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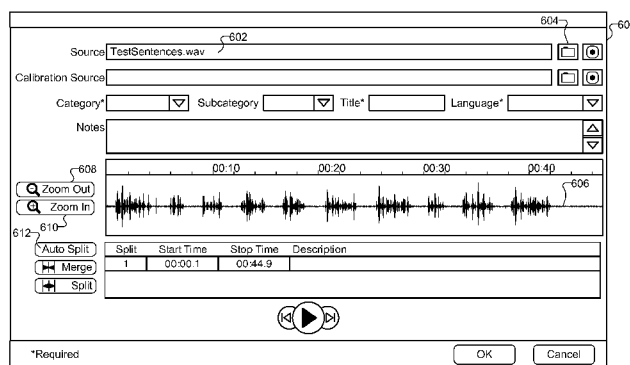


Fig. 6

(57) Abstract: An exemplary programming system receives a first user input command provided by a user and representative of a selection of an audio file that comprises a plurality of items configured to be audibly presented to a patient by way of a cochlear im-
plant system. The programming system displays, in response to the first user input command, a graphical representation of an acous-
tic waveform of the audio file, receives a second user input command provided by the user and representative of a request to auto
split the audio file into a plurality of audio clips each representative of a single item included in the plurality of items, automatically
splits, in response to the second user input command, the audio file into the plurality of audio clips, and graphically indicates, within
the graphical representation of the acoustic waveform, boundaries of each of the audio clips.

SYSTEMS AND METHODS FOR PREPARING AN AUDIO FILE FOR AN EVALUATION OF COCHLEAR IMPLANT SYSTEM PERFORMANCE

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BACKGROUND INFORMATION

[0001] It is often desirable to evaluate how well a cochlear implant system is performing for a particular patient. For example, it may be desirable to present the patient with items (e.g., sentences and/or lists of words) at different loudness levels and/or different signal-to-noise ratios and determine how well the patient recognizes the content of the items at the different loudness levels and/or different signal-to-noise ratios.

[0002] However, the items that are to be presented to the patient are often included in a single audio file. For example, a clinician may be provided with an audio file (e.g., a track on a compact disc) that includes a plurality of items separated by short gaps of silence. In this situation, it may be difficult and/or time consuming for the clinician to manually locate a desired item within the audio file (e.g., by fast forwarding, rewinding, or otherwise traversing through the audio file) and then present the item to the patient. Moreover, it may be difficult for the clinician to effectively evaluate cochlear implant system performance for a patient if the clinician cannot stop presenting the audio file at an ideal temporal location (e.g., immediately after an item is presented to the patient, but before too much of the silence gap that follows the item is presented).

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BRIEF DESCRIPTION OF THE DRAWINGS

[0003] The accompanying drawings illustrate various embodiments and are a part of the specification. The illustrated embodiments are merely examples and do not limit the scope of the disclosure. Throughout the drawings, identical or similar reference numbers designate identical or similar elements.

[0004] FIG. 1 illustrates an exemplary cochlear implant system according to principles described herein.

[0005] FIG. 2 illustrates a schematic structure of the human cochlea according to principles described herein.

[0006] FIG. 3 shows an exemplary configuration in which a programming system is communicatively coupled to a sound processor according to principles described herein.

[0007] FIG. 4 illustrates an exemplary implementation of the programming system shown in FIG. 3 according to principles described herein.

[0008] FIG. 5 illustrates an exemplary programming system according to principles described herein.

5 [0009] FIG. 6 shows an exemplary graphical user interface ("GUI") according to principles described herein.

[0010] FIG. 7 shows an acoustic waveform of an audio file after the audio file has been split into a plurality of audio clips according to principles described herein.

[0011] FIGS. 8-10 show exemplary GUIs according to principles described herein.

10 [0012] FIG. 11 shows an exemplary flowchart that includes various steps that may be performed in order to calibrate an audio clip for a particular loudness level requested by a user according to principles described herein.

[0013] FIG. 12 illustrates an exemplary method of preparing an audio file for an evaluation of cochlear implant system performance for a patient according to principles
15 described herein.

[0014] FIG. 13 illustrates an exemplary computing device according to principles described herein.

DETAILED DESCRIPTION

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[0015] Systems and methods for preparing an audio file for an evaluation of cochlear implant system performance for a patient are described herein. As will be described in more detail below, a programming system may receive a first user input command provided by a user. The first user input command is representative of a
25 selection of an audio file that comprises a plurality of items (e.g., sentences or lists of words) configured to be audibly presented to a patient by way of a cochlear implant system (e.g., while the at least one physical computing device is communicatively coupled to the cochlear implant system). In response to the first user input command, the programming system may display a graphical representation of an acoustic
30 waveform of the audio file within a graphical user interface ("GUI"). While the graphical representation of the acoustic waveform is being displayed within the GUI, the programming system may receive a second user input command provided by the user. The second user input command is representative of a request to auto split the audio file into a plurality of audio clips each representative of a single item included in the

plurality of items. In response to the second user input command, the programming system may automatically split the audio file into the plurality of audio clips and graphically indicate, within the graphical representation of the acoustic waveform displayed within the GUI, boundaries of each of the audio clips.

- 5 **[0016]** By automatically splitting the audio file into audio clips and graphically indicating boundaries of each of the audio clips, the systems and methods described herein may facilitate efficient and effective evaluation of cochlear implant system performance for a patient. For example, by automatically splitting the audio file into audio clips, the systems and methods described herein may allow a user to efficiently
- 10 switch between presenting different audio clips to the patient. Moreover, the systems and methods described herein may allow a user to efficiently and effectively create a smart list associated with the audio clips that may be used to evaluate cochlear implant system performance. Other benefits of the systems and methods described herein will be made apparent herein.
- 15 **[0017]** FIG. 1 illustrates an exemplary cochlear implant system 100. As shown, cochlear implant system 100 may include various components configured to be located external to a user including, but not limited to, a microphone 102, a sound processor 104, and a headpiece 106. Cochlear implant system 100 may further include various components configured to be implanted within the user including, but not limited to, a
- 20 cochlear implant 108 and a lead 110 (also referred to as an intracochlear electrode array) with a plurality of electrodes 112 disposed thereon. As will be described in more detail below, additional or alternative components may be included within cochlear implant system 100 as may serve a particular implementation. The components shown in FIG. 1 will now be described in more detail.
- 25 **[0018]** Microphone 102 may be configured to detect audio signals presented to the user. Microphone 102 may be implemented in any suitable manner. For example, microphone 102 may include a microphone that is configured to be placed within the concha of the ear near the entrance to the ear canal, such as a T-MIC™ microphone from Advanced Bionics. Such a microphone may be held within the concha of the ear
- 30 near the entrance of the ear canal by a boom or stalk that is attached to an ear hook configured to be selectively attached to sound processor 104. Additionally or alternatively, microphone 102 may be implemented by one or more microphones disposed within headpiece 106, one or more microphones disposed within sound

processor 104, one or more beam-forming microphones, and/or any other suitable microphone as may serve a particular implementation.

[0019] Sound processor 104 (i.e., one or more components included within sound processor 104) may be configured to direct cochlear implant 108 to generate and apply electrical stimulation (also referred to herein as “stimulation current”) representative of one or more audio signals (e.g., one or more audio signals detected by microphone 102, input by way of an auxiliary audio input port, etc.) to one or more stimulation sites associated with an auditory pathway (e.g., the auditory nerve) of the user. Exemplary stimulation sites include, but are not limited to, one or more locations within the cochlea, the cochlear nucleus, the inferior colliculus, and/or any other nuclei in the auditory pathway. To this end, sound processor 104 may process the one or more audio signals in accordance with a selected sound processing strategy or program to generate appropriate stimulation parameters for controlling cochlear implant 108. Sound processor 104 may include or be implemented by a behind-the-ear (“BTE”) unit, a body worn device, and/or any other sound processing unit as may serve a particular implementation. For example, sound processor 104 may be implemented by an electro-acoustic stimulation (“EAS”) sound processor included in an EAS system configured to provide electrical and acoustic stimulation to a user.

[0020] In some examples, sound processor 104 may wirelessly transmit stimulation parameters (e.g., in the form of data words included in a forward telemetry sequence) and/or power signals to cochlear implant 108 by way of a wireless communication link 114 between headpiece 106 and cochlear implant 108. It will be understood that communication link 114 may include a bidirectional communication link and/or one or more dedicated unidirectional communication links. In some examples, sound processor 104 may execute and operate in accordance with a sound processing program that has been loaded into memory contained within sound processor 104.

[0021] Headpiece 106 may be communicatively coupled to sound processor 104 and may include an external antenna (e.g., a coil and/or one or more wireless communication components) configured to facilitate selective wireless coupling of sound processor 104 to cochlear implant 108. Headpiece 106 may additionally or alternatively be used to selectively and wirelessly couple any other external device to cochlear implant 108. To this end, headpiece 106 may be configured to be affixed to the user’s head and positioned such that the external antenna housed within headpiece 106 is communicatively coupled to a corresponding implantable antenna (which may

also be implemented by a coil and/or one or more wireless communication components) included within or otherwise associated with cochlear implant 108. In this manner, stimulation parameters and/or power signals may be wirelessly transmitted between sound processor 104 and cochlear implant 108 via a communication link 114 (which may include a bidirectional communication link and/or one or more dedicated unidirectional communication links as may serve a particular implementation).

[0022] Cochlear implant 108 may include any type of implantable stimulator that may be used in association with the systems and methods described herein. For example, cochlear implant 108 may be implemented by an implantable cochlear stimulator. In some alternative implementations, cochlear implant 108 may include a brainstem implant and/or any other type of active implant or auditory prosthesis that may be implanted within a user and configured to apply stimulation to one or more stimulation sites located along an auditory pathway of a user.

[0023] In some examples, cochlear implant 108 may be configured to generate electrical stimulation representative of an audio signal processed by sound processor 104 (e.g., an audio signal detected by microphone 102) in accordance with one or more stimulation parameters transmitted thereto by sound processor 104. Cochlear implant 108 may be further configured to apply the electrical stimulation to one or more stimulation sites within the user via one or more electrodes 112 disposed along lead 110 (e.g., by way of one or more stimulation channels formed by electrodes 112). In some examples, cochlear implant 108 may include a plurality of independent current sources each associated with a channel defined by one or more of electrodes 112. In this manner, different stimulation current levels may be applied to multiple stimulation sites simultaneously (also referred to as “concurrently”) by way of multiple electrodes 112.

[0024] FIG. 2 illustrates a schematic structure of the human cochlea 200 into which lead 110 may be inserted. As shown in FIG. 2, the cochlea 200 is in the shape of a spiral beginning at a base 202 and ending at an apex 204. Within the cochlea 200 resides auditory nerve tissue 206, which is denoted by Xs in FIG. 2. The auditory nerve tissue 206 is organized within the cochlea 200 in a tonotopic manner. Relatively low frequencies are encoded at or near the apex 204 of the cochlea 200 (referred to as an “apical region”) while relatively high frequencies are encoded at or near the base 202 (referred to as a “basal region”). Hence, each location along the length of the cochlea 200 corresponds to a different perceived frequency. Cochlear implant system 100 may

therefore be configured to apply electrical stimulation to different locations within the cochlea 200 (e.g., different locations along the auditory nerve tissue 206) to provide a sensation of hearing.

[0025] In some examples, a programming system separate from (i.e., not included within) cochlear implant system 100 may be selectively and communicatively coupled to sound processor 104 in order to perform one or more programming or fitting operations with respect to cochlear implant system 100. For example, the programming system may present audio clips to the patient by way of the cochlear implant system in order to facilitate evaluation of how well the cochlear implant system is performing for the patient.

[0026] To illustrate, FIG. 3 shows an exemplary configuration 300 in which a programming system 302 is communicatively coupled to sound processor 104. Programming system 302 may be implemented by any suitable combination of physical computing and communication devices including, but not limited to, a fitting station or device, a programming device, a personal computer, a laptop computer, a handheld device, a mobile device (e.g., a mobile phone), a clinician's programming interface ("CPI") device, and/or any other suitable component as may serve a particular implementation. In some examples, programming system 302 may provide one or more GUIs (e.g., by displaying the one or more GUIs by way of a display screen) with which a clinician or other user may interact.

[0027] FIG. 4 illustrates an exemplary configuration 400 in which programming system 302 is implemented by a computing device 402 and a CPI device 404. As shown, computing device 402 may be selectively and communicatively coupled to CPI device 404 by way of a cable 406. Likewise, CPI device 404 may be selectively and communicatively coupled to sound processor 104 by way of a cable 408. Cables 406 and 408 may each include any suitable type of cable that facilitates transmission of digital data between computing device 402 and sound processor 104. For example, cable 406 may include a universal serial bus ("USB") cable and cable 408 may include any type of cable configured to connect to a programming port included in sound processor 104. In some examples, computing device 402 may present an audio clip to the patient by digitally streaming the audio clip to sound processor 104 by way of cable 406, CPI device 404, and cable 408 without the audio clip ever being converted to an analog signal. In some alternative examples, wireless connections may be used to

communicatively couple computing device 402 and CPI device 404, as well as CPI device 404 and sound processor 104.

[0028] Configuration 400 corresponds to a unilateral cochlear implant system (i.e., there is a single sound processor 104 that corresponds to one ear of the patient). It will be recognized that the systems and methods described herein may be applied to a bilateral cochlear implant system in which separate sound processors are associated with each ear of the patient or by a bimodal system in which a sound processor is associated with one of the patient's ears and a hearing aid is associated with the patient's other ear. In these instances, programming system 302 may be implemented by two CPI devices each associated with one of the sound processors, or by a single CPI device configured to connect to both sound processors.

[0029] FIG. 5 illustrates exemplary components of programming system 302. As shown, programming system 302 may include an evaluation facility 502, a sound booth emulation facility 504 ("emulation facility 504"), and a storage facility 506, which may be in communication with one another using any suitable communication technologies. Storage facility 506 may maintain audio file data 508 representative of one or more audio files that contain audio content that may be presented to the patient, evaluation data 510 generated and/or used by evaluation facility 502, and emulation data 512 generated and/or used by emulation facility 504. Storage facility 506 may maintain additional or alternative data as may serve a particular implementation.

[0030] Evaluation facility 502 may perform various operations configured to facilitate evaluation of cochlear implant system performance for a patient. For example, evaluation facility 502 may prepare an audio file for any suitable purpose (e.g., an evaluation of cochlear implant system performance for a patient). As mentioned, an audio file may include a plurality of items temporally separated one from another. As used herein, an "item" refers to a sentence or other grouping of elements that may be presented to a patient. An "element" may include a word or sound that is included in an item. For example, an exemplary item may include elements (e.g., words) organized into a sentence, such as "The brown dog jumped over the fence." Another exemplary item may include a list of words not organized into a sentence, such as "apple girl robot summer milk". Audio files may be digital files, for example, and may be stored locally by programming system 302 or otherwise accessed by programming system 302 (e.g., by remotely accessing the audio files via a network).

[0031] Evaluation facility 502 may prepare an audio file for an evaluation of cochlear implant system performance in any suitable manner. For example, evaluation facility 502 may receive a user input command provided by a user and representative of a selection of an audio file. The audio file may include a plurality of items configured to be audibly presented to a patient by way of a cochlear implant system (e.g., while programming system 302 is communicatively coupled to cochlear implant system 100) .

[0032] The user may provide the user input command that is representative of a selection of the audio file in any suitable manner. For example, FIG. 6 shows an exemplary GUI 600 that may be displayed by programming system 302 and that may be configured to facilitate selection of an audio file. A user may select the audio file by entering a name of the audio file into a source field 602, selecting an “open” option 604 (which may allow the user to navigate to a folder in which the audio file is stored and then select the audio file), or otherwise loading the audio file as may serve a particular implementation. In the example of FIG. 6, the user has selected an audio file named “TestSentences.wav”.

[0033] In response to the user input command that selects the audio file, evaluation facility 502 may display a graphical representation of an acoustic waveform of the audio file within the GUI. The acoustic waveform represents acoustic content of the audio file and may be displayed in the time domain. For example, FIG. 6 shows a graphical representation of an acoustic waveform 606 of the audio file named “TestSentences.wav.” As shown, the acoustic waveform 606 is arranged along a time axis. A use may zoom in or zoom out of the acoustic waveform 606 by selecting options 608 and 610, respectively.

[0034] As mentioned, the audio file represented by acoustic waveform 606 may include a plurality of items separated by periods of silence (which periods of silence are referred to herein as “silence gaps” or simply “gaps”). However, it may be desirable to split the audio file into a plurality of audio clips each representative of a single item included in the plurality of items. For example, as will be described below, it may be desirable to split the audio file into a plurality of audio clips each representative of a single item included in the plurality of items in order to create a smart list that may be used to evaluate cochlear implant system performance.

[0035] To this end, the user may provide, while the graphical representation of the acoustic waveform 606 is displayed within GUI 600, a user input command representative of a request to auto split the audio file into a plurality of audio clips each

representative of a single item included in the plurality of items. For example, the user may select “auto split” option 612 shown in GUI 600. Evaluation facility 502 may detect the user input command, and, in response, automatically split the audio file into the plurality of audio clips.

5 **[0036]** FIG. 7 shows the acoustic waveform 606 of the audio file after the audio file has been split into a plurality of audio clips 702 (e.g., audio clips 702-1 through 702-10) that each include a single item included in the plurality of items included in the audio file. Each audio 702 clip has a beginning boundary and an end boundary. For example, audio clip 702-1 has a beginning boundary 704-1 and an end boundary 704-
10 2. Likewise, audio clip 702-2 has a beginning boundary 704-3 and an end boundary 704-4. As shown, a silence gap 706 (e.g., silence gaps 706-1 through 706-10) may temporally separate each audio clip 702 one from another.

[0037] Evaluation facility 502 may automatically split the audio file into the plurality of audio clips 702 in any suitable manner. For example, evaluation facility 502 may
15 analyze the audio file in accordance with any suitable signal processing heuristic in order to determine the boundaries of each of the audio clips (i.e., when each item within the audio file begins and ends).

[0038] To illustrate, evaluation facility 502 may determine the boundaries of audio clips by identifying start and end times of the silence gaps included in the audio file.
20 For example, as shown in FIG. 7, silence gap 706-2 temporally separates audio clip 702-1 and audio clip 702-2. Evaluation facility 502 may identify a start time and an end time of silence gap 706-2 and set an end boundary (i.e., boundary 704-2) of the first audio clip 702-1 as the start time of silence gap 706-2 and a beginning boundary (i.e., boundary 704-3) of the second audio clip 702-2 as the end time of silence gap 706-2.
25 In some examples, the beginning and end boundaries of an audio clip 702 may be intentionally padded with leading and/or trailing silence as may serve a particular implementation.

[0039] Evaluation facility 502 may identify the start and end times of a silence gap 706 in any suitable manner. It will be recognized that there may be periods of silence
30 within the audio file that are not representative of silence gaps between items. For example, there may be periods of silence between elements in a particular item. Hence, in order to identify start and end times of silence gaps, evaluation facility 502 may be configured to differentiate between periods of silence that are in between items and periods of silence that are in between elements.

[0040] To do so, evaluation facility 502 may first identify a portion of the acoustic waveform of the audio file as being representative of silence. This may be performed in any suitable manner. For example, evaluation facility 502 may determine that a portion of the acoustic waveform has a sound level (e.g., an average sound level) that is less than a predetermined threshold and thereby determine that the portion is representative of silence. It will be recognized that “silence” may still have some sort of acoustic content (e.g., a noise floor). Hence, the predetermined threshold may be set to be any suitable sound level as may serve a particular implementation.

[0041] Additionally or alternatively, evaluation facility 502 may perform a peak analysis with respect to the acoustic waveform in order to determine whether a particular portion of the acoustic waveform is representative of silence. For example, an amplitude of a peak within the acoustic waveform may be identified and compared with an average amplitude of peaks included in portions of the waveform that have been identified as being representative of items (as opposed to silence). If the amplitude of the peak is less than the average amplitude, evaluation facility 502 may determine that the peak is included in a portion of the audio file that is representative of silence.

[0042] In some example, the size (i.e., temporal length) of the portion identified as being representative of silence may be adjusted (e.g., increased) until the average sound level of the portion is close to or equal to the predetermined threshold. In this manner, the temporal boundaries of the portion may be set to be at or near the edges of the adjacent items.

[0043] Once the portion of the acoustic waveform has been identified as being representative of silence, evaluation facility 502 may determine a temporal length of the portion. The temporal length may be compared to temporal lengths of other portions identified as being representative of silence, and, based on the comparison, evaluation facility 502 may statistically determine that the temporal length indicates that the portion is temporally located in between items instead of in between elements included in items. In response, evaluation facility 502 may designate a start time of the portion as the start time of the silence gap and an end time of the portion as the end time of the silence gap. It will be recognized that one or other characteristics of the acoustic waveform may be identified and used to determine whether a particular portion of the acoustic waveform is representative of a silence gap.

[0044] In some examples, evaluation facility 502 may identify the start and end times of a silence gap by placing the start and end times of the silence gap at zero crossings within the acoustic waveform. As used here, a “zero crossing” refers to a point within the acoustic waveform where the amplitude is zero. By ensuring that the start and end times of the silence gaps are at zero crossings, the transition between an audio clip and silence will be less perceptible to the patient when the audio clip is presented to the patient.

[0045] In some examples, evaluation facility 502 may graphically indicate, within the graphical representation of the acoustic waveform 606 displayed within GUI 600, the boundaries of each of the audio clips. FIG. 8 shows GUI 600 while evaluation facility 502 is graphically indicating the boundaries of each of the audio clips included in the audio file represented by acoustic waveform 606. For example, the beginning boundary 704-1 and the end boundary 704-2 of audio clip 702-1 are graphically portrayed in FIG. 8, as well as the boundaries of the other audio clips 702 included in the audio file.

[0046] In some examples, a user may interact with GUI 600 to manually adjust one or more boundaries graphically portrayed within the graphical representation of the acoustic waveform 606. For example, the user may select a particular boundary (e.g., by performing a touch gesture with respect to the boundary, selecting the boundary with a mouse cursor, or otherwise selecting the boundary) and then adjust a position of the boundary (e.g., by dragging the boundary from a first temporal position to a second temporal position). Evaluation facility 502 may detect this user input and adjust the boundary accordingly. For example, evaluation facility 502 may identify a zero crossing within the acoustic waveform 606 that is closest to the second temporal position and position the boundary at the identified zero crossing instead of at the actual second temporal position.

[0047] In some examples, a user may desire to merge multiple audio clips into a single audio clip. For example, the user may desire to merge audio clips 702-1 and 702-2 into a single audio clip. To do so, the user may select both audio clips 702-1 and 702-2 and select a “merge option” 802. Alternatively, a user may desire to split a single audio clip into two or more audio clips. To do so, the user may select the desired audio clip (e.g., audio clip 702-1) and select a “split” option 804. It will be recognized that a user may additionally or alternatively manipulate the size and contents of each audio clip 702 as may serve a particular implementation.

[0048] Once the boundaries have been set for each audio clip, the user may create a smart list that may be used to evaluate cochlear implant system performance for a patient. To facilitate creation of the smart list, evaluation facility 502 may automatically display, within GUI 600 information associated with each audio clip. For example, evaluation facility 502 may display a table 806 that identifies each audio clip by number (e.g., the “Split” column), a start time of each audio clip (e.g., the “Start Time” column), a stop time of each audio clip (e.g., the “Stop Time” column), and a description of each audio clip (e.g., the “Description” column).

[0049] As shown, the “Description” column may include a field 808 (e.g., fields 808-1 through 808-3) for each audio clip. Evaluation facility 502 may populate each field 808 with elements included in each field’s corresponding audio clip. For example, evaluation facility 502 may populate field 808-1 with elements included in the item included in audio clip 702-1.

[0050] Evaluation facility 502 may populate fields 808 in any suitable manner. For example, evaluation facility 502 may detect manual text entry by the user of one or more words into a particular field (e.g., field 808-1). In response, evaluation facility 502 may designate the one or more words as one or more elements included in the item included in audio clip 702-1 and display the one or more words within the particular field.

[0051] Additionally or alternatively, evaluation facility 502 may automatically identify, based on a speech recognition heuristic, one or more words included in a particular audio clip (e.g., audio clip 702-1). Evaluation facility 502 may then designate the one or more words as one or more elements included in the item included in the particular audio clip 702-1 and display the one or more words within a field (e.g., field 808-1) corresponding to the particular audio clip.

[0052] FIG. 9 shows GUI 600 after fields 808 have been populated with elements included in audio clips 702-1 through 702-3. For example, as shown, field 808-1 indicates that audio clip 702-1 includes the following sentence “He tried to convince her she was not right.”

[0053] Once fields 808 have been populated, the user may select a “Create Smart List” option 902 (or any other option, such as a “save” option) to create a smart list based on the identified audio clips 702 and the populated fields 808. In response to the user selection of option 902, evaluation facility 502 may create the smart list by, for example, saving data representative of the different audio clips and their associated

elements. In some alternative examples, evaluation facility 502 automatically creates the smart list once the audio file has been split into a plurality of audio clips.

[0054] Once the smart list has been created, the user may assign score weightings to each element included in the audio clips included in the smart list. This may be done in any suitable manner. Exemplary manners in which the user may assign score weightings to the elements are described in detail in co-pending PCT Application No. _____, Attorney Docket No. 3021-0427-WO, entitled "Systems and Methods for Facilitating Evaluation of Cochlear Implant System Performance," filed the same day as the present application, and incorporated herein by reference in its entirety.

[0055] Once the score weightings have been assigned, the user may commence with an evaluation of the cochlear implant system performance for the patient. For example, evaluation facility 502 may detect a selection by the user of the smart list, and, in response, display an evaluation GUI associated with the smart list.

[0056] FIG. 10 shows an exemplary evaluation GUI 1000 that may be displayed by evaluation facility 502 during an evaluation period in which cochlear implant system performance for the patient is evaluated using a smart list that has been selected by the user. As shown, each audio clip included in the smart list is represented in GUI 1000 by a particular row of graphical objects, wherein each graphical object is representative of a particular element included in the audio clips. For example, GUI 1000 shows five rows 1002 (e.g., rows 1002-1 through 1002-5) each corresponding to a different audio clip (i.e., sentence) included in the smart list. Each element included in each sentence is represented by a graphical object. For example, the element "He" in the first sentence shown in FIG. 10 is represented by graphical object 1004-1, the element "tried" is represented by graphical object 1004-2, the element "right" is represented by graphical object 1004-3, etc.

[0057] While GUI 1000 is displayed, the user may provide an input command representative of a request to play a particular audio clip included in the smart list. For example, the user may simply select a row that corresponds to the audio clip. To illustrate, the user may select row 1002-1. Evaluation facility 502 may detect the selection of row 1002-1 and, in response, initiate a presentation of the item (i.e., sentence) shown in row 1002-1. The user may additionally or alternatively interact with control options 1006 to play a particular audio clip, skip to a different audio clip, and/or stop playing a particular audio clip.

[0058] After the sentence in the audio clip has been presented to the patient, the user may have the patient repeat the sentence back to the user in order to determine which elements included in the sentence that the patient can correctly identify (i.e., correctly repeat back to the user) after listening to the presented audio clip. Based on the patient's response, the user may perform various types of interaction with GUI 1000 (e.g., with one or more graphical objects displayed within GUI 1000) in order to record which elements the patient correctly identified and which elements the patient incorrectly identified. Based on the interaction by the user with GUI 1000, evaluation facility 502 may determine an evaluation score for the patient. The evaluation score may represent a total number of elements that the patient correctly identifies after listening to the presented audio clip.

[0059] In some examples, evaluation facility 502 may facilitate different types of interaction by the user with GUI 1000 so that the user may quickly and accurately mark elements that the patient correctly identifies and elements that the patient incorrectly identifies. For example, the user may perform a first type of interaction (e.g., by left-clicking a mouse or other type of pointing device) with respect to a graphical object representative of a particular element included in a sentence (or other group of elements) in order to mark the particular element as being incorrectly identified by the patient and the remaining elements included in the sentence as being correctly identified by the patient. Alternatively, the user may perform a second type of interaction (e.g., by right-clicking a mouse or other type of pointing device) with respect to a graphical object representative of a particular element included in a sentence (or other group of elements) in order to mark the particular element as being correctly identified by the patient and the remaining elements included in the sentence as being incorrectly identified by the patient. In this manner, the user may mark all the words in the sentence as correct or incorrect with a single interactive event (e.g., a left or right click of a mouse).

[0060] The first and second types of interactions may include any type of interactions that differ one from another. For example, the first type of interaction may include a selection of a first button (a left-click button) included on a pointing device (e.g., a mouse) communicatively coupled to programming system 302 and the second type of interaction may include a selection of a second button (a right-click button) included on the pointing device. Additionally or alternatively, the first type of interaction may include a first type of touch gesture performed with respect to a display screen

within which GUI 1000 is displayed and the second type of interaction may include a second type of touch gesture performed with respect to the display screen within which GUI 1000 is displayed.

[0061] An exemplary evaluation process and examples of ways in which the user may interact with GUI 1000 are described more fully in the above-referenced co-pending PCT Application No. PCT/US15/52224, Attorney Docket No. 3021-0427-WO, entitled "Systems and Methods for Facilitating Evaluation of Cochlear Implant System Performance," filed the same day as the present application, and incorporated herein by reference in its entirety.

[0062] Returning to FIG. 5, emulation facility 504 may perform various operations configured to emulate a sound booth for a patient while the patient's cochlear implant system is communicatively coupled to programming system 302 (e.g., while a sound processor included in the cochlear implant system is communicatively coupled to programming system 302).

[0063] For example, emulation facility 504 may isolate the patient from an acoustic environment of the patient. In some examples, emulation facility 504 may isolate the patient from the acoustic environment by disabling each microphone included in the cochlear implant system. Emulation facility 504 may disable a microphone included in the cochlear implant system by transmitting a command to the sound processor included in the cochlear implant system to turn off the microphone and/or in any other suitable manner.

[0064] Emulation facility 504 may be further configured to calibrate audio clips that are presented to the patient so that the audio clips have a calibrated loudness level when they are presented to the patient. For example, in response to a user request to present an audio clip to the patient at a particular loudness level, emulation facility 504 may calibrate the audio clip to actually have the particular loudness level when the audio clip is presented to the patient.

[0065] Calibration of the audio clip may ensure that the audio clip actually has the particular loudness level selected by the user, regardless of the initial loudness level of the audio clip (i.e., the loudness level at which the audio clip is recorded or otherwise created), regardless of the particular programming system 302 (i.e., the particular hardware) used to present the audio clip to the patient, and regardless of the particular components included in the cochlear implant system used by the patient. In this manner, a clinician may use different programming systems 302 (e.g., different

computing devices) during different visits by the patient to the clinician's office to present audio clips to the patient and know that the selected loudness levels of the audio clips are accurate and consistent between the different programming systems 302.

- 5 **[0066]** Emulation facility 504 may calibrate the audio clip in any suitable manner. For example, FIG. 11 shows an exemplary flowchart 1100 that includes various steps that may be performed by emulation facility 504 in order to calibrate an audio clip for a particular loudness level requested by a user. While FIG. 11 illustrates exemplary steps according to one embodiment, other embodiments may omit, add to, reorder, and/or modify any of the steps shown in FIG. 11.
- 10 **[0067]** As shown, in step 1102, calibration of the audio clip may include determining, based on a root mean square ("RMS") value of a system calibration signal having a known loudness level, a target RMS value for the audio clip and that will produce the particular loudness level. The system calibration signal may include any suitable signal
- 15 having a known (e.g., predetermined) loudness level. For example, the system calibration signal may include a one kilohertz sine wave that has a known loudness level of 60 dB SPL.
- 20 **[0068]** The RMS value of the system calibration signal may be determined (e.g., by emulation facility 504) in any suitable manner. For example, the RMS value of a sine wave may be determined in accordance with $a/\sqrt{2}$, where a is the amplitude of the sine wave and representative of the known loudness level of the system calibration signal.
- 25 **[0069]** In some examples, programming system 302 may store data representative of the RMS value of the system calibration signal together with data representative of the known loudness level of the system calibration signal and that corresponds to the RMS value. Emulation facility 504 may access this data when determining the target RMS value or the calibration signal. Emulation facility 504 may alternatively access the data representative of the RMS value of the system calibration signal from a source other than programming system 302 in any suitable manner.
- 30 **[0070]** Emulation facility 504 may use the RMS value of the system calibration signal to determine the target RMS value for the audio clip in any suitable manner. For example, if the known loudness level of the system calibration signal is a_1 , the RMS value of the system calibration signal is RMS_1 , the particular loudness level requested by the user is a_2 , and the target RMS value of the audio clip that will result in the audio

clip having the particular loudness level is RMS_2 , emulation facility 504 may determine the target RMS value by calculating the following equation: $RMS_2 = RMS_1 * a_2 / a_1$.

[0071] In step 1104, emulation facility 504 may determine an initial RMS value of the audio clip. As used herein, the “initial RMS value” of the audio clip refers to the original
5 RMS value of the audio clip before it is calibrated. Emulation facility 504 may determine the initial RMS value of the audio clip in any suitable manner. For example, emulation facility 504 may store information representative of the initial RMS value of the audio clip within metadata associated with the audio clip and determine the initial RMS value of the audio clip by accessing the metadata. To illustrate, when an audio
10 clip is initially loaded onto (e.g., copied or downloaded by) programming system 302, emulation facility 504 may measure the RMS value of the audio clip and designate the measured RMS value as the initial RMS value of the audio clip. The measured RMS value may be stored in metadata associated with the audio clip and then accessed as needed by emulation facility 504 in order to determine the initial RMS value of the audio
15 clip.

[0072] As described above, an audio file stored or otherwise accessed by emulation facility 504 may include a plurality of audio clips (e.g., a plurality of audio clips separated by periods of silence). In this scenario, emulation facility 504 may determine the initial RMS value of a particular audio clip included in the audio file by measuring an
20 RMS value of an entire audio file and designating the measured RMS value as the initial RMS value of the audio clip. Hence, in this embodiment, each audio clip included in the audio file may be assigned the same initial RMS value. Alternatively, emulation facility 504 may measure individual RMS values for each audio clip included in an audio file.

[0073] In some alternative examples, a single calibration track may be provided for a set of audio files that each include one or more audio clips. For example, a CD may include a calibration track associated with a remaining number of tracks on the CD. The calibration track may include an audio clip encoded at the same loudness level of the other tracks on the CD. Hence, when the CD is loaded onto the programming
30 system 302, emulation facility 504 may recognize the presence of the calibration track and measure the RMS value of the calibration track. The measured RMS value may be designated by emulation facility 504 as the initial RMS value of each of the audio clips included in the remaining tracks on the CD. In this manner, programming system 302

may avoid having to measure the RMS values of each of the individual tracks provided on the CD.

[0074] In step 1106, emulation facility 504 may determine, based on the initial RMS value of the audio clip and the target RMS value, a gain factor that, when applied to the audio clip, will result in the audio clip having the target RMS value and the particular loudness level. This may be performed in any suitable manner. For example, emulation facility 504 may set the gain factor to be substantially equal to a difference between the target RMS value and the initial RMS value.

[0075] To illustrate, if the target RMS value is higher than the initial RMS value (i.e., if the particular loudness level requested by the user is higher than the original loudness level of the audio clip), emulation facility 504 may set the gain factor to a value that amplifies the audio clip when the audio clip is presented to the patient. Alternatively, if the target RMS value is lower than the initial RMS value (i.e., if the particular loudness level requested by the user is lower than the original loudness level of the audio clip), emulation facility 504 may set the gain factor to a value that attenuates the audio clip when the audio clip is presented to the patient.

[0076] In step 1108, emulation facility 504 may apply the gain factor to the audio clip. This may be performed in any suitable manner. For example, emulation facility 504 may apply the gain factor to the audio clip in real time as the audio clip is being streamed by emulation facility 504 to the sound processor of the cochlear implant system. Additionally or alternatively, emulation facility 504 may apply the gain factor to the audio clip before the audio clip is streamed to the sound processor (e.g., by buffering data representative of the gain factor-applied audio clip).

[0077] Once the audio clip has been calibrated (or as the audio clip is being calibrated in real time), emulation facility 504 may present the calibrated audio clip to the patient. This may be performed in any suitable manner. For example, emulation facility 504 may digitally stream the audio clip to the sound processor included in the cochlear implant system. In some examples, the calibrated audio clip may be digitally streamed to the sound processor without the calibrated audio clip ever being converted to an analog signal. This may ensure that the calibrated audio clip is presented at the specified loudness level.

[0078] Calibration of audio clips, as well as various other types of operations configured to emulate conditions within a sound booth for a cochlear implant patient, are described in more detail in co-pending PCT Application No. PCT/US15/52153,

Attorney Docket No. 3021-0426-WO, entitled "Systems and Methods for Emulating a Sound Booth for a Cochlear Implant Patient," filed the same day as the present application, and incorporated herein by reference in its entirety.

[0079] FIG. 12 illustrates an exemplary method 1200 of preparing an audio file for an evaluation of cochlear implant system performance for a patient. While FIG. 12 illustrates exemplary steps according to one embodiment, other embodiments may omit, add to, reorder, and/or modify any of the steps shown in FIG. 12. One or more of the steps shown in FIG. 12 may be performed by programming system 302 and/or any implementation thereof.

[0080] In step 1202, a programming system receives a first user input command provided by a user and representative of a selection of an audio file that comprises a plurality of items configured to be audibly presented to a patient by way of a cochlear implant system. Step 1202 may be performed in any of the ways described herein.

[0081] In step 1204, the programming system displays, in response to the first user input command and within a graphical user interface, a graphical representation of an acoustic waveform of the audio file. Step 1204 may be performed in any of the ways described herein.

[0082] In step 1206, the programming system receives, while the graphical representation of the acoustic waveform is displayed within the graphical user interface, a second user input command provided by the user and representative of a request to auto split the audio file into a plurality of audio clips each representative of a single item included in the plurality of items. Step 1206 may be performed in any of the ways described herein.

[0083] In step 1208, the programming system automatically splits, in response to the second user input command, the audio file into the plurality of audio clips. Step 1208 may be performed in any of the ways described herein.

[0084] In step 1210, the programming system graphically indicates, within the graphical representation of the acoustic waveform displayed within the graphical user interface, boundaries of each of the audio clips. Step 1210 may be performed in any of the ways described herein.

[0085] In certain embodiments, one or more of the processes described herein may be implemented at least in part as instructions embodied in a non-transitory computer-readable medium and executable by one or more computing devices. In general, a processor (e.g., a microprocessor) receives instructions, from a non-transitory

computer-readable medium, (e.g., a memory, etc.), and executes those instructions, thereby performing one or more processes, including one or more of the processes described herein. Such instructions may be stored and/or transmitted using any of a variety of known computer-readable media.

5 **[0086]** A computer-readable medium (also referred to as a processor-readable medium) includes any non-transitory medium that participates in providing data (e.g., instructions) that may be read by a computer (e.g., by a processor of a computer). Such a medium may take many forms, including, but not limited to, non-volatile media, and/or volatile media. Non-volatile media may include, for example, optical or magnetic
10 disks and other persistent memory. Volatile media may include, for example, dynamic random access memory ("DRAM"), which typically constitutes a main memory. Common forms of computer-readable media include, for example, a disk, hard disk, magnetic tape, any other magnetic medium, a compact disc read-only memory ("CD-ROM"), a digital video disc ("DVD"), any other optical medium, random access memory
15 ("RAM"), programmable read-only memory ("PROM"), erasable programmable read-only memory ("EPROM"), electrically erasable programmable read-only memory ("EEPROM"), a Flash EEPROM device, any other memory chip or cartridge, or any other tangible medium from which a computer can read.

[0087] FIG. 13 illustrates an exemplary computing device 1300 that may be
20 specifically configured to perform one or more of the processes described herein. As shown in FIG. 13, computing device 1300 may include a communication interface 1302, a processor 1304, a storage device 1306, and an input/output ("I/O") module 1308 communicatively connected via a communication infrastructure 1310. While an exemplary computing device 1300 is shown in FIG. 13, the components illustrated in
25 FIG. 13 are not intended to be limiting. Additional or alternative components may be used in other embodiments. Components of computing device 1300 shown in FIG. 13 will now be described in additional detail.

[0088] Communication interface 1302 may be configured to communicate with one or more computing devices. Examples of communication interface 1302 include,
30 without limitation, a wired network interface (such as a network interface card), a wireless network interface (such as a wireless network interface card), a modem, an audio/video connection, and any other suitable interface.

[0089] Processor 1304 generally represents any type or form of processing unit capable of processing data or interpreting, executing, and/or directing execution of one

or more of the instructions, processes, and/or operations described herein. Processor 1304 may direct execution of operations in accordance with one or more applications 1312 or other computer-executable instructions such as may be stored in storage device 1306 or another computer-readable medium.

5 **[0090]** Storage device 1306 may include one or more data storage media, devices, or configurations and may employ any type, form, and combination of data storage media and/or device. For example, storage device 1306 may include, but is not limited to, a hard drive, network drive, flash drive, magnetic disc, optical disc, RAM, dynamic RAM, other non-volatile and/or volatile data storage units, or a combination or sub-
10 combination thereof. Electronic data, including data described herein, may be temporarily and/or permanently stored in storage device 1306. For example, data representative of one or more executable applications 1312 configured to direct processor 1304 to perform any of the operations described herein may be stored within storage device 1306. In some examples, data may be arranged in one or more
15 databases residing within storage device 1306.

[0091] I/O module 1308 may be configured to receive user input and provide user output and may include any hardware, firmware, software, or combination thereof supportive of input and output capabilities. For example, I/O module 1308 may include hardware and/or software for capturing user input, including, but not limited to, a
20 keyboard or keypad, a touch screen component (e.g., touch screen display), a receiver (e.g., an RF or infrared receiver), and/or one or more input buttons.

[0092] I/O module 1308 may include one or more devices for presenting output to a user, including, but not limited to, a graphics engine, a display (e.g., a display screen), one or more output drivers (e.g., display drivers), one or more audio speakers, and one
25 or more audio drivers. In certain embodiments, I/O module 1308 is configured to provide graphical data to a display for presentation to a user. The graphical data may be representative of one or more graphical user interfaces and/or any other graphical content as may serve a particular implementation.

[0093] In some examples, any of the facilities described herein may be implemented
30 by or within one or more components of computing device 1300. For example, one or more applications 1312 residing within storage device 1306 may be configured to direct processor 1304 to perform one or more processes or functions associated with evaluation facility 502 and/or emulation facility 504. Likewise, storage facility 506 may be implemented by or within storage device 1306.

[0094] In the preceding description, various exemplary embodiments have been described with reference to the accompanying drawings. It will, however, be evident that various modifications and changes may be made thereto, and additional embodiments may be implemented, without departing from the scope of the invention

5 as set forth in the claims that follow. For example, certain features of one embodiment described herein may be combined with or substituted for features of another embodiment described herein. The description and drawings are accordingly to be regarded in an illustrative rather than a restrictive sense.

CLAIMS

What is claimed is:

- 5 1. A system comprising:
 at least one physical computing device that:
 receives a first user input command provided by a user and
representative of a selection of an audio file that comprises a plurality of items
configured to be audibly presented to a patient by way of a cochlear implant system,
10 displays, in response to the first user input command and within a
graphical user interface, a graphical representation of an acoustic waveform of the
audio file,
 receives, while the graphical representation of the acoustic waveform is
displayed within the graphical user interface, a second user input command provided by
15 the user and representative of a request to auto split the audio file into a plurality of
audio clips each representative of a single item included in the plurality of items,
 automatically splits, in response to the second user input command, the
audio file into the plurality of audio clips, and
 graphically indicates, within the graphical representation of the acoustic
20 waveform displayed within the graphical user interface, boundaries of each of the audio
clips.
2. The system of claim 1, wherein the at least one physical computing
device:
25 displays, within the graphical user interface, a plurality of fields each associated
with a different audio clip included in the plurality of audio clips; and
 populates the plurality of fields with elements included in the items.
3. The system of claim 2, wherein:
30 the plurality of audio clips includes a particular audio clip that is representative of
a particular item included in the plurality of items;
 the plurality of fields includes a particular field associated with the particular
audio clip; and
 the at least one physical computing device populates the particular field with one
35 or more elements included in the particular item by

detecting manual text entry by the user of one or more words into the particular field,

designating the one or more words as the one or more elements included in the particular item, and

5 displaying the one or more words within the particular field.

4. The system of claim 2, wherein:

the plurality of audio clips includes a particular audio clip that is representative of a particular item included in the plurality of items;

10 the plurality of fields includes a particular field associated with the particular audio clip; and

the at least one physical computing device populates the particular field with one or more elements included in the particular item by

15 automatically identifying, based on a speech recognition heuristic, one or more words included in the particular audio clip,

designating the one or more words as the one or more elements included in the particular item, and

displaying the one or more words within the particular field.

20 5. The system of claim 2, wherein the at least one physical computing device generates, based on the plurality of audio clips and on the populated fields, a smart list configured to be used in evaluating performance of the cochlear implant system for the patient.

25 6. The system of claim 5, wherein the at least one physical computing device:

detects a selection by the user of the smart list;

displays, in response to the selection by the user of the smart list, an evaluation graphical user interface associated with the smart list;

30 detects a third user input command provided by the user by way of the evaluation graphical user interface and representative of a request for the at least one physical computing device to present an audio clip included in the plurality of audio clips to the patient; and

presents, in response to the third user input command, the audio clip to the patient.

7. The system of claim 6, wherein the at least one physical computing device:

displays, within the evaluation graphical user interface, a plurality of graphical objects each representative of a different element included in a plurality of elements included in the audio clip;

detects an interaction by the user with a graphical object included in the plurality of graphical objects and representative of a particular element included in the plurality of elements, and

determines, based on the interaction by the user with the graphical object, an evaluation score for the patient, the evaluation score representative of a total number of elements included in the plurality of elements and that the patient correctly identifies after listening to the presented audio clip.

8. The system of claim 6, wherein the at least one physical computing device isolates the patient from an acoustic environment by disabling a microphone included in the cochlear implant system while the audio clip is presented to the patient.

9. The system of claim 6, wherein the at least one physical computing device:

receives, by way of the graphical user interface, user input representative of a request to present the audio clip at a particular loudness level; and

calibrates, in response to the request and prior to the presentation of the audio clip, the audio clip to have the particular loudness level when the audio clip is presented to the patient.

10. The system of claim 6, wherein the at least one physical computing device presents the audio clip to the patient by digitally streaming the audio clip to a sound processor included in the cochlear implant system without converting the audio clip to an analog signal.

11. The system of claim 1, wherein the at least one physical computing device automatically splits the audio file into the plurality of audio clips by determining the boundaries of each of the audio clips.

5 12. The system of claim 11, wherein the at least one physical computing device determines the boundaries of each of the audio clips by:

identifying a start time and an end time of a silence gap that temporally separates a first audio clip included in the plurality of audio clips and a second audio clip included in the plurality of audio clips;

10 setting an end boundary of the first audio clip to be a first time that is within a first threshold amount of time from the start time of the silence gap; and

setting a beginning boundary of the second audio clip to be a second time that is within a second threshold amount of time from the end time of the silence gap.

15 13. The system of claim 12, wherein the at least one physical computing device identifies the start and end times of the silence gap by:

identifying a portion of the acoustic waveform as being representative of silence;
determining a temporal length of the portion;

20 determining that the temporal length indicates that the portion is temporally located in between items instead of in between elements included in items; and

designating, in response to the determining that the temporal length indicates that the portion is temporally located in between items, a start time of the portion as the start time of the silence gap and an end time of the portion as the end time of the silence gap.

25 14. The system of claim 13, wherein the at least one physical computing device identifies the portion as being representative of silence by determining that a sound level of the portion is less than a predetermined threshold.

30 15. The system of claim 12, wherein the at least one physical computing device identifies the start and end times of the silence gap by placing the start and end times of the silence gap at zero crossings within the acoustic waveform.

16. The system of claim 1, wherein the at least one physical computing device:

receives a third user input command provided by the user and representative of a request to manually adjust a particular boundary included in the boundaries from a first temporal position to a second temporal position; and
adjusts the particular boundary in accordance within the third user input.

17. The system of claim 16, wherein the at least one physical computing device adjusts the particular boundary by:

identifying a zero crossing within the acoustic waveform that is closest to the second temporal position; and

positioning the particular boundary at the zero crossing instead of at the second temporal position.

18. A system comprising:

at least one physical computing device that:

receives a first user input command provided by a user and representative of a selection of an audio file that comprises a plurality of items configured to be audibly presented to a patient by way of a cochlear implant system,

displays, in response to the first user input command and within a graphical user interface, a graphical representation of an acoustic waveform of the audio file,

receives, while the graphical representation of the acoustic waveform is displayed within the graphical user interface, a second user input command provided by the user and representative of a request to auto split the audio file into a plurality of audio clips each representative of a single item included in the plurality of items,

automatically splits, in response to the second user input command, the audio file into the plurality of audio clips,

graphically indicates, within the graphical representation of the acoustic waveform displayed within the graphical user interface, boundaries of each of the audio clips,

displays, within the graphical user interface, a plurality of fields each associated with a different audio clip included in the plurality of audio clips,

detects manual text entry by the user of words into the plurality of fields,
and

generates, based on the plurality of audio clips and on the manual text
entry, a smart list configured to be used in evaluating performance of the cochlear
5 implant system for the patient.

19. A method comprising:

receiving, by a programming system, a first user input command provided by a
user and representative of a selection of an audio file that comprises a plurality of items
10 configured to be audibly presented to a patient by way of a cochlear implant system,

displaying, by the programming system in response to the first user input
command and within a graphical user interface, a graphical representation of an
acoustic waveform of the audio file,

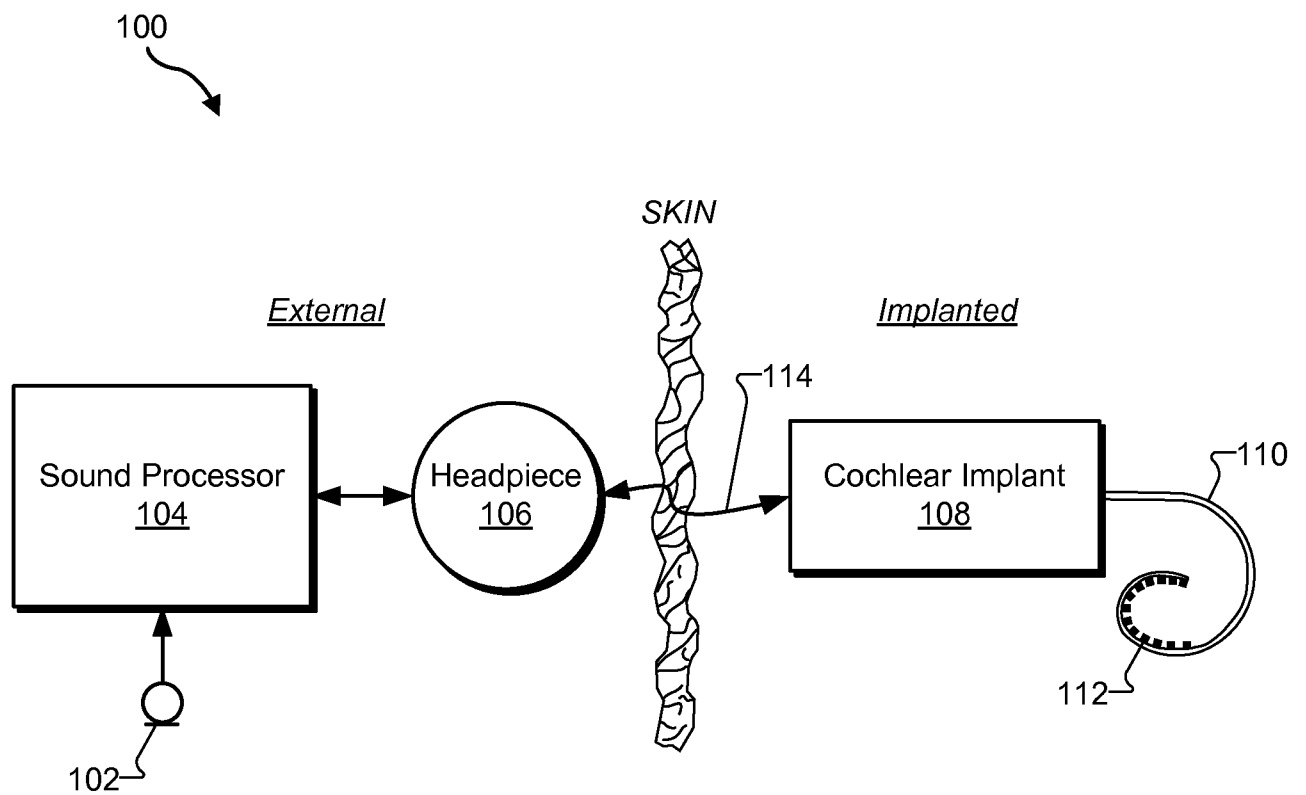
receiving, by the programming system while the graphical representation of the
15 acoustic waveform is displayed within the graphical user interface, a second user input
command provided by the user and representative of a request to auto split the audio
file into a plurality of audio clips each representative of a single item included in the
plurality of items,

automatically splitting, by the programming system in response to the second
20 user input command, the audio file into the plurality of audio clips, and

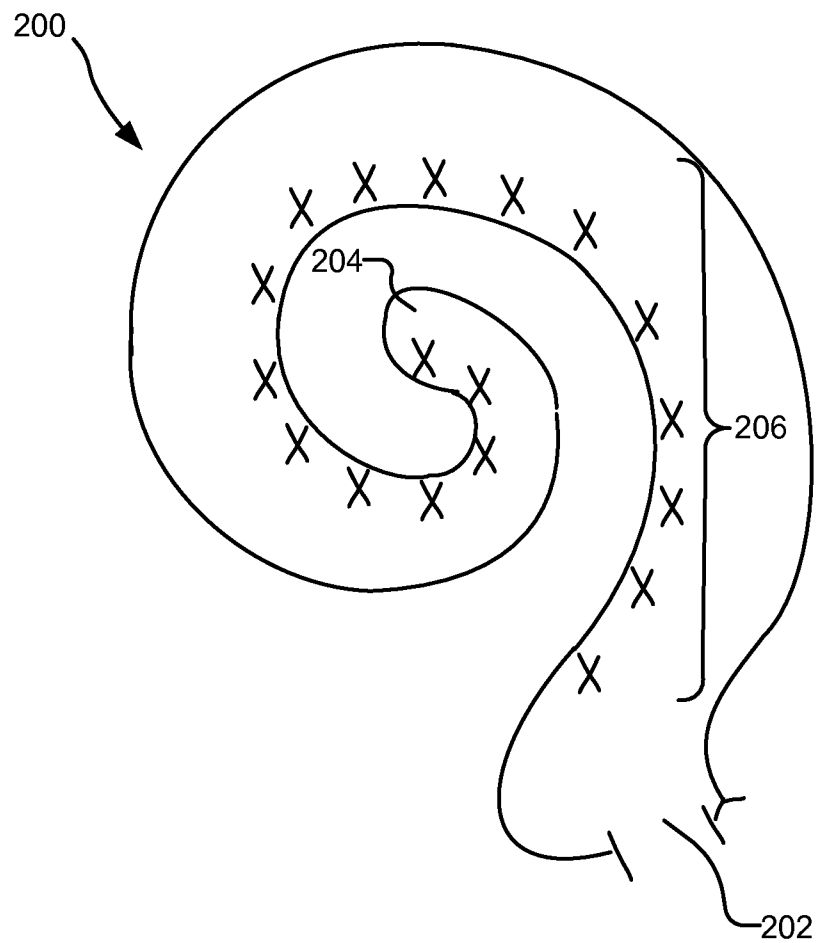
graphically indicating, by the programming system within the graphical
representation of the acoustic waveform displayed within the graphical user interface,
boundaries of each of the audio clips.

25 20. The method of claim 19, embodied as computer-executable instructions
on at least one non-transitory computer-readable medium.

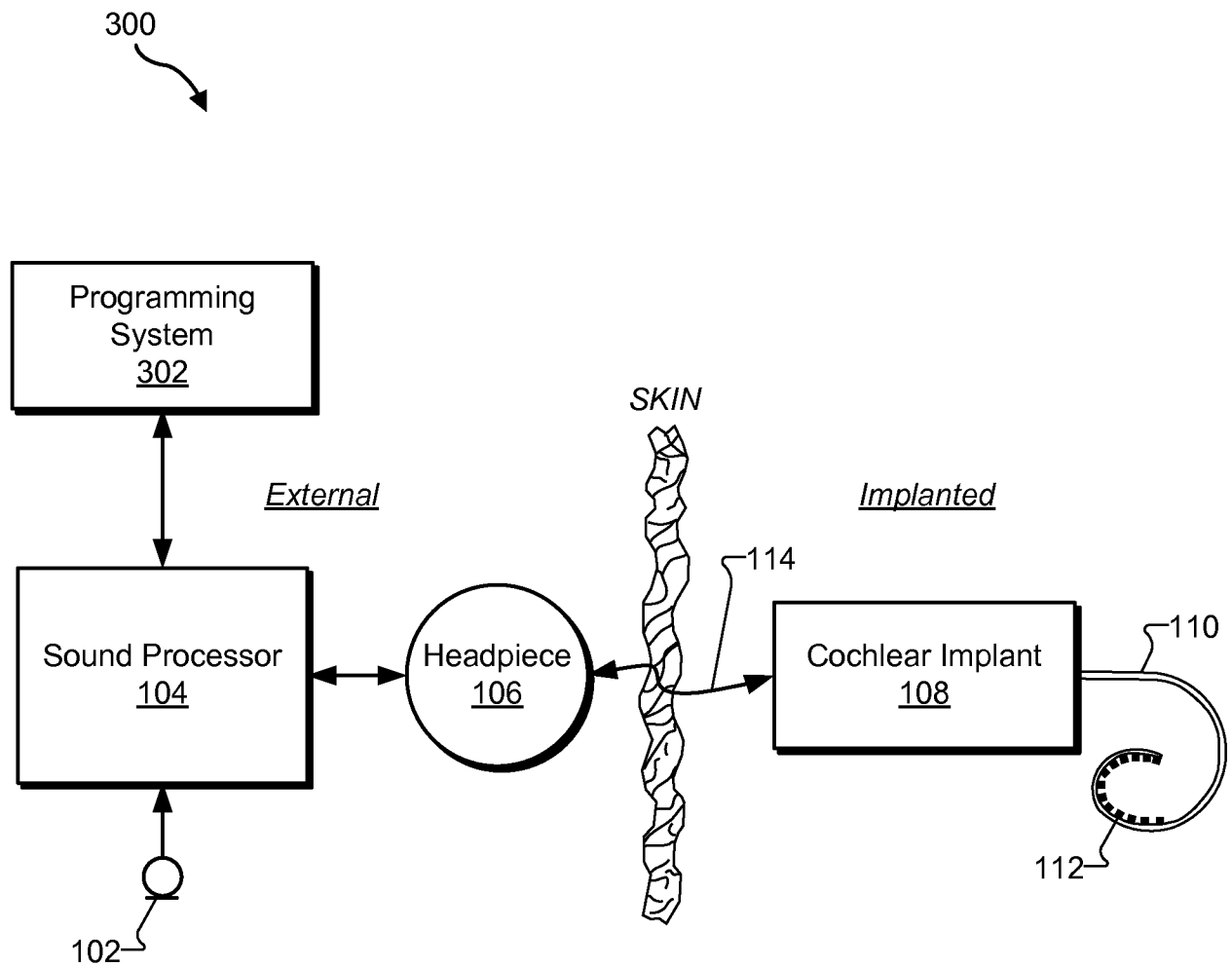
1/13

**Fig. 1**

2/13

**Fig. 2**

3/13

**Fig. 3**

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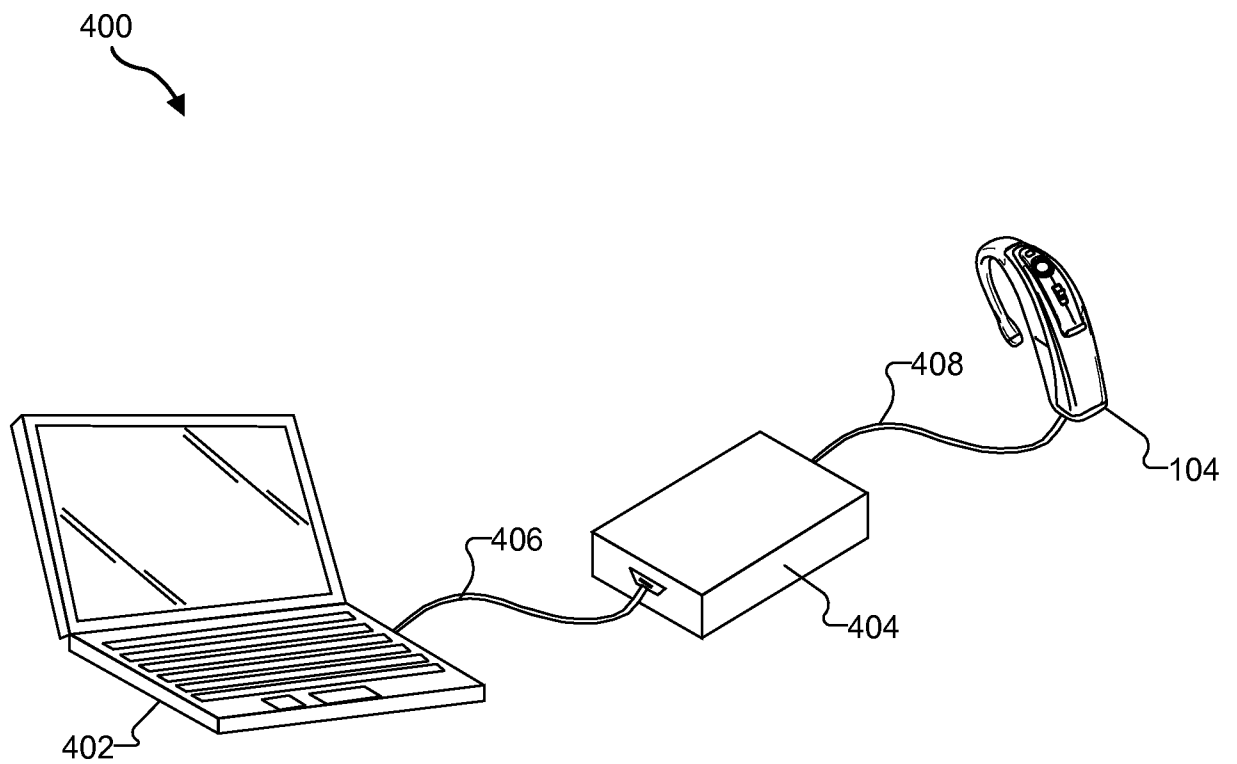


Fig. 4

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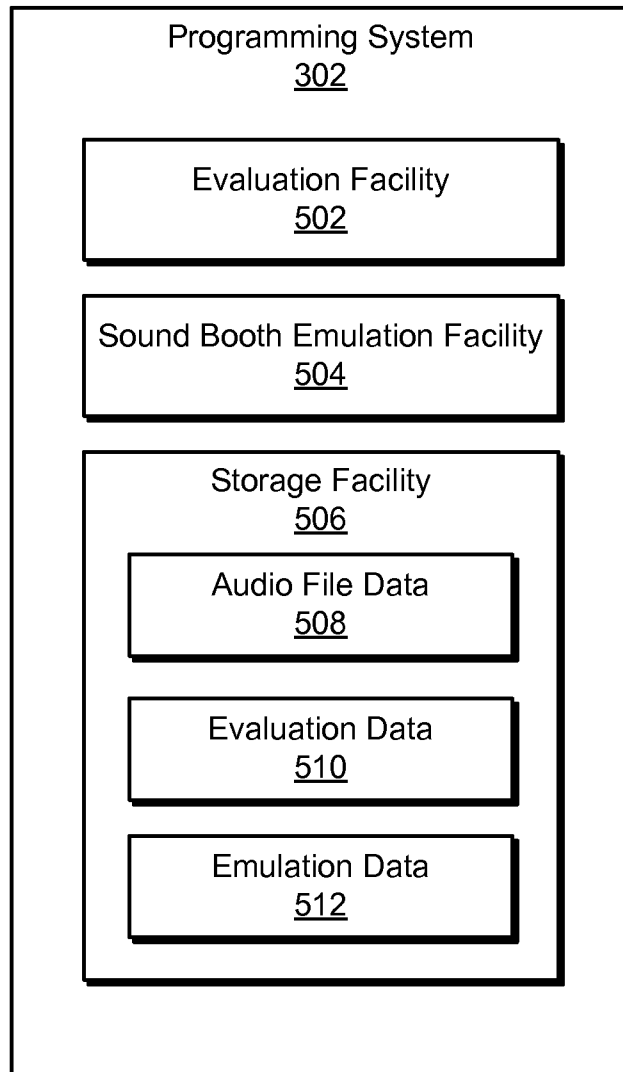


Fig. 5

600

604

Source

TestSentences.wav

602

Calibration Source

Category*

Subcategory

Title*

Language*

Notes

608

Zoom Out

Zoom In

610

Auto Split

Merge

Split

606

00:10

00:20

00:30

00:40

612

Split	Start Time	Stop Time	Description
1	00:00.1	00:44.9	

*Required

OK

Cancel

Fig. 6

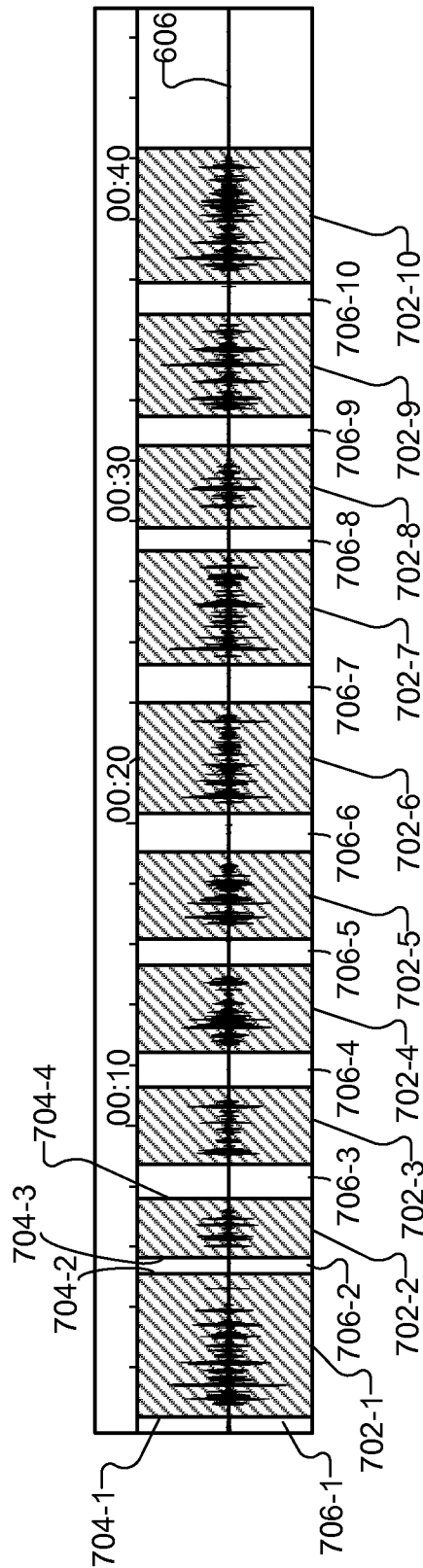


Fig. 7

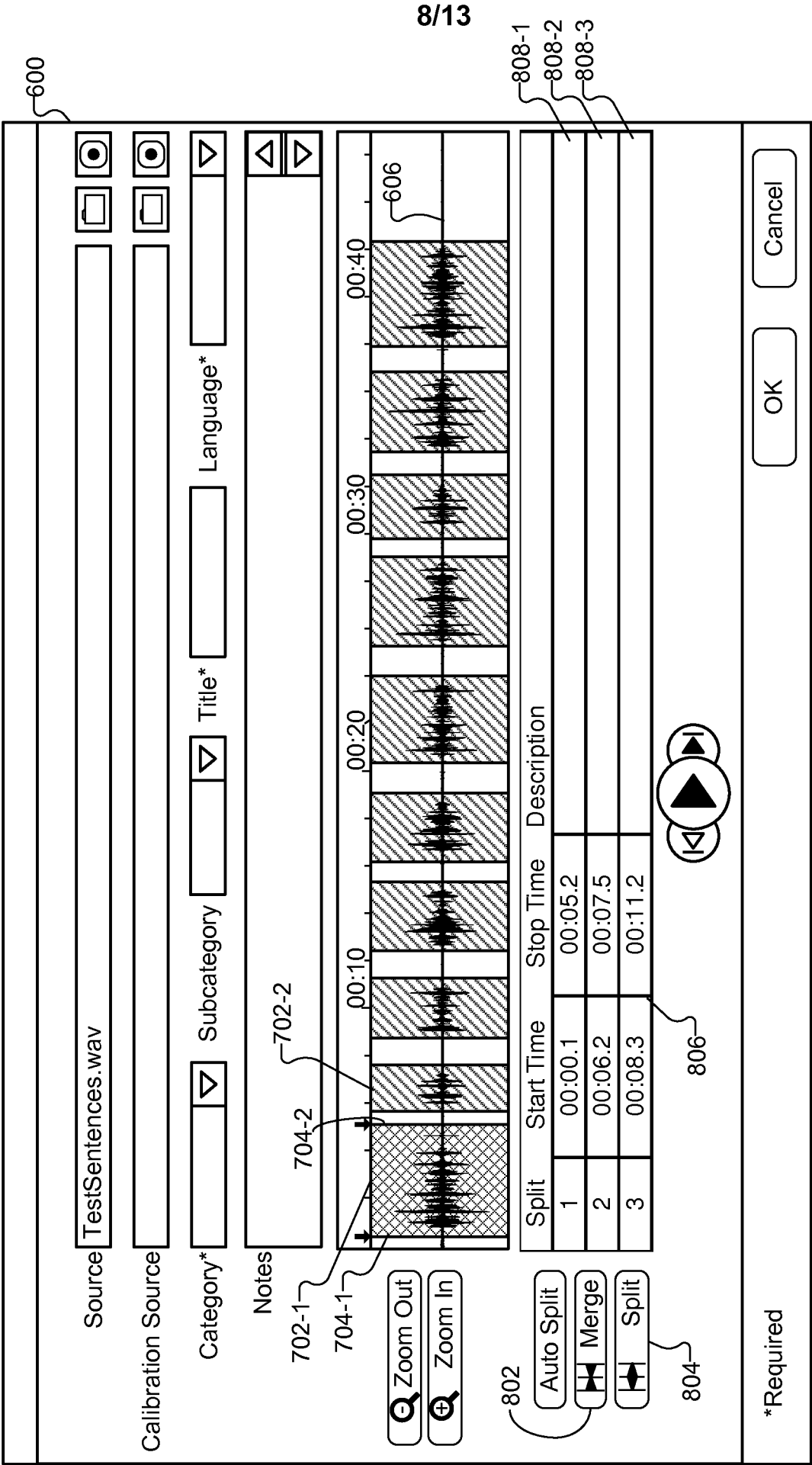


Fig- 8

600

Source

TestSentences.wav

Calibration Source

Category*

Subcategory

Title*

Language*

Notes

702-1

702-2

702-3

Zoom Out

Zoom In

808-1

808-2

808-3

00:00

00:10

00:20

00:30

00:40

902

Create Smart List

Auto Split

Merge

Split

Split	Start Time	Stop Time	Description
1	00:00.1	00:05.2	He tried to convince her she was not right
2	00:06.2	00:07.5	He was a very dedicated person
3	00:08.3	00:11.2	You smell like fresh lemons

902

Create Smart List

OK

Cancel

*Required

Fig- 9

Home

Evaluation Setup

Patients

Evaluation Setup A *

Evaluation Result A *

Evaluation Setup

Signal Level 63 dB

Notes

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Item Score

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Element Score

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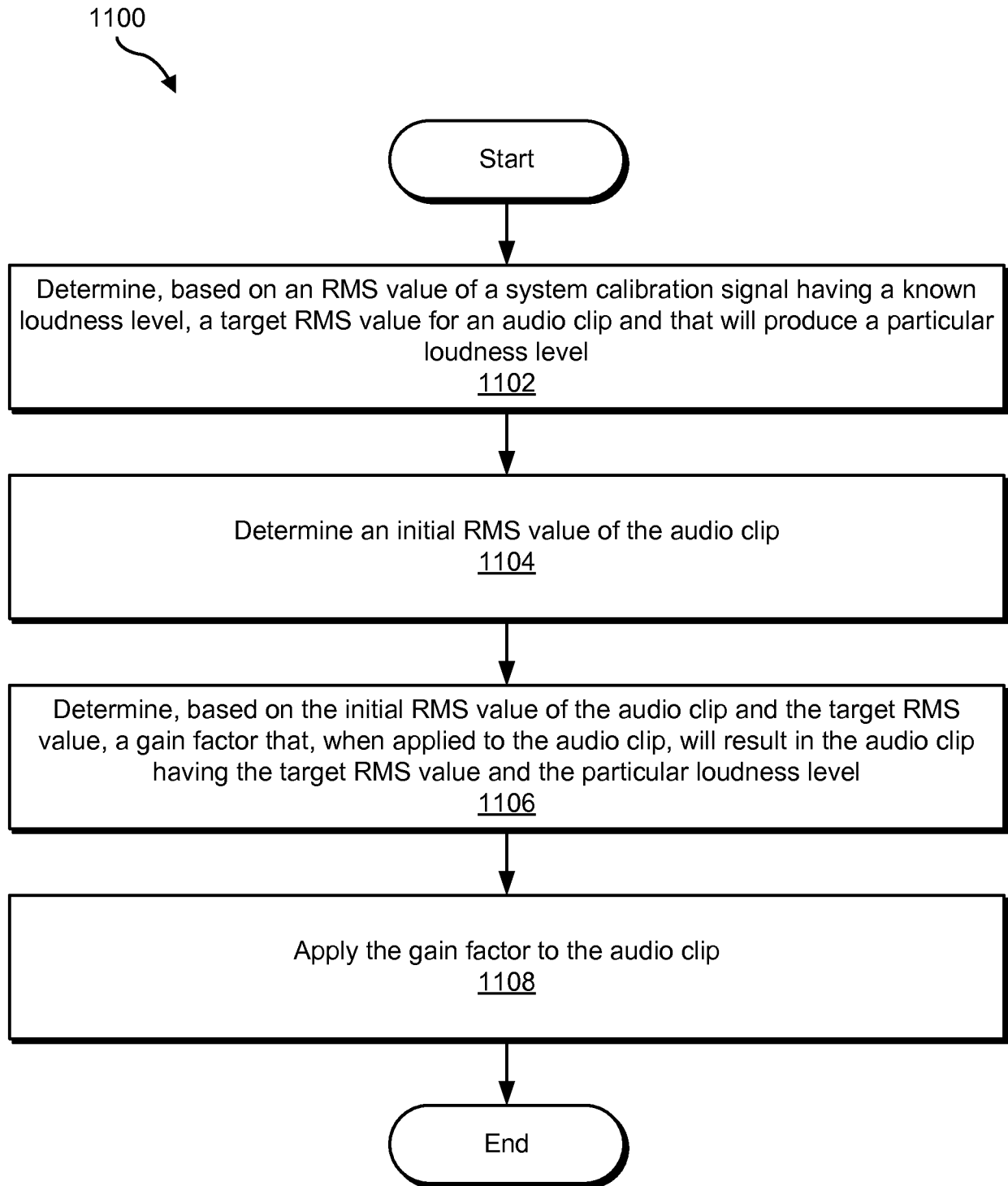
start

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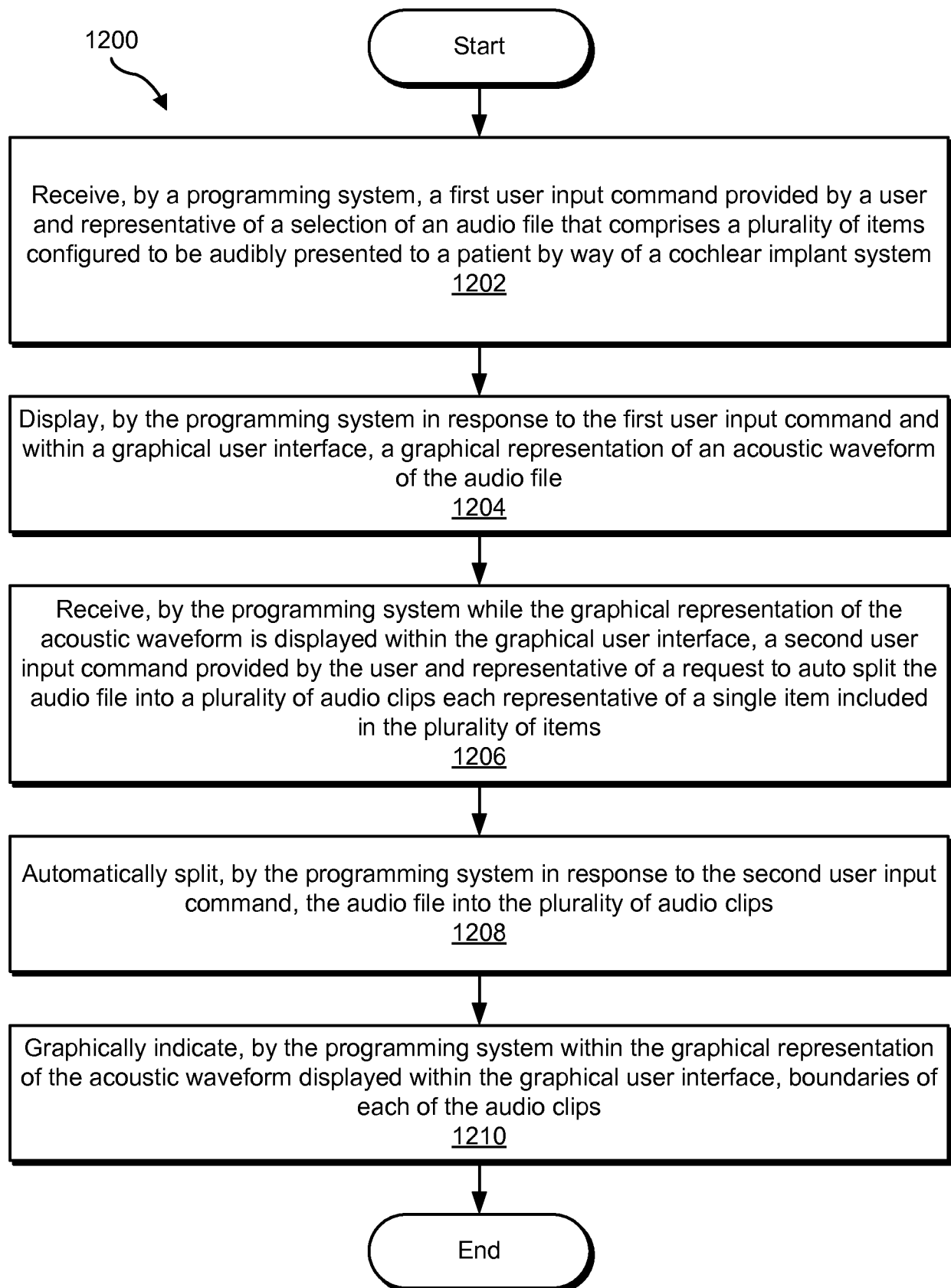
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Fig. 10

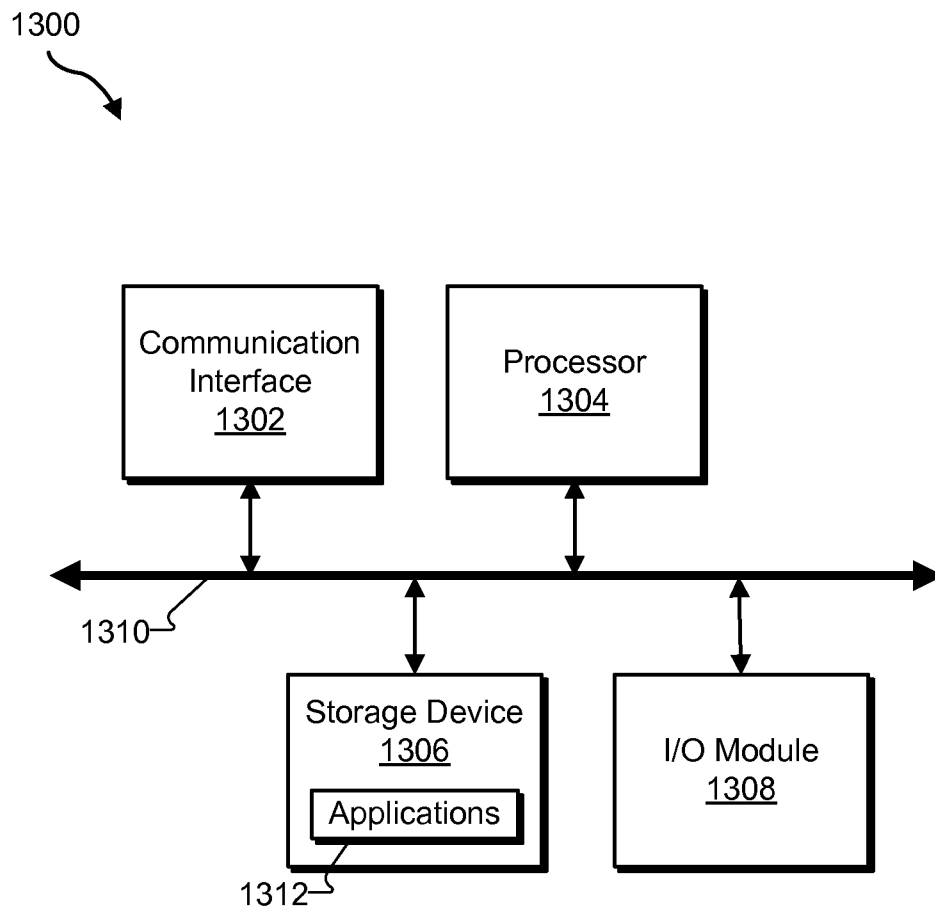
11/13

**Fig. 11**

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**Fig. 12**

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**Fig. 13**

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2015/052310

A. CLASSIFICATION OF SUBJECT MATTER

INV. G06F19/00

ADD. A61N1/36 A61N1/372

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G06F A61N G10L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	RONY KUBAT ET AL: "Totalrecall: Visualization and Semi-Automatic Annotation of Very Large Audio-Visual Corpora", ICMI '07: PROCEEDINGS OF THE 9TH INTERNATIONAL CONFERENCE ON MULTIMODAL INTERFACES, 12 November 2007 (2007-11-12), - 15 November 2007 (2007-11-15), page 208, XP055277667, US DOI: 10.1145/1322192.1322229 ISBN: 978-1-59593-817-6 abstract; figure 2 section 2. Architecture and the annotation model section 3. User interface section 4. Visualizations section 6. Audio analysis -/--	1-20



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

3 June 2016

Date of mailing of the international search report

13/06/2016

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Filloy García, E

INTERNATIONAL SEARCH REPORT

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	section 7. Annotation tasks ----- US 8 700 168 B1 (JOHNSTON JACOB [US] ET AL) 15 April 2014 (2014-04-15) abstract; figures 1-10 column 3, line 60 - column 4, line 5 column 4, line 51 - column 5, line 14 column 7, line 28 - line 41 column 10, line 18 - line 56 -----	1-20
A	Mark Dingemanse ET AL: "A high speed transcription interface for annotating primary linguistic data", Proceedings of the 6th EACL Workshop on Language Technology for Cultural Heritage, Social Sciences, and Humanities, 24 April 2012 (2012-04-24), pages 7-12, XP055277756, Retrieved from the Internet: URL:http://www.aclweb.org/anthology/W12-1002 [retrieved on 2016-06-02] abstract; figure 1 section 3 Description of the interface section 4 A prerequisite: semi-automatic segmentation -----	1-20
A	BARRAS C ET AL: "Transcriber: Development and use of a tool for assisting speech corpora production", SPEECH COMMUNICATION, ELSEVIER SCIENCE PUBLISHERS, AMSTERDAM, NL, vol. 33, no. 1-2, January 2001 (2001-01), pages 5-22, XP004221473, ISSN: 0167-6393, DOI: 10.1016/S0167-6393(00)00067-4 section 3.1. User interface; figure 1 -----	1-20

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2015/052310

Patent document cited in search report	Publication date	Patent family member(s)	Publication date	
US 8700168	B1	15-04-2014	US 8700168 B1	15-04-2014
			US 8923979 B1	30-12-2014
