal. The following equations describe the relationship among terms:

$$iASL = xASL - NRR \quad \text{(EQ 1)}$$

$$iASL = ECL - ACL \quad \text{(EQ 2)}$$

As EQ 1 shows, the iASL is the difference between the external ambient sound (xASL) and the attenuation of the earpiece (Noise Reduction Rating) due to the physical and sealing properties of the earpiece. The processor **206** can measure an external ambient sound level (xASL) of the ambient sound with the ASM **111** and subtracts an attenuation level of the earpiece (NRR) from the xASL to estimate the internal ambient sound level (iASL) within the ear canal.

EQ 2 is an alternate, or supplemental, method for calculating the iASL as the difference between the ECL and the Audio Content Level (ACL). By way of the ECM **123**, the processor **206** can estimate an internal ambient sound level (iASL) within the ear canal by subtracting the estimated audio content sound level (ACL) from the ECL. The processor **206** measures a voltage level of the audio content sent to the ECR **125**, and applies a transfer function of the ECR **125** to convert the voltage level to the ACL.

The processor **206** evaluates the equations above to pass sound from the ASM **111** directly to the ECR **125** to produce sound within the ear canal at a same sound pressure level (SPL) and frequency representation as the acute sound measured at an entrance to the ear canal. Further, the processor **206** can maintain an approximately constant ratio between an audio content level (ACL) and an internal ambient sound level (iASL) measured within the ear canal.

At step **314**, the earpiece **100** can estimate a proximity of the acute sound. For instance, as will be shown ahead, the processor **206** can perform a correlation analysis on at least two microphones to determine whether the sound source is internal (e.g., the user) or external (e.g., an object other than the user). At step **316**, the earpiece **100** determines whether it is the user's voice that generates the acute sound when the user speaks, or whether it is an external sound such as a vehicle approaching the user. If at step **316**, the processor **206** determines that the acute sound is a result of the user speaking, the processor **206** does not activate a pass-through mode, since this is not considered an external warning sound. The pass-through mode permits ambient sound detected at the ASM **111** to be transmitted directly to the ear canal. If however, the acute sound corresponds to an external sound source, such as an on-set of a warning sound, the earpiece at step **318** activates "sound pass-through" to reproduce the ambient sound in the ear canal by way of the ECR **125**. The earpiece **100** can also present an audible notification to the user indicating that an external sound source generating the acute sound has been detected. The method **300** can proceed back to step **302** to continually monitor for acute sounds in the environment.

FIG. **4** is a detailed approach to the method **400** of FIG. **3** for an Acute-Sound Pass-Through System (ACPTS) in accordance with an exemplary embodiment. The method **400** can be practiced with more or less than the number of steps shown and is not limited to the order shown. To describe the method **400**, reference will be made to components of FIG. **2**, although it is understood that the method **400** can be implemented in any other manner using other suitable components. The method **400** can be implemented in a single earpiece, a pair of earpieces, headphones, or other suitable headset audio delivery devices.

At step **402**, the earpiece **100** captures ambient sound signals from the ASM **111**. At step **404**, the processor **206** applies analog and discrete time signal processing to condition and compensate the ambient sound signal for the ASM **111** transducer. At step **406**, the processor **206** estimates a background noise level (BNL) as will be discussed ahead. At step **408**, the processor **206** identifies at least one peak in a data buffer storing a portion of the ambient sound signal. The processor **206** at step **410** gets a level of the peak (e.g., dBV). Block **412** presents a method for warning signal detection (e.g. car horns, klaxons). When a warning signal is detected at step **416**, the processor **206** invokes at step **418** a pass-through mode whereby the ASM signal is reproduced with the ECR **125**. Upon activating pass-through mode, the processor **206** can perform a safe level check at step **452**. If a warning signal is not detected, the method **400** proceeds to step **420**.

At step **420**, the processor **206** subtracts the estimated BNL from an SPL of the ambient sound signal to produce signal

"A". A high energy level transient signal is indicative of an acute sound. At step **422**, a frequency dependent threshold is retrieved at step **424**, and subtracted from signal "A", as shown in step **422** to produce signal "B". At step **426**, the processor **206** determines if signal "B" is positive. If not, the processor **206** performs a hysterisis to determine if the acute sound has already been detected. If not, the processor at step **428** determines if an SPL of the ambient sound is greater than a signal "C" (e.g. threshold). If the SPL is greater than signal "C", the earpiece generates a user generated sound at step **434**. The signal "C" is used to ensure that the SPL between the signal and background noise is positive and greater than a predetermined amount. For instance, a low SPL threshold (e.g., "C" **40** dB) can be used as shown in step **430**, although it can adapt to different environmental conditions. The low SPL threshold provides an absolute measure to the SPL difference. At step **436**, a proximity of a sound source generating the acute sound can be estimated as will be discussed ahead. The method **400** can continue to step **432**.

Briefly, if a transient, high-level sound (or acute sound) is detected in the ambient sound signal (ASM input signal), then it is converted to a level, and its magnitude compared with the BNL is calculated. The magnitude of this resulting difference (signal "A") is compared with the threshold (see step **422**). If the value is positive, and the level of the transient is greater than a predefined threshold (see step **428**), the processor **206** invokes the optional Source Proximity Detector at step **436**, which determines if the acute sound was created by the User's voice (i.e., a user generated sound). If a user-generated sound is NOT detected, then Pass-through operation at step **438** is invoked, whereby the ambient sound signal is reproduced with the ECR **125**. If the difference signal at step **428** is not positive, or the level of the identified transient is too low, then the hysteresis is invoked at step **432**. The processor **206** decides if the pass-through was recently used at step **440** (e.g. in the last 10 ms). If pass-through mode was recently activated, then processor **206** invokes the pass-through system at step **438**; otherwise there is no pass-through of the ASM signal to the ECR as shown at step **442**. Upon activating pass-through mode, the processor **206** can perform a safe level check at step **452**.

FIG. **5** is a flowchart of a method **500** for acute sound source proximity. The method **500** can be practiced with more or less than the number of steps shown and is not limited to the order shown. To describe the method **500**, reference will be made to components of FIG. **2**, although it is understood that the method **500** can be implemented in any other manner using other suitable components. The method **500** can be implemented in a single earpiece, a pair of earpieces, headphones, or other suitable headset audio delivery devices.

Briefly, FIG. **5** describes a method **500** for Source Proximity Detection (SPD) to determine if the Acute sound detected was created by the User's voice operating the earpiece **100**. The SPD method **500** uses as its inputs the external ambient sound signals from left and right electro-acoustic earpiece **100** assemblies (e.g., a headphone). In some embodiments the SPD method **500** employs Ear Canal Microphone (ECM) signals from left and right earpiece **100** assemblies placed on left and right ears respectively. The processor **206** performs an electronic cross-correlation between the external ambient sound signals to determine a Pass-through or Non Pass-through operating mode. In the described embodiment whereby the cross-correlation of both the ASM and ECM signals is involved, a pass-through mode is invoked when the cross-correlation analysis for both the left and right earpiece **100** assemblies return a "Pass-through" operating mode, as determined by a logical AND unit.

For instance, at step **502** a left ASM signal from a left headset incorporating the earpiece **100** assembles is received. Simultaneously, at step **504** a right ASM signal from a right headset is received. At step **510**, the processor **206** performs a binaural cross correlation on the left ASM signal and the right ASM signal to evaluate a pass through mode **516**. At step **506** a left ECM signal from the left headset is received. At step **508**, a right ECM signal from the right headset is received. At step **514**, the processor **206** performs a binaural cross correlation on the left ECM signal and the right ECM signal to evaluate a pass through mode **518**. A pass through mode **524** is invoked if both the ASM and ECM cross correlation analysis are the same as determined in step **520**. A safe level check can be performed by processor **206** at step **522**.

FIG. **6** is a flowchart of a method **600** for binaural analysis. The method **600** can be practiced with more or less than the number of steps shown and is not limited to the order shown. To describe the method **600**, reference will be made to components of FIG. **2**, although it is understood that the method **600** can be implemented in any other manner using other suitable components. The method **600** can be implemented in a single earpiece, a pair of earpieces, headphones, or other suitable headset audio delivery devices.

Briefly, FIG. **6** describes a component of the SPD method **500** wherein a cross-correlation of two input audio signals **602** and **604** (e.g., left and right ASM signals) is calculated. The input signals may first be weighted using a frequency-dependant filter (e.g. an FIR-type filter) using filter coefficients **606** and filtering networks **608** and **610**. Alternatively, an interchannel cross-correlation calculated with function **612** can return a frequency-dependant correlation such as a coherence function. The absolute maximum peak of a calculated cross-correlation **614** can be subtracted from a mean (or RMS) **616** correlation, with subtractor **622**, and compared **628** with a predefined threshold **626**, to determine if the peak is significantly greater than the average correlation (i.e. a test for peakedness). Alternatively, the maxima of the peak may simply be compared with the threshold **628** without the subtraction process **622**. If the lag-time of the peak **618** is at approximately lag-sample **0**, then the sound source is determined, at step **624**, as being on the interaural axis-indicative of User-generated speech, and a no-pass through mode is returned **630** (a further function described in FIG. **7** may be used to confirm that the sound source originates in the User-head, rather than external to the user- and further confirming that the acute sound is a User-generated voice sound). The logical AND unit **632** activates the pass-through mode **636** if both criteria in the decision units **628** and **624** confirm that the absolute maxima of the peak is above a predefined threshold **626**, AND the lag of the peak is NOT at approximately lag sample zero. A safe level check may be performed by processor **206** at step **634**.

FIG. **7** is a flowchart of a method **700** for logic control. The method **700** can be practiced with more or less than the number of steps shown and is not limited to the order shown. To describe the method **700**, reference will be made to components of FIG. **2**, although it is understood that the method **700** can be implemented in any other manner using other suitable components. The method **700** can be implemented in a single earpiece, a pair of earpieces, headphones, or other suitable headset audio delivery devices.

Briefly, FIG. **7** describes a further component of the SPD method **500**, which is optional to confirm that the acute sound source is from a location indicative of user-generated speech; i.e. inside the head. Method steps **702-712** are similar to Method steps **502-514** of FIG. **5**. The cross-correlations of step **710** and **712** provide a time-lag of the maximum absolute

peak for a pair of input signals; the ASM and ECM signals for the same headset (e.g. the ASM and ECM for the left headset). At step **714** a left lag of a peak of the left cross correlation is determined, and simultaneously, a right lag of a peak of the right cross correlation is determined at step **718**. If a lag of a respective peak is greater than zero—this indicates that the sound arrived at the ECM signal before the ASM signal. Decision step **716** determines if the lag is greater than zero for both the left and right headsets—and activates the pass-through mode **722** if so. A safe level check may be performed by processor **206** at step **720**.

FIG. **8** is a flowchart of a method **800** for estimating background sound level. The method **800** can be practiced with more or less than the number of steps shown and is not limited to the order shown. To describe the method **800**, reference will be made to components of FIG. **2**, although it is understood that the method **800** can be implemented in any other manner using other suitable components. The method **800** can be implemented in a single earpiece, a pair of earpieces, headphones, or other suitable headset audio delivery devices.

Briefly, method **800** receives as its input **802** either or both the ASM signal from ASM **111** and a signal from the ECM **123**. An audio buffer **804** of the input audio signal is accumulated (e.g. 10 ms of data), which is then processed by squaring step **806** to obtain the temporal envelope. The envelope is smoothed (e.g. an FIR-type low-pass digital filter) at step **808** using a smoothing window **810** stored in data memory (e.g. a Hanning or Hamming shaped window). At step **812**, transient peaks in the input buffer can be identified and removed to determine a "steady-state" Background Noise Level (BNL). At step **814** an average BNL **816** can be obtained (similar to, or the same as, the RMS) that is frequency dependant or a single value averaged over all frequencies. If the ECM **123** is used to determine the BNL, then decision step **818** adjusts the ambient BNL estimation to provide an equivalent ear-canal BNL SPL, by deducting an Earpiece Noise Reduction Rating **828** from the BNL estimate **826**. Alternatively, if the ECM **123** is used, then the Audio Content SPL level (ACL) **822** of any reproduced Audio Content **820** is deducted from the ECM level at step **824**. The updated BNL estimate is then converted to a Sound Pressure Level (SPL) equivalent **832** (i.e. substantially equal to the SPL at the ear-drum in which the earphone device is inserted) by taking into account the sensitivity (e.g. measured in V per dB) of either the ASM **111** or ECM **123** at steps **830** and **834** respectively. The resulting BNL SPL is then combined at step **842** with the previous BNL estimate **840**, by averaging **838** a weighted previous BNL (weighted with coefficient **836**), to give a new ear-canal BNL **844**.

FIG. **9** is a flowchart of a method **900** for maintaining constant audio content level (ACL) to internal ambient sound level (iASL). The method **900** can be practiced with more or less than the number of steps shown and is not limited to the order shown. To describe the method **900**, reference will be made to components of FIG. **2**, although it is understood that the method **900** can be implemented in any other manner using other suitable components. The method **900** can be implemented in a single earpiece, a pair of earpieces, headphones, or other suitable headset audio delivery devices.

Briefly, FIG. **9** describes a method **900** for Constant Signal-to-Noise Ratio (CSNRS). At step **904** an input signal is captured from the ASM **111** and processed at step **910** (e.g. ADC, EQ, gain). Similarly, at step **906** an input signal from the ECM **123** is captured and processed at step **912**. The method **900** also receives as input an Audio Content signal **902**, e.g. a music audio signal from a portable Media Player or mobile-phone, which is processed with an analog and digital signal processing system as shown in step **908**. An Audio Content Level (ACL) is determined at step **914** based on an earpiece sensitivity from step **916**, and returns a dBV value.

In one exemplary embodiment, method **900** calculates a RMS value over a window (e.g. the last 100 ms). The RMS value can then be first weighted with a first weighting coefficient and then averaged with a weighted previous level estimate. The ACL is converted to an equivalent SPL value (ACL), which may use either a look-up-table or algorithm to calculate the ear-canal SPL of the signal if it was reproduced with the ECR **125**. To calculate the equivalent ear canal SPL, the sensitivity of the ear canal receiver can be factored in during processing.

At step **922** the BNL is estimated using inputs from either or both the ASM signal at step **902**, and/or the ECM signal at step **906**. The BNL may be adjusted by the earpiece noise reduction rating **924**. These signals are selected using the BNL input switch at step **918**, which may be controlled automatically or with a specific user-generated manual operation at step **926**. The Ear-Canal SNR is calculated at step **920** by differencing the ACL from step **914** and the BNL from step **922** and the resulting SNR **930** is passed to the method step **932** for AGC coefficient calculation. The AGC coefficient calculation **932** calculates gains for the Audio Content signal and ASM signal from the Automatic Gain Control steps **928** and **936** (for the Audio Content and ASM signals, respectively). AGC coefficient calculation **932** may use a default preferred SNR **938** or a user-preferred SNR **934** in its calculation. After the ASM signal and Audio content signal have been processed by the AGCs **928** and **936**, the two signals are mixed at step **940**.

At step **942**, a safe-level check determines if the resulting mixed signal is too high, if it were reproduced with the ECR **125** as shown in block **944**. The safe-level check can use information regarding the user's listening history to determine if the user's sound exposure is such that it may cause a temporary or a permanent hearing threshold shift. If such high levels are measured, then the safe-level check reduces the signal level of the mixed signals via a feedback path to step **940**. The resulting audio signal generated after step **942** is then reproduced with the ECR **125**.

FIG. **10** is a flowchart of a method **950** for maintaining a constant signal to noise ratio based on automatic gain control (AGC). The method **950** can be practiced with more or less than the number of steps shown and is not limited to the order shown. To describe the method **950**, reference will be made to components of FIG. **2**, although it is understood that the method **950** can be implemented in any other manner using other suitable components. The method **950** can be implemented in a single earpiece, a pair of earpieces, headphones, or other suitable headset audio delivery devices.

Method **950** describes calculation of AGC coefficients. The method **950** receives as its inputs an Ear Canal SNR **952** and a target SNR **960** to provide a SNR mismatch **958**. The target SNR **964** is chosen from a pre-defined SNR **954**, sorted in computer memory or a manually defined SNR **956**. At step **958**, a difference is calculated between the actual ear-canal SNR and the target SNR to produce the mismatch **962**. The mismatch level **962** is smoothed over time at step **968**, which uses a previous mismatch **970** that is weighted using single or multiple weighting coefficients **966**, to give a new time-smoothed SNR mismatch **974**. Depending on the magnitude of this mismatch, various operating modes **972**, **978** can be invoked, for example, as described by the AGC decision module **976** (step **932** in FIG. **9**).

While the present invention has been described with reference to exemplary embodiments, it is to be understood that the invention is not limited to the disclosed exemplary

embodiments. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all modifications, equivalent structures and functions of the relevant exemplary embodiments. Thus, the description of the invention is merely exemplary in nature and, thus, variations that do not depart from the gist of the invention are intended to be within the scope of the exemplary embodiments of the present invention. Such variations are not to be regarded as a departure from the spirit and scope of the present invention.

What is claimed is:

1. An earpiece comprising:
- an Ambient Sound Microphone (ASM) configured to capture ambient sound, the ambient sound containing an acute sound having an abrupt high energy sound profile;
- at least one Ear Canal Receiver (ECR) configured to deliver audio to an ear canal; and
- a processor operatively coupled to the ASM and the at least one ECR, the processor being configured to:
  - monitor a change in an ambient sound level of the ambient sound,
  - detect an on-set of a fast rising amplitude wave-front of the acute sound, and
  - upon detecting the on-set of the fast rising amplitude wave-front of the acute sound, reproduce the acute sound within the ear canal via the ECR.

2. The earpiece of claim **1**, wherein the processor passes the ambient sound from the ASM directly to the ECR to produce sound within the ear canal at a same sound pressure level (SPL) and frequency representation as the acute sound measured at an entrance to the ear canal.

3. The earpiece of claim **1**, wherein the processor maintains an approximately constant ratio between an audio content level (ACL) presented to the earpiece and an internal ambient sound level (iASL) measured within the ear canal.

4. The earpiece of claim **1**, wherein the processor measures an external ambient sound level (xASL) of the ambient sound with the ASM and subtracts an attenuation level of the earpiece from the xASL to estimate an internal ambient sound level (iASL) within the ear canal.

5. The earpiece of claim **1**, further comprising:
- an Ear Canal Microphone (ECM) to measure an ear canal sound level (ECL) within the ear canal,
- wherein the processor estimates an internal ambient sound level (iASL) within the ear canal by subtracting an estimated audio content sound level (ACL) from the ECL.

6. The earpiece of claim **5**, wherein the processor measures a voltage level of audio content sent to the ECR, and applies a transfer function of the ECR to convert the voltage level to the ACL.

7. The earpiece of claim **1**, wherein the processor is located external to the earpiece on a portable computing device.

8. The earpiece of claim **1**, wherein the processor detects the on-set of the acute sound without identifying the acute sound.

9. The earpiece of claim **1**, wherein the ASM is located internal to the earpiece.

10. The earpiece of claim **1**, wherein the ASM is located external to the earpiece on a remote device.

11. The earpiece of claim **10**, wherein the remote device includes at least one of a further earpiece, a cell phone, a media player, a portable computing device or a personal digital assistant.

12. The earpiece of claim **11**, wherein the earpiece and the further earpiece are configured to be worn by a same individual.

13. The earpiece of claim **11**, wherein the earpiece and the further earpiece are configured to be worn by different individuals.

14. An earpiece, comprising:
- an Ambient Sound Microphone (ASM) configured to capture ambient sound, the ambient sound containing an acute sound having an abrupt high energy sound profile;
- at least one Ear Canal Receiver (ECR) configured to deliver audio to an ear canal;
- an audio interface configured to receive audio content; and
- a processor operatively coupled to the ASM, the at least one ECR, and the audio interface, the processor being configured to:
  - monitor a change in an ambient sound level of the ambient sound,
  - detect an on-set of a fast rising amplitude wave-front of the acute sound,
  - adjust an audio content level (ACL) of the audio content delivered to the ear canal, and
  - upon detecting the on-set of the fast rising amplitude wave-front of the acute sound, reproduce the acute sound within the ear canal via the ECR.

15. The earpiece of claim **14**, wherein the audio interface receives the audio content from at least one among a portable music player, a cell phone, and a portable communication device.

16. The earpiece of claim **14**, wherein the processor maintains an approximately constant ratio between the audio content level (ACL) and an internal ambient sound level (iASL) measured within the ear canal.

17. The earpiece of claim **16**, wherein the processor mutes the audio content and passes the acute sound to the ECR for reproducing the acute sound within the ear canal.

18. The earpiece of claim **16**, wherein the processor amplifies the acute sound with respect to the audio content level (ACL).

19. The earpiece of claim **14**, wherein the processor detects the on-set of the acute sound without identifying the acute sound.

20. The earpiece of claim **14**, wherein the ASM is located internal to the earpiece.

21. The earpiece of claim **14**, wherein the ASM is located external to the earpiece on a remote device.

22. The earpiece of claim **21**, wherein the remote device includes at least one of a further earpiece, a cell phone, a media player, a portable computing device or a personal digital assistant.

23. The earpiece of claim **22**, wherein the earpiece and the further earpiece are configured to be worn by a same individual.

24. The earpiece of claim **22**, wherein the earpiece and the further earpiece are configured to be worn by different individuals.

25. A method for acute sound detection and reproduction the method comprising:
- measuring an ambient sound level (xASL) of ambient sound external to an ear at least partially occluded by an earpiece, the ambient sound containing an acute sound having an abrupt high energy sound profile;
- monitoring a change in the xASL of the ambient sound;
- detecting an on-set of a fast rising amplitude wave-front of the acute sound; and
- upon detecting the on-set of the fast rising amplitude wave-front of the acute sound, reproducing the acute sound within an ear canal.

26. The method of claim 25, wherein the xASL is measured by an ambient sound microphone located internal to the earpiece.

27. The method of claim 25, wherein the xASL is measured by an ambient sound microphone located external to the earpiece on a remote device.

28. The method of claim 27, wherein the remote device includes at least one of a further earpiece, a cell phone, a media player, a portable computing device or a personal digital assistant.

29. The method of claim 28, wherein the earpiece and the further earpiece are configured to be worn by a same individual.

30. The method of claim 28, wherein the earpiece and the further earpiece are configured to be worn by different individuals.

31. The method of claim 25, wherein the step of detecting the on-set comprises detecting an abrupt magnitude change across frequency sub-bands.

32. The method of claim 25, wherein the step of reproducing produces sound within the ear canal at a same sound pressure level (SPL) as the acute sound measured at an entrance to the ear canal.

33. The method of claim 25, further comprising:

receiving audio content from an audio interface that is directed to the ear canal;

maintaining an approximately constant ratio between a level of the audio content (ACL) and an internal ambient sound level (iASL) measured within the ear canal.

34. The method of claim 33, wherein the ACL is determined by

measuring a voltage level of the audio content directed to the ear canal, the audio content being directed via an Ear Canal Receiver (ECR); and

applying a transfer function of the ECR to convert the voltage level to the ACL.

35. The method of claim 33, further comprising:

measuring an Ear Canal Level (ECL) within the ear canal; and

subtracting the ACL from the ECL to estimate the iASL.

36. The method of claim 33, wherein the iASL is estimated by subtracting an attenuation level of the earpiece from the xASL.

37. The method of claim 33, further comprising:

muting the audio content and passing the acute sound to an Ear Canal Receiver (ECR) for reproducing the acute sound within the ear canal.

38. The method of claim 33, further comprising:

amplifying the acute sound with respect to the audio content level (ACL).

* * * * *

Patent Assignment Abstract of Title

Total Assignments: 4

Application #: 16987396 **Filing Dt:** 08/07/2020 **Patent #:** 11244666 **Issue Dt:** 02/08/2022
PCT #: NONE **Intl Reg #:** **Publication #:** US20200365132 **Pub Dt:** 11/19/2020
Inventors: John Usher, Steven Wayne Goldstein, Marc Andre Boillot
Title: METHOD AND DEVICE FOR ACUTE SOUND DETECTION AND REPRODUCTION

Assignment: 1

Reel/Frame: 054756 / 0398 **Received:** 12/28/2020 **Recorded:** 12/28/2020 **Mailed:** 12/29/2020 **Pages:** 6
Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).
Assignors: GOLDSTEIN, STEVEN WAYNE **Exec Dt:** 04/03/2008
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Assignment: 2

Reel/Frame: 054756 / 0427 **Received:** 12/28/2020 **Recorded:** 12/28/2020 **Mailed:** 12/29/2020 **Pages:** 5
Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).
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Assignment: 3

Reel/Frame: 054756 / 0451 **Received:** 12/28/2020 **Recorded:** 12/28/2020 **Mailed:** 12/29/2020 **Pages:** 16
Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).
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Assignment: 4

Reel/Frame: 054756 / 0494 **Received:** 12/28/2020 **Recorded:** 12/28/2020 **Mailed:** 12/29/2020 **Pages:** 15
Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).
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Search Results as of: 02/28/2023 01:12 PM

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BIB DATA SHEET

CONFIRMATION NO. 7859

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
90/019,169	02/24/2023 RULE	381	3992	0027071.00133

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**** CONTINUING DATA ***************************

This application is a REX of 16/987,396 08/07/2020 PAT 11244666
which is a CON of 16/669,490 10/30/2019 PAT 10810989
which is a CON of 16/193,568 11/16/2018 PAT 10535334
which is a CON of 14/574,589 12/18/2014 PAT 10134377
which is a CON of 12/017,878 01/22/2008 PAT 8917894
which claims benefit of 60/885,917 01/22/2007

**** FOREIGN APPLICATIONS ***************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****

Foreign Priority claimed ❑ Yes ❑ No 35 USC 119(a-d) conditions met ❑ Yes ❑ No Verified and Acknowledged _____ Examiner's Signature	❑ Met after Allowance _____ Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
				11	1

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TITLE

METHOD AND DEVICE FOR ACUTE SOUND DETECTION AND REPRODUCTION

FILING FEE RECEIVED	FEES: Authority has been given in Paper	❑ All Fees
0.00	No._____ to charge/credit DEPOSIT ACCOUNT	❑ 1.16 Fees (Filing)
	No._____ for following:	❑ 1.17 Fees (Processing Ext. of time)
		❑ 1.18 Fees (Issue)
		❑ Other _____
		❑ Credit

BIB (Rev. 05/07).

Litigation Search Report CRU 3999

Reexamination Control No. 90/019,169

To:	GE	**From:**	MANUEL SALDANA
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Search Notes

(OPEN) 2:22cv53, Staton Techiya, Llc Et Al V. Samsung Electronics Co., Ltd. Et Al

(OPEN) 2:21cv413, Staton Techiya, Llc Et Al V. Samsung Electronics Co., Ltd. Et Al

1. Performed a KeyCite Search in Westlaw, which retrieves all history on the patent including any litigation.
2. Performed a search on the patent in Lexis CourtLink for any open dockets or closed cases.
3. Performed a search in Lexis in the Federal Courts and Administrative Materials databases for any cases found.
4. Performed a search in Lexis in the IP Journal and Periodicals database for any articles on the patent.
5. Performed a search in Lexis in the news databases for any articles about the patent or any articles about litigation on this patent.

Paper No. 202303011



User Name: Manuel Saldana
Date and Time: Wednesday, March 1, 2023 9:01:00AM EST
Job Number: 191485554

Document (1)

1. *2:22cv53 Staton Techiya, Llc Et Al V. Samsung Electronics Co., Ltd. Et Al*
   Client/Matter: -None-
   Search Terms: number(2:22CV00053)
   Search Type: Terms and Connectors
   Narrowed by:

Content Type	Narrowed by
Dockets	Case Status: Open,Unknown,Closed

2:22cv53, Staton Techiya, Llc Et Al V. Samsung Electronics Co., Ltd. Et Al

US District Court Docket

United States District Court, Texas Eastern

(Marshall)

This case was retrieved on 09/27/2022

Header

Case Number: 2:22cv53
Date Filed: 02/14/2022
Assigned To: District Judge Rodney Gilstrap
Referred To: Magistrate Judge Roy S. Payne
Nature of Suit: Patent (830)
Cause: Patent Infringement
Lead Docket: 2:21cv00413
Other Docket: 2:21cv00413
Jurisdiction: Federal Question

Class Code: Open
Statute: 35:271
Jury Demand: Plaintiff
Demand Amount: $0
NOS Description: Patent

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Proceedings

#	Date	Proceeding Text	Source
1	02/14/2022	***SEALED PER ORDER #8*** COMPLAINT for Patent Infringement against Samsung Electronics America, Inc., Samsung Electronics Co., Ltd. (Filing fee $ 402 receipt number 0540-8788477.), filed by Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit A, # 2 Exhibit B, # 3 Exhibit C, # 4 Exhibit D, # 5 Civil Cover Sheet)(Cangro, Bradford) Modified on 3/8/2022 (ch,). (Entered: 02/14/2022)	
	02/14/2022	Case Assigned to District Judge Rodney Gilstrap and Magistrate Judge Roy S. Payne. (nkl,) (Entered: 02/14/2022)	
	02/14/2022	In accordance with the provisions of 28 USC Section 636(c), you are hereby notified that a U.S. Magistrate Judge of this district court is available to conduct any or all proceedings in this case including a jury or non-jury trial and to order the entry of a final judgment. The form Consent to Proceed Before Magistrate Judge is available on our website. All signed consent forms, excluding pro se parties, should be filed electronically using the event Notice Regarding Consent to Proceed Before Magistrate Judge. (nkl,) (Entered: 02/14/2022)	
2	02/14/2022	CORPORATE DISCLOSURE STATEMENT filed by Staton Techiya, LLC, Synergy IP Corporation (Cangro, Bradford) (Entered: 02/14/2022)	
3	02/14/2022	Notice of Filing of Patent/Trademark Form (AO 120). AO 120 mailed to the Director of the U.S. Patent and Trademark Office. (Cangro, Bradford) (Entered: 02/14/2022)	
4	03/01/2022	Unopposed MOTION for Extension of Time to File Answer , MOVE, OR OTHERWISE RESPOND TO PLAINTIFFS COMPLAINT AND WAIVER OF FOREIGN SERVICE REQUIREMENT by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 03/01/2022)	
5	03/02/2022	ORDER granting 4 Motion for Extension of Time to Answer. Signed by Magistrate Judge Roy S. Payne on 3/2/2022. (ch,) (Entered: 03/02/2022)	
6	03/03/2022	NOTICE of Attorney Appearance by Jacob Andrew Snodgrass on behalf of Staton Techiya, LLC, Synergy IP Corporation (Snodgrass, Jacob) (Entered: 03/03/2022)	
7	03/07/2022	Unopposed MOTION to Seal Document 1 Complaint, by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit A, # 2 Text of Proposed Order)(Smith, Melissa) (Entered: 03/07/2022)	
8	03/08/2022	ORDER granting 7 Motion to Seal Document 1 Complaint. ORDERED that a redacted version of Dkt. No. 1 be filed no later than March 11, 2022. Signed by Magistrate Judge Roy S. Payne on 3/8/2022. (ch,) Modified on 3/8/2022 (ch,). (Entered: 03/08/2022)	
9	03/09/2022	REDACTION to 1 Complaint, by Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit A, # 2 Exhibit B, # 3 Exhibit C, # 4 Exhibit D, # 5 Civil Cover Sheet)(Snodgrass, Jacob) (Entered: 03/09/2022)	
10	04/06/2022	NOTICE of Discovery Disclosure by Staton Techiya, LLC, Synergy IP Corporation of Service of P.R. 3-1 and 3-2 Disclosures (Snodgrass, Jacob) (Entered: 04/06/2022)	
11	04/14/2022	ORDER,- Scheduling Conference set for 5/18/2022 02:00 PM before District Judge Rodney Gilstrap. Signed by Magistrate Judge Roy S. Payne on 4/14/2022. (ch,) (Entered: 04/14/2022)	

#	Date	Proceeding Text	Source
12	05/04/2022	CONSOLIDATION ORDER - ORDERED that Case No. 2:21-cv-00413-JRG-RSP and Case No. 2:22-cv-00053-JRG-RSP are CONSOLIDATED for all purposes, including pre-trial and trial, with Case No. 2:21-cv-00413-JRG-RSP designated as the LEAD CASE. Signed by District Judge Rodney Gilstrap on 5/4/2022. (ch,) (Entered: 05/05/2022)	
13	05/18/2022	***FILED IN ERROR***Unopposed MOTION to Seal Document Answer and Counterclaims by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) Modified on 5/19/2022 (ch,). (Entered: 05/18/2022)	
	05/19/2022	***FILED IN ERROR. PER ATTORNEY Document # 13, Motion to Seal. PLEASE IGNORE.*** (ch,) (Entered: 05/19/2022)	
14	07/13/2022	***FILED IN ERROR***Unopposed MOTION TO FILE UNDER SEAL by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) Modified on 7/14/2022 (ch,). (Entered: 07/13/2022)	
15	07/13/2022	***FILED IN ERROR***SEALED PATENT DOCUMENT SAMSUNG'S FIRST AMENDED ANSWER AND COUNTERCLAIMS (Attachments: # 1 Exhibit 1)(Smith, Melissa) Modified on 7/14/2022 (ch,). (Entered: 07/13/2022)	
	07/14/2022	***FILED IN ERROR. FILE IN THE LEAD CASE Document # 14, Motion to Filed under Seal. PLEASE IGNORE.*** (ch,) (Entered: 07/14/2022)	
	07/14/2022	***FILED IN ERROR. PLEASE FILE IN LEAD CASE Document # 15, Sealed Document. PLEASE IGNORE.*** (ch,) (Entered: 07/14/2022)	

Patents

Number	Title	Issued	Class	Subclass
11,039,259	Method and system for sound monitoring over a network	06/15/2021	1	1
11,057,701	Method and device for in ear canal echo suppression	07/06/2021	1	1
11,217,237	Method and device for voice operated control	01/04/2022	1	1
11,244,666	Method and device for acute sound detection and reproduction	02/08/2022	1	1

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User Name: Manuel Saldana
Date and Time: Wednesday, March 1, 2023 8:56:00AM EST
Job Number: 191485219

Document (1)

1. *SAMSUNG ELECS. CO. v. TECHIYA, 2022 PAT. APP. FILINGS LEXIS 5874*

Client/Matter: -None-
Search Terms: 11244666 OR 11,244,666
Search Type: Terms and Connectors
Narrowed by:

Content Type	Narrowed by
Briefs, Pleadings and Motions	-None-

Case IPR2022-01099; U.S. Patent 11,244,666

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT TRIAL AND APPEAL BOARD

June 9, 2022

Reporter
2022 PAT. APP. FILINGS LEXIS 5874 *

SAMSUNG ELECTRONICS CO., LTD., and SAMSUNG ELECTRONICS AMERICA, INC., Petitioners v. STATON TECHIYA, LLC, Patent Owner

Type: Petitions

Counsel

Ali R. Sharifahmadian (Reg. No. 48,202), Counsel for Petitioners .

Title

Petition for Inter Partes Review of U.S. Patent *11,244,666*

Text

TABLE OF CONTENTS [*1]

PETITIONERS' EXHIBIT LIST	v
LISTING OF CHALLENGED CLAIMS	vi
I. INTRODUCTION	1
II. GROUNDS FOR STANDING	1
III. STATEMENT OF PRECISE RELIEF REQUESTED FOR EACH CLAIM CHALLENGED	1
IV. OVERVIEW OF THE '666 PATENT	3
V. OVERVIEW OF THE PRIMARY PRIOR ART REFERENCES	4
A. Platz	4
B. Victorian	6
C. Inanaga	9
VI. LEVEL OF ORDINARY SKILL IN THE ART	11
VII. CLAIM CONSTRUCTION	11
VIII. DETAILED EXPLANATION OF GROUNDS	12
A. Ground 1A: Platz Renders Obvious Claims 1 and 11	12
1. Claim 1	12
a. 1[pre]	12
b. 1[a] and 1[b]	12
c. 1[c]	17
d. 1[d] and 1[e]	17
e. 1[f]	21
f. 1[g]	21
g. 1[h]	22
h. 1[i]	23
i. 1[j] and 1[k]	24

Manuel Saldana

2. Claim 11 26
B. Ground 1B: Platz and Kvaløy Render Obvious Claim 2 27
1. Claim 2 27
C. Ground 1C Platz, Kvaløy and Inanaga Render Obvious Claims 8-10 31
1. Claim 8 31
2. Claim 9 34
3. Claim 10 34
D. Ground 2A: Victorian and Inanaga Render Obvious Claims 1 and 11 36
1. Claim 1 36
a. 1[pre] 36
b. 1[a] 36
c. 1[b] 37
d. 1[c] 39
e. 1[d] and 1[e] 39
f. 1[f] 41
g. 1[g] 41
h. 1[h] 42
i. 1[i], 1[j], and 1[k] 43
2. Claim 11 46
E. Ground 2B: Victorian, Inanaga and Kvaløy Render Obvious Claims 2, and 8-10 47
1. Claim 2 47
2. Claim 8 50
3. Claim 9 51
4. Claim 10 51
F. Ground 3A: **[*2]** Inanaga Renders Obvious Claims 1 and 11 53
1. Claim 1 53
a. 1[pre] 53
b. 1[a] 53
c. 1[b] 55
d. 1[c] 56
e. 1[d] and 1[e] 56
f. 1[f] 58
g. 1[g] 59
h. 1[h] 59
i. 1[i] 60
j. 1[j] and 1[k] 60
2. Claim 11 61
G. Ground 3B: Inanaga and Engle Render Obvious Claims 2 and 8-10 62
1. Claim 2 62
2. Claim 8 64
3. Claim 9 65
4. Claim 10 65
IX. THE DISCRETIONARY FACTORS FAVOR INSTITUTING TRIAL 66
A. 35 U.S.C. § 314(a) 66
B. 35 U.S.C. § 325(d) 69

71
X. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8
A. Real Parties-in-Interest 71
B. Related Matters 71
C. Lead and Backup Counsel 73
D. Service Information 73
XI. FEES 73

I. INTRODUCTION

Samsung Electronics Co., Ltd. and Samsung Electronics America, Ltd. ("Petitioners") requests *inter partes* review of claims 1-2 and 8-11 ("challenged claims") of U.S. Patent ***11,244,666*** ("the '666 patent").

II. GROUNDS FOR STANDING

Petitioners certify that the '666 patent is available for *inter partes* review ("IPR") and Petitioners are not barred or estopped from requesting IPR to challenge the claims on the grounds herein.

III. STATEMENT OF PRECISE RELIEF REQUESTED FOR EACH CLAIM CHALLENGED

Petitioners respectfully request review and cancellation under 35 U.S.C. [*3] § 311 of the challenged claims on the following bases: [1]

Ground

1A

Claims

1, 11

Basis

§ 103: *Platz*

Ground

1B

Claims

2

Basis

§ 103: *Platz* and *Kvaløy*

Ground

1C

Claims

8-10

Basis

[1] Petitioners do not concede that any challenged claims satisfy other requirements for patentability that cannot be raised in IPR, including Section 101 and 112.

§ 103: *Platz*, *Kvaløy*, and *Inanaga*

Ground
2A

Claims
1, 11

Basis

§ 103: *Victorian* and *Inanaga*

Ground
2B

Claims
2, 8-10

Basis

§ 103: *Victorian*, *Inanaga*, and *Kvaløy*

Ground
3A

Claims
1, 11

Basis § 103: *Inanaga*

Ground
3B

Claims
2, 8-10

Basis

§ 103: *Inanaga* and *Engle*

As shown below, each reference pre-dates the '666 patent's earliest proclaimed priority date (January 22, 2007), which Petitioners do not concede. Petitioners reserve the right to dispute any priority claim.

Reference

U.S. 2010/0119077 (" *Platz*")

Date
12/8/2006 (filed)
5/13/2010 (published)

Prior Art At Least Under
§ 102(e)

Reference

EP 1,519,625A2 (" *Victorian*)

Date

3/30/2005 (published)

Prior Art At Least Under [*4]

§ 102(b)

Reference

U.S. 5,276,740 (" *Inanaga*")

Date

1/4/1994 (issued)

Prior Art At Least Under

§ 102(b)

Reference

U.S. 6,728,385 (" *Kvaløy*")

Date

4/27/2004 (issued)

Prior Art At Least Under

§ 102(b)

Reference

U.S. 8,477,955 (" *Engle*")

Date

7/14/2005 (filed)

7/2/2013 (issued)

Prior Art At Least Under

§ 102(e)

IV. OVERVIEW OF THE '666 PATENT

The '666 patent explains in the Background section that "Environmental noise is constantly presented in industrialized societies given the ubiquity of external sound intrusions." *Id.*, 1:32-54. To "combat" this noise, "people are arming themselves with portable audio playback devices to drown out intrusive noise." *Id.*, 1:55-2:14. Because the audio content is often played at high volume, the user can be isolated from their environment, for example, people talking to them or warning sounds like sirens. *Id.* "A need therefore exists for enhancing the user's ability to 20 listen in the environment without harming his or her hearing faculties." *Id.* 2:19-21.

The '666 patent addresses this purported need with an "earpiece" device that monitors sound directed to an occluded ear, **[*5]** detects acute sounds and allows the acute sounds to be reproduced in an ear canal of the occluded ear. '666 patent, 1:23-28. The earpiece includes an Ambient Sound Microphone (ASM) to capture ambient sound, at least one Ear Canal Receiver (ECR) to deliver audio to an ear canal, and a processor operatively coupled to the ASM and the at least one ECR. The processor monitors a change in the ambient sound level to detect an acute sound from the change. The acute sound is reproduced within the ear canal via the ECR responsive to

detecting the acute sound. *Id.* 2:28-36. In some embodiments, an internal microphone to detect sounds within the ear canal is also used, for example, to detect the voice of the earpiece user or for other functions. *Id.*, 2:49-51, 10:8-40.

V. OVERVIEW OF THE PRIMARY PRIOR ART REFERENCES

A. *Platz*

Platz is directed to an active hearing protection system having a left earplug 10, a right earplug 12, and a central unit 14 connected to a communication device 20. *Platz*, Abstract, [0020], FIG. 1. *Platz* describes earplugs 10, 12 each having a hard shell 22 that includes an active unit 24 (*id.*, [0021]-[0022], FIG. 1), and "each being adapted for providing **[*6]** for an acoustic attenuation of at least 10 dB averaged over the audible frequency range" (*id.*, [0002]).

The active unit 24 includes a microphone 28 which "is acoustically oriented towards ambience in order to capture primarily ambient sound." *Id.*, [0042]; *see also* [0022], [0025], FIG. 1. Active unit 24 also includes a second inner microphone 31 that "is acoustically oriented towards the ear canal in order to capture primarily the user's voice" (*id.*, [0042]), and "a loudspeaker 30 for providing audio signals into the user's ear canal via the sound channel 26" (*id.*, [0022]). *Platz* explains that audio signals captured by microphones 28 are processed by audio signal processing unit 34 (of central unit 14) and supplied to loudspeakers 30 for reproduction to the user's ear. *Id.*, [0023].

Platz describes central unit 14 as connected to a communication device 20, which may comprise, for example, "a mobile phone or a FM radio device, such as a walkie-talkie." *Id.*, [0024]. *Platz* provides that, in addition to audio signals captured from ambient sound by microphones 28, loudspeaker 30 also provides audio signals received from the communication device 20 to the user's ear. **[*7]** *Id.*, [0025]. *Platz* describes a communication mode in which a mixture of audio signals representative of the ambient sound as captured by microphone 28 and the audio signal provided by the communication device 20 is provided to both ears. *Id.* at [0036].

Platz describes capturing the user's voice via the microphones 28, 31. *Platz*, [0025]. *Platz* also describes central unit 14 performing blind source separation ("BSS") on audio signals received from microphones 28, 31 in order to separate the user's voice from background noise. *Id.*, [0042], claim 59.

B. *Victorian*

Victorian relates to "ear-level communication systems" for communicating with remote devices such as a cellular telephone via full duplex audio. *Victorian*, [0001]-[0002]. *Victorian* discloses, for example, an "ear-level device 110." *Victorian*, [0019].

[SEE FIGURE IN ORIGINAL]

Victorian, FIG. 1 (annotated)

Victorian discloses various configurations for "ear-level device 110", including an "in-the-canal (ITC) device 310B." *Victorian*, [0025].

[SEE FIGURE IN ORIGINAL]

Victorian, FIG. 3B (annotated)

By reference to FIG. 4A, *Victorian* discloses the circuit of the single ear-level device **[*8]** 110. *Id.*, [0029].

[SEE FIGURE IN ORIGINAL]

Victorian, FIG. 4A

The circuit includes, *inter alia*, the following features:

. an "external microphone 420," which "picks up ambient sound";

. an "ear canal microphone 440," which detects the "speech of the person wearing ear-level device 110";

. an "ear canal speaker 470" which "transmits sound received from remote device 190 and/or external microphone 420 to the same ear canal";

. a "processor 460" which "includes one or more of amplification circuitry, filtering circuitry, acoustic feedback reduction circuitry, noise reduction circuitry, and tone control circuitry, among other circuits performing signal processing functions as known in the art"; and

. a voice operated exchange (VOX) circuit 430.

Victorian, [0030]. *Victorian* discloses that processor 460 in ear-level device 100 converts the signals received from remote device 190 and/or external microphone 420 to a sound audible to the person wearing ear-level device 110. *Id.*

By reference to FIG. 4B, *Victorian* discloses the operation of VOX 430. *Id.*, [0031]. *Victorian* uses gating modules to reduce echo or ringing caused by the feedback loop between **[*9]** the ear canal speaker and ear canal microphone 440. *Id.* If a module is "on," that means sound is passed through; if "off," that sound is blanked or attenuated. *Id.*, [0032].

[SEE FIGURE IN ORIGINAL]

Victorian, FIG. 4B (annotated)

Victorian discloses a gating rule that allows the transmission of both the remote sound and the ambient sound to the ear canal. *Id.*, [0038]

C. *Inanaga*

Inanaga is directed to an earphone device that includes an acoustic tube and is configured to reduce external noises. Generally, *Inanaga* discloses an external microphone unit 37 disposed externally of the acoustic tube for picking external noises and an internal microphone unit 36 adjacent to an earphone unit 33 that picks up sound in the acoustic tube 31, wherein the earphone unit 33 provides reproduced sound to the eardrum. *Inanaga*, at 5:34-56, 6:22-30, 6:37-50.

[SEE FIGURE IN ORIGINAL]

Inanaga, FIG. 4

Inanaga further discloses a mixing circuit 38 for mixing an input audio signal (such as a music signal reproduced from a compact portable stereo cassette tape recorder), a signal obtained by negatively feeding back the signal obtained from internal microphone unit 36, and the **[*10]** signal obtained from external microphone unit 37 at a desired mixing ratio. *Inanaga*, at 5:52-56. *Inanaga* describes the mixing circuit 38 having a third variable gain control circuit 42 for variably changing the gain of the external noise signal prior to the external noise signal being mixed with the input audio signal and the negatively fed back internal microphone signal. *Id.* at 5:57-65. *Inanaga* also discloses the output signal of said mixing being supplied to earphone unit 33, which converts the output signals into an audio signal for providing sounds. *Id.* at 6:15-21 & 6:48-50.

VI. LEVEL OF ORDINARY SKILL IN THE ART

A person of ordinary skill in the art at the time of the alleged invention of the '666 patent ("POSITA"), which for purposes of this proceeding is no earlier than January 22, 2007, would have had a bachelor's degree in electrical engineering, computer science, or a similar field and two years of experience in the design of digital audio systems

and associated signal processing. The POSITA could have also obtained similar knowledge and experience through other means. *Polish*, P20.

VII. CLAIM CONSTRUCTION

Petitioners are unaware of any "prior claim **[*11]** construction determination" related to the '666 patent. *See* 37 C.F.R. § 42.100(b). Given the close correlation and substantial identity between the prior art references and the challenged claims, Petitioners believe that no express constructions of the claims are necessary to assess whether the prior art reads on the challenged claims. Thus, the claims should be given their plain and ordinary meaning. [2] *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (*en banc*).

VIII. DETAILED EXPLANATION OF GROUNDS

A. Ground 1A: *Platz* Renders Obvious Claims 1 and 11

1. Claim 1

a. 1[pre]

To the extent the preamble is limiting, *Platz* discloses or suggests this feature. *Polish*, PP51-53. *Platz* discloses an active hearing protection system having a left earplug 10, a right earplug 12, and a central unit 14. *Platz*, Abstract, [0020], FIG. 1. A POSITA would have understood each of *Platz*'s earplugs 10, **[*12]** 12 to comprise "[a]n earphone device" at least because they each include a speaker 30 configured to provide audio signals received from a communication device 20 to the user's ear. *Id.*, [0024]-[0025]; *Polish*, P52. *Platz*'s earplugs 10, 12 are also of the same general construction as the "earphone device" (or "earpiece") described in the '666 patent. *'666Pat.*, 4:52-65, 6:21-26. *Id.*

b. 1[a] and 1[b]

Platz discloses or suggests these features. *Polish*, PP54-66.

Platz discloses that active unit 24 of each earplug 10, 12 includes a microphone 28 configured to "captur[e] audio signals from ambient sound." *Id.*, [0022], [0025]. *Platz* provides that "microphone 28 is acoustically oriented towards ambience in order to capture primarily ambient sound." *Id.*, [0042].

Platz discloses that active unit 24 also includes a second, inner microphone 31 that "is acoustically oriented towards the ear canal in order to capture primarily the user's voice." *Platz*, [0042]. *Platz*'s Figure 1 depicts inner microphone 31 as closer than microphone 28 to the outlet of sound channel 26, through which *Platz* indicates active unit 24 is acoustically connected to the ear canal. *Id.*, [0022], **[*13]** FIG. 1. *Polish*, P55.

[SEE FIGURE IN ORIGINAL]

Platz, FIG. 1

To the extent PO argues that *Platz*'s microphone 28 capturing sound from the ambient environment does not encompass " *measur[ing]* an ambient acoustic environment," or that *Platz*' microphone 31 capturing sound from the ear canal does not encompass " *measur[ing]* an acoustic environment closer to the ear canal of a wearer than that measured by the first microphone," such an argument would be incorrect at least because a POSITA would have understood that sound captured by a microphone necessarily comprises a measure of the sound reaching that microphone. [3] *Polish*, P56. For example, a POSITA would have understood that the spectral characteristics of a

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[2] Petitioners reserve all rights to raise claim construction arguments and other arguments in any parallel or future litigation concerning the '666 patent. For example, comparing the claims to the accused products in the litigation may raise controversies that require construction of certain claim terms.

[3] All **bold**/ *italics*/color emphases and annotations are added unless noted otherwise.

sound signal captured by a microphone correspond to the spectral characteristics of the sound reaching that microphone. *Id.* A POSITA would have recognized that this feature is also supported by *Platz*, which discloses its active hearing protection system including noise dosimeter functionality for which the level of the audio signals captured by the microphones 28 or 31 may be **[*14]** used to estimate the user's sound exposure. *Platz*, [0051]. A POSITA would have understood that, in order to use the level of the audio signal captured by microphones 28 or 31 to estimate the user's sound exposure, the audio signals captured by microphones 28 and 31 indicate a measure of the sound they capture. *Polish*, PP57-58. For these reasons, a POSITA would have understood microphone 28 to be configured to measure ambient sound within its vicinity (i.e., within an ambient environment surrounding the user), and microphone 31 is positioned and configured to measure sound closer to the ear canal of a user than microphone 28. *Polish*, P58.

Platz does not expressly state "the first microphone ***has a first microphone port*** " or that "the second microphone ***has a second microphone port*** ." However, it would have been obvious to a POSITA to incorporate a port into the microphones 28 and 31 to receive sounds, because this was a common way of designing microphones incorporated into earpieces. *Polish*, PP59-62. Incorporating a port into microphones 28 and 31 would also have been obvious because the port would provide less acoustic impedance to sounds than if the microphone **[*15]** was completely covered by its packaging, which a POSITA would have recognized would have unnecessarily or inappropriately attenuated sounds before reaching the microphone. *Polish*, P61. Thus, a POSITA would have been motivated to incorporate such a port into *Platz*'s microphones 28 and 31 to facilitate or improve their intended purpose of capturing/measuring ambient and ear canal sounds, respectively. *Id.*

It would also have been obvious to a POSITA to orient microphone 28's port to face away from the user and microphone 31's port to face towards the user, when the earphone is inserted. A POSITA would have recognized, as stated in *Platz*, that it was well known within the art to acoustically orient microphones towards desired sound sources. *See, e.g.*, *Platz*, [0042], FIG. 1; *Polish*, PP63-64 (citing *Svean*, 5:40-45, FIG. 1). [4] A POSITA would have been motivated to orient microphone 28's port away from **[*16]** the user to ensure that the microphone performed its intended purpose of capturing ambient sounds, and to orient microphone 31's port towards the user's ear canal to ensure that the microphone performed its intended purpose of capturing sound closer to the user's ear canal. *Id.*

Accordingly, *Platz* discloses or suggests a microphone 28 ("a first microphone") for capturing/measuring audio signals representing ambient sound ("configured to measure an ambient acoustic environment"), and the microphone 28 having a port oriented towards the desired source of ambient sound ("a first microphone port that is configured to face away from a user when the earphone is inserted"). *Polish*, P65.

Accordingly, *Platz* also discloses or suggests a microphone 31 ("a second microphone") for capturing/measuring audio signals representing ear canal sound ("configured to measure an acoustic environment closer to the ear canal of a wearer than that measure by the first microphone"), and the microphone 31 having a port oriented towards the desired source of ear canal sound ("a second microphone port that is configured to face toward the user when the earphone is inserted"). *Polish*, P66.

c. [*17] 1[c]

Platz discloses or suggests this feature. *Polish*, PP67-68. *Platz*'s active unit 24 includes "a loudspeaker 30 for providing audio signals into the user's ear canal via the sound channel 26." *Platz*, [0022]. *Platz* teaches that audio signals captured by microphones 28 are processed and supplied to loudspeakers 30 for reproduction to the user's ear. *Id.*, [0023]. *Platz* teaches that loudspeaker 30 also provides audio signals received from the communication device 20 to the user's ear. *Id.*, [0024]-[0025], claim 40.

d. 1[d] and 1[e]

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[4] To the extent this Petition cites EX1010 to EX1014, it is merely to demonstrate a POSITA's knowledge and/or as evidence that a POSITA would have been motivated to make the combinations in the manner discussed herein. These exhibits are not part of the unpatentability grounds.

Platz discloses or suggests these features. *Polish*, PP69-83. *Platz* describes central unit 14 comprising "an audio signal processing unit 34 for receiving and processing the audio signals captured by the microphones 28 and for supplying the loudspeakers 30 with audio signals to be reproduced to the user's ear." *Id.*, [0023]. In an embodiment having a second inner microphone 31, *Platz* discloses audio signal processing unit 34 including a BSS unit configured to separate a user's voice from ambient sound using audio signals received from microphones 28 and 31. *Id.*, [0042], claim 59; *Polish*, P69.

Accordingly, *Platz* discloses **[*18]** an audio signal processing unit 34 ("a processor") communicatively coupled to microphone 28 ("coupled to the first microphone"), microphone 31 ("coupled to the second microphone"), and loudspeaker 30 ("the speaker is coupled to the processor"). *Polish*, P70.

To the extent PO argues that claim 1 requires that the processor is included within the portion of the earphone device that is inserted into the ear, such an argument would be incorrect as the claim does not recite a location or orientation of the processor, but simply requires that the earphone include a processor coupled to the ambient microphone, the ear canal microphone, and the speaker. *Polish*, P71. The '666 patent also specifically contemplates embodiments in which the earphone is not a single device, but is instead a family of devices. For example, it provides that "earpiece 100 can further represent a single operational device or a family of devices configured in a master-slave arrangement, for example, a mobile device and an earpiece." *'666Pat.*, 6:21-24. [5]

Nonetheless, should **[*19]** the Board accept such an argument and construe claim 1 to require the processor to be included within the portion of the device that is inserted in the ear, it would have been obvious to a POSITA to modify *Platz* to incorporate an audio signal processing unit within shell 22 of earplugs 10, 12. *Polish*, PP73-80. For example, *Dijkstra* provides at least one example of a similar earplug including a digital audio signal processing unit included within the portion of the earplug inserted in the ear. *See, e.g., Dijkstra*, [0020], [0029]-[0030]. A POSITA would also have recognized the advantages of "lightweight, ***all-in-the-ear*** intelligent hearing protector with wireless communication." *Polish* PP76-77 (citing *Svean*, 1:11-33). While incorporating a processor in earplugs 10, 12 would entail two processors instead of one, a POSITA would have still found it a reasonable design choice because it would have resulted in an overall more compact device by, for example, obviating the need for the wearer to have another component including a processor hanging around their neck. *Polish*, P78.

A POSITA would have recognized the feasibility of modifying *Platz* to incorporate within **[*20]** shell 22 of each earplug an audio signal processing unit. *Polish*, PP79. Indeed, *Platz* explains that, in ambient mode, ambient sounds captured at the left and right ear microphones are provided to their respective speakers. *Platz*, [0028]. *Platz* also discloses a communication mode in which audio signals from communication device 20 may be mixed with the audio signals captured by the left and right ear microphones 28, respectively, and with the audio signals captured by the left and right ear microphones 28 provided to the respective left and right speakers. *Id.*, [0040]. *Platz* provides that the mixing ratio may be different for each of these channels. *Id. Platz* also explains that central unit 14, which houses audio signal processing unit 34, may be connected to communication device 20 by a wireless link. *Id.*, [0024]. Accordingly, a POSITA would have recognized that *Platz* discloses at least one embodiment in which the earphones operate independently of one another and are wirelessly compatible with a communication device. *Polish*, PP79-80.

A POSITA would also have known that *Platz*'s device would include a memory to store the instructions executed by *Platz*'s audio **[*21]** signal processing unit(s) 34. *Polish*, P81. At the least, it would have been obvious in view of the knowledge of a POSITA for *Platz*'s device to include a memory to store the instructions executed by *Platz*'s audio signal processing unit because this was a well-known and common way of implementing a processor-based system. *Id.* (citing *Svean*; *Dijkstra*). In an embodiment in which the processor is within earplugs 10, 12, a POSITA would have also found it obvious to locate the memory within the earplug because it was well-known, indeed common, technique to locate a processor and its memory on the same printed circuit board. *Polish*, P82.

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[5] Notably, the '666 patent uses the terms "earpiece" and "earphone device" interchangeably. *Polish*, P72 (citing *'666Pat.*, 12:2-7).

Accordingly, *Platz* discloses or suggests an audio signal processing unit and a memory that stores instructions executed by the processor ("a memory that stores instructions; and a processor that is configured to execute the instructions to perform operations"), where the audio signal processing unit is coupled to microphones 28, 31 and loudspeaker 30 ("wherein the processor is coupled to the first microphone, wherein the processor is coupled to the second microphone, wherein the speaker is coupled to the processor"). *Polish*, P83. *Platz* ***[*22]*** discloses or suggests audio signal processing unit 34 performing the claimed operations, as discussed below.

e. 1[f]

Platz discloses or suggests this feature. *Polish*, PP84-85. *Platz* discloses "an audio signal processing unit 34 for *receiving* and processing ***the audio signals captured by the microphones 28*** and for supplying the loudspeakers 30 with audio signals to be reproduced to the user's ear." *Id.*, [0023]; *see also id.* [0025], [0026], [0042]; *Polish*, P84.

Accordingly, *Platz* discloses or suggests a processor configured to receive audio signals from microphone 28 ("receiving a first microphone signal from the first microphone"). *Polish*, P85.

f. 1[g]

Platz discloses or suggests this feature. *Polish*, PP86-87. *Platz* discloses the audio signal processing unit 34 including a BSS unit configured to separate a user's voice from ambient sound ***using audio signals received*** from microphone 28 ***and microphone 31*** . *Id.*, [0042], claim 59; *Polish*, P86.

Accordingly, *Platz* discloses or suggests a processor configured to receive audio signals from microphone 31 ("receiving a second microphone signal from the second microphone"). *Polish* ***[*23]***, P87.

g. 1[h]

Platz discloses or suggests this feature. *Polish*, PP88-91. *Platz* discloses that microphone 28 is acoustically oriented towards ambience to capture audio signals from ambient sound. *Platz*, [0022], [0042]. *Platz* also provides that "audio signals captured from ambient sound by the microphones 28 are provided, after processing in the audio signal processing unit 34, to the speakers 30 in order to provide sound impinging on the left ear to the left ear canal and sound impinging on the right ear to the right ear canal despite the acoustic attenuation provided by the shell 22 for relatively low sound pressure levels ...." *Platz*, [0025], [0029].

Platz further discloses an "ambient mode" in which the device has a "transparent" gain when the ambient sound is below the "knee point" (in one example set at 70dB). *Id.*, [0030], [0032], Fig. 4. In other words, for sounds below the knee point the gain is constant, and the "user has the same sound feeling as if he was not wearing the earplugs 10, 12." *Id.* A POSITA would have understood the audio signal processing unit 34 providing a constant gain version of the ambient sound signal received from microphone 28 to **[*24]** loudspeaker 30 to entail generating an ambient sound signal. *Polish*, P90.

Accordingly, *Platz* discloses or suggests a processor configured to receive an ambient sound signal from microphone 28 and provide a constant gain version of the signal to loudspeaker 30 ("generating an ambient sound signal from at least one of the first microphone signal ..."). *Polish*, P91. [6]

h. 1[i]

Platz discloses or suggests this feature. *Polish*, PP92-96. *Platz* discloses that in "ambient mode," when the ambient sound signals are above the "knee point" (e.g., 70dB), "the gain [of the ambient sound signal] is progressively reduced so that the output level remains constant. *Platz*, [0030], [0032], Fig. 4. *Platz* also discloses

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[6] *See Brown v. 3M*, 265 F.3d 1349, 1351 (Fed. Cir. 2001) ("When a claim covers several structures or compositions, either generically or as alternatives, the claim is deemed anticipated if any of the structures or compositions within the scope of the claim is known in the prior art.").

a volume control for adjusting the value of the constant gain applied in the linear region below the knee point between a minimum value and a maximum value. *Id.*, [0031].

Additionally, **[*25]** *Platz* discloses a "communication mode" in which "a mixture of audio signals representative of the ambient sound as captured by the left ear microphone 28 and the audio signals provided by the communication device 20 is provided to both ears." *Id.*, [0036]. *Platz* further discloses that the user can adjust the relative level of the "ambient channel" (i.e., the channel comprising signals from microphone 28) and the "communication channel" (i.e., the channel comprising signals from communication device 20) using a volume control on central unit 14 or a remote control unit 18. *Platz*, [0036]. Having reviewed *Platz*, a POSITA would have understood that by "adjust[ing] the relative level of the ambient channel," *Platz* was referring to adjusting the gain applied to the ambient sounds received from microphone 28 and provided to loudspeaker 30. *Polish*, PP92-94. *Platz* also discloses that its acoustic sound gain models are implemented by the audio signal processing unit 34 (*Platz*, [0029]), and "may be automatically selected according to the results of an auditory scene analysis" (*id.*, [0034]).

Accordingly, *Platz* discloses or suggests a processor configured to receive an ambient **[*26]** sound signal from microphone 28 and modify the gain of the received signal ("applying an ambient sound gain to the ambient sound signal to generate a modified ambient sound signal"). *Polish*, P96.

i. 1[j] and 1[k]

Platz discloses or suggests these features. *Polish*, PP97-98. *Platz* describes a "communication mode" in which "a mixture of audio signals representative of the ambient sound as captured by the left ear microphone 28 and the audio signals provided by the communication device 20 is provided to both ears." *Id.*, [0036]. As discussed in Section VIII.A.1.h, *Platz* discloses processing the ambient sound signal to generate a modified ambient sound signal. *Platz* discloses that "after having undergone respective audio signal processing," the modified ambient sound signal and the audio sound signal from the communication device 20 "may be combined and then may be supplied as a mono signal to both loudspeakers 30." *Id.*, [0035], claims 41, 45-47. The mixing is depicted in *Platz*'s Figure 3 as being performed within the audio signal processor 34:

[SEE FIGURE IN ORIGINAL]

Platz, FIG. 3 (annotated)

Accordingly, *Platz* discloses or suggests a processor configured **[*27]** to mix a modified ambient sound signal ("mixing the modified ambient sound signal") with an audio sound signal from a communication device ("with an audio content signal") to generate a mono signal ("to generate a mixed audio signal"), which is supplied to a speaker ("sending the mixed audio signal to the speaker"). *Polish*, P98.

2. Claim 11

Platz discloses or suggests this feature. *Polish*, PP99-102.

The '666 patent describes achieving a "seal" by providing for an assembly that "is designed to be inserted into the user's ear canal 131 ... to form an acoustic seal with the walls 129 of the ear canal." *'666Pat.*, 5:3-10. The '666 patent recognizes that complete sound attenuation is not practical and states that "the passive aspect of the physical earpiece 100, due to the mechanical and sealing properties, can provide upwards of 22-26dB noise reduction." *Id.*, 6:47-59.

Platz's earplugs 10, 12 closely resemble the '666 patent's disclosure. *Polish*, P101. Each earplug has a hard shell 22 configured to the shape of the user's outer ear and ear canal. *Platz*, [0021]. The earplugs are designed to provide for an acoustic attenuation of ***at least*** 10 dB averaged over **[*28]** the audible frequency range when worn by the user. *Id. Platz* describes the earplugs providing sound attenuation of as much as 30dB. *Id.*, [0029].

Accordingly, *Platz* discloses or suggests an earplug comprising a hard shell custom fitted into a user's ear canal for acoustic attenuation of as much as 30dB ("the earphone includes a sealing section"). *Polish*, P102.

B. Ground 1B: *Platz* and *Kvaløy* Render Obvious Claim 2

1. Claim 2

Platz in combination with *Kvaløy* discloses or suggests these features. *Polish*, PP103-118. Initially, the '666 patent does not define the term "acute sounds" but identifies abrupt high energy sounds such as warning sounds (e.g., bell, security system), siren (e.g., police car), voice (e.g., 'help', 'stop', 'police', etc.), or specific noise types (e.g., breaking glass) as examples of acute sounds. *'666Pat.*, 5:40-47.

Platz discloses microphones 28, 31 capturing the user's voice (*Platz*, [0025]), and audio signal processing unit 34 performing blind source separation ("BSS") on audio signals received from microphones 28, 31 to separate the user's voice from background noise (*id.*, [0042], claim 59). *Platz* also discloses central unit **[*29]** 14 including a voice dialing activation element for when communication device 20 comprises a mobile phone. *Id.*, [0033], [0046]; *Polish*, P105. *Platz*, however, arguably does not provide the details of how to detect a voice and/or voice command based on an analysis of the audio signals received from microphones 28, 31.

Kvaløy discloses "a voice detection and discrimination apparatus" (*Kvaløy*, 1:16-18), designed for use "in situations where it is desirable for people to use a hearing protection arrangement, while still requiring some means of communicating, e.g., to speak with other people or to give commands to voice operated equipment" (*id.*, 1:39-44). *Kvaløy* provides for "voice detection" in noisy environments "with improved voice detection capability and which has a reduced false activation due to acoustic noise." *Kvaløy*, 2:14-24.

Kvaløy describes an embodiment "where the voice detection and discrimination is included in an earplug based hearing protective voice communication terminal," which is depicted in *Kvaløy*'s Figure 1. *Kvaløy*, 3:39-41, 3:12-14.

[SEE FIGURE IN ORIGINAL]

Kvaløy, FIG. 1

Kvaløy's earplug is very similar to *Platz*'s. For example, **[*30]** like *Platz*'s, *Kvaløy*'s earplug has an outer microphone (M1), an inner microphone (M2), and a speaker (SG) all coupled to a processor (E3). *Kvaløy*, Fig. 1 (and associated description); *Polish*, PP106-108.

Kvaløy teaches that, when a user speaks, "the signal from his voice produces a signal in the inner [microphone] M2," causing the difference between the signals detected by microphones M1 and M2 to decrease. *Kvaløy*, 4:42-52. *Kvaløy* discloses that, "[w]hen such a decrease in signal difference is detected, this is interpreted as a voice signal being present." *Id.*, 4:52-55.

A POSITA would have understood *Kvaløy*'s detection of a user's voice by comparing the strength of two signals to disclose or suggest detecting voice using a first and second microphone signals. *Polish*, P111 (citing *Kvaløy*, 8:13-23).

Kvaløy further discloses analyzing the user's voice to detect the presence of speech components in order to operate a device using voice commands. *Kvaløy*, 9:30-45, claims 1, 15, 16 and 13, 42, 43. A POSITA would have understood that typical voice commands for operating a device such as a mobile phone would have included words such as "answer," "hang up," "play," **[*31]** "pause," "stop," etc., and that these words comprise abrupt high energy sounds. *Polish*, PP113-114 (citing *Greve* as evidence of POSITA's knowledge that mobile phones could play music/videos).

A POSITA would have been motivated to apply *Kvaløy*'s teaching to *Platz*'s active hearing protection system to detect voice commands for operating a device such as a mobile phone. *Polish*, P115. A POSITA would have understood that *Kvaløy*'s teachings are applicable to *Platz* because they both disclose or suggest earplug-based devices configured to protect a user's hearing without sacrificing communication. *Id.*

Moreover, *Platz* teaches or at a minimum suggests the desirability of using voice commands for operating a mobile phone connected to *Platz*'s active hearing protection system. *Polish*, P116. *Kvaløy* provides additional detail for how to use the signals from an outer microphone (e.g., *Platz*'s microphone 28) and an inner microphone (e.g., *Platz*'s microphone 31) in an earplug-type device to detect a user's voice and further detect specific user spoken commands. *Id.* A POSITA would also have recognized that the voice separation functionality of *Platz*'s audio signal **[*32]** processing unit 34 would be improved with *Kvaløy*'s voice detection functionality. *Id.* (citing *Visser*).

A POSITA would have considered the combination to be predictable and would have had a reasonable expectation of success insofar as *Platz* already includes the components to implement *Kvaløy*'s voice command detection and implementation functionality. *Polish*, P117. Incorporating this functionality into *Platz*'s active hearing protection system would have been obvious to a POSITA because it amounts to merely applying a known technique (*Kvaløy*'s voice command detection and implementation functionality) to a known device ready for improvement (*Platz*'s active hearing protection system) to yield predictable results (using voice commands to control, e.g., a mobile device as already suggested by *Platz*).

Accordingly, the *Platz-Kvaløy* device discloses or suggests a processor configured to detect user spoken commands ("detecting an acute sound") by analyzing signals from outer and inner microphones ("by analyzing at least one of the first microphone signal or the second microphone signal or a combination of both"). A POSITA would have further understood that this analysis **[*33]** entailed "determining whether the acute sound is a user's voice." *Polish*, P118.

C. Ground 1C *Platz, Kvaløy* and *Inanaga* Render Obvious Claims 8-10

1. Claim 8

Platz in combination with *Kvaløy* and *Inanaga* discloses or suggests this feature. *Polish*, PP119-128.

Inanaga discloses an earphone device configured to reduce external noises while the user listens to audio content from, for example, "compact portable headphone players and the like and handsets of telephones." *Inanaga*, 5:23-26; *see generally id.*, 5:27-7:20, Fig. 4; *Polish*, PP39-41, 120-121. *Inanaga* discloses an earphone device having an external microphone unit 37, an internal microphone unit 36, and an internal earphone unit 33. *Id.*, 5:34-56, 6:25-30. *Inanaga* provides that its device enables external sounds to be listened to and external noises to be reduced. *Id.*, 2:47-50. *Inanaga* further provides that, "when external emergency information and human voices are desired to be listened to while listening to reproduced sounds, the ***gains of the input audio signal*** and the negatively fed back signal are not adjusted or ***adjusted to low values*** or zero and the ***gain of the external [*34] noise is increased***, the gain of which has been a low value or zero." *Id.*, 6:67-7:9. *Inanaga* states that external emergency information and human voices can thus be listened without removing the earphone device from the ear. *Id.*, 7:6-9.

A POSITA would have been motivated to incorporate *Inanaga*'s technique of decreasing the gain of the input audio signal and increasing the gain of the external noise (i.e., the ambient audio) into the *Platz-Kvaløy* device to allow the user to hear, for example, human voices while wearing the *Platz-Kvaløy* device and listening to audio content from the communication device. *Polish*, P122. More particularly, *Platz* discloses performing auditory scene analysis to determine whether speech is present. *Platz*, [0038]. A POSITA would have understood that "auditory scene analysis" refers to the detection and division of sound into individual recognized units akin to the manner in which humans perceive distinct audio elements. *Polish*, P123. *Platz* further discloses that its gain model "may be automatically selected according to the results of an auditory scene analysis based on the audio signal provided by the microphone 28." *Platz*, [0034]; **[*35]** *Polish*, P123. As discussed in Section VIII.A.1.i, *Platz* discloses a "communication mode" in which a mixture of audio signals representative of the ambient sound as captured by the microphone 28 and the audio signals provided by the communication device 20 is provided to both ears.

A POSITA would have recognized the advantage, when in "communication mode," of adjusting *Platz*'s gain model (e.g., the gain of the ambient sound signal as captured by the microphone 28 and the gain of the audio signal provided by the communication device 20 in the mixed signal) when the results of the auditory scene analysis detect the user's speech. *Polish*, P125. Indeed, it was well-known prior to January 2007 to adjust a mixed audio signal comprised of ambient sound detected by an ambient microphone and audio content provided by a communication device when a voice (e.g., the user's voice) is detected. *Polish*, PP125-126 (discussing POSITA's knowledge as evidenced by *Rosenberg* at, e.g., [0021], [0055]-[0056]).

Thus, a POSITA would have been motivated to further modify the *Platz-Kvaløy* device in view of *Inanaga* to decrease the gain of audio content from the communication device and increase **[*36]** the gain of the ambient sound signal in "communication mode" when the auditory scene analysis detects the user's voice in order to achieve the well-known benefit of allowing the user to better hear themselves or a person in their vicinity speaking. *Polish*, P127. Such a modification would have been obvious to a POSITA because it would have amounted to merely applying a known technique (*Inanaga*'s relative gain adjustment) to a similar device (the *Platz-Kvaløy* device) in the same way (to allow the user to speak to another person and hear themselves well while continuing to wear the earphone device and listening to audio content). *Id.*

Accordingly, the *Platz-Kvaløy-Inanaga* device discloses or suggests a processor configured to decrease the gain of audio content from a communication device and increase the gain of the ambient sound signal in a mixed audio signal when the user's voice is detected ("adjusting the mixed audio signal when the user's voice is detected"). *Polish*, P128.

2. Claim 9

Platz in combination with *Kvaløy* and *Inanaga* discloses or suggests this feature for the reasons discussed in Section VIII.C.1. *Polish*, P129.

3. Claim 10

Platz in combination **[*37]** with *Kvaløy* and *Inanaga* discloses or suggests this feature. *Polish*, PP130-132. *Inanaga* discloses a mixing circuit for mixing the input audio signal, the signal obtained by negatively feeding back the signal from the internal microphone unit, and the signal from the external microphone unit with each other at a desired ratio, the output signal of said mixing circuit being supplied to the earphone unit. *Inanaga*, 4:57-65. In this manner, external sounds can be listened to while the device is worn and external noises that reach the ear can be reduced. *Id.*, 2:47-50, 7:10-17.

A POSITA would have been motivated to further modify the *Platz-Kvaløy-Inanaga* device in view of *Inanaga*'s negative feedback feature so as to reduce the effect of any noise that may still reach the user's ear canal. *Polish*, P131. Each of *Platz*, *Kvaløy*, and *Inanaga* are directed, among other aspects, to protecting the user's hearing and/or reducing the amount of ambient sound heard by the user while wearing their respectively disclosed earphones. *See, e.g., Platz*, Abstract, [0012]-[0013]; *Kvaløy*, 1:30-39; *Inanaga*, 1:8-10, 2:47-50. Incorporating this feature would further improve the hearing **[*38]** protection capabilities provided by the *Platz-Kvaløy-Inanaga* device. Such a modification would have been obvious to a POSITA because it would have amounted to merely applying a known technique (*Inanaga*'s negatively fed back internal microphone signal) to a similar device (the *Platz-Kvaløy-Inanaga* device) in the same way (reducing noise reaching the user's ear canal). *Polish*, P131.

Accordingly, the *Platz-Kvaløy-Inanaga* device discloses or suggests a processor configured to reverse the phase of an audio signal detected by an internal microphone (e.g., similar to *Platz*'s microphone 31) and mix ("the mixed audio signal") this reversed phase signal with an ambient audio signal and an audio content signal ("includes a noise reduction signal derived from the second microphone signal"). *Polish*, P132.

D. Ground 2A: *Victorian* and *Inanaga* Render Obvious Claims 1 and 11

1. Claim 1

a. 1[pre]

To the extent the preamble is limiting, *Victorian* discloses or suggests this feature. *Polish*, PP133-135. *Victorian* discloses an ear-level communication system 100 comprising an ear-level device 110. *Victorian*, [0018]. Ear-level device 110 is depicted in the user's ear **[*39]** in Figure 1 of *Victorian*, which also provides that this device can be implemented in an "in-the-ear" or "in-the-canal" configuration as shown in Figures 3A and 3B. *Id.*, [0024]-[0025]. The ear-level device 110 can be used as an ear piece. *Id.*, Abstract, [0008].

b. 1[a]

Victorian discloses or suggests this feature. *Polish*, PP136-140. For example, *Victorian* discloses ear-level device 110 including an "external microphone 420 picks up ambient sound such that a hearing impaired person wearing ear-level device 110 is not 'isolated' when communicating to remote device 190." *Victorian*, [0030]. Moreover, it would have been obvious to incorporate a port into microphone 420, and to orient such a port away from the user to detect desired ambient sounds, for the same reasons discussed in Section VIII.A.1.b. *Polish*, P137.

To the extent PO argues that *Victorian*'s external microphone 420 capturing sound from the ambient environment does not encompass " *measur[ing]* an ambient acoustic environment," such an argument would be incorrect for the reasons discussed in Section VIII.A.1.b. Additionally, *Victorian* discloses an ambient sound gating module 421 that "compares the amplitude **[*40]** of a detected ambient sound with a predetermined threshold for the ambient sound," and"[w]hen the amplitude of the detected ambient sound exceeds the threshold for the ambient sound, ... ambient sound gating module 421 is turned on." *Victorian*, [0033]. Accordingly, a POSITA would have understood *Victorian* discloses or suggests obtaining an amplitude of ambient sound captured by an external microphone and that this amplitude can be compared to a threshold. *Polish*, P139.

Accordingly, *Victorian* discloses or suggests an external microphone 420 ("a first microphone") for picking up/measuring sound outside a user's ear and converting it to an amplitude ("configured to measure an ambient acoustic environment"), and having a port oriented towards the desired source of ambient sound ("a first microphone port that is configured to face away from a user when the earphone is inserted"). *Polish*, P140.

c. 1[b]

Victorian discloses or suggests this feature. *Polish*, PP141-145. *Victorian* discloses ear-level device 110 including an "[e]ar canal microphone 440 detects sound from the ear canal." *Victorian*, [0030]. "The sound includes primarily speech of the person wearing ear-level **[*41]** device 110." *Id.* It would have been obvious to incorporate a port into microphone 440, and to orient the port to face towards the user, for the same reasons discussed in Section VIII.A.1.b. *Polish*, PP141-142.

To the extent PO argues that *Victorian*'s external ear canal microphone 440 capturing sound from the ear canal does not encompass " *measur[ing]* an acoustic environment closer to the ear canal of a wearer than that measured by the first microphone" because the limitation encompasses more than capturing and reproducing sound from the ear canal, such an argument would be wrong for the reasons discussed in Section VIII.A.1.b. Additionally, *Victorian* discloses an occluded sound gating module 441 that compares the amplitude of a detected occluded sound with a predetermined threshold for the occluded sound, and that "when the amplitude of the detected occluded sound exceeds the threshold for the occluded sound, ... occluded sound gating module 441 is turned on." *Victorian*, [0034], [0031]. Accordingly, a POSITA would have understood *Victorian* discloses or suggests obtaining an amplitude of ear canal sound captured by ear canal microphone 440 and that this amplitude can **[*42]** be compared to a threshold. *Polish*, P144.

Accordingly, *Victorian* discloses or suggests an ear canal microphone 440 ("a second microphone") for picking up/measuring sound in a user's ear canal and converting it to an amplitude ("configured to measure an acoustic environment closer the ear canal of a wearer than that measured by the first microphone), and the ear canal microphone 440 having a port oriented towards the user ("a second microphone port that is configured to face toward the user when the earphone is inserted"). *Polish*, P145.

Manuel Saldana

d. 1[c]

Victorian discloses or suggests this feature. *Polish*, PP146-147. *Victorian* discloses "ear-level device 110 includes ... an ***ear canal speaker*** 470" disposed in the ear canal that "transmits sound received from remote device 190 and/or external microphone 420 to the same ear canal." *Victorian*, [0030], [0051].

e. 1[d] and 1[e]

Victorian discloses or suggests these features. *Polish*, PP148-153. *Victorian* discloses ear-level device 110 including "a **processor 460**." *Victorian*, [0030]. *Victorian*'s FIG. 4A shows processor 460 coupled to ear canal speaker 470 and, through VOX Circuit 430, to external microphone **[*43]** 420 and ear canal microphone 440.

[SEE FIGURE IN ORIGINAL]

Victorian, FIG. 4A

A POSITA would have found it obvious to implement *Victorian*'s processor 460 using a digital signal processor and/or other similar digital processor because such digital processors were widely available and commonly used to perform signal processing. *Polish*, PP150-151. A POSITA would have known that a digital processor inherently operates by executing instructions and that these instructions are inherently stored in a memory. *Polish*, P150. At the least, it would have been obvious in view of the knowledge of a POSITA that a digital processor would execute instructions and that these instructions would be stored in a memory, as this configuration was a well-known and common way of implementing a digital processor-based system to perform operations. *Id.*, P151 (citing *Svean*).

Accordingly, *Victorian* discloses or suggests a processor 460 with a memory that stores instructions executed by the processor ("a memory that stores instructions; and a processor that is configured to execute the instructions to perform operations") where the processor is coupled to ear canal speaker 470 ("the speaker is coupled to the **[*44]** processor") and, through VOX Circuit 430, to external microphone 420 and ear canal microphone 440 ("the processor is coupled to the first microphone, wherein the processor is coupled to the second microphone"). *Polish*, P152. *Victorian* discloses or suggest processor 460 performing the claimed operations, as discussed below.

f. 1[f]

Victorian discloses or suggests this feature. *Polish*, PP154-155. *Victorian* discloses processor 460 "converts the signals ***received*** from ... ***external microphone 420*** to a sound audible to the person wearing ear-level device 110." *Victorian*, [0030]; *Polish*, P154.

Accordingly, *Victorian* discloses or suggests a processor configured to convert the sound received from an external microphone into a sound audible to the user ("receiving a first microphone signal from the first microphone"). *Polish*, P155.

g. 1[g]

Victorian discloses or suggests this feature. *Polish*, PP156-157. *Victorian* discloses processor 460 converts "the sound picked up from the ear canal to an electrical signal to be transmitted to remote device 190." *Victorian*, [0030]; *Polish*, P156.

Accordingly, *Victorian* discloses or suggests a processor **[*45]** configured to convert the sound received from an ear canal microphone into a sound to be transmitted to a remote device ("receiving a second microphone signal from the second microphone"). *Polish*, P157.

h. 1[h]

Victorian discloses or suggests this feature. *Polish*, PP158-159. *Victorian* discloses processor 460 "converts the signals received from ... external microphone 420 to a sound audible to the person wearing ear-level device 110" (*Victorian*, [0030]), which a POSITA would have understood entails generating a signal from the first microphone

signal to be played by the ear canal speaker 470, the signal being an ambient sound signal, because it has been generated from the ambient sound received by the first microphone. *Polish*, P158.

Accordingly, *Victorian* discloses or suggests a processor configured to convert a signal from an external microphone to a sound audible to the user ("generating an ambient sound signal from at least one of the first microphone signal ..."). [7] *Polish*, P159.

i. 1[i], 1[j], and 1[k]

Victorian in combination with *Inanaga* discloses or suggests these features. *Polish*, PP160-166. *Victorian* discloses the processor **[*46]** 460 "includes one or more of ***amplification circuitry***, filtering circuitry, acoustic feedback reduction circuitry, noise reduction circuitry, and tone control circuitry, among other circuits ***performing signal processing functions as known in the art***." *Victorian*, [0030]; *Polish*, P160.

As discussed in Section VIII.D.1.e, a POSITA would have found it obvious to implement *Victorian*'s processor 460 using a digital signal processor and/or other similar digital processor. A POSITA would have further understood that a widely known and common technique for amplifying an audio signal in the digital domain was to adjust (e.g., increase or decrease) its gain. *Polish*, P161.

Victorian further discloses a gating rule that allows the transmission of both the remote sound and the ambient sound to the ear canal. *Victorian*, [0038] ("According to another exemplary rule, ambient sound gating module 421 is on, occluded sound gating module 441 is off, and remote sound gating module 451 is on. This rule allows the transmission of both the remote sound and the ambient sound to ear canal 303 ...."). The gating rule determines which sounds reach the processor 460, but a POSITA would **[*47]** have understood that *Victorian*'s processor 460 mixes the ambient sound signal from the external microphone 420 and the audio content from the remote device 190 to provide a mixed signal to the ear canal speaker 470 for playback. *Id.*, [0030] ("Processor 460 ... converts the signals received from remote device 190 ***and*** /or external microphone 420 to a sound audible to the person wearing ear-level device 110."); *Polish*, P162.

It would have been obvious to a POSITA to adjust the gain of the ambient sound signal to generate a modified-gain ambient sound signal, and to then mix this modified-gain ambient sound signal with the audio content from the remote device for playback by the ear canal speaker 470, as doing so was a commonly-known technique for mixing such signals. *Polish*, P163. For example, *Inanaga* discloses adjusting (e.g., increasing) the gain of an ambient sound signal and decreasing the gain of an audio content signal from a remote device when mixing the two signals before providing them to a speaker in an earphone/earpiece device. *Inanaga*, 6:51-7:9; *Polish*, P163; Sections VIII.C.1 & VIII.G.2.

Inanaga describes its technique as enabling a user to hear **[*48]** emergency information or human voices while listening to audio content from a remote device when wearing an earphone device configured to reduce external noises. *Inanaga*, 6:67-7:9. *Victorian* is directed to an ear-level device having a custom earmold that "is fully occluded to maximize audio efficiency" (*Victorian*, [0027]), which can be used, for example, by a hearing impaired person to communicate with a person in their vicinity while at the same time listening to audio content from a remote device (*id.*, [0006], [0016]).

A POSITA would have found it obvious to incorporate *Inanaga*'s teachings--regarding modifying the gain of an ambient sound signal and the gain of an audio content signal before mixing the two signals for playback to a user through the speaker of an earphone/earpiece device--into *Victorian*'s ear-level device, because doing so would have been consistent with and/or improved *Victorian*'s goal of allowing the wearer of the ear-level device to hear ambient sound in the wearer's vicinity while permitting the wearer to also listen to audio content from a remote device. *Polish*, P165. Doing so would have been obvious because it would have amounted to merely **[*49]** combining a known technique (*Inanaga*'s modifying the gain of an ambient sound signal) to improve a similar device (*Victorian*'s ear level device) ready for improvement (*Victorian* discloses that its processor can perform

[7] *See* footnote 6.

signal processing functions known in the art) to obtain predictable results (improving the wearer of *Victorian*'s ear-level device listening to a mix of ambient audio and audio content from a remote device). *Id.*

Accordingly, the *Victorian-Inanaga* device discloses or suggests an ear-level device having a processor configured to modify the gain of an ambient sound signal to generate a modified-gain ambient sound signal ("applying an ambient sound gain to the ambient sound signal to generate a modified ambient sound signal"), mix the modified-gain ambient sound signal with audio content from a remote device ("mixing the modified ambient sound signal with an audio content signal to generate a mixed audio signal"), and provide the mixed audio signal to a speaker in the earlevel device ("sending the mixed audio signal to the speaker"). *Polish*, P166.

2. Claim 11

Victorian in combination with *Inanaga* discloses or suggests this feature. *Polish*, PP167-169. **[*50]** *Victorian* discloses embodiments in which an earmold is used with the ear-level device. *Victorian*, Abstract. "In one embodiment, the earmold is fully occluded to maximize audio efficiency." *Id.*, [0027]. The earmold has a sealing section, as depicted, e.g., in Figures 3A, 3B, and 3C. These embodiments include the same "ear-level device 110" discussed above with respect to claim 1. *See id.*, [0029]. A POSITA would have understood that an ear-level device having a custom earmold designed to "fully occlude" the ear would have been capable of achieving noise reduction in the range of up to 22-26dB, which is the example of "sealing" provided in the '666 patent. *'666Pat.*, 6:47-54; *Polish*, P168. At a minimum a POSITA would have found it obvious to configure the ear-level device and its earmold to achieve noise reduction of at least 22-26dB to achieve *Victorian*'s goal of "full occlusion." *Polish*, P168.

Accordingly, the *Victorian-Inanaga* device discloses or suggests an ear-level device having an earmold designed to fully occlude a user's ear canal to maximize audio efficiency ("the earphone includes a sealing section"). *Polish*, P169.

E. Ground 2B: *Victorian, Inanaga [*51]* and *Kvaløy* Render Obvious Claims 2, and 8-10

1. Claim 2

Victorian in combination with *Inanaga* and *Kvaløy* discloses or suggests these features. *Polish*, PP170-177. As noted in Section VIII.B.1, the '666 patent does not define the term "acute sounds" but provides human speech as examples of such sounds.

Victorian discloses the processor 460 having "a speech recognition module to enhance the audio signal receive by and/or transmitted from ear-level device 110." *Victorian*, [0030]. *Victorian* additionally discloses enhancing an ambient audio signal with a voice recognition system to improve the audio signal's signal to noise ratio or remove undesired echo, where the signal is any voice included in the ambient sound, and the noise is any sound other than the voice. *Id.*, [0050]. *Victorian* further discloses the ear-level device being used to communicate with a remote device (i *d.*, [0008]), such as a cellular phone (*id.*, [0016]). *Victorian*, however, arguably does not discuss in great detail how to perform voice recognition and/or how to communicate *with* a communication device using voice. *Polish*, P171.

For the reasons discussed in Section VIII.B.1, *Kvaløy **[*52]*** discloses an earplug device that is very similar to *Victorian*'s ear-level device. For example, both devices have an outer microphone, an in-ear microphone, and an in-ear speaker, all coupled to a processor. *Polish*, P172. As also discussed in Section VIII.B.1, *Kvaløy* discloses detecting commands spoken by a user ("detecting an acute sound") by analyzing signals from an outer microphone similar to *Victorian*'s external microphone 420 and an inner microphone similar to *Victorian*'s internal microphone 420 ("by analyzing at least one of the first microphone signal or the second microphone signal or a combination of both").

A POSITA would have been motivated to apply *Kvaløy*'s teachings to the *Victorian-Inanaga* ear-level device to detect voice commands for operating a device such as a cellular phone. *Polish*, P173. As an initial matter, a POSITA would have understood that *Victorian*'s, *Inanaga*'s and *Kvaløy*'s teachings are related because they all

relate to earpiece/earplug-based devices configured to assist a user to hear ambient sound as well as audio content from a remote device while achieving significant passive noise attenuation. *Id.*

Moreover, *Victorian* teaches **[*53]** or at a minimum suggests the desirability of using voice commands for operating a cellular phone connected to *Victorian*'s earlevel device inasmuch as it discloses the user communicating ***with*** such devices. *Polish*, P174. Additionally, a POSITA would have been motivated to incorporate voice command capability into the *Victorian-Inanaga* ear-level device because, as evidenced by *Kvaløy*, such features were well-known to a POSITA and a POSITA would have recognized that they would have made the *Victorian-Inanaga* ear-level device more capable and useful to the user. *Polish*, P175. *Kvaløy* provides additional detail for how to use the signals from an outer microphone (e.g., *Victorian*'s external microphone 420 or *Kvaløy*'s microphone M1) and in inner microphone (e.g., *Victorian*'s ear canal microphone 440 or *Kvaløy*'s microphone M2) in a device similar to the *Victorian-Inanaga* device to detect a user's voice and further detect specific commands spoken by the user. *Polish*, P175.

A POSITA would have considered the combination to be predictable and would have had a reasonable expectation of success because the *Victorian-Inanaga* device already includes the components **[*54]** to implement *Kvaløy*'s voice command detection and implementation functionality. *Polish*, P176. Incorporating this functionality into the *Victorian-Inanaga* ear-level device would have been obvious to a POSITA because it amounted to merely applying a known technique (*Kvaløy*'s voice command detection and implementation functionality) to a similar device (the *Victorian-Inanaga* ear-level device) in the same way (using voice commands to control, e.g., a cellular phone as already suggested by *Victorian*). *Id.*

Accordingly, the *Victorian-Inanaga-Kvaløy* device discloses or suggests a processor configured to detect user spoken commands ("detecting an acute sound") by analyzing signals from outer and inner microphones ("by analyzing at least one of the first microphone signal or the second microphone signal or a combination of both"). A POSITA would have further understood that this analysis entailed "determining whether the acute sound is a user's voice." *Polish*, P177.

2. Claim 8

Victorian in combination with *Inanaga* and *Kvaløy* discloses or suggests this feature. *Polish*, PP178-182. A POSITA would have been motivated to modify the *Victorian-Inanaga-Kvaløy* device **[*55]** to adjust the relative gains of the signals received from a remote device and an ambient microphone for the reasons discussed in Section VIII.D.1.i. *Polish*, P178.

A POSITA would have also recognized the advantage of adjusting the gains of *Victorian*'s ambient audio signal and audio content signal when the results of *Victorian*'s voice recognition analysis detects a voice. *Polish*, P179. Indeed, as discussed in Section VIII.C.1, it was well-known prior to January 2007 to adjust a mixed audio signal comprised of ambient sound detected by an ambient microphone and audio content provided by a communication device when a voice (e.g., the user's voice or the voice of a person speaking to the user) is detected.

Thus, a POSITA would have been motivated to further modify the *Victorian-Inanaga-Kvaløy* device to decrease the gain of audio content from the communication device and increase the gain of the ambient sound signal when the voice recognition analysis detects a voice in order to achieve the well-known benefit of allowing the user to hear a person in the user's vicinity. *Polish*, P180. Such a modification would have been consistent with and/or improved *Victorian*'s goal **[*56]** of permitting a user to hear ambient sound (e.g., hear another person in the user's vicinity) as well as audio content from a remote device while achieving significant passive noise attenuation. *Id.*

Such a modification would have been obvious to a POSITA because it would have amounted to merely applying a known technique (*Inanaga*'s relative gain adjustment) to a similar device (the *Victorian-Inanaga-Kvaløy* device) in the same way (to allow the user to hear another person in their vicinity while continuing to wear the ear-level device and listening to audio content). *Polish*, P181.

Accordingly, the *Victorian-Inanaga-Kvaløy* device discloses or suggests a processor configured to decrease the gain of audio content from a communication device and increase the gain of the ambient sound signal in a mixed

audio signal when the user's voice is detected ("adjusting the mixed audio signal when the user's voice is detected"). *Polish*, P182.

3. Claim 9

Victorian in combination with *Inanaga* and *Kvaløy* discloses or suggests this feature for the reasons discussed in Section VIII.E.2. *Polish*, P183.

4. Claim 10

Victorian in combination with *Inanaga* and *Kvaløy* discloses **[*57]** or suggests this feature. *Polish*, PP184-186. For the reasons discussed in Section VIII.C.3, *Inanaga* discloses or suggests a noise reduction signal. *Polish*, P184.

A POSITA would have been motivated to further modify the *Victorian- Inanaga-Kvaløy* device in view of *Inanaga*'s negative feedback feature so as to reduce the effect of any noise that may still reach the user's ear canal. Each of *Victorian, Inanaga*, and *Kvaløy* are directed to, among other aspects, reducing the amount of ambient sound that passively reaches the user's ear canal while wearing their respectively disclosed earphones. *Polish*, P185; s *ee, e.g., Victorian*, [0027]; *Inanaga*, 1:8-10, 2:47-50; *Kvaløy*, 1:30-39. Incorporating this feature would further improve the capability of the *Victorian-Inanaga-Kvaløy* device to reduce the amount of unwanted noise heard by the user. Such a modification would have been obvious to a POSITA because it would have amounted to merely applying a known technique (*Inanaga*'s negatively fed back internal microphone signal) to a similar device (the *Victorian-Inanaga-Kvaløy* device) in the same way (further reducing noise reaching the user's ear canal). *Polish*, P185. **[*58]**

Accordingly, the *Victorian-Inanaga-Kvaløy* device discloses or suggests a processor configured to reverse the phase of an audio signal detected by an internal microphone (e.g., similar to *Victorian*'s microphone 440) and mix ("the mixed audio signal") this reversed phase signal with an ambient audio signal and an audio content signal ("includes a noise reduction signal derived from the second microphone signal"). *Polish*, P186.

F. Ground 3A: *Inanaga* Renders Obvious Claims 1 and 11

1. Claim 1

a. 1[pre]

To the extent the preamble is limiting, *Inanaga* discloses or suggests this feature. *Polish*, P187. *Inanaga* discloses an "earphone device." *Inanaga*, 2:29-50, Abstract, FIG. 4.

b. 1[a]

Inanaga discloses or suggests this feature. *Polish*, PP188-191. *Inanaga* discloses an external microphone unit 37 disposed externally of the acoustic tube 31, which picks up external noises (ambient sound) and outputs an external noise signal. *Inanaga*, 5:34-56, Fig. 4. A POSITA would have understood the microphone picking up sound to encompass measuring sound for the reasons discussed in Section VIII.A.1.b. *Polish*, P189.

[SEE FIG. 4 IN ORIGINAL]

Inanaga, FIG. 4 **[*59]**

Further, a POSITA would have understood *Inanaga*'s microphone 37 facing outward of the tube comprises an external microphone facing away from the user when the earphone is inserted. *Polish, P*190. Moreover, it would have been obvious to incorporate a port into microphone 37, and to orient such a port away from the user to detect desired ambient sounds, for the same reasons discussed in Section VIII.A.1.b. *Id.*

Accordingly, *Inanaga* discloses or suggests a microphone unit 37 disposed externally of the acoustic tube 31 ("a first microphone") configured to detect external noise ("configured to measure an ambient acoustic environment"), and the microphone 37 having a port oriented towards the desired source of ambient sound ("a first microphone port that is configured to face away from a user when the earphone is inserted"). *Polish*, P191.

c. 1[b]

Inanaga discloses or suggests this feature. *Polish*, PP192-194. *Inanaga* discloses an internal microphone unit 36 adjacent to the earphone unit 33 provided on the periphery of the acoustic tube 31 and having a vibration plate 36' facing inward of the tube. *Inanaga*, 5:34-56, Fig. 4. Sound provided by the earphone unit 33 transmits **[*60]** to the eardrum via the external auditory canal A and is picked up by the internal microphone unit 36. *Inanaga*, 6:25-30. A POSITA would have understood the microphone picking up sound to encompass measuring sound for the reasons discussed in Section VIII.A.1.b. *Polish*, P192.

Moreover, it would have been obvious to a POSITA to incorporate a port into the microphone 36, and to orient the port to face towards the user, for the same reasons discussed in Section VIII.A.1.b. *Polish*, P193.

Accordingly, *Inanaga* discloses or suggests an internal microphone unit 36 ("a second microphone") that generates audio signals representing captured sound provided by the earphone unit 33 that transmits to the eardrum ("configured to measure an acoustic environment closer to the ear canal of a wearer than that measure by the first microphone"), and the internal microphone unit 36 having a port oriented to detect sound transmitted to the eardrum via external auditory canal A ("a second microphone port that is configured to face toward the user when the earphone is inserted"). *Polish*, P194.

d. 1[c]

Inanaga discloses or suggests this feature. *Polish*, PP195-196. *Inanaga* discloses an **[*61]** earphone unit 33 that transmits a reproduced sound (e.g., a music signal from portable stereo cassette tape recorder) to the user's eardrum. *Inanaga*, 5:34-56, 6:15-21.

e. 1[d] and 1[e]

Inanaga at a minimum suggests this feature. *Polish*, PP197-203. *Inanaga* discloses a **mixing circuit 38** which is capable of mixing the input audio signal (such as a music signal reproduced from a compact portable stereo cassette tape recorder), the signal obtained by negatively feeding back the signal obtained from internal microphone unit 36, and the signal obtained from external microphone unit 37 at a desired mixing ratio. *Inanaga*, 2:29-47, 5:34-56. *Inanaga* also discloses the output signal of said mixing being supplied to earphone unit 33. *Inanaga*, 2:46-47, 6:44-50. Accordingly, *Inanaga* describes a mixing circuit 38 communicatively coupled to an external microphone, an internal microphone, and an earphone unit. *Polish*, P197.

It would have been obvious to a POSITA to implement the functionality of mixing circuit 38, as well as the phase reversing circuit 32 and amplifiers 44-46, by using a digital signal processor (DSP), and a POSITA would have been motivated to do so. *Polish* ***[*62]***, PP198-200 (also discussing *Mulgrew*). Indeed, *Inanaga* was filed in 1991, when DSPs were less common, less capable and more expensive. By January 2007, however, DSPs were much more capable, ubiquitous and affordable, and in fact were preferred over analog circuits for performing the type of signal processing disclosed in *Inanaga*. *Polish*, P198. *See, e.g., Silicon Labs., Inc., v. Cresta Tech. Corp.*, IPR2014-00809, Paper 56 at 23-24 (October 21, 2015) (finding motivation to replace an analog adaptive filter with a digital signal processor because "digital signal processor circuitry was available and would be resorted to by the person of ordinary skill to replace other circuit components, like the adaptive filter in [reference]").

A POSITA would have further recognized that processing signals using a DSP provided benefits over performing analog signal processing, such as, greater degree of flexibility in operation (e.g., adjusting filtering and gain parameters) through programming instead of having to change physical parts, and that processing audio signals using a DSP required fewer precision parts than analog systems. *Polish*, P199. A POSITA would also have recognized the **[*63]** feasibility of incorporating a DSP in a system that includes an external microphone, an internal

microphone, and a speaker, such as *Inanaga*. *Polish*, P200 (citing *Svean*; *Dijkstra*). It also would have been obvious to a POSITA to incorporate the additional elements necessary to perform digital signal processing, such as A/D and D/A converters and program and data memory components. *Polish*, P201 (citing *Dijkstra*).

Employing a DSP to perform the functionality of *Inanaga*'s mixing circuit 38, phase reversing circuit 32, and amplifiers 44-46 would have necessarily entailed, but at the least rendered obvious, a memory to store the instructions executed by the digital signal processor. *Polish*, P201 (citing *Svean*,; *Dijkstra*); *see also* Section VIII.A.1.d.

Accordingly, *Inanaga* at a minimum suggests a DSP with a memory that stores instructions executed by the DSP ("a memory that stores instructions; and a processor that is configured to execute the instructions to perform operations") where the DSP receives the signal from internal microphone unit 36 (and generates a negative phase version of the signal) and the signal obtained from external microphone unit 37 ("the processor **[*64]** is coupled to the first microphone, wherein the processor is coupled to the second microphone") and the output of the mixed signal from the DSP is supplied to earphone unit 33 ("the speaker is coupled to the processor"). *Polish*, P202. *Inanaga*, modified to incorporate a DSP, discloses or suggests the DSP performing the claimed operations, as discussed below.

f. 1[f]

Inanaga discloses or suggests this feature. *Polish*, PP204-205. *Inanaga* discloses external microphone unit 37 picking up external noises (ambient sound) and providing the external noise signal to the mixing circuit 38 (replaced with a DSP). *Inanaga*, 5:57-65, 6:37-43; *Polish*, P204.

Accordingly, *Inanaga* discloses or suggests a DSP configured to receive a signal from external microphone unit 37 ("receiving a first microphone signal from the first microphone"). *Polish*, P205.

g. 1[g]

Inanaga discloses or suggests this feature. *Polish*, PP206-207. *Inanaga* discloses internal microphone unit 36 picking up sound provided by the earphone unit 33, and providing the signal from the internal microphone unit 36 to the mixing circuit 38 via phase reversing circuit 32 (both replaced by a DSP). *Inanaga* **[*65]** , 5:57-65, 6:25-36, Fig. 4; *Polish*, P206.

Accordingly, *Inanaga* discloses or suggests a DSP configured to receive a signal from internal microphone unit 36 ("receiving a second microphone signal from the second microphone"). *Polish*, P207.

h. 1[h]

Inanaga discloses or suggests this feature. *Polish*, PP208-210. *Inanaga* discloses an external microphone unit 37 picking up external noises (ambient sound) and outputting an external noise signal to the mixing circuit 38. *Inanaga*, 5:34-56, 6:37-43; *Polish*, P208. *Inanaga* discloses the amplification circuit 46 (replaced by a DSP) changing the gain of the external noise signal. *Inanaga*, 6:37-56. A POSITA would have understood that to amplify the received external noise signal the DSP (replacing the amplification circuit 46) would first internally (re)generate the external noise signal that it had received. *Polish*, P209.

Accordingly, *Inanaga* discloses or suggests a DSP configured to (re)generate an external noise signal ("generating an ambient sound signal") received from the external microphone unit 37 ("from at least one of the ... second microphone signal ..."). *Polish*, P210.

i. 1[i]

Inanaga discloses **[*66]** or suggests this feature. *Polish*, PP211-212. *Inanaga* discloses the mixing circuit 38 (replaced by a DSP) comprising a third variable gain control circuit 42 for variably changing the gain of the external noise signal (ambient sound) from microphone unit 37. *Inanaga*, 5:57-65, 6:51-7:6; *Polish*, P211.

Accordingly, *Inanaga* discloses or suggests a DSP configured to change the gain of the external noise signal ("applying an ambient sound gain to the ambient sound signal to generate a modified ambient sound signal"). *Polish*, P212.

j. 1[j] and 1[k]

Inanaga discloses or suggests these features. *Polish*, PP213-215. *Inanaga* discloses the mixing circuit 38 comprising adder 43 (replaced by a DSP) mixing the inputted audio signal (such as a music signal reproduced from a compact portable stereo cassette tape recorder) with the gain-adjusted external noise signal at a desired mixing ratio. *Inanaga*, 5:34-65; 6:51-66; *Polish*, P213. *Inanaga* discloses the mixing circuit 38 (replaced by a DSP) supplying the mixed signal to the earphone unit 33 to be outputted by the earphone unit. *Inanaga*, 6:15-21, 6:44-50; *Polish*, P214.

Accordingly, *Inanaga* discloses or suggests **[*67]** a DSP configured to mix ("mixing") a gain-adjusted external noise signal ("the modified ambient sound signal") with an inputted audio signal ("with an audio content signal") to generate a mixed signal ("to generate a mixed audio signal"), which is supplied to an earphone unit ("sending the mixed audio signal to the speaker"). *Polish*, P215.

2. Claim 11

Inanaga discloses or suggests this feature. *Polish*, PP216-218. *Inanaga* discloses that the acoustic tube forms an earphone casing. *Inanaga*, 5:66-6:4. *Inanaga* provides that the inner diameter of the acoustic tube is made uniform and substantially identical with the inner diameter of the external auditory canal and provided with an auricle mounting member made of a material such as synthetic resin or rubber having an elasticity. *Inanaga*, 5:34-39; *Polish*, PP216-217. *Inanaga* provides that an aim of the earphone device is to reduce external noise. *Inanaga*, 1:8-10, 1:66-2:2. A POSITA would have understood that *Inanaga*'s structure would have formed a seal of the ear canal. *Polish*, P217. A POSITA would have understood that *Inanaga*'s structure would have been capable of achieving noise reduction in the range of up **[*68]** to 22-26dB, which is the example of "sealing" provided in the '666 patent. *'666Pat.*, 5:3-10; *Polish*, P217. At a minimum a POSITA would have found it obvious to configure *Inanaga*'s earphone--having a uniform diameter substantially identical with the inner diameter of the external auditory canal and provided with an auricle mounting member--to achieve noise reduction of at least up to 22-26dB. *Polish*, P217.

Accordingly, *Inanaga* discloses or suggests an earphone that includes an acoustic tube that is identical with the inner diameter of the external auditory canal and provided with an auricle mounting member having an elasticity, the aim of which is to reduce external noise ("the earphone includes a sealing section"). *Polish*, P218.

G. Ground 3B: *Inanaga* and *Engle* Render Obvious Claims 2 and 8-10

1. Claim 2

Inanaga in combination with *Engle* discloses or suggests these features. *Polish*, PP219-226. As noted in Section VIII.B.1, the '666 patent does not define the term "acute sounds" but provides speech by a human as examples of such sounds.

Inanaga discloses that, when external emergency information and human voices are desired to be listened to while also **[*69]** listening to an audio input signal (for example, a music signal reproduced from a compact portable stereo cassette tape recorder), "the ***gains of the input audio signal*** and the negatively fed back signal ***are*** not adjusted or ***adjusted to low values*** or zero and the ***gain of the external noise is increased***, the gain of which has been a low value or zero." *Inanaga*, 6:67-7:9.

Engle discloses a method for controlling a headphone having a microphone which detects a signal by the microphone; if the signal has a predefined characteristic, the signal is mapped to a control command and the headphone is operated according to the command. *Engle*, Abstract. *Engle* describes an embodiment in which the microphone signals are provided to a digital signal processor to perform voice recognition and to translate the

received voice message into a particular command. *Engle*, 5:54-67; *Polish*, P221. A POSITA would have understood that the voice detected by *Engle*'s headphone to determine voice commands is the headphone user's voice because, for example, *Engle*'s disclosure is directed to an apparatus and method for a ***user*** to control a headphone's operation. **[*70]** *Polish*, P221. *Engle* discloses the headphone changing its mode of operation based on the detected voice commands that are translated into commands. *See, e.g., Engle*, 8:45-10:50; *Polish*, P223.

It would have been obvious to a POSITA to modify *Inanaga* to have the DSP (which a POSITA would have found obvious to use to implement *Inanaga* for the reasons discussed in Section VIII.F.1.e) use the signal received from one or more external microphone units 37 to detect a user's voice command, e.g., a command to change the earphone's mode of operation to one in which emergency information and human voices can be heard while also listening to reproduced sounds from a device such as a portable music player. *Polish*, PP221-222, 224. *Inanaga* discloses changing the headphone's mode of operation while *Engle* provides additional detail regarding how to effectuate such a change. A POSITA would have found it obvious modify *Inanaga* based on *Engle*'s disclosure because doing so would have amounted to merely applying a known technique (*Engle*'s method of using a user's voice to modify the operation of a headphone) to a known device (*Inanaga*'s headphone) ready for improvement to yield **[*71]** predictable results (improving *Inanaga* to change its mode of operation based on detecting a user's voice command). *Polish*, P225.

Accordingly, the *Inanaga-Engle* earphone discloses or suggests a DSP configured to detect voice commands spoken by a user ("detecting an acute sound") by analyzing signal(s) from an external microphone unit 37 ("by analyzing at least one of the first microphone signal ..."). A POSITA would have further understood that this analysis entailed "determining whether the acute sound is a user's voice." *Polish*, P226.

2. Claim 8

Inanaga in combination with *Engle* discloses or suggests this feature. *Polish*, P227. For the reasons discussed in Section VIII.G.1, the *Inanaga-Engle* headphone discloses or suggests a DSP configured to adjust the gain of an audio signal from an external microphone unit 37 and the gain of an audio input source (e.g., from a music player) in a mixed audio signal that is played by an earphone unit 33 ("adjusting the mixed audio signal") based on detecting a command in the user's voice ("when the user's voice is detected"). *Polish*, P227.

3. Claim 9

Inanaga in combination with *Engle* discloses or suggests this feature **[*72]** for the reasons discussed in Section VIII.G.1. *Polish*, P228.

4. Claim 10

Inanaga in combination with *Engle* discloses or suggests this feature. *Polish*, PP229-230. *Inanaga* discloses a phase reversing circuit 32 for reversing the phase of an audio signal in the acoustic tube 31 supplied from the internal microphone unit 36. *Inanaga*, 5:46-49, 6:28-36. *Inanaga* also discloses a mixing circuit 38 for "mixing the inputted audio signal such as music signal reproduced from a compact portable stereo cassette tape recorder with the negatively fed back signal and the external noise signal at a desired mixing ratio." *Id.*, 5:52-56, 6:44-47. As *Inanaga* explains, reversing the phase of the signal detected by the internal microphone unit and adding it back into the mixed signal "enables the sound provided by the earphone unit 3 [or 33] to become a clear reproduced sound from which external noises are removed." *Id.*, 4:4-9; *Polish*, P229. As discussed in Section VIII.F.1.e, a POSITA would have found it obvious to implement the phase reversing circuit 32, the mixing circuit 38, and amplifiers 44-46 using a DSP. *Polish*, P229.

Accordingly, the *Inanaga-Engle* headphone discloses **[*73]** or suggests a DSP configured to reverse the phase of an audio signal detected by an internal microphone and mix ("the mixed audio signal") this reversed phase signal with an ambient audio signal and an audio content signal ("includes a noise reduction signal derived from the second microphone signal"). *Polish*, P230.

IX. THE DISCRETIONARY FACTORS FAVOR INSTITUTING TRIAL

A. 35 U.S.C. § 314(a)

The weight of the factors articulated in *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11, 6 (Mar. 20, 2020) (precedential) strongly favors institution.

1. ***Potential for a District Court Stay.*** The parallel litigation in which this patent has been asserted (EX1016), has been consolidated with an earlier case filed by PO (EX1017, EX1018). Petitioners had moved to stay the earlier case prior to the consolidation, and intend to timely inform the district court of this petition and update their motion to stay. Factor 1, therefore, is at worst neutral.

2. ***Trial Date Relative to Final Written Decision (FWD) Due Date.*** Petitioners have been diligent, filing this Petition less than four months after the complaint was filed. EX1016; *see Apple Inc. v. Seven Networks, LLC*, IPR2020- **[*74]** 00156, Paper 10, 9 & n.8 (June 15, 2020) (" *Seven Networks*") (indicating that factor 2 should be analyzed on a sliding scale based on petitioner diligence and relative trial dates). Under the typical 18-month IPR schedule, the FWD would issue in December 2023 depending on when the Board accords a filing date.

The parallel district court action has been consolidated with an earlier action filed by PO (EX1017, EX1018), and the consolidated actions currently have a trial date set for June 26, 2023 (EX1019). Any comparison of a projected FWD date against potential trial dates, however, is at best speculative, and this factor should not be strictly applied because Petitioners would be deprived of a reasonable opportunity to file an IPR (and make meaningless the one year statutory deadline) entirely based on the PO's choice of jurisdiction and PO's choice to file a second suit alleging infringement of four patents over three months after filing a first suit alleging infringement of ten patents.

3. ***Investment in the Parallel Proceeding.*** Factor 3 weighs strongly against discretionary denial. Investment in the parallel litigation will remain low at the time of institution. No substantive **[*75]** orders have been issued by the court in the underlying litigation, and the court's *Markman* hearing is not scheduled until January 10, 2023. EX1019. Assuming the Board's institution decision issues in December 2022, significant work as to invalidity will remain in district court. For example, assuming no extensions to the schedule, fact discovery and expert discovery will remain ongoing, and dispositive motions will not yet have been filed or briefed. *Id.*

Petitioners have also been extremely diligent. Petitioners filed this petition less than four months after the district court complaint, approximately two months after PO served infringement contentions, and a month ***before*** Petitioner's invalidity contentions are due. EX1019. When the Board considers both investment and diligence, it should weigh this factor heavily in favor of institution.

4. ***Overlap of Issues.*** Factor 4 weighs strongly against discretionary denial. While Petitioners are challenging all asserted claims, to avoid any doubt as to the absence of overlap between the proceedings, Petitioners have stipulated that, if IPR is instituted, they will not challenge the validity of the '666 patent in the district **[*76]** court litigation based on: (1) the grounds instituted in any review; or (2) any ground utilizing *Platz*, *Victorian* or *Inanaga* as the primary reference. EX1020. This stipulation is broader than that in *Sand Revolution II, LLC v. Continental Intermodal Group-Trucking LLC*, IPR2019-01393, Paper 24, at 11-12 (PTAB June 16, 2020) (informative), and weighs against exercising discretion to deny institution.

Additionally, PO has asserted 176 total claims across 14 patents against Petitioners in the same consolidated district court action. The district court will almost certainly not permit PO to assert all challenged claims at the scheduled trial. Thus, this proceeding will likely address numerous claims that will not be at issue in the parallel district court proceeding. Factor 4 thus weighs heavily in favor of institution.

5. ***Parties.*** Petitioners and PO are also parties to the parallel litigation.

6. ***Other Considerations.*** Factor 6 weighs strongly against discretionary denial. The merits of this Petition are particularly strong as demonstrated in the Petition with reference to Dr. Polish's testimony and additional evidence.

The strength of the merits alone is enough to outweigh **[*77]** any inefficiencies born of parallel litigation. *See Fintiv*, 14-15.

Petitioners therefore respectfully submit that the *Fintiv* factors favor institution and that discretionary denial of this Petition would be neither appropriate nor equitable.

B. *35 U.S.C. § 325(d)*

The Board should not deny institution under § 325(d). *See Becton, Dickinson & Co. v. B. Braun Melsungen AG*, IPR2017-01586, Paper 8, 17-18 (PTAB Dec. 15, 2017) (precedential); *Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6, 9-11 (PTAB Feb. 13, 2020) (precedential).

Victorian is the only reference presented here that was previously before the Office. However, it was not cited in any office action, not used to reject any claims during the prosecution, nor otherwise substantively discussed during prosecution of the '666 patent. Rather, another reference (US2016002146) with a substantively identical disclosure to *Victorian* was used to reject the claims then pending in a great grandparent application to the '666 patent (Application No. 14/574,589, issued as U.S. 10,134,377). None of these claims recited a purported invention with the scope of the Challenged Claims, for **[*78]** which *Victorian* is used in Grounds 2A and 2B.

When a reference is cited during prosecution, *Becton, Dickinson* factors (c), (e), and (f) are evaluated. *Advanced Bionics*, Paper 6, 10-11. Factor (c) is "the extent to which the asserted art was evaluated during examination, including whether the prior art was the basis for rejection." During prosecution of the '666 patent, the Examiner did not rely on *Victorian* to reject any claims. This strongly favors not exercising discretion to deny this Petition. *SolarEdge Techs. LTD v. SMA Solar*, IPR2020-00021, Paper 8, 12 (PTAB Apr. 10, 2020) ("Because the Examiner did not rely on [the cited references] to reject a claim, *Becton* factor (c) weighs strongly against exercising our discretion to deny institution.").

Factor (e) asks "whether Petitioner has pointed out sufficiently how the Examiner erred in its evaluation of the asserted prior art." Here, the Examiner never relied on *Victorian* in a rejection. The Examiner erred.

Becton, Dickinson factor (f) considers "the extent to which additional evidence and facts presented in the Petition warrant reconsideration of the prior art or arguments." Here, Petitioners combine *Victorian* ***[*79]*** with *Inanaga* and *Kvaløy*, which were not before the Examiner. Petitioners also present arguments based on *Platz* and *Inanaga* as primary references, neither of which was before the Examiner either. Thus, Petitioners present challenges that the Examiner did not consider.

To the extent PO argues that *Kvaløy* is cumulative of *Svean*, *Kvaløy* has significant disclosure pertinent to the grounds presented in this Petition that is not disclosed in *Svean*. For example, *Kvaløy* discloses a voice detection and discrimination apparatus that detects a user's voice by comparing the strength of signals from microphones M1 and M2, which is not disclosed by *Svean*. *Kvaløy*, 6:50-7:8.

X. MANDATORY NOTICES UNDER *37 C.F.R. § 42.8*

A. Real Parties-in-Interest

Petitioners identify themselves as the real parties-in-interest.

B. Related Matters

To the best of Petitioners' knowledge, the '666 patent has only been involved in the following district court litigation: *Staton Techiya, LLC et al. v. Samsung Electronics Co., Ltd. et al.*, 2:22-cv-00053 (E.D. Tex.), filed February 14, 2022.

Attached to this petition as EX1015 is a chart identifying all patents/applications that are in **[*80]** the same family as the '666 patent.

To the best of Petitioners' knowledge, the '666 patent has not been challenged in any *inter partes* review or post grant review prior to this proceeding.

Petitioners have previously challenged other of PO's patents in the following proceedings:

Case No.
IPR2022-00234

Challenged Patent No.
9,124,982

Case No.
IPR2022-00242

Challenged Patent No.
8,111,839

Case No.
IPR2022-00243

Challenged Patent No.
8,111,839

Case No.
IPR2022-00253

Challenged Patent No.
9,491,542

Case No.
IPR2022-00281

Challenged Patent No.
9,270,244

Case No.
IPR2022-00282

Challenged Patent No.
8,315,400

Case No.
IPR2022-00302

Challenged Patent No.
9,609,424

Case No.
IPR2022-00324

Challenged Patent No.
8,254,591

Case No.
IPR2022-00369

Challenged Patent No.
10,405,082

Case No.
IPR2022-00388

Challenged Patent No.
10,966,015

Case No.
IPR2022-00410

Challenged Patent No.
10,979,836

Concurrent with this petition, Petitioners are filing *inter partes* review challenges of the following PO patents:

Case No.
IPR2022-01078

Challenged Patent No. [*81]
11,057,701

Case No.
IPR2022-01098

Challenged Patent No.
11,217,237

Case No.
IPR2022-01106

Challenged Patent No.
11,039,259

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D. Service Information

Please address all correspondence to lead and back-up counsel at the addresses shown above. Petitioner consents to electronic service by e-mail.

XI. FEES

Petitioners concurrently electronically submit the required fees for this Petition. The Board is authorized to charge Arnold & Porter Kaye Scholer LLP's deposit account, No. 50-2387, for any fee deficiency.

Date: June 9, 2022

Respectfully submitted,

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Counsel for Petitioners

CERTIFICATE OF COMPLIANCE

The undersigned hereby certifies that the foregoing Petition for *Inter Partes* Review contains 13,909 words, excluding those portions identified in 37 C.F.R. § 42.24(a), as measured by the word-processing system used to prepare this paper.

/Ali R. Sharifahmadian/
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CERTIFICATE OF SERVICE

I certify that on June 9, 2022, I caused a true and correct copy of the foregoing Petition for *Inter Partes* Review of U.S. Patent ***11,244,666*** and supporting exhibits to be served via overnight delivery on the Patent Owner at the following correspondence address of record as listed on PAIR:

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[SEE PETITIONERS' EXHIBIT LIST IN ORIGINAL]

End of Document

User Name: Manuel Saldana
Date and Time: Wednesday, March 1, 2023 9:03:00AM EST
Job Number: 191485818

Document (1)

1. *2:21cv413, Staton Techiya, Llc Et Al V. Samsung Electronics Co., Ltd. Et Al*
   Client/Matter: -None-
   Search Terms: number(2:21CV413)
   Search Type: Natural Language
   Narrowed by:

Content Type	Narrowed by
Dockets	Case Status: Open,Unknown,Closed

2:21cv413, Staton Techiya, Llc Et Al V. Samsung Electronics Co., Ltd. Et Al

US District Court Docket

United States District Court, Texas Eastern

(Marshall)

This case was retrieved on 02/17/2023

Header

Case Number: 2:21cv413
Date Filed: 11/05/2021
Assigned To: District Judge Rodney Gilstrap
Referred To: Magistrate Judge Roy S. Payne
Nature of Suit: Patent (830)
Cause: Patent Infringement
Lead Docket: None
Other Docket: 2:22cv00053
Jurisdiction: Federal Question

Class Code: Open
Statute: 35:271
Jury Demand: Plaintiff
Demand Amount: $0
NOS Description: Patent

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Proceedings

#	Date	Proceeding Text	Source
1	11/05/2021	COMPLAINT for Patent Infringement against All Defendants (Filing fee $ 402 receipt number 0540-8660995.), filed by Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit A, # 2 Exhibit B, # 3 Exhibit C, # 4 Exhibit D, # 5 Exhibit E, # 6 Exhibit F, # 7 Exhibit G, # 8 Exhibit H, # 9 Exhibit I, # 10 Exhibit J, # 11 Civil Cover Sheet)(Cangro, Bradford) (Entered: 11/05/2021)	
2	11/05/2021	CORPORATE DISCLOSURE STATEMENT filed by Staton Techiya, LLC, Synergy IP Corporation (Cangro, Bradford) (Entered: 11/05/2021)	
	11/05/2021	Case Assigned to District Judge Rodney Gilstrap. (nkl,) (Entered: 11/05/2021)	
	11/05/2021	In accordance with the provisions of 28 USC Section 636(c), you are hereby notified that a U.S. Magistrate Judge of this district court is available to conduct any or all proceedings in this case including a jury or non-jury trial and to order the entry of a final judgment. The form Consent to Proceed Before Magistrate Judge is available on our website. All signed consent forms, excluding pro se parties, should be filed electronically using the event Notice Regarding Consent to Proceed Before Magistrate Judge. (nkl,) (Entered: 11/05/2021)	
3	11/08/2021	NOTICE of Attorney Appearance - Pro Hac Vice by Robert J Gaybrick on behalf of Staton Techiya, LLC, Synergy IP Corporation. Filing fee $ 100, receipt number 0540-8662487. (Gaybrick, Robert) (Entered: 11/08/2021)	
4	11/08/2021	Notice of Filing of Patent/Trademark Form (AO 120). AO 120 mailed to the Director of the U.S. Patent and Trademark Office. (Truelove, Jennifer) (Entered: 11/08/2021)	
5	11/08/2021	SUMMONS Issued as to Samsung Electronics Co., Ltd.. (klc,) (Entered: 11/08/2021)	
6	11/08/2021	SUMMONS Issued as to Samsung Electronics America, Inc.. (klc,) (Entered: 11/08/2021)	
7	11/08/2021	NOTICE of Attorney Appearance by Jennifer Leigh Truelove on behalf of Staton Techiya, LLC, Synergy IP Corporation (Truelove, Jennifer) (Entered: 11/08/2021)	
8	11/08/2021	NOTICE of Attorney Appearance by Jacob Andrew Snodgrass on behalf of Staton Techiya, LLC, Synergy IP Corporation (Snodgrass, Jacob) (Entered: 11/08/2021)	
9	11/10/2021	NOTICE of Attorney Appearance by Roger D Taylor on behalf of All Plaintiffs (Taylor, Roger) (Entered: 11/10/2021)	
10	11/12/2021	SUMMONS Returned Executed by Staton Techiya, LLC, Synergy IP Corporation. Samsung Electronics America, Inc. served on 11/10/2021, answer due 12/1/2021. (Truelove, Jennifer) (Entered: 11/12/2021)	
11	11/12/2021	AMENDED COMPLAINT against Samsung Electronics America, Inc., Samsung Electronics Co., Ltd., filed by Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit A, # 2 Exhibit B, # 3 Exhibit C, # 4 Exhibit D, # 5 Exhibit E, # 6 Exhibit F, # 7 Exhibit G, # 8 Exhibit H, # 9 Exhibit I, # 10 Exhibit J)(Cangro, Bradford) (Entered: 11/12/2021)	
12	11/17/2021	Unopposed MOTION for Extension of Time to File Answer , MOVE, OR OTHERWISE RESPOND TO PLAINTIFFS COMPLAINT AND WAIVER OF FOREIGN SERVICE REQUIREMENT by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 11/17/2021)	

#	Date	Proceeding Text	Source
13	11/17/2021	***DEFICIENT DOCUMENT***Joint MOTION to Seal Document by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit A, # 2 Text of Proposed Order)(Smith, Melissa) Modified on 11/17/2021 (ch,). (Entered: 11/17/2021)	
	11/17/2021	NOTICE of Deficiency regarding the 13 submitted NO CERTIFICATE OF CONFERENCE. Correction should be made by one business day (ch,) (Entered: 11/17/2021)	
14	11/17/2021	Joint MOTION to Seal Document 1 Complaint, by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 11/17/2021)	
	11/18/2021	CASE REFERRED to Magistrate Judge Roy S. Payne. (ch,) (Entered: 11/18/2021)	
15	11/22/2021	ORDER granting 12 Unopposed MOTION for Extension of Time to File Answer, MOVE, OR OTHERWISE RESPOND TO PLAINTIFFS COMPLAINT AND WAIVER OF FOREIGN SERVICE REQUIREMENT. Signed by Magistrate Judge Roy S. Payne on 11/22/2021. (ch,) (Entered: 11/22/2021)	
	11/22/2021	Answer Due Deadline Updated for Samsung Electronics America, Inc. to 2/10/2022; Samsung Electronics Co., Ltd. to 2/10/2022. (ch,) (Entered: 11/22/2021)	
16	11/22/2021	ORDER granting 14 Motion to Seal Document. ORDERED that the clerk place Dkt. No. 1 under seal, and that Exhibit A to this motion replace the original Dkt. No. 1 in the public record. Signed by Magistrate Judge Roy S. Payne on 11/22/2021. (ch,) (Entered: 11/22/2021)	
17	01/18/2022	MOTION to Stay PENDING INTER PARTES REVIEW by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit A, # 2 Exhibit B, # 3 Text of Proposed Order)(Smith, Melissa) (Entered: 01/18/2022)	
18	01/20/2022	NOTICE of Attorney Appearance - Pro Hac Vice by Gregory S Arovas on behalf of Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. Filing fee $ 100, receipt number 0540-8753636. (Arovas, Gregory) (Entered: 01/20/2022)	
19	01/20/2022	NOTICE of Attorney Appearance - Pro Hac Vice by Alex R Henriques on behalf of Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. Filing fee $ 100, receipt number 0540-8753654. (Henriques, Alex) (Entered: 01/20/2022)	
20	01/20/2022	NOTICE of Attorney Appearance - Pro Hac Vice by Todd M Friedman on behalf of Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. Filing fee $ 100, receipt number 0540-8753726. (Friedman, Todd) (Entered: 01/20/2022)	
21	01/21/2022	NOTICE of Attorney Appearance - Pro Hac Vice by David Rokach on behalf of Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. Filing fee $ 100, receipt number 0540-8756134. (Rokach, David) (Entered: 01/21/2022)	
22	01/21/2022	NOTICE of Designation of Attorney in Charge to Bradford A Cangro on behalf of Staton Techiya, LLC, Synergy IP Corporation (Cangro, Bradford) (Entered: 01/21/2022)	
23	01/21/2022	NOTICE of Attorney Appearance by Ghee Jung Lee on behalf of Staton Techiya, LLC, Synergy IP Corporation (Lee, Ghee) (Entered: 01/21/2022)	
24	02/01/2022	RESPONSE in Opposition re 17 MOTION to Stay PENDING INTER PARTES REVIEW filed by Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Affidavit Declaration of Jacob A. Snodgrass in Support of Plaintiffs' Opposition to Samsung's Motion to Stay Pending Inter Partes Review, # 2 Exhibit A, # 3	

#	Date	Proceeding Text	Source
		Text of Proposed Order)(Snodgrass, Jacob) (Entered: 02/01/2022)	
25	02/08/2022	REPLY to Response to Motion re 17 MOTION to Stay PENDING INTER PARTES REVIEW filed by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Friedman, Todd) (Entered: 02/08/2022)	
26	02/10/2022	Unopposed MOTION to Seal Document by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 02/10/2022)	
27	02/10/2022	SEALED SAMSUNGS ANSWER AND COUNTERCLAIMS. (Attachments: # 1 Exhibit 1, # 2 Exhibit 2, # 3 Exhibit 3, # 4 Exhibit 4, # 5 Exhibit 5, # 6 Exhibit 6, # 7 Exhibit 7, # 8 Exhibit 8, # 9 Exhibit 9, # 10 Exhibit 10, # 11 Exhibit 11)(Smith, Melissa) (Entered: 02/10/2022)	
28	02/13/2022	REDACTION to 27 Sealed Patent Document, by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit 1, # 2 Exhibit 2, # 3 Exhibit 3, # 4 Exhibit 4, # 5 Exhibit 5, # 6 Exhibit 6, # 7 Exhibit 7, # 8 Exhibit 8, # 9 Exhibit 9, # 10 Exhibit 10, # 11 Exhibit 11)(Smith, Melissa) (Entered: 02/13/2022)	
29	02/14/2022	ORDER granting 26 Unopposed MOTION to Seal Document. Signed by Magistrate Judge Roy S. Payne on 2/14/2022. (ch,) (Entered: 02/14/2022)	
30	02/15/2022	SUR-REPLY to Reply to Response to Motion re 17 MOTION to Stay PENDING INTER PARTES REVIEW filed by Staton Techiya, LLC, Synergy IP Corporation. (Snodgrass, Jacob) (Entered: 02/15/2022)	
31	02/15/2022	NOTICE of Readiness for Scheduling Conference by Staton Techiya, LLC, Synergy IP Corporation (Snodgrass, Jacob) (Entered: 02/15/2022)	
32	02/15/2022	ORDER - Scheduling Conference set for 3/16/2022 02:00 PM before District Judge Rodney Gilstrap. Signed by Magistrate Judge Roy S. Payne on 2/15/2022. (ch,) (Entered: 02/15/2022)	
33	03/01/2022	Unopposed MOTION for Extension of Time to File Answer re 27 Sealed Patent Document, by Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Text of Proposed Order)(Snodgrass, Jacob) (Entered: 03/01/2022)	
34	03/02/2022	ORDER granting 33 Motion for Extension of Time to Answer. Signed by Magistrate Judge Roy S. Payne on 3/2/2022. (ch,) (Entered: 03/02/2022)	
35	03/03/2022	NOTICE of Discovery Disclosure by Staton Techiya, LLC, Synergy IP Corporation of Service of P.R. 3-1 and 3-2 Disclosures (Snodgrass, Jacob) (Entered: 03/03/2022)	
36	03/14/2022	NOTICE of Attorney Appearance by Samuel Franklin Baxter on behalf of Staton Techiya, LLC, Synergy IP Corporation (Baxter, Samuel) (Entered: 03/14/2022)	
	03/16/2022	Minute Entry for proceedings held before District Judge Rodney Gilstrap: Scheduling Conference held on 3/16/2022. Counsel for the parties appeared. Court asked whether they consented to trial before the U.S. Magistrate Judge. Court then gave the parties Claim Construction and Jury Selection/Trial dates. (Court Reporter Shawn McRoberts, RMR, CRR) (aeb) (Entered: 03/17/2022)	
37	03/17/2022	PAPER TRANSCRIPT REQUEST by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd. for proceedings held on 3/16/2022 Scheduling Conference before Judge Rodney Gilstrap. (Smith, Melissa) (Forwarded to Court Reporter Shawn McRoberts, on 3/17/2022) (slo) (Entered: 03/17/2022)	
38	03/17/2022	NOTICE OF FILING OF OFFICIAL TRANSCRIPT of Scheduling	

#	Date	Proceeding Text	Source
		Conference Proceedings held on 03/16/2022 before Judge Rodney Gilstrap. Court Reporter/Transcriber: Shawn McRoberts,Telephone number: (903) 923-8546. <P>NOTICE RE REDACTION OF TRANSCRIPTS: The parties have seven (7) days to file with the Court a Notice of Intent to Request Redaction of this transcript. If no such Notice is filed, the transcript will be made remotely electronically available to the public without redaction after 90 calendar days. The policy is located on our website at www.txed.uscourts.gov<P> Transcript may be viewed at the court public terminal or purchased through the Court Reporter/Transcriber before the deadline for Release of Transcript Restriction. After that date it may be obtained through PACER.. Motion to Redact due 4/7/2022. Release of Transcript Restriction set for 6/15/2022. (smm,) (Entered: 03/17/2022)	
39	03/28/2022	Joint MOTION to Consolidate Cases THIS CASE WITH CASE NO. 2:22-CV-53-JRG by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 03/28/2022)	
40	03/30/2022	Joint MOTION to Amend/Correct Docket Control Order by Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Text of Proposed Order)(Snodgrass, Jacob) (Entered: 03/30/2022)	
41	03/30/2022	Joint MOTION for Entry of Partially Disputed Discovery Order by Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Text of Proposed Order)(Snodgrass, Jacob) (Entered: 03/30/2022)	
42	03/31/2022	DISCOVERY ORDER. Signed by Magistrate Judge Roy S. Payne on 3/31/2022. (bjc,) (Entered: 03/31/2022)	
43	03/31/2022	SCHEDULING ORDER: Pretrial Conference set for 5/22/2023 09:00 AM in Marshall Courthouse before Magistrate Judge Roy S. Payne. Jury Selection set for 6/26/2023 09:00 AM in Marshall Courthouse before District Judge Rodney Gilstrap. Proposed Joint Pretrial Order due by 5/15/2023. Claim construction hearing set for January 10, 2023 at 9:00 a.m. in Marshall, Texas before Judge Roy Payne. Order granting 40 Joint MOTION to Amend/Correct Docket Control Order filed by Synergy IP Corporation, Staton Techiya, LLC.. Signed by Magistrate Judge Roy S. Payne on 3/31/2022. (bjc,) (Entered: 03/31/2022)	
	03/31/2022	Set/Reset Hearings: Claim Construction hearing set for 1/10/2023 09:00 AM in Marshall Courthouse before Magistrate Judge Roy S. Payne. (bjc,) (Entered: 04/01/2022)	
44	04/06/2022	NOTICE of Discovery Disclosure by Staton Techiya, LLC, Synergy IP Corporation of Service of Initial and Additional Disclosures (Snodgrass, Jacob) (Entered: 04/06/2022)	
45	04/06/2022	NOTICE by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd. of Compliance Regarding Initial and Additional Disclosures (Smith, Melissa) (Entered: 04/06/2022)	
46	04/06/2022	Joint MOTION Entry of Partially Disputed Protective Order by Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Text of Proposed Order Protective Order)(Snodgrass, Jacob) (Entered: 04/06/2022)	
47	05/04/2022	CONSOLIDATION ORDER - ORDERED that Case No. 2:21-cv-00413-JRG-RSP and Case No. 2:22-cv-00053-JRG-RSP are CONSOLIDATED for all purposes, including pre-trial and trial, with Case No. 2:21-cv-00413-JRG-RSP designated as the LEAD CASE. Signed by District Judge Rodney Gilstrap on 5/4/2022. (ch,) (Entered: 05/05/2022)	
48	05/11/2022	NOTICE of Attorney Appearance by Brent Nelson Bumgardner on behalf of Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation (Bumgardner, Brent) (Entered:	

#	Date	Proceeding Text	Source
		05/11/2022)	
49	05/11/2022	NOTICE of Attorney Appearance by Justin Bryce Kimble on behalf of Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation (Kimble, Justin) (Entered: 05/11/2022)	
50	05/11/2022	NOTICE of Attorney Appearance by Christopher G Granaghan on behalf of Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation (Granaghan, Christopher) (Entered: 05/11/2022)	
51	05/11/2022	NOTICE of Attorney Appearance by Robert A Delafield, II on behalf of Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation (Delafield, Robert) (Entered: 05/11/2022)	
52	05/12/2022	Unopposed MOTION to Seal Counterclaim Defendants' Unopposed Motion to File Under Seal by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Text of Proposed Order)(Bumgardner, Brent) (Entered: 05/12/2022)	
53	05/12/2022	SEALED MOTION Counterclaim Defendants' Motion to: (1) Dismiss for Lack of Personal Jurisdiction, (2) Dismiss Under the Doctrine of Forum Non Conveniens, and (3) Dismiss for Failure to State a Claim by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit A, # 2 Text of Proposed Order)(Bumgardner, Brent) (Entered: 05/12/2022)	
54	05/12/2022	Additional Attachments to Main Document: 53 SEALED MOTION Counterclaim Defendants' Motion to: (1) Dismiss for Lack of Personal Jurisdiction, (2) Dismiss Under the Doctrine of Forum Non Conveniens, and (3) Dismiss for Failure to State a Claim.. (Attachments: # 1 Exhibit B, # 2 Exhibit C)(Bumgardner, Brent) (Entered: 05/12/2022)	
55	05/16/2022	REDACTION to 53 SEALED MOTION Counterclaim Defendants' Motion to: (1) Dismiss for Lack of Personal Jurisdiction, (2) Dismiss Under the Doctrine of Forum Non Conveniens, and (3) Dismiss for Failure to State a Claim by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit A)(Bumgardner, Brent) (Entered: 05/16/2022)	
56	05/16/2022	ORDER granting 52 Unopposed MOTION to Seal Counterclaim Defendants' Unopposed Motion to File Under Seal. Signed by Magistrate Judge Roy S. Payne on 5/16/2022. (ch,) (Entered: 05/16/2022)	
57	05/18/2022	Unopposed MOTION to Seal Answer and Counterclaims by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 05/18/2022)	
58	05/18/2022	SEALED PATENT DOCUMENT SAMSUNGS ANSWER AND COUNTERCLAIMS. (Smith, Melissa) (Entered: 05/18/2022)	
59	05/18/2022	CORPORATE DISCLOSURE STATEMENT filed by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd. (Smith, Melissa) (Entered: 05/18/2022)	
60	05/19/2022	NOTICE by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd. of Compliance Regarding P.R. 3-3 and 3-4 and Subject Matter Eligibility Contentions (Smith, Melissa) (Entered: 05/19/2022)	
61	05/19/2022	Unopposed MOTION for Extension of Time to File Response/Reply as to 53 SEALED MOTION Counterclaim Defendants' Motion to: (1) Dismiss for Lack of Personal Jurisdiction, (2) Dismiss Under the Doctrine of Forum Non Conveniens, and (3) Dismiss for Failure to State a Claim by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa)	

#	Date	Proceeding Text	Source
		(Entered: 05/19/2022)	
62	05/20/2022	REDACTION to 58 Sealed Patent Document by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Smith, Melissa) (Entered: 05/20/2022)	
63	05/24/2022	NOTICE of Attorney Appearance - Pro Hac Vice by Sean M McEldowney on behalf of Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics Co., Ltd., Samsung Electronics Co., Ltd., Samsung Electronics Corporation, Ltd. Filing fee $ 100, receipt number ATXEDC-8940710. (McEldowney, Sean) (Entered: 05/24/2022)	
64	05/25/2022	ORDER granting 57 Unopposed MOTION to Seal Answer and Counterclaims. Signed by Magistrate Judge Roy S. Payne on 5/25/2022. (ch,) (Entered: 05/25/2022)	
65	05/25/2022	ORDER granting 61 Motion for Extension of Time to File Response/Reply re 61 Unopposed MOTION for Extension of Time to File Response/Reply as to 53 SEALED MOTION Counterclaim Defendants' Motion to: (1) Dismiss for Lack of Personal Jurisdiction, (2) Dismiss Under the Doctrine of Forum Non Conveniens, and (3) Dismis. 53 SEALED MOTION Counterclaim Defendants' Motion to: (1) Dismiss for Lack of Personal Jurisdiction, (2) Dismiss Under the Doctrine of Forum Non Conveniens, and (3) Dismiss for Failure to State a Claim Responses due by 6/9/2022. Signed by Magistrate Judge Roy S. Payne on 5/25/2022. (ch,) (Entered: 05/25/2022)	
66	06/07/2022	ORDER re 46 Joint MOTION Entry of Partially Disputed Protective Order. Signed by Magistrate Judge Roy S. Payne on 6/7/2022. (ch,) (Entered: 06/07/2022)	
67	06/08/2022	Joint MOTION JOINT MOTION TO EXTEND BRIEFING SCHEDULE ON PLAINTIFFS MOTION TO: (1) DISMISS FOR LACK OF PERSONAL JURISDICTION, (2) DISMISS UNDER THE DOCTRINE OF FORUM NON CONVENIENS, AND (3) DISMISS FOR FAILURE TO STATE A CLAIM (DKT. 53) re 53 SEALED MOTION Counterclaim Defendants' Motion to: (1) Dismiss for Lack of Personal Jurisdiction, (2) Dismiss Under the Doctrine of Forum Non Conveniens, and (3) Dismiss for Failure to State a Claim by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 06/08/2022)	
68	06/08/2022	Unopposed MOTION to Seal Document 58 Sealed Patent Document Counterclaim Defendants' Unopposed Motion to File Under Seal by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Text of Proposed Order)(Bumgardner, Brent) (Entered: 06/08/2022)	
69	06/08/2022	SEALED MOTION Counterclaim Defendants' Motion to: (1) Dismiss for Lack of Personal Jurisdiction, (2) Dismiss Under the Doctrine of Forum Non Conveniens, and (3) Dismiss for Failure to State a Claim by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit A, # 2 Text of Proposed Order)(Bumgardner, Brent) (Entered: 06/08/2022)	
70	06/08/2022	Additional Attachments to Main Document: 69 SEALED MOTION Counterclaim Defendants' Motion to: (1) Dismiss for Lack of Personal Jurisdiction, (2) Dismiss Under the Doctrine of Forum Non Conveniens, and (3) Dismiss for Failure to State a Claim.. (Attachments: # 1 Exhibit B, # 2 Exhibit C)(Bumgardner, Brent) (Entered: 06/08/2022)	
71	06/09/2022	Joint MOTION for Entry of Protective Order by Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Text of Proposed	

#	Date	Proceeding Text	Source
		Order Protective Order)(Snodgrass, Jacob) (Entered: 06/09/2022)	
72	06/10/2022	***FILED IN ERROR***REDACTION to 69 SEALED MOTION Counterclaim Defendants' Motion to: (1) Dismiss for Lack of Personal Jurisdiction, (2) Dismiss Under the Doctrine of Forum Non Conveniens, and (3) Dismiss for Failure to State a Claim by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit A)(Bumgardner, Brent) Modified on 6/10/2022 (ch,). (Entered: 06/10/2022)	
	06/10/2022	***FILED IN ERROR. PER ATTORNEY Document # 72, REDACTED DOCUMENT. PLEASE IGNORE.*** (ch,) (Entered: 06/10/2022)	
73	06/10/2022	REDACTION to 69 SEALED MOTION Counterclaim Defendants' Motion to: (1) Dismiss for Lack of Personal Jurisdiction, (2) Dismiss Under the Doctrine of Forum Non Conveniens, and (3) Dismiss for Failure to State a Claim by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit A)(Bumgardner, Brent) (Entered: 06/10/2022)	
74	06/13/2022	PROTECTIVE ORDER granting 71 Joint MOTION for Entry of Protective Order. Signed by Magistrate Judge Roy S. Payne on 6/13/2022. (ch,) (Entered: 06/13/2022)	
75	06/13/2022	ORDER granting 68 Motion to Seal Document 68 Unopposed MOTION to Seal Document 58 Sealed Patent Document Counterclaim Defendants' Unopposed Motion to File Under Seal. Signed by Magistrate Judge Roy S. Payne on 6/13/2022. (ch,) (Entered: 06/13/2022)	
76	06/13/2022	ORDER granting 67 Motion to extend the briefing deadlines.. Signed by Magistrate Judge Roy S. Payne on 06/13/2022. (klc,) (Entered: 06/13/2022)	
77	06/14/2022	MOTION to Compel IN-PERSON DEPOSITIONS RELATING TO COUNTERCLAIM DEFENDANTS MOTION TO DISMISS FOR LACK OF PERSONAL JURISDICTION by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 06/14/2022)	
	06/15/2022	NOTICE of Hearing on Motion 77 MOTION to Compel IN-PERSON DEPOSITIONS RELATING TO COUNTERCLAIM DEFENDANTS MOTION TO DISMISS FOR LACK OF PERSONAL JURISDICTION : Motion Hearing set for 7/6/2022 01:30 PM before Magistrate Judge Roy S. Payne. (bga) (Entered: 06/15/2022)	
78	06/16/2022	RESPONSE to Motion re 77 MOTION to Compel IN-PERSON DEPOSITIONS RELATING TO COUNTERCLAIM DEFENDANTS MOTION TO DISMISS FOR LACK OF PERSONAL JURISDICTION Counterclaim Defendants Response To Defendants Motion To Compel In-Person Depositions filed by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Bumgardner, Brent) (Entered: 06/16/2022)	
79	06/17/2022	ORDER granting 77 MOTION to Compel IN-PERSON DEPOSITIONS RELATING TO COUNTERCLAIM DEFENDANTS MOTION TO DISMISS FOR LACK OF PERSONAL JURISDICTION. Signed by Magistrate Judge Roy S. Payne on 6/17/2022. (ch,) (Entered: 06/17/2022)	
	06/17/2022	NOTICE that the Motion Hearing set for 7/6/22 is CANCELLED. (bga) (Entered: 06/17/2022)	
80	06/17/2022	NOTICE of Attorney Appearance - Pro Hac Vice by Ali-Reza Boloori on behalf of Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics Co., Ltd., Samsung Electronics Co., Ltd., Samsung Electronics Corporation, Ltd. Filing fee $ 100, receipt number ATXEDC-8981109. (Boloori, Ali-Reza) (Entered:	

#	Date	Proceeding Text	Source
		06/17/2022)	
81	06/17/2022	NOTICE of Attorney Appearance - Pro Hac Vice by Jay Emerick on behalf of Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics Co., Ltd., Samsung Electronics Co., Ltd., Samsung Electronics Corporation, Ltd. Filing fee $ 100, receipt number ATXEDC-8981184. (Emerick, Jay) (Additional attachment(s) added on 6/23/2022: # 1 Sealed Attachment) (saenz,). (Entered: 06/17/2022)	
82	06/17/2022	NOTICE by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd. REGARDING FILING OF INTER PARTES REVIEW PETITIONS (Attachments: # 1 Exhibit A, # 2 Exhibit B, # 3 Exhibit C, # 4 Exhibit D)(Smith, Melissa) (Entered: 06/17/2022)	
83	06/20/2022	NOTICE by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd. OF INSTITUTION OF INTER PARTES REVIEW (Attachments: # 1 Exhibit 1, # 2 Exhibit 2)(Smith, Melissa) (Entered: 06/20/2022)	
84	06/22/2022	NOTICE of Attorney Appearance - Pro Hac Vice by Nikhil Rama Krishnan on behalf of Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics Co., Ltd., Samsung Electronics Co., Ltd., Samsung Electronics Corporation, Ltd. Filing fee $ 100, receipt number ATXEDC-8985243. (Krishnan, Nikhil) (Entered: 06/22/2022)	
85	06/22/2022	Unopposed MOTION TO CONSOLIDATE BRIEFING ON PLAINTIFFS MOTIONS TO DISMISS (DKT. 53 AND 69) by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 06/22/2022)	
86	06/23/2022	NOTICE of Attorney Appearance - Pro Hac Vice by John R. Rhine on behalf of Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics Co., Ltd., Samsung Electronics Co., Ltd., Samsung Electronics Corporation, Ltd. Filing fee $ 100, receipt number ATXEDC-8986908. (Rhine, John) (Entered: 06/23/2022)	
87	06/24/2022	NOTICE by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd. OF INSTITUTION OF INTER PARTES REVIEW (Attachments: # 1 Exhibit 1, # 2 Exhibit 2)(Smith, Melissa) (Entered: 06/24/2022)	
88	06/26/2022	ORDER granting 85 Unopposed MOTION TO CONSOLIDATE BRIEFING ON PLAINTIFFS MOTIONS TO DISMISS (DKT. 53 AND 69). Signed by Magistrate Judge Roy S. Payne on 6/26/2022. (ch,) (Entered: 06/27/2022)	
89	06/28/2022	NOTICE of Attorney Appearance by Ali R Sharifahmadian on behalf of Samsung Electronics America, Inc., Samsung Electronics Co., Ltd. (Sharifahmadian, Ali) (Entered: 06/28/2022)	
90	06/29/2022	NOTICE of Attorney Appearance - Pro Hac Vice by Daniel S Shimell on behalf of All Defendants. Filing fee $ 100, receipt number ATXEDC-8996345. (Shimell, Daniel) (Entered: 06/29/2022)	
91	07/06/2022	STIPULATION AND NOTICE REGARDING PERSONAL JURISDICTION (JOINT) by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Smith, Melissa) (Entered: 07/06/2022)	
92	07/07/2022	NOTICE by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd. of Compliance Regarding P.R. 3-3 and 3-4 and Subject Matter Eligibility Contentions (Smith, Melissa) (Entered: 07/07/2022)	

#	Date	Proceeding Text	Source
93	07/13/2022	Unopposed MOTION TO FILE UNDER SEAL by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 07/13/2022)	
94	07/13/2022	SEALED PATENT DOCUMENT SAMSUNG'S FIRST AMENDED ANSWER AND COUNTERCLAIMS (Attachments: # 1 Exhibit 1, # 2 Exhibit 2, # 3 Exhibit 3, # 4 Exhibit 4, # 5 Exhibit 5, # 6 Exhibit 6, # 7 Exhibit 7, # 8 Exhibit 8, # 9 Exhibit 9, # 10 Exhibit 10, # 11 Exhibit 11, # 12 Exhibit 12)(Smith, Melissa) (Entered: 07/13/2022)	
95	07/13/2022	RESPONSE to Motion re 53 SEALED MOTION Counterclaim Defendants' Motion to: (1) Dismiss for Lack of Personal Jurisdiction, (2) Dismiss Under the Doctrine of Forum Non Conveniens, and (3) Dismiss for Failure to State a Claim and Notice of Mootness filed by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 07/13/2022)	
96	07/14/2022	ORDER granting 93 Unopposed MOTION TO FILE UNDER SEAL. Signed by Magistrate Judge Roy S. Payne on 7/14/2022. (ch,) (Entered: 07/14/2022)	
97	07/15/2022	NOTICE by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd. OF INSTITUTION OF INTER PARTES REVIEW (Attachments: # 1 Exhibit 1, # 2 Exhibit 2)(Smith, Melissa) (Entered: 07/15/2022)	
98	07/15/2022	REDACTION to 94 Sealed Patent Document, SAMSUNGS FIRST AMENDED ANSWER AND COUNTERCLAIMS by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd., Samsung Electronics Corporation, Ltd. (Attachments: # 1 Exhibit 1, # 2 Exhibit 2, # 3 Exhibit 3, # 4 Exhibit 4, # 5 Exhibit 5, # 6 Exhibit 6, # 7 Exhibit 7, # 8 Exhibit 8, # 9 Exhibit 9, # 10 Exhibit 10, # 11 Exhibit 11, # 12 Exhibit 12)(Smith, Melissa) (Entered: 07/15/2022)	
99	07/18/2022	NOTICE by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd. OF INSTITUTION OF INTER PARTES REVIEW (Attachments: # 1 Exhibit 1, # 2 Exhibit 2)(Smith, Melissa) (Entered: 07/18/2022)	
100	07/18/2022	SEALED PATENT DOCUMENT FIRST AMENDED ANSWER AND COUNTERCLAIMS REGARDING 2:22-CV-53 (MEMBER CASE) (Attachments: # 1 Exhibit 1)(Smith, Melissa) (Entered: 07/18/2022)	
101	07/18/2022	REDACTION to 100 Sealed Patent Document by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit 1)(Smith, Melissa) (Entered: 07/18/2022)	
102	07/22/2022	Joint MOTION FOR ENTRY OF PARTIALLY DISPUTED E-DISCOVERY ORDER by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit 1, # 2 Exhibit 2, # 3 Text of Proposed Order)(Smith, Melissa) (Entered: 07/22/2022)	
103	07/22/2022	Unopposed MOTION to Consolidate Briefing on Counterclaim Defendants' Responses to Defendants' First Amended Answers and Counterclaims (Dkt. 94 and 100) and Extension of Time to File by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Text of Proposed Order)(Bumgardner, Brent) (Entered: 07/22/2022)	
104	07/25/2022	SEALED MOTION to Compel Complete Responses to Interrogatory Nos. 1-4 and 6-7 by Staton Techiya, LLC. (Kimble, Justin) (Additional attachment(s) added on 7/25/2022: # 1 Text of Proposed Order) (ch,). (Entered: 07/25/2022)	
105	07/25/2022	NOTICE by Staton Techiya, LLC re 104 SEALED MOTION to	

#	Date	Proceeding Text	Source
		Compel Complete Responses to Interrogatory Nos. 1-4 and 6-7 (Attachments: # 1 Exhibit, # 2 Addendum)(Kimble, Justin) (Entered: 07/25/2022)	
106	07/27/2022	***FILED IN ERROR***Opposed SEALED MOTION Counterclaim-Defendants' Motion to Compel Complete Responses to Interrogatory Nos. 1-4 and 6-7 by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Kimble, Justin) Modified on 7/27/2022 (ch,). (Entered: 07/27/2022)	
	07/27/2022	***FILED IN ERROR. PER ATTORNEY Document # 106, Opposed Motion. PLEASE IGNORE.*** (ch,) (Entered: 07/27/2022)	
107	07/27/2022	REDACTION to 104 SEALED MOTION to Compel Complete Responses to Interrogatory Nos. 1-4 and 6-7 Counterclaim-Defendants' Motion to Compel Complete Responses to Interrogatory Nos. 1-4 and 6-7 by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Kimble, Justin) (Entered: 07/27/2022)	
	07/29/2022	NOTICE of Hearing on Motion 102 Joint MOTION FOR ENTRY OF PARTIALLY DISPUTED E-DISCOVERY ORDER , 104 SEALED MOTION to Compel Complete Responses to Interrogatory Nos. 1-4 and 6-7 : Motion Hearing set for 8/16/2022 02:00 PM before Magistrate Judge Roy S. Payne. (bga) (Entered: 07/29/2022)	
108	07/29/2022	ORDER granting 103 Unopposed MOTION to Consolidate Briefing on Counterclaim Defendants' Responses to Defendants' First Amended Answers and Counterclaims (Dkt. 94 and 100) and Extension of Time to File. Signed by Magistrate Judge Roy S. Payne on 7/29/2022. (ch,) (Entered: 07/29/2022)	
109	08/01/2022	SEALED MOTION Counterclaim Defendants' Motion to Dismiss Under the Doctrine of Forum Non Conveniens and to Dismiss for Failure to State a Claim by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Text of Proposed Order)(Bumgardner, Brent) (Entered: 08/01/2022)	
110	08/01/2022	Additional Attachments to Main Document: 109 SEALED MOTION Counterclaim Defendants' Motion to Dismiss Under the Doctrine of Forum Non Conveniens and to Dismiss for Failure to State a Claim.. (Attachments: # 1 Exhibit A, # 2 Exhibit B, # 3 Exhibit C)(Bumgardner, Brent) (Entered: 08/01/2022)	
111	08/03/2022	REDACTION to 109 SEALED MOTION Counterclaim Defendants' Motion to Dismiss Under the Doctrine of Forum Non Conveniens and to Dismiss for Failure to State a Claim by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Bumgardner, Brent) (Entered: 08/03/2022)	
112	08/03/2022	STATUS REPORT of Meet and Confer Regarding Plaintiffs' And Counterclaimant Defendants' Motion to Compel (Joint) by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Cangro, Bradford) (Entered: 08/03/2022)	
113	08/09/2022	SEALED PATENT RESPONSE to SEALED MOTION re 104 SEALED MOTION to Compel Complete Responses to Interrogatory Nos. 1-4 and 6-7 filed by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit 1, # 2 Text of Proposed Order)(Smith, Melissa) (Entered: 08/09/2022)	
114	08/11/2022	REDACTION to 113 Sealed Patent Response to Sealed Patent Motion, by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit 1)(Smith, Melissa) (Entered: 08/11/2022)	
115	08/15/2022	NOTICE of Attorney Appearance - Pro Hac Vice by Edward C Donovan on behalf of Samsung Electronics America, Inc.,	

#	Date	Proceeding Text	Source
		Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics Co., Ltd., Samsung Electronics Co., Ltd., Samsung Electronics Corporation, Ltd. Filing fee $ 100, receipt number ATXEDC-9070507. (Donovan, Edward) (Entered: 08/15/2022)	
116	08/15/2022	NOTICE of Attorney Appearance by Andrew Thompson (Tom) Gorham on behalf of Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics Co., Ltd., Samsung Electronics Co., Ltd., Samsung Electronics Corporation, Ltd (Gorham, Andrew) (Entered: 08/15/2022)	
117	08/15/2022	SEALED PATENT RESPONSE to SEALED MOTION re 109 SEALED MOTION Counterclaim Defendants' Motion to Dismiss Under the Doctrine of Forum Non Conveniens and to Dismiss for Failure to State a Claim filed by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Affidavit Kwang Hyun SUK, # 2 Affidavit S. McEldowney, # 3 Exhibit 1, # 4 Exhibit 2, # 5 Text of Proposed Order)(Smith, Melissa) (Entered: 08/15/2022)	
118	08/16/2022	NOTICE by Staton Techiya, LLC, Synergy IP Corporation of Denial of Inter Partes Review (Attachments: # 1 Exhibit A)(Snodgrass, Jacob) (Entered: 08/16/2022)	
119	08/16/2022	PAPER TRANSCRIPT REQUEST by Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics Co., Ltd., Samsung Electronics Co., Ltd., Samsung Electronics Corporation, Ltd for proceedings held on 8/16/2022 Motion Hearing re 102 before Judge Roy S. Payne. (Smith, Melissa) (Forwarded to Court Reporter, Shelly Holmes, on 8/16/2022) (slo) (Entered: 08/16/2022)	
121	08/16/2022	E-DISCOVERY ORDER granting 102 Joint MOTION FOR ENTRY OF PARTIALLY DISPUTED E-DISCOVERY ORDER. Signed by Magistrate Judge Roy S. Payne on 8/16/2022. (ch,) (Entered: 08/17/2022)	
122	08/16/2022	ORDER denying 104 SEALED MOTION to Compel Complete Responses to Interrogatory Nos. 1-4 and 6-7. Signed by Magistrate Judge Roy S. Payne on 8/16/2022. (ch,) (Entered: 08/17/2022)	
123	08/16/2022	Minute Entry for proceedings held before Magistrate Judge Roy S. Payne: Motion Hearing held on 8/16/2022 re 102 Joint MOTION FOR ENTRY OF PARTIALLY DISPUTED E-DISCOVERY ORDER filed by Samsung Electronics Co., Ltd., Samsung Electronics America, Inc., 104 SEALED MOTION to Compel Complete Responses to Interrogatory Nos. 1-4 and 6-7 filed by Staton Techiya, LLC. (Court Reporter Shelly Holmes.) (bga) (Entered: 08/17/2022)	
120	08/17/2022	Joint MOTION for Extension of Time to File Response/Reply as to 109 SEALED MOTION Counterclaim Defendants' Motion to Dismiss Under the Doctrine of Forum Non Conveniens and to Dismiss for Failure to State a Claim Joint Motion to Extend Briefing Schedule on Counterclaim Defendants' Motion to Dismiss Under the Doctrine of Forum Non Conveniens and to Dismiss for Failure to State a Claim by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Bumgardner, Brent) (Additional attachment(s) added on 8/17/2022: # 1 Text of Proposed Order) (ch,). (Entered: 08/17/2022)	
124	08/17/2022	REDACTION to 117 Sealed Patent Response to Sealed Patent Motion, by Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics America, Inc.,	

#	Date	Proceeding Text	Source
		Samsung Electronics Co., Ltd., Samsung Electronics Co., Ltd., Samsung Electronics Corporation, Ltd. (Attachments: # 1 Exhibit 1, # 2 Exhibit 2, # 3 Declaration of Kwang Hyun SUK, # 4 Declaration of McEldowney, # 5 Text of Proposed Order)(Smith, Melissa) (Entered: 08/17/2022)	
125	08/21/2022	NOTICE OF FILING OF OFFICIAL TRANSCRIPT of Proceedings held on 8/16/22 (Motions Hearing) before Judge Roy Payne. Court Reporter/Transcriber: Shelly Holmes, CSR, TCRR,Telephone number: (903) 794-1018 (Shelly_Holmes@txed.uscourts.gov). NOTICE RE REDACTION OF TRANSCRIPTS: The parties have seven (7) days to file with the Court a Notice of Intent to Request Redaction of this transcript. If no such Notice is filed, the transcript will be made remotely electronically available to the public without redaction after 90 calendar days. The policy is located on our website at www.txed.uscourts.gov Transcript may be viewed at the court public terminal or purchased through the Court Reporter/Transcriber before the deadline for Release of Transcript Restriction. After that date it may be obtained through PACER.. Motion to Redact due 9/11/2022. Release of Transcript Restriction set for 11/19/2022. (Holmes, Shelly) (Entered: 08/21/2022)	
126	08/22/2022	ORDER granting 120 Joint MOTION for Extension of Time to File Response/Reply as to 109 SEALED MOTION Counterclaim Defendants' Motion to Dismiss Under the Doctrine of Forum Non Conveniens and to Dismiss for Failure to State a Claim Joint Motion to E. Replies due by 8/30/2022. Motion Ripe Deadline set for 9/14/2022.. Signed by Magistrate Judge Roy S. Payne on 8/22/2022. (nki,) (Entered: 08/22/2022)	
127	08/30/2022	SEALED REPLY to Response to Motion re 109 SEALED MOTION Counterclaim Defendants' Motion to Dismiss Under the Doctrine of Forum Non Conveniens and to Dismiss for Failure to State a Claim filed by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit A, # 2 Exhibit B, # 3 Exhibit C)(Bumgardner, Brent) (Entered: 08/30/2022)	
128	08/31/2022	SEALED PATENT MOTION FOR DISQUALIFICATION by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Affidavit S. McEldowney, # 2 Exhibit 1, # 3 Exhibit 2, # 4 Exhibit 3, # 5 Exhibit 4, # 6 Exhibit 5, # 7 Exhibit 6, # 8 Exhibit 7, # 9 Exhibit 8, # 10 Exhibit 9, # 11 Exhibit 10, # 12 Exhibit 11, # 13 Exhibit 12, # 14 Exhibit 13, # 15 Exhibit 14, # 16 Exhibit 15, # 17 Text of Proposed Order)(Smith, Melissa) (Entered: 08/31/2022)	
129	08/31/2022	Unopposed MOTION FOR LEAVE TO EXCEED PAGE LIMIT re 128 SEALED PATENT MOTION FOR DISQUALIFICATION by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 08/31/2022)	
130	09/01/2022	REDACTION to 127 Sealed Reply to Response to Motion, Counterclaim Defendants' Reply In Support of Motion to Dismiss by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit C)(Bumgardner, Brent) (Entered: 09/01/2022)	
131	09/02/2022	REDACTION DEFENDANTS MOTION FOR DISQUALIFICATION by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit 1, # 2 Exhibit 2, # 3 Exhibit 3, # 4 Exhibit 4, # 5 Exhibit 5, # 6 Exhibit 6, # 7 Exhibit 7, # 8 Exhibit 8, # 9 Exhibit 9, # 10 Exhibit 10, # 11 Exhibit 11, # 12 Exhibit 12, # 13 Exhibit 13, # 14 Exhibit 14, # 15 Exhibit 15, # 16 Declaration of Sean McEldowney, # 17 Text of Proposed Order)(Smith, Melissa) (Entered: 09/02/2022)	

#	Date	Proceeding Text	Source
132	09/06/2022	ORDER granting 129 Unopposed MOTION FOR LEAVE TO EXCEED PAGE LIMIT re 128 SEALED PATENT MOTION FOR DISQUALIFICATION. Signed by Magistrate Judge Roy S. Payne on 9/6/2022. (ch,) (Entered: 09/06/2022)	
133	09/06/2022	NOTICE of Discovery Disclosure by Staton Techiya, LLC, Synergy IP Corporation of Service of P.R. 4-1 Disclosures (Snodgrass, Jacob) (Entered: 09/06/2022)	
134	09/06/2022	MEMORANDUM ORDER. Signed by Magistrate Judge Roy S. Payne on 9/6/2022. (ch,) (Entered: 09/06/2022)	
135	09/06/2022	NOTICE by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd. of Compliance Regarding P.R. 4-1 (Smith, Melissa) (Entered: 09/06/2022)	
	09/07/2022	NOTICE of Hearing on Motion 128 SEALED PATENT MOTION FOR DISQUALIFICATION : Motion Hearing set for 10/6/2022 09:00 AM before Magistrate Judge Roy S. Payne. (bga) (Entered: 09/07/2022)	
136	09/12/2022	Unopposed MOTION for Extension of Time to File Response/Reply as to 128 SEALED PATENT MOTION FOR DISQUALIFICATION Unopposed Motion for Extension of Time to File Response to Samsung's Motion for Disqualification by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Text of Proposed Order)(Bumgardner, Brent) (Entered: 09/12/2022)	
137	09/13/2022	ORDER granting 136 Unopposed MOTION for Extension of Time to File Response/Reply as to 128 SEALED PATENT MOTION FOR DISQUALIFICATION Unopposed Motion for Extension of Time to File Response to Samsung's Motion for Disqualification, 128 SEALED PATENT MOTION FOR DISQUALIFICATION Responses due by 9/28/2022. Signed by Magistrate Judge Roy S. Payne on 9/13/2022. (ch,) (Entered: 09/13/2022)	
138	09/13/2022	Unopposed MOTION for Extension of Time to File SUR-REPLY TO COUNTERCLAIM DEFENDANTS' MOTION TO DISMISS UNDER THE DOCTRINE OF FORUM NON CONVENIENS AND TO DISMISS FOR FAILURE TO STATE A CLAIM (DKT. NO. 109) by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 09/13/2022)	
139	09/16/2022	SEALED PATENT SUR-REPLY to Reply to Response to PATENT Motion re 109 SEALED MOTION Counterclaim Defendants' Motion to Dismiss Under the Doctrine of Forum Non Conveniens and to Dismiss for Failure to State a Claim filed by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit 3)(Smith, Melissa) (Entered: 09/16/2022)	
140	09/19/2022	ORDER granting 138 Motion for Extension of Time to File. Signed by Magistrate Judge Roy S. Payne on 9/19/2022. (nkl,) (Entered: 09/19/2022)	
141	09/22/2022	REDACTION to 139 Sealed PATENT Sur-Reply to Reply to Response to PATENT Motion, by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit 3)(Smith, Melissa) (Entered: 09/22/2022)	
142	09/27/2022	NOTICE by Staton Techiya, LLC, Synergy IP Corporation of Service of P.R. 4-2 Disclosures (Snodgrass, Jacob) (Entered: 09/27/2022)	
143	09/27/2022	NOTICE by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd. of Compliance Regarding P.R. 4-2 (Smith, Melissa) (Entered: 09/27/2022)	
144	09/28/2022	SEALED RESPONSE to Motion re 128 SEALED PATENT MOTION FOR DISQUALIFICATION filed by Seung-Ho Ahn,	

#	Date	Proceeding Text	Source
		Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit 1, # 2 Exhibit 2, # 3 Exhibit 3, # 4 Exhibit 4, # 5 Exhibit 5, # 6 Exhibit 6, # 7 Exhibit 7, # 8 Exhibit 8, # 9 Exhibit 9, # 10 Exhibit 10, # 11 Exhibit 11, # 12 Exhibit 12, # 13 Exhibit 13, # 14 Exhibit 14, # 15 Exhibit 15, # 16 Exhibit 16, # 17 Exhibit 17, # 18 Exhibit 18, # 19 Exhibit 19, # 20 Exhibit 20, # 21 Exhibit 21, # 22 Exhibit 22, # 23 Exhibit 23, # 24 Exhibit 24, # 25 Exhibit 25, # 26 Exhibit 26, # 27 Exhibit 27, # 28 Exhibit 28, # 29 Exhibit 29, # 30 Exhibit 30, # 31 Text of Proposed Order)(Bumgardner, Brent) (Entered: 09/28/2022)	
145	09/30/2022	Unopposed MOTION for Extension of Time to File Response/Reply as to 128 SEALED PATENT MOTION FOR DISQUALIFICATION by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 09/30/2022)	
146	09/30/2022	REDACTION to 144 Sealed Response to Motion,,, Redacted Counterclaim Defendants' Response to Motion for Disqualification by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit 1, # 2 Exhibit 2, # 3 Exhibit 3, # 4 Exhibit 4, # 5 Exhibit 5, # 6 Exhibit 6, # 7 Exhibit 7, # 8 Exhibit 8, # 9 Exhibit 9, # 10 Exhibit 10, # 11 Exhibit 11, # 12 Exhibit 13, # 13 Exhibit 14, # 14 Exhibit 15, # 15 Exhibit 16, # 16 Exhibit 18, # 17 Exhibit 19, # 18 Exhibit 20, # 19 Exhibit 21, # 20 Exhibit 22, # 21 Exhibit 23, # 22 Exhibit 24, # 23 Exhibit 25, # 24 Exhibit 26, # 25 Exhibit 27, # 26 Exhibit 28, # 27 Exhibit 29, # 28 Exhibit 30, # 29 Text of Proposed Order, # 30 Exhibit 17, # 31 Exhibit 12)(Bumgardner, Brent) (Entered: 09/30/2022)	
147	10/03/2022	ORDER granting 145 Unopposed MOTION for Extension of Time to File Response/Reply as to 128 SEALED PATENT MOTION FOR DISQUALIFICATION. Order, the hearing on the motion for disqualification set Thursday October 6, 2022, is CANCELLED to be reset. Signed by Magistrate Judge Roy S. Payne on 10/3/2022. (ch,) (Entered: 10/03/2022)	
148	10/06/2022	Unopposed MOTION for Extension of Time to File JOINT NOTICE by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 10/06/2022)	
149	10/10/2022	***DEFICIENT DOCUMENT***Joint MOTION for Extension of Time to File Joint Notice Regarding the Hearing on Defendants' Motion for Disqualification and Joint Motion for Extension and to Exceed the Page Limits on the Remainder of the Briefing by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Text of Proposed Order)(Bumgardner, Brent) Modified on 10/11/2022 (ch,). (Entered: 10/10/2022)	
	10/11/2022	NOTICE of Deficiency regarding the 149 submitted No Certificate of Conference. Correction should be made by one business day (ch,) (Entered: 10/11/2022)	
150	10/11/2022	Joint MOTION for Extension of Time to File Joint Notice Regarding the Hearing on Defendants' Motion for Disqualification and Joint Motion for Extension and to Exceed the Page Limits on the Remainder of the Briefing by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Text of Proposed Order)(Bumgardner, Brent) (Entered: 10/11/2022)	
	10/11/2022	NOTICE of Hearing on Motion 128 SEALED PATENT MOTION FOR DISQUALIFICATION : Motion Hearing set for 11/10/2022 09:00 AM before Magistrate Judge Roy S. Payne. (bga) (Entered: 10/11/2022)	

#	Date	Proceeding Text	Source
153	10/13/2022	ORDER granting 150 Joint MOTION for Extension of Time to File Joint Notice Regarding the Hearing on Defendants' Motion for Disqualification and Joint Motion for Extension and to Exceed the Page Limits on the Remainder of the Briefing by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. Signed by Magistrate Judge Roy S. Payne on 10/13/22. (jc,) (Entered: 10/17/2022)	
	10/13/2022	NOTICE of Hearing on Motion 128 SEALED PATENT MOTION FOR DISQUALIFICATION : Motion Hearing set for 11/10/2022 at 9:00 AM in Mag Ctrm (Marshall) before Magistrate Judge Roy S. Payne. (jc,) (Entered: 10/17/2022)	
151	10/14/2022	SEALED REPLY to Response to Motion re 128 SEALED PATENT MOTION FOR DISQUALIFICATION filed by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit 16, # 2 Exhibit 17)(Smith, Melissa) (Entered: 10/14/2022)	
152	10/17/2022	Joint MOTION to Amend/Correct Docket Control Order by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 10/17/2022)	
154	10/18/2022	REDACTION to 151 Sealed Reply to Response to Motion re 128 SEALED PATENT MOTION FOR DISQUALIFICATION by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit 16, # 2 Exhibit 17)(Smith, Melissa) (Entered: 10/18/2022)	
155	10/20/2022	MOTION to Compel DISCOVERY REGARDING EMAIL COMMUNICATIONS AT ISSUE IN TRADE SECRET AND FIDUCIARY DUTY CLAIMS by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit A, # 2 Exhibit B, # 3 Exhibit C, # 4 Text of Proposed Order)(Smith, Melissa) (Entered: 10/20/2022)	
156	10/21/2022	AMENDED DOCKET CONTROL ORDER- Markman Hearing set for 1/10/2023 09:00 AM before Magistrate Judge Roy S. Payne., Jury Selection set for 6/26/2023 09:00AM before District Judge Rodney Gilstrap., Pretrial Conference set for 5/22/2023 09:00 AM before Magistrate Judge Roy S. Payne.. Signed by Magistrate Judge Roy S. Payne on 10/21/2022. (klc,) (Entered: 10/21/2022)	
157	10/21/2022	Patent Rule 4-3 Joint Claim Construction and Prehearing Statement by Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Appendix A, # 2 Appendix B)(Snodgrass, Jacob) (Entered: 10/21/2022)	
158	10/21/2022	NOTICE of Discovery Disclosure by Staton Techiya, LLC, Synergy IP Corporation of Service of Expert Witness Disclosures Pursuant to P.R. 4-3(b) (Snodgrass, Jacob) (Entered: 10/21/2022)	
159	10/24/2022	NOTICE of Discovery Disclosure by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd. of Service of Expert Witness Disclosures Pursuant to P.R. 4-3(b) (Smith, Melissa) (Entered: 10/24/2022)	
160	10/24/2022	Unopposed MOTION FOR LEAVE TO AMEND DEFENDANTS PRELIMINARY CLAIM CONSTRUCTIONS AND EXTRINSIC EVIDENCE by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 10/24/2022)	
161	10/25/2022	ORDER granting 160 MOTION FOR LEAVE TO AMEND DEFENDANTS PRELIMINARY CLAIM CONSTRUCTIONS AND EXTRINSIC EVIDENCE. Signed by Magistrate Judge Roy S. Payne on 10/25/2022. (nkl,) (Entered: 10/25/2022)	
162	10/28/2022	SEALED SUR-REPLY to Reply to Response to Motion re 128 SEALED PATENT MOTION FOR DISQUALIFICATION filed by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP	

#	Date	Proceeding Text	Source
		Corporation. (Attachments: # 1 Exhibit 31)(Bumgardner, Brent) (Entered: 10/28/2022)	
163	11/01/2022	***FILED IN ERROR***SUR-REPLY to Reply to Response to Motion re 128 SEALED PATENT MOTION FOR DISQUALIFICATION REDACTED Counterclaim Defendants' Sur-Reply to Motion for Disqualification filed by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit 31)(Bumgardner, Brent) Modified on 11/1/2022 (ch,). (Entered: 11/01/2022)	
	11/01/2022	***FILED IN ERROR. REFILE UNDER REDACTED DOCUMENT Document # 163, Sur=Reply. PLEASE IGNORE.*** (ch,) (Entered: 11/01/2022)	
164	11/01/2022	REDACTION to 128 SEALED PATENT MOTION FOR DISQUALIFICATION REDACTED Counterclaim Defendants' Sur-Reply to Motion for Disqualification by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit 31)(Bumgardner, Brent) (Entered: 11/01/2022)	
165	11/02/2022	RESPONSE to Motion re 155 MOTION to Compel DISCOVERY REGARDING EMAIL COMMUNICATIONS AT ISSUE IN TRADE SECRET AND FIDUCIARY DUTY CLAIMS Counterclaim Defendants' Response to Motion to Compel Email Discovery filed by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit 1, # 2 Exhibit 2, # 3 Text of Proposed Order)(Kimble, Justin) (Entered: 11/02/2022)	
	11/02/2022	NOTICE of Hearing on Motion 128 SEALED PATENT MOTION FOR DISQUALIFICATION : Motion Hearing RESET for 11/10/2022 10:30 AM before Magistrate Judge Roy S. Payne. *Note that only the TIME has changed*(bga) (Entered: 11/02/2022)	
166	11/02/2022	NOTICE of Attorney Appearance by Michael E. Flynn-O'Brien on behalf of Staton Techiya, LLC, Synergy IP Corporation (Flynn-O'Brien, Michael) (Entered: 11/02/2022)	
167	11/02/2022	NOTICE of Attorney Appearance by Aaron R Hand on behalf of All Plaintiffs (Hand, Aaron) (Entered: 11/02/2022)	
168	11/02/2022	NOTICE of Attorney Appearance by Aden Martin Allen on behalf of All Plaintiffs (Allen, Aden) (Entered: 11/02/2022)	
169	11/03/2022	Unopposed MOTION for Leave to File Excess Pages Unopposed Motion to Exceed Page Limit on Counterclaim Defendants' Sur-Reply to Motion for Disqualification by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Text of Proposed Order)(Bumgardner, Brent) (Entered: 11/03/2022)	
170	11/03/2022	NOTICE of Attorney Appearance by Robin K. Curtis on behalf of Staton Techiya, LLC, Synergy IP Corporation (Curtis, Robin) (Entered: 11/03/2022)	
171	11/07/2022	ORDER granting 169 Unopposed MOTION for Leave to File Excess Pages Unopposed Motion to Exceed Page Limit on Counterclaim Defendants' Sur-Reply to Motion for Disqualification. Signed by Magistrate Judge Roy S. Payne on 11/7/2022. (ch,) (Entered: 11/07/2022)	
172	11/07/2022	Unopposed MOTION for Hearing re 155 MOTION to Compel DISCOVERY REGARDING EMAIL COMMUNICATIONS AT ISSUE IN TRADE SECRET AND FIDUCIARY DUTY CLAIMS by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 11/07/2022)	
173	11/08/2022	Unopposed MOTION to Excuse Lead Counsel from Discovery Hearing by Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Text of Proposed Order)(Cangro, Bradford)	

#	Date	Proceeding Text	Source
		(Entered: 11/08/2022)	
174	11/08/2022	ORDER granting 172 Unopposed MOTION for Hearing re 155 MOTION to Compel DISCOVERY REGARDING EMAIL COMMUNICATIONS AT ISSUE IN TRADE SECRET AND FIDUCIARY DUTY CLAIMS granting 173 Motion to excuse lead counsel Bradford A. Cangro from the hearing set November 10, 2022. Signed by Magistrate Judge Roy S. Payne on 11/8/2022. (ch,) (Entered: 11/08/2022)	
175	11/09/2022	STATUS REPORT OF MEET AND CONFER REGARDING SAMSUNGS MOTION TO COMPEL (DKT. 155) (JOINT) by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Smith, Melissa) (Entered: 11/09/2022)	
176	11/10/2022	NOTICE of Attorney Appearance by James Travis Underwood on behalf of Samsung Electronics America, Inc., Samsung Electronics Co., Ltd. (Underwood, James) (Entered: 11/10/2022)	
177	11/10/2022	PAPER TRANSCRIPT REQUEST by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd. for proceedings held on 2022-11-10 - Motion Hearing before Judge Judge Roy S. Payne. (Smith, Melissa) (Forwarded to Court Reporter, Shawn McRoberts, on 11/10/2022) (slo) (Entered: 11/10/2022)	
178	11/10/2022	NOTICE by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd. of Filing Hearing Presentation (Attachments: # 1 Presentation Slides)(Smith, Melissa) (Entered: 11/10/2022)	
179	11/10/2022	Minute Entry for proceedings held before Magistrate Judge Roy S. Payne: Motion Hearing held on 11/10/2022 re 128 SEALED PATENT MOTION FOR DISQUALIFICATION filed by Samsung Electronics Co., Ltd., Samsung Electronics America, Inc. (Court Reporter Shawn McRoberts.) (bga) (Entered: 11/10/2022)	
180	11/11/2022	Unopposed MOTION FOR ISSUANCE OF A LETTER OF REQUEST TO THE ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE IN THE REPUBLIC OF KOREA by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit 1, # 2 Exhibit 2, # 3 Text of Proposed Order)(Smith, Melissa) (Entered: 11/11/2022)	
181	11/14/2022	PAPER TRANSCRIPT REQUEST by Staton Techiya, LLC for proceedings held on 11/10/2022 Motion Hearing before Judge Roy S. Payne. (Truelove, Jennifer) (Forwarded to Court Reporter, Shawn McRoberts, on 11/14/2022) (slo) (Entered: 11/14/2022)	
182	11/14/2022	ORDER granting 180 Unopposed MOTION FOR ISSUANCE OF A LETTER OF REQUEST TO THE ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE IN THE REPUBLIC OF KOREA. Signed by Magistrate Judge Roy S. Payne on 11/14/2022. (ch,) (Entered: 11/14/2022)	
183	11/16/2022	MEMORANDUM ORDER. Signed by Magistrate Judge Roy S. Payne on 11/16/2022. (ch,) (Entered: 11/16/2022)	
184	11/17/2022	STIPULATION re 155 MOTION to Compel DISCOVERY REGARDING EMAIL COMMUNICATIONS AT ISSUE IN TRADE SECRET AND FIDUCIARY DUTY CLAIMS (JOINT) by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Smith, Melissa) (Entered: 11/17/2022)	
185	11/23/2022	MOTION to Amend/Correct P.R. 3-1 Infringement Contentions by Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Snodgrass Decl., # 2 Exhibit 1, # 3 Exhibit 2, # 4 Exhibit 3, # 5 Exhibit 4, # 6 Exhibit 5, # 7 Exhibit 6, # 8 Text of Proposed Order)(Snodgrass, Jacob) (Entered: 11/23/2022)	
186	11/23/2022	Unopposed MOTION for Extension of Time to File Unopposed Motion for Extension of Time to File Objections to Memorandum Order (Dkt. 183) by Seung-Ho Ahn, Sungil Cho, Staton Techiya,	

#	Date	Proceeding Text	Source
		LLC, Synergy IP Corporation. (Attachments: # 1 Text of Proposed Order)(Bumgardner, Brent) (Entered: 11/23/2022)	
187	11/23/2022	Opposed SEALED MOTION Counterclaim Defendants' Motion to Compel Materials Withheld as Privileged by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit A, # 2 Text of Proposed Order)(Granaghan, Christopher) (Entered: 11/23/2022)	
188	11/28/2022	REDACTION to 187 Opposed SEALED MOTION Counterclaim Defendants' Motion to Compel Materials Withheld as Privileged Counterclaim Defendants' Motion to Compel Materials withheld as Privileged by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit A)(Granaghan, Christopher) (Entered: 11/28/2022)	
189	11/28/2022	Unopposed MOTION FOR ISSUANCE OF A LETTER OF REQUEST FOR DOCUMENTS TO THE ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE IN THE REPUBLIC OF KOREA (AMENDED) by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit 1, # 2 Text of Proposed Order)(Smith, Melissa) (Entered: 11/28/2022)	
190	11/28/2022	Unopposed MOTION FOR ISSUANCE OF A LETTER OF REQUEST FOR TESTIMONY TO THE ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE IN THE REPUBLIC OF KOREA (AMENDED) by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit 1, # 2 Text of Proposed Order)(Smith, Melissa) (Entered: 11/28/2022)	
191	11/29/2022	CLAIM CONSTRUCTION BRIEF filed by Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Affidavit Declaration of David Kleinschmidt on Claim Construction and Definiteness, # 2 Affidavit Declaration of Christopher J. Struck Regarding Claim Construction and Definiteness, # 3 Affidavit Declaration of Marshall Buck, Ph.D. Regarding Definiteness, # 4 Affidavit Declaration of Jacob A. Snodgrass in Support of Plaintiffs' Opening Claim Construction Brief, # 5 Exhibit 1, # 6 Exhibit 2, # 7 Exhibit 3, # 8 Exhibit 4, # 9 Exhibit 5, # 10 Exhibit 6, # 11 Exhibit 7, # 12 Exhibit 8, # 13 Exhibit 9, # 14 Exhibit 10, # 15 Exhibit 11, # 16 Exhibit 12, # 17 Exhibit 13, # 18 Exhibit 14, # 19 Exhibit 15, # 20 Exhibit 16, # 21 Exhibit 17, # 22 Exhibit 18, # 23 Exhibit 19, # 24 Exhibit 20, # 25 Exhibit 21, # 26 Exhibit 22, # 27 Exhibit 23, # 28 Exhibit 24, # 29 Exhibit 25, # 30 Exhibit 26, # 31 Exhibit 27, # 32 Exhibit 28, # 33 Exhibit 29, # 34 Exhibit 30, # 35 Exhibit 31, # 36 Exhibit 32, # 37 Exhibit 33, # 38 Exhibit 34, # 39 Exhibit 35, # 40 Exhibit 36, # 41 Exhibit 37, # 42 Exhibit 38, # 43 Exhibit 39, # 44 Exhibit 40, # 45 Exhibit 41, # 46 Exhibit 42, # 47 Exhibit 43)(Snodgrass, Jacob) (Entered: 11/29/2022)	
192	11/29/2022	ORDER granting 186 Unopposed MOTION for Extension of Time to File Unopposed Motion for Extension of Time to File Objections to Memorandum Order. Signed by Magistrate Judge Roy S. Payne on 11/29/2022. (ch,) (Entered: 11/29/2022)	
193	11/29/2022	NOTICE by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd. of Compliance Regarding Technical Tutorial (Smith, Melissa) (Entered: 11/29/2022)	
194	11/29/2022	NOTICE by Staton Techiya, LLC, Synergy IP Corporation of Submission of Technical Tutorial (Snodgrass, Jacob) (Entered: 11/29/2022)	
195	12/02/2022	Unopposed MOTION for Extension of Time to File Response/Reply as to 187 Opposed SEALED MOTION Counterclaim Defendants' Motion to Compel Materials Withheld as	

#	Date	Proceeding Text	Source
		Privileged by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 12/02/2022)	
196	12/07/2022	RESPONSE to Motion re 185 MOTION to Amend/Correct P.R. 3-1 Infringement Contentions filed by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit A, # 2 Text of Proposed Order)(Smith, Melissa) (Entered: 12/07/2022)	
197	12/09/2022	SEALED RESPONSE by Staton Techiya, LLC to 183 Memorandum & Opinion filed by Staton Techiya, LLC. (Bumgardner, Brent) (Additional attachment(s) added on 12/9/2022: # 1 Text of Proposed Order) (ch,). (Entered: 12/09/2022)	
198	12/09/2022	***FILED IN ERROR***Additional Attachments to Main Document: 197 Response to Non-Motion.. (Bumgardner, Brent) Modified on 12/9/2022 (ch,). (Entered: 12/09/2022)	
	12/09/2022	***FILED IN ERROR. ORDERS ARE NOT FILE SEPARATELY ON DOCKET Document # 198, additonal attachment. PLEASE IGNORE.*** (ch,) (Entered: 12/09/2022)	
199	12/10/2022	ORDER granting 195 Unopposed MOTION for Extension of Time to File Response/Reply as to 187 Opposed SEALED MOTION Counterclaim Defendants' Motion to Compel Materials Withheld as Privileged . Signed by Magistrate Judge Roy S. Payne on 12/10/2022. (ch,) (Entered: 12/12/2022)	
200	12/12/2022	SEALED PATENT RESPONSE to SEALED MOTION re 187 Opposed SEALED MOTION Counterclaim Defendants' Motion to Compel Materials Withheld as Privileged filed by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit 1, # 2 Text of Proposed Order)(Smith, Melissa) (Entered: 12/12/2022)	
201	12/13/2022	NOTICE of Attorney Appearance by John Paul Murphy on behalf of Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation (Murphy, John) (Entered: 12/13/2022)	
202	12/13/2022	ORDER granting 189 Unopposed MOTION FOR ISSUANCE OF A LETTER OF REQUEST FOR DOCUMENTS TO THE ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE IN THE REPUBLIC OF KOREA (AMENDED) ; granting 190 Unopposed MOTION FOR ISSUANCE OF A LETTER OF REQUEST FOR DOCUMENTS TO THE ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE IN THE REPUBLIC OF KOREA (AMENDED). Signed by Magistrate Judge Roy S. Payne on 12/13/2022. (ch,) (Entered: 12/13/2022)	
203	12/13/2022	SAMSUNG'S RESPONSIVE CLAIM CONSTRUCTION BRIEF to 191 Claim Construction Brief,,,,, filed by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Affidavit Declaration of Friedman, # 2 Exhibit 1, # 3 Exhibit 2, # 4 Exhibit 3, # 5 Exhibit 4, # 6 Exhibit 5, # 7 Exhibit 6, # 8 Exhibit 7, # 9 Exhibit 8, # 10 Exhibit 9, # 11 Exhibit 10, # 12 Exhibit 11, # 13 Exhibit 12, # 14 Exhibit 13, # 15 Exhibit 14, # 16 Exhibit 15, # 17 Exhibit 16, # 18 Exhibit 17, # 19 Exhibit 18, # 20 Exhibit 19, # 21 Exhibit 20)(Smith, Melissa) (Entered: 12/13/2022)	
204	12/14/2022	NOTICE of Attorney Appearance - Pro Hac Vice by Peter Jason Evangelatos on behalf of Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics Co., Ltd., Samsung Electronics Co., Ltd., Samsung Electronics Corporation, Ltd. Filing fee $ 100, receipt number ATXEDC-9269737. (Evangelatos, Peter) (Entered: 12/14/2022)	
205	12/14/2022	***FILED IN ERROR***RESPONSE in Support re 185 MOTION to	

#	Date	Proceeding Text	Source
		Amend/Correct P.R. 3-1 Infringement Contentions filed by Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Snodgrass Decl., # 2 Exhibit 7, # 3 Exhibit 8, # 4 Exhibit 9)(Snodgrass, Jacob) Modified on 12/14/2022 (ch,). (Entered: 12/14/2022)	
	12/14/2022	***FILED IN ERROR. FILED UNDER WRONG EVENT Document # 205, RESPONSE TO MOTION. PLEASE IGNORE.*** (ch,) (Entered: 12/14/2022)	
206	12/14/2022	REPLY to Response to Motion re 185 MOTION to Amend/Correct P.R. 3-1 Infringement Contentions filed by Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Snodgrass Decl., # 2 Exhibit 7, # 3 Exhibit 8, # 4 Exhibit 9)(Snodgrass, Jacob) (Entered: 12/14/2022)	
207	12/15/2022	REDACTION to 197 Response to Non-Motion Counterclaim Defendants' Objections to Memorandum Order (Dkt. 183) Granting Defendants' Motion for Disqualification (Dkt. 128) by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Bumgardner, Brent) (Entered: 12/15/2022)	
208	12/20/2022	ORDER re 183 Memorandum Order 197 SEALED RESPONSE filed by Staton Techiya, LLC. Signed by District Judge Rodney Gilstrap on 12/20/2022. (nkl,) (Entered: 12/20/2022)	
209	12/20/2022	REPLY TO RESPONSE to 191 Claim Construction Brief,,,,, filed by Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Affidavit Declaration of Jacob A. Snodgrass in Support of Plaintiffs' Reply Claim Construction Brief, # 2 Exhibit 44)(Snodgrass, Jacob) (Entered: 12/20/2022)	
210	12/21/2022	NOTICE of Attorney Appearance - Pro Hac Vice by Paul Sampson on behalf of Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics Co., Ltd., Samsung Electronics Co., Ltd., Samsung Electronics Corporation, Ltd. Filing fee $ 100, receipt number ATXEDC-9280342. (Sampson, Paul) (Entered: 12/21/2022)	
211	12/21/2022	ORDER - Michael Paul appointed as the Courts technical advisor in the above-captioned case. Signed by Magistrate Judge Roy S. Payne on 2/21/2022. (nkl,) Modified on 12/21/2022 (nkl,). (Entered: 12/21/2022)	
212	12/21/2022	SEALED PATENT MOTION TO COMPEL DISCOVERY REGARDING SAMSUNGS MARKING DEFENSE AND COUNTERCLAIMS by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit A, # 2 Exhibit B, # 3 Exhibit C, # 4 Exhibit D, # 5 Exhibit E, # 6 Text of Proposed Order)(Smith, Melissa) (Entered: 12/21/2022)	
213	12/21/2022	SUR-REPLY to Reply to Response to Motion re 185 MOTION to Amend/Correct P.R. 3-1 Infringement Contentions filed by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Smith, Melissa) (Entered: 12/21/2022)	
214	12/21/2022	SEALED PATENT MOTION TO COMPEL MATERIALS WITHHELD AS PRIVILEGED by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit A, # 2 Text of Proposed Order)(Smith, Melissa) (Entered: 12/21/2022)	
215	12/22/2022	NOTICE of Attorney Appearance - Pro Hac Vice by Michael Lehr on behalf of Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics Co., Ltd., Samsung Electronics Co., Ltd., Samsung Electronics Corporation, Ltd. Filing fee $ 100, receipt number ATXEDC-9282347. (Lehr, Michael) (Entered: 12/22/2022)	
216	12/23/2022	NOTICE by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd. OF COMPLIANCE FOR SERVICE OF	

#	Date	Proceeding Text	Source
		DOCUMENTS FOR IN CAMERA REVIEW (Smith, Melissa) (Entered: 12/23/2022)	
217	12/23/2022	P.R. 4-5(d) Joint Claim Construction Chart by Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit A)(Snodgrass, Jacob) (Entered: 12/23/2022)	
218	12/23/2022	Unopposed MOTION for Extension of Time to File Response/Reply as to 214 SEALED PATENT MOTION TO COMPEL MATERIALS WITHHELD AS PRIVILEGED Counterclaim Defendants' Unopposed Motion for an Extension of Time to Respond to Defendants Motion to Compel by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Text of Proposed Order)(Bumgardner, Brent) (Entered: 12/23/2022)	
219	12/26/2022	ORDER granting 218 Unopposed MOTION for Extension of Time to File Response/Reply as to 214 SEALED PATENT MOTION TO COMPEL MATERIALS WITHHELD AS PRIVILEGED Signed by Magistrate Judge Roy S. Payne on 12/26/2022 (no document attached). (Payne, Roy) (Entered: 12/26/2022)	
220	12/27/2022	Opposed SEALED MOTION Counterclaim Defendants' Motion to Compel Email Production by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Text of Proposed Order)(Bumgardner, Brent) (Entered: 12/27/2022)	
221	12/28/2022	Opposed SEALED MOTION Counterclaim Defendants' Motion to Compel Licenses and Related Production by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Text of Proposed Order)(Bumgardner, Brent) (Entered: 12/28/2022)	
222	12/28/2022	Unopposed MOTION for Hearing re 214 SEALED PATENT MOTION TO COMPEL MATERIALS WITHHELD AS PRIVILEGED, 111 Redacted Document, 212 SEALED PATENT MOTION TO COMPEL DISCOVERY REGARDING SAMSUNGS MARKING DEFENSE AND COUNTERCLAIMS, 187 Opposed SEALED MOTION Counterclaim Defendants' Motion to Compel Materials Withheld as Privileged Unopposed Motion For A Hearing by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Text of Proposed Order)(Bumgardner, Brent) (Entered: 12/28/2022)	
223	12/30/2022	NOTICE of Attorney Appearance by David Thomas DeZern on behalf of Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation (DeZern, David) (Entered: 12/30/2022)	
224	01/03/2023	REDACTION to 220 Opposed SEALED MOTION Counterclaim Defendants' Motion to Compel Email Production by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Text of Proposed Order)(Bumgardner, Brent) (Entered: 01/03/2023)	
225	01/04/2023	REDACTION to 221 Opposed SEALED MOTION Counterclaim Defendants' Motion to Compel Licenses and Related Production by Staton Techiya, LLC. (Attachments: # 1 Text of Proposed Order)(Bumgardner, Brent) (Entered: 01/04/2023)	
226	01/04/2023	DEFICIENT DOCUMENT SEALED RESPONSE to Motion re 212 SEALED PATENT MOTION TO COMPEL DISCOVERY REGARDING SAMSUNGS MARKING DEFENSE AND COUNTERCLAIMS filed by Staton Techiya, LLC. (Attachments: # 1 Exhibit, # 2 Exhibit, # 3 Exhibit, # 4 Text of Proposed Order)(Bumgardner, Brent) Modified on 1/4/2023 (nkl,). (Entered: 01/04/2023)	
	01/04/2023	NOTICE of Deficiency regarding the SEALED RESPONSE to Motion submitted document 226 does not contain a Certificate of Authorization to File Under Seal per Local Rule CV-5(a)(7)(A).	

#	Date	Proceeding Text	Source
		Correction should be made by one business day. (nkl,) (Entered: 01/04/2023)	
227	01/04/2023	SEALED RESPONSE to Motion re 212 SEALED PATENT MOTION TO COMPEL DISCOVERY REGARDING SAMSUNGS MARKING DEFENSE AND COUNTERCLAIMS filed by Staton Techiya, LLC. (Attachments: # 1 Exhibit, # 2 Exhibit, # 3 Exhibit, # 4 Text of Proposed Order)(Bumgardner, Brent) (Entered: 01/04/2023)	
228	01/04/2023	SEALED RESPONSE to Motion re 214 SEALED PATENT MOTION TO COMPEL MATERIALS WITHHELD AS PRIVILEGED filed by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit 1, # 2 Text of Proposed Order)(Bumgardner, Brent) (Entered: 01/04/2023)	
229	01/06/2023	NOTICE of Attorney Appearance - Pro Hac Vice by R. Allan Pixton on behalf of Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics Co., Ltd., Samsung Electronics Co., Ltd., Samsung Electronics Corporation, Ltd. Filing fee $ 100, receipt number ATXEDC-9296456. (Pixton, R. Allan) (Entered: 01/06/2023)	
230	01/10/2023	Minute Entry for proceedings held before Magistrate Judge Roy S. Payne: Markman Hearing held on 1/10/2023, from 9:00 am-12:21 pm (No exhibits)(Court Reporter April Hargett.) (bga) (Entered: 01/10/2023)	
231	01/10/2023	SEALED PATENT RESPONSE IN OPPOSITION to SEALED PATENT MOTION re 220 Opposed SEALED MOTION Counterclaim Defendants' Motion to Compel Email Production filed by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit A, # 2 Exhibit B, # 3 Exhibit C, # 4 Text of Proposed Order)(Smith, Melissa) (Entered: 01/10/2023)	
232	01/11/2023	PAPER TRANSCRIPT REQUEST by Staton Techiya, LLC for proceedings held on 01/10/2023 Markman Hearing before Judge Roy S. Payne. (Truelove, Jennifer) (Forwarded to Court Reporter, April Hargett, on 1/11/2023) (slo) (Entered: 01/11/2023)	
233	01/11/2023	REDACTION to 227 Sealed Response to Motion, by Staton Techiya, LLC. (Attachments: # 1 Exhibit, # 2 Text of Proposed Order)(Bumgardner, Brent) (Entered: 01/11/2023)	
234	01/11/2023	PAPER TRANSCRIPT REQUEST by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd. for proceedings held on January 10, 2023 Markman Hearing before Judge Roy S. Payne. (Smith, Melissa) (Forwarded to Court Reporter, April Hargett, on 1/11/2023) (slo) (Entered: 01/11/2023)	
235	01/11/2023	REDACTION to 228 Sealed Response to Motion, Counterclaim Defendants' Response to Samsung's Motion to Compel Materials Withheld as Privileged by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit 1 (redacted), # 2 Text of Proposed Order)(Bumgardner, Brent) (Entered: 01/11/2023)	
236	01/11/2023	SEALED PATENT RESPONSE to SEALED PATENT MOTION re 221 Opposed SEALED MOTION Counterclaim Defendants' Motion to Compel Licenses and Related Production filed by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit A, # 2 Text of Proposed Order)(Smith, Melissa) (Entered: 01/11/2023)	
237	01/17/2023	NOTICE OF FILING OF OFFICIAL TRANSCRIPT of Markman Hearing, held on January 10, 2023, before Judge Roy Payne. Court Reporter/Transcriber: April Hargett, Telephone number:	

#	Date	Proceeding Text	Source
		(409) 654-2891. NOTICE RE REDACTION OF TRANSCRIPTS: The parties have seven (7) days to file with the Court a Notice of Intent to Request Redaction of this transcript. If no such Notice is filed, the transcript will be made remotely electronically available to the public without redaction after 90 calendar days. The policy is located on our website at www.txed.uscourts.gov Transcript may be viewed at the court public terminal or purchased through the Court Reporter/Transcriber before the deadline for Release of Transcript Restriction. After that date it may be obtained through PACER.. Motion to Redact due 2/7/2023. Release of Transcript Restriction set for 4/17/2023. (ahargett,) (Entered: 01/17/2023)	
238	01/18/2023	SEALED PATENT MOTION to Compel Technical Documents and Source Code by Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit A, # 2 Exhibit B, # 3 Text of Proposed Order)(Flynn-O'Brien, Michael) (Entered: 01/18/2023)	
239	01/18/2023	MOTION to Compel Discovery Regarding Samsung's Financial and Licensing Information by Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit 1, # 2 Exhibit 2, # 3 Exhibit 3, # 4 Text of Proposed Order)(Curtis, Robin) (Entered: 01/18/2023)	
240	01/19/2023	NOTICE of Attorney Appearance - Pro Hac Vice by Sophia Lee on behalf of Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics Co., Ltd., Samsung Electronics Co., Ltd., Samsung Electronics Corporation, Ltd. Filing fee $ 100, receipt number ATXEDC-9316914. (Lee, Sophia) (Entered: 01/19/2023)	
241	01/20/2023	Joint MOTION to Amend/Correct 156 Order,, Set Deadlines/Hearings, (Docket Control Order) by Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Text of Proposed Order)(Cangro, Bradford) (Entered: 01/20/2023)	
242	01/20/2023	NOTICE of Attorney Appearance - Pro Hac Vice by Matthew J McIntee on behalf of Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics Co., Ltd., Samsung Electronics Co., Ltd., Samsung Electronics Corporation, Ltd. Filing fee $ 100, receipt number ATXEDC-9320075. (McIntee, Matthew) (Entered: 01/20/2023)	
243	01/20/2023	ORDER granting in part 222 Unopposed MOTION for Hearing re 214 SEALED PATENT MOTION TO COMPEL MATERIALS WITHHELD AS PRIVILEGED, 111 Redacted Document, 212 SEALED PATENT MOTION TO COMPEL DISCOVERY REGARDING SAMSUNGS MARKING DEFENSE AND COUNTERCLAIMS, 187 Opposed SEALED MOTION Counterclaim Defendants' Motion to Compel Materials Withheld as Privileged Unopposed Motion For A Hearing. Motion Hearing set for 2/10/2023 09:00 AM before Magistrate Judge Roy S. Payne. All pending motions to compel, Dkt. Nos. 187, 212, 214, 220, 221, 238 and 239. Signed by Magistrate Judge Roy S. Payne on 1/20/2023. (ch,) (Entered: 01/23/2023)	
244	01/23/2023	NOTICE of Attorney Appearance by Timothy E Grochocinski on behalf of Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation (Grochocinski, Timothy) (Entered: 01/23/2023)	
245	01/25/2023	REDACTION to 238 SEALED PATENT MOTION to Compel Technical Documents and Source Code by Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit A, # 2 Exhibit B, # 3 Text of Proposed Order)(Flynn-O'Brien, Michael) (Entered: 01/25/2023)	
246	01/25/2023	SECOND AMEND DOCKET CONTROL ORDER granting 241	

#	Date	Proceeding Text	Source
		Motion to Amend/Correct Docket Control Order. Signed by Magistrate Judge Roy S. Payne on 1/25/2023. (ch,) (Entered: 01/26/2023)	
247	01/27/2023	Unopposed MOTION to Excuse Lead Counsel from Discovery Hearing by Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Text of Proposed Order)(Cangro, Bradford) (Entered: 01/27/2023)	
248	01/30/2023	Unopposed MOTION TO CONDUCT CERTAIN DISCOVERY FROM THIRD PARTY INVENTORS AFTER THE CLOSE OF FACT DISCOVERY by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 01/30/2023)	
249	01/30/2023	ORDER granting 247 Unopposed MOTION to Excuse Lead Counsel from Discovery Hearing. Signed by Magistrate Judge Roy S. Payne on 1/30/2023. (ch,) (Entered: 01/30/2023)	
250	01/30/2023	SEALED MOTION Counterclaim Defendants' Motion to Compel Deposition of Sang Kyun Kim by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Text of Proposed Order Proposed Order Granting Motion to Compel)(Bumgardner, Brent) (Entered: 01/30/2023)	
251	01/30/2023	NOTICE of Attorney Appearance - Pro Hac Vice by Luke L Dauchot on behalf of Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics America, Inc., Samsung Electronics Co., Ltd., Samsung Electronics Co., Ltd., Samsung Electronics Corporation, Ltd. Filing fee $ 100, receipt number ATXEDC-9333401. (Dauchot, Luke) (Entered: 01/30/2023)	
252	01/30/2023	SEALED PATENT MOTION to Compel Depositions by Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit A, # 2 Text of Proposed Order)(Flynn-O'Brien, Michael) (Entered: 01/30/2023)	
253	01/30/2023	SEALED PATENT MOTION to Compel Marketing and Financial Related Documents by Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit A, # 2 Text of Proposed Order)(Flynn-O'Brien, Michael) (Entered: 01/30/2023)	
254	01/30/2023	SEALED PATENT MOTION TO COMPEL DEPOSITION OF SYNERGY WITNESSES UNDER RULE 30(B)(1) by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit 1, # 2 Text of Proposed Order)(Smith, Melissa) (Entered: 01/30/2023)	
255	01/30/2023	SEALED PATENT MOTION TO COMPEL DISCOVERY FROM TECHIYA by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit 1, # 2 Exhibit 2, # 3 Text of Proposed Order)(Smith, Melissa) (Entered: 01/30/2023)	
256	01/30/2023	SEALED PATENT MOTION TO COMPEL FORENSIC ANALYSIS OF COUNTERCLAIM DEFENDANTS DEVICES AND EMAIL ACCOUNTS by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit A, # 2 Text of Proposed Order)(Smith, Melissa) (Entered: 01/30/2023)	
257	01/30/2023	SEALED PATENT MOTION to Compel Technical Documents and Source Code by Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit A, # 2 Exhibit B, # 3 Text of Proposed Order)(Flynn-O'Brien, Michael) (Entered: 01/30/2023)	
258	01/31/2023	ORDER - ORDERED to file any response in opposition to the additional discovery motions at Docket Numbers 248, 250, and 252-257, no later than February 8, 2023, and the Court will hear oral arguments on the additional discovery motions at Docket Numbers 248, 250, and 252-257 together with those already set for hearing on February 10, 2023. Signed by Magistrate Judge	

#	Date	Proceeding Text	Source
		Roy S. Payne on 1/31/2023. (ch,) (Entered: 01/31/2023)	
259	02/01/2023	REPORT AND RECOMMENDATIONS re 109 SEALED MOTION Counterclaim Defendants' Motion to Dismiss Under the Doctrine of Forum Non Conveniens and to Dismiss for Failure to State a Claim filed by Sungil Cho, Synergy IP Corporation, Seung-Ho Ahn, Staton Techiya, LLC.. Signed by Magistrate Judge Roy S. Payne on 2/1/2023. (ch,) (Entered: 02/01/2023)	
260	02/01/2023	REDACTION to 200 Sealed Patent Response to Sealed Patent Motion, by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit 1, # 2 Text of Proposed Order)(Smith, Melissa) (Entered: 02/01/2023)	
261	02/01/2023	REDACTION to 212 SEALED PATENT MOTION TO COMPEL DISCOVERY REGARDING SAMSUNGS MARKING DEFENSE AND COUNTERCLAIMS by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit C, # 2 Exhibit D, # 3 Text of Proposed Order)(Smith, Melissa) (Entered: 02/01/2023)	
262	02/01/2023	REDACTION to 214 SEALED PATENT MOTION TO COMPEL MATERIALS WITHHELD AS PRIVILEGED by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 02/01/2023)	
263	02/01/2023	REDACTION to 231 Sealed Patent Response to Sealed Patent Motion, by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 02/01/2023)	
264	02/01/2023	REDACTION to 236 Sealed Patent Response to Sealed Patent Motion, by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Smith, Melissa) (Entered: 02/01/2023)	
265	02/01/2023	REDACTION to 255 SEALED PATENT MOTION TO COMPEL DISCOVERY FROM TECHIYA by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Smith, Melissa) (Entered: 02/01/2023)	
266	02/01/2023	SEALED PATENT RESPONSE to SEALED PATENT MOTION re 238 SEALED PATENT MOTION to Compel Technical Documents and Source Code filed by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit 1, # 2 Exhibit 2, # 3 Exhibit 3, # 4 Text of Proposed Order)(Smith, Melissa) (Entered: 02/01/2023)	
267	02/01/2023	SEALED PATENT RESPONSE to 239 MOTION to Compel Discovery Regarding Samsung's Financial and Licensing Information filed by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit 1, # 2 Exhibit 2, # 3 Text of Proposed Order)(Smith, Melissa) (Entered: 02/01/2023)	
268	02/01/2023	REDACTION to 256 SEALED PATENT MOTION TO COMPEL FORENSIC ANALYSIS OF COUNTERCLAIM DEFENDANTS DEVICES AND EMAIL ACCOUNTS by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit A)(Smith, Melissa) (Entered: 02/01/2023)	
269	02/03/2023	ORDER - ORDERED to meet and confer, agree to, and jointly propose (1) a grouping of related motions to be addressed together, and (2) an order to address the motions, whether individually or grouped. The parties shall file the Joint Notice by February 8, 2023. Signed by Magistrate Judge Roy S. Payne on 2/3/2023. (ch,) (Entered: 02/03/2023)	
270	02/06/2023	REDACTION to 266 Sealed Patent Response to Sealed Patent Motion, by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 02/06/2023)	

#	Date	Proceeding Text	Source
271	02/06/2023	REDACTION to 267 Sealed Patent Response to Sealed Patent Motion, by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit 2, # 2 Text of Proposed Order)(Smith, Melissa) (Entered: 02/06/2023)	
272	02/06/2023	REDACTION to 250 SEALED MOTION Counterclaim Defendants' Motion to Compel Deposition of Sang Kyun Kim by Seung-Ho Ahn, Sungil Cho, Michael D. Paul, Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Bumgardner, Brent) (Entered: 02/06/2023)	
273	02/07/2023	NOTICE of Discovery Disclosure by Staton Techiya, LLC, Synergy IP Corporation Notice of Service of Opening Expert Reports (Snodgrass, Jacob) (Entered: 02/07/2023)	
274	02/08/2023	ORDER granting 248 Unopposed MOTION TO CONDUCT CERTAIN DISCOVERY FROM THIRD PARTY INVENTORS AFTER THE CLOSE OF FACT DISCOVERY. Signed by Magistrate Judge Roy S. Payne on 2/8/2023. (ch,) (Entered: 02/08/2023)	
275	02/08/2023	NOTICE by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd. OF SERVICE OF DISCLOSURES FOR EXPERT WITNESSES (Smith, Melissa) (Entered: 02/08/2023)	
276	02/08/2023	SEALED MOTION Counterclaim Defendants' Motion to Strike Untimely Supplemental Interrogatory Responses and Initial Disclosures by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit 1, # 2 Exhibit 2, # 3 Exhibit 3, # 4 Exhibit 4, # 5 Exhibit 5, # 6 Exhibit 6, # 7 Exhibit 7, # 8 Exhibit 8, # 9 Exhibit 9, # 10 Exhibit 10, # 11 Exhibit 11, # 12 Exhibit 12, # 13 Text of Proposed Order)(Granaghan, Christopher) (Entered: 02/08/2023)	
277	02/08/2023	SEALED RESPONSE to Motion re 256 SEALED PATENT MOTION TO COMPEL FORENSIC ANALYSIS OF COUNTERCLAIM DEFENDANTS DEVICES AND EMAIL ACCOUNTS filed by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit A, # 2 Text of Proposed Order)(Kimble, Justin) (Entered: 02/08/2023)	
278	02/08/2023	***FILED IN ERROR***SEALED PATENT RESPONSE to SEALED PATENT MOTION re 250 SEALED MOTION Counterclaim Defendants' Motion to Compel Deposition of Sang Kyun Kim filed by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit 1, # 2 Exhibit 2, # 3 Exhibit 3, # 4 Exhibit 4, # 5 Text of Proposed Order)(Smith, Melissa) Modified on 2/9/2023 (ch,). (Entered: 02/08/2023)	
279	02/08/2023	SEALED PATENT RESPONSE to SEALED PATENT MOTION re 253 SEALED PATENT MOTION to Compel Marketing and Financial Related Documents filed by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit 1, # 2 Text of Proposed Order)(Smith, Melissa) (Entered: 02/08/2023)	
280	02/08/2023	SEALED PATENT RESPONSE to SEALED PATENT MOTION re 257 SEALED PATENT MOTION to Compel Technical Documents and Source Code filed by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 02/08/2023)	
281	02/08/2023	NOTICE by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd. REGARDING DISCOVERY MOTIONS (JOINT) (Smith, Melissa) (Entered: 02/08/2023)	
282	02/08/2023	RESPONSE in Opposition re 255 SEALED PATENT MOTION TO COMPEL DISCOVERY FROM TECHIYA filed by Staton Techiya, LLC, Synergy IP Corporation. (Flynn-O'Brien, Michael) (Entered: 02/08/2023)	

#	Date	Proceeding Text	Source
283	02/08/2023	SEALED PATENT RESPONSE to SEALED PATENT MOTION re 252 SEALED PATENT MOTION to Compel Depositions filed by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Exhibit 1, # 2 Exhibit 2, # 3 Exhibit 2, # 4 Exhibit 4, # 5 Text of Proposed Order)(Smith, Melissa) (Entered: 02/08/2023)	
285	02/08/2023	CLAIM CONSTRUCTION ORDER. Signed by Magistrate Judge Roy S. Payne on 2/8/2023. (nkl,) (Entered: 02/09/2023)	
284	02/09/2023	NOTICE by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd. JOINT REPORT OF MEET AND CONFER REGARDING MOTIONS TO COMPEL SET FOR HEARING ON FEB. 10, 2023 (Smith, Melissa) (Entered: 02/09/2023)	
	02/09/2023	***FILED IN ERROR. PER ATTORNEY Document # 278. Sealed Patent Response to Sealed Patent Motion. PLEASE IGNORE.*** (REFILED AT 283)(ch,) (Entered: 02/09/2023)	
286	02/11/2023	ORDER granting in part and denying in part 256 SEALED PATENT MOTION TO COMPEL FORENSIC ANALYSIS OF COUNTERCLAIM DEFENDANTS DEVICES AND EMAIL ACCOUNTS. Signed by Magistrate Judge Roy S. Payne on 2/11/2023. (ch,) (Entered: 02/13/2023)	
287	02/13/2023	PAPER TRANSCRIPT REQUEST by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd. for proceedings held on February 10, 2023 Motions Hearing before Judge Roy S. Payne. (Smith, Melissa) (Forwarded to Court Reporter, Shawn McRoberts, on 2/13/2023) (slo) (Entered: 02/13/2023)	
288	02/13/2023	PAPER TRANSCRIPT REQUEST by Staton Techiya, LLC for proceedings held on 2/10/2023 Motion Hearing before Judge Roy Payne. (Truelove, Jennifer) (Forwarded to Court Reporter, Shawn McRoberts, on 2/13/2023) (slo) (Entered: 02/13/2023)	
289	02/13/2023	Unopposed MOTION for Extension of Time to File Objections to Report and Recommendations (Dkt. 259) by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Text of Proposed Order)(Bumgardner, Brent) (Entered: 02/13/2023)	
290	02/14/2023	Minute Entry for proceedings held before Magistrate Judge Roy S. Payne: Motion Hearing held on 2/14/2023 re 214 SEALED PATENT MOTION TO COMPEL MATERIALS WITHHELD AS PRIVILEGED filed by Samsung Electronics Co., Ltd., Samsung Electronics America, Inc., 256 SEALED PATENT MOTION TO COMPEL FORENSIC ANALYSIS OF COUNTERCLAIM DEFENDANTS DEVICES AND EMAIL ACCOUNTS filed by Samsung Electronics Co., Ltd., Samsung Electronics America, Inc., 212 SEALED PATENT MOTION TO COMPEL DISCOVERY REGARDING SAMSUNGS MARKING DEFENSE AND COUNTERCLAIMS filed by Samsung Electronics Co., Ltd., Samsung Electronics America, Inc., 187 Opposed SEALED MOTION Counterclaim Defendants' Motion to Compel Materials Withheld as Privileged filed by Sungil Cho, Synergy IP Corporation, Seung-Ho Ahn, Staton Techiya, LLC, 239 MOTION to Compel Discovery Regarding Samsung's Financial and Licensing Information filed by Synergy IP Corporation, Staton Techiya, LLC. from 9:00 am - 4:28 pm (No exhibits)(Court Reporter Shawn McRoberts.) (Attachments: # 1 Attorney Sign-In Sheet) (bga) (Entered: 02/14/2023)	
291	02/15/2023	MOTION to Take Deposition from TRYM HOLTER THIRD-PARTY WITNESS, AFTER THE CLOSE OF FACT DISCOVERY by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 02/15/2023)	

#	Date	Proceeding Text	Source
292	02/15/2023	REDACTION to 276 SEALED MOTION Counterclaim Defendants' Motion to Strike Untimely Supplemental Interrogatory Responses and Initial Disclosures by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit 8, # 2 Exhibit 9, # 3 Exhibit 10, # 4 Exhibit 11, # 5 Text of Proposed Order)(Granaghan, Christopher) (Entered: 02/15/2023)	
293	02/15/2023	REDACTION to 277 Sealed Response to Motion, to Compel Forensic Analysis by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Text of Proposed Order)(Granaghan, Christopher) (Entered: 02/15/2023)	
294	02/15/2023	Unopposed MOTION to Expedite BRIEFING SCHEDULE ON DEFENDANTS MOTION TO CONDUCT DEPOSITION OF THIRD-PARTY WITNESS TRYM HOLTER AFTER THE CLOSE OF FACT DISCOVERY by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 02/15/2023)	
295	02/16/2023	ORDER granting 294 Unopposed MOTION to Expedite BRIEFING SCHEDULE ON DEFENDANTS MOTION TO CONDUCT DEPOSITION OF THIRD-PARTY WITNESS TRYM HOLTER AFTER THE CLOSE OF FACT DISCOVERY. Plaintiffs Staton Techiya, LLC and Synergy IP Corporation may file an opposition by 10:00 AM on February 20, 2023. Signed by Magistrate Judge Roy S. Payne on 2/16/2023. (ch,) (Entered: 02/16/2023)	
296	02/16/2023	ORDER granting 289 Unopposed MOTION for Extension of Time to File Objections to Report and Recommendations (Dkt. 259). Signed by Magistrate Judge Roy S. Payne on 2/16/2023. (ch,) (Entered: 02/16/2023)	
297	02/16/2023	Sealed Motion Hearing Transcript. (smm,) (Entered: 02/16/2023)	
298	02/17/2023	Joint MOTION FOR CLARIFICATION re 285 Order by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 02/17/2023)	
299	02/17/2023	SEALED JOINT NOTICE REGARDING DKT. 239 MOTION TO COMPEL DISCOVERY REGARDING SAMSUNGS FINANCIAL AND LICENSING INFORMATION (Attachments: # 1 Exhibit A, # 2 Exhibit B, # 3 Exhibit C, # 4 Exhibit D, # 5 Exhibit E, # 6 Exhibit F, # 7 Exhibit G)(Flynn-O'Brien, Michael) (Entered: 02/17/2023)	
300	02/17/2023	Unopposed MOTION REGARDING THE SEALING AND UNSEALING OF CERTAIN PORTIONS re 297 Sealed Transcript by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 02/17/2023)	
301	02/20/2023	SEALED RESPONSE to Motion re 291 MOTION to Take Deposition from TRYM HOLTER THIRD-PARTY WITNESS, AFTER THE CLOSE OF FACT DISCOVERY filed by Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit 1, # 2 Text of Proposed Order)(Snodgrass, Jacob) (Entered: 02/20/2023)	Events since last full update
302	02/21/2023	ORDER granting 300 Unopposed MOTION REGARDING THE SEALING AND UNSEALING OF CERTAIN PORTIONS re 297 Sealed Transcript. Signed by Magistrate Judge Roy S. Payne on 2/21/2023. (ch,) (Entered: 02/21/2023)	Events since last full update
303	02/21/2023	Unopposed MOTION for Extension of Time to File Response/Reply TO COUNTERCLAIM DEFENDANTS MOTION TO STRIKE UNTIMELY SUPPLEMENTAL INTERROGATORY RESPONSES AND INITIAL DISCLOSURES [DKT. 276] by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 02/21/2023)	Events since last full update

#	Date	Proceeding Text	Source
304	02/21/2023	ORDER granting 298 Joint MOTION FOR CLARIFICATION re 285 Order. Signed by Magistrate Judge Roy S. Payne on 2/21/2023. (ch,) (Entered: 02/21/2023)	Events since last full update
305	02/21/2023	MEMORANDUM ORDER - denying 291 . Signed by Magistrate Judge Roy S. Payne on 2/21/2023. (ch,) (Entered: 02/22/2023)	Events since last full update
306	02/22/2023	ORDER granting 303 Unopposed MOTION for Extension of Time to File Response/Reply TO COUNTERCLAIM DEFENDANTS MOTION TO STRIKE UNTIMELY SUPPLEMENTAL INTERROGATORY RESPONSES AND INITIAL DISCLOSURES [DKT. 276], 276 SEALED MOTION Counterclaim Defendants' Motion to Strike Untimely Supplemental Interrogatory Responses and Initial Disclosures Responses due by 3/1/2023. Signed by Magistrate Judge Roy S. Payne on 2/22/2023. (ch,) (Entered: 02/22/2023)	Events since last full update
307	02/22/2023	SEALED RESPONSE to 259 Report and Recommendations, 109 Sealed Motion, to Dismiss filed by Seung-Ho Ahn, Sungil Cho, Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Exhibit 1, # 2 Exhibit 2, # 3 Text of Proposed Order)(Bumgardner, Brent) Modified on 2/22/2023 (ch,). (Entered: 02/22/2023)	Events since last full update
308	02/22/2023	OBJECTION TO CLAIM CONSTRUCTION filed by Staton Techiya, LLC, Synergy IP Corporation. (Snodgrass, Jacob) (Entered: 02/22/2023)	Events since last full update
309	02/22/2023	NOTICE by Staton Techiya, LLC Regarding Mediation (Snodgrass, Jacob) (Entered: 02/22/2023)	Events since last full update
310	02/24/2023	OBJECTION to 259 Report and Recommendations Granting in Part Defendants' Motion to Compel Materials Withheld as Privileged by Seung-Ho Ahn, Sungil Cho, Synergy IP Corporation. (Attachments: # 1 Text of Proposed Order)(Bumgardner, Brent) (Entered: 02/24/2023)	Events since last full update
311	02/24/2023	STATUS REPORT REGARDING THE MOTION TO COMPEL HEARING ON FEBRUARY 10, 2023 (JOINT) by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Smith, Melissa) (Entered: 02/24/2023)	Events since last full update
312	02/27/2023	REDACTION to 301 Sealed Response to Motion, to Take Deposition of Third-Party Trym Holter after Close of Fact Discovery by Staton Techiya, LLC, Synergy IP Corporation. (Attachments: # 1 Text of Proposed Order)(Snodgrass, Jacob) (Entered: 02/27/2023)	Events since last full update
313	02/28/2023	Unopposed MOTION for Extension of Time to File Response/Reply as to 276 SEALED MOTION Counterclaim Defendants' Motion to Strike Untimely Supplemental Interrogatory Responses and Initial Disclosures by Samsung Electronics America, Inc., Samsung Electronics Co., Ltd.. (Attachments: # 1 Text of Proposed Order)(Smith, Melissa) (Entered: 02/28/2023)	Events since last full update

Patents

Number	Title	Issued	Class	Subclass
8,111,839	Always on headwear recording system	02/07/2012	381	92
8,254,591	Method and device for audio recording	08/28/2012	381	74
8,315,400	Method and device for acoustic management control of multiple microphones	11/20/2012	381	57
9,124,982	Always on headwear recording system	09/01/2015	1	1
9,270,244	System and method to detect close voice sources and automatically enhance situation awareness	02/23/2016	1	1
9,491,542	Automatic sound pass-through method and system for earphones	11/08/2016	1	1

Number	Title	Issued	Class	Subclass
9,609,424	Method and device for personalized hearing	03/28/2017	1	1
10,405,082	Automatic keyword pass-through system	09/03/2019	1	1
10,966,015	Automatic keyword pass-through system	03/30/2021	1	1
10,979,836	Acoustic sealing analysis system	04/13/2021	1	1

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User Name: Manuel Saldana
Date and Time: Wednesday, March 1, 2023 8:55:00AM EST
Job Number: 191485088

Document (1)

1. *US Patent Issued to Staton Techiya on Feb. 8 for "Method and device for acute sound detection and reproduction" (British, American Inventors)*

Client/Matter: -None-
Search Terms: 11244666 OR 11,244,666
Search Type: Terms and Connectors
Narrowed by:

Content Type	Narrowed by
News	-None-

US Patent Issued to Staton Techiya on Feb. 8 for "Method and device for acute sound detection and reproduction" (British, American Inventors)

US Fed News

February 9, 2022 Wednesday GENERAL_EDIT_CORRECTION ERROR Document ID 525 Has error Validate old format failed - Input Date Invalid - 00:41: Unparseable date: "00:41" EST

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Length: 220 words

Dateline: ALEXANDRIA, Va.

Body

ALEXANDRIA, Va., Feb. 9 -- United States Patent no. ***11,244,666***, issued on Feb. 8, was assigned to Staton Techiya LLC (Delray Beach, Fla.).

"Method and device for acute sound detection and reproduction" was invented by Steven Wayne Goldstein (Delray Beach, Fla.), John Usher (Beer, Great Britain) and Marc Andre Boillot (Plantation, Fla.). According to the abstract* released by the U.S. Patent & Trademark Office: "Earpieces and methods for acute sound detection and reproduction are provided. A method can include measuring an external ambient sound level (xASL), monitoring a change in the xASL for detecting an acute sound, estimating a proximity of the acute sound, and upon detecting the acute sound and its proximity, reproducing the acute sound within an ear canal, where the ear canal is at least partially occluded by an earpiece. Other embodiments are disclosed." The patent was filed on Aug. 7, 2020, under Application No. 16/987,396. *For further information, including images, charts and tables, please visit: http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&p=1&u=%2Fnetahtml%2FPTO%2Fsearch-bool.html&r=1&f=G&l=50&co1=AND&d=PTXT&s1=11244666&OS=11244666&RS=11244666 For any query with respect to this article or any other content requirement, please contact Editor at contentservices@htlive.com

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Manuel Saldana

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REEXAM CONTROL NUMBER	FILING OR 371 (c) DATE	PATENT NUMBER
90/019,169	02/24/2023	11244666

CONFIRMATION NO. 7859

REEXAM ASSIGNMENT NOTICE

150139
Akerman LLP
777 South Flagler Drive
Suite 1100 West Tower
West Palm Beach, FL 33401

OC000000137484406

Date Mailed: 03/01/2023

NOTICE OF ASSIGNMENT OF REEXAMINATION REQUEST

The above-identified request for reexamination has been assigned to Art Unit 3992. All future correspondence to the proceeding should be identified by the control number listed above and directed to the assigned Art Unit.

A copy of this Notice is being sent to the latest attorney or agent of record in the patent file or to all owners of record. (See 37 CFR 1.33(c)). If the addressee is not, or does not represent, the current owner, he or she is required to forward all communications regarding this proceeding to the current owner(s). An attorney or agent receiving this communication who does not represent the current owner(s) may wish to seek to withdraw pursuant to 37 CFR 1.36 in order to avoid receiving future communications. If the address of the current owner(s) is unknown, this communication should be returned within the request to withdraw pursuant to Section 1.36.

NOTICE OF USPTO EX PARTE REEXAMINATION PATENT OWNER STATEMENT WAIVER PROGRAM

The USPTO has implemented a pilot program where, after a reexamination proceeding has been granted a filing date and before the examiner begins his or her review, the patent owner may orally waive the right to file a patent owner's statement. See *"Pilot Program for Waiver of Patent Owner's Statement in Ex Parte Reexamination Proceedings,"* 75 FR 47269 (August 5, 2010). One goal of the pilot program is to reduce the pendency of reexamination proceedings and improve the efficiency of the reexamination process.

Ordinarily when ex parte reexamination is ordered, the USPTO must wait until after the receipt of the patent owner's statement and the third party requester's reply, or after the expiration of the time period for filing the statement and reply (a period that can be as long as 5 to 6 months), before mailing a first determination of patentability. The USPTO's first determination of patentability is usually a first Office action on the merits or a Notice of Intent to Issue Reexamination Certificate (NIRC).

Under the pilot program, the patent owner's oral waiver allows the USPTO to act on the first determination of patentability immediately after determining that reexamination will be ordered, and in a suitable case issue the reexamination order and the first determination of patentability (which could be a NIRC if the claims under reexamination are confirmed) at the same time.

Benefits to the Patent Owner for participating in this pilot program include reduction in pendency.

To participate in this pilot program, Patent Owners may contact the USPTO's Central Reexamination Unit (CRU) at 571-272-7705. The USPTO will make the oral waiver of record in the reexamination file in an interview summary and a copy will be mailed to the patent owner and any third party requester.

cc: Third Party Requester(if any)
ARNOLD & PORTER KAYE SCHOLER LLP
601 MASSACHUSETTS AVE., NW
WASHINGTON, DC 20001-3743

/tplovelace/

Legal Instruments Examiner
Central Reexamination Unit 571-272-7705; FAX No. 571-273-9900

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REEXAM CONTROL NUMBER	FILING OR 371 (c) DATE	PATENT NUMBER
90/019,169	02/24/2023	11244666

CONFIRMATION NO. 7859

ARNOLD & PORTER KAYE SCHOLER LLP
601 MASSACHUSETTS AVE., NW
WASHINGTON, DC 20001-3743

REEXAMINATION REQUEST NOTICE

OC000000137484404

Date Mailed: 03/01/2023

NOTICE OF REEXAMINATION REQUEST FILING DATE

(Third Party Requester)

Requester is hereby notified that the filing date of the request for reexamination is 02/24/2023, the date that the filing requirements of 37 CFR § 1.510 were received.

A decision on the request for reexamination will be mailed within three months from the filing date of the request for reexamination. (See 37 CFR 1.515(a)).

A copy of the Notice is being sent to the person identified by the requester as the patent owner. Further patent owner correspondence will be the latest attorney or agent of record in the patent file. (See 37 CFR 1.33). Any paper filed should include a reference to the present request for reexamination (by Reexamination Control Number).

cc: Patent Owner
150139
Akerman LLP
777 South Flagler Drive
Suite 1100 West Tower
West Palm Beach, FL 33401

/tplovelace/

Legal Instruments Examiner
Central Reexamination Unit 571-272-7705; FAX No. 571-273-9900

PTO/SB/81C (12-08)
Approved for use through 09/30/2025. OMB 0651-0035
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Control Number(s)	90/019,169
Filing Date(s)	February 24, 2023
First Named Inventor	Seven Wayne GOLDSTEIN
Title	Method and Device for Acute Sound Detection and Reproduction
Patent Number	11,244,666
Examiner Name	To Be Assigned
Attorney Docket No(s).	0027071.00133

I hereby revoke all previous requester powers of attorney given in the above-identified reexamination proceeding control number(s).

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s) to prosecute the proceeding(s) identified above, and to transact all business in the United States Patent and Trademark Office connected therewith: 28381

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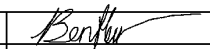
OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the *third party* requester.

☐ Proof of authority to act on behalf of requester submitted herewith or filed on _____ .

SIGNATURE of Third Party Requester

Signature		Date	2023/03/02
Name	Seung Woo Hur	Telephone	82-2-6147-8021
Title and Company	Senior Legal Counsel, Samsung Electronics Co., Ltd.		

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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
90/019,169	**03/02/2023 02:44:27 PM ET**	**0027071.00133**

Title of Invention

METHOD AND DEVICE FOR ACUTE SOUND DETECTION AND REPRODUCTION

Application Information

APPLICATION TYPE	Utility / ex parte reexam	PATENT #	11244666
CONFIRMATION #	7859	FILED BY	Sandra Tartisel
PATENT CENTER #	61679144	FILING DATE	02/24/2023
CUSTOMER #	150139	FIRST NAMED INVENTOR	- 11244666
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Ali Sharifahmadian

Documents

TOTAL DOCUMENTS: 2

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
666EPR_Executed_POA_SEC.pdf	2	Power of Attorney	171 KB
666EPR_Executed_POA_SEA.pdf	2	Power of Attorney	1904 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
666EPR_Executed_POA_SEC.pdf	6A1BF71BF35FC2BDDB16680A01119A137CAB9385211552D786C9C48B1B6E671E121C67416F2A62877383E325D314815E39EF52BDD46333E0042609ED282E7113

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This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

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Control Number(s)	90/019,169
Filing Date(s)	February 24, 2023
First Named Inventor	Steven Wayne GOLDSTEIN
Title	Method and Device for Audio Sound Detection and Reproduction
Patent Number	11,244,666
Examiner Name	To Be Assigned
Attorney Docket No(s).	0027071.00133

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I am the *third party* requester.

☐ Proof of authority to act on behalf of requester submitted herewith or filed on _____.

SIGNATURE of Third Party Requester

Signature	/Brittany Dietz/	Date	03/02/2023
Name	Brittany Dietz	Telephone	469-631-8081
Title and Company	Senior Legal Counsel, Samsung Electronics America, Inc.		

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
90/019,169	02/24/2023	11244666	0027071.00133	7859

150139 7590 03/03/2023

Akerman LLP
777 South Flagler Drive
Suite 1100 West Tower
West Palm Beach, FL 33401

EXAMINER	
GE, YUZHEN	

ART UNIT	PAPER NUMBER
3992	

MAIL DATE	DELIVERY MODE
03/03/2023	PAPER

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(THIRD PARTY REQUESTER'S CORRESPONDENCE ADDRESS)

Samsung Electronics Co., Ltd.
c/o Arnold & Porter Kaye Scholer LLP
601 Massachusetts Avenue, NW
Washington, DC 20001-3743

EX PARTE REEXAMINATION COMMUNICATION TRANSMITTAL FORM

REEXAMINATION CONTROL NO. *90/019,169* .

PATENT UNDER REEXAMINATION *11244666* .

ART UNIT *3992* .

Enclosed is a copy of the latest communication from the United States Patent and Trademark Office in the above identified *ex parte* reexamination proceeding (37 CFR 1.550(f)).

Where this copy is supplied after the reply by requester, 37 CFR 1.535, or the time for filing a reply has passed, no submission on behalf of the *ex parte* reexamination requester will be acknowledged or considered (37 CFR 1.550(g)).

/Patricia Martin, Paralegal/

PTOL-465 (Rev.07-04)

Ex Parte Reexamination Interview Summary – Pilot Program for Waiver of Patent Owner's Statement	**Control No.** 90/019,169	**Patent Under Reexamination is Requested** 11244666	
	Examiner Yuzhen GE	**Art Unit** 3992	**AIA (FITF) Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address. --

All participants (USPTO official and patent owner):

(1) Patricia Martin (3) _____

(2) John Keady, 56389 (4) _____

Date of Telephonic Interview: 28 February 2023.

A. The USPTO official requested waiver of the patent owner's statement pursuant to the pilot program for waiver of patent owner's statement in *ex parte* reexamination proceedings.*

☐ The patent owner **agreed** to waive its right to file a patent owner's statement under 35 U.S.C. 304 in the event reexamination is ordered for the above-identified patent.

☐ The patent owner **did not agree** to waive its right to file a patent owner's statement under 35 U.S.C. 304 at this time.

☑ USPTO personnel were unable to reach the patent owner.**

B. The Patent Owner of record telephoned the Office and indicated they would like to participate in the pilot program for waiver of patent owner's statement in *ex parte* reexamination proceedings.*

☐ The Patent owner of record telephoned the Office and **agreed** to waive its right to file a patent owner's statement under 35 U.S.C. 304 in the event reexamination is ordered for the above-identified patent.

The patent owner is not required to file a written statement of this telephone communication under 37 CFR 1.560(b) or otherwise. However, any disagreement as to this interview summary must be brought to the immediate attention of the USPTO, and no later than one month from the mailing date of this interview summary. Extensions of time are governed by 37 CFR 1.550(c).

*For more information regarding this pilot program, see *Pilot Program for Waiver of Patent Owner's Statement in Ex Parte Reexamination Proceedings, 75 Fed. Reg.* 47269 (August 5, 2010), available on the USPTO Web site at http://www.uspto.gov/patents/law/notices/2010.jsp.

**The patent owner may contact the USPTO personnel at (571) 272-7705 or at the telephone number provided below if the patent owner decides to waive the right to file a patent owner's statement under 35 U.S.C. 304.

/Patricia Martin/
Paralegal Specialist, OCRU (571) 272-5004
Signature and telephone number of the USPTO official, who contacted, was contacted by, or attempted to contact the patent owner.

cc: Requester (if third party requester)

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
90/019,169	02/24/2023	11244666	0027071.00133	7859

150139 7590 05/23/2023

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West Palm Beach, FL 33401

EXAMINER	
GE, YUZHEN	

ART UNIT	PAPER NUMBER
3992	

MAIL DATE	DELIVERY MODE
05/23/2023	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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Where this copy is supplied after the reply by requester, 37 CFR 1.535, or the time for filing a reply has passed, no submission on behalf of the *ex parte* reexamination requester will be acknowledged or considered (37 CFR 1.550(g)).

Order Granting Request For Ex Parte Reexamination	Control No. 90/019,169	Patent Under Reexamination 11244666	
	Examiner YUZHEN GE	Art Unit 3992	AIA (FITF) Status No

--The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

The request for *ex parte* reexamination filed 02/24/2023 has been considered and a determination has been made. An identification of the claims, the references relied upon, and the rationale supporting the determination are attached.

Attachments: a)☐ PTO-892, b)☐ PTO/SB/08, c)☑ Other: Substitute 1449

1. ☑ The request for *ex parte* reexamination is GRANTED.

RESPONSE TIMES ARE SET AS FOLLOWS:

For Patent Owner's Statement (Optional): TWO MONTHS from the mailing date of this communication (37 CFR 1.530 (b)). **EXTENSIONS OF TIME ARE GOVERNED BY 37 CFR 1.550(c).**

For Requester's Reply (optional): TWO MONTHS from the **date of service** of any timely filed Patent Owner's Statement (37 CFR 1.535). **NO EXTENSION OF THIS TIME PERIOD IS PERMITTED.** If Patent Owner does not file a timely statement under 37 CFR 1.530(b), then no reply by requester is permitted.

cc:Requester (if third party requester)

ORDER GRANTING REQUEST FOR *EX PARTE* REEXAMINATION – CONTINUED

I. ACKNOWLEDGMENTS

On Feb. 24, 2023, Third Party Requester ("**Requester**") filed a request ("**Request**") for *ex parte* reexamination of claims 1-11 ("**Requested Claims**") of US Patent 11,244,666 ("**the '666 Patent**") which issued to Goldstein et al with title "METHOD AND DEVICE FOR ACUTE SOUND DETECTION AND REPRODUCTION." The '666 Patent was filed on Aug. 7, 2020 with application number 16/987,396 ("**the 396 Application**") and issued on Feb. 8, 2022 with claims 1-11.

Based on the analysis herein, *ex parte* reexamination of claims 1-11 of the '666 Patent is ordered.

II. PRIORITY CLAIMS

Based upon a review of the '666 Patent, the Examiner finds that the '666 Patent or the 396 Application claims the following domestic priority:

It is a continuation of and claims priority to U.S. patent application Ser. No. 16/669,490, filed 30 Oct. 2019, which is a continuation of and claims priority to U.S. patent application Ser. No. 16/193,568, filed 16 Nov. 2018, now U.S. Pat. No. 10,535,334, which is a continuation of and claims priority to U.S. patent application Ser. No. 14/574,589, filed on Dec. 18, 2014, now U.S. Pat. No. 10,134,377, which claims priority to and is a continuation of U.S. patent application Ser. No. 12/017,878, filed on Jan. 22, 2008, now U.S. Pat. No. 8,917,894, which claims the benefit of U.S. Provisional Patent Application Ser. No. 60/885,917, filed on Jan. 22, 2007.

The '666 Patent does not claim any foreign priority.

Because the effective filing date of the '666 Patent is not on or after March 16, 2013, the AIA First Inventor to File ("AIA-FITF") provisions do not apply and instead the earlier 'First to Invent' provisions apply.

III. PRIOR OR CONCURRENT PROCEEDINGS

Based upon Examiner's review of the '666 Patent itself, the Request, and its prosecution history, the Examiner finds that there are no prior or concurrent *ex parte* or supplemental reexaminations for the '666 Patent.

There was a petition for *inter partes* review, IPR2022-01099, filed on June 9, 2022 which was not instituted (Decision Denying Institution of IPR2022-01099, pp. 16-19, 24-25 and 29-30).

IV. REFERENCES

A. References Cited Herein

i. US Patent 6,647,368 to Nemirovski, filed on Jul. 2, 2001 and issued on Nov. 11, 2003.

ii. US Patent Application Publication 2001/0046304 A1 to Rast, filed on Apr. 24, 2001 and issued on Nov. 29, 2001.

iii. European Patent Application Publication No. EP1640972A1 to Dijkstra et al ("Dijkstra"), filed on Dec. 23, 2005 and published on March 29, 2006.

iv. U.S. Patent Application Publication No. 2004/0047486A1 to Van Doorn et al ("Van Doorn"), filed on Sep. 6, 2002, published on Mar. 11, 2004.

v. European Patent Application Publication No. EP1519625A2 to Victorian et al ("Victorian"), filed on Sep. 13, 2004 and published on March 3, 2005.

vi. U.S. Patent Application Publication No. 2006/0153394A1 ("Beasley") filed on Jan. 10, 2006, published on Jul. 13, 2006.

vii. U.S. Patent No. 5,251,263 to Andrea et al ("Andrea"), issued on Oct. 5, 1993.

viii. U.S. Patent No. 7,903,826 to Boersma, filed on Mar. 8, 2006, issued on Mar. 8, 2011.

B. Availability of References for Rejections Under 35 U.S.C. § 102

References i-ii, iv-v, and vii, i.e., Nemirovski, Rast, Van Doorn, Victorian, and Andrea, qualify as prior art under § 102 (b).

Reference iii, i.e., Dijkstra, qualifies as prior art under § 102 (a).

References vi and viii, i.e., Beasley and Boersma, qualifies as prior art under § 102 (e).

It appeared that Nemirovski, Van Doorn, Andrea and Beasley were not cited nor considered during the original prosecution of the '666 Patent.

Therefore Nemirovski in view of Rast, Dijkstra, Van Doorn can be used to raise a Substantial New Question of Patentability ("**SNQ**") for claims 1-11 in this *ex parte* reexamination proceeding.

Also Van Doorn, Andrea and Beasley can be used in combination with other references such as Victorian and Dijkstra to raise a SNQ.

Further, an old reference such as Victorian or Dijkstra can be used when the combinations based on Victorian or Dijkstra are presented in a new light. See MPEP 2258.

V. PROSECUTION HISTORY

The Examiner has reviewed the prosecution history file provided by the third-party requester (see Request at pp. 20-24) and essentially agrees with the Requester's summary of the prosecution history. The prosecution history can be summarized below.

A. Prosecution History of the '666 Patent

On Sep. 28, 2020, the Office mailed a non-final office action for the 396 Application which rejected claims 1-3, 7, 9-11 and 14 under 35 USC §102 (e) by Goldstein et al (US Patent Pub. 2008/0240458) and claims 4-6, 8 and 12-13 under 35 USC §112 1st paragraph.

On Dec. 28, 2020, the Applicant filed a response.

On Jan. 28, 2021, the Office mailed a non-final office action ("Jan 2021 Non-final Office Action") which rejected claims 1-11 and 14 under 35 USC §102 (b) by Alley (US Patent Pub. 2004/0179694).

On Mar. 18, 2021, Applicant filed a response to the Jan 2021 Non-final Office Action.

On Apr. 2, 2021, the Office mailed a final office action ("Apr 2021 Final Office Action") which rejected claims 2-3 under 35 USC §112 1st paragraph and indicated claims 1, 4-11 and 14-15 allowable.

On Jun. 1, 2021, the Office mailed a non-final office action which rejected claims 1, 4-9, 11 and 14-15 under 35 USC §103.

On Aug. 4, 2021, Applicant filed a response and amended first two limitations of claim 1 as follows:

> a first microphone configured to measure an ambient acoustic environment, wherein the first microphone has a first microphone port that is configured to face away from a user when the earphone is inserted;

> a second microphone configured to measure an acoustic environment closer the ear canal of a wearer than that measured by the first microphone, wherein the second microphone has a second microphone port that is configured to face toward the user when the earphone is inserted;

On Aug. 16, 2021, the Office mailed a final office action rejecting claims 1, 4-9, 11 and 14-15 under 35 USC §103 over Terlizzi (US 2008/0165988 A1) Dijkstra (US 2007/0147635 A1) and Gauger, Jr (US 2006/0262938 A1).

The Examiner relied on Terlizzi to disclose the following limitations:

> a first microphone configured to measure an ambient acoustic environment (2250, capable of picking up ambient sounds);
>
> a second microphone (2106) configured to measure an acoustic environment closer the ear canal of a wearer than that measured by the first microphone (note locations of microphones 2106 and 2250 are used at different locations relative to a user's ear and therefor ear canal);
>
> a speaker (2102, 2104) configured to play an audio signal; and
>
> a processor (2210) that is configured to execute instructions to perform operations, wherein the processor is coupled to the first microphone (figure 2), wherein the processor is coupled to the second microphone (figure 2), wherein the speaker is coupled to the processor (figure 2), and the operations comprising:
>
> receiving a first microphone signal from the first microphone (figure 2, via use of element 2222);
>
> receiving a second microphone signal from the second microphone (figure 2, via use of element 2222); generating an ambient sound signal from at least one of the first microphone signal or the second microphone signal or a combination of both signals (paragraph [0028]);
>
> applying an ambient sound gain to the ambient sound signal to generate a modified ambient sound signal (paragraph [0028] by the use of parameters for amplification gain);
>
> mixing (use or combiner (2224)) the modified ambient sound signal with an audio content signal (from music storage (2230) to generate a mixed audio signal; and
>
> sending the mixed audio signal to the speaker (figure 2, by use of (2226)).

-Aug 2021 Final Office Action, 16/987,396, pp. 3-4.

On Oct. 25, 2021, Applicant filed a response and a declaration under 37 CFR § 1.131 to predate the reference of Terlizzi.

On Nov. 9, 2021, the Office mailed a Notice of Allowability.

B. IPR2022-01099

Requester filed a petition for *inter partes* review, i.e., IPR2022-01099 of claims 1-2 and 8-11 of the '666 Patent on Jun. 9, 2022. On Jan. 3, 2023, PTAB denied institution because PTAB found that none of references used in the petition disclosed a "*first microphone port that is configured to face away from a user when the earphone is inserted*" and a "*second microphone port that is configured to face toward the user when the earphone is inserted*" (Decision Denying Institution of IPR, pp. 16-19, 24-25 and 29-30). PTAB noted that the Petition did "not provide a construction or otherwise explain what either 'first microphone port' or the 'second microphone port' encompasses," and that the "record does not help [the Board] ascertain the plain and ordinary mean of 'microphone port.'" (*Id.*, p. 28).

C. Summary

Based on the prosecution history, a reference or a combination of references that discloses the following technical feature of claim 1, i.e.,

> a first microphone configured to measure an ambient acoustic environment;
> a second microphone configured to measure an acoustic environment closer the ear canal of a wearer than that measured by the first microphone;
> a speaker configured to play an audio signal;
> a processor that is configured to execute the instructions to perform operations, wherein the processor is coupled to the first microphone, wherein the

processor is coupled to the second microphone, wherein the speaker is coupled to the processor, and the operations comprising:

receiving a first microphone signal from the first microphone;

receiving a second microphone signal from the second microphone;

generating an ambient sound signal from at least one of the first microphone signal or the second microphone signal or a combination of both signals;

applying an ambient sound gain to the ambient sound signal to generate a modified ambient sound signal;

mixing the modified ambient sound signal with an audio content signal to generate a mixed audio signal; and

sending the mixed audio signal to the speaker.

in the context of an earphone device will raise an SNQ.

VI. PROPOSED SUBSTANTIAL NEW QUESTION OF PATENTABILITY

A. Proposed SNQs

The Request alleges the following substantial new questions of patentability (SNQs) based on the above-identified art:

SNQ1: A SNQ as to Claims 1-11 is raised by Nemirovski in view of Rast.

SNQ2: A SNQ as to Claims 1-11 is raised by Nemirovski in view of Rast and Dijkstra.

SNQ3: A SNQ as to Claims 1-11 is raised by Nemirovski in view of Rast and Van Doorn.

SNQ4: A SNQ as to Claims 1-2, 8-9 and 11 is raised by Victorian in view of Dijkstra and Beasley.

SNQ5: A SNQ as to Claims 10 is raised by Victorian in view of Dijkstra and Beasley and Andrea.

SNQ6: A SNQ as to Claims 1-2, 8-9 and 11 is raised by Victorian in view of Van Doorn and Beasley.

SNQ7: A SNQ as to Claims 10 is raised by Victorian in view of Van Doorn and Beasley and Andrea.

SNQ8: A SNQ as to Claims 1 and 11 is raised by Dijkstra in view of Boersma.

SNQ9: A SNQ as to Claims 2, 8 and 9 is raised by Dijkstra in view of Boersma and Beasley.

SNQ10: A SNQ as to Claims 1 and 11 is raised by Dijkstra in view of Boersma and Van Doorn.

SNQ11: A SNQ as to Claims 2, 8 and 9 is raised by Dijkstra in view of Boersma and Van Doorn and Beasley.

B. SNQ1-SNQ3 - Nemirovski in view of Rast, Dijkstra ,Van Doorn or Andrea

Nemirovski is directed to "a sensor placed with respect to an ear" that is "used to detect physical or mental actions of a person such as speech" and "and provides an output which can be converted into system control functions." *(Nemirovski,* l:13-20.)

In view of the prior art, Nemirovski discloses a "more aesthetically pleasing and comfortable" device, including an "internal microphone" that is "disposed with respect to an ear of a user and detects air pressure changes within the ear." *(Id.,* 4:1-7.) The sensor can "detect a person's speech" which can be used for many purposes including voice recognition or retransmitting the detected speech with a cell phone. *(Id.,* 4: 14-23.) In addition, Nemirovski discloses implementing in the sensor an external microphone to detect "air pressure changes, or sounds, originating outside the user's ear." *(Id.,* 4:24-33.) The sensor can also include a speaker. *(Id.,* Fig.1C, 8:6-9,14:1-6.) Nemirovski explains that this device can be used for many purposes.

(Id., 5: 1-27.) For example, it may be used by a handicapped person to control operation of a computer, machinery, or a video game. *(Id.)*

Nemirovski describes a sensor 12 having an internal microphone 34 and an external microphone 54 each disposed on a housing 150 "to be inserted at least part way into the ear of a person." (*Id*, 9:5-28.) FIG. 2B, reproduced and annotated below, "illustrates sensor 12 inserted at least partially into the ear 100 of a person" (*Id*, 11:63-67):

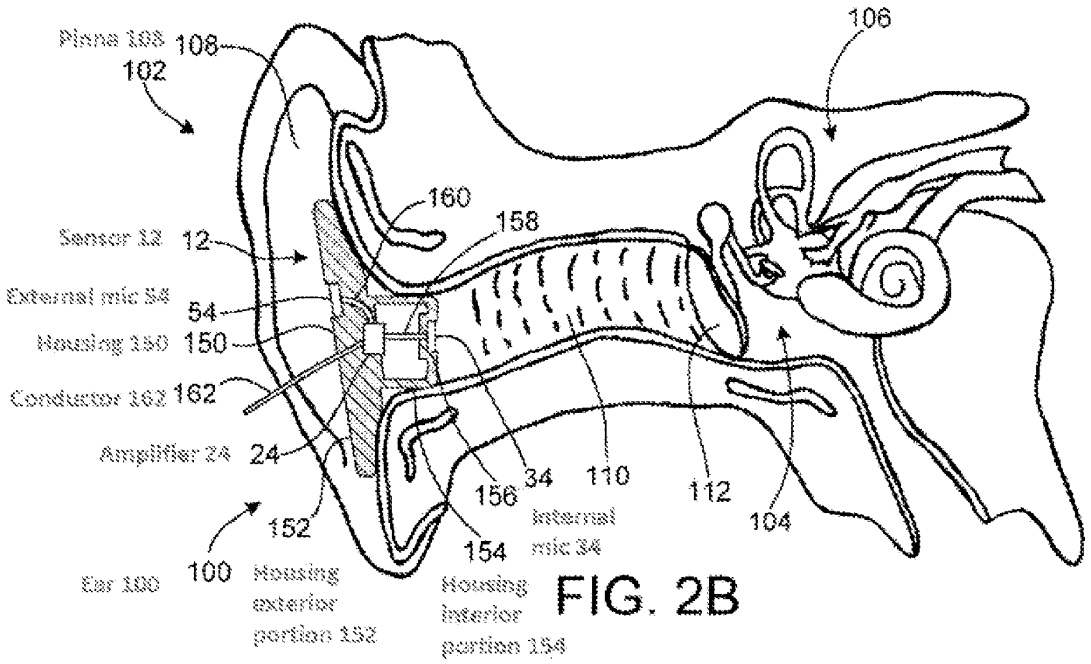


FIG. 2B

-Fig. 2B of Nemirovski,(annotated).

Nemirovski discloses system 52 including an external microphone 54 (first earphone) and an "internal microphone 34" (second earphone) that is disposed on housing 150. (Nemirovski, 9:10-15; see also Figs. 1E & 2B.) Nemirovski explains that "internal microphone 34 detects air pressure changes" within the ear. (*Id.*, 9:15-17.) Nemirovski explains that the disclosure uses the term "changes in air pressure: to characterize "the parameter being measured." (*Id*, 11:20-23.) Nemirovski further describes "[c]hanges in air pressure" as "sound waves." (*Id*, 11:23-24.)

Thus, a POSITA would have understood Nemirovski's internal microphone 34 detecting air pressure changes located within the ear to comprise a second microphone configured to measure an acoustic environment closer the ear canal of a wearer than that measured by the external microphone 54.

As can be seen in Fig. 2B of Nemirovski, the first earphone 54 has a port or opening that measures or faces away from the user when the earphone is inserted into user's ear while the second earphone 34 has a port or opening that measures or faces towards the user when the earphone is inserted into user's ear.

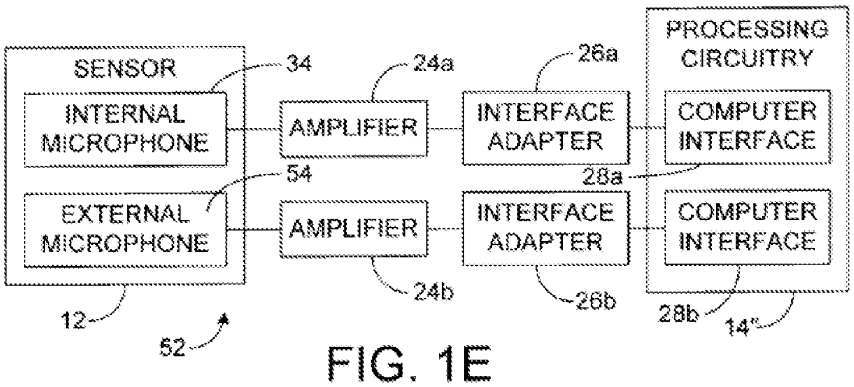


FIG. 1E

-Fig. 1E of Nemirovski.

Nemirovski discloses that each of internal microphone 34 and external microphone 54 are connected to processing circuitry 14. (*Id*, 9:29-41.) Nemirovski also describes a speaker 38 included within the housing 150.

Rast explains that, when utilizing the headset in a digital embodiment with a digital input source, audio input would be routed through the DSP/microcontroller on the way to the speakers, enabling power to be easily derived from the digital signal or bias level embedded within the signal. (Rast, ¶ [0063].)

Rast also discloses that in "hearthrough mode," the "acoustics of the environment" are routed to the headset wearer at a "user selected amplification level." (¶[0017].) Rast further discloses that "one preferred method delivers environmental audio to the wearer during a predetermined interval by amplifying the signal from the microphone and playing it over the speakers within the earpieces." (*Id*, ¶[0022]; see also *Id*, ¶¶[0051], [0053], [0057], [0058], [0060], [0061], and Table 1.) Rast further explains that in "hearthrough" mode, "external sounds picked up by the microphones are amplified and played within the earcups, preferably in concert with attenuating the audio amplitude of the programmed sound source." (*Id*, ¶[0058]; see also *Id*, ¶¶[0011], [0012], [0014], [0021], [0023], [0025], [0051], [0059], [0060], Table 1.)

Therefore Nemirovski in view of Rast discloses or suggests:

> a first microphone configured to measure an ambient acoustic environment;
> a second microphone configured to measure an acoustic environment closer the ear canal of a wearer than that measured by the first microphone;
> a speaker configured to play an audio signal;
> a processor that is configured to execute the instructions to perform operations, wherein the processor is coupled to the first microphone, wherein the processor is coupled to the second microphone, wherein the speaker is coupled to the processor, and the operations comprising:
> receiving a first microphone signal from the first microphone;
> receiving a second microphone signal from the second microphone;
> generating an ambient sound signal from at least one of the first microphone signal or the second microphone signal or a combination of both signals;
> applying an ambient sound gain to the ambient sound signal to generate a modified ambient sound signal;
> mixing the modified ambient sound signal with an audio content signal to generate a mixed audio signal; and
> sending the mixed audio signal to the speaker.

Based on the above analysis, the Examiner herein concludes that a reasonable examiner would find the teachings of Nemirovski and Rast important in deciding whether or not the technical feature of claim 1 is patentable. Therefore the Examiner agrees with the Requester that Nemirovski in view of Rast raises a substantial new questions of patentability for claim 1 of the

'666 Patent. Because Nemirovski in view of Rast raises an SNQ for claim 1, Nemirovski in view of Rast further in view of Dijkstra ,Van Doorn or Andrea also raises an SNQ for claim 1 and dependent claims 2-11 or the Requested Claim of the '666 Patent.

The teachings of Nemirovski in view of Rast and Nemirovski in view of Rast further in view of Dijkstra ,Van Doorn or Andrea were not cumulative to any written discussion of the Requested Claims on the record in the prosecution history. Additionally, the teachings of Nemirovski in view of Rast and Nemirovski in view of Rast further in view of Dijkstra ,Van Doorn or Andrea regarding the Requested Claims, were not previously addressed during a prior examination, and are not the subject of a final holding of invalidity by Federal Courts.

C. SNQ4-SNQ7 - Victorian in view of Beasley, Dijkstra or Van Doorn

Victorian discloses ear-level device 110 including an "external microphone 420 [that] picks up ambient sound" and an "[e]ar canal microphone 440 [that] detects sound from the ear canal," that is primarily the wearer's speech. (Victorian, Fig., 4A, ¶[0030].) Victorian discloses implementing ear-level device 110 with an earmold that fully occludes the ear to maximize audio efficiency. *(Id,* Abstract,¶ [0027].) See also Fig. 1 that shows the ear-level device 110 worn by a user.

Victorian discloses that "[p]rocessor 460 converts" the signals received from external microphone 420 to a sound audible to the user and that the processor includes "amplification circuitry, filtering circuitry, acoustic feedback reduction circuitry, noise reduction circuitry, and tone control circuitry, among other circuits performing signal processing functions as known in the art." (*Id*, ¶[0030].) Victorian also discloses that

processor 460 includes a "speech recognition module" that "enhances" the converted ambient sound signal to "improve the signal-to-noise ratio." (*Id*, ¶¶[0030], [0052].)

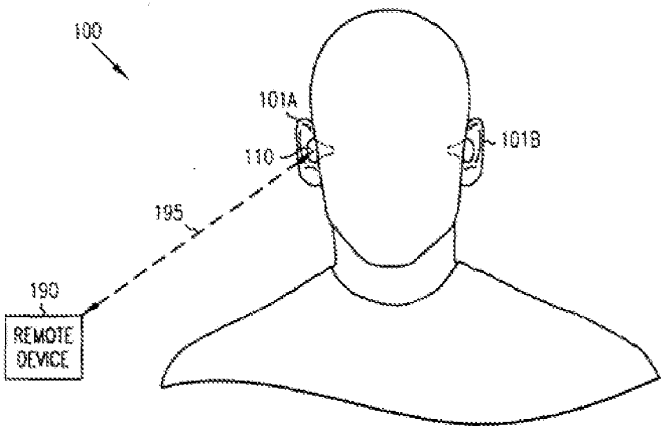


FIG. 1

-Fig. 1 of Victorian showing the ear-level device 110.

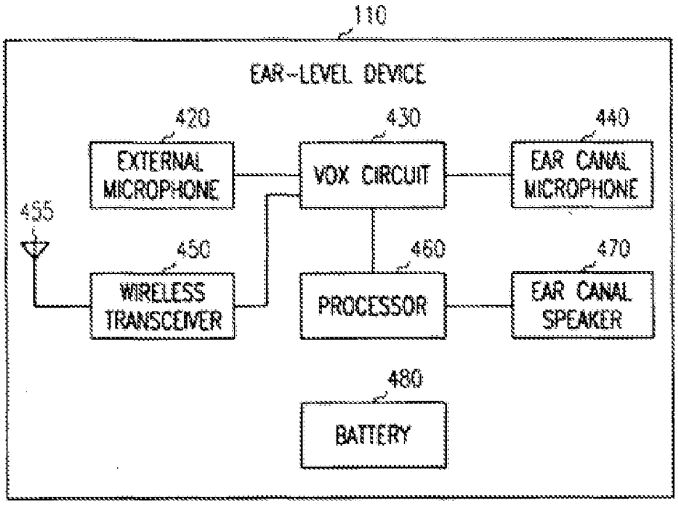


FIG. 4A

-Fig. 4A of Victorian showing external microphone 420 and ear canal microphone 440.

Beasley discloses digitizing a background noise signal and providing the digitized signal to DSP 996, which is utilized to "enhance the background audio signal such that the conversation or other audio that the user desires to hear in the bypass mode is better heard via speaker 332." Beasley also discloses utilizing a digital signal processor to amplify the speech signal. (Beasley, ¶[0054] "Once digitized, these signals can be processed utilizing a digital signal processor to, for example, amplify the speech signal, diminish the background noise, and inhibit the audio signal 314 from passing through to speaker 332.")

Beasley describes an embodiment in which a noise cancellation signal 728, a background audio signal 726, and an audio signal 314 are selectively provided to a user. (*Id*, ¶[0053].)

Therefore Victorian in view of Beasley discloses or suggests:

> a first microphone configured to measure an ambient acoustic environment;
> a second microphone configured to measure an acoustic environment closer the ear canal of a wearer than that measured by the first microphone;
> a speaker configured to play an audio signal;
> a processor that is configured to execute the instructions to perform operations, wherein the processor is coupled to the first microphone, wherein the processor is coupled to the second microphone, wherein the speaker is coupled to the processor, and the operations comprising:
> receiving a first microphone signal from the first microphone;
> receiving a second microphone signal from the second microphone;
> generating an ambient sound signal from at least one of the first microphone signal or the second microphone signal or a combination of both signals;
> applying an ambient sound gain to the ambient sound signal to generate a modified ambient sound signal;
> mixing the modified ambient sound signal with an audio content signal to generate a mixed audio signal; and
> sending the mixed audio signal to the speaker.

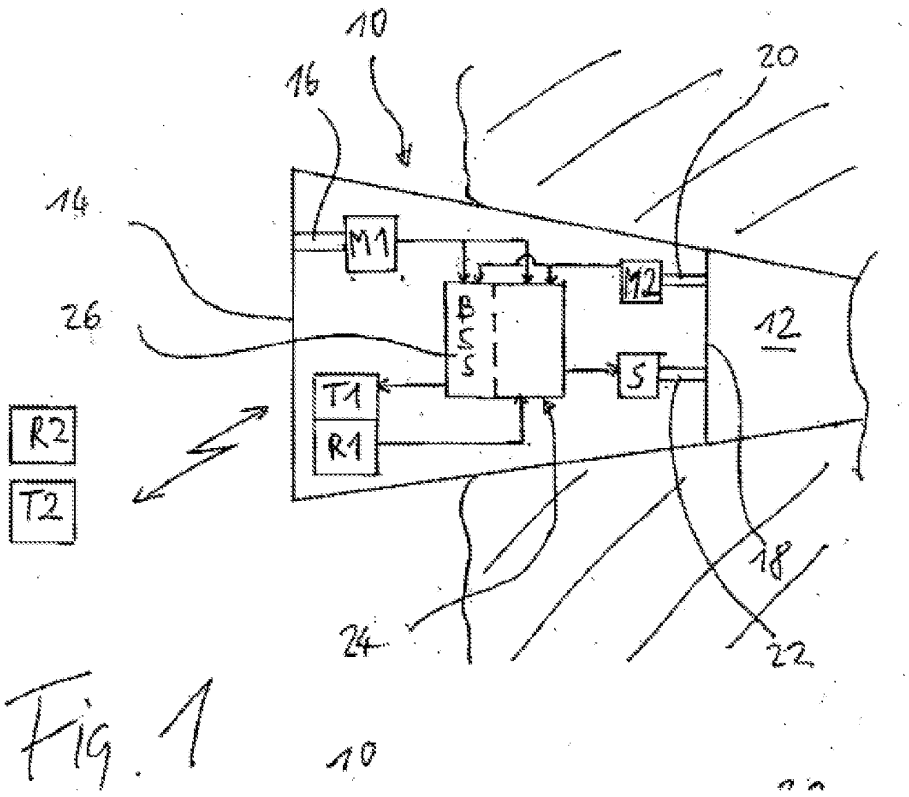
Based on the above analysis, the Examiner herein concludes that a reasonable examiner would find the teachings of Victorian and Beasley important in deciding whether or not the technical feature of claim 1 is patentable. Therefore the Examiner agrees with the Requester that Victorian in view of Beasley raises a substantial new questions of patentability for claim 1 of the

'666 Patent. Because Victorian in view of Beasley raises an SNQ for claim 1, Victorian in view of Beasley further in view of Dijkstra ,Van Doorn or Andrea also raises an SNQ for claim 1 and dependent claims 2 and 8-11 of the '666 Patent.

The teachings of Victorian in view of Beasley and Victorian in view of Beasley further in view of Dijkstra ,Van Doorn or Andrea were not cumulative to any written discussion of the Requested Claims on the record in the prosecution history. Additionally, the teachings of Victorian in view of Beasley and Victorian in view of Beasley further in view of Dijkstra, Van Doorn or Andrea regarding the Requested Claims, were not previously addressed during a prior examination, and are not the subject of a final holding of invalidity by Federal Courts.

D. SNQ8-11: – Dijkstra in view of Boersma, Beasley or Van Doorn

Dijkstra discloses a "hearing protection device" comprising an earplug inserted into the user's ear and that implements a blind source separation ("BSS") algorithm to obtain an intelligible speech signal for use in wireless communications. (Dijkstra, ¶¶[0010], [0013].) The earplug includes an outer microphone M1, an inner microphone M2, and an audio signal processing unit 24 including a BSS unit 26. *(Id.,* ¶[0029].) The outer microphone M1 is open to the outer end 14 of the earplug via a sound channel 16 and primarily picks up ambient sound. *(Id.,* ¶¶[0029], [0031].) The inner microphone M2 is open to the inner end 18 of the earplug via sound channel 20 and primarily picks up the user's voice. *(Id.)* The audio signal processing unit includes a digital signal processor and program and data memory components. *(Id.,* ¶[0029]). The processing unit also includes a transceiver and receiver for communication with a mobile telephone.*(Id,* ¶¶[0030], [0032], [0033].)



-Fig. 1 of Dijkstra showing outer microphone M1 and inner microphone M2.

Dijkstra discloses that the earplug includes a speaker to provide an external or remote audio signal, for example, from a mobile telephone, to the user to provide bidirectional communication. (*Id*, ¶¶[0017], [0029]-[0030], [0032], [0034].)

Dijkstra discloses that the earplug IO includes an audio signal processing unit including a digital signal processor that has a program memory component. (*Id*, ¶[0029].)

Boersma discloses that the mix switch 74 provides the user with control over the mix of ambient sound signal and the audio signal. (Boersma, 7:30-46, 8:12-26.) Boersma also discloses that the processor includes a level detector 92 that, together with adjustable gain amplifier 92, is used to automatically adjust the level of an ambient sound signal in proportion to changes in the level of the received audio signal. (*Id*, 8:33-42.) "In this manner, even if the user adjusts the audio output volume of the mobile phone IO or other electronic equipment, the mix ratio of the audio signal and the

ambient sound signal will remain substantially constant." (*Id*, 8:42-46.) Thus, the ambient sound signal from the microphone 50 is amplified by a variable gain amplifier 90 in response to a signal from level detector 92 to ensure that the selected ratio of ambient sound to audio will be kept constant. (*Id*, 8:33-46.)

Boersma discloses a mix switch 74 that controls the adjustable gain amplifier 91 and gives the user control over the "ratio by which the processor 34 combines the audio signal from the mobile telephone 10 and the ambient sound signal from the microphones 50." (*Id*, 7:30-33, 8:15-18.) The switch gives the user control over whether the earpieces provide more or less ambient sound in relation to an incoming audio signal. (*Id*, 7:33-36.) The user can (1) block most or all of the environmental sound, (2) retain ambient sound at a lower level, or (3) retain ambient sound at a higher level. (*Id*, 7:36-46.)

Boersma further discloses that adder 82 "functions to combine the ambient sound signal with the audio signal from the mobile phone 10." (*Id*, 8:19-21)

Therefore Dijkstra in view of Boersma discloses or suggests:

> a first microphone configured to measure an ambient acoustic environment;
> a second microphone configured to measure an acoustic environment closer the ear canal of a wearer than that measured by the first microphone;
> a speaker configured to play an audio signal;
> a processor that is configured to execute the instructions to perform operations, wherein the processor is coupled to the first microphone, wherein the processor is coupled to the second microphone, wherein the speaker is coupled to the processor, and the operations comprising:
> receiving a first microphone signal from the first microphone;
> receiving a second microphone signal from the second microphone;
> generating an ambient sound signal from at least one of the first microphone signal or the second microphone signal or a combination of both signals;
> applying an ambient sound gain to the ambient sound signal to generate a modified ambient sound signal;
> mixing the modified ambient sound signal with an audio content signal to generate a mixed audio signal; and
> sending the mixed audio signal to the speaker.

Based on the above analysis, the Examiner herein concludes that a reasonable examiner would find the teachings of Dijkstra in view of Boersma important in deciding whether or not the technical feature of claim 1 is patentable. Therefore the Examiner agrees with the Requester that Dijkstra in view of Boersma raises a substantial new questions of patentability for claim 1 of the '666 Patent. Because Dijkstra in view of Boersma raises an SNQ for claim 1, Dijkstra in view of Boersma further in view of Beasley or Van Doorn also raises an SNQ for dependent claims 1-2, 8-9 and 11 of the '666 Patent.

The teachings of Dijkstra in view of Boersma and Dijkstra in view of Boersma further in view of Beasley or Van Doorn were not cumulative to any written discussion of the Requested Claims on the record in the prosecution history. Additionally, the teachings of Dijkstra in view of Boersma and Dijkstra in view of Boersma further in view of Beasley or Van Doorn regarding the Requested Claims, were not previously addressed during a prior examination, and are not the subject of a final holding of invalidity by Federal Courts.

35 USC 325(d)

35 USC 325(d) states in part that "[I]n determining whether to institute or order a proceeding under this chapter, chapter 30, or chapter 31, the Director may take into account whether, and reject the petition or request because, the same or substantially the same prior art or arguments previously were presented to the Office." Thus, pursuant to the statute, in order for the Director to exercise discretion as to whether to Order a reexamination proceeding under chapter 30, the request must first be determined to be based on the same or substantially the same prior art or arguments previously were presented to the Office.

A review of the post grant history of the '666 patent indicates that the patent was the subject of a single Office post grant challenge.

On June 9, 2022, Petitioner Samsung Electronics Co, filed a single petition seeking *inter partes* review of claims 1,2 and 8-11 asserting the following grounds as raising a reasonable likelihood in prevailing (RLP) in showing the unpatentability of these claims (IPR2022-01099).

Ground	Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
2A	1, 11	103(a)	Victorian[5], Inanaga
2B	2, 8–10	103(a)	Victorian, Inanaga, Kvaloy
3A	1, 11	103(a)	Inanaga
3B	2, 8–10	103(a)	Inanaga, Engle[6]

On January 3, 2023, the Patent Trial and Appeal Board (PTAB) denied institution on the merits pursuant to 35 USC 314(a). In the decision denying *inter partes* review, the PTAB found that none of references cited in the petition were demonstrated to disclose a "first microphone port that is configured to face away from a user when the earphone is inserted" and a "second microphone port that is configured to face toward the user when the earphone is inserted" (See Decision Denying Institution of IPR, pp. 16-19, 24-25 and 29-30). The PTAB specifically noted that the Petition did "not provide a construction or otherwise explain what either 'first microphone port' or the 'second microphone port' encompasses," and that the "record does not help [the Board] ascertain the plain and ordinary mean of 'microphone port.'" (Id, p. 28).

A comparison between the prior art and arguments presented in the instant Request *for ex parte* reexamination of the '666 patent indicates that the neither the prior art nor arguments are the same or substantially the same as the art or arguments presented in the prior denied *inter partes* review petition.

As an initial matter none of the grounds asserting a substantial new question of patentability (SNQ) presented in the Request for the '666 patent are identical to or rely on any of

the same prior art references as compared to any of the grounds presented in the prior denied IPR petition.

Further, in addition, as pointed out above and in the Request, the newly presented prior art references Nemirovski, Victorian and Dijkstra, each disclose the claimed limitations of a "first microphone port that is configured to face away from a user when the earphone is inserted" and a "second microphone port that is configured to face toward the user when the earphone is inserted" (See pages 51, 92 and page 125 or the February 24, 2023 Request).

Thus, because the arguments in the Request cite to this newly presented prior art reference as providing the teachings of the limitations held to be missing from the prior denied IPR petition, neither the prior art nor the arguments presented in the Request are the same or substantially the sameas those that were previously presented to the Office.

Accordingly, the Request does not meet the threshold for a discretionary denial of reexmation pursuant to 35 USC 325(d).

Thus, the Request to reexamine claims 1, 2 and 8-11 of the '666 patent is GRANTED in view of the determination above that the Request raises a substantial new question of patentability (SNQ) as to the requested claims.

VII. PATENT OWNER STATEMENT (OPTIONAL)

In response to this Order for Reexamination, the Patent Owner is given a two (2) month period to file an optional Patent Owner Statement in accordance with 37 C.F.R. 1.530(b) and (c). The Patent Owner Statement must clearly point out why the patent claims are believed to be patentable, considering the cited prior art patents or printed publications alone or in any reasonable combination. In addition, the Patent Owner may utilize the Patent Owner Statement

to introduce amendments. A copy of the Patent Owner Statement must be served on the Third-Party Requester. See MPEP § 2249.

If a Patent Owner Statement is timely filed and served on the Third-Party Requester, the Third Party is given the opportunity to reply within two (2) months from the date of service in accordance with 37 C.F.R. 1.535. The reply need not be limited to the issues raised in the Patent Owner Statement and may include additional prior art patents and printed publications as well as any issue appropriate for reexamination. A copy of the reply must be served on the Patent Owner. If no Patent Owner Statement is filed, no reply is permitted from the Third-Party Requester. See MPEP § 2251.

VIII. EX PARTE REEXAMINATION REMINDERS

A. Specific Explanation of Support Must be Provided

37 CFR 1.530 (e) states:

> (e) Status of claims and support for claim changes. Whenever there is an amendment to the claims pursuant to paragraph (d) of this section, there must also be supplied, on pages separate from the pages containing the changes, the status (i.e., pending or canceled), as of the date of the amendment, of all patent claims and of all added claims, and an explanation of the support in the disclosure of the patent for the changes to the claims made by the amendment paper.

In other words, explanation of support of changes made to claims including amended claims and new claims must be provided and specific.

B. Amended Claims or New Claims Cannot be Broadened.

37 CFR 1.552 (b) states:

> (b) Claims in an ex parte reexamination proceeding will not be permitted to enlarge the scope of the claims of the patent.

MPEP 2258 states:

A reexamination proceeding ordered under 35 U.S.C. 304 provides a complete reexamination of the patent claims on the basis of prior art patents and printed publications. Double patenting issues may also be considered during reexamination. See subsection I.D. below. Issues relating to 35 U.S.C. 112 are addressed only with respect to new claims or amendatory subject matter in the specification, claims or drawings. Any new or amended claims are examined to ensure that the scope of the original patent claims is not enlarged, i.e., broadened. See 35 U.S.C. 305.

Therefore, the Patent Owner is reminded that any new or amended claims cannot be broadened.

IX. NOTICE RE PATENT OWNER'S CORRESPONDENCE ADDRESS

37 C.F.R. § 1.33(c) states:

(c) All notices, official letters, and other communications for the patent owner or owners in a reexamination or supplemental examination proceeding will be directed to the correspondence address in the patent file.

The correspondence address for any pending reexamination proceeding not having the same correspondence address as that of the patent is, by way of this revision to 37 C.F.R. § 1.33(c), automatically changed to that of the patent file as of the effective date.

This change is effective for any reexamination proceeding which is pending before the Office as of May 16, 2007, including the present reexamination proceeding, and to any reexamination proceeding which is filed after that date.

Parties are to take this change into account when filing papers, and direct communications accordingly.

In the event the patent owner's correspondence address listed in the papers (record) for the present proceeding is different from the correspondence address of the patent, it is strongly encouraged that the patent owner affirmatively file a Notification of Change of Correspondence Address in the reexamination proceeding and/or the patent (depending on which address patent

owner desires), to conform the address of the proceeding with that of the patent and to clarify the record as to which address should be used for correspondence.

Telephone Numbers for reexamination inquiries:

Reexamination	(571) 272-7703

X. CONCLUSION

Extensions of time under 37 C.F.R. § 1.136(a) will not be permitted in these proceedings because the provisions of 37 C.F.R. § 1.136 apply only to "an applicant" and not to parties in a reexamination proceeding. Additionally, 35 U.S.C. 305 requires that ex parte reexamination proceedings "will be conducted with special dispatch" (37 C.F.R. § 1.550(a)). Extensions of time in ex parte reexamination proceedings are provided for in 37 C.F.R. § 1.550(c).

Patent owner is reminded of the continuing responsibility under 37 C.F.R. § 1.565(a), to apprise the Office of any litigation activity, or other prior or concurrent proceeding, involving the 538 patent throughout the course of this reexamination proceeding. See MPEP §§ 2207, 2282 and 2286. The third-party requester is similarly apprised of the ability to disclose such proceedings.

Registered users of EFS-Web may alternatively submit correspondence via the electronic filing system at https://efs.uspto.gov/efile/myportal/efs-registered

Signed:

/YUZHEN GE/
Primary Examiner, Art Unit 3992

Conferees:

/COLIN M LAROSE/
Primary Examiner, Art Unit 3992

/ANDREW J. FISCHER/
Supervisory Patent Reexamination Specialist, Art Unit 3992

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	90/019,169	11244666
	Examiner	Art Unit
	YUZHEN GE	3992

CPC - Searched*		
Symbol	Date	Examiner
H04R29/001;H04R1/1083,1016; H04R3/002,005;G10K11/17827,002 ; H04R2499/11; H04R2225/41; H04R2460/05;	03/21/2023	/YG/

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Reviewed the file history of the '666 Patent or underlying patent file wrapper for the '666 Patent.	03/01/2023	/YG/
Reviewed the result of litigation search of the '666 Patent	03/02/2023	/YG/
Reviewed IPR2022-01099	03/01/2023	/YG/
Reviewed P-TACTS system for any reexams or an AIA proceedings on the patent. None was found.	03/01/2023	/YG/
Reviewed PDP (Patent Data Portal) for continuity data.	03/01/2023	/YG/
Reviewed the reexamed file wrapper 90/019169.	03/03/2023	/YG
Updated the above search.		/YG/

/YUZHEN GE/ Primary Examiner, Art Unit 3992	

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	90/019,169	11244666
	Examiner	Art Unit
	YUZHEN GE	3992

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/YUZHEN GE/ Primary Examiner, Art Unit 3992	

Reexamination	Application/Control No.	Applicant(s)/Patent Under Reexamination
	90/019,169	11244666
	Certificate Date	Certificate Number

Requester Correspondence Address: ☐ Patent Owner ☑ Third Party
Arnold & Porter Kaye Scholer LLP 601 Massachusetts Ave, NW Washington, D.C. 20001

LITIGATION REVIEW ☑	/YG/ (examiner initials)	03 March 2023 (date)
Case Name		Director Initials
2:22cv53, Station Techiya, Llc et al V. Samsung Electronics Co., Ltd. et al, US Dist Court, Texas Eastern, open		
.2:21cv413 Station Techiya, Llc et al V. Samsung Electronics Co., Ltd. et al , US Dist Court, Texas Eastern, open		

COPENDING OFFICE PROCEEDINGS	
TYPE OF PROCEEDING	NUMBER
None	

/YUZHEN GE/ Primary Examiner, Art Unit 3992	

SUBSTITUTE 1449 INFORMATION DISCLOSURE STATEMENT	ATTY. DOCKET NO.	APPLICATION NO.
	0027071.00133	To Be Assigned
	APPLICANT	
	Staton Techiya, LLC	
	FILING DATE	GROUP
	Herewith	To Be Assigned

U.S. PATENT DOCUMENTS					
		DOCUMENT NUMBER	DATE	NAME	REFERENCE PROVIDED*
	1	4,533,795	08/06/1985	Baumhauer, Jr. *et al.*	Herewith
	2	5,251,263	10/05/1993	Andrea *et al.*	Herewith
	3	US 2001/0046304 A1	11/29/2001	Rast	Herewith
	4	US 2003/0035551 A1	02/20/2003	Light *et al.*	Herewith
	5	US 6,647,368 B2	11/11/2003	Nemirovski	Herewith
	6	US 6,671,379 B2	12/30/2003	Nemirovski	Herewith
	7	US 2004/0047486 A1	03/11/2004	Van Doorn *et al.*	Herewith
	8	US 6,728,385 B2	04/27/2004	Kvaloy *et al.*	Herewith
	9	US 6,754,359 B1	06/22/2004	Svean *et al.*	Herewith
	10	US 2006/0083388 A1	04/20/2006	Rothschild	Herewith
	11	US 2006/0153394 A1	07/13/2006	Beasley	Herewith
	12	US 7,502,484 B2	03/10/2009	Ngia *et al.*	Herewith
	13	US 7,903,826 B2	03/08/2011	Boersma	Herewith
	14	US 7,953,241 B2	05/31/2011	Jorgensen *et al.*	Herewith
	15	US 7,983,433 B2	07/19/2011	Nemirovski	Herewith
	16	US 8,014,553 B2	09/06/2011	Radivojevic *et al.*	Herewith
	17	US 8,150,084 B2	04/03/2012	Jessen *et al.*	Herewith
	18	US 8,351,634 B2	01/08/2013	Khenkin	Herewith
	19	US 9,135,797 B2	09/15/2015	Couper *et al.*	Herewith

FOREIGN PATENT DOCUMENTS						
		DOCUMENT NUMBER	DATE	COUNTRY	TRANSLATION	REFERENCE PROVIDED*
	20	EP 1 519 625 A2	03/30/2005	Europe	N/A	Herewith
	21	EP 1 640 972 A1	03/29/2006	Europe	N/A	Herewith

EXAMINER	DATE CONSIDERED
/YUZHEN GE/	03/02/2023

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to Applicant.

*Copies of the listed references are either submitted herewith or were previously cited by or submitted to, the Office in a prior application. Pursuant to 37 C.F.R. § 1.97(d) and MPEP §609, the indicated reference may have been previously cited by or submitted to, the Office in a prior application, where the prior application is identified by its U.S. Application Number in this Information Disclosure Statement.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /Y.G./

SUBSTITUTE 1449 INFORMATION DISCLOSURE STATEMENT	ATTY. DOCKET NO.	APPLICATION NO.
	0027071.00133	To Be Assigned
	APPLICANT	
	Staton Techiya, LLC	
	FILING DATE	GROUP
	Herewith	To Be Assigned

NON-PATENT LITERATURE DOCUMENTS			
		DOCUMENT (Including Author, Title, Date, Pertinent Pages, etc.)	REFERENCE PROVIDED*
	22	Oshana, DSP Software Development Techniques for Embedded and Real-Time Systems, Introduction, pp. xi-xvii (2006)	Herewith
	23	Mulgrew *et al.*, Digital Signal Processing: Concepts and Applications, Introduction, pp. xxiii-xxvi (2nd ed. 2002)	Herewith

EXAMINER	DATE CONSIDERED
/YUZHEN GE/	03/02/2023

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to Applicant.

*Copies of the listed references are either submitted herewith or were previously cited by or submitted to, the Office in a prior application. Pursuant to 37 C.F.R. § 1.97(d) and MPEP §609, the indicated reference may have been previously cited by or submitted to, the Office in a prior application, where the prior application is identified by its U.S. Application Number in this Information Disclosure Statement.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /Y.G./

Bibliographic Data

Application No: 90/019,169

Foreign Priority claimed: ○ Yes ◉ No

35 USC 119 (a-d) conditions met: ☐ Yes ☐ No ☐ Met After Allowance

Verified and Acknowledged: /YUZHEN GE/ (Examiner's Signature) | (Initials)

Title: METHOD AND DEVICE FOR ACUTE SOUND DETECTION AND REPRODUCTION

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
02/24/2023	381	3992	0027071.00133
RULE			

APPLICANTS

INVENTORS

11244666,

STATON TECHIYA, LLC (Assignee), DELRAY BEACH, FL, UNITED STATES

ARNOLD & PORTER KAYE SCHOLER LLP (3rd Pty Req), WASHINGTON, DC, UNITED STATES

CONTINUING DATA

This application is a REX of 16987396 08/07/2020 PAT 11244666

16987396 is a CON of 16669490 10/30/2019 PAT 10810989

16669490 is a CON of 16193568 11/16/2018 PAT 10535334

16193568 is a CON of 14574589 12/18/2014 PAT 10134377

14574589 is a CON of 12017878 01/22/2008 PAT 8917894

12017878 has PRO of 60885917 01/22/2007

FOREIGN APPLICATIONS

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STATE OR COUNTRY

ADDRESS

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777 South Flagler Drive
Suite 1100 West Tower
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UNITED STATES

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UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
90/019,169	02/24/2023	11244666	0027071.00133	7859

150139 7590 09/05/2023

Akerman LLP
777 South Flagler Drive
Suite 1100 West Tower
West Palm Beach, FL 33401

EXAMINER	
GE, YUZHEN	

ART UNIT	PAPER NUMBER
3992	

MAIL DATE	DELIVERY MODE
09/05/2023	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

UNITED STATES PATENT AND TRADEMARK OFFICE

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United States Patent and Trademark Office
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Alexandria, VA 22313-1450
www.uspto.gov

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(THIRD PARTY REQUESTER'S CORRESPONDENCE ADDRESS)

ARNOLD & PORTER KAYE SCHOLER LLP
601 MASSACHUSETTS AVE., NW
WASHINGTON, DC 20001-3743

EX PARTE REEXAMINATION COMMUNICATION TRANSMITTAL FORM

REEXAMINATION CONTROL NO. *90/019,169* .

PATENT UNDER REEXAMINATION *11244666* .

ART UNIT *3992* .

Enclosed is a copy of the latest communication from the United States Patent and Trademark Office in the above identified *ex parte* reexamination proceeding (37 CFR 1.550(f)).

Where this copy is supplied after the reply by requester, 37 CFR 1.535, or the time for filing a reply has passed, no submission on behalf of the *ex parte* reexamination requester will be acknowledged or considered (37 CFR 1.550(g)).

PTOL-465 (Rev.07-04)

Notice of Intent to Issue Ex Parte Reexamination Certificate	**Control No.** 90/019,169	**Patent Under Reexamination** 11244666	
	Examiner YUZHEN GE	**Art Unit** 3992	**AIA Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

1. ☑ Prosecution on the merits is (or remains) closed in this *ex parte* reexamination proceeding. This proceeding is subject to reopening at the initiative of the Office or upon petition. *Cf.* 37 CFR 1.313(a). A Certificate will be issued in view of
   (a) ☐ Patent owner's communication(s) filed: _____.
   (b) ☐ Patent owner's failure to file an appropriate timely response to the Office action mailed: _____.
   (c) ☐ Patent owner's failure to timely file an Appeal Brief (37 CFR 41.31).
   (d) ☐ The decision on appeal by the ☐ Board of Patent Appeals and Interferences ☐ Court dated _____
   (e) ☑ Other: reexamed claims 1-11 are confirmed based on invoking 35 USC 112 6th paragraph.
2. The Reexamination Certificate will indicate the following:
   (a) Change in the Specification: ☐ Yes ☑ No
   (b) Change in the Drawing(s): ☐ Yes ☑ No
   (c) Status of the Claim(s):
      (1) Patent claim(s) confirmed: 1-11.
      (2) Patent claim(s) amended (including dependent on amended claim(s)): _____
      (3) Patent claim(s) canceled: _____.
      (4) Newly presented claim(s) patentable: _____.
      (5) Newly presented canceled claims: _____.
      (6) Patent claim(s) ☐ previously ☐ currently disclaimed: _____
      (7) Patent claim(s) not subject to reexamination: _____.
3. ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
4. ☑ Note the attached statement of reasons for patentability and/or confirmation. Any comments considered necessary by patent owner regarding reasons for patentability and/or confirmation must be submitted promptly to avoid processing delays. Such submission(s) should be labeled: "Comments On Statement of Reasons for Patentability and/or Confirmation."
5. ☐ Note attached NOTICE OF REFERENCES CITED (PTO-892).
6. ☑ Note attached LIST OF REFERENCES CITED (PTO/SB/08 or PTO/SB/08 substitute).
7. ☐ The drawing correction request filed on _____ is: ☐approved ☐disapproved.
8. ☐ Acknowledgment is made of the priority claim under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐None of the certified copies have
   ☐been received.
   ☐not been received.
   ☐been filed in Application No. _____.
   ☐been filed in reexamination Control No. _____.
   ☐been received by the International Bureau in PCT Application No. _____.

   * Certified copies not received: _____.
9. ☐ Note attached Examiner's Amendment.
10. ☐ Note attached Interview Summary (PTO-474).
11. ☐ Other: _____.

All correspondence relating to this reexamination proceeding should be directed to the **Central Reexamination Unit** at the mail, FAX, or hand-carry addresses given at the end of this Office action.

/YUZHEN GE/ Primary Examiner, Art Unit 3992	

cc: Requester (if third party requester)

EX PARTE REEXAMINATION OF US PATENT 11,244,666

I. ACKNOWLEDGMENTS

On Feb. 24, 2023, Third Party Requester ("**Requester**") filed a request ("**Request**") for *ex parte* reexamination of claims 1-11 ("**Requested Claims**") of US Patent 11,244,666 ("**the '666 Patent**") which issued to Goldstein et al with title "METHOD AND DEVICE FOR ACUTE SOUND DETECTION AND REPRODUCTION." The '666 Patent was filed on Aug. 7, 2020 with application number 16/987,396 ("**the 396 Application**") and issued on Feb. 8, 2022 with claims 1-11.

On May 23, 2023, the Office mailed an order ("**2023 Order**") granting reexamination of claims 1-11 of the '666 Patent.

A Patent Owner's statement has not been received after two months that the reexamination is ordered.

II. PRIORITY CLAIMS

This section is the same as that in the 2023 Order.

Based upon a review of the '666 Patent, the Examiner finds that the '666 Patent or the 396 Application claims the following domestic priority:

It is a continuation of and claims priority to U.S. patent application Ser. No. 16/669,490, filed 30 Oct. 2019, which is a continuation of and claims priority to U.S. patent application Ser. No. 16/193,568, filed 16 Nov. 2018, now U.S. Pat. No. 10,535,334, which is a continuation of and claims priority to U.S. patent application Ser. No. 14/574,589, filed on Dec. 18, 2014, now U.S. Pat. No. 10,134,377, which claims priority to and is a continuation of U.S. patent application Ser. No. 12/017,878, filed on Jan. 22, 2008, now U.S. Pat. No. 8,917,894, which

claims the benefit of U.S. Provisional Patent Application Ser. No. 60/885,917, filed on Jan. 22, 2007.

The '666 Patent does not claim any foreign priority.

Because the effective filing date of the '666 Patent is not on or after March 16, 2013, the AIA First Inventor to File ("AIA-FITF") provisions do not apply and instead the earlier 'First to Invent' provisions apply.

III. PRIOR OR CONCURRENT PROCEEDINGS

This section is the same as that in the 2023 Order.

Based upon Examiner's review of the '666 Patent itself, the Request, and its prosecution history, the Examiner finds that there are no prior or concurrent *ex parte* or supplemental reexaminations for the '666 Patent.

There was a petition for *inter partes* review, i.e., IPR2022-01099, filed on June 9, 2022 which was not instituted by PTAB (Decision Denying Institution of IPR2022-01099, pp. 16-19, 24-25 and 29-30).

IV. REFERENCES

i. US Patent 6,647,368 to Nemirovski, filed on Jul. 2, 2001 and issued on Nov. 11, 2003.

ii. US Patent Application Publication 2001/0046304 A1 to Rast, filed on Apr. 24, 2001 and issued on Nov. 29, 2001.

iii. European Patent Application Publication No. EP1640972A1 to Dijkstra et al ("Dijkstra"), filed on Dec. 23, 2005 and published on March 29, 2006.

iv. U.S. Patent Application Publication No. 2004/0047486A1 to Van Doorn et al ("Van Doorn"), filed on Sep. 6, 2002, published on Mar. 11, 2004.

v. European Patent Application Publication No. EP1519625A2 to Victorian et al ("Victorian"), filed on Sep. 13, 2004 and published on March 3, 2005.

vi. U.S. Patent Application Publication No. 2006/0153394A1 ("Beasley") filed on Jan. 10, 2006, published on Jul. 13, 2006.

vii. U.S. Patent No. 5,251,263 to Andrea et al ("Andrea"), issued on Oct. 5, 1993.

viii. U.S. Patent No. 7,903,826 to Boersma, filed on Mar. 8, 2006, issued on Mar. 8, 2011.

V. CLAIM INTERPRETATION

A. Lexicographic Definitions

After careful review of the original specification and unless expressly noted otherwise by the Examiner, the Examiner cannot locate any lexicographic definitions in the original specification with the required clarity, deliberateness, and precision. Because the Examiner cannot locate any lexicographic definitions in the original specification with the required clarity, deliberateness, and precision the Examiner concludes the Patent Owner is not their own lexicographer. See MPEP § 2111.01 IV.

B. 'Sources' for the 'Broadest Reasonable Interpretation'

For terms not lexicographically defined by Patent Owner, the Examiner hereby adopts the following interpretations under the broadest reasonable interpretation standard. In other words,

the Examiner has provided the following interpretations simply as express *notice* of how she is interpreting particular terms under the broadest reasonable interpretation standard. Additionally, these interpretations are only a guide to claim terminology since claim terms must be interpreted in context of the surrounding claim language.[1] In accordance with *In re Morris*, 127 F.3d 1048, 1056, 44 USPQ2d 1023, 1029 (Fed. Cir. 1997), the Examiner points to these other "sources" to support her interpretation of the claims. Finally, the following list is not intended to be exhaustive in any way:

1. Processor: "1: one that processes 2. a: (1) a computer (2) The part of a computer system that operates on data – called also a central processing unit b : a computer program (as a compiler) that puts another program into a form acceptable to the computer " Microsoft Press Computer Dictionary , 2nd Edition, Microsoft Press, Redmond, WA, 1994.

2. Controller: A device that controls the operation of another device by relaying information to that device, the controller potentially a processor or computer. Newton' s Telecom Dictionary, 14th Expanded Edition, Telecom Books, October 1998.

3. Configuration: "(C) The physical and logical elements of an information processing system, the manner in which they are organized and connected, or both. Note: May refer to a hardware configuration or software configuration." The Authoritative Dictionary of IEEE Standards Terms, 7th Ed., IEEE, Inc., New York, NY, 12/2000.

4. Microphone: " An electroacoustic transducer that responds to sound waves and delivers essentially equivalent electric waves." The Authoritative Dictionary of IEEE Standards Terms, 7th Ed., IEEE, Inc., New York, NY, 12/2000.

[1] While most interpretations are cited because these terms are found in the claims, the Examiner may have provided additional interpretations to help interpret words, phrases, or concepts found in the interpretations themselves, the instant patent, or in the prior art.

5. Earphone: "An electroacoustic transducer intended to be closely coupled acoustically to the ear." The Authoritative Dictionary of IEEE Standards Terms, 7th Ed., IEEE, Inc., New York, NY, 12/2000.

6. Background noise level: ambient sound level. "*The processor 206 estimates a background noise level from the ambient sound received at the ASM 111, and adjusts the audio level of delivered audio content (e.g., music, cell phone audio) to maintain a constant signal (e.g., audio content) to noise level (e.g., ambient sound).*" Col. 7, lines 13-24, the '666 Patent.

7. Microphone port: The opening of the microphone that detects or receives sound waves. See below.

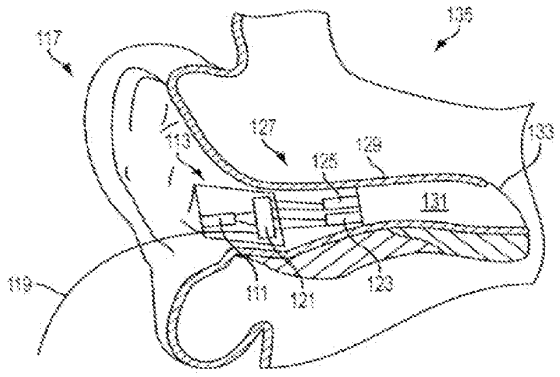


FIG. 1

-Fig. 1 of the '666 Patent.

The term "microphone port" was added during the original prosecution of the '666 Patent in the Aug 2021 Response. Referencing Fig. 1, Applicant stated:

> The support for the clarification can be found in at least Figures 1 and 2 of the present application, where the second microphone is often referred to as an ear canal microphone (ECM) since it samples the acoustic environment that is closer to the ear canal region. This region is more useful in determining the noise that is to reach the user's tympanic membrane (hence amended claim 15). **Where the terms "face toward" and "face away" can be interpreted as an orientation of an axis running through the middle of the port intersecting with a user**

> **or not, respectively.** This can be seen in the non limiting example of Figure 1 where the ASM faces away (i.e., measures in a direction away) from the user, and the ECM 123 faces toward it (i.e., measure in a direction toward the user).

-Applicant's Remarks, Aug. 4, 2021, pp. 6-7, emphasis added with "the port" referring to the opening of the microphone.

In other words, the microphone 111 is the first microphone and microphone 123 is the second microphone. The opening of microphone 111 that is used to detect or measure sound waves in a direction away from the user is the first microphone port because it faces (or measures in a direction away) away from the user. The opening of microphone 123 that is used to measure sound waves that faces (i.e., or measures in a direction) toward the user is the second microphone port because it faces (or measures in a direction) towards the user.

C. Claims Invoking 35 U.S.C. § 112 6th Paragraph

A second exception to BRI is when a claimed phrase is interpreted in accordance with 35 U.S.C. § 112 6th paragraph (§ 112 ¶ 6). See MPEP § 2181 et seq. To invoke § 112 ¶ 6, a claimed phrase must meet the three (3) prong analysis as set forth in MPEP § 2181 I. The following phrases will be analyzed to determine if the claimed phrases invoke § 112 ¶ 6. If a phrase invokes § 112 ¶ 6, the corresponding structure or materials will also be determined. See MPEP §2181 I. *See Williamson v. Citrix Online, L.L.C.,* 115 USPQ2d 1105, 1112 (Fed. Cir. 2015).

The Examiner has reviewed the Reexamined Claims of the '666 Patent and concludes that based on the three-Prong analysis set forth in MPEP§ 2181 I, the following limitations or functional phrases of the Reexamined Claims invokes § 112 ¶ 6.

(1) "Functional Phrase #1

a processor that is configured to execute the instructions to perform operations, wherein the processor is coupled to the first microphone, wherein the processor is coupled to the second microphone, wherein the speaker is coupled to the processor, and the operations comprising:

generating an ambient sound signal from at least one of the first microphone signal or the second microphone signal or a combination of both signals;

--"**Functional Phrase #1**" or "**FP#1**" as recited in *e.g.* claim 1.

i. 3 Prong Analysis: Invocation Prong (A)

As an initial matter, the Examiner finds that Functional Phrase #1 does not use the term "means." Therefore the issue arising under Invocation Prong (A) then becomes whether or not FP#1, including the claimed "a processor configured to execute instructions [and perform the claimed functions]," is a generic placeholder for "means."

In assessing whether or not FP#1 invokes § 112 ¶ 6, the Examiner must not only consider the introductory phrase "processor," but the entire FP#1. "In assessing whether the claim limitation is in means-plus-function format, we do not merely consider the introductory phrase (e.g., 'mechanical control assembly') in isolation, but look to the entire passage including functions performed by the introductory phrase. [Emphasis added.]" *MTD Prods. Inc.* v. *Iancu*, 933 F.3d 1336, 1342 (Fed. Cir. 2019).

Second, the Examiner has reviewed the original specification and drawings as set forth in the '666 Patent, general and subject matter specific dictionaries, and the prior art now of record to determine if FP#1 provides a description sufficient to inform one of ordinary skill in this particular art that FP#1 denotes a particular structure.

Third, the Examiner finds that "processor" is structure. However the claimed "processor" as set forth in FP#1 has a particular configuration (i.e. it is "configured to execute

instructions [and perform the claimed functions]"). In light of the claimed 'configuration,' the Examiner concludes that the claimed "processor" is not a generic computer processor or a general purpose computer but a particular processor requiring special programming since the three claimed "generating…," "applying …" and "mixing…" functions as set forth in FP#1 cannot be performed by a general purpose processor or computer.

In light of the above, the Examiner concludes that the phrase "processor configured to execute instructions [and perform the claimed functions]" is a generic placeholder. Because "processor" is merely a generic placeholder, the Examiner concludes that Functional Phrase #1 meets invocation Prong (A).

ii. 3 Prong Analysis: Invocation Prong (B)

Based upon a review of the Functional Phrase #1, the Examiner finds that for Functional Phrase #1, the claimed functions are:

> generating an ambient sound signal from at least one of the first microphone signal or the second microphone signal or a combination of both signals;

--"Claim Function of FP#1" or "Function of FP#1."

Additionally, the Examiner finds that because nothing in the written description of the '666 Patent contradicts the plain language as set forth in the Function of FP#1, Function of FP#1 will have their ordinary and accustomed meaning. Because Functional Phrase #1 includes the Function of FP#1, the Examiner concludes that, Functional Phrase #1 meets invocation prong (B).

iii. 3 Prong Analysis: Invocation Prong (C)

Based upon a review of Functional Phrase #1, the Examiner finds that Functional Phrase #1 does not contain sufficient structure for performing the entire Function of FP#1. In fact, the

Examiner finds that Functional Phrase #1 recites very little structure (if any) for performing the Function of FP#1.

Because Functional Phrase #1 does not contain sufficient structure for performing the entire claimed function, the Examiner concludes that Functional Phrase #1 meets invocation Prong (C).

Because Functional Phrase #1 meets the three prong analysis as set forth in MPEP § 2181 I, the Examiner concludes that Functional Phrase #1 invokes § 112 ¶ 6.

iv. Corresponding Structure or Materials

"The next step in construing a means-plus-function claim limitation is to look to the specification and identify the corresponding structure for that function." In re Aoyama, 656 F3d 1293, 99 USPQ2d 1936 (Fed. Cir. 2011) quoting Golight, Inc. v. Wal-Mart Stores, Inc., 355 F.3d 1327, 1333, 1334, [69 USPQ2d 1481, 1486] (Fed. Cir. 2004). "Under this second step, structure disclosed in the specification is `corresponding' structure only if the specification or prosecution history clearly links or associates that structure to the function recited in the claim." In re Aoyama, , 99 USPQ2d at 1939 quoting Med. Instrumentation & Diagnostics Corp. v. Elekta AB, 344 F.3d 1205, 1210, [68 USPQ2d 1263, 1267] (Fed. Cir. 2003).

Based upon a review of the '666 Patent itself, the Examiner concludes that the corresponding structure/algorithms for FP#1 is indicated below:

generating an ambient sound signal from at least one of the first microphone signal or the second microphone signal or a combination of both signals (Fig. 8 and associated descriptions, see the enclosed Fig. 8, generating an ambient sound signal is generating a background noise level. The algorithm includes Step 804 to Step 844 in Fig. 8 of the '666 Patent).

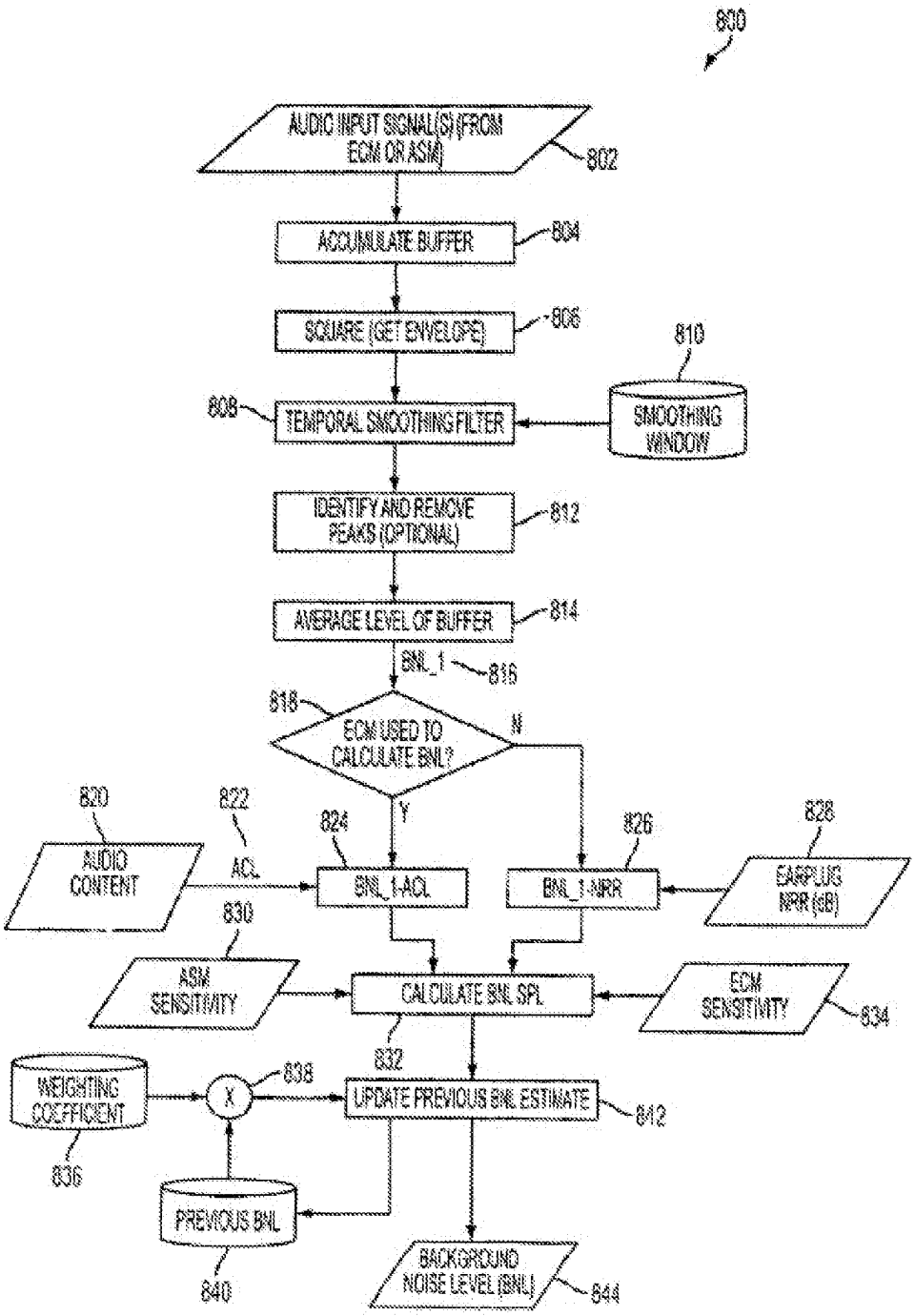

800
AUDIO INPUT SIGNAL(S) (FROM ECM OR ASM)
802
ACCUMULATE BUFFER
804
SQUARE (GET ENVELOPE)
806
810
SMOOTHING WINDOW
808
TEMPORAL SMOOTHING FILTER
IDENTIFY AND REMOVE PEAKS (OPTIONAL)
812
AVERAGE LEVEL OF BUFFER
814
BNL_1
816
818
ECM USED TO CALCULATE BNL?
N
Y
820
AUDIO CONTENT
822
ACL
824
BNL_1-ACL
826
BNL_1-NRR
828
EARPLUG NRR (dB)
830
ASM SENSITIVITY
CALCULATE BNL SPL
ECM SENSITIVITY
834
832
WEIGHTING COEFFICIENT
836
X
838
UPDATE PREVIOUS BNL ESTIMATE
842
PREVIOUS BNL
840
BACKGROUND NOISE LEVEL (BNL)
844

FIG. 8

-Fig. 8 shows the algorithm for the function "*generating an ambient sound signal from at least one of the first microphone signal or the second microphone signal or a combination of both signals*." The Background Noise Level (BNL) obtained at 844 in Fig. 8 is the ambient sound signal.

(2) Functional Phrase #2

> a processor that is configured to execute the instructions to perform operations, wherein the processor is coupled to the first microphone, wherein the processor is coupled to the second microphone, wherein the speaker is coupled to the processor, and the operations comprising:
> applying an ambient sound gain to the ambient sound signal to generate a modified ambient sound signal;

--"**Functional Phrase #2**" or "**FP#2**" as recited in *e.g.* claim 1.

i-iii. 3 Prong Analysis: Invocation Prong (A)-(C)

3-Prong analysis similar to that performed for FP#1 is also performed for FP#2. The Examiner concludes that FP#2 also invoke § 112 ¶ 6.

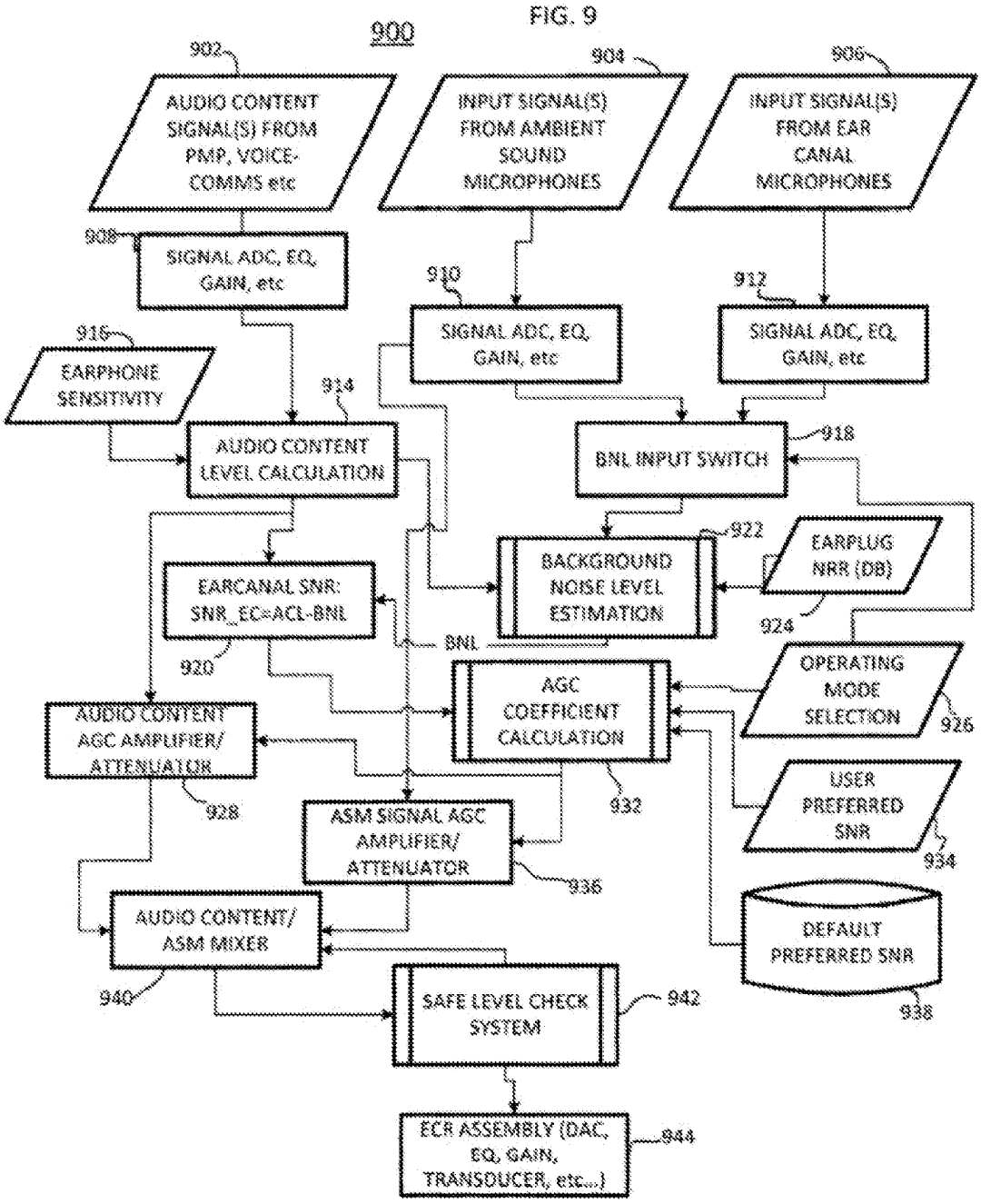
iv. Corresponding Structure or Materials

Based upon a review of the '666 Patent itself, the Examiner concludes that the corresponding structure/algorithms for FP#2 is indicated below:

applying an ambient sound gain to the ambient sound signal to generate a modified ambient sound signal (col. 12, lines 53-61, Fig. 9, "The AGC coefficient calculation 932 calculates gains for the Audio Content signal and ASM signal from the Automatic Gain Control steps 928 and 936 (for the Audio Content and ASM signals, respectively). AGC coefficient calculation 932 may use a default preferred SNR 938 or a user-preferred SNR 934 in its calculation. After the ASM signal and Audio content signal have been processed by the AGCs

928 and 936, the two signals are mixed at step 940." The background noise level BNL 922 is outputted to Earcanal SNR 920, which is output to AGC coefficient calculation 932, the gains have to be obtained first for applying the gains).

FIG. 9



-Fig. 9 of the '666 Patent showing the algorithm for "applying an ambient sound gain to the ambient sound signal to generate a modified ambient sound signal." The algorithm can be summarized as: i) BNL is obtained at 922; ii) gains are calculated at 932 based on BNL; iii) Signals are processed by the calculated gains at 928 and 936 based on the signal type.

(3) Functional Phrase #3

> a processor that is configured to execute the instructions to perform operations, wherein the processor is coupled to the first microphone, wherein the processor is coupled to the second microphone, wherein the speaker is coupled to the processor, and the operations comprising:
> mixing the modified ambient sound signal with an audio content signal to generate a mixed audio signal.

--"**Functional Phrase #3**" or "**FP#3**" as recited in *e.g.* claim 1.

i-iii. 3 Prong Analysis: Invocation Prong (A)-(C)

3-Prong analysis similar to that performed for FP#1 is also performed for FP#3. The Examiner concludes that FP#3 also invoke § 112 ¶ 6.

iv. Corresponding Structure or Materials

Based upon a review of the '666 Patent itself, the Examiner concludes that the corresponding structure/algorithms for FP#3 is indicated below:

mixing the modified ambient sound signal with an audio content signal to generate a mixed audio signal (col. 12, lines 53-60, algorithm of mixing is known in the art, 940 in Fig. 9, "After the ASM signal and Audio content signal have been processed by the AGCs 928 and 936, the two signals are mixed at step 940").

(4) Functional Phrase #4

a processor that is configured to execute the instructions to perform operations, wherein the processor is coupled to the first microphone, wherein the processor is coupled to the second microphone, wherein the speaker is coupled to the processor, and the operations comprising:

sending the mixed audio signal to the speaker.

--"**Functional Phrase #4**" or "**FP#4**" as recited in *e.g.* claim 1.

i-iii. 3 Prong Analysis: Invocation Prong (A)-(C)

3-Prong analysis similar to that performed for FP#1 is also performed for FP#4. The Examiner concludes that FP#4 also invoke § 112 ¶ 6.

iv. Corresponding Structure or Materials

Based upon a review of the '666 Patent itself, the Examiner concludes that the corresponding structure/algorithms for FP#4 is indicated below:

sending the mixed audio signal to the speaker (col. 12, line 62-col. 13, line 4, a safe-level check is performed when sending. "At step 942, a safe-level check determines if the resulting mixed signal is too high, if it were reproduced with the ECR 125 as shown in block 944. The safe-level check can use information regarding the user's listening history to determine if the user's sound exposure is such that it may cause a temporary or a permanent hearing threshold shift. If such high levels are measured, then the safe-level check reduces the signal level of the mixed signals via a feedback path to step 940. The resulting audio signal generated after step 942 is then reproduced with the ECR 125.").

(5) "Functional Phrase #5

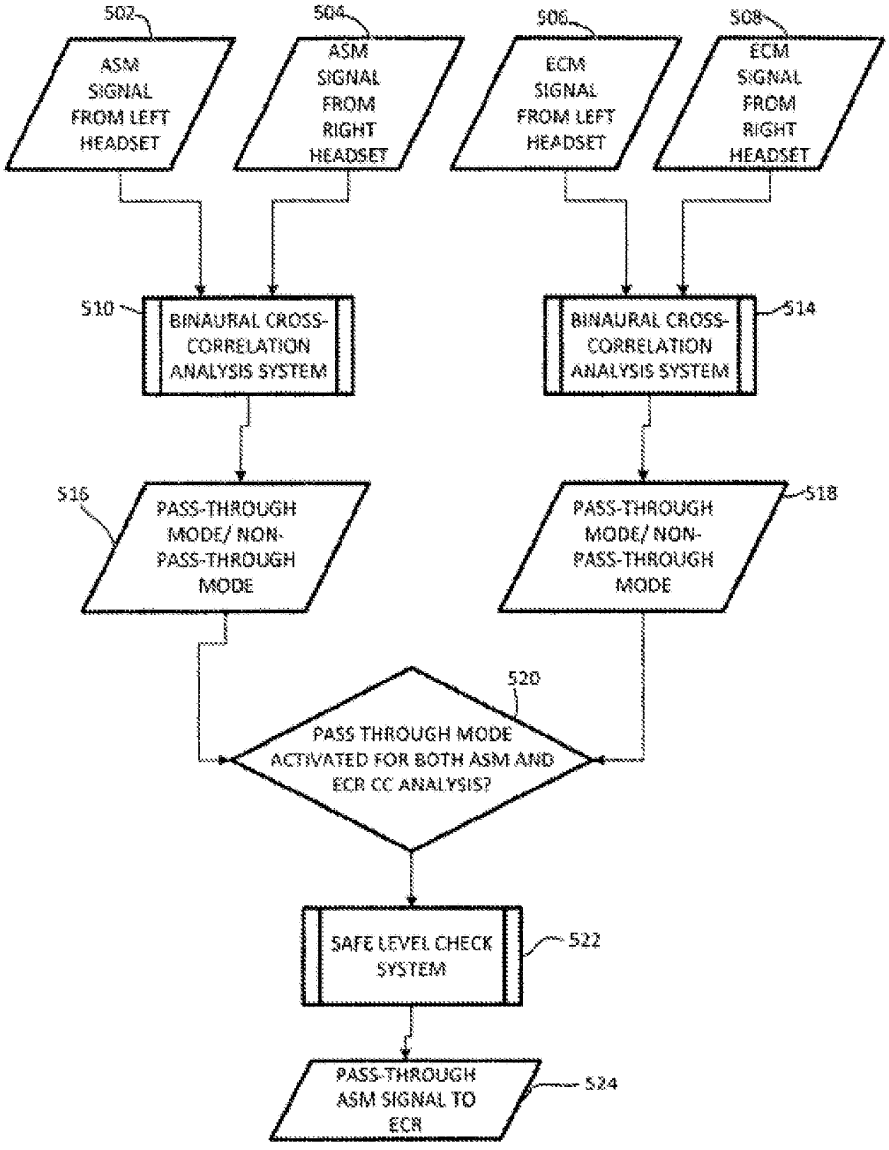
where the operations further comprise

detecting an acute sound by analyzing at least one of the first microphone signal or the second microphone signal or a combination of both signals; and

determining whether the acute sound is a user's voice by analyzing at least one of the first microphone signal or the second microphone signal or a combination of both signals.

--"**Functional Phrase #5**" or "**FP#5**" as recited in *e.g.* claim 2.

FIG. 5



-Fig. 5 of the '666 Patent showing a method/algorithm for detecting acute sound source proximity.

i-iii. 3 Prong Analysis: Invocation Prong (A)-(C)

3-Prong analysis similar to that performed for FP#1 is also performed for FP#5. The Examiner concludes that FP#5 also invoke § 112 ¶ 6.

iv. Corresponding Structure or Materials

Based upon a review of the '666 Patent itself, the Examiner concludes that the corresponding structure/algorithms for FP#5 is indicated below:

detecting an acute sound by analyzing at least one of the first microphone signal or the second microphone signal or a combination of both signals (col. 10, lines 26-40, Fig. 5); and

determining whether the acute sound is a user's voice by analyzing at least one of the first microphone signal or the second microphone signal or a combination of both signals (col. 8, lines 36-42, "the processor 206 can perform a correlation analysis on at least two microphones to determine whether the sound source is internal (e.g., the user) or external (e.g., an object other than the user)." Fig. 5, col. 10, lines 8-11, "Fig. 5 describes a method 500 for Source Proximity Detection (SPD) to determine if the Acute sound detected was created by the User's voice operating the earpiece 100.").

(6) "Functional Phrase #6

> where the operations further comprise: determining whether the acute sound is a warning sound or siren by analyzing the spectrum of at least one of the first microphone signal or the second microphone signal or a combination of both signals.

--"**Functional Phrase #6**" or "**FP#6**" as recited in *e.g.* claim 3.

i-iii. 3 Prong Analysis: Invocation Prong (A)-(C)

3-Prong analysis similar to that performed for FP#1 is also performed for FP#6. The Examiner concludes that FP#6 also invoke § 112 ¶ 6.

iv. Corresponding Structure or Materials

Based upon a review of the '666 Patent itself, the Examiner concludes that the corresponding structure/algorithms for FP#6 is indicated below:

determining whether the acute sound is a warning sound or siren by analyzing the spectrum of at least one of the first microphone signal or the second microphone signal or a combination of both signals (col. 5, lines 40-46, col. 7, lines 50-58, "the earpiece 100 looks for temporal and spectral characteristics in the ambient sound for detecting acute sounds. For instance, as will be explained ahead, the processor 206 looks for an abrupt change in the Sound Pressure Level (SPL) of an ambient sound across a small time period. The processor 206 can also detect abrupt magnitude changes across frequency sub-bands (e.g. filter-bank, FFT, etc.). Notably, the processor 206 can search for on-sets (e.g., fast rising amplitude wave-front) of an acute sound or other abrupt feature characteristics without initially attempting to initially identify or recognize the sound source. That is, the processor 206 is actively listening for a presence of acute sounds before identifying the type of sound source.".)

(7) "Functional Phrase #7

where the operations further comprise: adjusting the mixed audio signal when the user's voice is detected.

--"**Functional Phrase #7**" or "**FP#7**" as recited in *e.g.* claim 8.

i-iii. 3 Prong Analysis: Invocation Prong (A)-(C)

3-Prong analysis similar to that performed for FP#1 is also performed for FP#7. The Examiner concludes that FP#7 also invoke § 112 ¶ 6.

iv. Corresponding Structure or Materials

Based upon a review of the '666 Patent itself, the Examiner concludes that the corresponding structure/algorithms for FP#7 is indicated below:

adjusting the mixed audio signal when the user's voice is detected (col. 8, lines 44-50, "the processor 206 determines that the acute sound is a result of the user speaking, the processor 206 does not activate a pass-through mode, since this is not considered an external warning sound. The pass-through mode permits ambient sound detected at the ASM 111 to be transmitted directly to the ear canal." Not passing the acute sound is adjusting the mixed audio signal. Also see 942 in Fig. 9 which adjusts the mixed signal before sending it to the ECR 125 or the speaker).

VI. PATENTABLE/CONFIRMED SUBJECT MATTER

Claims 1-11 are patentable/confirmed.

The following is an examiner's statement of reasons for confirmation:

FP#1-FP#4 in claim 1 invoke § 112 ¶ 6 and claims 2-11 depend on claim 1. FP#1-FP#4 in claim 1 recites, among other things,

> generating an ambient sound signal from at least one of the first microphone signal or the second microphone signal or a combination of both signals;
> applying an ambient sound gain to the ambient sound signal to generate a modified ambient sound signal;
> mixing the modified ambient sound signal with an audio content signal to generate a mixed audio signal; and
> sending the mixed audio signal to the speaker.

The corresponding structure/algorithm of the function "*generating an ambient sound signal...*" is described in Fig. 8 and in description in association with Fig. 8 as indicated above in the Section of "Claim Interpretation."

The corresponding structure/algorithm of the function "*applying an ambient sound gain to the ambient sound signal to generate a modified ambient sound signal*" is described in col. 12, lines 53-61 and in association with 932, 928 and 936 in Fig. 9 as indicated above in the Section of "Claim Interpretation."

The corresponding structure/algorithm of the function "*mixing the modified ambient sound signal with an audio content signal to generate a mixed audio signal*" is described in col. 12, lines 53-60 and in association with 940 in Fig. 9 as indicated above in the Section of "Claim Interpretation."

The corresponding structure/algorithm of the function "*sending the mixed audio signal to the speaker*" is described in col. 12, line 62-col. 13, line 4 and in association with 942 in Fig. 9 as indicated above in the Section of "Claim Interpretation."

The prior art on the record including Nemirovski, Rast, Dijkstra, Victorian, Van Dorn, Beasley and Andrea or a combination thereof fails to teach the corresponding structure/algorithm of "generating an ambient sound signal from at least one of the first microphone signal or the second microphone signal or a combination of both signals" identified above and the structure/algorithm of "applying an ambient sound gain to the ambient sound signal to generate a modified ambient sound signal" identified above.

Specifically, Nemirovski discloses "filter[ing]" or "mathematically remov[ing]" the noise detected by external microphone 54 from the internal signal to isolate the initiating action (15:48- 67). Nemirovski also discloses or suggests filtering or mathematically removing the

noise detected by internal microphone 34 from the external signal from external microphone 54 "to derive a signal of externally generated sounds." (16:1-7). However these steps performed by Nemirovski are different from steps 804-844 in Fig. 8 of the '666 Patent. Further, neither Nemirovski nor Rast discloses using the ambient sound signal generated from the algorithm described in steps 804-844 of Fig. 8 of the '666 Patent to calculate gains and then process the signals by the calculated gains based on a signal type. Even further, neither Nemirovski nor Rast performs the safe-level check described in col. 12, line 62-col. 13, line 4 of the '666 Patent when sending mixed audio signal to speaker.

Similarly, Victorian discloses processor 460 includes a "speech recognition module" that enhances" the converted ambient sound signal to "improved the signal-to-noise ratio"(¶¶ 0030, 0052). However, Victorian fails to disclose algorithm described in steps 804-844 of Fig. 8 of the '666 Patent to generate ambient sound signal. Further, neither Victorian nor Dijkstra nor Beasley discloses using the ambient sound signal generated from the algorithm described in steps 804-844 of Fig. 8 of the '666 Patent to calculate gains and then process the signals by the calculated gains based on a signal type. Even further, neither Victorian nor Dijkstra nor Beasley performs the safe-level check described in col. 12, line 62-col. 13, line 4 of the '666 Patent when sending mixed audio signal to speaker.

VII. NOTICE RE PATENT OWNER'S CORRESPONDENCE ADDRESS

37 C.F.R. § 1.33(c) states:

> (c) All notices, official letters, and other communications for the patent owner or owners in a reexamination or supplemental examination proceeding will be directed to the correspondence address in the patent file.

The correspondence address for any pending reexamination proceeding not having the same correspondence address as that of the patent is, by way of this revision to 37 C.F.R. § 1.33(c), automatically changed to that of the patent file as of the effective date.

This change is effective for any reexamination proceeding which is pending before the Office as of May 16, 2007, including the present reexamination proceeding, and to any reexamination proceeding which is filed after that date.

Parties are to take this change into account when filing papers, and direct communications accordingly.

In the event the patent owner's correspondence address listed in the papers (record) for the present proceeding is different from the correspondence address of the patent, it is strongly encouraged that the patent owner affirmatively file a Notification of Change of Correspondence Address in the reexamination proceeding and/or the patent (depending on which address patent owner desires), to conform the address of the proceeding with that of the patent and to clarify the record as to which address should be used for correspondence.

Telephone Numbers for reexamination inquiries:

Reexamination	(571) 272-7703

VIII. CONCLUSION

Extensions of time under 37 C.F.R. § 1.136(a) will not be permitted in these proceedings because the provisions of 37 C.F.R. § 1.136 apply only to "an applicant" and not to parties in a reexamination proceeding. Additionally, 35 U.S.C. 305 requires that ex parte reexamination proceedings "will be conducted with special dispatch" (37 C.F.R. § 1.550(a)). Extensions of time in ex parte reexamination proceedings are provided for in 37 C.F.R. § 1.550(c).

Patent owner is reminded of the continuing responsibility under 37 C.F.R. § 1.565(a), to apprise the Office of any litigation activity, or other prior or concurrent proceeding, involving the '666 Patent throughout the course of this reexamination proceeding. See MPEP §§ 2207, 2282 and 2286. The third-party requester is similarly apprised of the ability to disclose such proceedings.

Registered users of EFS-Web may alternatively submit correspondence via the electronic filing system at https://efs.uspto.gov/efile/nwportal/efs-registered

Signed:

/YUZHEN GE/
Primary Examiner, Art Unit 3992

Conferees:

/COLIN M LAROSE/
Primary Examiner, Art Unit 3992

Reexamination	Application/Control No.	Applicant(s)/Patent Under Reexamination
	90/019,169	11244666
	Certificate Date	Certificate Number
		C-1

Requester Correspondence Address: ☐ Patent Owner ☑ Third Party
Arnold & Porter Kaye Scholer LLP 601 Massachusetts Ave, NW Washington, D.C. 20001

LITIGATION REVIEW ☑	/YG/ (examiner initials)	03 March 2023 (date)
Case Name		Director Initials
2:22cv53, Station Techiya, Llc et al V. Samsung Electronics Co., Ltd. et al, US Dist Court, Texas Eastern, open		
.2:21cv413 Station Techiya, Llc et al V. Samsung Electronics Co., Ltd. et al , US Dist Court, Texas Eastern, open		

COPENDING OFFICE PROCEEDINGS	
TYPE OF PROCEEDING	NUMBER
None	

/YUZHEN GE/ Primary Examiner, Art Unit 3992	

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	90/019,169	11244666
	Examiner	Art Unit
	YUZHEN GE	3992

CPC						
Symbol					Type	Version
G10K	/	11	/	17827	F	2018-01-01
G10K	/	11	/	002	I	2013-01-01
H04R	/	1	/	1016	I	2013-01-01
H04R	/	1	/	1083	I	2013-01-01
H04R	/	3	/	002	I	2013-01-01
H04R	/	3	/	005	I	2013-01-01
H04R	/	29	/	001	I	2013-01-01
H04R	/	2225	/	41	A	2013-01-01
H04R	/	2460	/	05	A	2013-01-01
H04R	/	2499	/	11	A	2013-01-01

CPC Combination Sets							
Symbol					Type	Set	Ranking	Version
	/		/					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	11	
/YUZHEN GE/ Primary Examiner, Art Unit 3992	05 August 2023	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

U.S. Patent and Trademark Office — Part of Paper No.: 20230315

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	90/019,169	11244666
	Examiner	Art Unit
	YUZHEN GE	3992

INTERNATIONAL CLASSIFICATION				
CLAIMED				
G10K	/	11	/	178
H04R	/	3	/	00
H04R	/	1	/	10
G10K	/	11	/	00
H04R	/	29	/	00

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS

CROSS REFERENCES(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	11	
/YUZHEN GE/ Primary Examiner, Art Unit 3992	05 August 2023	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

U.S. Patent and Trademark Office — Part of Paper No.: 20230315

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	90/019,169	11244666
	Examiner	Art Unit
	YUZHEN GE	3992

☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	11	
/YUZHEN GE/ Primary Examiner, Art Unit 3992	05 August 2023	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

U.S. Patent and Trademark Office Part of Paper No.: 20230315

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	90/019,169	11244666
	Examiner	Art Unit
	YUZHEN GE	3992

CPC - Searched*		
Symbol	Date	Examiner
H04R29/001;H04R1/1083,1016; H04R3/002,005;G10K11/17827,002 ; H04R2499/11; H04R2225/41; H04R2460/05;	03/21/2023	/YG/

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Reviewed the file history of the '666 Patent or underlying patent file wrapper for the '666 Patent.	03/01/2023	/YG/
Reviewed the result of litigation search of the '666 Patent	03/02/2023	/YG/
Reviewed IPR2022-01099	03/01/2023	/YG/
Reviewed P-TACTS system for any reexams or an AIA proceedings on the patent. None was found.	03/01/2023	/YG/
Reviewed PDP (Patent Data Portal) for continuity data.	03/01/2023	/YG/
Reviewed the reexamed file wrapper 90/019169.	03/03/2023	/YG
Updated the above search.	08/05/2023	/YG/

/YUZHEN GE/ Primary Examiner, Art Unit 3992	

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	90/019,169	11244666
	Examiner	Art Unit
	YUZHEN GE	3992

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/YUZHEN GE/ Primary Examiner, Art Unit 3992	

Bibliographic Data

Application No: 90/019,169

Foreign Priority claimed: ○ Yes ◉ No

35 USC 119 (a-d) conditions met: ☐ Yes ☐ No ☐ Met After Allowance

Verified and Acknowledged: /YUZHEN GE/ (Examiner's Signature) | (Initials)

Title: METHOD AND DEVICE FOR ACUTE SOUND DETECTION AND REPRODUCTION

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
02/24/2023	381	3992	0027071.00133
RULE			

APPLICANTS

INVENTORS

11244666,

STATON TECHIYA, LLC (Assignee), DELRAY BEACH, FL, UNITED STATES

ARNOLD & PORTER KAYE SCHOLER LLP (3rd Pty Req), WASHINGTON, DC, UNITED STATES

CONTINUING DATA

This application is a REX of 16987396 08/07/2020 PAT 11244666

16987396 is a CON of 16669490 10/30/2019 PAT 10810989

16669490 is a CON of 16193568 11/16/2018 PAT 10535334

16193568 is a CON of 14574589 12/18/2014 PAT 10134377

14574589 is a CON of 12017878 01/22/2008 PAT 8917894

12017878 has PRO of 60885917 01/22/2007

FOREIGN APPLICATIONS

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777 South Flagler Drive
Suite 1100 West Tower
West Palm Beach, FL 33401
UNITED STATES

FILING FEE RECEIVED

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Exhibit PAT-B

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	
Filing Date	
First Named Inventor	Steven Wayne Goldstein
Art Unit	
Examiner Name	
Attorney Docket Number	CONT-16669490

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	8638239		2014-01-28	Fabien Cases et al.	
	2	6226389		2001-05-01	Jerome H. Lemelson et al.	
	3	8514100		2013-08-20	Youji Yamashita	
	4	8493204		2013-07-23	Adrian Wong, et al.	
	5	9648436		2017-05-09	Doppler Labs, Inc.	
	6	9041545		2015-05-26	Eric Allen Zelepugas	
	7					

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	
Filing Date	
First Named Inventor	Steven Wayne Goldstein
Art Unit	
Examiner Name	
Attorney Docket Number	CONT-16669490

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20170124847		2017-05-04	Sigh, LLC	
	2	20060253282		2006-11-09	Gerhard Uwe Schmidt et al.	
	3	20140185828		2014-07-03	Cellco Partnership	
	4	20020135485		2002-09-26	Kaoru Arakawa	
	5	20100136950		2010-06-03	Erik Johan Vendel Backlund et al.	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							
	2							

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Exhibit PAT-B

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	
Filing Date	
First Named Inventor	Steven Wayne Goldstein
Art Unit	
Examiner Name	
Attorney Docket Number	CONT-16669490

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1		

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EXAMINER SIGNATURE

Examiner Signature	/YUZHEN GE/	Date Considered	08/05/2023

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
90/019,169	02/24/2023	11244666	0027071.00133	7859

150139 7590 09/07/2023

Akerman LLP
777 South Flagler Drive
Suite 1100 West Tower
West Palm Beach, FL 33401

EXAMINER	
GE, YUZHEN	

ART UNIT	PAPER NUMBER
3992	

MAIL DATE	DELIVERY MODE
09/07/2023	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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601 MASSACHUSETTS AVE., NW
WASHINGTON, DC 20001-3743

EX PARTE REEXAMINATION COMMUNICATION TRANSMITTAL FORM

REEXAMINATION CONTROL NO. *90/019,169* .

PATENT UNDER REEXAMINATION *11244666* .

ART UNIT *3992* .

Enclosed is a copy of the latest communication from the United States Patent and Trademark Office in the above identified *ex parte* reexamination proceeding (37 CFR 1.550(f)).

Where this copy is supplied after the reply by requester, 37 CFR 1.535, or the time for filing a reply has passed, no submission on behalf of the *ex parte* reexamination requester will be acknowledged or considered (37 CFR 1.550(g)).

PTOL-465 (Rev.07-04)

Corrected ***Notice of Intent to Issue*** ***Ex Parte Reexamination Certificate***	**Control No.** 90/019,169	**Patent Under Reexamination** 11244666	
	Examiner YUZHEN GE	**Art Unit** 3992	**AIA Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

1. ☑ Prosecution on the merits is (or remains) closed in this *ex parte* reexamination proceeding. This proceeding is subject to reopening at the initiative of the Office or upon petition. *Cf.* 37 CFR 1.313(a). A Certificate will be issued in view of
   (a) ☐ Patent owner's communication(s) filed: _____.
   (b) ☐ Patent owner's failure to file an appropriate timely response to the Office action mailed: _____.
   (c) ☐ Patent owner's failure to timely file an Appeal Brief (37 CFR 41.31).
   (d) ☐ The decision on appeal by the ☐ Board of Patent Appeals and Interferences ☐ Court dated _____
   (e) ☑ Other: reexamed claims 1-11 are confirmed based on invoking 35 USC 112 6th paragraph.
2. The Reexamination Certificate will indicate the following:
   (a) Change in the Specification: ☐ Yes ☑ No
   (b) Change in the Drawing(s): ☐ Yes ☑ No
   (c) Status of the Claim(s):
      (1) Patent claim(s) confirmed: 1-11.
      (2) Patent claim(s) amended (including dependent on amended claim(s)): _____
      (3) Patent claim(s) canceled: _____.
      (4) Newly presented claim(s) patentable: _____.
      (5) Newly presented canceled claims: _____.
      (6) Patent claim(s) ☐ previously ☐ currently disclaimed: _____
      (7) Patent claim(s) not subject to reexamination: _____.
3. ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
4. ☑ Note the attached statement of reasons for patentability and/or confirmation. Any comments considered necessary by patent owner regarding reasons for patentability and/or confirmation must be submitted promptly to avoid processing delays. Such submission(s) should be labeled: "Comments On Statement of Reasons for Patentability and/or Confirmation."
5. ☐ Note attached NOTICE OF REFERENCES CITED (PTO-892).
6. ☑ Note attached LIST OF REFERENCES CITED (PTO/SB/08 or PTO/SB/08 substitute).
7. ☐ The drawing correction request filed on _____ is: ☐approved ☐disapproved.
8. ☐ Acknowledgment is made of the priority claim under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐None of the certified copies have
   ☐been received.
   ☐not been received.
   ☐been filed in Application No. _____.
   ☐been filed in reexamination Control No. _____.
   ☐been received by the International Bureau in PCT Application No. _____.

   * Certified copies not received: _____.
9. ☐ Note attached Examiner's Amendment.
10. ☐ Note attached Interview Summary (PTO-474).
11. ☐ Other: _____.

All correspondence relating to this reexamination proceeding should be directed to the **Central Reexamination Unit** at the mail, FAX, or hand-carry addresses given at the end of this Office action.

/YUZHEN GE/ Primary Examiner, Art Unit 3992	

cc: Requester (if third party requester)

CORRECTED NOTICE OF INTENT ISSUE *EX PARTE* REEXAMINATION CERTIFICATE (NIRC)

This corrected NIRC is being remailed to include all conferees' signatures which were inadvertently not included on the NIRC mailed September 5, 2023.

EX PARTE REEXAMINATION OF US PATENT 11,244,666

I. ACKNOWLEDGMENTS

On Feb. 24, 2023, Third Party Requester ("**Requester**") filed a request ("**Request**") for *ex parte* reexamination of claims 1-11 ("**Requested Claims**") of US Patent 11,244,666 ("**the '666 Patent**") which issued to Goldstein et al with title "METHOD AND DEVICE FOR ACUTE SOUND DETECTION AND REPRODUCTION." The '666 Patent was filed on Aug. 7, 2020 with application number 16/987,396 ("**the 396 Application**") and issued on Feb. 8, 2022 with claims 1-11.

On May 23, 2023, the Office mailed an order ("**2023 Order**") granting reexamination of claims 1-11 of the '666 Patent.

A Patent Owner's statement has not been received after two months that the reexamination is ordered.

II. PRIORITY CLAIMS

This section is the same as that in the 2023 Order.

Based upon a review of the '666 Patent, the Examiner finds that the '666 Patent or the 396 Application claims the following domestic priority:

It is a continuation of and claims priority to U.S. patent application Ser. No. 16/669,490, filed 30 Oct. 2019, which is a continuation of and claims priority to U.S. patent application Ser.

No. 16/193,568, filed 16 Nov. 2018, now U.S. Pat. No. 10,535,334, which is a continuation of and claims priority to U.S. patent application Ser. No. 14/574,589, filed on Dec. 18, 2014, now U.S. Pat. No. 10,134,377, which claims priority to and is a continuation of U.S. patent application Ser. No. 12/017,878, filed on Jan. 22, 2008, now U.S. Pat. No. 8,917,894, which claims the benefit of U.S. Provisional Patent Application Ser. No. 60/885,917, filed on Jan. 22, 2007.

The '666 Patent does not claim any foreign priority.

Because the effective filing date of the '666 Patent is not on or after March 16, 2013, the AIA First Inventor to File ("AIA-FITF") provisions do not apply and instead the earlier 'First to Invent' provisions apply.

III. PRIOR OR CONCURRENT PROCEEDINGS

This section is the same as that in the 2023 Order.

Based upon Examiner's review of the '666 Patent itself, the Request, and its prosecution history, the Examiner finds that there are no prior or concurrent *ex parte* or supplemental reexaminations for the '666 Patent.

There was a petition for *inter partes* review, i.e., IPR2022-01099, filed on June 9, 2022 which was not instituted by PTAB (Decision Denying Institution of IPR2022-01099, pp. 16-19, 24-25 and 29-30).

IV. REFERENCES

i. US Patent 6,647,368 to Nemirovski, filed on Jul. 2, 2001 and issued on Nov. 11, 2003.

ii. US Patent Application Publication 2001/0046304 A1 to Rast, filed on Apr. 24, 2001 and issued on Nov. 29, 2001.

iii. European Patent Application Publication No. EP1640972A1 to Dijkstra et al ("Dijkstra"), filed on Dec. 23, 2005 and published on March 29, 2006.

iv. U.S. Patent Application Publication No. 2004/0047486A1 to Van Doorn et al ("Van Doorn"), filed on Sep. 6, 2002, published on Mar. 11, 2004.

v. European Patent Application Publication No. EP1519625A2 to Victorian et al ("Victorian"), filed on Sep. 13, 2004 and published on March 3, 2005.

vi. U.S. Patent Application Publication No. 2006/0153394A1 ("Beasley") filed on Jan. 10, 2006, published on Jul. 13, 2006.

vii. U.S. Patent No. 5,251,263 to Andrea et al ("Andrea"), issued on Oct. 5, 1993.

viii. U.S. Patent No. 7,903,826 to Boersma, filed on Mar. 8, 2006, issued on Mar. 8, 2011.

V. CLAIM INTERPRETATION

A. Lexicographic Definitions

After careful review of the original specification and unless expressly noted otherwise by the Examiner, the Examiner cannot locate any lexicographic definitions in the original specification with the required clarity, deliberateness, and precision. Because the Examiner cannot locate any lexicographic definitions in the original specification with the required clarity, deliberateness, and precision the Examiner concludes the Patent Owner is not their own lexicographer. See MPEP § 2111.01 IV.

B. 'Sources' for the 'Broadest Reasonable Interpretation'

For terms not lexicographically defined by Patent Owner, the Examiner hereby adopts the following interpretations under the broadest reasonable interpretation standard. In other words, the Examiner has provided the following interpretations simply as express *notice* of how she is interpreting particular terms under the broadest reasonable interpretation standard. Additionally, these interpretations are only a guide to claim terminology since claim terms must be interpreted in context of the surrounding claim language.[1] In accordance with *In re Morris*, 127 F.3d 1048, 1056, 44 USPQ2d 1023, 1029 (Fed. Cir. 1997), the Examiner points to these other "sources" to support her interpretation of the claims. Finally, the following list is not intended to be exhaustive in any way:

1. Processor: "1: one that processes 2. a: (1) a computer (2) The part of a computer system that operates on data – called also a central processing unit b : a computer program (as a compiler) that puts another program into a form acceptable to the computer " Microsoft Press Computer Dictionary , 2nd Edition, Microsoft Press, Redmond, WA, 1994.

2. Controller: A device that controls the operation of another device by relaying information to that device, the controller potentially a processor or computer. Newton' s Telecom Dictionary, 14th Expanded Edition, Telecom Books, October 1998.

3. Configuration: "(C) The physical and logical elements of an information processing system, the manner in which they are organized and connected, or both. Note: May refer to a

[1] While most interpretations are cited because these terms are found in the claims, the Examiner may have provided additional interpretations to help interpret words, phrases, or concepts found in the interpretations themselves, the instant patent, or in the prior art.

hardware configuration or software configuration." The Authoritative Dictionary of IEEE Standards Terms, 7th Ed., IEEE, Inc., New York, NY, 12/2000.

4. Microphone: " An electroacoustic transducer that responds to sound waves and delivers essentially equivalent electric waves." The Authoritative Dictionary of IEEE Standards Terms, 7th Ed., IEEE, Inc., New York, NY, 12/2000.

5. Earphone: "An electroacoustic transducer intended to be closely coupled acoustically to the ear." The Authoritative Dictionary of IEEE Standards Terms, 7th Ed., IEEE, Inc., New York, NY, 12/2000.

6. Background noise level: ambient sound level. "*The processor 206 estimates a background noise level from the ambient sound received at the ASM 111, and adjusts the audio level of delivered audio content (e.g., music, cell phone audio) to maintain a constant signal (e.g., audio content) to noise level (e.g., ambient sound).*" Col. 7, lines 13-24, the '666 Patent.

7. Microphone port: The opening of the microphone that detects or receives sound waves. See below.

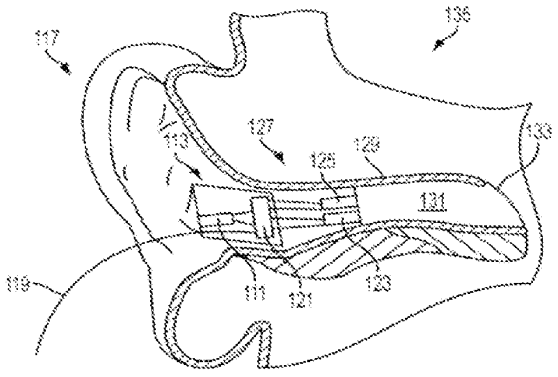


FIG. 1

-Fig. 1 of the '666 Patent.

The term "microphone port" was added during the original prosecution of the '666 Patent in the Aug 2021 Response. Referencing Fig. 1, Applicant stated:

> The support for the clarification can be found in at least Figures 1 and 2 of the present application, where the second microphone is often referred to as an ear canal microphone (ECM) since it samples the acoustic environment that is closer to the ear canal region. This region is more useful in determining the noise that is to reach the user's tympanic membrane (hence amended claim 15). **Where the terms "face toward" and "face away" can be interpreted as an orientation of an axis running through the middle of the port intersecting with a user or not, respectively.** This can be seen in the non limiting example of Figure 1 where the ASM faces away (i.e., measures in a direction away) from the user, and the ECM 123 faces toward it (i.e., measure in a direction toward the user).

-Applicant's Remarks, Aug. 4, 2021, pp. 6-7, emphasis added with "the port" referring to the opening of the microphone.

In other words, the microphone 111 is the first microphone and microphone 123 is the second microphone. The opening of microphone 111 that is used to detect or measure sound waves in a direction away from the user is the first microphone port because it faces (or measures in a direction away) away from the user. The opening of microphone 123 that is used to measure sound waves that faces (i.e., or measures in a direction) toward the user is the second microphone port because it faces (or measures in a direction) towards the user.

C. Claims Invoking 35 U.S.C. § 112 6th Paragraph

A second exception to BRI is when a claimed phrase is interpreted in accordance with 35 U.S.C. § 112 6th paragraph (§ 112 ¶ 6). See MPEP § 2181 et seq. To invoke § 112 ¶ 6, a claimed phrase must meet the three (3) prong analysis as set forth in MPEP § 2181 I. The following phrases will be analyzed to determine if the claimed phrases invoke § 112 ¶ 6. If a phrase invokes § 112 ¶ 6, the corresponding structure or materials will also be determined. See

MPEP §2181 I. *See Williamson v. Citrix Online, L.L.C.,* 115 USPQ2d 1105, 1112 (Fed. Cir. 2015).

The Examiner has reviewed the Reexamined Claims of the '666 Patent and concludes that based on the three-Prong analysis set forth in MPEP§ 2181 I, the following limitations or functional phrases of the Reexamined Claims invokes § 112 ¶ 6.

(1) "Functional Phrase #1

> a processor that is configured to execute the instructions to perform operations, wherein the processor is coupled to the first microphone, wherein the processor is coupled to the second microphone, wherein the speaker is coupled to the processor, and the operations comprising:
> generating an ambient sound signal from at least one of the first microphone signal or the second microphone signal or a combination of both signals;

--"**Functional Phrase #1**" or "**FP#1**" as recited in *e.g.* claim 1.

i. 3 Prong Analysis: Invocation Prong (A)

As an initial matter, the Examiner finds that Functional Phrase #1 does not use the term "means." Therefore the issue arising under Invocation Prong (A) then becomes whether or not FP#1, including the claimed "a processor configured to execute instructions [and perform the claimed functions]," is a generic placeholder for "means."

In assessing whether or not FP#1 invokes § 112 ¶ 6, the Examiner must not only consider the introductory phrase "processor," but the entire FP#1. "In assessing whether the claim limitation is in means-plus-function format, we do not merely consider the introductory phrase (e.g., 'mechanical control assembly') in isolation, but look to the entire passage including functions performed by the introductory phrase. [Emphasis added.]" *MTD Prods. Inc.* v. *Iancu*, 933 F.3d 1336, 1342 (Fed. Cir. 2019).

Second, the Examiner has reviewed the original specification and drawings as set forth in the '666 Patent, general and subject matter specific dictionaries, and the prior art now of record to determine if FP#1 provides a description sufficient to inform one of ordinary skill in this particular art that FP#1 denotes a particular structure.

Third, the Examiner finds that "processor" is structure. However the claimed "processor" as set forth in FP#1 has a particular configuration (i.e. it is "configured to execute instructions [and perform the claimed functions]"). In light of the claimed 'configuration,' the Examiner concludes that the claimed "processor" is not a generic computer processor or a general purpose computer but a particular processor requiring special programming since the three claimed "generating…," "applying …" and "mixing…" functions as set forth in FP#1 cannot be performed by a general purpose processor or computer.

In light of the above, the Examiner concludes that the phrase "processor configured to execute instructions [and perform the claimed functions]" is a generic placeholder. Because "processor" is merely a generic placeholder, the Examiner concludes that Functional Phrase #1 meets invocation Prong (A).

ii. 3 Prong Analysis: Invocation Prong (B)

Based upon a review of the Functional Phrase #1, the Examiner finds that for Functional Phrase #1, the claimed functions are:

> generating an ambient sound signal from at least one of the first microphone signal or the second microphone signal or a combination of both signals;

--"Claim Function of FP#1" or "Function of FP#1."

Additionally, the Examiner finds that because nothing in the written description of the '666 Patent contradicts the plain language as set forth in the Function of FP#1, Function of FP#1

will have their ordinary and accustomed meaning. Because Functional Phrase #1 includes the Function of FP#1, the Examiner concludes that, Functional Phrase #1 meets invocation prong (B).

iii. 3 Prong Analysis: Invocation Prong (C)

Based upon a review of Functional Phrase #1, the Examiner finds that Functional Phrase #1 does not contain sufficient structure for performing the entire Function of FP#1. In fact, the Examiner finds that Functional Phrase #1 recites very little structure (if any) for performing the Function of FP#1.

Because Functional Phrase #1 does not contain sufficient structure for performing the entire claimed function, the Examiner concludes that Functional Phrase #1 meets invocation Prong (C).

Because Functional Phrase #1 meets the three prong analysis as set forth in MPEP § 2181 I, the Examiner concludes that Functional Phrase #1 invokes § 112 ¶ 6.

iv. Corresponding Structure or Materials

"The next step in construing a means-plus-function claim limitation is to look to the specification and identify the corresponding structure for that function." In re Aoyama, 656 F3d 1293, 99 USPQ2d 1936 (Fed. Cir. 2011) quoting Golight, Inc. v. Wal-Mart Stores, Inc., 355 F.3d 1327, 1333, 1334, [69 USPQ2d 1481, 1486] (Fed. Cir. 2004). "Under this second step, structure disclosed in the specification is `corresponding' structure only if the specification or prosecution history clearly links or associates that structure to the function recited in the claim." In re Aoyama, , 99 USPQ2d at 1939 quoting Med. Instrumentation & Diagnostics Corp. v. Elekta AB, 344 F.3d 1205, 1210, [68 USPQ2d 1263, 1267] (Fed. Cir. 2003).

Based upon a review of the '666 Patent itself, the Examiner concludes that the corresponding structure/algorithms for FP#1 is indicated below:

generating an ambient sound signal from at least one of the first microphone signal or the second microphone signal or a combination of both signals (Fig. 8 and associated descriptions, see the enclosed Fig. 8, generating an ambient sound signal is generating a background noise level. The algorithm includes Step 804 to Step 844 in Fig. 8 of the '666 Patent).

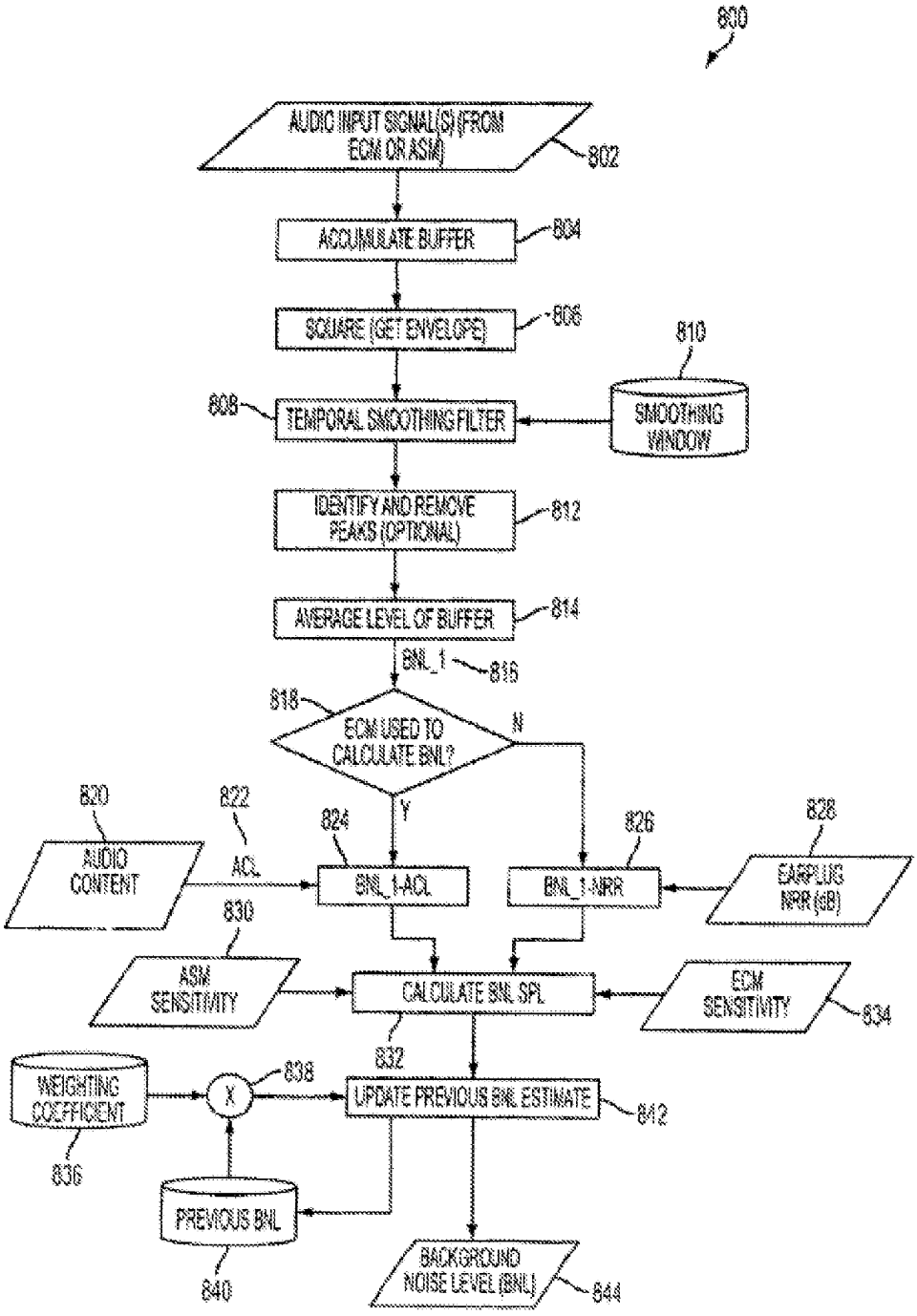

800
AUDIO INPUT SIGNAL(S) (FROM ECM OR ASM)
802
ACCUMULATE BUFFER
804
SQUARE (GET ENVELOPE)
806
810
SMOOTHING WINDOW
808
TEMPORAL SMOOTHING FILTER
IDENTIFY AND REMOVE PEAKS (OPTIONAL)
812
AVERAGE LEVEL OF BUFFER
814
BNL_1
816
818
ECM USED TO CALCULATE BNL?
N
Y
820
AUDIO CONTENT
822
ACL
824
BNL_1-ACL
826
BNL_1-NRR
828
EARPLUG NRR (dB)
830
ASM SENSITIVITY
CALCULATE BNL SPL
ECM SENSITIVITY
834
832
WEIGHTING COEFFICIENT
836
X
838
UPDATE PREVIOUS BNL ESTIMATE
842
PREVIOUS BNL
840
BACKGROUND NOISE LEVEL (BNL)
844

FIG. 8

-Fig. 8 shows the algorithm for the function "*generating an ambient sound signal from at least one of the first microphone signal or the second microphone signal or a combination of both signals*." The Background Noise Level (BNL) obtained at 844 in Fig. 8 is the ambient sound signal.

(2) Functional Phrase #2

> a processor that is configured to execute the instructions to perform operations, wherein the processor is coupled to the first microphone, wherein the processor is coupled to the second microphone, wherein the speaker is coupled to the processor, and the operations comprising:
> applying an ambient sound gain to the ambient sound signal to generate a modified ambient sound signal;

--"**Functional Phrase #2**" or "**FP#2**" as recited in *e.g.* claim 1.

i-iii. 3 Prong Analysis: Invocation Prong (A)-(C)

3-Prong analysis similar to that performed for FP#1 is also performed for FP#2. The Examiner concludes that FP#2 also invoke § 112 ¶ 6.

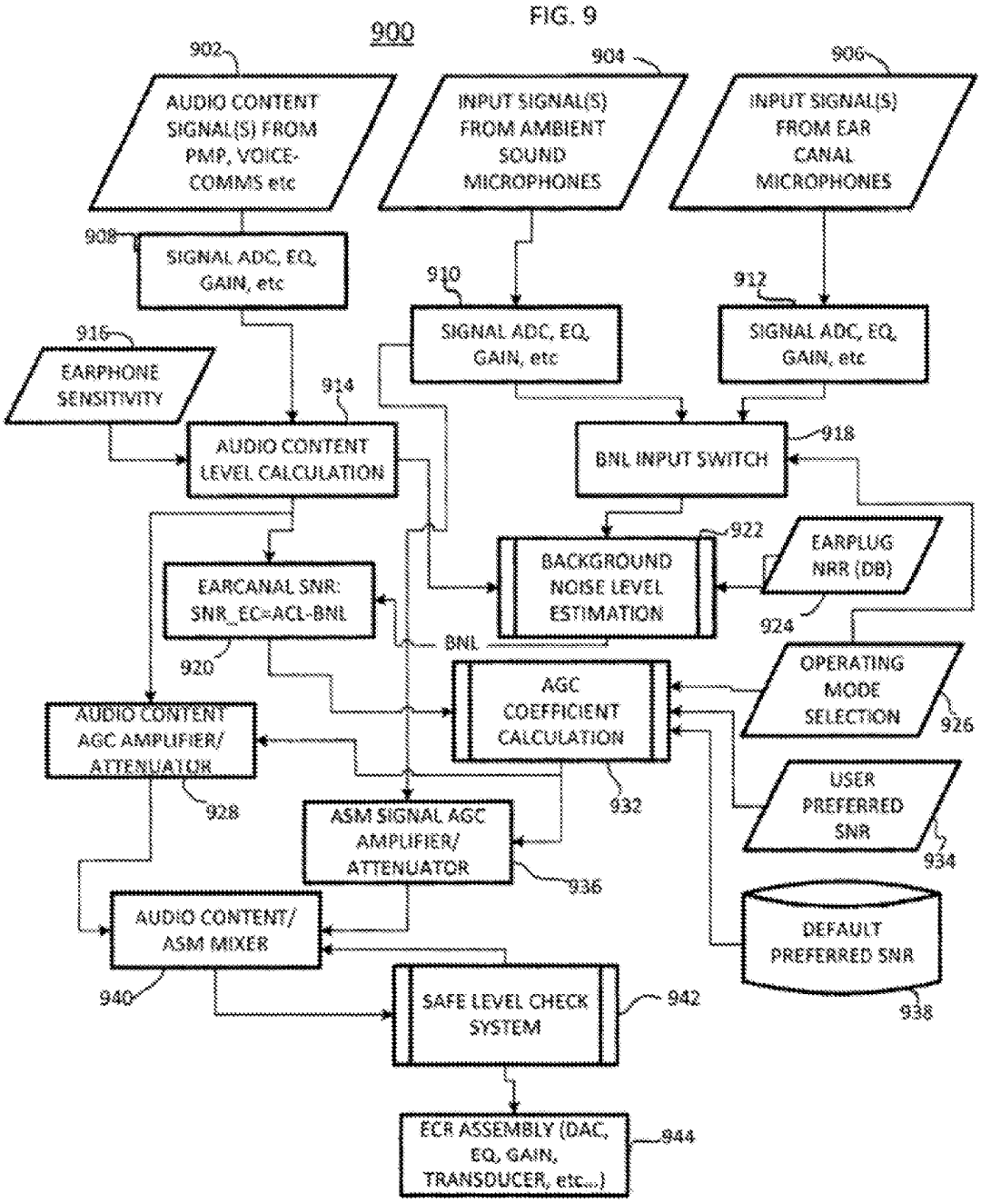
iv. Corresponding Structure or Materials

Based upon a review of the '666 Patent itself, the Examiner concludes that the corresponding structure/algorithms for FP#2 is indicated below:

applying an ambient sound gain to the ambient sound signal to generate a modified ambient sound signal (col. 12, lines 53-61, Fig. 9, "The AGC coefficient calculation 932 calculates gains for the Audio Content signal and ASM signal from the Automatic Gain Control steps 928 and 936 (for the Audio Content and ASM signals, respectively). AGC coefficient calculation 932 may use a default preferred SNR 938 or a user-preferred SNR 934 in its calculation. After the ASM signal and Audio content signal have been processed by the AGCs

928 and 936, the two signals are mixed at step 940." The background noise level BNL 922 is outputted to Earcanal SNR 920, which is output to AGC coefficient calculation 932, the gains have to be obtained first for applying the gains).

FIG. 9



-Fig. 9 of the '666 Patent showing the algorithm for "applying an ambient sound gain to the ambient sound signal to generate a modified ambient sound signal." The algorithm can be summarized as: i) BNL is obtained at 922; ii) gains are calculated at 932 based on BNL; iii) Signals are processed by the calculated gains at 928 and 936 based on the signal type.

(3) Functional Phrase #3

> a processor that is configured to execute the instructions to perform operations, wherein the processor is coupled to the first microphone, wherein the processor is coupled to the second microphone, wherein the speaker is coupled to the processor, and the operations comprising:
> mixing the modified ambient sound signal with an audio content signal to generate a mixed audio signal.

--"**Functional Phrase #3**" or "**FP#3**" as recited in *e.g.* claim 1.

i-iii. 3 Prong Analysis: Invocation Prong (A)-(C)

3-Prong analysis similar to that performed for FP#1 is also performed for FP#3. The Examiner concludes that FP#3 also invoke § 112 ¶ 6.

iv. Corresponding Structure or Materials

Based upon a review of the '666 Patent itself, the Examiner concludes that the corresponding structure/algorithms for FP#3 is indicated below:

mixing the modified ambient sound signal with an audio content signal to generate a mixed audio signal (col. 12, lines 53-60, algorithm of mixing is known in the art, 940 in Fig. 9, "After the ASM signal and Audio content signal have been processed by the AGCs 928 and 936, the two signals are mixed at step 940").

(4) Functional Phrase #4

a processor that is configured to execute the instructions to perform operations, wherein the processor is coupled to the first microphone, wherein the processor is coupled to the second microphone, wherein the speaker is coupled to the processor, and the operations comprising:

sending the mixed audio signal to the speaker.

--"**Functional Phrase #4**" or "**FP#4**" as recited in *e.g.* claim 1.

i-iii. 3 Prong Analysis: Invocation Prong (A)-(C)

3-Prong analysis similar to that performed for FP#1 is also performed for FP#4. The Examiner concludes that FP#4 also invoke § 112 ¶ 6.

iv. Corresponding Structure or Materials

Based upon a review of the '666 Patent itself, the Examiner concludes that the corresponding structure/algorithms for FP#4 is indicated below:

sending the mixed audio signal to the speaker (col. 12, line 62-col. 13, line 4, a safe-level check is performed when sending. "At step 942, a safe-level check determines if the resulting mixed signal is too high, if it were reproduced with the ECR 125 as shown in block 944. The safe-level check can use information regarding the user's listening history to determine if the user's sound exposure is such that it may cause a temporary or a permanent hearing threshold shift. If such high levels are measured, then the safe-level check reduces the signal level of the mixed signals via a feedback path to step 940. The resulting audio signal generated after step 942 is then reproduced with the ECR 125.").

(5) "Functional Phrase #5

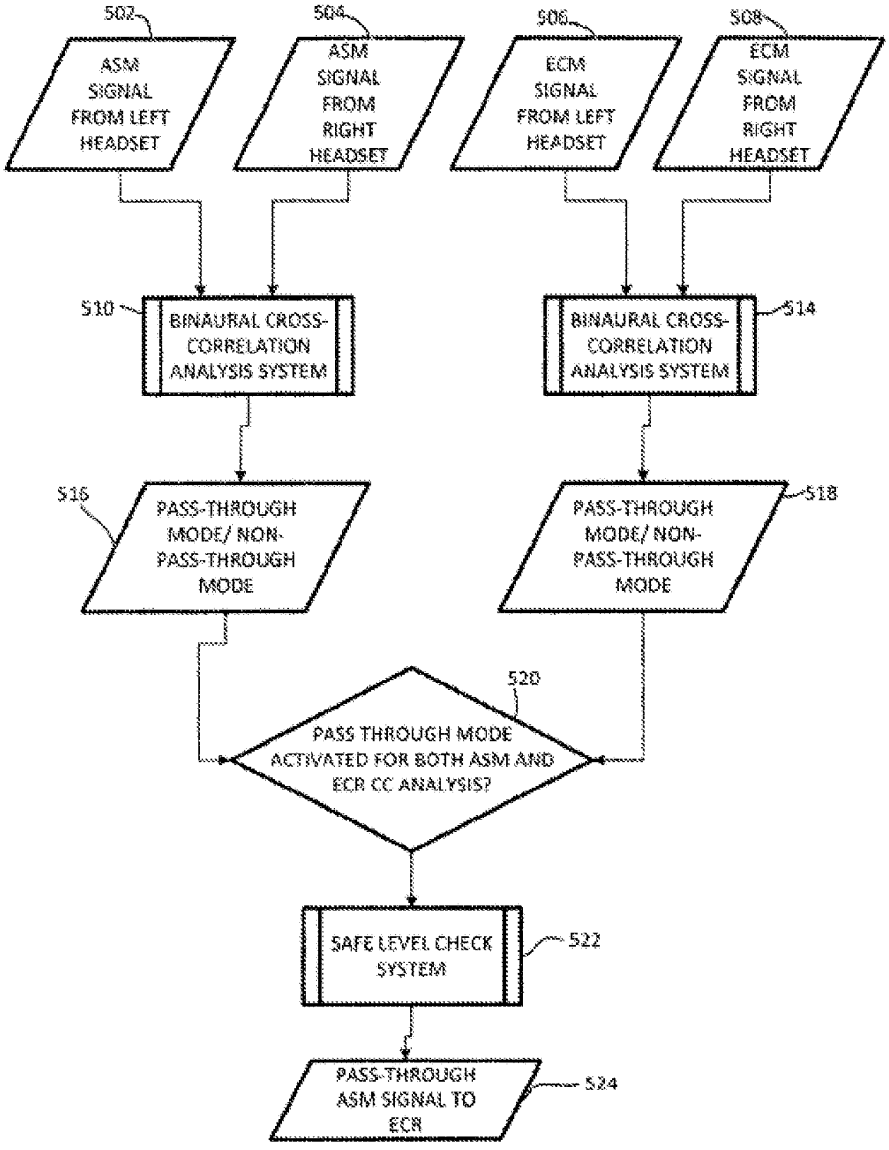
where the operations further comprise

detecting an acute sound by analyzing at least one of the first microphone signal or the second microphone signal or a combination of both signals; and

determining whether the acute sound is a user's voice by analyzing at least one of the first microphone signal or the second microphone signal or a combination of both signals.

--"**Functional Phrase #5**" or "**FP#5**" as recited in *e.g.* claim 2.

FIG. 5



-Fig. 5 of the '666 Patent showing a method/algorithm for detecting acute sound source proximity.

i-iii. 3 Prong Analysis: Invocation Prong (A)-(C)

3-Prong analysis similar to that performed for FP#1 is also performed for FP#5. The Examiner concludes that FP#5 also invoke § 112 ¶ 6.

iv. Corresponding Structure or Materials

Based upon a review of the '666 Patent itself, the Examiner concludes that the corresponding structure/algorithms for FP#5 is indicated below:

detecting an acute sound by analyzing at least one of the first microphone signal or the second microphone signal or a combination of both signals (col. 10, lines 26-40, Fig. 5); and

determining whether the acute sound is a user's voice by analyzing at least one of the first microphone signal or the second microphone signal or a combination of both signals (col. 8, lines 36-42, "the processor 206 can perform a correlation analysis on at least two microphones to determine whether the sound source is internal (e.g., the user) or external (e.g., an object other than the user)." Fig. 5, col. 10, lines 8-11, "Fig. 5 describes a method 500 for Source Proximity Detection (SPD) to determine if the Acute sound detected was created by the User's voice operating the earpiece 100.").

(6) "Functional Phrase #6

> where the operations further comprise: determining whether the acute sound is a warning sound or siren by analyzing the spectrum of at least one of the first microphone signal or the second microphone signal or a combination of both signals.

--"**Functional Phrase #6**" or "**FP#6**" as recited in *e.g.* claim 3.

i-iii. 3 Prong Analysis: Invocation Prong (A)-(C)

3-Prong analysis similar to that performed for FP#1 is also performed for FP#6. The Examiner concludes that FP#6 also invoke § 112 ¶ 6.

iv. Corresponding Structure or Materials

Based upon a review of the '666 Patent itself, the Examiner concludes that the corresponding structure/algorithms for FP#6 is indicated below:

determining whether the acute sound is a warning sound or siren by analyzing the spectrum of at least one of the first microphone signal or the second microphone signal or a combination of both signals (col. 5, lines 40-46, col. 7, lines 50-58, "the earpiece 100 looks for temporal and spectral characteristics in the ambient sound for detecting acute sounds. For instance, as will be explained ahead, the processor 206 looks for an abrupt change in the Sound Pressure Level (SPL) of an ambient sound across a small time period. The processor 206 can also detect abrupt magnitude changes across frequency sub-bands (e.g. filter-bank, FFT, etc.). Notably, the processor 206 can search for on-sets (e.g., fast rising amplitude wave-front) of an acute sound or other abrupt feature characteristics without initially attempting to initially identify or recognize the sound source. That is, the processor 206 is actively listening for a presence of acute sounds before identifying the type of sound source.".)

(7) "Functional Phrase #7

where the operations further comprise: adjusting the mixed audio signal when the user's voice is detected.

--"**Functional Phrase #7**" or "**FP#7**" as recited in *e.g.* claim 8.

i-iii. 3 Prong Analysis: Invocation Prong (A)-(C)

3-Prong analysis similar to that performed for FP#1 is also performed for FP#7. The Examiner concludes that FP#7 also invoke § 112 ¶ 6.

iv. Corresponding Structure or Materials

Based upon a review of the '666 Patent itself, the Examiner concludes that the corresponding structure/algorithms for FP#7 is indicated below:

adjusting the mixed audio signal when the user's voice is detected (col. 8, lines 44-50, "the processor 206 determines that the acute sound is a result of the user speaking, the processor 206 does not activate a pass-through mode, since this is not considered an external warning sound. The pass-through mode permits ambient sound detected at the ASM 111 to be transmitted directly to the ear canal." Not passing the acute sound is adjusting the mixed audio signal. Also see 942 in Fig. 9 which adjusts the mixed signal before sending it to the ECR 125 or the speaker).

VI. PATENTABLE/CONFIRMED SUBJECT MATTER

Claims 1-11 are patentable/confirmed.

The following is an examiner's statement of reasons for confirmation:

FP#1-FP#4 in claim 1 invoke § 112 ¶ 6 and claims 2-11 depend on claim 1. FP#1-FP#4 in claim 1 recites, among other things,

> generating an ambient sound signal from at least one of the first microphone signal or the second microphone signal or a combination of both signals;
> applying an ambient sound gain to the ambient sound signal to generate a modified ambient sound signal;
> mixing the modified ambient sound signal with an audio content signal to generate a mixed audio signal; and
> sending the mixed audio signal to the speaker.

The corresponding structure/algorithm of the function "*generating an ambient sound signal*..." is described in Fig. 8 and in description in association with Fig. 8 as indicated above in the Section of "Claim Interpretation."

The corresponding structure/algorithm of the function "*applying an ambient sound gain to the ambient sound signal to generate a modified ambient sound signal*" is described in col. 12, lines 53-61 and in association with 932, 928 and 936 in Fig. 9 as indicated above in the Section of "Claim Interpretation."

The corresponding structure/algorithm of the function "*mixing the modified ambient sound signal with an audio content signal to generate a mixed audio signal*" is described in col. 12, lines 53-60 and in association with 940 in Fig. 9 as indicated above in the Section of "Claim Interpretation."

The corresponding structure/algorithm of the function "*sending the mixed audio signal to the speaker*" is described in col. 12, line 62-col. 13, line 4 and in association with 942 in Fig. 9 as indicated above in the Section of "Claim Interpretation."

The prior art on the record including Nemirovski, Rast, Dijkstra, Victorian, Van Dorn, Beasley and Andrea or a combination thereof fails to teach the corresponding structure/algorithm of "generating an ambient sound signal from at least one of the first microphone signal or the second microphone signal or a combination of both signals" identified above and the structure/algorithm of "applying an ambient sound gain to the ambient sound signal to generate a modified ambient sound signal" identified above.

Specifically, Nemirovski discloses "filter[ing]" or "mathematically remov[ing]" the noise detected by external microphone 54 from the internal signal to isolate the initiating action (15:48- 67). Nemirovski also discloses or suggests filtering or mathematically removing the

noise detected by internal microphone 34 from the external signal from external microphone 54 "to derive a signal of externally generated sounds." (16:1-7). However these steps performed by Nemirovski are different from steps 804-844 in Fig. 8 of the '666 Patent. Further, neither Nemirovski nor Rast discloses using the ambient sound signal generated from the algorithm described in steps 804-844 of Fig. 8 of the '666 Patent to calculate gains and then process the signals by the calculated gains based on a signal type. Even further, neither Nemirovski nor Rast performs the safe-level check described in col. 12, line 62-col. 13, line 4 of the '666 Patent when sending mixed audio signal to speaker.

Similarly, Victorian discloses processor 460 includes a "speech recognition module" that enhances" the converted ambient sound signal to "improved the signal-to-noise ratio"(¶¶ 0030, 0052). However, Victorian fails to disclose algorithm described in steps 804-844 of Fig. 8 of the '666 Patent to generate ambient sound signal. Further, neither Victorian nor Dijkstra nor Beasley discloses using the ambient sound signal generated from the algorithm described in steps 804-844 of Fig. 8 of the '666 Patent to calculate gains and then process the signals by the calculated gains based on a signal type. Even further, neither Victorian nor Dijkstra nor Beasley performs the safe-level check described in col. 12, line 62-col. 13, line 4 of the '666 Patent when sending mixed audio signal to speaker.

VII. NOTICE RE PATENT OWNER'S CORRESPONDENCE ADDRESS

37 C.F.R. § 1.33(c) states:

> (c) All notices, official letters, and other communications for the patent owner or owners in a reexamination or supplemental examination proceeding will be directed to the correspondence address in the patent file.

The correspondence address for any pending reexamination proceeding not having the same correspondence address as that of the patent is, by way of this revision to 37 C.F.R. § 1.33(c), automatically changed to that of the patent file as of the effective date.

This change is effective for any reexamination proceeding which is pending before the Office as of May 16, 2007, including the present reexamination proceeding, and to any reexamination proceeding which is filed after that date.

Parties are to take this change into account when filing papers, and direct communications accordingly.

In the event the patent owner's correspondence address listed in the papers (record) for the present proceeding is different from the correspondence address of the patent, it is strongly encouraged that the patent owner affirmatively file a Notification of Change of Correspondence Address in the reexamination proceeding and/or the patent (depending on which address patent owner desires), to conform the address of the proceeding with that of the patent and to clarify the record as to which address should be used for correspondence.

Telephone Numbers for reexamination inquiries:

Reexamination	(571) 272-7703

VIII. CONCLUSION

Extensions of time under 37 C.F.R. § 1.136(a) will not be permitted in these proceedings because the provisions of 37 C.F.R. § 1.136 apply only to "an applicant" and not to parties in a reexamination proceeding. Additionally, 35 U.S.C. 305 requires that ex parte reexamination proceedings "will be conducted with special dispatch" (37 C.F.R. § 1.550(a)). Extensions of time in ex parte reexamination proceedings are provided for in 37 C.F.R. § 1.550(c).

Patent owner is reminded of the continuing responsibility under 37 C.F.R. § 1.565(a), to apprise the Office of any litigation activity, or other prior or concurrent proceeding, involving the '666 Patent throughout the course of this reexamination proceeding. See MPEP §§ 2207, 2282 and 2286. The third-party requester is similarly apprised of the ability to disclose such proceedings.

Registered users of EFS-Web may alternatively submit correspondence via the electronic filing system at https://efs.uspto.gov/efile/nwportal/efs-registered

Signed:

/YUZHEN GE/
Primary Examiner, Art Unit 3992

Conferees:

/COLIN M LAROSE/
Primary Examiner, Art Unit 3992

/ANDREW J. FISCHER/
Supervisory Patent Reexamination Specialist, Art Unit 3992

PTO/SB/81B (12-08)
Approved for use through 09/30/2025. OMB 0651-0035
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REEXAMINATION – PATENT OWNER POWER OF ATTORNEY OR REVOCATION OF POWER OF ATTORNEY WITH A NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS

Control Number(s)	90/019,169
Filing Date(s)	February 24, 2023
First Named Inventor	Steven Wayne Goldstein
Title	Method and Device for Acute Sound Detection and Reproduction
Patent Number	11,244,666
Examiner Name	Ge, Yuzhen
Attorney Docket No(s).	3-00051-666EPR

I hereby revoke all previous patent owner powers of attorney given in the above-identified reexamination proceeding control number(s).

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the Customer Number identified in the box at right as my/our attorney(s) or agent(s) to prosecute the proceeding(s) identified above, and to transact all business in the United States Patent and Trademark Office connected therewith: 176134

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s) to prosecute the proceeding(s) identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

Practitioner(s) Name	Registration Number

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Address					
City		State		Zip	
Country					
Telephone		Email			

I am the:

☐ Inventor, having ownership of the patent being reexamined.

OR

☒ Patent owner.

Statement under 37 CFR 3.73(b) (Form PTO/SB/96) submitted herewith or filed on _____.

SIGNATURE of Inventor or Patent Owner

Signature	/John P. Keady/	Date	9/6/2023
Name	John P. Keady	Telephone	571-606-1291
Title and Company	Chief Technology Officer and Assistant General Counsel, Staton Techiya, LLC		

NOTE: Signatures of all the inventors or patent owners of the entire interest or their representative(s) are required. If more than one signature is required, submit multiple forms, check the box below, and identify the total number of forms submitted in the blank below.

☐ A total of _____ forms are submitted.

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PTO/SB/96 (11-18)
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STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: Staton Techiya, LLC

Application No./Patent No.: 11,244,666 Filed/Issue Date: February 8, 2022

Titled:
Method and Device for Acute Sound Detection and Reproduction

Staton Techiya, LLC, a Corporation
(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.

states that it is:

1. ■ the assignee of the entire right, title, and interest in;

2. ☐ an assignee of less than the entire right, title, and interest in
(The extent (by percentage) of its ownership interest is _____ %); or

3. ☐ the assignee of an undivided interest in the entirety of (a complete assignment from one of the joint inventors was made)

the patent application/patent identified above, by virtue of either:

A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel_____, Frame_____, or a copy* is attached.

OR

B. ■ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: Steven Wayne Goldstein To: Personics Holdings, Inc.
The document was recorded in the United States Patent and Trademark Office at
Reel 054756, Frame 0398, or a copy* is attached.

2. From: John Usher To: Personics Holdings, Inc.
The document was recorded in the United States Patent and Trademark Office at
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3. From: Marc Andre Boillot To: Personics Holdings, Inc.
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☒ Additional documents in the chain of title are listed on a supplemental sheet(s).

☐ *As required by 37 CFR 3.73(b)(1)(i), if a copy/copies is/are attached, the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (*i.e.*, a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/John P. Keady/ 9/6/2023
Signature Date

John P. Keady CTO and Assistant General Counsel
Printed or Typed Name Title or Registration Number

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Statement under 37 CFR 3.73(b)
Supplemental Sheet to PTO/SB/96

Patent Owner:	Staton Techiya, LLC
Patent No.:	11/244,666
Issued:	February 8, 2022
Titled:	Method and Device for Acute Sound Detection and Reproduction

The chain of title from the inventors to the current assignee continues as follows:

4. From: Personics Holdings, Inc. To: Personics Holdings, LLC
The document was recorded in the United States Patent and Trademark Office at Reel 054756, Frame 0427

5. From: Personics Holdings, Inc.
Personics Holdings, LLC
To: DM Staton Family Limited Partnership
The document was recorded in the United States Patent and Trademark Office at Reel 054756, Frame 0451

6. From: DM Staton Family Limited Partnership
To: Staton Techiya, LLC
The document was recorded in the United States Patent and Trademark Office at Reel 054756, Frame 0494

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 1.550(f), the undersigned hereby certifies that on September 7, 2023, copies of the following:

- Reexamination – Power of Attorney
- Statement under 37 CFR 3.73(b)

were served on Third Party Requester at the following address:

Ali R. Sharifahmadian
Arnold & Porter Kaye Scholer LLP
601 Massachusetts Ave., N.W.
Washington, DC 20001

Dated: September 7, 2023

Respectfully submitted,

/s/ Jacob A. Snodgrass
Jacob A. Snodgrass
Registration No. 66,032

PV Law LLP
Customer No. 176134
5335 Wisconsin Avenue, N.W., Suite 440
Washington, DC 20015
T: 202.371.6861
F. 202.888.3163

Electronic Acknowledgement Receipt

EFS ID:	48550915
Application Number:	90019169
International Application Number:	
Confirmation Number:	7859
Title of Invention:	METHOD AND DEVICE FOR ACUTE SOUND DETECTION AND REPRODUCTION
First Named Inventor/Applicant Name:	11244666
Customer Number:	150139
Filer:	Jacob Andrew Snodgrass
Filer Authorized By:	
Attorney Docket Number:	0027071.00133
Receipt Date:	07-SEP-2023
Filing Date:	24-FEB-2023
Time Stamp:	11:23:38
Application Type:	Reexam (Third Party)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	90_019169-POA.pdf	525851 de8ef72fd3d7a4feb2beaf383f758e110d985565	no	2

Warnings:

Information:					
2	Assignee showing of ownership per 37 CFR 3.73	90_019169-3_73bStatement.pdf	273056 e5d92635a23e63d9910f169502666833efdd2a2a	no	3
Warnings:					
Information:					
3	Reexam Certificate of Service	90_019169-COS.pdf	104625 f52c2cdbcebda770785486aff98612412169 0e02	no	1
Warnings:					
Information:					
			Total Files Size (in bytes):	903532	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
90/019,169	02/24/2023	11244666	0027071.00133

CONFIRMATION NO. 7859

150139
Akerman LLP
777 South Flagler Drive
Suite 1100 West Tower
West Palm Beach, FL 33401

POWER OF ATTORNEY NOTICE

OC000000061626960

Date Mailed: 09/11/2023

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 09/07/2023.

- The Power of Attorney to you in this application has been revoked by the applicant. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/rbell/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
90/019,169	02/24/2023	11244666	0027071.00133

CONFIRMATION NO. 7859

176134
PV Law LLP
5335 Wisconsin Avenue, N.W., Suite 440
Washington, DC 20015

POA ACCEPTANCE LETTER

OC000000061627267

Date Mailed: 09/11/2023

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 09/07/2023.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/rbell/

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Control No.	90/019,169
U.S. Patent No.	11,244,666
Reexamination Filing Date	February 24, 2023
Inventors	Steven Wayne Goldstein et al.
Title	METHOD AND DEVICE FOR ACUTE SOUND DETECTION AND REPRODUCTION
Examiner	Ge, Yuzhen
Art Unit	3992
Confirmation No.	7859

Submitted via EFS-Web
Mail Stop Ex Parte Reexamination
Attn: Central Reexamination Unit
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

ASSERTION OF SMALL ENTITY STATUS

Pursuant to MPEP § 509.03 and 37 C.F.R. § 1.27(c), Patent Owner hereby asserts that it is a small entity under 37 C.F.R. § 1.27(a).

Dated: September 15, 2023

Respectfully submitted,

/s/ Jacob A. Snodgrass
Jacob A. Snodgrass
Registration No. 66,032

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5335 Wisconsin Avenue, N.W., Suite 440
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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 1.550(f), the undersigned hereby certifies that on September 15, 2023, a copy of this Assertion of Small Entity Status was served on Third Party Requester at the following address.

Ali R. Sharifahmadian
Arnold & Porter Kay Scholer LLP
601 Massachusetts Ave., N.W.
Washington, DC 20001

Dated: September 15, 2023

Respectfully submitted,

/s/ Jacob A. Snodgrass
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Control No.	90/019,169
U.S. Patent No.	11,244,666
Reexamination Filing Date	February 24, 2023
Inventors	Steven Wayne Goldstein et al.
Title	METHOD AND DEVICE FOR ACUTE SOUND DETECTION AND REPRODUCTION
Examiner	Ge, Yuzhen
Art Unit	3992
Confirmation No.	7859

Submitted via EFS-Web
Mail Stop Ex Parte Reexamination
Attn: Central Reexamination Unit
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

COMMENTS ON STATEMENT OF REASONS FOR CONFIRMATION

In response to the Notice of Intent to Issue Ex Parte Reexamination Certificate dated September 5, 2023, and the Corrected Notice of Intent to Issue Ex Parte Reexamination Certificate dated September 7, 2023 ("the Corrected NIRC"), Patent Owner states as follows.

Patent Owner disagrees that the "generating," "applying," "mixing," and "sending" limitations of claim 1 (see pages 20-22 of the Corrected NIRC) invoke § 112 ¶ 6. None of the limitations recite "means" and therefore all such limitations are presumptively not subject to § 112 ¶ 6. MPEP § 2181.I ("[A] claim limitation that does not use the term 'means' or 'step' will trigger the rebuttable presumption that 35 U.S.C. 112(f) does not apply.").

Further, the presumption that the limitations do not invoke § 112 ¶ 6 is not overcome. The Corrected NIRC alleges that "the claimed 'processor' is not a generic computer processor or a general purpose computer but a particular processor requiring special programming since the three claimed 'generating . . .," "applying . . ." and "mixing . . ." functions as set forth in [the 'generating,' 'applying,' and 'mixing' limitations] cannot be performed by a general purpose

processor or computer." Corrected NIRC at 9; *see also id.* at 13, 15. The Corrected NIRC fails to provide evidentiary support for those allegations. Patent Owner further disagrees with the rationale of the Corrected NIRC, which is not in accord with recent Federal Circuit decisions on the matter. For example, in *VDPP LLC v. Vizion, Inc.*, Appeal No. 2021-2040, 2022 WL 885771, at *3 (Fed. Cir. Mar. 25, 2022), the Federal Circuit found that the term "a processor adapted to" perform certain functions, such as (i) obtain a first image, (ii) expand the first image frame, (iii) generate a bridge frame, and (iv) blend the modified image frame with the bridge frame, are not means-plus-function limitations. The Federal Circuit found fault with the district court's conclusion that the "processor" term was a means-plus-function limitation because the district court "failed to give effect to the presumption against the application of § 112(f)." *Id.* at *3.

Further, although not mentioned as a reason for confirmation, for similar reasons, Patent Owner disagrees that the "detecting" and "determining" limitations of claim 2, the "determining" limitation of claim 3, and the "adjusting" limitation of claim 8 (see pages 16-20 of the Corrected NIRC) invoke § 112 ¶ 6.

Dated: September 15, 2023

Respectfully submitted,

/s/ Jacob A. Snodgrass
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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 1.550(f), the undersigned hereby certifies that on September 15, 2023, a copy of this Comments on Statement of Reasons for Confirmation was served on Third Party Requester at the following address.

Ali R. Sharifahmadian
Arnold & Porter Kay Scholer LLP
601 Massachusetts Ave., N.W.
Washington, DC 20001

Dated: September 15, 2023

Respectfully submitted,

/s/ Jacob A. Snodgrass
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Control No.	90/019,169
U.S. Patent No.	11,244,666
Reexamination Filing Date	February 24, 2023
Inventors	Steven Wayne Goldstein et al.
Title	METHOD AND DEVICE FOR ACUTE SOUND DETECTION AND REPRODUCTION
Examiner	Ge, Yuzhen
Art Unit	3992
Confirmation No.	7859

Submitted via EFS-Web
Mail Stop Ex Parte Reexamination
Attn: Central Reexamination Unit
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

STATEMENT OF RELATED PROCEEDINGS

Pursuant to 37 C.F.R. § 1.565(a), Patent Owner provides the following information regarding other proceedings involving U.S. Patent No. 11,244,666 ("the '666 patent").

The '666 patent was challenged in IPR2022-01099, filed on June 9, 2022. The Patent Trial and Appeal Board ("PTAB") denied institution of IPR on January 3, 2023. *Samsung Elecs. Co., Ltd., et al. v. Staton Techiya, LLC*, IPR2022-01099, Paper 10.

The '666 patent is asserted by Patent Owner in *Staton Techiya, LLC, et al. v. Samsung Elecs. Co., Ltd., et al.*, Case No. 2:21-cv-00413-JRG-RSP (E.D. Tex.). That case is the lead case of two consolidated cases, including *Staton Techiya, LLC, et al. v. Samsung Elecs. Co., Ltd., et al.*, Case No. 2:22-cv-00053-JRG-RSP (E.D. Tex.), filed February 14, 2022, in which the '666 patent was first asserted. The litigation is pending. Trial is scheduled to begin on October 30, 2023. One claim term of the '666 patent was construed by the court as follows:

Term	Construction
"a processor . . . the processor" (claim 1)	The same processor must perform each of the recited functions.

Staton Techiya, LLC, et al. v. Samsung Elecs. Co., Ltd., et al., Case No. 2:21-cv-00413-JRG-RSP (E.D. Tex.), Dkt. No. 285 at 48.

The defendants in the litigation, Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc., filed a Motion for Summary Judgment of Invalidity under 35 U.S.C. § 112 of the '666 Patent. Dkt. Nos. 433 (sealed motion), 457 (redacted motion), 486 (sealed opposition), 515 (redacted opposition), 543 (sealed reply), 556 (redacted reply), 587 (sur-reply). That motion remains pending.

Dated: September 15, 2023

Respectfully submitted,

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 1.550(f), the undersigned hereby certifies that on September 15, 2023, a copy of this Statement of Related Proceedings was served on Third Party Requester at the following address.

Ali R. Sharifahmadian
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601 Massachusetts Ave., N.W.
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Dated: September 15, 2023

Respectfully submitted,

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Electronic Acknowledgement Receipt

EFS ID:	48591143
Application Number:	90019169
International Application Number:	
Confirmation Number:	7859
Title of Invention:	METHOD AND DEVICE FOR ACUTE SOUND DETECTION AND REPRODUCTION
First Named Inventor/Applicant Name:	11244666
Customer Number:	176134
Filer:	Jacob Andrew Snodgrass
Filer Authorized By:	
Attorney Docket Number:	0027071.00133
Receipt Date:	15-SEP-2023
Filing Date:	24-FEB-2023
Time Stamp:	06:22:28
Application Type:	Reexam (Third Party)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		90_019169_Assertion_of_Small_Entity.pdf	93127 047390edefc7dcf5eac2582e22b1904c22ba52da	yes	2