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(54) **SENSORY STIMULATION OR MONITORING
APPARATUS FOR THE BACK OF NECK**

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A61M 21/02 (2006.01)

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(US)

(52) **U.S. Cl.**

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A61H 2201/165 (2013.01); *H04R 5/0335*
(2013.01)

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(63) Continuation-in-part of application No. PCT/
US2015/021286, filed on Mar. 18, 2015, Continu-
ation of application No. 16/915,275, filed on Jun. 29,
2020.

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19, 2014.

Publication Classification

(51) **Int. Cl.**

A61B 5/00 (2006.01)

A61H 23/02 (2006.01)

(57)

ABSTRACT

Described herein are wearable sensory stimulation and monitoring devices that can be worn around the back of the neck along and in contact with the spine. The wearable device includes cuff, band and head cover members as form factors. Apparatuses described herein stimulate one or more senses including auditory, tactile or olfactory. Apparatuses are also described that allow for sensing and monitoring of physiologic parameters such as heart rate, blood pressure and movement. The device also has features that allow for easy attachment or integration to articles worn on the head such as augmented reality and virtual reality accessories to provide visual stimulation and entertainment.

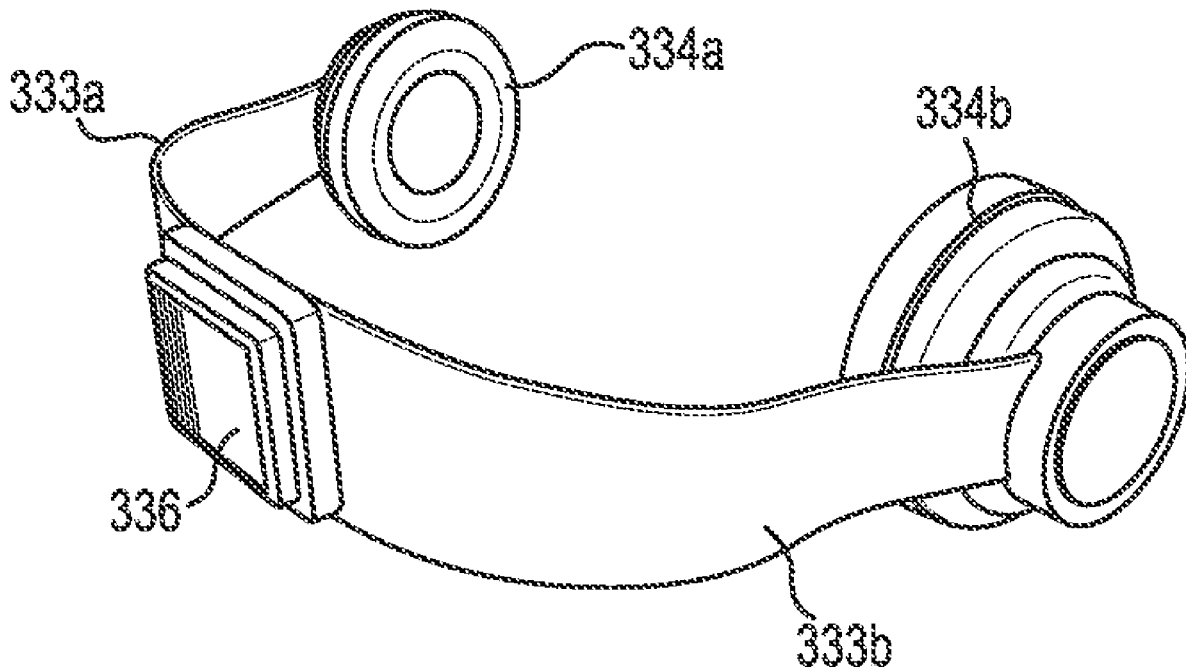


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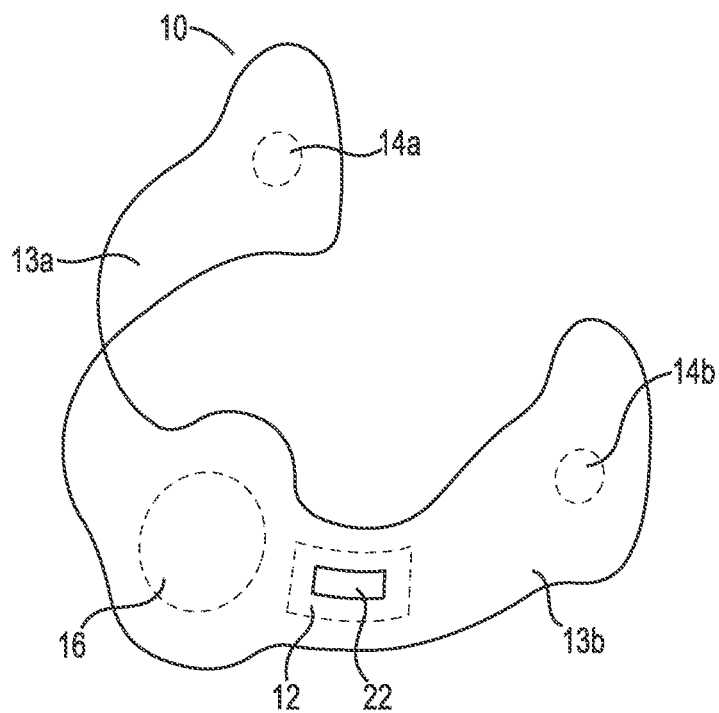


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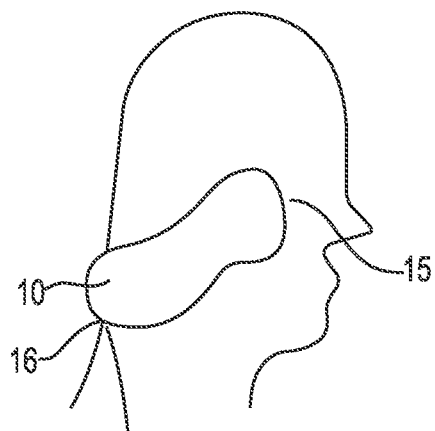


Figure 1C

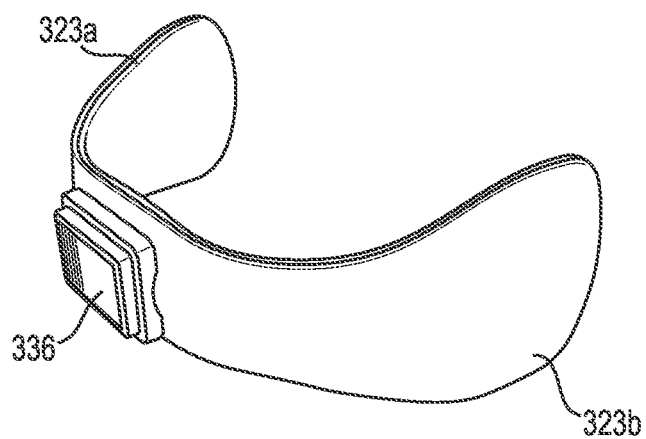


Figure 1D

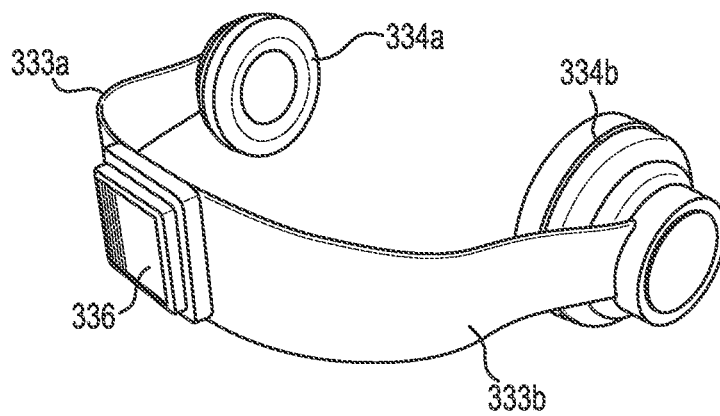


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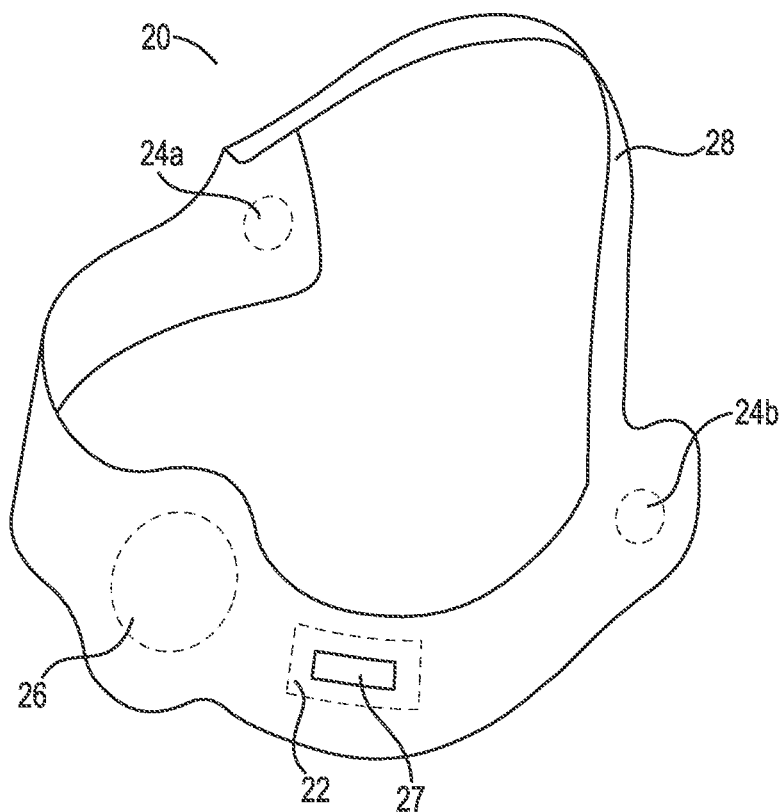


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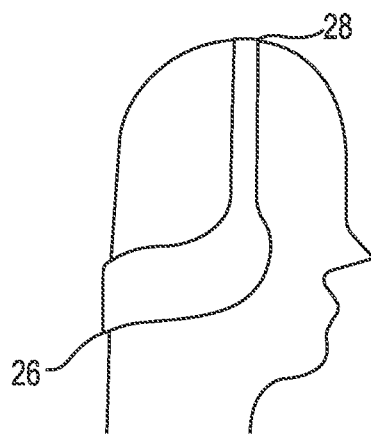


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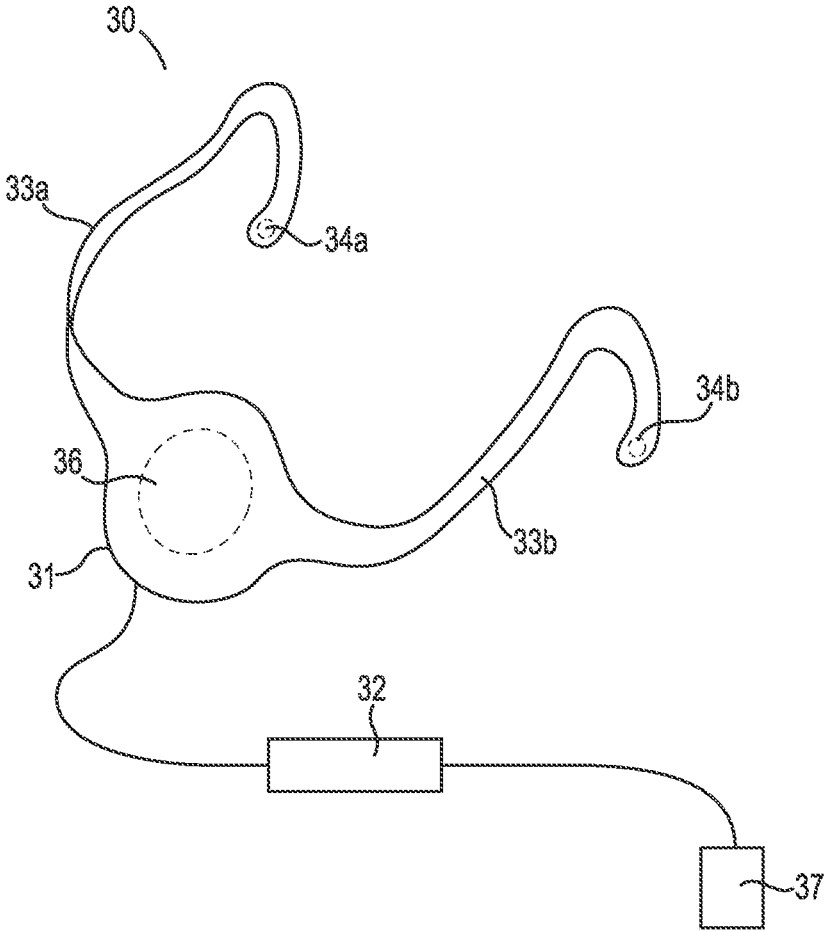


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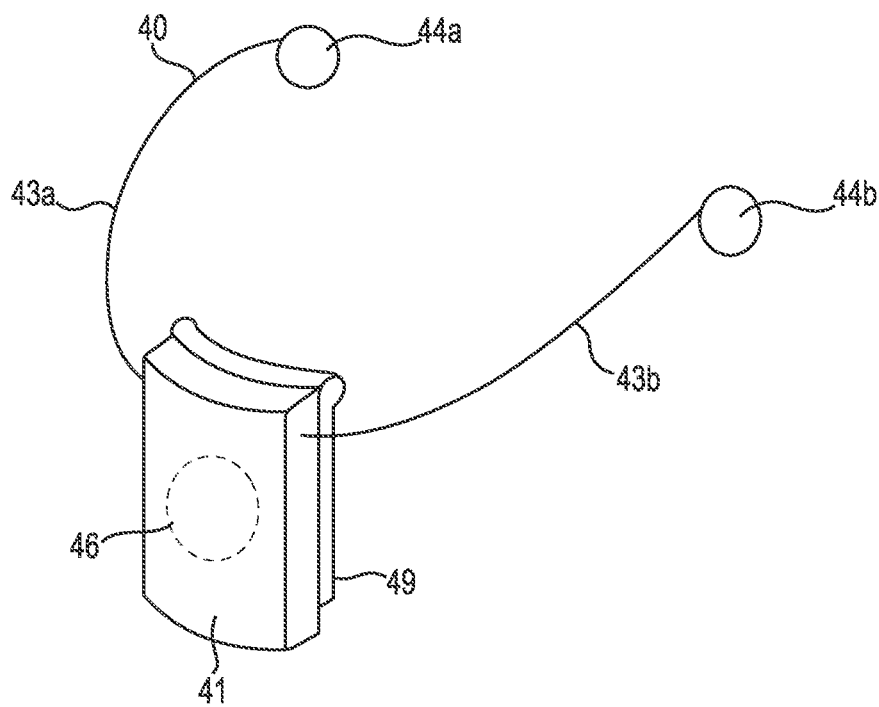


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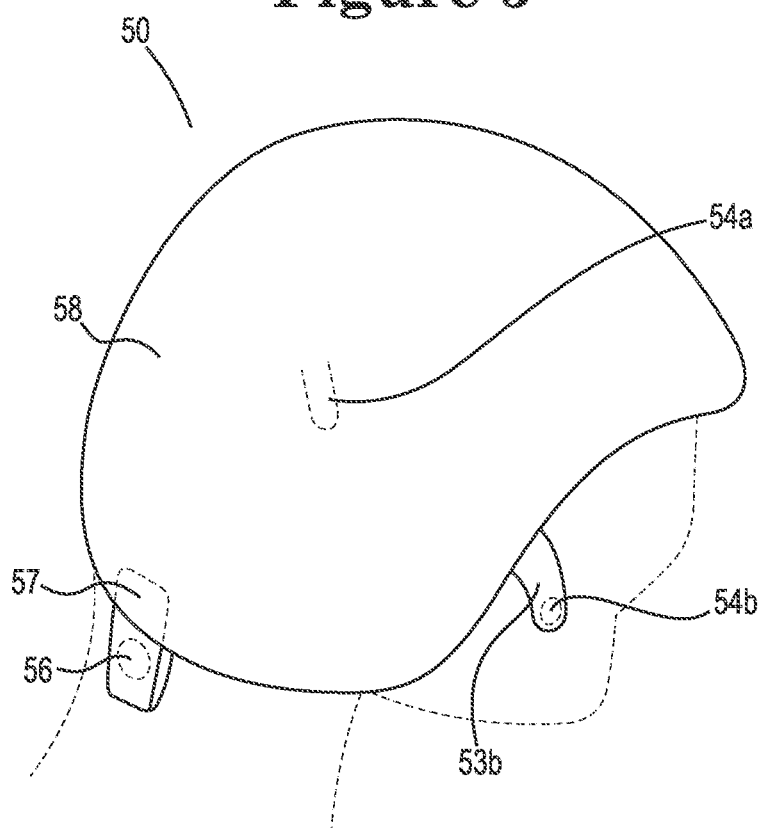


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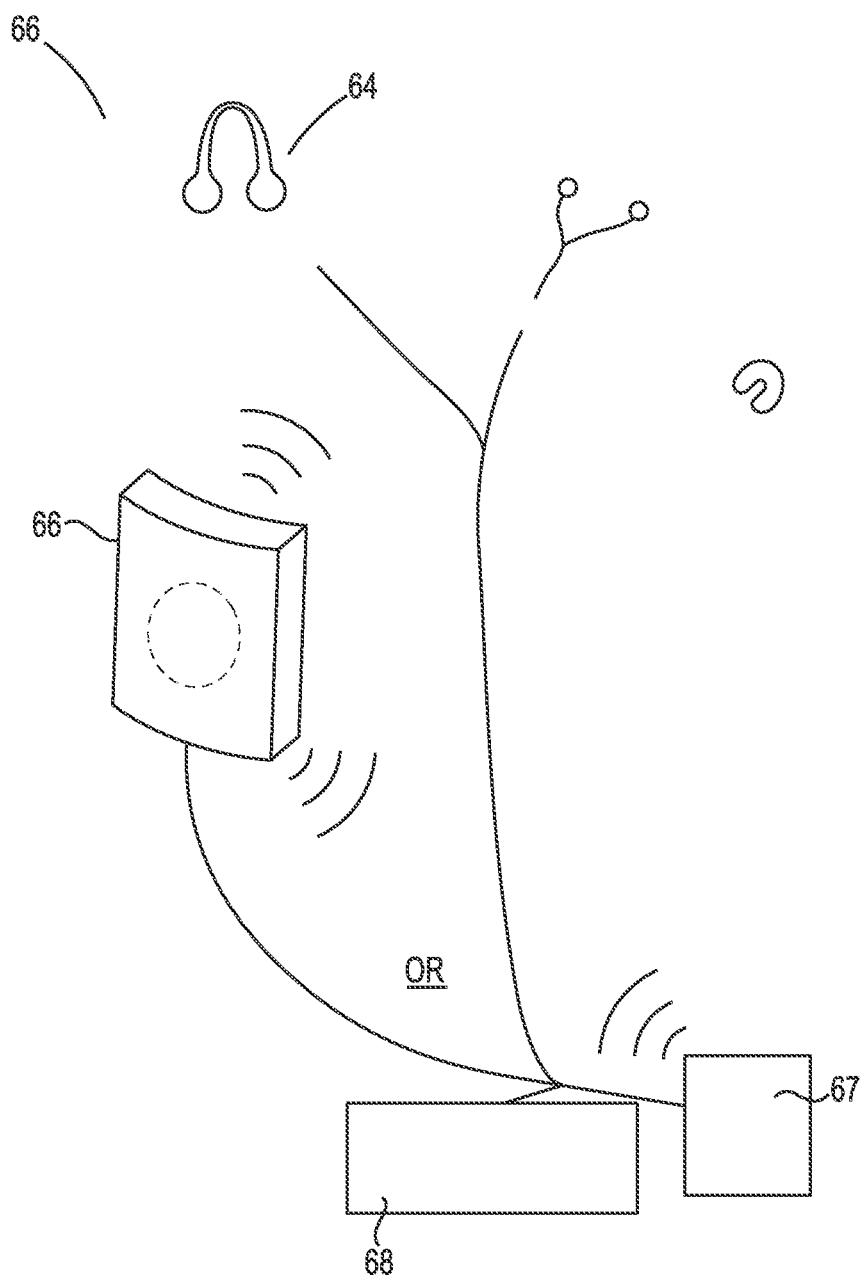


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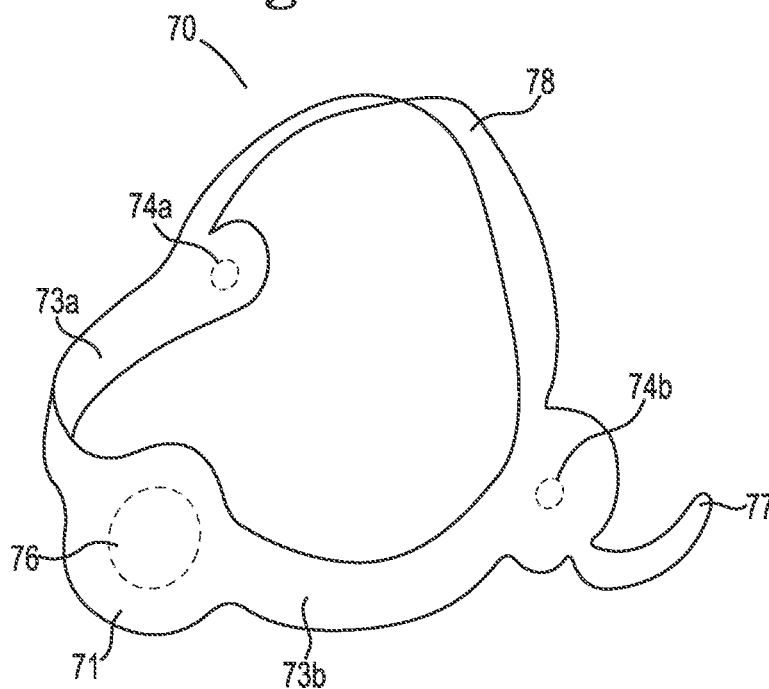


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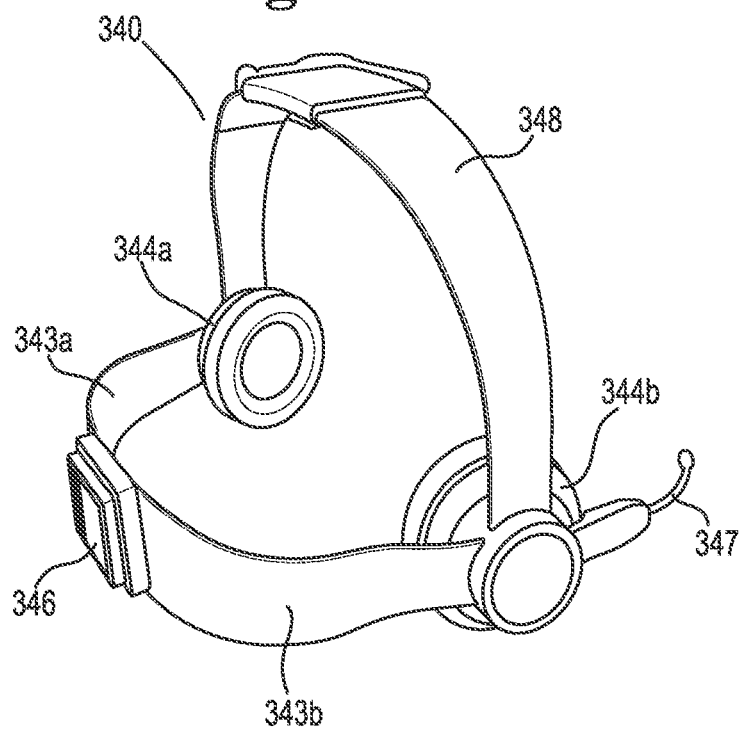


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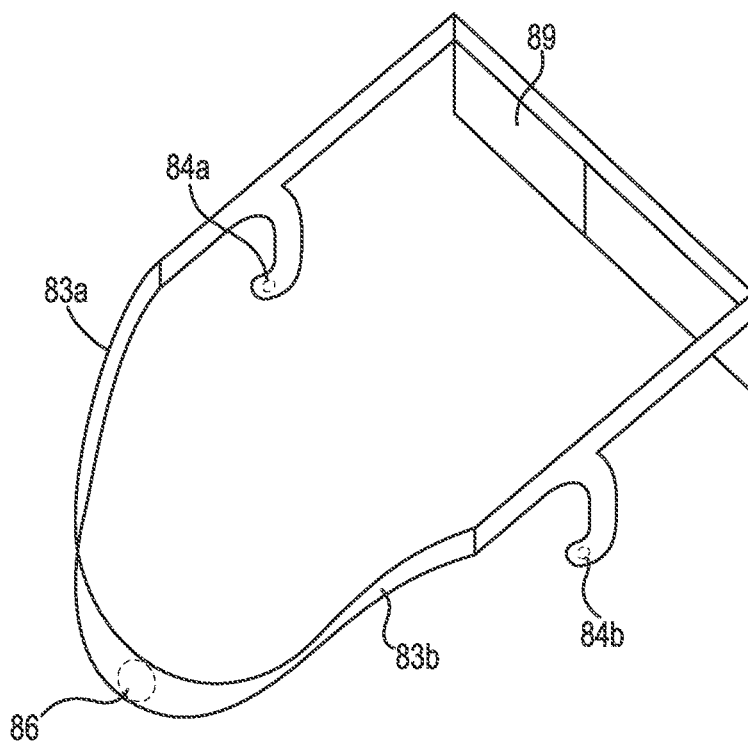


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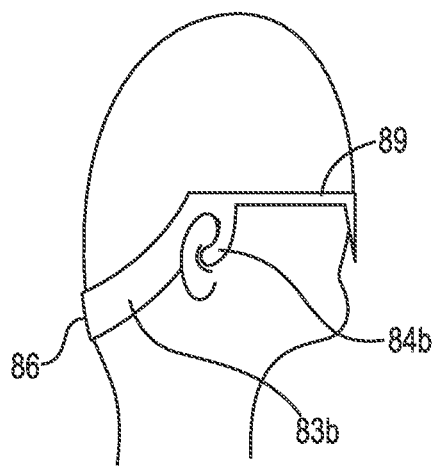
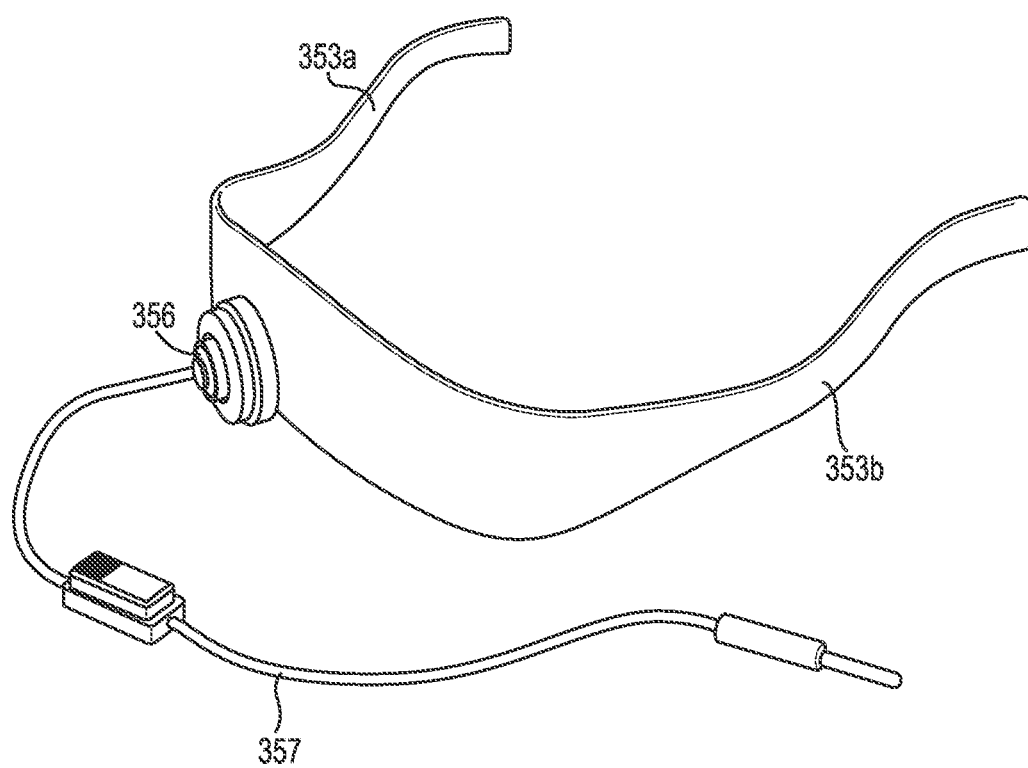


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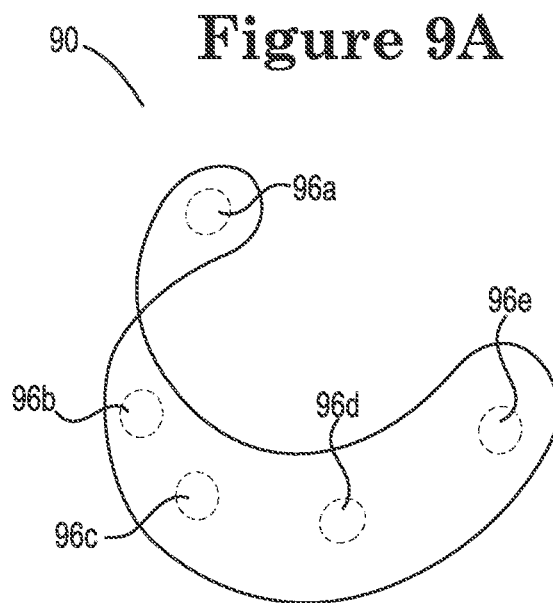
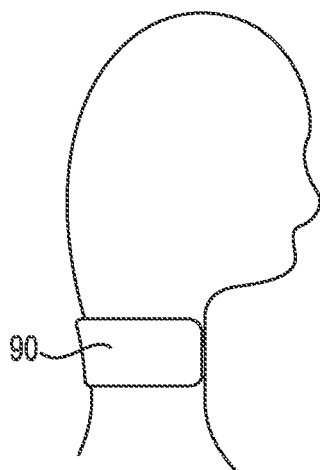


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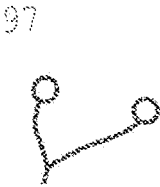
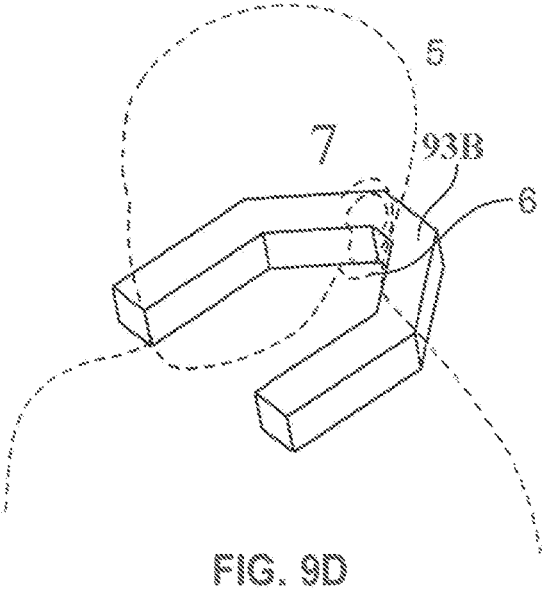
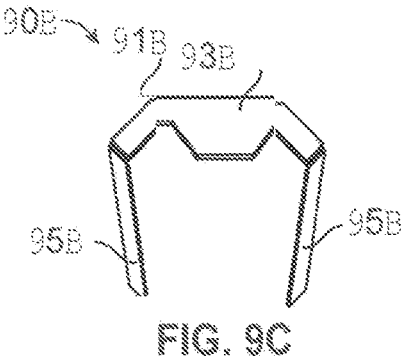


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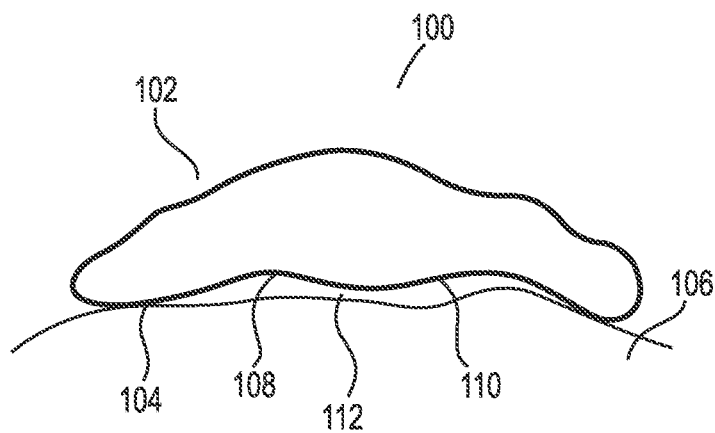


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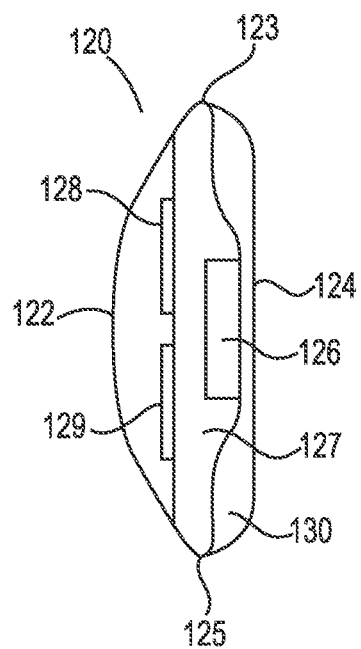


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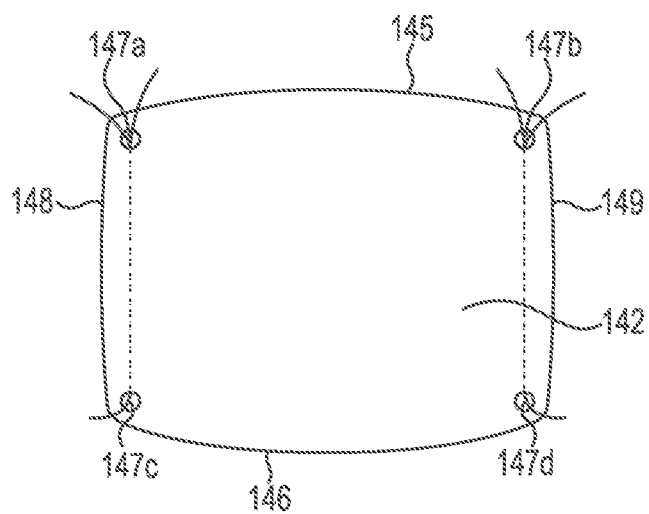


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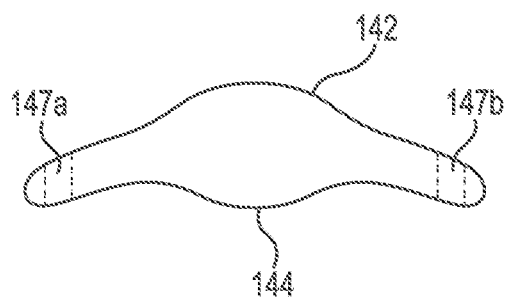


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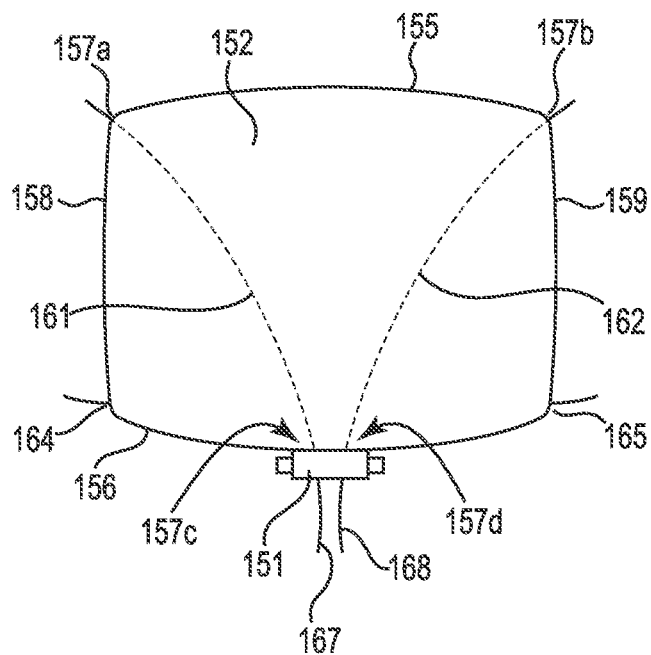


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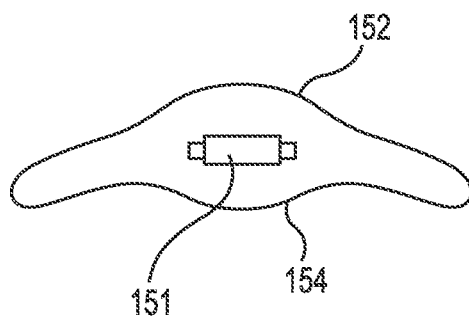


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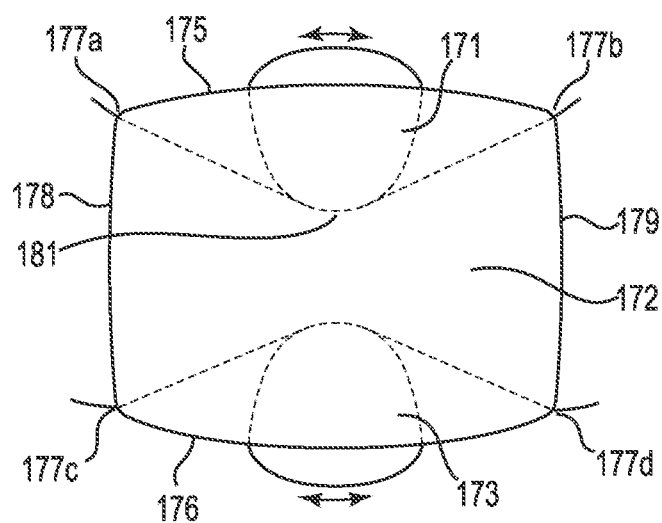


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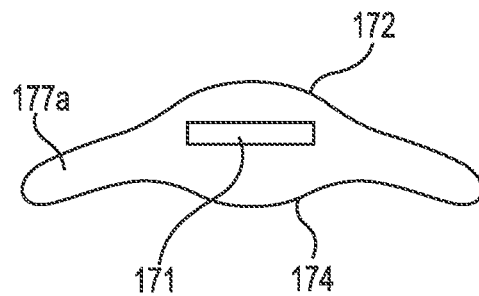


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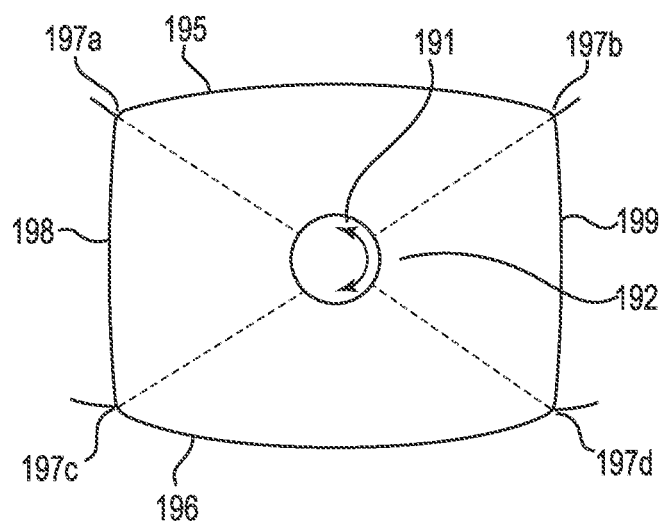


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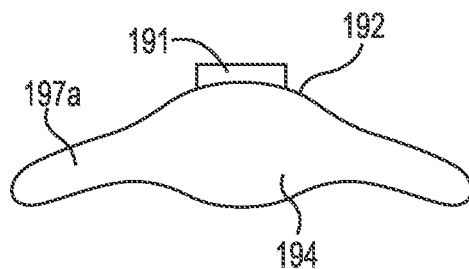


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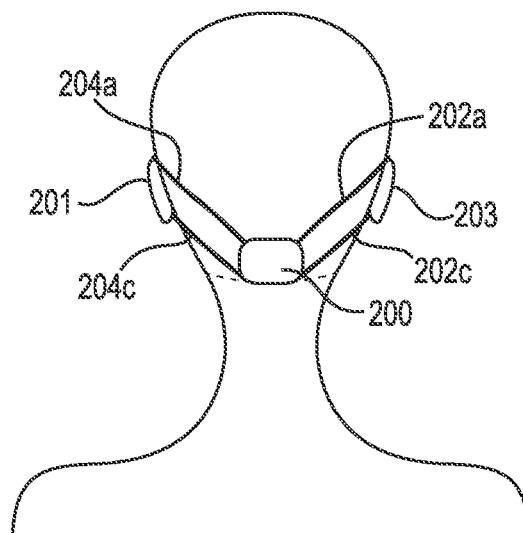


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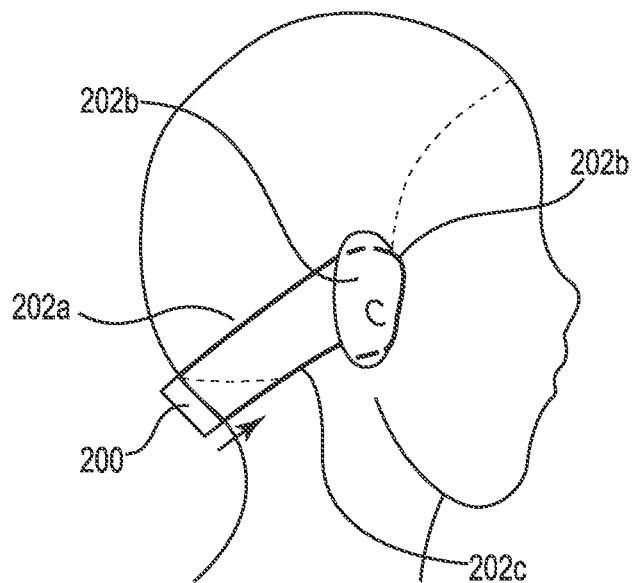


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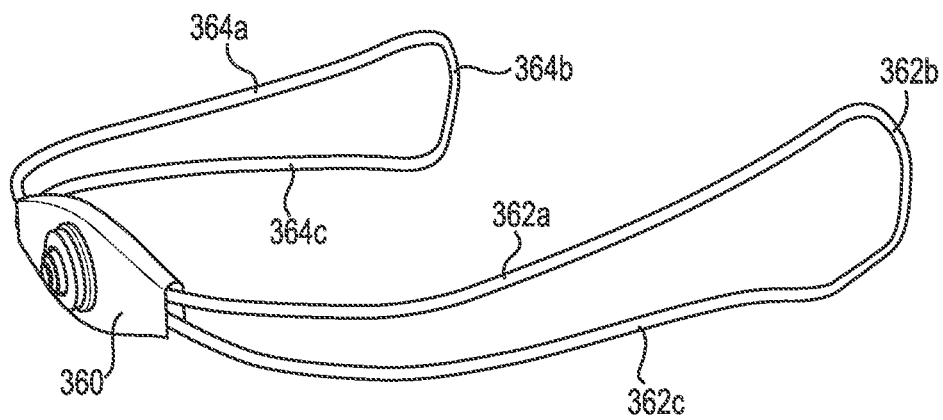


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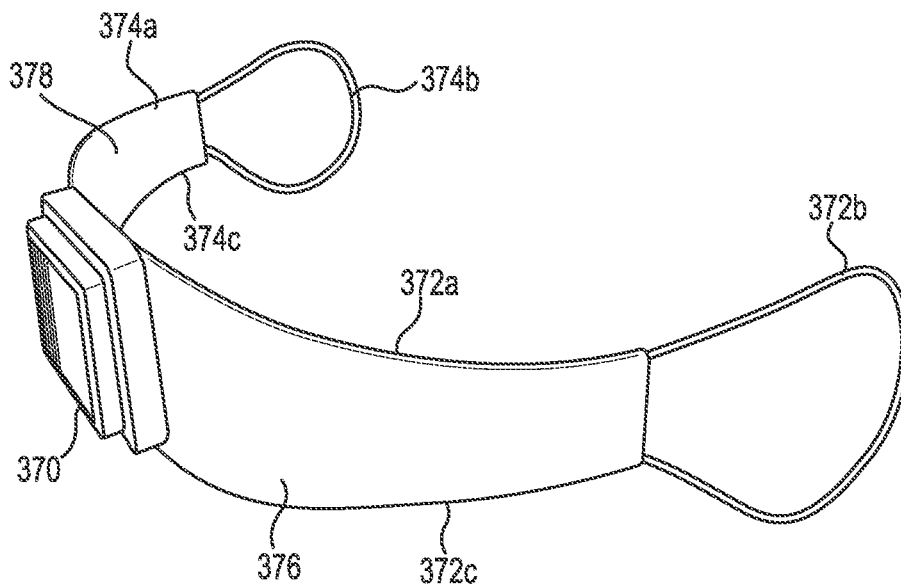


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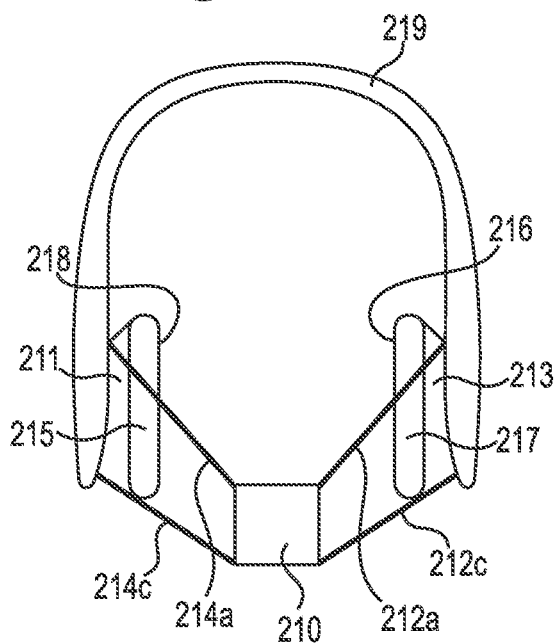


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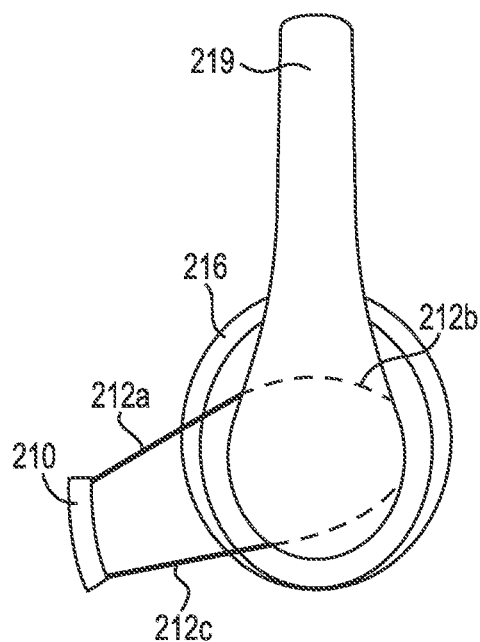


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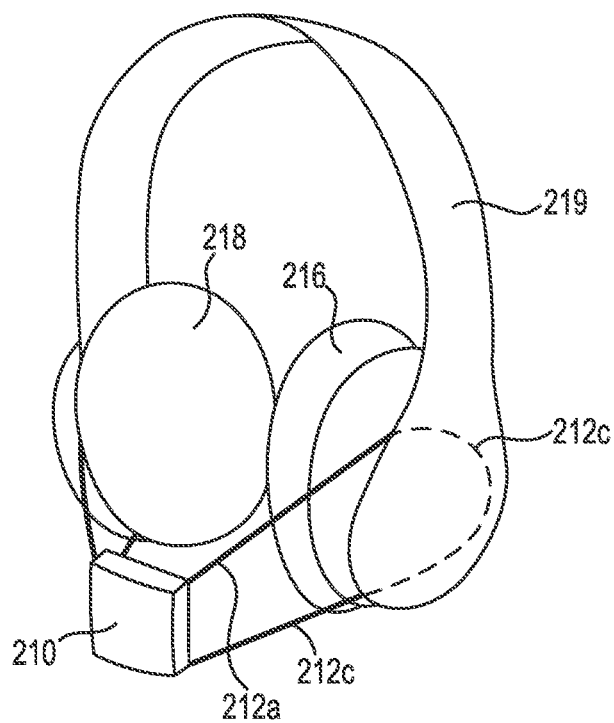


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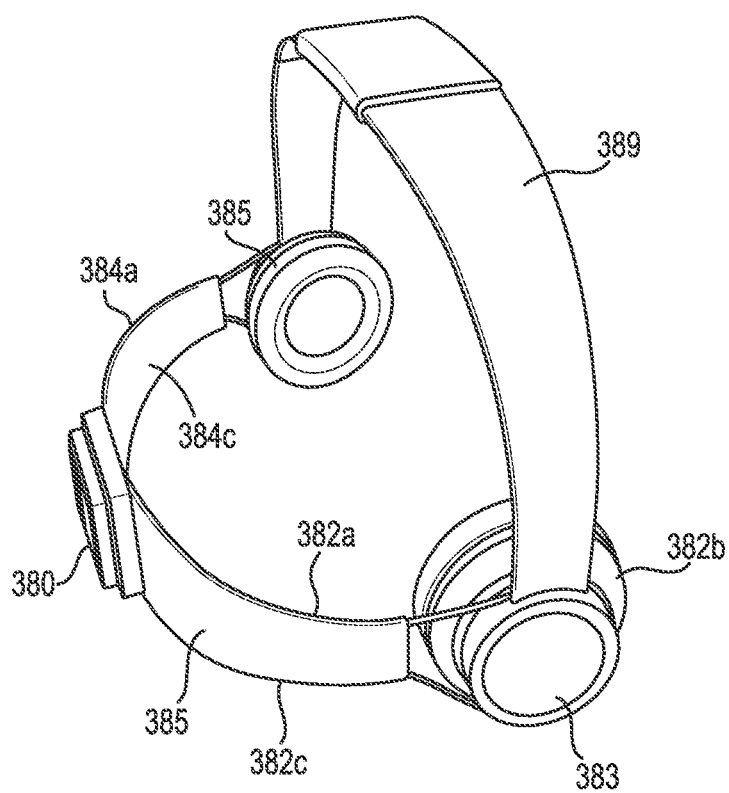


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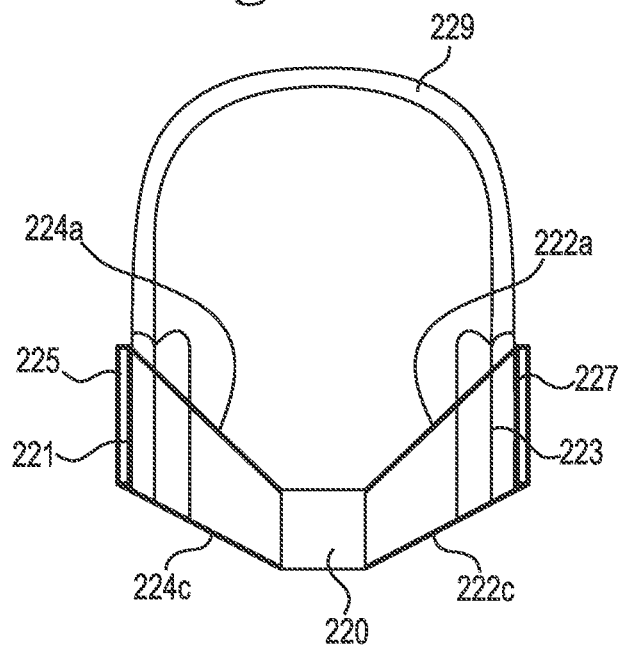


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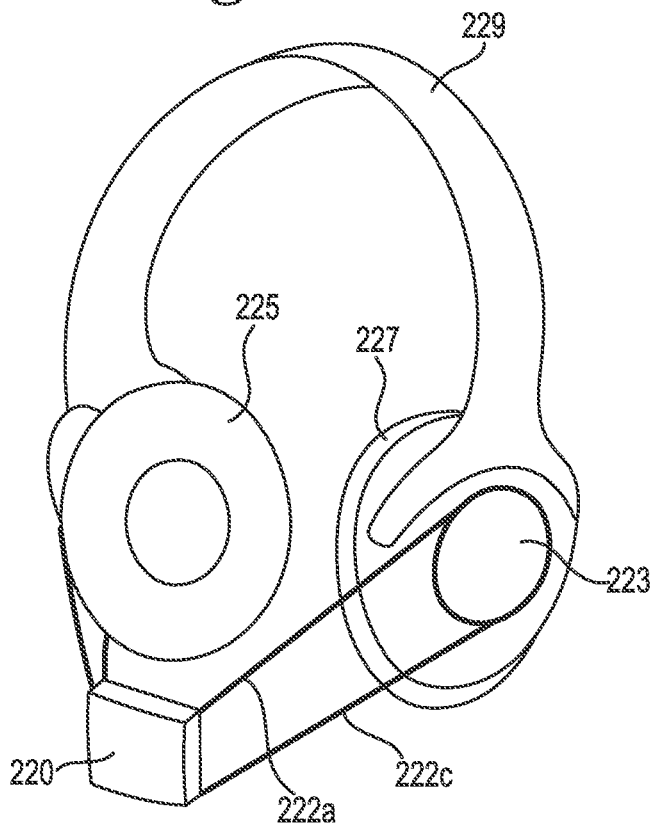


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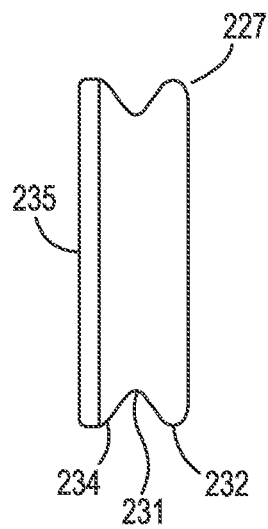


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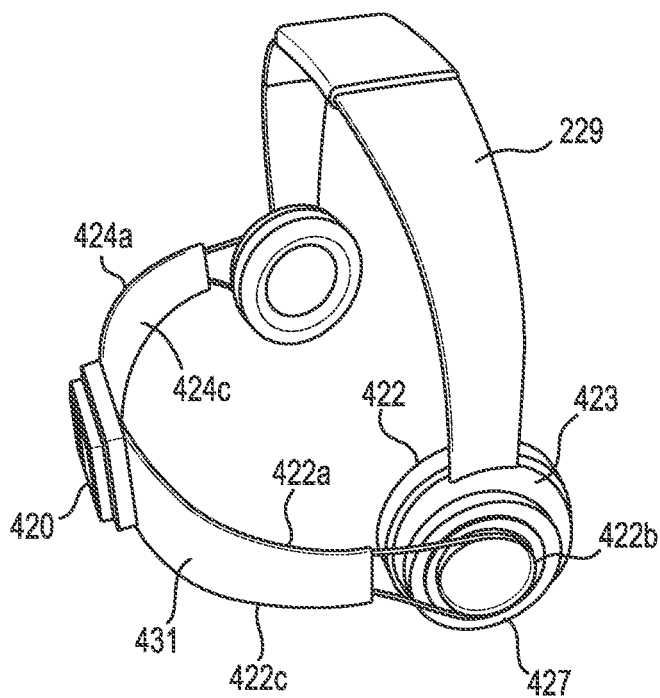


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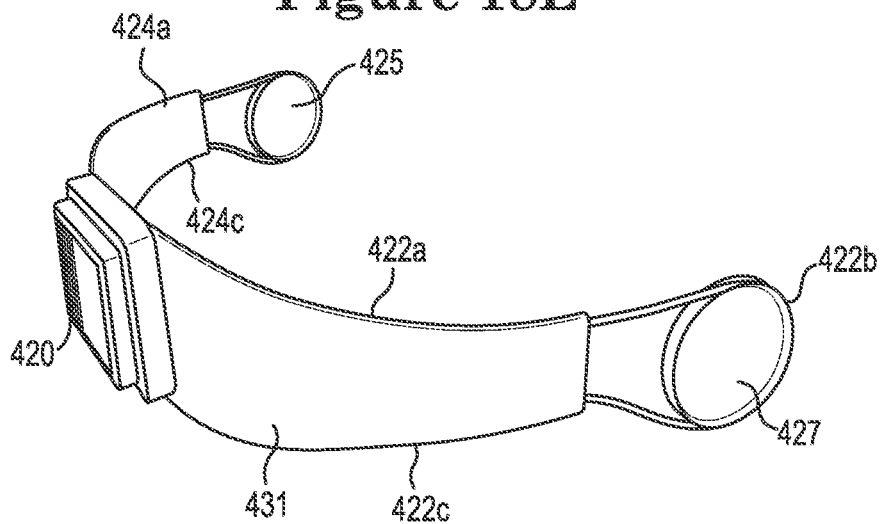


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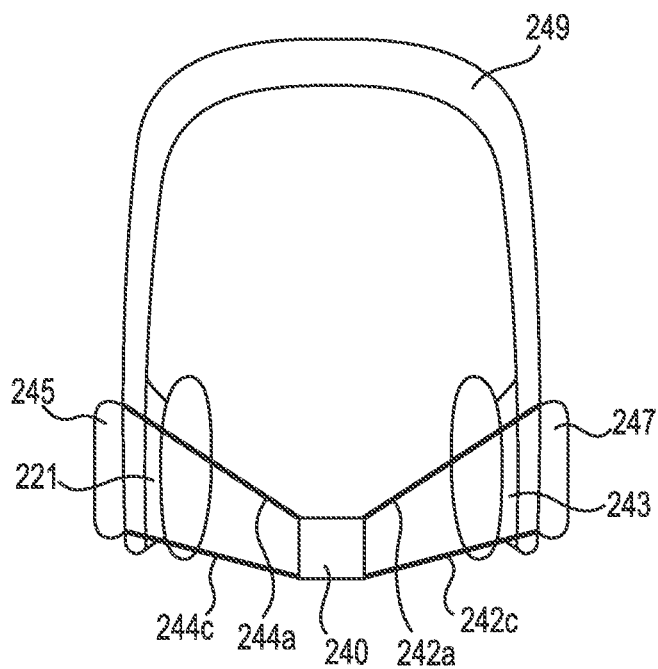


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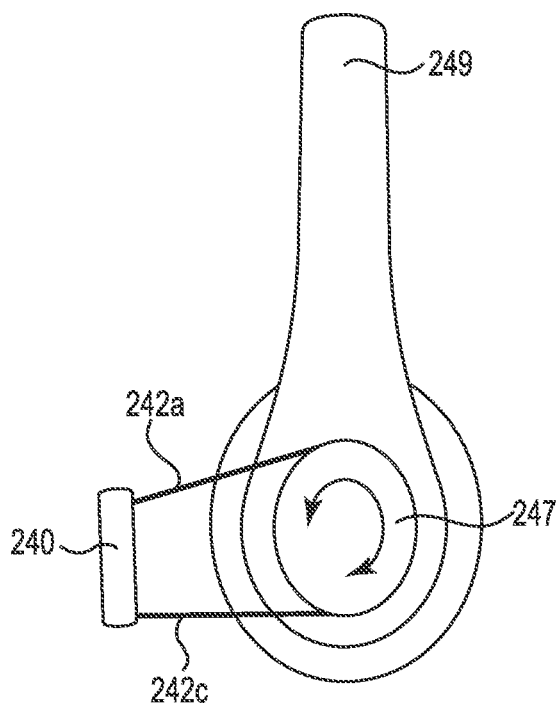


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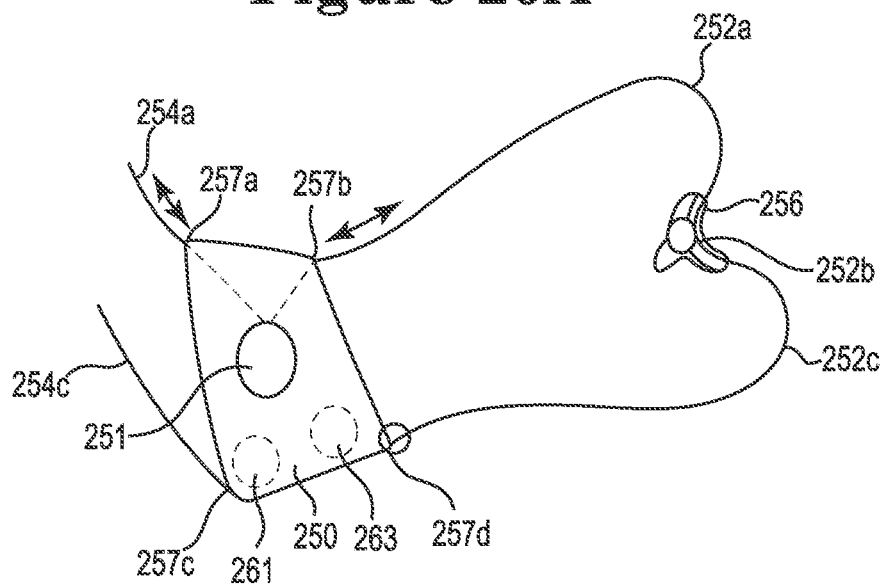


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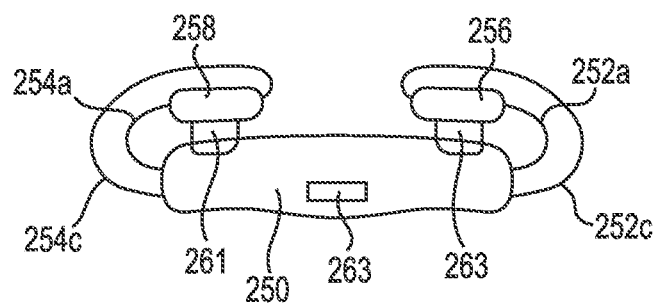


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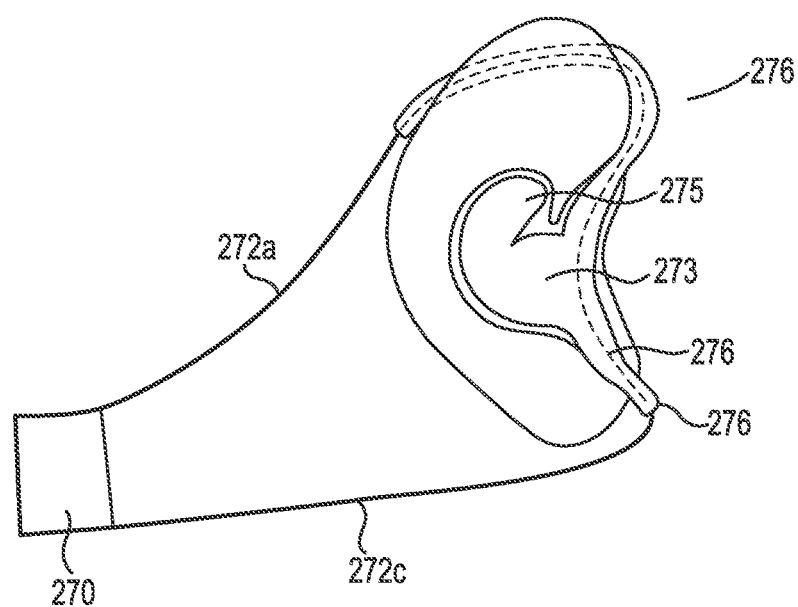


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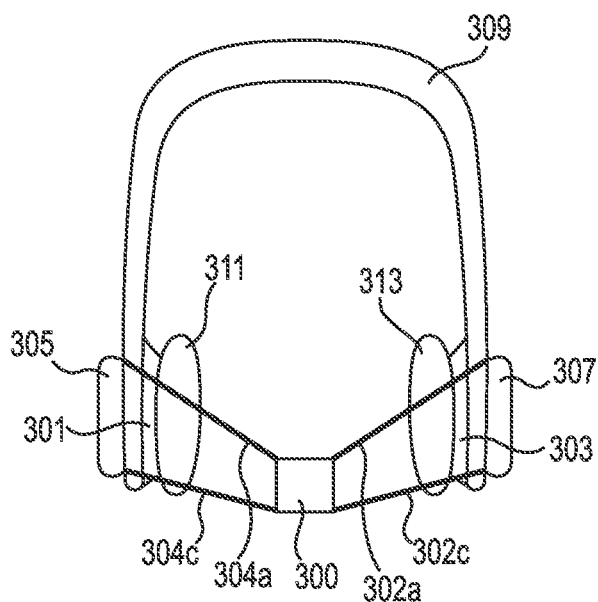


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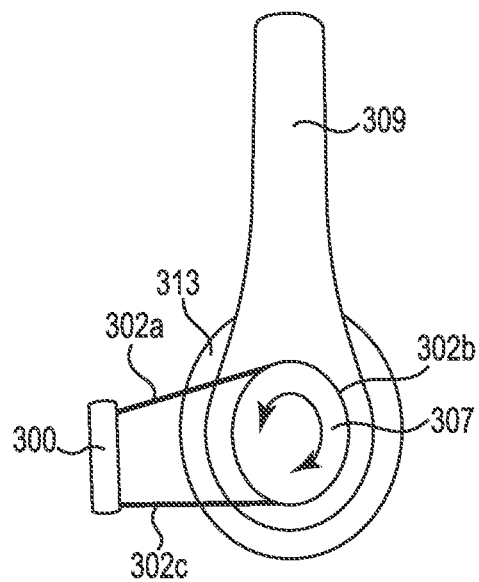


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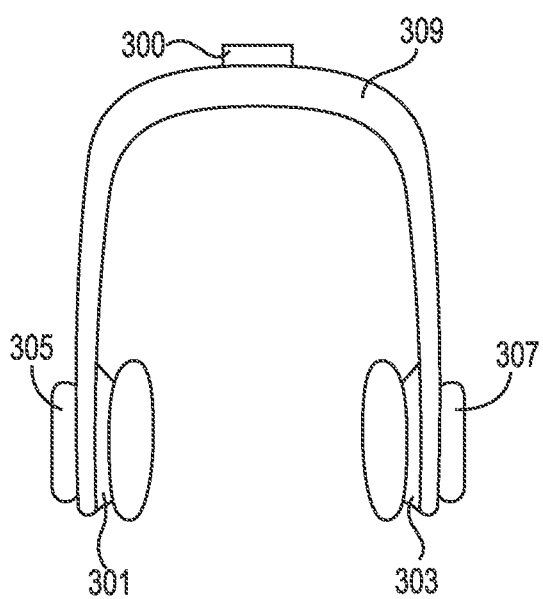


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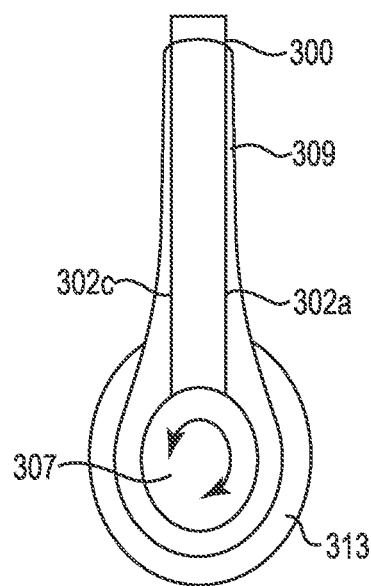


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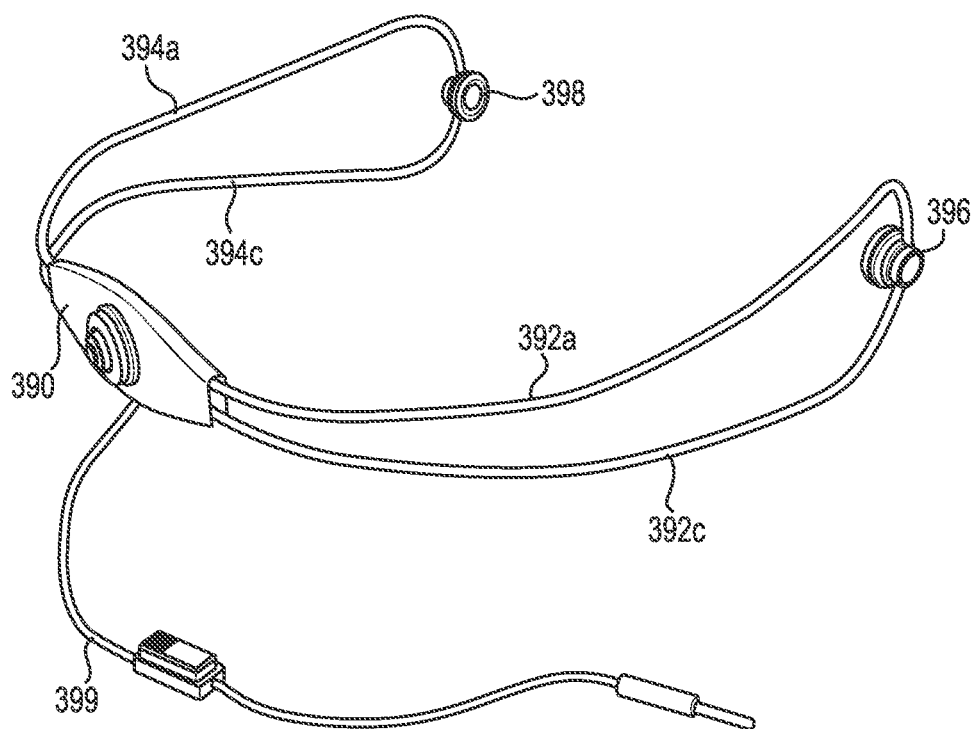


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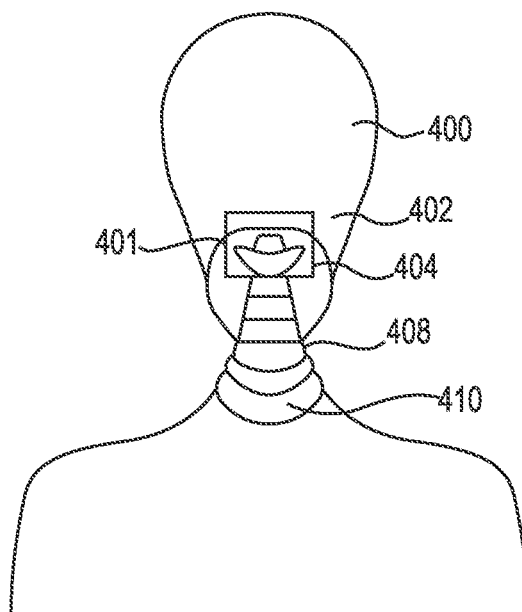


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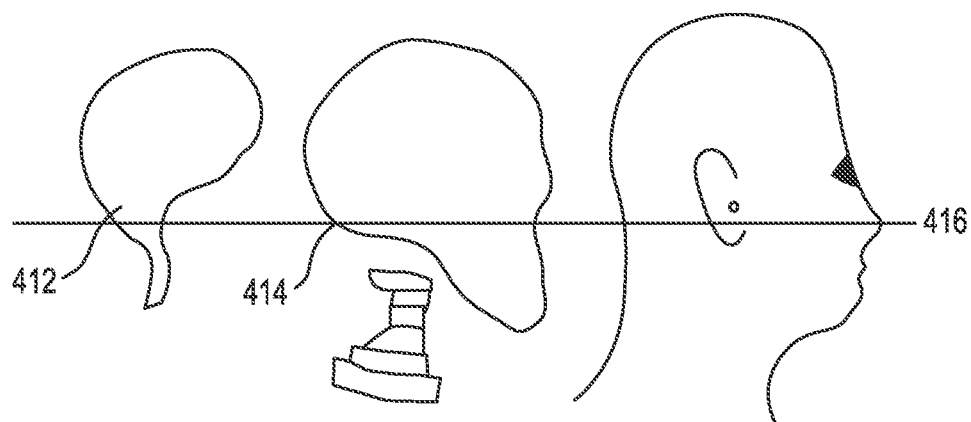


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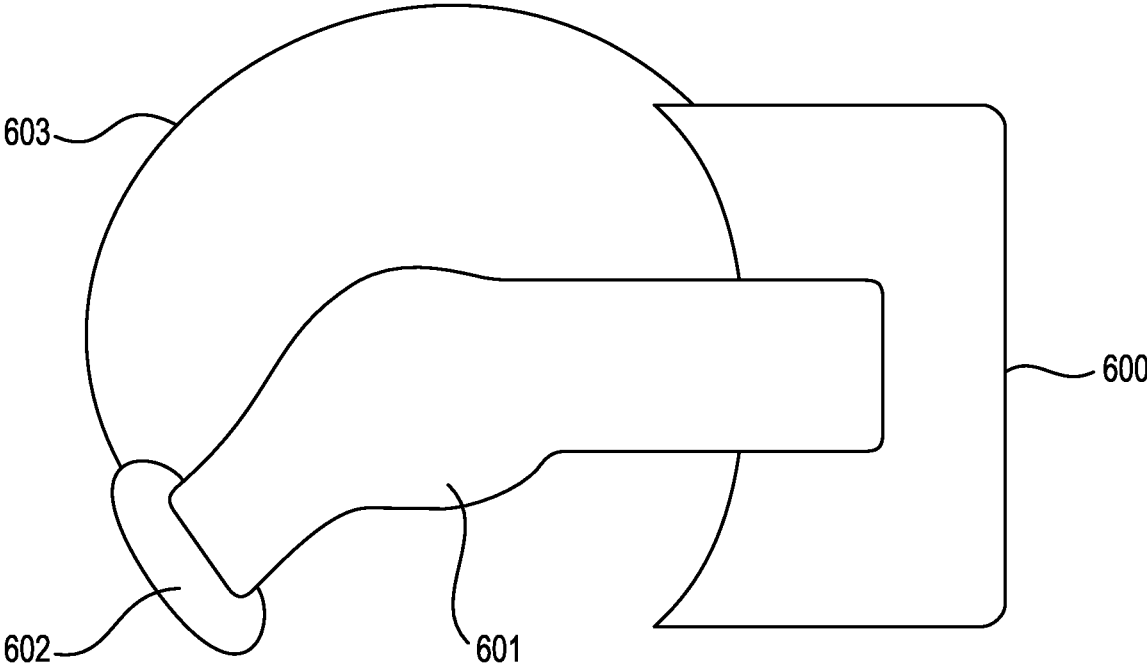


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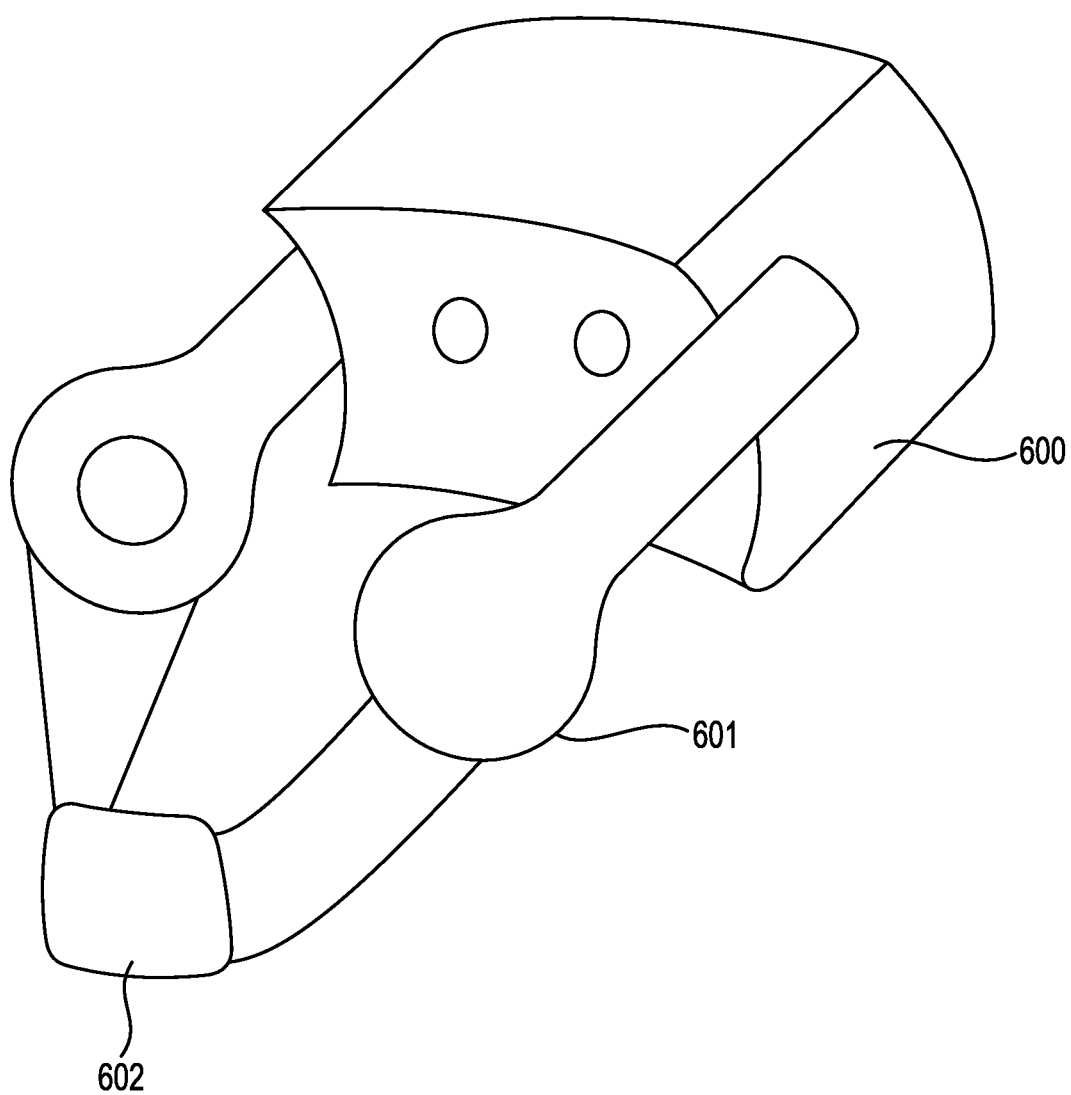


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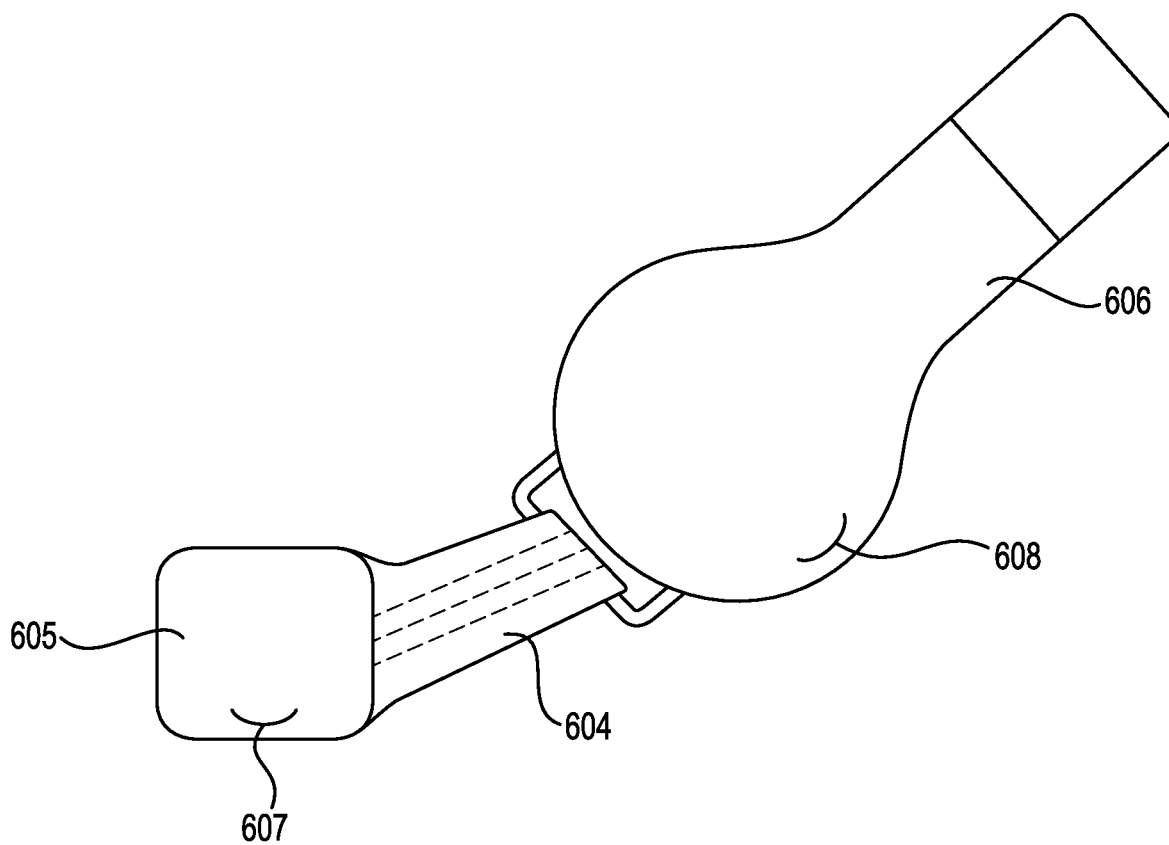


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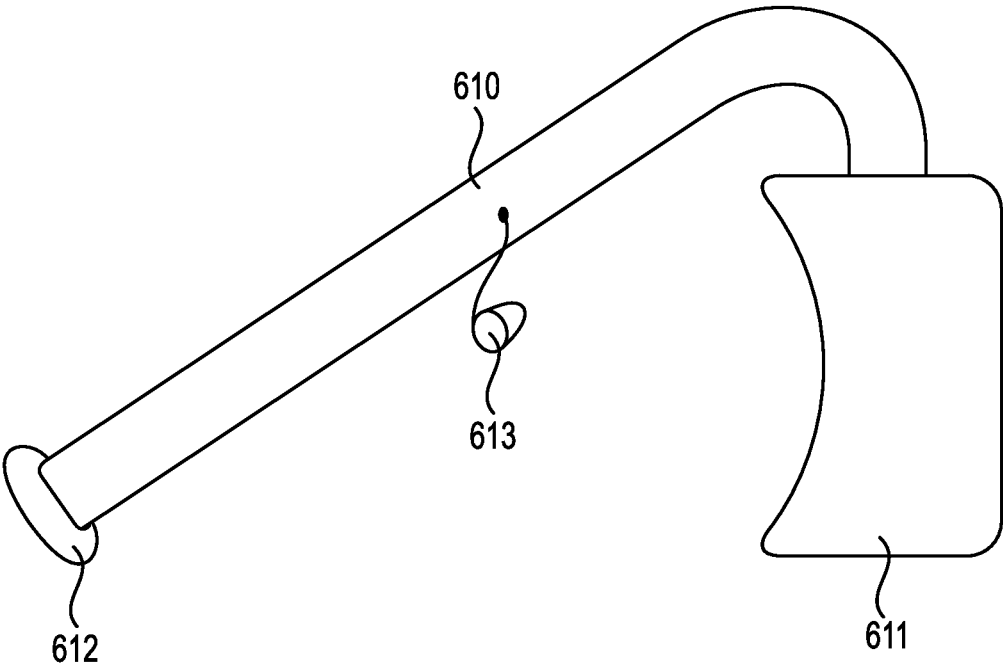


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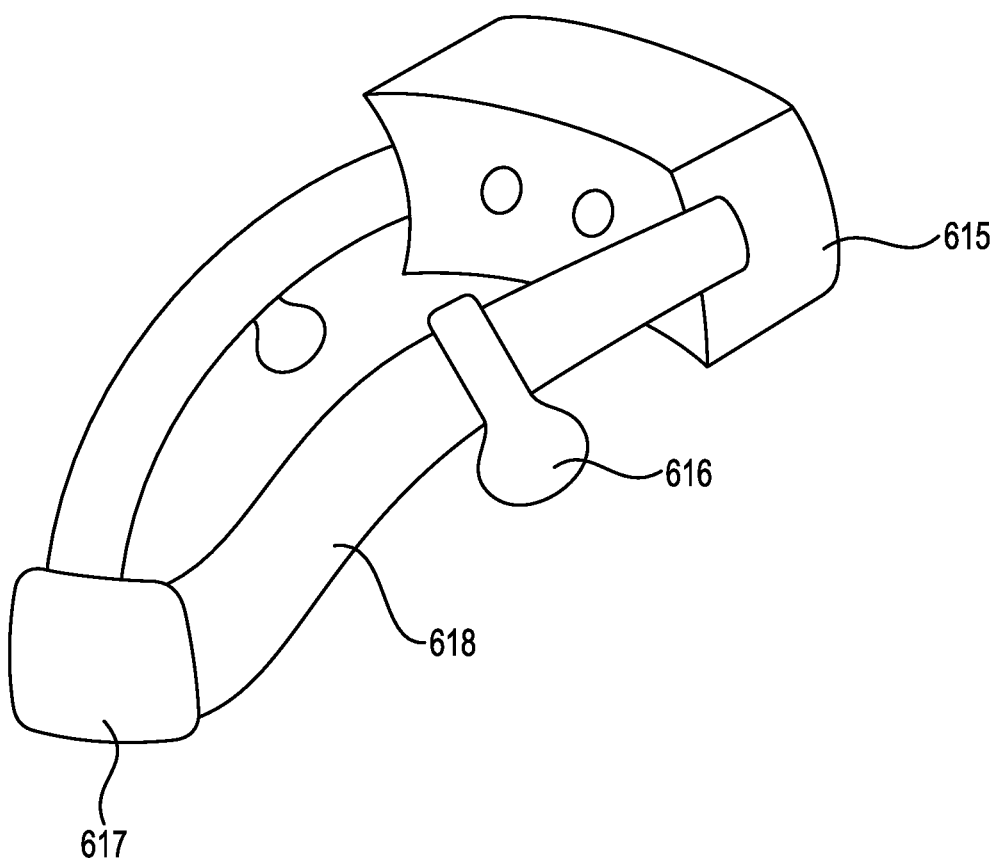


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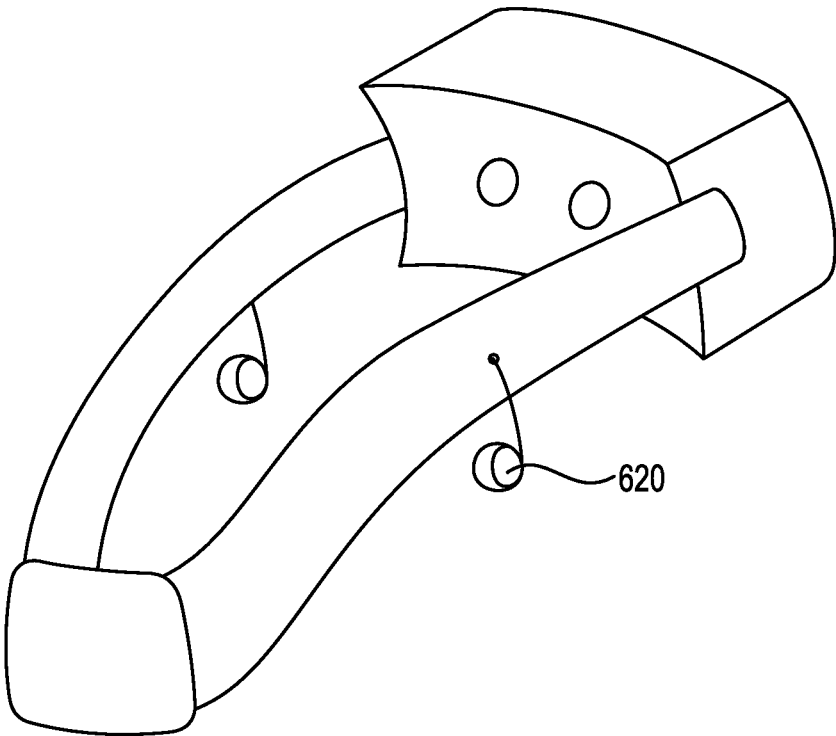


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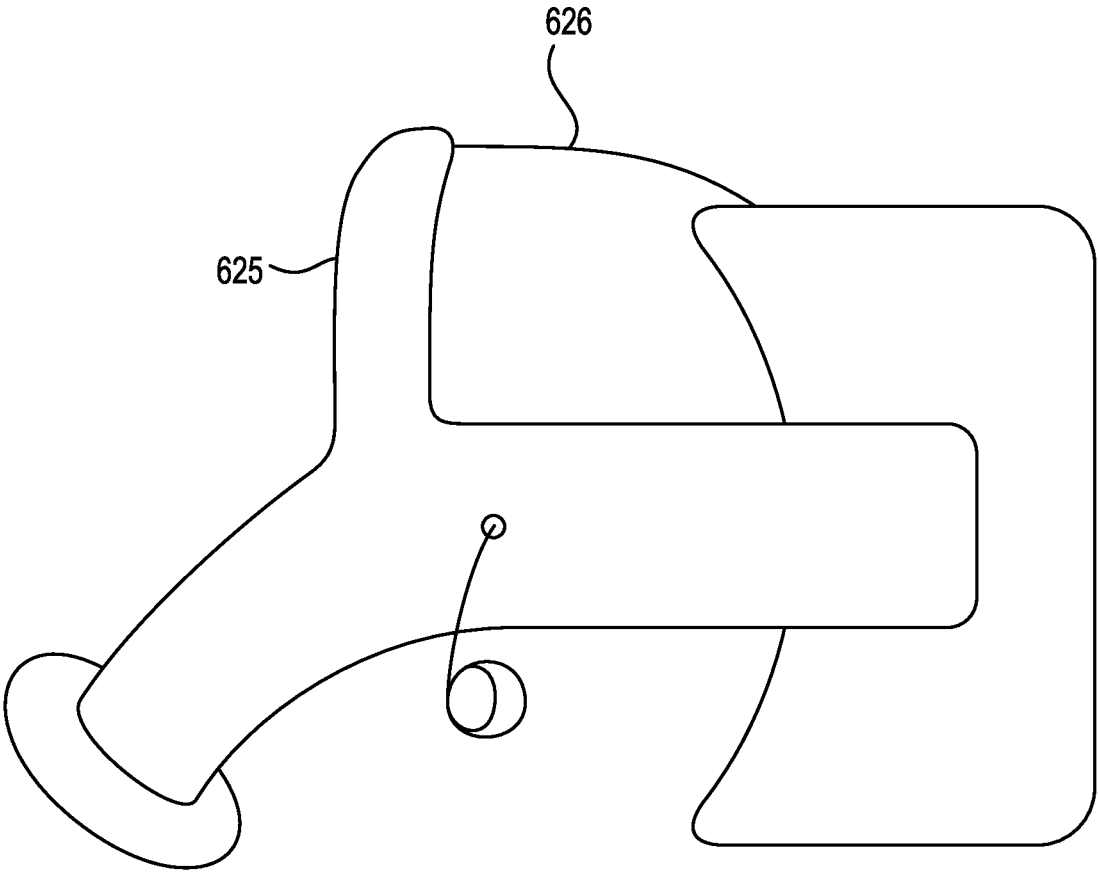


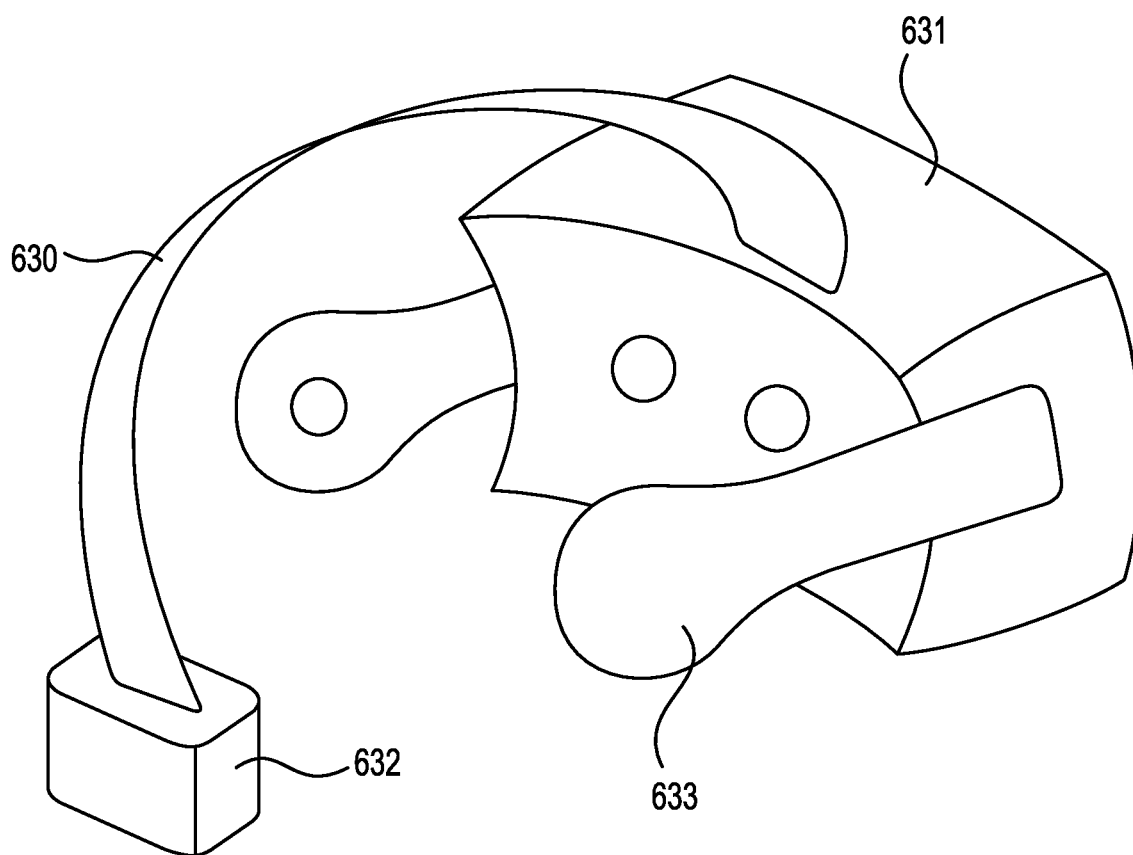
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Figure 34

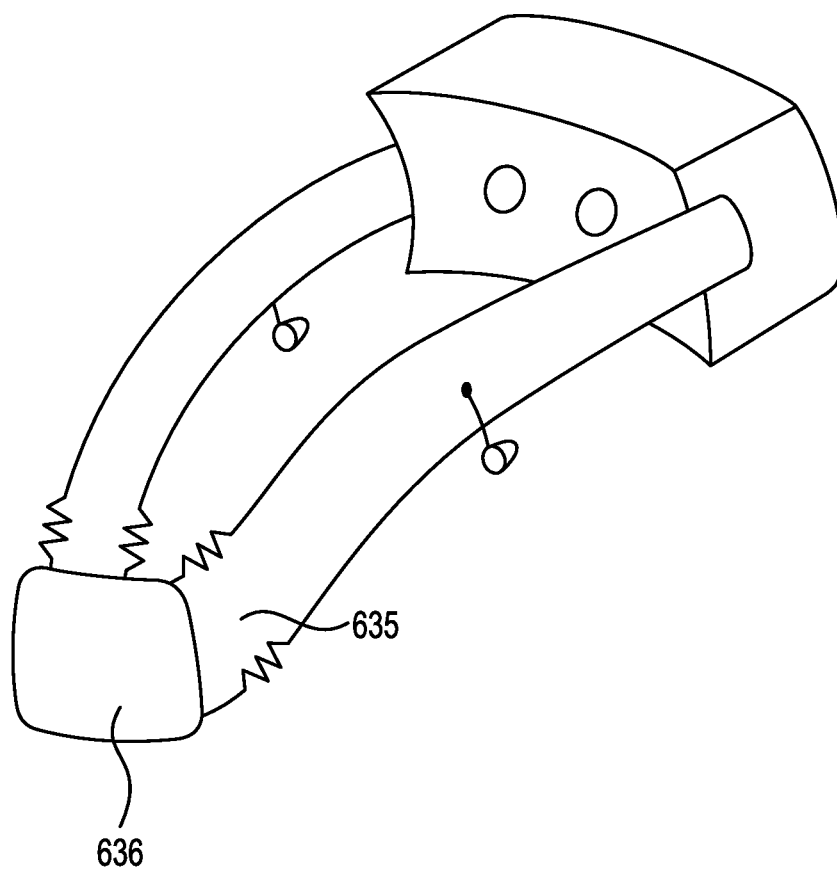


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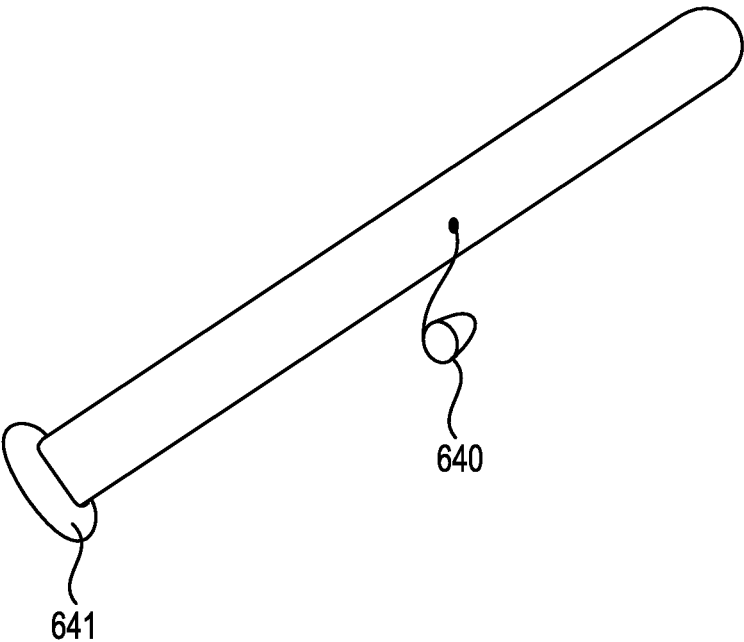
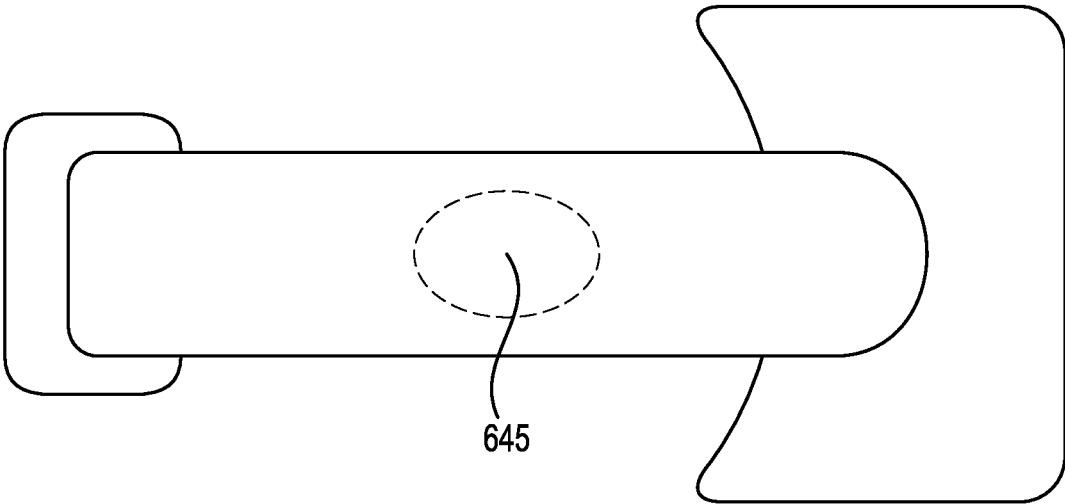
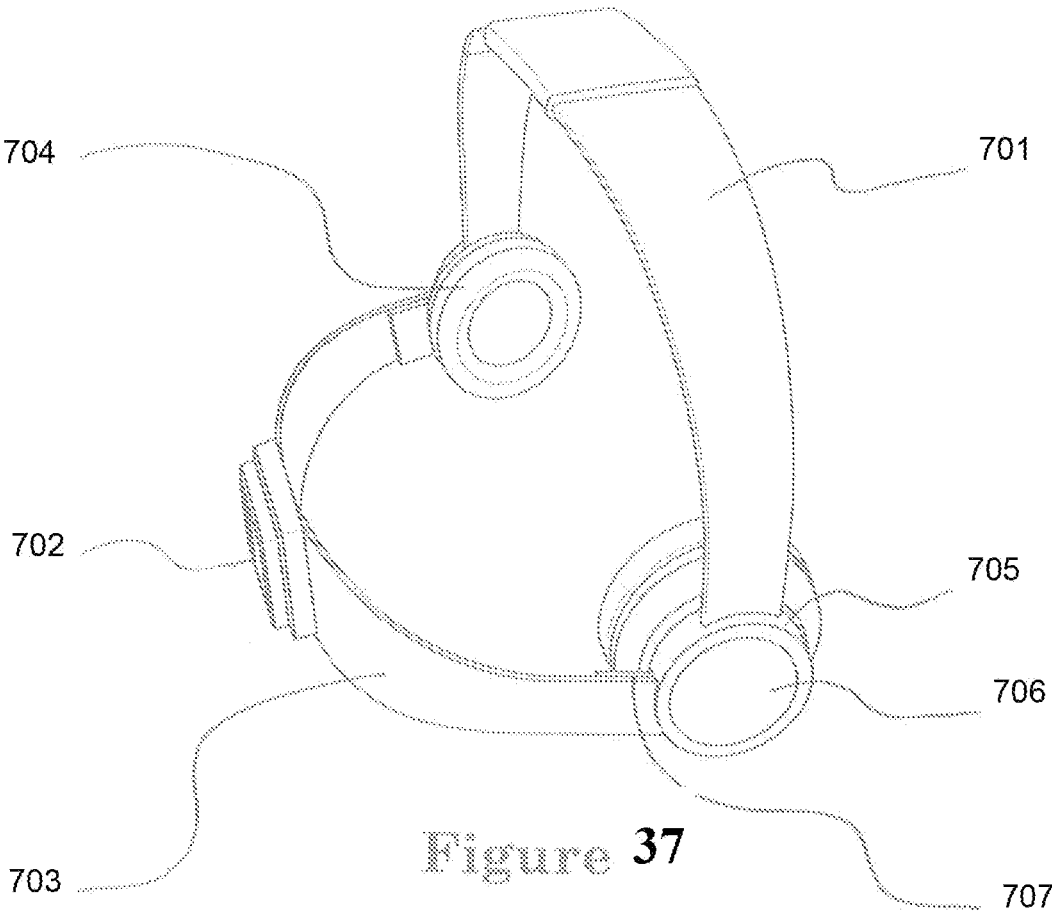
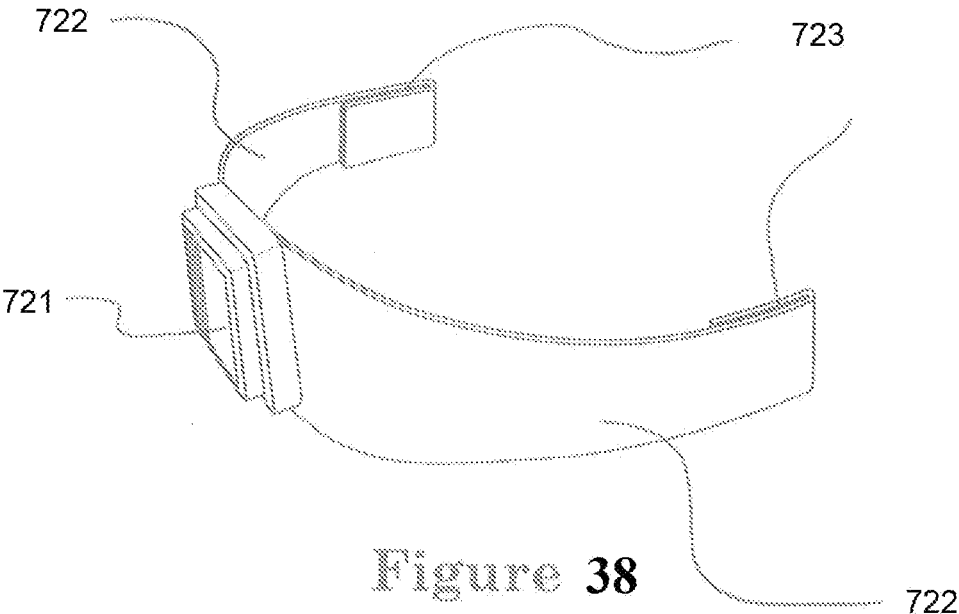
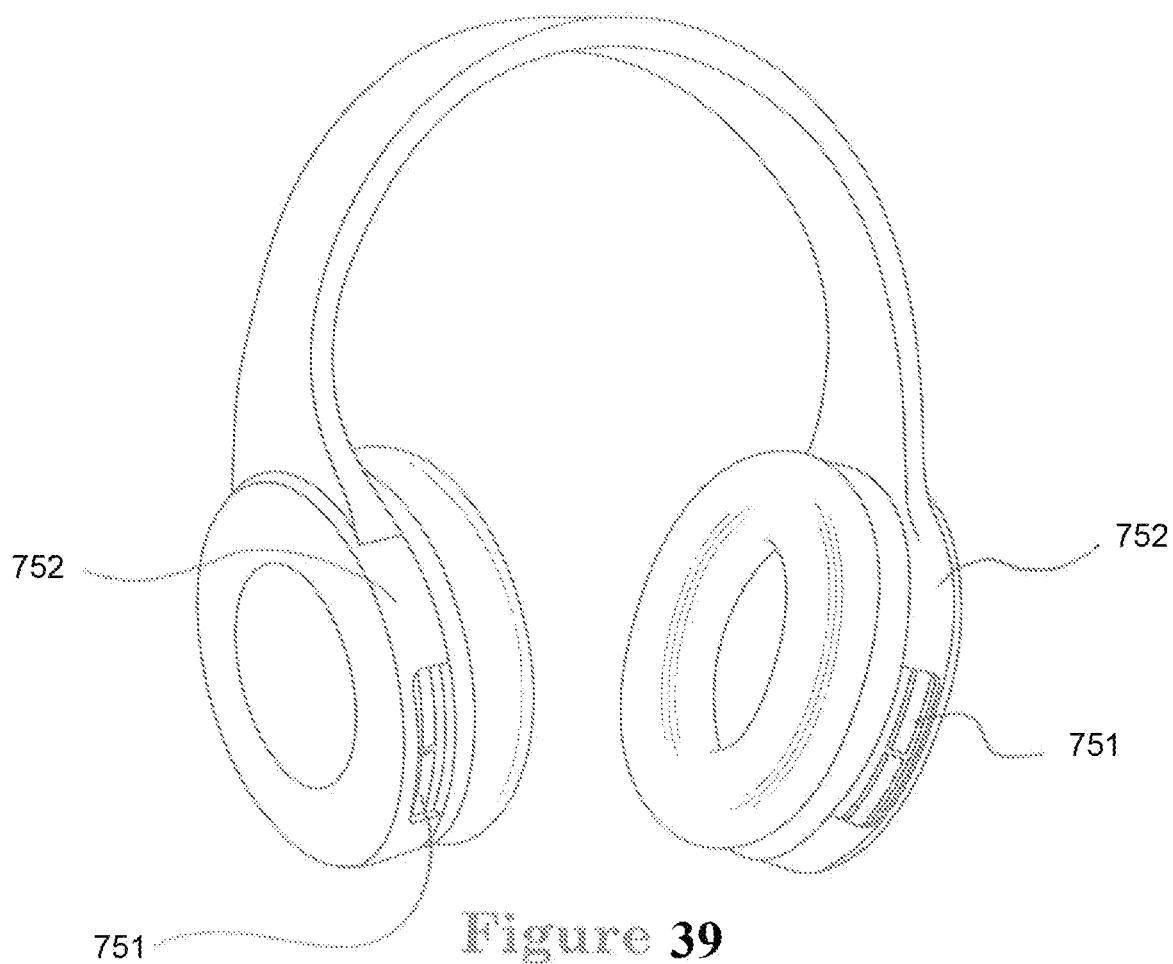


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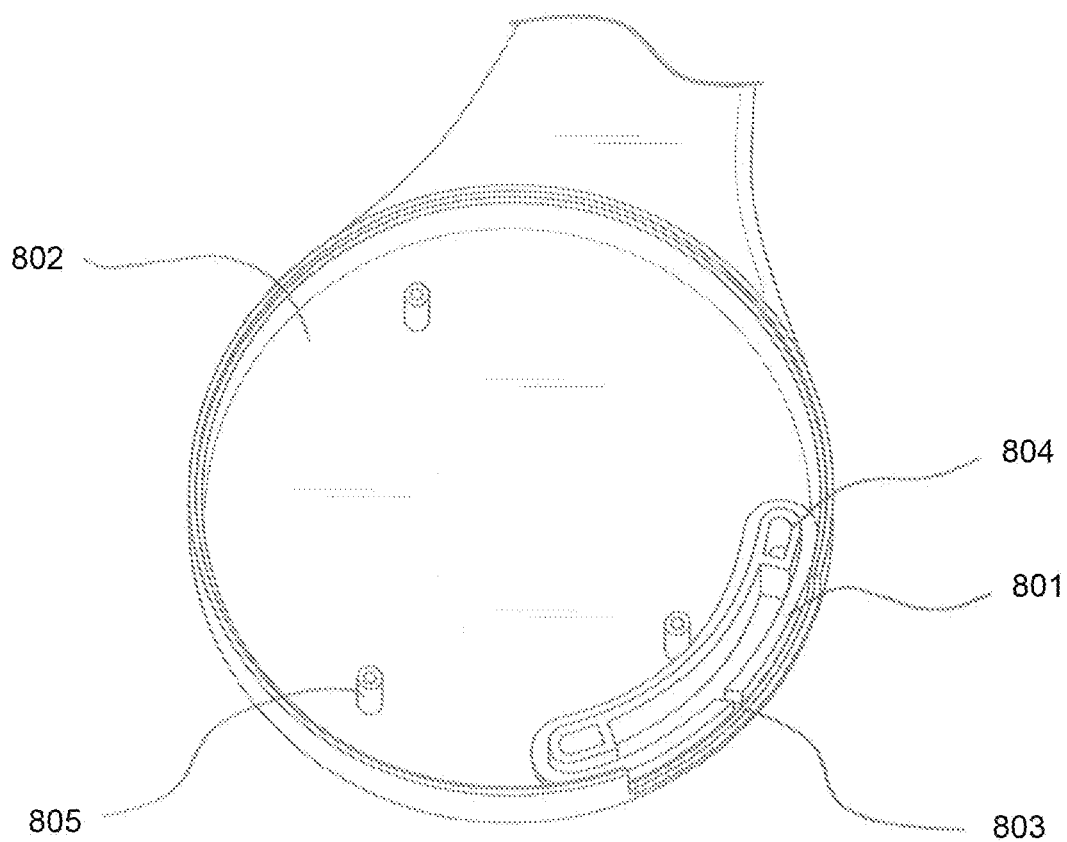


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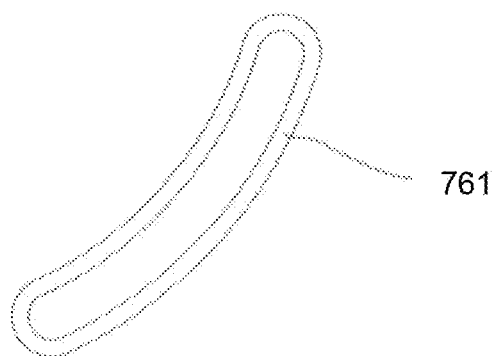


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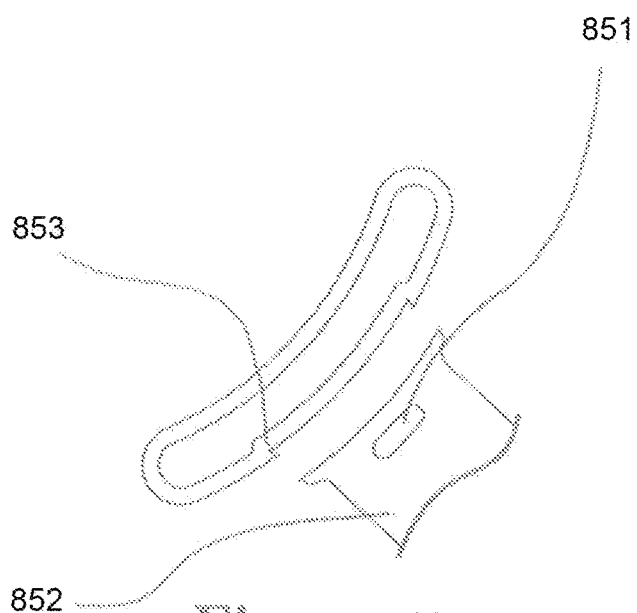


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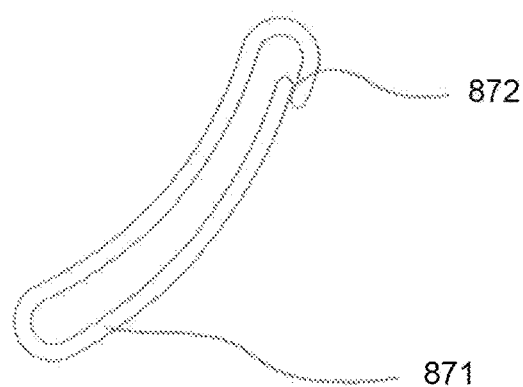


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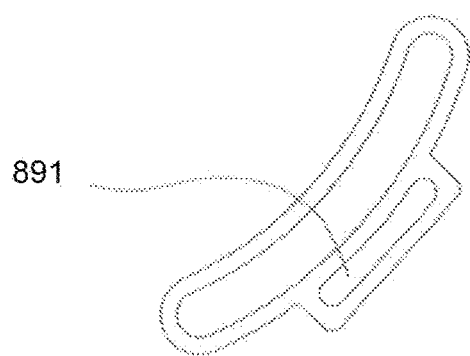


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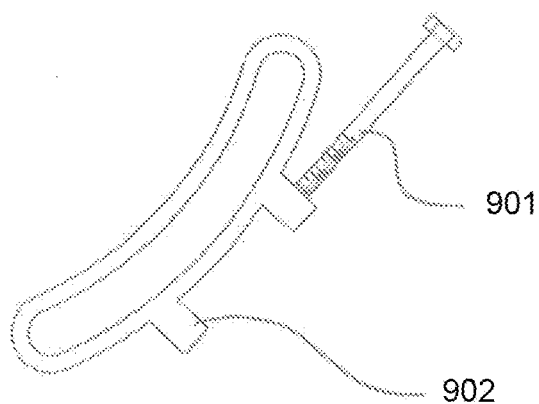


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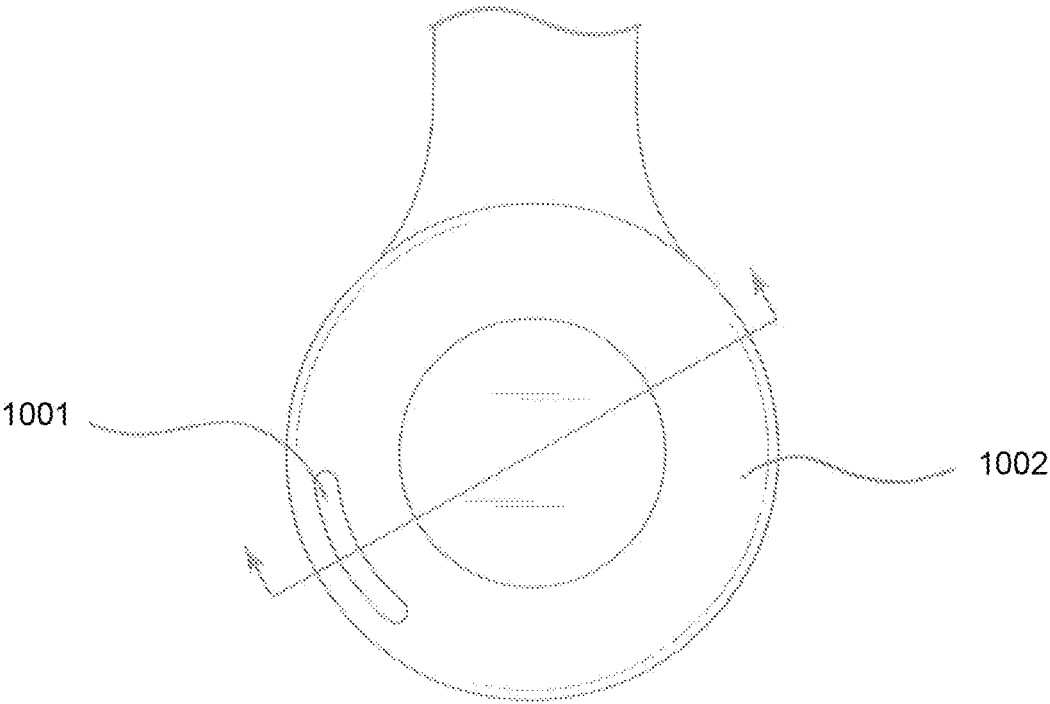


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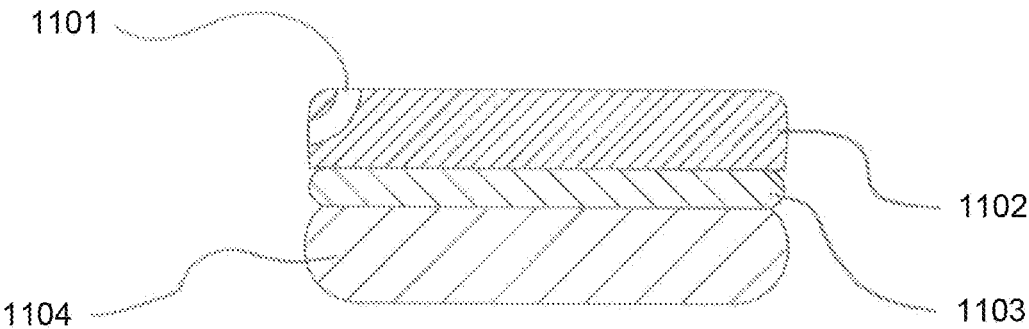


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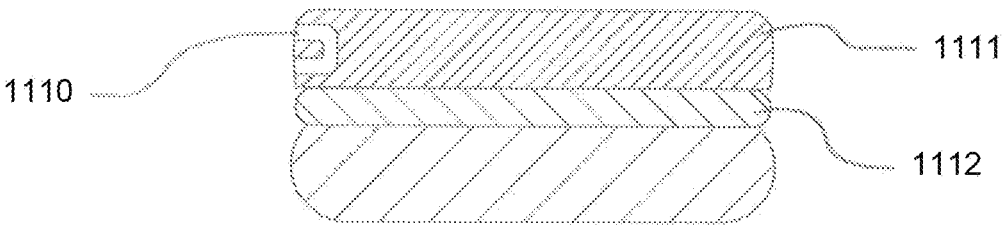


Figure 47 B

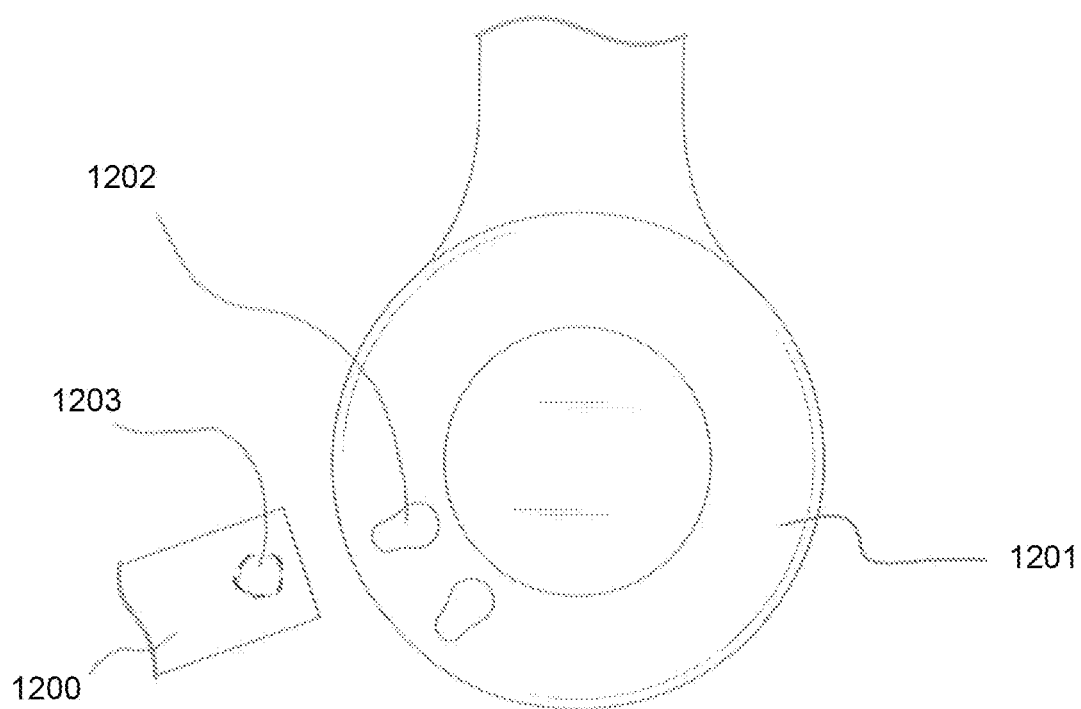


Figure 48



Figure 49

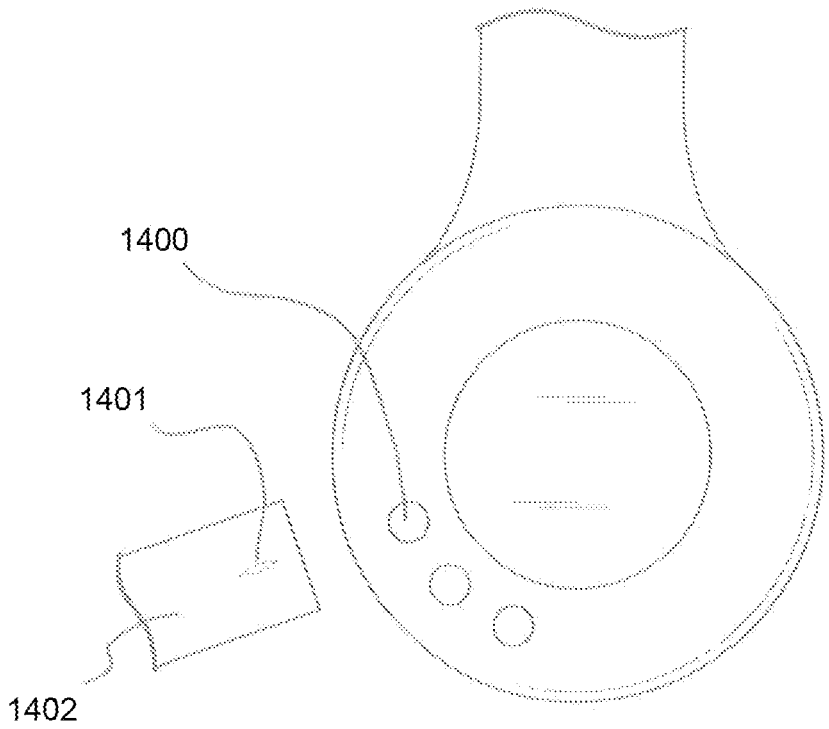


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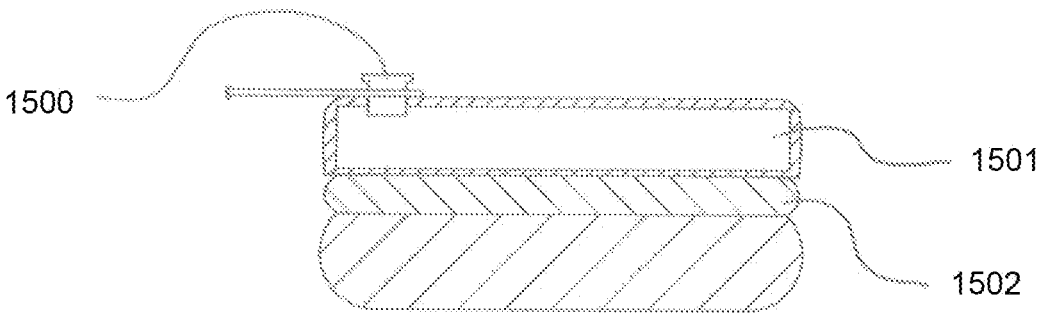
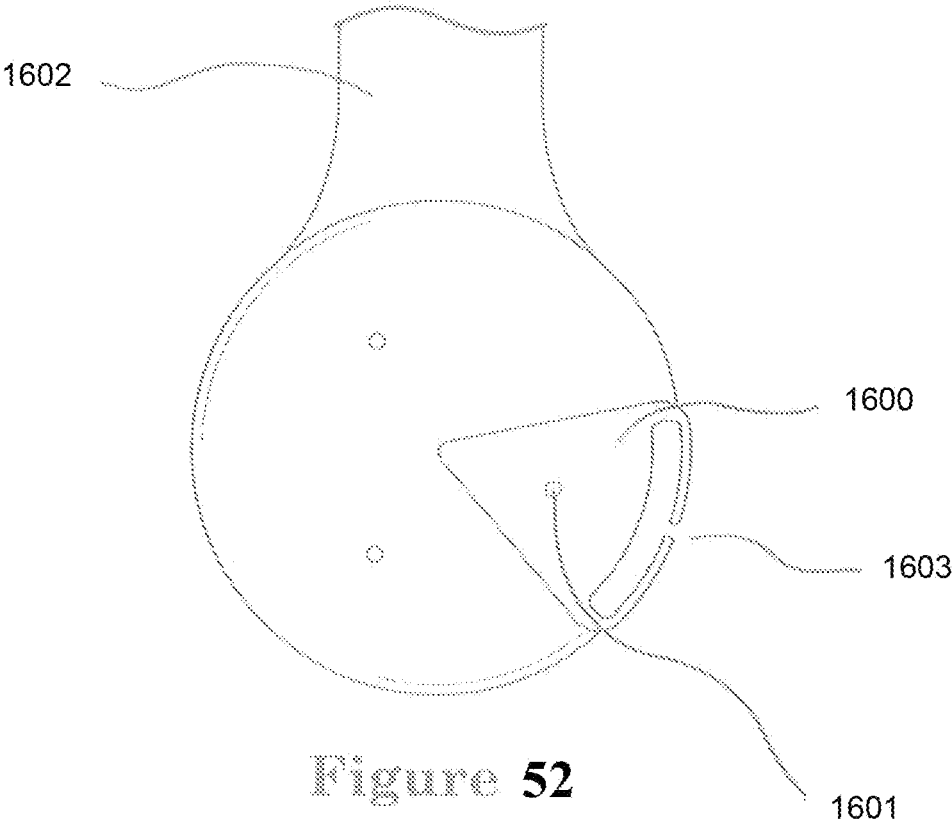


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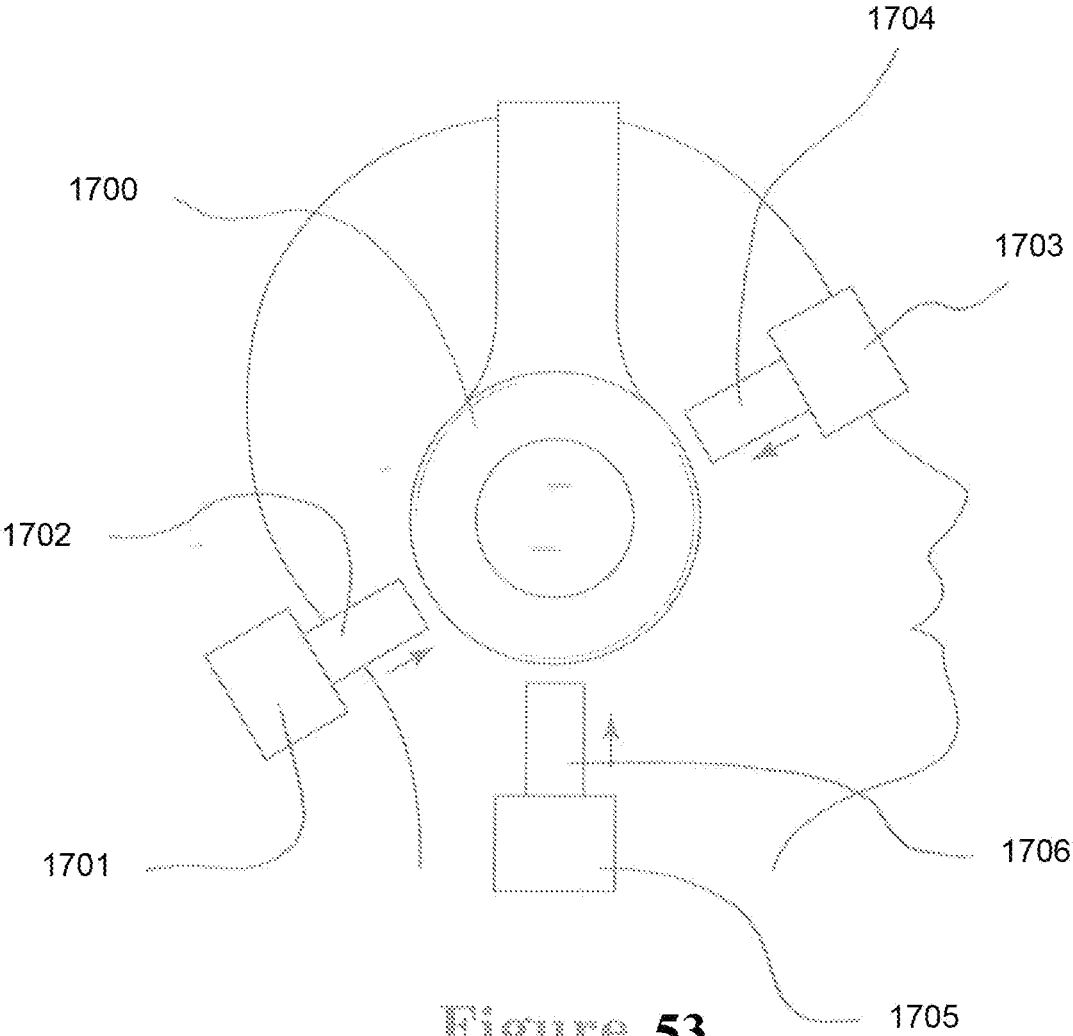


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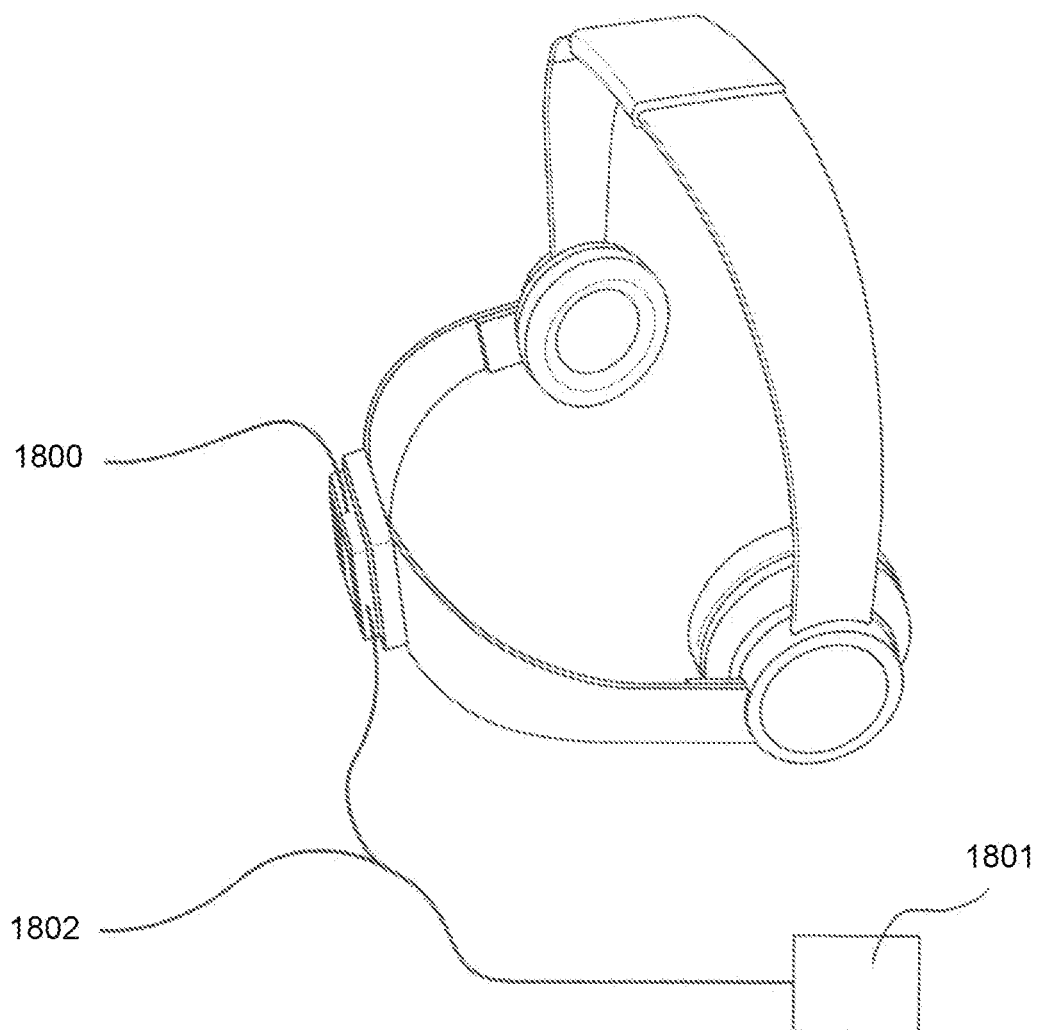


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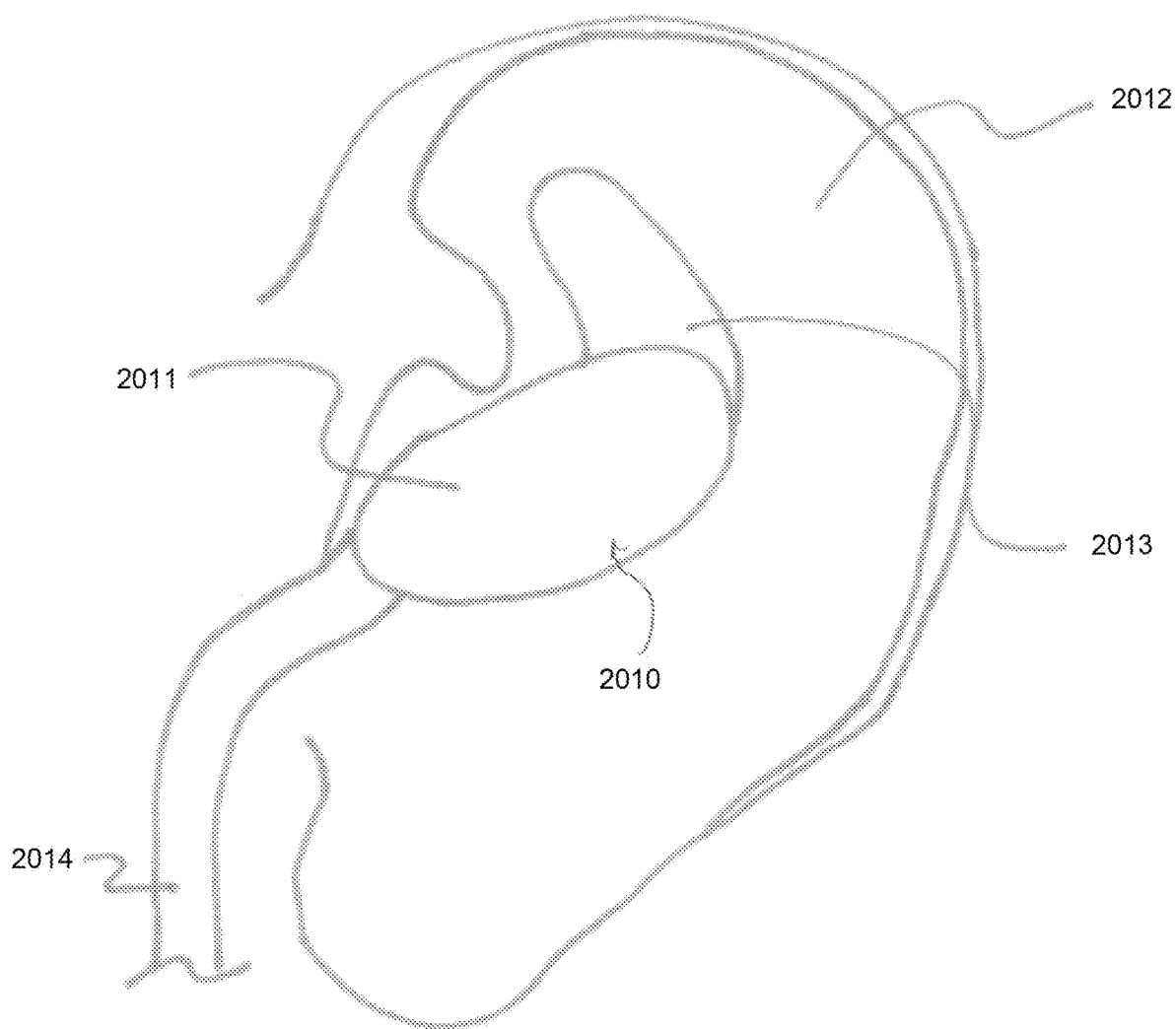


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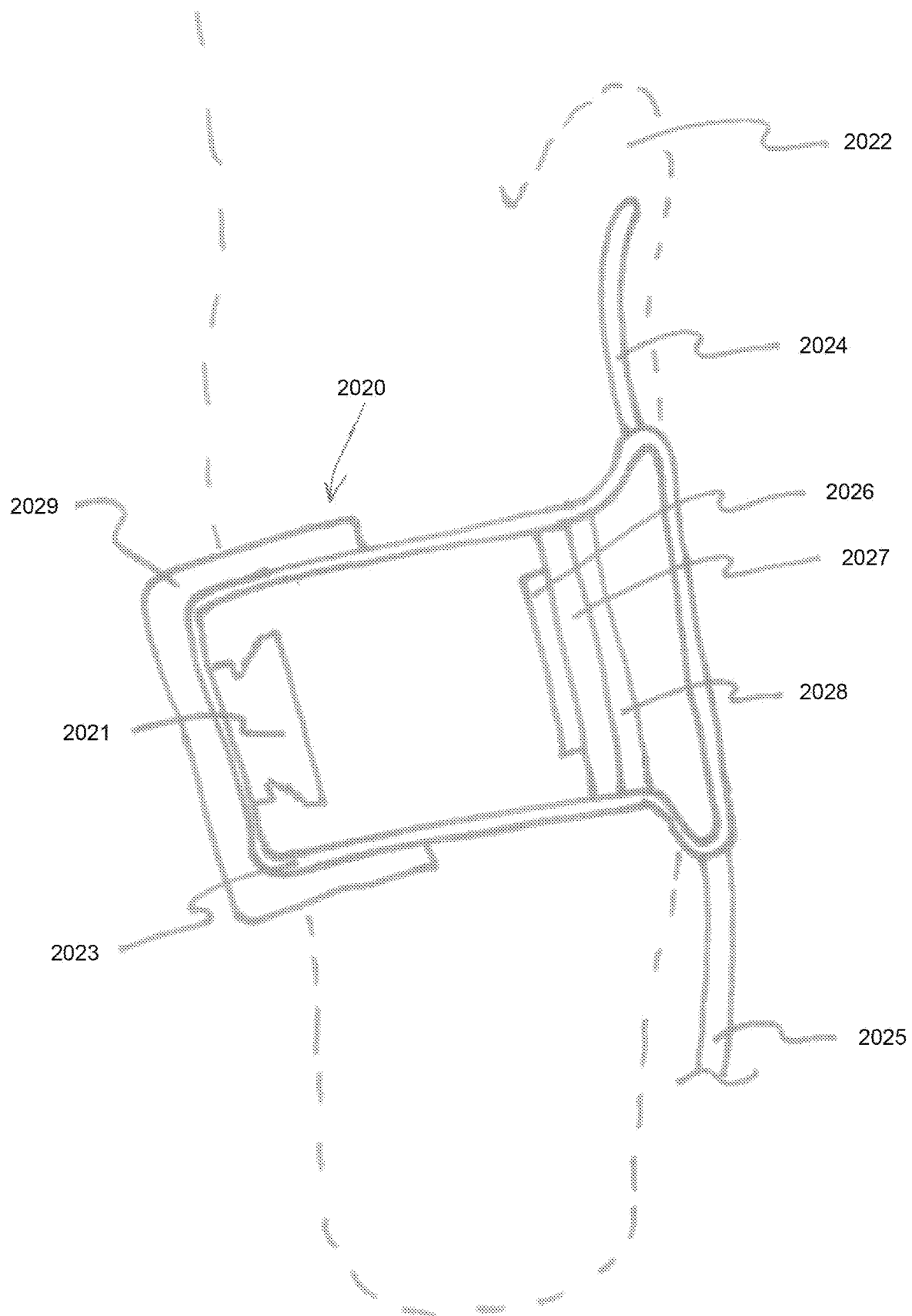


Figure 56

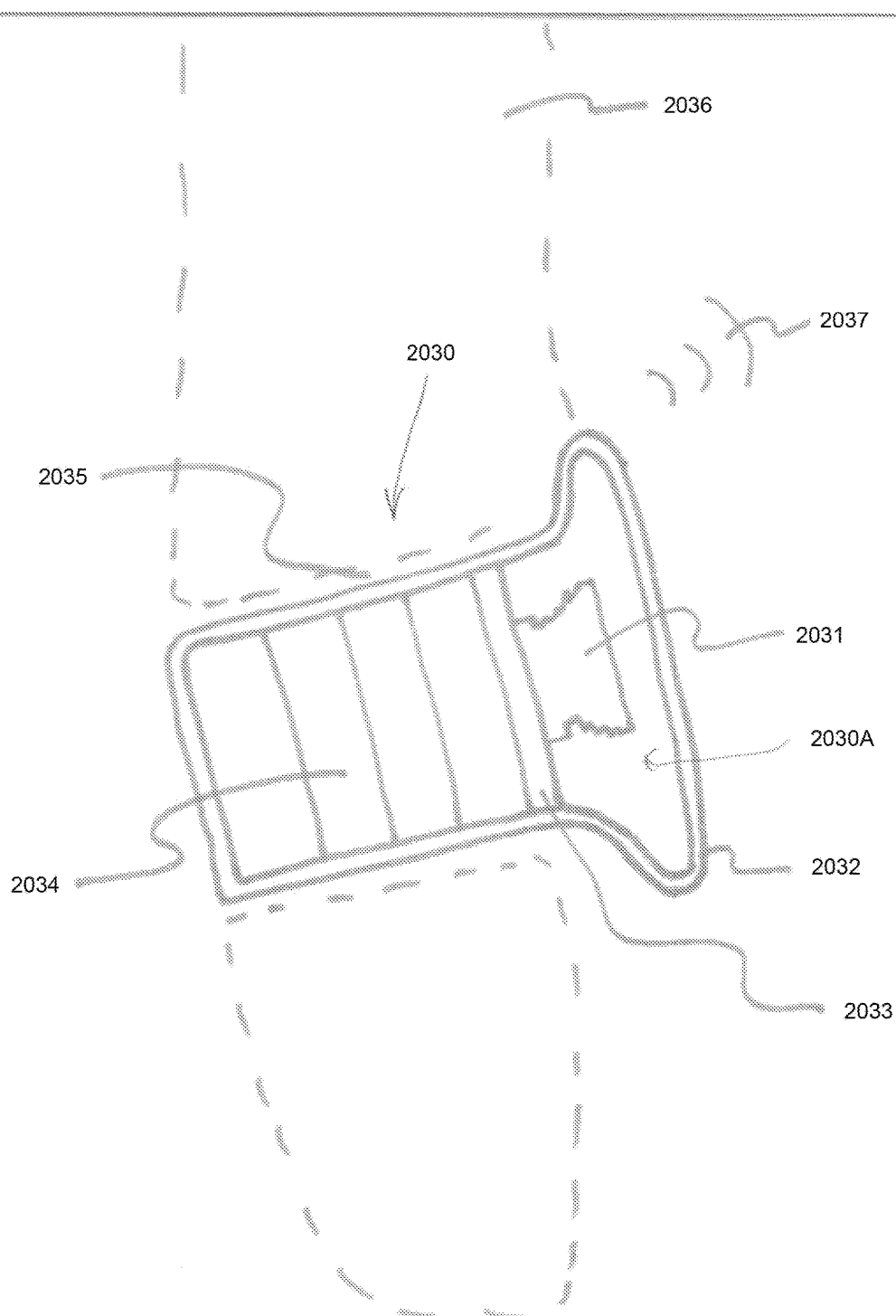


Figure 57

SENSORY STIMULATION OR MONITORING APPARATUS FOR THE BACK OF NECK

CLAIM OF PRIORITY

[0001] This application is a continuation-in-part of International Application No. PCT/US2015/021286, filed on Mar. 18, 2015, which claims priority to U.S. Provisional Patent Application No. 61/955,384, filed Mar. 19, 2014, this application is also a continuation-in-part of US 2017/0135896 filed on Sep. 19, 2016 and having Ser. No. 15/269,655, and is a continuation of U.S. Ser. No. 16/915,275 filed on Jun. 29, 2020, the entire contents of which are all incorporated herein by reference in their entireties.

FIELD OF THE INVENTION

[0002] The present invention relates generally to wearable sensory stimulation apparatuses worn on the head and neck.

BACKGROUND OF THE INVENTION

[0003] The human brain is multi-sensory and receives stimulation from the outside world via sound, touch, smell, vision and taste. Commercially available options for delivering and receiving stimulation include headphones or ear buds that deliver audio to the ear, as well as monitoring and sensing apparatuses worn on various parts of the body. Known apparatuses have limitations in their design, function and performance.

SUMMARY OF THE INVENTION

[0004] The various embodiments of the invention relate to apparatuses that improve upon existing sensory stimulation devices such as headphones, ear buds and other wearable headset devices by adding a transduction component to the device, such as vibration speakers, haptic exciters, electrical stimulation, olfactory release, or similar transduction members. The various devices taught herein also include monitoring sensors located on the back of the neck and the spine. These apparatuses can be used to improve audio output performance at lower frequencies, and therefore lower volumes. In an example embodiment, the apparatus is used to train, teach, improve, and recover from athletic performance or activity. In other embodiments, the apparatus is used for entertainment or communication purposes. Alternative embodiments are also used to monitor and diagnose physiological processes, and even deliver forms of sensory stimulation for health, healing or improve coordination purposes.

[0005] The teachings herein improve the performance and experience of existing headphones, ear buds, headsets and other wearable audio delivery devices by adding transduction components such as vibration speakers or similar haptic delivery methods to the system, and placing these components on the back of the neck and/or upper spine of the user. The vibration transduction components allow for better delivery of lower frequencies, especially when in direct contact with the user. This improvement allows lower frequencies to be optimally played, heard and felt through the peripheral sensory nerve pathway, in conjunction with the existing auditory channel, thus more closely resembling larger room speaker output experiences. The wearable audio delivery devices may also be waterproof, adjustable, remote controlled, lightweight, foldable, noise cancellation capable and the like.

[0006] By activating neurologic pathways along the spine, especially cranial nerves, using sound, vibration and music therapy, the user can also receive health benefits. This application provides the embodiments that can be used to monitor, assess and deliver various forms of vibration therapy to individuals, as well as methods to help coach, train, and recover for improved athletic performance.

Additionally, embodiments describe apparatuses that can be used to treat conditions such as tinnitus, Alzheimer's, Parkinson's, autism, or similar brain-related conditions.

[0007] It would be preferable to place a plurality of sensing components on the back of the neck to assess the health condition of the individual. Brain stem activity, heart rate, oxygenation, pulse, movement and other processes may be monitored effectively on the back of the neck. Also, when used in conjunction with the above transduction components, various forms of vibration therapy can be administered, either on the neck, wrist, back, or other points on the body to achieve neurologic stimulation.

[0008] It is taught herein to have a training device for athletic performance such as for golf, baseball, tennis, or other sports. The device can be worn around the neck and over the ears to deliver specific instruction before, during and after the activity. When accompanied by a vibration speaker or similar transducer, the device can stimulate the spine for improved neurologic outcomes. In one example embodiment, the device includes instruction methods, such as swing tempo for golfers, which are loaded on the device and delivered to help train, teach, heal and recover during and after athletic performance or activity.

[0009] Embodiments of the invention set forth a wearable audio delivery apparatus configured for use with a speaker set that is placed in or about the ears, with the apparatus including (a) a housing having at least one vibration speaker or vibration transduction component, the housing configured to be positioned on the back of the neck and on the spine, and (b) right and left attachment members with a proximal portion directly or indirectly connected to the housing, and the attachment members each having a distal portion configured for removable attachment to the ears or to speaker enclosures of a speaker set that is placed about the ears.

[0010] Embodiments of the invention also set forth a wearable audio delivery apparatus that include (a) a speaker set that is placed in or about the ears, (b) a housing having at least one vibration speaker or vibration transduction component, the housing configured to be positioned on the back of the neck and on the spine, and (c) right and left attachment members each comprising a proximal portion directly or indirectly connected to the housing, and a distal portion attached to a portion of a speaker set that is placed in or about the ears, wherein the attachment members are flexible, stretchable, or both flexible and stretchable.

[0011] Embodiments of the invention also set forth a wearable monitoring apparatus that includes (a) a housing having a sensing feature, the housing configured to be positioned on the back of the neck and on the spine, and (b) right and left attachment members directly or indirectly connected to the housing, wherein the attachment members allow the housing to be stably immobilized on the head of a user or to be attached to a headpiece. In a related example embodiment and platform, there is provided mobile content delivery systems that allow people to engage with various forms of recorded, digital content while being mobile and wanting to experience the content via as many sensory

stimuli as possible. This example embodiment delivers music, gaming, video, therapeutic, or other forms of digital content to entertain, improve or enhance a person's life. Specifically, these related embodiments encompass various forms of wearable headsets that deliver various forms of multi-sensory stimulation content to users. These mobile headsets deliver content such as audio, video, virtual reality (VR), augmented reality (AR) and mixed reality (MR), allowing the user to hear, feel, see and smell the content. Content can be streamed, uploaded or connected directly to the headsets or components via methods such as smartphones, tablets, hard drives, cables and other connection methods. The drawback with existing video headsets is they only deliver one or two sensory stimulation methods, primarily visual and sometimes audio. These existing headsets limit the experience and mobility options consumers have with the digital content. One of the additional characteristics of this embodiment is that it allows the audio signal to be split, filtered, amplified and delivered to multiple speakers and similar audio outputs to provide the user with a more realistic, surround sound experience.

[0012] In one of various example embodiments, there is provided headphones with a modular attachment system, along with methods how to attach various components to the headphones. The modular headphone system incorporates methods of component attachment using a variety of fixtures that are part of or in addition to the headphone or the headphone ear cup molds. These fixtures, or methods of attachment, allow for components to be held securely in place on or around the head including, but not limited to, on the neck, over the eyes, on the face, from the ear cups, around the forehead, extending from or on top of the head. The fixtures can be fixed into the headphones or can be interchanged to allow for other fixtures. One representative embodiment use would be to allow a user to experience digital content in a new way. A user could play a video on their smartphone or other device, put on our headphones to listen to the audio, attach a subwoofer to the headphone fixture so it rests on the back of the neck to add tactile sensation, and then insert their smartphone into a virtual reality attachment that plugs into the headphone attachment fixture on the front of the ear cup and plays video in front of the user's eyes.

[0013] Another representative embodiment use would be for an air traveler who wants to connect a thermal node around their neck to help relax and sooth, and insert an eye covering shade into the headphones to block out lights and noises. Still another representative embodiment would be for a user to attach a heart rate or blood pressure monitoring device to the headphone to monitor conditions that could then be transmitted to external users such as physicians. Another representative embodiment would be to attach or insert a mechanism to the headphone or headphone ear cup that projects images, videos, virtual or augmented reality images, or the like in front of the user for entertainment, wellness or for training. Still another representative embodiment would be a user who wants to personalize their headphones by adding a decorative attachment to the ear cups. The attached or connected components can be new forms of stimulation to the user, as well as various types of other accessories. These components can be connected to headphones using flexible, rigid or semi-rigid attachment members that secure to the headphones and ear cups through various types of fixtures or accessories. Additionally, these

attached components can also be directly or wirelessly connected to external devices such as power supplies, content delivery systems, entertainment systems, training apparatuses, fitness machines or diagnostic equipment. One of the main benefits of this invention is to create new methods so various forms of recorded digital content, such as movies, fitness or wellness training, sports events, travel, music concerts, amusement parks, or the like, can be delivered through our modular headphones so users can have multi-sensory stimulation experiences without needing to travel to places for entertainment or healthcare needs.

[0014] Articles and types of manufacture, materials, features and advantages of the various embodiments of the invention will become apparent to someone in the art having ordinary skill. It is intended that all such articles included within this description be within the scope of the present invention, and thus protected by the associated claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] Other important advantages of the invention will be apparent from the following detailed description of the invention taken in connection with the accompanying drawings.

[0016] FIGS. 1A-1B illustrate perspective views and a side view of a wearable audio and vibrational delivery or monitoring device that incorporates vibration speakers, other transduction components, and physiological sensors that is placed on the back of the neck;

[0017] FIGS. 1C-1D illustrate perspective view of a wearable audio and vibrational delivery device that includes a vibration speaker and arms that extend over the ears but in FIG. 1D the arms are attached to over the ear speakers;

[0018] FIGS. 2A-2B illustrate perspective and side views of a wearable audio and vibrational delivery or monitoring device that includes an adjustable headband embodiment that is placed over the head;

[0019] FIG. 3 illustrates a wearable audio and vibrational delivery or monitoring device that includes vibration speakers or similar transduction members into headphones that go around the back of the head to the ears;

[0020] FIG. 4 illustrates a wearable audio and vibrational delivery or monitoring device that includes a system of attaching vibration speakers or similar transduction members via a wired or wireless connection, in or over the ear buds, and placed on the back of the neck;

[0021] FIG. 5 illustrates a wearable audio and vibrational delivery or monitoring device that includes vibration speakers or transduction members on the back of the neck and into an audio system built inside a helmet;

[0022] FIG. 6 illustrates a wearable audio and vibrational delivery or monitoring system that includes vibration speakers or transduction members on the back of the neck and is attached with or without wires to headphones to an audio output device, headphones and ear buds;

[0023] FIGS. 7A-7B illustrate perspective views of a wearable audio and vibrational delivery or monitoring device that includes vibration speakers or similar transduction members on the back of the neck.

[0024] FIGS. 8A-8C illustrate perspective views and a side view of a wearable audio and vibrational delivery or monitoring device that works in conjunction with glasses or goggles or other headgear; and

[0025] FIGS. 9A-9B illustrate perspective and side views of a wearable monitoring device that contains physiological sensors and therapeutic delivery components.

[0026] FIGS. 9C-9D shows a wearable device that is placed on or around the neck of a human and incorporates a sensory stimulation delivery device.

[0027] FIG. 10 illustrates a top view of a housing for a vibration speaker or transduction member placed on the back of the neck.

[0028] FIG. 11 illustrates a cross-sectional side view of a housing for a vibration speaker or transduction member.

[0029] FIGS. 12A and 12B illustrate rear and cross-sectional top views of an embodiment of housing for a vibration speaker or transduction member

[0030] FIGS. 13A and 13B illustrate rear and bottom views of an embodiment of housing for a vibration speaker or transduction member

[0031] FIGS. 14A and 14B illustrate rear and top views of an embodiment of housing for a vibration speaker or transduction member

[0032] FIGS. 15A and 15B illustrate rear and top views of an embodiment of housing for a vibration speaker or transduction member

[0033] FIGS. 16A and 16B illustrate an attachable audio delivery device with housing for placement on the back of the neck, as shown attached to a user's head (back view and side view).

[0034] FIGS. 16C and 16D illustrate embodiments of an attachable audio delivery device with housing for placement on the back of the neck.

[0035] FIGS. 17A-17D are front, side and perspective views of embodiments of an attachable audio delivery device with housing for placement on the back of the neck, the device attached to speaker enclosures of a headphone set.

[0036] FIGS. 18A-18E are front, perspective and side views of embodiments of an attachable audio delivery device with housing for placement on the back of the neck, the device attached to a headphone set.

[0037] FIGS. 19A-19B are front and side views of another embodiment of an attachable audio delivery device with housing for placement on the back of the neck attached to a headphone set.

[0038] FIG. 20A is an illustration of an integrated audio delivery device including a housing for placement on the back of the neck and earbuds, and FIG. 20B is an illustration of the device in a storage configuration for battery recharging.

[0039] FIG. 21 is an illustration of an earbud construction for an integrated audio delivery device.

[0040] FIGS. 22A-22D are views of an integrated audio delivery device with housing for placement on the back of the neck with a headphone set.

[0041] FIG. 23 is an illustration of an integrated audio delivery device including a housing for placement on the back of the neck and earbuds.

[0042] FIG. 24 illustrates anatomical features of the upper body relevant for placement of an audio delivery device or device having a sensing mechanism.

[0043] FIG. 25 illustrates anatomical features of the upper body including relevant for placement of an audio delivery device or device having a sensing mechanism.

[0044] FIG. 26 illustrates a side view of a mobile content delivery headset.

[0045] FIG. 27 illustrates a perspective view of a mobile content delivery headset.

[0046] FIG. 28 illustrates a side view with details of a component attached to a mobile content delivery headset arm.

[0047] FIG. 29 illustrates a side view of another mobile content delivery headset with a different shape.

[0048] FIG. 30 illustrates a perspective view of a mobile content delivery headset that has a conforming shape to a user's head and speakers adjacent a user's ears.

[0049] FIG. 31 illustrates similar headset to FIG. 30 with in-ear speakers for a user.

[0050] FIG. 32 illustrates a side view of a mobile content delivery headset that incorporates an over the head attachment to hold an eyepiece or viewing display in place.

[0051] FIG. 33 illustrates a perspective view of a mobile content delivery headset with an over the top of the head design.

[0052] FIG. 34 illustrates a mobile content delivery headset with features that allow components to adjust, conform and move independent of each other.

[0053] FIG. 35 illustrates a mobile content delivery headset, similar to FIG. 29, but without the eyepiece or viewing display.

[0054] FIG. 36 illustrates a mobile content delivery headset with speakers directly over the ears.

[0055] FIG. 37 illustrates a modular headphone system with an attachment to be disposed about a user's neck.

[0056] FIG. 38 illustrates a headphone attachment device for use with a headphone set.

[0057] FIG. 39 illustrates a headphone with a set of attachment mechanisms or fixtures.

[0058] FIG. 40 illustrates a portion of a headphone attachment fixture with a slot in an ear cup.

[0059] FIG. 41 illustrates a headphone attachment fixture for use in a headphone set that is in a closed configuration.

[0060] FIG. 42 illustrates a headphone attachment fixture or configuration for use in a headphone set with a depressible locking mechanism.

[0061] FIG. 43 illustrates a headphone attachment fixture for use in a headphone set with a hinged locking mechanism.

[0062] FIG. 44 illustrates a headphone attachment fixture for use in a headphone set with an extended closed loop.

[0063] FIG. 45 illustrates a headphone attachment fixture for use in a headphone set with a screw locking mechanism.

[0064] FIG. 46 illustrates an outside side view of an attachment slot located in a headphone ear cup.

[0065] FIGS. 47A and 47B illustrate section side views of a headphone attachment mechanism located within a headphone set.

[0066] FIG. 48 illustrates a headphone attachment mechanism for use in a headphone set with slotted holes, magnets or apertures in the ear cup and a connection post or mechanism in an attachment band.

[0067] FIG. 49 illustrates a side section view of FIG. 48 with a male post inserted into slotted holes, magnets or apertures.

[0068] FIG. 50 illustrates a headphone attachment method with a plurality of male posts in an ear cup and female connection slots in an attachment band.

[0069] FIG. 51 illustrates a side section view of FIG. 50 with at least one female slot connected to at least one male post.

[0070] FIG. 52 illustrates a headphone attachment fixture disposed within an ear cup mold having a slotted opening.

[0071] FIGS. 53 and 54 illustrate modular headphone systems, where FIG. 53 illustrates same with various receptacles for various attachments to be disposed on a user's neck, ear and face while FIG. 54 illustrates same with attachable components for wired and wireless connection to other external devices.

[0072] FIGS. 55-57 illustrate an in-ear wireless audio assembly according to the teachings herein using vibrational transduction technology to enhance hearing.

DETAILED DESCRIPTION OF THE INVENTION

[0073] The detailed description that follows below is intended to provide illustration to the principles of the invention. This description is not provided to limit the possibilities of the invention described herein, but rather to explain and teach the principles in such a way that a person of ordinary skill in the art could apply them to practice not only to the embodiments described herein, but also to other embodiments that could come into mind when applying the principles. The intention is to not limit the disclosures and claims listed herein, but to also include all similar embodiments.

[0074] The various embodiments described herein detail improvements to currently available devices, such as headphones, ear buds, headsets, headbands, glasses, and the like, that are worn by humans to deliver sound. By including additional speakers or other haptic transducers to these devices, and placing them around the back of the neck along and in contact with the spine, allows lower frequencies to be played more effectively, and can be heard and felt at the same time, thus improving audio output performance. Musicians, disc jockeys and audiophiles will be able to enhance the audio output. In a related embodiment, videos gamers will also enjoy an enhanced experience with the improved audio device taught herein. Features such as waterproof, adjustable, remote control, volume control, lightweight, foldable, noise cancellation and the like may also be included.

[0075] Additionally, since the neck is an ideal location to assess the health of a human, it is also envisioned that physiological health monitoring sensors may be incorporated into the systems, thus allowing users to track brain activity, movement, heart rate, blood pressure, glucose output and similar bodily functions. In an example embodiment, the device is capable of delivering this information to a user's computer or smartphone. These assessments could be used in conjunction with the delivery of therapy through transduction members also placed within the wearable devices on the back of the neck and used to stimulate the nervous system throughout the body.

[0076] Also, it is taught herein that the device is capable of incorporating teaching, training, and recovery regimens into the delivery device and worn on the back of the neck. This placement keeps the unit out of the way, allows for focus since it covers the ears, and delivers therapy along the spine before, during, and after performance needs. The device may be used for athletic activities, such as golf, baseball, tennis, bicycling, and other sports. When combined with the various forms of vibration delivery, improvements such as balance, stability, hand/eye coordination, muscle firing, and other neurologic processes are expected.

[0077] Additionally, placing optional sensing mechanisms within one or more embodiments allows the accurate assessment of physiological processes such as heart rate, blood flow, blood pressure, brain stem activity, and user activity. This monitoring functionality is used to not only assess health and deliver that output to the user, but also can be connected to wearable forms of delivering therapy through the transduction components. Example benefits of this embodiment allow for users to wear the headphones to assess conditions associated with aging, such as balance or stability issues, anxiety, fatigue, lack of mobility or pain, and deliver a sensory therapy to help correct or address these symptoms.

[0078] Also, throughout the disclosure various embodiments are described that include a vibratory or audio transducer component(s) placed inside of a housing, which is configured for placement on back of the neck. It is envisioned that the vibratory or audio transducer component in any of the disclosed embodiments could be supplemented with or replaced by other non-audio or non-vibrational stimulation components to provide a stimulatory effect to a user to achieve a desired outcome.

Exemplary non-audio or non-vibrational stimulation components include but are not limited to electrical stimulation, transcutaneous electrical nerve stimulation (TENS), extracorporeal shock wave therapy (ESWT), olfactory or pheromone stimulation.

[0079] FIG. 6 illustrates a system 60 with components for wearable audio delivery and/or monitoring that can include a vibration speaker 66 or similar transduction members having a housing, and/or monitoring sensors, configured for placement on the back of the neck. The vibration speaker 66 can be attached either with or without wires (wirelessly) to headphones 64 to an audio output device 67, headphones and ear buds 69.

The wearable audio delivery and monitoring device 60 can include a splitter jack 68 that allows the device to be connected to both the ear buds 30 and vibrational speakers 20.

[0080] In some embodiments the vibration transduction component that provides lower frequency output is an "add-on" component, meaning that is provided apart, i.e., as a separate component, from a headphone or earbud speaker set that the user may already possess. In this embodiment, the audio delivery apparatus can be referred to as configured for the "removable attachment" to the ears, or to speaker enclosures of a speaker set that is placed about the ears. In order to explain aspects of the invention, features of commercially available over the ear-type headphones and earbud-type headphones, and which can be used with an "attachable" audio delivery apparatus including vibration speaker or vibration transduction component, are described.

[0081] Commercially available "over the ear" headphones (herein referred to as "headphones") generally include a pair of small loudspeakers within an enclosure or housing that is held in place over a user's ears. Typically, the speaker enclosures are attached to a band that goes over the user's head and that provides a slight inward force to press the enclosures up against the user's ears, which aid in providing stability during use. Speaker enclosures generally include padding, such as a foam material covering all or a portion (such as about the periphery) of the inner (user) side of the enclosure to improve the comfort of the headphones. Typically, the band over the top of the user's head is adjustable

to provide desired placement of the speaker enclosures. Commercially available speaker enclosures of headphones are of various shapes and sizes. Common shapes for speaker enclosures include oval, circular, and oblong shapes. The size of such enclosures can be somewhat small, such as less than the size of the outer ear of a user or can be rather large and have a periphery that is larger than the outer ear. For example, the periphery of a speaker enclosure of a headphone may be in the range of about 10 cm to about 30 cm, or about 15 cm to about 25 cm.

[0082] Other commercially available speaker sets for use on the head include earphones (referred to herein as “earbuds”) and in-ear headphones (also referred to as “in-ear monitors,” (IEMs) or “canal phones”). Earbuds are very small speaker enclosures that are configured to fit within the outer ear, and which face but are not inserted into the ear canal. Earbuds typically include a soft firm material, such as a foam pad, on the ear-canal facing surface to provide comfort. In-ear headphones have a speaker enclosure that is configured to extend into the ear canal. In-ear headphones can be generic, or custom fitted, and made from materials such as silicone rubber, elastomers, and foam. Speakers found within headphones, earbuds, and in-ear headphones are electroacoustic transducers which convert an electrical signal to a corresponding audio wave which provides a sound in the user’s ear. Typical speakers within headphones, earbuds, and in-ear headphones provide an audio signal generally over a broad frequency range, for example in the range of about 20 Hz (very low bass tones) to about 20,000 Hz (the highest treble), which represent the lower and upper ends, respectively, of what the human ear can detect. However, unlike low frequency speaker systems, the output of commercial headphones, earbuds, and in-ear headphones is desirably equally distributed over the broad frequency range.

[0083] In contrast to speakers found within headphones, earbuds, and in-ear headphones the vibration speaker or vibration transduction component of the current disclosure can provide a low frequency output to create vibration on the back of the neck and over the spine. The vibration speaker or vibration transduction component can be used with the attachment embodiments and integrated embodiments of the invention. In some respects, the apparatus can be described by parameters of the low frequency output. For example, most (greater than 50%, greater than 60%, greater than 70%, greater than 80%, greater than 90%, greater than 95%, greater than 99%) of the output of vibration transduction component can be below 250 Hz, below 200 Hz, below 150 Hz, below 125 Hz, or below 100 Hz, such as in the range of about 20 Hz to about 200 Hz, or about 20 Hz to about 100 Hz.

[0084] In some embodiments the vibration transduction component can produce infrasonic waves (i.e., acoustic waves having a frequency below 20 Hz, versus “sonic” having a frequency of 20 to about 20,000 Hz). Devices such as tactile transducers and specialized transducers referred to as linear actuators can produce infrasonic waves. The vibration transduction component capable of producing infrasonic waves can include an electromagnetic motor, with a new magnet structure with a vented center pole to allow air to move in and out more efficiently.

[0085] An exemplary electromechanical transducer which can be used in association with the audio output apparatus of the current disclosure is described in EP2779696A1, which

is incorporated herein by reference. In one aspect, the apparatus has a housing that has electromechanical transducer that transduces an electric signal into mechanical vibration, the transducer including a structural unit with at least the following integrated components: at least one pair of magnets, a yoke conducting a magnetic flux generated by the magnets, and a coil supplied with the electric signal. The transducer also includes an armature having an inner portion passing through an internal space of the structural unit and first and second outer portions protruding on both sides from the inner portion. The armature constitutes a magnetic circuit with the structural unit via two regions through which components of the magnetic flux flow in directions opposite to each other in the inner portion. The transducer also includes a first elastic member connecting between the first outer portion of the armature and the structural unit; and a second elastic member connecting between the second outer portion of the armature and the structural unit.

[0086] In some embodiments, the vibration transduction component provides both infrasonic and sonic frequencies. For example, most vibration transduction component can produce predominantly (greater than 50%, greater than 60%, etc.) infrasonic frequencies and sonic frequencies of below 100 Hz. The vibration transduction component can be partially or fully enclosed within a housing. Generally, the housing is configured to be placed on the back of the neck, over the uppermost portion of the spine. In particular the housing can be configured for placement below the occipital ridge of the skull, over the cerebellum, where the spinal cord meets the brain. In position, the housing will be proximal to cervical vertebra 1-3.

[0087] Reference is made to FIG. 24 illustrating relevant anatomical features of the upper body including skull 400, occipital ridge 402, cervical spine 1-3 404, spine 408, and central nervous system 410. In modes of practice, the target area for placement of the device with the vibration transduction component is represented by circle 401, where the device is placed. FIG. 25 provide illustrations of portions of the head, showing the cerebellum 412, the location where the skull curves down to the spine 414, and line 416 representing the transverse plane for device placement, which allows easy access to audible, tactile, and olfactory receptors.

[0088] The advantage of placing vibration speakers or similar delivery transducers on the back of the neck is the direct stimulation into the brain since they are engineered to deliver lower audio and vibration frequencies. This also allows the ear speakers to be optimized to play higher frequencies. An additional benefit of this placement for audio information and sound delivery is for the hearing-impaired population that can feel vibration but may not be able to hear clearly. Other uses include assistance in training, post-operative recovery or rehabilitation. Still another use may be situations such as movie theatres, concerts, or similar settings where surround sound output performance may be delivered individually and personally through worn headsets.

[0089] In some cases, the housing can be described in terms of height, width, and thickness ranges. In many configurations, the housing can have a width and height that is greater than its thickness, which can provide the housing with an overall “flat” shape. When in position the height dimension can be defined by upper and lower portions, or edges, which is towards that top of the user’s head and

towards the user's back, respectively. The width dimension can be defined by left and right portions or edges. The thickness can be defined by a body-facing surface, which is configured to be placed against the skin of a user's neck, and an outer surface, facing away from the neck.

[0090] One or more surfaces of the housing can have curvature. For example, the inner surface of the housing can include one or more curved surfaces. The curved surface can include one or more convex and concave shape(s) providing one or more bulges or one or more indentations on the body facing on the surface. FIG. 10 is a top view of an exemplary housing 100 construction, with outward facing surface 102, and body facing surface 104 (an area of the neck 106 is also shown). The indentations 108 and 110 and bulge 112 can match the contour of the neck.

[0091] In exemplary embodiments, the housing has a height in the range of about 6.5 cm to about 3.5 cm, or about 5.5 cm to about 4.5 cm; a width in the range of about 10 cm to about 5 cm, or about 8.5 cm to about 6.5 cm; and a thickness in the range of about 2 cm to about 0.5 cm, or about 1.5 cm to about 1 cm. As viewed from the outer face or surface, the housing can have a square, rectangular, oval, or circular shape. An exemplary weight for the housing, including the vibration component therein, is in the range of about 30 to about 55 grams, or about 35 to 45 grams. Exemplary housing materials include plastics and metals and combinations thereof.

[0092] FIG. 11 shows a cross sectional side view of an exemplary housing 120 construction, with outward-facing surface 122, and body-facing surface 124. The outward-facing surface 122 can be curved outwards from the top 123 to the bottom 125 of the housing. A vibration component 126, such as a speaker cone or transduction member, can be secured within the housing. The vibration component can be adjacent to an open area in the housing (e.g., space 127) in which acoustic waves can be generated. The acoustic waves, in turn, are absorbed by the body-facing surface of the housing, which can have a rigid or flexible construction, and cause the vibration of this portion of the housing. The housing can also include one or more areas (e.g., 128, 129) for placement of components useful for operation of the vibration component, such as a battery, a splitter, a short range wireless receiver (e.g., Bluetooth) device, a micro-processor board, and a sensor. Areas for the placement of these features can be located between the outwards-facing surface and the vibration component or open area in the housing.

[0093] In embodiments of the disclosure, the attachment member is configured to allow for removable attachment of the apparatus to the ears or to speaker enclosures of a speaker set that is placed about the ears. In embodiments of the disclosure, the attachment member is formed of a cord, a strip of material, a band of material, a mesh, etc. The attachment member can have one or more of the following properties: flexibility, stretchability, elasticity, compliance, durability, and strength. Preferably, the attachment member is flexible, stretchable, or both flexible and stretchable. In this regard, the attachment member can be described as "non-rigid" or made from a "non-hardened material." Use of a flexible and/or stretchable attachment member such as an elastic cord attachment member can provide advantages during use. For example, unlike a hardened plastic material, a flexible and stretchable attachment member can provide better isolation of the low frequency vibrations from the

vibration component to the back of the neck. Unlike a hardened material, the flexible and/or stretchable attachment member poorly conducts the vibration from the housing, and therefore provides better response at the point of contact, and prevents low frequency vibrational "bleed through" to the speakers around or in the ears.

[0094] The attachment member that is flexible and stretchable can include one or more elastomers. An elastomer is a material that can exhibit a rapid and large reversible strain in response to a stress. Exemplary elastomers include natural rubber (cis-1,4-isoprene polymer), styrene-butadiene rubber, butyl rubber, ethylene propylene diene monomer (EPDM) rubber, polychloroprene, polysulfide, polyurethane elastomers, acrylonitrile butadiene rubber, and silicone rubber. The attachment member that is flexible and stretchable can optionally be described in terms of its "stretchability." For smaller and moderate forces applied to a stretchable material such as an elastomeric cord, a spring constant of a cord can be expressed. A spring constant (k), as measured in N/m, can be calculated by the force applied to the cord over the change in length of the cord.

[0095] If the attachment member is in the form of a cord, the cord can have a certain cross-sectional shape, such as a circular shape. However, the cord may also have an oval or polygonal shape (e.g., square, rectangular, etc.) The size of the cord can be expressed as its cross-sectional area, which in some embodiments can be in the range of about 1 mm² to about 120 mm², or about 7 mm² to about 40 mm². For example, an exemplary cord has a diameter in the range of about 3 mm to about 8 mm. The attachment member, such as an elastomeric cord, can have an inner elastic material and a fabric outer layer coated around an outer periphery of the elastic inner tube. The fabric outer layer can provide improved comfort for a user.

[0096] The housing can also include one or more features that facilitate attachment of the right and left attachment members to the housing. For example, the housing can include one or more apertures or channels through which the attachment member can pass. The attachment member, such as a cord, can be movable through the aperture or channel. Generally, the size of the aperture or channel will be at least as large as the largest cross-sectional dimension of the attachment member, such as a cord. Using this arrangement, the attachment member such as a flexible cord, can be moved through the aperture to adjust the length of the attachment member that is to be looped around the ears or around a speaker enclosure of headphones. In this regard, the apparatus can include a tensioning member that allows the attachment member to be secured in relation to the housing, so that a desired length of cord can extend from the housing for attachment to the ears or a speaker enclosure of headphones. The tensioning member can be one that is integrated in or attached to the housing, such as a clip or a clamp. Alternatively, the tensioning member can be independent from the housing, such as one that is movable over the cord. For example, the tensioning member can be a small clamp having an opening through which the cord can move, which can be immobilized on the cord in a clamped state, and which can contact the housing to provide a stop to the movement of the cord.

[0097] In some embodiments the housing includes two or more apertures through which the attachment members can be moved through. The housing can include additional apertures, such as a total of 3, 4, 5, 6, etc. according to the

design of the apparatus. In some embodiments, the apertures can be located at the periphery of the housing. For example, the housing can have a rectangular or oval shape (e.g., the housing having a width that is greater than its height), where at least one aperture is located on each side of the housing. If each side of the housing has two apertures (for a total of four apertures) the apertures may be referred to as upper and lower apertures.

[0098] As an example, FIG. 12A shows a view of the outward-facing surface 142, with upper 145, lower 146, left 148, and right 149 sides, defining upper right, upper left, lower right, and lower left corners of the housing. In each corner there is an aperture, for a total of four apertures (147a, 147b, 147c, and 147d). As shown in FIG. 12B, which is a top cross-sectional view of the housing, each aperture (top apertures 147a and 147b are shown) extends from the outward-facing surface 142 to the body-facing surface 144. From the outward-facing surface 142 to the body-facing surface 144 the apertures can be about 2 cm to about 0.5 cm, or about 1.5 cm to about 1 cm.

[0099] There are various ways to connect an attachment member to the housing having apertures as shown in FIGS. 12A and 12B. For example, an attachment member that is a cord can enter aperture 147b from the outward-facing surface 142, continue along the body-facing surface 144 parallel to right side 149 and then exit through aperture 147d. The length of cord that extends away from apertures 147b and 147d can form a continuous loop from the right side of the housing and along the right side of the head, where the proximal end of the loop can attach to the ear or to a speaker enclosure of a headphone. A corresponding arrangement can be provided on the left side of the housing.

[0100] In other modes of attaching, the cord may also enter aperture 147b from the outward-facing surface 142, continue along the body-facing surface 144 parallel to top side 145 and then exit through aperture 147a. The length of cord that extends away from aperture 147a can extend distally to form a continuous loop from the left side of the housing and along the left side of the head, and then return in to aperture 147c from the outward-facing surface 142, continue along the body-facing surface 144 parallel to bottom side 146 and then exit through aperture 147a. The length of cord that extends away from aperture 147d can extend distally to form a continuous loop from the right side of the housing and along the right side of the head, and then return into aperture 147d.

[0101] In other modes of attaching, the cord may enter any aperture from the body-facing surface 144 and then continue along the outward-facing surface 142, parallel to either the top or bottom (145, 146) or left or right (148, 149) sides. In some embodiments the housing includes at least one channel (e.g., tunnel) through which the cord is movable wherein the at least one channel is integrated in the housing. For example, the housing can include one or more channels along any part of the periphery of the housing. Alternatively, one or more channels can be present across all or a portion of the outer surface of the housing, across all or a portion of the inner surface of the housing, or through the central portion of the housing. The channel can have entry and exit points for the cord, and therefore can be of a predetermined length, such about 0.5 cm or greater, or 1 cm or greater. The length of a channel can be as great as the entire periphery of the housing, or the length of the upper or lower portions of the housing. The housing can include, or be associated with,

one or more attachment member tensioning feature(s) such as illustrated in FIGS. 13A-15B. The tensioning features can provide a mechanism for adjustment (lengthening or shortening) of the attachment member such as a cord so the user can achieve a desired tension between the housing and the ears or the speaker enclosures of headphones.

[0102] As an example, FIG. 13A shows a view of a housing with outward-facing surface 152, with upper 155, lower 156, left 158, and right 159 sides. Within the housing are two channels (161 and 162, shown as dashed lines) sized to accommodate the attachment member (e.g., cord). Channel 161 can have an entry/exit point 157a on the left side 158 of the housing, near the upper side 155; likewise, channel 162 can have an entry/exit point 157b on the right side 159 of the housing, near the upper side 155. Channels 161 and 162 extend from 157a and 157b towards lower side 156, and towards the middle of the housing, and have an exit points 157c and 157d, respectively. Ends of the cord (167 and 168) are shown extending out of channels 161 and 162 from the bottom side 156. The cord can continue out of channels 161 and 162 (via entry/exit points 157c and 157d) and form loops from the left and right sides of the housing, and along the left and right sides of the head respectively, and then return to points 164 and 165 on the left 158 and right 159 sides of the housing, near the lower side 156, where the cord may be fixed to the housing. The length of the loops may be adjusted by feeding a length of cord through the channels. Further, the cord can be secured using a depressible clamping member 151, which can include openings for each cord, and which can clamp the cord in place using a spring mechanism. FIG. 13B shows a view of a housing from the lower side, with outward-facing surface 152 and body-facing surface 154.

[0103] In some embodiments, the housing includes one movable member(s), such as a member that is rotatable in place, or movable in relation to the housing, which allows the extension and/or retraction of a length of cord from the housing. As an example, FIG. 14a shows a view of a housing with outward-facing surface 172, with upper 175, lower 176, left 178, and right 179 sides. Within the housing is an upper space that allows passage of the cord from an entry/exit point 177a on the left side 178 of the housing, near the upper side 175, to an entry/exit point 177b on the right side 178 of the housing, near the upper side 175. The housing also includes a movable member 171, such as a disc or dial that is rotatably immobilized by a portion of the housing. A portion of the movable member 171 can protrude from the upper side 175 of the housing 172, so that it can be manipulated by a user. Within the housing, the movable member 171 can contact a portion of the cord, for example, the rotatable member can be attached to the cord. Upon rotation of the movable member 171, the cord is pulled further into the housing, causing shortening of its length, and therefore shortening of the length of the loop from the either or both side(s) of the housing. The movable member 171 can also be rotated in the opposite direction so length of the cord is released from the housing, causing lengthening of the loop from the either or both side(s) of the housing. The lower portion of the housing can have a mirror arrangement of features, including entry/exit points 177c and 177d and movable member 173, which function to shorten and lengthen the cord in the same manner. FIG. 14B shows a view of the housing from the upper surface showing movable member 171.

[0104] Alternatively, the movable member 171 can be pushed towards the center of the housing to cause shortening of the attachment member such as a cord. For example, movable member 171 is in contact with attachment member at point 181 within the housing, and movement of the member 171 towards the center of the housing draws length of the cord within the housing to shorten its overall length outside of the housing. Member 171 can be movable within a slot formed in the housing. The lower portion of the housing can have a mirror arrangement of features, including entry/exit points 177c and 177d and movable member 173, which function to shorten and lengthen the cord in the same manner.

[0105] As another example of a tensioning member, FIG. 15A shows a view of a housing with outward-facing surface 192, with upper 195, lower 196, left 198, and right 199 sides. Within the housing is an upper space that allows passage of the cord from an entry/exit point 197a on the left side 198 of the housing to an entry/exit point 197b on the right side 198 of the housing. Also, within the housing is a lower space that allows passage of the cord from an entry/exit point 197c on the left side 198 of the housing to an entry/exit point 197d on the right side 198 of the housing. The housing also includes a rotatable member 191, such as a disc or dial that is rotatably immobilized by a portion of the housing, near the center of the housing. Within the housing, the cords can be attached to the rotatable member 191 and can contact a portion of the cord. Upon rotation of the rotatable member 191, the cord is pulled further into the housing, causing shortening of its length, and therefore shortening of the length of the loop from the either or both side(s) of the housing. The rotatable member 191 can also be rotated in the opposite direction so length of the cord is released from the housing, causing lengthening of the loop from the either or both side(s) of the housing. The lower portion of the housing can have a mirror arrangement of features, including entry/exit points 177c and 177d and rotatable member 173, which function to shorten and lengthen the cord in the same manner. Alternatively, length of the cord can be adjusted using two entry/exit points instead of four. For example, the length of the cord can be adjusted through any two entry points on the left 198, right 199, upper 195, or lower 196 sides.

[0106] In other embodiments, the attachment apparatus includes a tensioning member that is attachable to the speaker enclosure or band of a headphone set. For example, as another example of a tensioning member, FIGS. 19A-19B illustrate a housing 240 which can be positioned on the back of the neck of a user, over the uppermost portion of the spine, and two cord loops (242a-c, 244a-c) and extending from the sides of the housing towards and around attachment discs (245, 247) which include a tensioning mechanism to cause shortening or lengthening of the cord. The tensioning mechanism can include a dial that is attached to a portion of the cord to draw in or release the cord when the dial is turned in a clockwise or counterclockwise direction, respectively. The attachment discs (245, 247) can be attached to the outer surface of the headphone band 249 or speaker enclosures (241, 243) through an adhesive or an attachment mechanism, such as a suction cup. Reference is made to FIG. 18C, illustrating use of an adhesive to attach an attachment disc with tensioning mechanism.

[0107] The housing can also include a port for an electrical connection, or electrical connections (e.g., wire) leading

from the housing, to a charging outlet, headphone, smart-phone, or similar peripheral device. The electrical connection can provide power and/or signal to the internal components. In other arrangements the apparatus can include a Bluetooth receiver, such as located within the housing, to provide signal to the low frequency vibration component. In this arrangement, the housing may also include a power source to drive the vibration component along with the signal. The power source could be provided by a disposable battery that is placed within the housing, or a rechargeable battery could be permanently built into the housing.

[0108] The attachment member can be in the form of a cord that is attached directly or indirectly connected to the housing. The portion of the cord that is attached to the housing is referred to as the proximal portion, and the portion of the cord that is configured for removable attachment to the ears or to speaker enclosures of a speaker set that is placed about the ears is referred to as the distal portion. The distal portion of the cord can be in the form of a loop of a size that fits around the front of the ear; for example, the proximal portion of the loop portion is configured to contact a user between the upper helix of the ear and the skull and then down underneath the ear lobe. In this portion of the loop, the cord includes a material which stiffens the cord, or makes it less flexible and more rigid, and conformable to the shape of this portion of the ear. Therefore, the cord may have a flexibility that differs along its length, being more flexible at the proximal portion near the housing, and less flexible at the distal portion.

[0109] FIGS. 16A and 16B are illustrations of an attachment audio delivery device in accordance with one embodiment of the invention. The apparatus has a housing 200 which is positioned on the back of the neck of a user, over the uppermost portion of the spine, and two cord loops extending from the sides of the housing towards the ears (201, 203) of the user. The right loop has right upper portion 202a, right lower portion 202c, and a right loop distal portion 202b configured to go around the top, front, and bottom of the right ear 203. The left loop correspondingly has left upper portion 204a, left lower portion 204c, and a left loop distal portion 204b (not shown) configured to go around the top, front, and bottom of the left ear 201. The distal portion of the loop around the ear (202b, 204b) can be of the same material and construction portions 202a and 202c, and 204a and 204c, or can be of a different material and/or construction. If of a different material and/or construction, the distal portion of the loop around the ear (202b, 204b) can have one or more of the following properties to facilitate placement around the ear: increased rigidity of the cord, a different texture or material on the outside of the cord, and/or a different shape and/or thickness of the cord.

[0110] Similar to the device shown in FIGS. 16A and 16B, the device of 16C includes housing 360 for the vibration component, with right and left loops (362a-c, 364a-c) configured to go around the ears or speaker enclosures at their distal ends. The device of 16D includes housing 370 for the vibration component, with right and left loops (372a-c, 374a-c) configured to go around the ears or speaker enclosures at their distal ends, and a material, such as a fabric or plastic between the upper and lower portions of the loops (372a and c, and 374a and c).

[0111] FIGS. 17A-17C are illustrations of an attachment audio delivery device in accordance with one embodiment of the invention, attached to a headphone set. The apparatus

has a housing **210** which is positioned on the back of the neck of a user, over the uppermost portion of the spine, and two cord loops (**212a-c**, **214a-c**) and extending from the sides of the housing towards and around rigid speaker enclosures (**211**, **213**) of a headphone set. The rigid speaker enclosures (**211**, **213**) can be between ear padding for the headphones and a headphone band **219**. The right loop has right upper portion **212a**, right lower portion **212c**, which do not contact the speaker enclosure of the headset. The right loop also has portion **212b**, which is configured to contact the speaker enclosure on its upper, forward, and bottom portions. The distal portion of the loops (**212b**, **214b**) around the rigid speaker enclosures can have one or more of the following properties to facilitate its placement around the enclosures: increased rigidity of the cord, a different texture or material on the outside of the cord, and/or a different shape and/or thickness of the cord.

[0112] Similar to the device of FIGS. **17A-17C**, the device of FIG. **17D** includes housing **380** for the vibration component, with right and left loops (**382a-c**, **384a-c**) configured to go around speaker enclosures (**383**, **385**) at their distal ends, and a material, such as a fabric or plastic between the upper and lower portions of the loops (**382a** and **c**, and **384a** and **c**).

[0113] FIGS. **18A-18C** are illustrations of an attachment audio delivery device in accordance with another embodiment of the invention, attached to a headphone set. The apparatus has a housing **210** which is positioned on the back of the neck of a user, over the uppermost portion of the spine, and two cord loops (**222a-c**, **224a-c**) and extending from the sides of the housing towards and around attachment discs (**225**, **227**). The attachment discs (**225**, **227**) are attached to the outer surface of the speaker enclosures (**221**, **223**) through an adhesive or an attachment mechanism, such as a suction cup. For example, with reference to FIG. **18C**, the attachment disc **227** can have a speaker-facing face **235** with an adhesive that can contact the outward-facing face of the speaker enclosure **223**. An adhesive lining can be peeled away to expose the adhesive so a user can apply the disc **227** to a speaker enclosure. The disc **227** can also include a groove **231** around all or part of the circumference of the disc, defined by two ridges (**234**, **232**). The attachment member can be looped around disc **227** and held within the groove **231**.

[0114] In this example embodiment, FIGS. **9A** and **9B** illustrate a wearable audio delivery and monitoring device **90A** (cuff or band **91A**) that is placed around the back of neck **6** of a user **5** and around an uppermost part of a spine **8**, and not over the ears **7**, and contains one or more speakers (e.g., vibration speakers or transduction components), physiological sensors and/or therapeutic delivery components **96a-96e**. In one example embodiment, delivery component **96e** is substituted for a neck monitoring device (not shown) for monitoring physiological aspects of the user. Output information may be transmitted to a user's computer or smartphone so the user can utilize the information to increase performance. In related embodiments, due to the close proximity or contact with the user's skin, the devices taught herein include sensors and the neck monitoring device that detect body temperature, humidity levels, chemical levels emitted by the body and detectable at skin level and other physiological functions that are detectable noninvasively and can be used to assess the health of the user. See

for example U.S. Pat. Nos. 8,040,758 and 11,432,766, which are incorporated herein by reference in their entireties.

[0115] Referring now to FIGS. **9C-9D**, there is shown another wearable device **90B** (rigid or semi-rigid cuff or band that may be foldable like sunglasses) that is configured to be placed on or around the neck **6** of a user **5** having ears **7**, or uppermost portion of the spine **8**, of a human and incorporates a sensory stimulation delivery device. Referring specifically to FIG. **9C**, wearable therapy system **90B** includes a wearable device **91B** that is placed on and around the neck **6** of a human user **5** and incorporates a therapeutic delivery device **93B** such as described in more detail in FIGS. **8** and **9A-9B**. In this example embodiment, device **91B** has a tensile-based, retractable, foldable or similar arm extensions **91B** to hold the unit **93B** securely in place on the back of the neck. The arm extension for extensions) **95B** are foldable similar to sunglasses and securely stored when not in use alone or in a portable case (not shown). In one example embodiment, the portable case includes electrical contacts and a rechargeable power source to recharge device **90B**. Uses for this type of design **91B** include anxiety, balance and stability, training, performance improvement and recovery for sports such as golf, relaxation and focus for travelers and professionals such as doctors. Construction materials for device **91B** could be similar to those listed in Figures above and the delivery of therapeutic energy is similar as those described in the Figures above.

[0116] In one example embodiment, device **91B** was successfully used on nine humans with balance and stability issues, along with reduced kinesthetic strength and elevated blood pressure, were given the therapeutic device to wear around the neck for five minutes. On each human, balance, stability, blood pressure and kinesthetic strength were improved by delivering vibrational and tonal energy in the ranges of 45 through 250. Additionally, two of these patients suffered from shoulder and knee pain. After the therapy was administered, both patients indicated that their level of pain had been reduced dramatically.

[0117] In one example embodiment, system **90B** includes one or a pair of earphones (wireless or wired) **97** that are configured to be paired with either wearable device **90A** or **90B** via a smart device or smartphone (not shown) and the appropriate software for performing the pairing. The smart device then acts as a signal generating device providing signals to wearable device **90A**, **90B** or earphones **97**, either individually or all collectively.

[0118] In yet other embodiments, the disclosure provides an integrated audio delivery apparatus. The term "integrated" refers to arrangements where the housing including the vibration transduction component configured for placement at the back on the neck is non-removably attached to speaker components configured for use in or about the ear, such as headphones and earbuds. In some embodiments, the integrated audio delivery apparatus includes a housing including a vibration speaker or vibration transduction component configured to be placed on the back of the neck and over the spine, right and left ear bud or headphone speaker enclosures for the ear, and right and left attachment members connecting the housing to the right and left ear bud or headphone speaker enclosures.

[0119] In one embodiment of an integrated apparatus is illustrated in FIGS. **1A** and **1B**. FIGS. **1A** and **1B** illustrate a wearable audio delivery and/or monitoring device **10**, such as over-the-ear headphones, that incorporate vibration

speakers or similar transduction members, as well as physiological sensors 16. The device is designed to be placed on the back of the neck and extends to the ears. This wearable device can be connected to an output device by a cable, wire, or wireless methods. Other items such as a control board, audio file, amplifier, equalizer, battery, wireless or similar components 12 can be incorporated into the device, and can include controls 22 for power, volume selection, LED, and charger. The over-the-ear speakers 14a and 14b can be similar to existing commercially available over-the-ear devices, and delivery methods. Arms (13a, 13b) can extend between the speakers (14a, 14b) and a housing 31. The clamp and compression attachment method of FIGS. 1A and 1B can be similar to behind the neck earmuffs that include a tension member capable of rolling up when not in use and providing tension against the head when in use. This allows for the device to be held in place on the back of the neck and does not require an over the top head-band component.

[0120] In related embodiments, the devices illustrated in FIGS. 1C and 1D can also include portions that similar to behind the neck earmuffs that include a tension member. For example, in FIG. 1C the apparatus includes a vibration speaker 326 and arms (323a, 323b) that extend over the ears, but that do not necessarily include in-ear or over-the-ear speakers. In FIG. 1D the apparatus includes a vibration speaker 336 and arms (333a, 333b) that extend over the ears attached to over the ear speakers (334a, 334b).

[0121] In further detail, FIG. 2 illustrates a wearable audio delivery and/or monitoring device 20 with features and functionalities similar to the device of FIG. 1. In this embodiment, the wearable audio delivery and/or monitoring device 20 includes an over the head member 28 to help keep the device in place. The device 20 can also include vibration speakers or similar transduction members, or physiological sensors 26; a control board, audio file, amplifier, equalizer, battery, wireless or similar components 22; controls 22 for power, volume selection, LED, and charger; and over-the-ear speakers 24a and 24b.

[0122] Referring now to FIG. 3, shown is an integrated wearable audio delivery and/or monitoring device 30 that incorporates vibration speakers 36 or similar transduction members, and/or monitoring sensors, into headphones that go around the back of the head and to the ears, is described. The device 30 can include attachment arms (33a, 33b) between the earphones (33a, 33b) and a housing 31 around the vibration speakers 36 or similar transduction members, and/or monitoring sensors. In an example embodiment, the control board 32 and other components can be placed in a separate housing and connected to an audio output device 37, thus decreasing the weight and size of the wearable audio delivery and monitoring device 30.

[0123] Referring to FIG. 4, show is a wearable audio delivery and/or monitoring device 40 that incorporates a system of attaching vibration speakers 46 or similar transduction members, and/or sensors configured for placement on the back of the neck, and also including in or over the ear buds (44a, 44b), which can be connected to the audio output through wired or wireless features. The vibration speakers 46 or similar transduction member may be within a device housing 41, which can be attached directly to the collar, hatband or inside a pouch located in the collar with the use of a clip 49 or similar mechanism.

[0124] FIG. 5 shows a wearable audio delivery and monitoring device or system 50 that incorporates a vibration

speaker 56 or similar transduction members, and/or health monitoring sensors, placed on the back of the neck and associated with the back of a helmet or hat 58, such as by attachment tab 57. Ear buds (54a, 54b), can be connected to the audio output through wired or wireless features, and optionally attached to the side of the helmet or hat 58 with attachment tab 53b (attachment tab 53a not shown). The helmet or hat 58 may be worn during activities requiring a helmet such as skiing, snowboarding, hockey, or other similar activities.

[0125] Referring now to FIG. 7A, a wearable audio delivery and/or monitoring device 70 includes vibration speakers 76 or similar transduction members located on the back of the neck, is described. The device 70 also includes an over the head member 78 to help keep the device in place, in or over-the-ear speakers 74a and 74b, and attachment arms (73a, 73b) between the earphones and a housing 71 around the vibration speaker 76. In an example embodiment, the wearable audio delivery and monitoring device 70 includes a microphone 77 to communicate with others, such as those used in gaming. In an example embodiment, wearable audio delivery and monitoring device 70 is capable of connecting to a gaming system such as Xbox®, PS3®, games on a smartphone or handheld device, or any other similar device. The audio sensory information and vibrational energy generated by signals from the game may be delivered to the user through wearable audio delivery and monitoring device 70. In an alternative embodiment, users using electronic devices to practice flying or driving may wear a wearable audio delivery and monitoring device 70. In still another alternative embodiment, users can communicate with professionals such as doctors to receive and deliver diagnoses and therapies.

[0126] Similar to FIG. 7A, of device 340 of FIG. 7B includes a vibration speaker 346 or similar transduction members located on the back of the neck, headband 348 to help keep the device in place, over-the-ear speakers 344a and 344b, and attachment arms (343a, 343b) between the earphones and a housing 71 around the vibration speaker 76.

[0127] FIGS. 8A-C illustrate a wearable audio delivery and monitoring device 80 that is attached, incorporated into or in conjunction with wearing glasses 89, headsets such as for virtual reality experiences or eye covering. This embodiment holds the speakers (84a, 84b) over or near the ears, and allows for vibration speakers, sensors, or similar transduction member 86 to be attached around the back of the head. The device includes sleeves (83a, 83b) in which distal portion of the eyeglass temples (i.e., temple tips) can be placed. The sleeves can be made of an elastomeric material. The wearable glasses 89 may be glasses without corrective lenses, glasses with corrective lenses, or other lenses known in the art. An additional benefit of this embodiment could be used in conjunction with travel masks or eye covers where the vibratory members can enhance relaxation, relieve anxiety and calmness. FIG. 8C illustrates a device having transduction member 356, input cord 357, and sleeves (353a, 353b), which is not attached to eyeglasses.

[0128] Another embodiment of an integrated apparatus is illustrated in FIGS. 20A-20B. The integrated apparatus has a housing 250 which is configured to be positioned on the back of the neck of a user, over the uppermost portion of the spine, and two cord loops (252a-c, 254a-c) extending from the sides of the housing towards the ears of the user. The right loop has right upper portion 252a, right lower portion

252c, and a right loop distal portion **252b** attached or associated with an ear bud **256**, which is configured to be placed within the user's right ear. A corresponding arrangement is on the left side of the apparatus (left with left upper portion **252a**, left lower portion **252c**, etc.). Within the housing is an upper space that allows passage of the cord from an entry/exit point **257a** on the left side of the housing to an entry/exit point **257b** on the right side of the housing. The lower portion of the housing can have a mirror arrangement of features, including entry/exit points **257c** and **257d**, or the cord can be affixed at these corners. The housing **250** can also include a rotatable member **251**, such as a disc or dial that is rotatably immobilized by a portion of the housing, near the center of the housing, which, upon its rotation, can cause the cord to be pulled into the housing, or released from the housing when turned the other way. The length of the cord can be adjusted using two entry/exit points or four entry/exit points. Similar to the device of FIG. 20A, the device of FIG. 23 includes a housing **390** with vibration speaker or similar transduction members configured to be located on the back of the neck, and two cord loops (**392a-c**, **394a-c**) extending from the sides of the housing towards the ears of the user, and ear buds (**396**, **398**).

[0129] The earbuds as shown in the integrated apparatus of FIGS. 20A-20B can receive signal via wired or wireless components. If a wire is used to provide signal, the wire (not shown in FIGS. 20A-20C) can run along the length of the upper portion (e.g., **252a**) or lower portion (e.g., **252c**) of the loop of cord, towards and into the housing **250**. Using a loop of cord that is flexible and stretchable, the extra length of wire can be bunched and attached to the cord at intervals along the cords length to accommodate for the stretching of the cord when it is pulled towards the ears. If a wireless component (e.g., Bluetooth) is used to provide signal, the receiver can be located as a part of the earbud assembly **256**. The earbud assembly can also include a small battery, which can be disposable or rechargeable. If the battery is rechargeable, the housing **251** can include one or more induction components (**261**, **263**) so the batteries of the ear buds can be charged when not in use. For example, with reference to FIG. 20B, the cord loops (**252a-c**, **254a-c**), can be retracted into the housing **250** and the earbuds (**256**, **258**) can be placed proximal to the induction components (**261**, **263**) to charge the batteries in the earbud assemblies.

[0130] In some embodiments, an earbud member comprises features as illustrated in FIG. 21. Earbud assembly **276** includes a central portion **273** that is positioned over the ear canal and that houses an earbud speaker, and optionally battery and receiver (Bluetooth) components. Upper central portion **275** can have a shape that conforms to a portion of the concha. The earbud assembly **276** also includes a channel portion configured to accommodate a portion of the attachment member, such as a cord. For example, the channel portion can be in the form of a curved tube having a first upper portion **281** that is configured to be placed between the upper helix **288** of the ear and the head, a second upper portion **283**, configured to curve downward toward the tragus of the ear, a middle portion **285** that is connected to the central portion **273** of the earbud member and configured to reside over the tragus of the ear, and a lower portion configured to be adjacent to the earlobe **286**. The earbud assembly also has an upper opening **278** in which the upper portion **272a** of the loop of cord enters/exits, and a lower opening **279** which the upper portion **272c**

of the loop of cord enters/exits. The earbud member **276** can be made from a semi-flexible semi-rigid material, such as poly(ethylene), poly (vinyl chloride) (PVC), and poly(urethane).

[0131] Another embodiment of an integrated apparatus is illustrated in FIGS. 22A-22D. The integrated apparatus has a housing **300** which is configured to be positioned on the back of the neck of a user, over the uppermost portion of the spine. Two cord loops (**302a-c**, **304a-c**) extend from the sides of the housing and attach to rotatable members (**305**, **307**), such as discs or dials, are associated with the outer surface of the headphone band **309**. (Alternatively, the rotatable members (**305**, **307**) are associated with the outer surface of the speaker enclosures (**301**, **303**)). The right loop has right upper portion **302a**, right lower portion **302c**, and a right loop distal portion **302b** affixed to rotatable members **305**. A corresponding arrangement is on the left side of the apparatus (left with left upper portion **302a**, left lower portion **302c**, etc.). Referring to FIGS. 22A and 22B, in use, the user can place the housing **300** on the back of the neck and the speaker enclosures (**301**, **303**) with soft pads (**311**, **313**) about the ears. For example, the housing **300** with two cord loops (**302a-c**, **304a-c**) can be at an angle in the range of about 80° to about 140°, or about 95° to about 125° to the headphone band **309**.

[0132] Referring to FIGS. 22C and 22D, when the vibration transduction component in the housing is not in use the user can rotate the rotatable members (**305**, **307**) so the two cord loops (**302a-c**, **304a-c**) are swung upwards and aligned with the headphone band **309**, and so to place the housing on the outside surface of the headphone band **309**. If needed, the cord loops (**302a-c**, **304a-c**) can be loosened or tightened at the housing to provide a desired tension at the back of the neck in use, and over the top of the headphone band **309** during storage.

[0133] The various embodiments described herein improve upon existing audio and video content delivery headsets such as headphones, virtual reality, augmented reality or other such headsets that are used when playing games, listening to music or watching videos. By including a vibratory content delivery method that is held in place on the spine, the user's mobile audio experience is enhanced. Additionally, by including a place and method to release olfactory stimulation over or near the nose, we help to create a multi-sensory experience to consumers wherever they are. In a related embodiment, it is also taught herein that various forms of content, such as audio, video, vibratory, and olfactory sensory stimulation, can be created and delivered through the described embodiments to teach, improve, entertain and heal an individual. As an example, an included embodiment illustrates where a medical professional could record and deliver multi-sensory content to help a patient with a specific condition. As another example, a parent could use recorded multi-sensory content to help their child with conditions.

[0134] Referring now to FIGS. 26-36, FIG. 26 illustrates a mobile content delivery headset such as a virtual or augmented reality headset that delivers recorded content that can be seen, heard, felt and smelled. The headset receives recorded content and delivers video through a face or eyepiece or viewing display **600**. Auditory content is delivered through various types of speakers or transducers that are attached or integrated into the headset system and worn over, on or near ears **601**, as well as through a tactile

transducer that is placed over a spine **602**. It is envisioned that other auditory delivery methods such as bone conduction could be incorporated into the headset as well. An over-the-head strap **603** that holds the eyepiece **600** in place is shown. Additionally, it is envisioned that olfactory receptacles could be included in the eyepiece or system and when activated, could release smells in conjunction with the content over or near a user's nose.

[0135] Referring now to FIG. 27, and similar to FIG. 26, there is illustrated an example embodiment of a mobile content delivery headset such as a virtual, mixed or augmented reality headset with included visual **600**, auditory **601** and tactile **602** sensory stimulation components.

[0136] FIG. 28 illustrates an example embodiment of an adjustable connection assembly or system **604** for attaching a tactile transducer component **605** to an adjustable audio delivery arm **606** of a mobile content delivery headset. The adjustable audio delivery arm could have similar features as over the head headphones, and could be made from such materials as plastic, rubber or similar stretchable materials. The adjustable connection assembly could be made from adjustable and pliable materials such as elastic or similar. This embodiment allows the transducer to be held in place on the back of the neck and top of the spine. Additionally, it allows the transducer to move freely and deliver tactile vibrations to the user. Also shown are manual controls, such as for volume, for both the transducer component **607** and the speaker on the ears **608**. This manual adjustability of each component allows the user to customize the user's audio experience.

[0137] Referring now to FIG. 29, this figure illustrates a side view of a mobile content delivery system with a different shape. Rather than attaching the audio arm and earpieces **610**, an in-ear earphone set **613** is provided adjacent the user's ears and to the side of the video eyepiece **611**. This description illustrates how the earpieces can attach to the top of the eyepiece that hangs from the forehead and over the eyes. The benefit of this product feature allows the tactile transducer component **612** to be held in place on a user's spine without bending the audio arms.

[0138] FIG. 30 illustrates a mobile content delivery system that is a fully integrated system with video **615**, audio **616** and tactile **617** delivery components. Construction materials are envisioned to be similar to other types of wearable electronics products. The benefit of this system is the lightweight, all-inclusive, comfortable design that molds to the user's head. Additionally, the arms have a conforming bended shape behind the ears **618** to allow the tactile transducer to be held in place on the spine.

[0139] Referring now to FIG. 31, there is illustrated a mobile content delivery system with similar features as FIG. 30. The primary difference between the two is the use of in-ear speakers **620** compared to other designs that show over or even on ear speakers.

[0140] FIG. 32 illustrates a mobile content delivery system that incorporates an over-the-head band **625**, similar to over the head headphones. The benefit over other described embodiments is the ability to shorten the over-the-head eyepiece attachment **626** so it does not go all the way to the back of a user's head. This is especially beneficial for users with longer hair.

[0141] Referring now to FIG. 33, there is illustrated a mobile content delivery headset with an over-the-head attachment system **630** that holds an eyepiece **631** and tactile

component **632** securely in place. Audio delivery arms **633** such as over, on or in-ear speakers are attached to and extend from the eyepiece.

[0142] FIG. 34 illustrates a mobile content delivery headset similar to other embodiments with the improvement being an adjustable feature **635** that allows components such as the tactile transducer **636** to move independently but fit snugly. Additional features include accordion or spring designs, stretchable materials such as elastic, sliding rails, and the like.

[0143] Referring now to FIG. 35, there is illustrated a mobile content delivery headset, similar to FIG. 29, but without the eyepiece. The shape is similar to a headband or hairband and circumferential around the user's head to hold the audio delivery speakers **640** and tactile transducer **641** in place.

[0144] FIG. 36 illustrates a mobile content delivery headset with speakers or similar transduction components placed inside the materials and worn directly over, on or near the user's ears **645**. This feature is beneficial in that it simplifies the construction of the headset.

[0145] Referring now to FIGS. 37-54, the various embodiments described herein describe a wired or wireless headphone or headset system with various attachments and hooking configurations and methods. Construction materials are similar to other headphones or headsets, including plastic, metals, synthetics and softer materials such as mesh and foam. Attachment fixtures are shown herein on the rear and bottom of the headphone ear cup for attachment around the back of the neck, but it is envisioned the attachment mechanisms could be anywhere on the ear cup, such as on the front to attach glasses, virtual reality (VR) or augmented reality (AR) goggles, on the bottom to attach accessories, as well as on the headband for other types of attachments. Additionally, the headphone design described herein shows the attachment methods in one design, such as over the head, but it is envisioned that the methods and teachings could be incorporated into any type of headphone, headset or helmet design. Also, the attachment fixture molds are shown on the inside headphone mold, but it is envisioned that the fixtures could be secured on the outer ear cup or headband mold as well. Additionally, it is envisioned that the various attachment fixtures shown herein could be incorporated into the headphone mold, rather than a separate component, as well as part of an assembly that is wrapped around or affixed to the headphone mold. Also, the descriptions and images detail embodiments that attach to both left and right-side ear cups, but it is envisioned that accessories that attach to only one point of the headphone.

[0146] Now in more detail to FIG. 37 is described a headphone worn on or about the head with an attached component **702** held in place by attachment members **103**. Similar to the other figures, the headphone type shown is over the head **701**, but it is envisioned that other types of headphones could be used. The headphone has ear cups on each ear that comprise ear cushions **704**, inner ear cup molds **705** and outer ear cup molds **706**. The attached or attachable component can be various forms of stimulation such as visual or video, auditory, vibratory, electrical, thermal, olfactory or wind, as well as other types of accessories such as power, decorative, lighting or monitoring. The component can be held in place or worn in numerous places such as the back of the neck, on the head, and on the face.

[0147] The attachment members can be made from rigid, semi rigid, semi flexible or flexible materials. The attachment members connect to each headphone ear cup using various types of methods or fixtures 707. As shown, the attachment member connects to the back of each ear cup through a looping mechanism around a fixture in the headphone ear cup, which will be described below. The attachment members can connect directly to a component, can hold a component in a suspendable pouch-type method, and also hold a component in a particular position via rigid or bar-like methods.

[0148] Now in greater detail to FIG. 38 is described a representative component 721 with attachment members 722. The attachment members can be manufactured from a variety of soft and flexible materials, such as elastic or mesh, to allow the component to be worn comfortably in place, such as around the back of the neck or around the eyes. Additionally, the attachment members can be manufactured from more rigid materials such as plastic or metal, to hold the component securely in place. As an example, rigid mechanisms or arms could be inserted or attached to the front of the headphone and extended in front of the face or eyes of the user such as to attach a virtual or augmented reality eyepiece or projection device to it. The benefit of this approach is to create a modular headphone attachment system where the user can select from a variety of attachment members and attachable components to attach to their headphones. The attachment members can attach to the headphone ear cups on each end 723 by a variety of established methods such as Velcro®, latches, loops, pegs, rods, snaps, magnets, anchors, buckles or the like.

[0149] Now in greater detail to FIG. 39 is described a headphone with an incorporated component attachment system with attachment fixtures 751 in each ear cup mold. Here, the fixtures are shown as part of the inner headphone ear cup 752 but the fixtures or attachment configurations could be in other places on the headphone. The fixtures allow the user to attach various types of accessories, components or stimulation devices to the headphone system. Another benefit of such a design is the fixtures are recessed inside the mold, thus hiding the fixtures when not needed for component attachment. The fixtures are shown on the bottom of each ear cup so as to hold a component in place on the back of the neck, but it is envisioned they could be placed anywhere in or about the ear cup.

[0150] FIGS. 40 through 45 describe in greater detail different embodiments of a representative attachment system using modular fixtures that are a part of, in addition to, or attached to, headphones and headsets. While many types of fixtures are disclosed, it is envisioned other types, such as rod inserts, snaps and magnets, could be incorporated; therefore, the invention should also include these fixture or attachment methods. Construction materials of the attachment fixtures could include metal, plastic or similar hardened material that can support and hold the items attached to it.

[0151] FIG. 40 describes in greater detail one representative method for including an attachment fixture 801 in a headphone inner ear cup mold 802. The fixture shown has a slotted opening 803 to allow for easy attachment or removal of the attachment members, such as a loop of a stretchable band. The fixture can be molded in the ear cup, attached directly to the ear cup, and secured around predetermined molds in the ear cup 804. Construction materials of the

attachment fixture can be strong and lightweight, such as plastic or metal. Screw holes 805 are shown that connect the inner and outer ear cup molds together.

[0152] FIG. 41 describes an attachment fixture 761 by itself that is solid and has no slots. The attachment member can be looped through and passed around the fixture or can be connected via other methods such as Velcro, snaps or rings. The main benefit of this design is the secure attachment to the headphone.

[0153] Now in greater detail to FIG. 42 is described an attachment fixture 853 to accommodate a depressible locking mechanism similar to those found on watchbands and other wearable products, as well as rigid members with depressible locking mechanisms that insert into receptor holes to lock the members into place. The user can depress a locking mechanism 851 on the end of the attachment member 852, to connect or disconnect it from the fixture. It is envisioned the locking mechanism can be on the headphone as well. It is also envisioned the mechanism could have a different shape but a similar functionality, such as a smaller fixture with a deeper mold to hold a rigid attachment rod, such as for virtual reality goggles, in place.

[0154] FIG. 43 describes an attachment fixture with a hinge mechanism 871 and locking feature 872, similar to carabiner connectors that are used in camping. FIG. 44 describes an attachment fixture with a loop 891 that extends farther outside of the headphone ear cup mold than other described fixtures. The benefits of such a design are to allow for easier attachment to the headphone, as well as for larger or irregular shaped attachment members. In greater detail to FIG. 45 describes an attachment fixture with a removable screw or pin 901, similar to watchband or camping attachments, which can screw into the other side of the fixture 902 to secure the attachment member to the fixture.

[0155] FIG. 46 describes how a slot or attachment fixture 1001 can be molded into or placed onto the headphone ear cup 1002 to allow various attachment members to connect to or pass through it. The benefit of this method is to eliminate the need for an additional or extra fixture piece like detailed above. Now in more detail to FIG. 47A is a section view of FIG. 46 showing how the slot or attachment fixture 1101 can be cut or molded where the attachment member can connect through the outer ear cup mold 1102. Section view of an inner ear cup mold 1103 and ear cushion 1104 are also shown, and it is envisioned that the attachment fixture mechanism can be included in these as well. Various forms of electronics and speaker components can reside in these ear cup molds. FIG. 47B shows in greater detail the section view of FIG. 46 where the slot or attachment fixture 1110 is cut or molded into the ear cup where the attachment member passes through an inner channel. This inner channel is shown in the outer ear cup mold 1111 but could be in the inner mold 1112.

[0156] FIG. 48 describes in greater detail a different but similar method to connect an attachment member 1200 to a headphone or headphone ear cup 1201. Female holes, snaps, magnets or slots 1202 are molded or placed into the headphone ear cup and the opposite or male counterpart or post 1203 is placed on the end of the attachment member. The female slots are shown in one position on the headphone, but it is envisioned the slots could be placed anywhere on the headphone assembly. FIG. 49 describes in greater detail how the male post 1300 described in FIG. 12 is slid into, snapped, magnetized and connected to the female hole on the head-

phone, shown on the outer ear cup **1301** to secure the attachment member in place, but could be on the inner mold **1302** as well.

[0157] FIG. **50** describes a similar headphone attachment method to FIGS. **48** and **49**. Here, the male posts **1400** are molded into the headphone ear cup mold and the female counterpart or slot **1401** is placed in the component attachment member **1402**. FIG. **51** describes in greater detail how the female slot on the attachment member is secured to the male post **1500** on the headphone ear cup. The male posts are shown on the outside of the outer ear cup **1501** but it is envisioned they could be on the inner portion of the outer ear cup or in the inner cup **1502**.

[0158] Now in greater detail to FIG. **52**, a headphone attachment method similar to FIG. **4** is shown. In this embodiment, rather than placing the fixture **1600** around the ear cup mold to secure in place, the fixture, here shown with a slot **1603** but could be shaped like other methods described herein, is larger and is attached directly to the ear cup via a screw **1601** or similar attachment method. Similar to other Figures, it is envisioned that the fixtures could be included in the outer or inner headphone ear cup, or in the headphone headband **1602**.

[0159] Now in greater detail to FIG. **53** is shown a representative view of a modular headphone attachment system with various components and attachment members connecting to headphones in various receptacle positions on and around the headphone ear cups through the fixtures described herein **1700**. Neck-based components **1701** can be worn around the back of the head and neck with attachment members **1702**. Such components could include but are not limited to stimulation or monitoring devices, and power or lighting accessories. As an example use, a mobile user can attach a device, with methods described similar to above, that contains and releases olfactory smells that correlate to content being played through their headphone, similar to rides at amusement parks such as “Soaring over California” at Disney®.

[0160] Face or forehead-worn components **1703** can be worn on or about the eyes, around the forehead or in front of the face with flexible or rigid attachment members **1704**. Such components could include but are not limited to virtual or augmented reality glasses or video projection devices, lighting accessories, cameras, fans, eye covers, forehead monitoring or stimulation devices. One example use is a user wanting to join a virtual cycling training class can insert a video projection or augmented reality device into the front of our headphones to play content that displays in front of them similar to Peloton® but without the fixed screen. The benefit is that through augmented lenses, content can be projected in front of the user that mimics virtual riders passing in front of near them while riding. A rider can listen to an instructor through the headphone ear speakers and hear the cars going past them. Additionally, with a tactile unit on the neck, users can feel the virtual content in real time of going over bumps in the road or getting bumped by other riders.

[0161] While not shown here, it is also envisioned to provide a headphone system with channels in each ear cup facing to the front of the user's face that facilitate easy placement of reading glasses. The main benefit of this embodiment of the invention is to relieve the pressure that existing over or on ear headphone styles put on users who wear glasses with arms that rest between the top of the ear

and the head. By placing a channel in the headphone or headphone ear cup so the user can insert the arms of their glasses inside them, the user can eliminate the squeeze and uncomfortable feeling caused by the pressure of traditional headphone ear cups on the arms around the ears.

[0162] Other components **1705** can connect to the bottom of the ear cups with various types of attachment members **1706**. Such components could include but are not limited to decorative or lighting accessories, camera devices or power accessories. As an example, in surgery, a doctor in training could wear the headphones to receive audio instruction from another surgeon, attach a video recording accessory on one ear and a lighting accessory on the other to display the surgical procedure to the observing physician. The benefit is through a single head-worn system, content can be seen, recorded, shared and commented on with many participants at one time.

[0163] FIG. **54** describes a modular headphone attachment system with a component **1800** that is attached to headphones and connected to other external devices **1801** via wires or cables **1802**, or wirelessly and remotely. While we describe an external device connecting to a component wrapped on the neck, it is envisioned the device could connect or interact with components attached to other areas of the headphone. These external devices could include but are not limited to power sources, computers, diagnostic machines, fitness or wellness equipment, rehabilitation equipment, training equipment, or other types of control units such as mobile devices.

[0164] One representative embodiment of a treatment application is a patient, such as a child, undergoing a surgical procedure and instead of using a sedative to relax them, placing a modular headphone system that is connected to an outside source of content. The patient can select the type of content they wish to use as a distraction, and the types of stimulative accessories, such as vibration, video, olfactory or thermal, to connect to the audio receptor in the headphones to help them relax. The benefit being is that the patient does not need to be administered drugs before, during or after the procedure.

[0165] Another example use of this embodiment is a remote medical provider can assess, diagnose and deliver various forms of wearable therapy to the user who is wearing the headphone with an attached diagnostic and therapeutic delivery component. This way, the patients can be in their homes or other location and can receive non-invasive therapies from doctors in remote locations. Another example of this embodiment is the user can receive instructional content from an outside source, which is delivered through the headphone system with an attached vibratory component on the neck and a virtual reality headset on the eyes, which simultaneously sends a wireless vibratory signal to a hand-held golf or baseball swing trainer. The result is a multi-modal training system that activates the brain and body in multiple ways at the same time.

[0166] Referring now to FIGS. **55-58**, in a related embodiment, there is provided in-ear style transducers in which there is placed a vibration transducer, vibration speaker or similar transduction output method inside the housing of in-earphones or hearing aids that are worn in each ear canal, so when music, audio and other forms of digital content is played through them, they deliver low frequency tactile vibration output, in addition to audio output, to the user. Sound consists of vibration that can be heard and felt by the

body. Current earphones and hearing aids have very small speakers that can only play music and sound that can be heard. However, if you strike a tuning fork and hold the fork end next to your ear, you can hear the audio vibration, and if you gently place the straight end into your ear canal, you can feel the tactile vibration. By adding vibration transducers, vibration speakers or similar transduction output devices into each earphone or hearing aid housing and placing the housing into the ears, the user will also be able to feel the tactile vibrations in the sound output. There are several advantages for the user: experience music like they are at a live event; they can experience movies like they are at a theater; they can feel like they are sitting in a vibration gaming chair wherever they are; if they have hearing loss in low frequencies, they can feel and hear the sound output as most hearing aids only deliver frequencies down to 125 Hz; they can use with vibration-based content as a bimodal (hear, feel) restorative wearable that activates the brain to help relax, improve balance and reduce pain; they can have balance activated through vibrational content that's delivered when the accelerometer in the earphones detects a fall; they can have relaxing vibrational content delivered when the heart rate sensor detects stress; they can work with other software, such as live entertainment events, to deliver the feeling of bass; they can stimulate both the auditory and peripheral sensory systems at the same time to reduce pain and relieve anxiety; as well as many other uses.

[0167] Specifically, FIG. 55 illustrates a side view of the left ear 2012 with an earphone device 2010 inserted inside the ear or ear canal 2013. The shape of the device 2010 is for illustrative purposes only and can resemble any shape of currently available earphones or hearing aids. In this example embodiment, an outer shell 2011 of earphone device 2010 includes control buttons or lights on the surface and includes electronics integrated inside. There could also include various methods to hold the earphone in place inside the ear 2013. The device 2010 could be connected via wires 2014 or alternatively via wireless connections (Bluetooth or RF).

[0168] FIG. 56 illustrates a representative cut away view of earphone device 2020 located inside a user's ear/ear canal 2022. The vibration speaker, transducer or similar vibratory output method or device 2021 is attached directly to the outer shell or housing 2023 so that when sound is played and the transducer is activated, the outer shell 2023 transmits the vibration to the user so he/she can feel the vibrations inside the ear canal 2022. It is envisioned that the earphone device 2020 would have an outer layer 2029 made from a softer and more pliable material (such as silicone) to securely and comfortably hold it in place. Other components are included (not shown in detailed but housed by housing 2023) such as control board electronics 2028, battery 2027 and additional speakers 2026, in addition to heart rate assessments, accelerometers, and other diagnostic components, could also be included. In this example embodiment, earphone device 2020 is held in place with structures or elongate members extending from a base 2024 (or could be an over the ear attachment member) and can be connected to or driven by wires or cables 2025.

[0169] FIG. 57 illustrates a cut away view of a different earphone device 2030 embodiment where the vibration transducer 2031 is placed in an outer portion 2030A of device 2030 to allow for more room for transducer 2031. The transducer can still be secured directly to the outer

housing 2032 through attachment to an internal section of the housing 2033. The other electronics and components (not shown in detailed), such as battery and speaker components 2034 can be placed in the end of the earphone device 2030, which is placed inside the ear canal 2035 of the ear 2036. It is also envisioned that the earphones can remotely or wirelessly communicate via RF or Bluetooth waves 2037 with other devices or software.

[0170] Referring again briefly to FIGS. 6 and 9A-9D, this is provided a related embodiment, a wearable sensory stimulation apparatus including a cuff or band member 90A or 90B configured to be positioned at least partially circumferential on or around a user's neck 6 and a housing member or module 66A or 94B comprising at least one vibration speaker or vibration transduction component 66 or 96c electrically coupled to a power source located therein. Housing module 66A or 94B is configured to be supported by the cuff or band member 90A or 90B and configured to be positioned on a back of the user's neck 6, and wherein the at least one vibration speaker or vibration transduction component within the housing member 66A includes an RF module (not shown) operatively coupled to the transduction component and is configured to receive a wired or wireless signal from a signal generating output device, such as a smart device. The wired or wireless signal from the signal generating device provides the vibration speaker or vibration transduction component digital media that becomes sensory vibrational stimulation. In an example embodiment, the band member includes a flexible and stretchable non-rigid material adapted to prevent low frequency vibrational bleed through from the at least one vibration speaker or vibration transduction component to the user's ears. Also housing can be formed from a material selected from the group consisting of a plastic, metal and a plastic-metal composite. In a related embodiment there is included a set of wired or wireless in-ear or over-ear audio delivery devices operatively coupled to the RF module and to at least one vibration speaker or vibration transduction component supported by the cuff or band member. The wearable apparatus can include at least one of an augmented reality (AR) accessory, a virtual reality (VR) accessory and a mixed reality (MR) accessory attachable to the cuff or band member. Further, the housing member and the transduction component are configured to receive audio vibrational sensory content and digital data and deliver same to the user. In another example embodiment, the apparatus in a system includes a portable case for the cuff or band member and the housing member, the portable case configured to include electrical contacts for charging a battery within the housing member. In a related embodiment, each of the AR, VR and MR accessories are configured to provide at least video or visual images to the user. In another embodiment, the housing member further includes a neck monitoring module electrically coupled to the power source and adapted to be operatively coupled to the spine of the user, the neck monitoring module configured to transdermally sense or detect and transmit physiological data of the user to an external device. In a related example embodiment, the virtual reality accessory is selected from a group consisting of VR goggles, VR helmet, VR headset, display screen or TV, VR olfactory device and a lens or lenses a VR headset. In another embodiment, the augmented reality accessory is selected from a group consisting of AR wearable glasses or goggles, an AR eye piece, an AR video projection device, an AR lens or lenses, a helmet and an AR

olfactory device. In yet another embodiment and as part of a system a portable case is included for encasing the cuff or band member and the housing member, the portable case configured to include electrical contacts for charging the power source within the housing member and for charging the set of earphones.

[0171] Referring to FIGS. 9A-9D, this is provided another example embodiment of a system for providing a user or audiophile stimuli to multiple parts of a user's body including a wearable housing member (such as 66A or 96C) including at least one of a vibration speaker and transduction component electrically coupled to a power source (not shown) located therein, wherein there is further included an RF module (not shown) operatively coupled to the transduction component. Also included is a wearable audio listening device selected from the group consisting of a set of earphones, headphones, a helmet and a headset as well as a signal generation output device configured to wirelessly pair with the housing member and with the wearable listening device thereby providing stimuli to the user simultaneously from both the transduction component and the wearable audio listening device. The wireless signals from the signal generating output device (or smart device) provide the vibration speaker or vibration transduction component digital media that becomes sensory vibrational stimulation and provide audio digital media simultaneously to the user. In a related embodiment, the wireless signals include components for each of the audio listening device and vibration speaker and transduction component.

[0172] Referring again to FIGS. 9A-9D, there is provided yet another example embodiment of a wearable sensory stimulation neck apparatus including a housing member having at least one vibration speaker or vibration transduction component electrically coupled to a power source located therein and wherein there is included an RF module operatively coupled to the transduction component, the housing member 66A or 94B configured to be positioned on a back of a user's neck and over an uppermost portion of a spine 8 of the user 5, and wherein an outer portion of the housing member includes an attachment member (not shown) configured to attach or adhere the housing member to the user's neck 6. The at least one vibration speaker or vibration transduction component within the housing member configured to receive a wired or wireless signal from a signal generating output device via the RF module, and wherein the wired or wireless signal from the signal generating output device provides the vibration speaker or vibration transduction component digital media that becomes sensory vibrational stimulation. In a related embodiment, at least one of an augmented reality (AR) accessory, a virtual reality (VR) accessory and a mixed reality (MR) accessory operatively coupled to the housing member or module. In one embodiment, the housing member and the transduction component are configured to receive vibrational sensory content and digital data and deliver same to the user. In another embodiment, each of the AR, VR and MR accessories are configured to provide at least video or visual images to the user. Also the at least one vibration speaker or vibration transduction component within the housing are each configured to receive a wired or wireless signal from a multiple signal source output device via the RF module, wherein the signal from the multiple source output device provides the wired or wireless in-ear or over-ear audio delivery devices with audio sensory stimulation and pro-

vides the vibration speaker or vibration transduction component digital media that becomes tactile vibrational stimulation upon the AR accessory being activated. In a related embodiment, the wired or wireless in-ear or over-ear audio devices and the at least one vibration speaker or vibration transduction component within the housing are each adapted to receive a wired or wireless signal from a multiple signal source output device via the RF module, with the signal from the multiple source output device providing the ear audio devices with audio sensory stimulation and providing the vibration speaker or vibration transduction component digital media that becomes tactile vibrational stimulation upon the VR accessory being activated. In yet another related embodiment the housing member further comprises a neck monitoring module adapted to be operatively coupled to the spine of the user, the neck monitoring module configured to transdermally sense or detect and transmit physiological data via the RF module to an external device.

[0173] Referring again briefly to FIGS. 5 and 53, in yet another example embodiment there is provided a system 50 for delivering tactile vibrational energy to an uppermost portion of a user's spine 8 and neck 6 a head cover member 58 configured to be positioned at least partially circumferential on or around a user's head and disposed adjacent the user's neck. The system includes at least one vibration speaker or vibration transduction component 56 operatively coupled to a power source (not shown) and an RF module (not shown), wherein the transduction component is located in or about the head cover member 50, wherein a received wired or wireless signal from a signal generating device provides via the RF module the vibration speaker or vibration transduction component digital media that becomes sensory vibrational stimulation to the user's head and neck. In a related embodiment, the head cover is selected from the group consisting of a helmet, a construction hardhat, a baseball cap, an inflatable head cover or wrap, a knit or cloth hat, and a wearable head frame. In a related embodiment, at least one of a physiological sensor or a neck monitoring module is supported by the head cover member and operatively coupled to the RF module, wherein the sensor or monitoring module is operatively coupled to the user's neck and spine to detect physiological data, the physiological data being transmittable to an external device. In a related embodiment, at least one of an augmented reality (AR) accessory, a virtual reality (VR) accessory and a mixed reality (MR) accessory attachable to the head cover member and the head cover member and the transduction component are configured to receive vibrational sensory content and digital data via the RF module and deliver same to the user. In one example, each of the AR, VR and MR accessories are configured to provide at least one of a video image, visual images or audio to the user and the at least one vibration speaker or vibration transduction component within the housing are each configured to receive via the RF module a wired or wireless signal from a multiple signal source output device, wherein the signal from the multiple source output device provides a wired or wireless in-ear or over-ear audio delivery devices with audio sensory stimulation and provides the vibration speaker or vibration transduction component digital media that becomes tactile vibrational stimulation upon the AR accessory being activated.

In a related embodiment, a wired or wireless in-ear or over-ear audio devices and the at least one vibration speaker or vibration transduction component within the housing are

each adapted to receive via the RF module a wired or wireless signal from a multiple signal source output device, with the signal from the multiple source output device providing ear audio devices with audio sensory stimulation and providing the vibration speaker or vibration transduction component digital media that becomes tactile vibrational stimulation upon the VR accessory being activated. In yet another related embodiment, the housing member is configured to encase the vibration or transduction component, the RF module and the power source, the housing member adapted to be operatively coupled to the head cover member and adapted to be positioned on a back of the user's neck. In one example, the head cover member comprises a flexible and stretchable non-rigid material adapted to prevent low frequency vibrational bleed through from the at least one vibration speaker or vibration transduction component to the user's ears. In a related embodiment, there is included a set of wired or wireless in-ear or over-ear audio delivery devices operatively coupled to the at least one vibration speaker or vibration transduction component supported by the head cover member. The system also includes portable case for at least the head cover member and configured to include electrical contacts for charging at least the power source. In another example, the housing member is configured to be attachable to the head cover member with an attachment device, the attachment device selected from the group consisting of a clip or clasp, a hook and loop assembly, a snap button and a magnetic clasp. In another example, the head cover member is operable with a hearing aid accessory.

[0174] The following patents and publications are incorporated herein by reference in their entireties: U.S. Publication Nos. 2012/0253236 A1; US 2015/0038886; and US 2017/0135896; U.S. Pat. Nos. 8,040,758; 10,182,964; 10,695,263; 10,042,595 to Behzadi; U.S. Pat. Nos. 11,083,383; 11,432,766 and International Publication No. WO 2013/122870 A1.

[0175] The foregoing specific embodiments of the present invention as set forth in the specification herein are for illustrative purposes only. Various deviations and modifications may be made within the spirit and scope of the invention without departing from the main theme thereof.

What is claimed is:

1. A wearable sensory stimulation apparatus comprising:
 - a cuff or band member adapted to be positioned at least partially circumferential on or around a user's neck; and
 - a housing member or module comprising at least one vibration speaker or vibration transduction component electrically coupled to a power source located therein, the housing module adapted to be supported by the cuff or band member and adapted to be positioned on a back of the user's neck, and
 wherein the at least one vibration speaker or vibration transduction component within the housing member includes an RF module operatively coupled to the transduction component and is adapted to receive a wired or wireless signal from a signal generating output device,
 - wherein the wired or wireless signal from the signal generating device provides the vibration speaker or vibration transduction component digital media that becomes sensory vibrational stimulation.
2. The apparatus of claim 1 wherein the band member includes a flexible and stretchable non-rigid material

adapted to prevent low frequency vibrational bleed through from the at least one vibration speaker or vibration transduction component to the user's ears.

3. The apparatus of claim 1 wherein the housing is formed from a material selected from the group consisting of a plastic, metal and a plastic-metal composite.

4. The apparatus of claim 1 further comprising a set of wired or wireless in-ear or over-ear audio delivery devices operatively coupled to the RF module and to at least one vibration speaker or vibration transduction component supported by the cuff or band member.

5. The apparatus of claim 1 further comprising at least one of an augmented reality (AR) accessory, a virtual reality (VR) accessory and a mixed reality (MR) accessory attachable to the cuff or band member.

6. The apparatus of claim 1 wherein the housing member and the transduction component are adapted to receive audio vibrational sensory content and digital data and deliver same to the user.

7. The apparatus of claim 1 further comprising a portable case for the cuff or band member and the housing member, the portable case adapted to include electrical contacts for charging a battery within the housing member.

8. The apparatus of claim 5 wherein each of the AR, VR and MR accessories are adapted to provide at least video or visual images to the user.

9. The apparatus of claim 1, wherein the housing member further comprises a neck monitoring module electrically coupled to the power source and adapted to be operatively coupled to the spine of the user, the neck monitoring module adapted to transdermally sense or detect and transmit physiological data of the user to an external device.

10. The apparatus of claim 9 wherein the virtual reality accessory is selected from a group consisting of VR goggles, VR helmet, VR headset, display screen or TV, VR olfactory device and a lens or lenses a VR headset.

11. The apparatus of claim 9 wherein the augmented reality accessory is selected from a group consisting of AR wearable glasses or goggles, an AR eye piece, an AR video projection device, an AR lens or lenses, a helmet and an AR olfactory device.

12. The apparatus of claim 4 as part of a system further comprising a portable case for encasing the cuff or band member and the housing member, the portable case adapted to include electrical contacts for charging the power source within the housing member and for charging the set of earphones.

13. A system for providing a user or audiophile stimuli to multiple parts of a user's body comprising:

- a wearable housing member including at least one of a vibration speaker and transduction component electrically coupled to a power source located therein, wherein there is further included an RF module operatively coupled to the transduction component;
- a wearable audio listening device selected from the group consisting of a set of earphones, headphones, a helmet and a headset; and
- a signal generation output device adapted to wirelessly pair with the housing member and with the wearable listening device thereby providing stimuli to the user simultaneously from both the transduction component and the wearable audio listening device, wherein wireless signals from the signal generating output device provide the vibration speaker or vibration transduction

component digital media that becomes sensory vibrational stimulation and provide audio digital media simultaneously to the user.

14. The system of claim **13** wherein the wireless signals include components for each of the audio listening device and vibration speaker and transduction component.

15. A wearable sensory stimulation neck apparatus comprising:

- a housing member comprising at least one vibration speaker or vibration transduction component electrically coupled to a power source located therein and wherein there is included an RF module operatively coupled to the transduction component, the housing member adapted to be positioned on a back of a user's neck and over an uppermost portion of a spine of the user, and

wherein an outer portion of the housing member includes an attachment member adapted to attach or adhere the housing member to the user's neck, wherein at least one vibration speaker or vibration transduction component within the housing member is adapted to receive a wired or wireless signal from a signal generating output device via the RF module, and wherein the wired or wireless signal from the signal generating output device provides the vibration speaker or vibration transduction component digital media that becomes sensory vibrational stimulation.

16. The apparatus of claim **15** further comprising at least one of an augmented reality (AR) accessory, a virtual reality (VR) accessory and a mixed reality (MR) accessory operatively coupled to the housing member or module.

17. The apparatus of claim **15** wherein the housing member and the transduction component are adapted to receive vibrational sensory content and digital data and deliver same to the user.

18. The apparatus of claim **16** wherein each of the AR, VR and MR accessories are adapted to provide at least video or visual images to the user.

19. The apparatus of claim **16** wherein the at least one vibration speaker or vibration transduction component within the housing are each adapted to receive a wired or wireless signal from a multiple signal source output device via the RF module, wherein the signal from the multiple source output device provides the wired or wireless in-ear or over-ear audio delivery devices with audio sensory stimulation and provides the vibration speaker or vibration transduction component digital media that becomes tactile vibrational stimulation upon the AR accessory being activated.

20. The apparatus of claim **16** wherein the wired or wireless in-ear or over-ear audio devices and the at least one vibration speaker or vibration transduction component within the housing are each adapted to receive a wired or wireless signal from a multiple signal source output device via the RF module, with the signal from the multiple source output device providing the ear audio devices with audio sensory stimulation and providing the vibration speaker or vibration transduction component digital media that becomes tactile vibrational stimulation upon the VR accessory being activated.

21. The apparatus of claim **15**, wherein the housing member further comprises a neck monitoring module adapted to be operatively coupled to the spine of the user, the

neck monitoring module adapted to transdermally sense or detect and transmit physiological data via the RF module to an external device.

22. A system for delivering tactile vibrational energy to an uppermost portion of a user's spine and neck comprising:

- a head cover member adapted to be positioned at least partially circumferential on or around a user's head and disposed adjacent the user's neck; and

at least one vibration speaker or vibration transduction component operatively coupled to a power source and an RF module, wherein the transduction component is located in or about the head cover member,

wherein a received wired or wireless signal from a signal generating device provides via the RF module the vibration speaker or vibration transduction component digital media that becomes sensory vibrational stimulation to the user's head and neck.

23. The system of claim **22** wherein the head cover is selected from the group consisting of a helmet, a construction hardhat, a baseball cap, an inflatable head cover or wrap, a knit or cloth hat, and a wearable head frame.

24. The system of claim **22** further including at least one of a physiological sensor or a neck monitoring module supported by the head cover member and operatively coupled to the RF module, wherein the sensor or monitoring module is operatively coupled to the user's neck and spine to detect physiological data, the physiological data being transmittable to an external device.

25. The system of claim **22** wherein at least one of an augmented reality (AR) accessory, a virtual reality (VR) accessory and a mixed reality (MR) accessory attachable to the head cover member.

26. The system of claim **22** wherein the head cover member and the transduction component are adapted to receive vibrational sensory content and digital data via the RF module and deliver same to the user.

27. The system of **25** wherein each of the AR, VR and MR accessories are adapted to provide at least one of a video image, visual images or audio to the user.

28. The system of claim **25** wherein the at least one vibration speaker or vibration transduction component within the housing are each adapted to receive via the RF module a wired or wireless signal from a multiple signal source output device, wherein the signal from the multiple source output device provides a wired or wireless in-ear or over-ear audio delivery devices with audio sensory stimulation and provides the vibration speaker or vibration transduction component digital media that becomes tactile vibrational stimulation upon the AR accessory being activated.

29. The system of claim **25** wherein a wired or wireless in-ear or over-ear audio devices and the at least one vibration speaker or vibration transduction component within the housing are each adapted to receive via the RF module a wired or wireless signal from a multiple signal source output device, with the signal from the multiple source output device providing ear audio devices with audio sensory stimulation and providing the vibration speaker or vibration transduction component digital media that becomes tactile vibrational stimulation upon the VR accessory being activated.

30. The system of claim **22** further including a housing member configured to encase the vibration or transduction component, the RF module and the power source, the

housing member adapted to be operatively coupled to the head cover member and adapted to be positioned on a back of the user's neck.

31. The system of claim **22** wherein the head cover member comprises a flexible and stretchable non-rigid material adapted to prevent low frequency vibrational bleed through from the at least one vibration speaker or vibration transduction component to the user's ears.

32. The system of claim **22** further comprising a set of wired or wireless in-ear or over-ear audio delivery devices operatively coupled to the at least one vibration speaker or vibration transduction component supported by the head cover member.

33. The system of claim **22** further comprising a portable case for at least the head cover member and adapted to include electrical contacts for charging at least the power source.

34. The system of claim **30** wherein the housing member is adapted to be attachable to the head cover member with an attachment device, the attachment device selected from the group consisting of a clip or clasp, a hook and loop assembly, a snap button and a magnetic clasp.

35. The system of claim **22** wherein the head cover member is operable with a hearing aid accessory.

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