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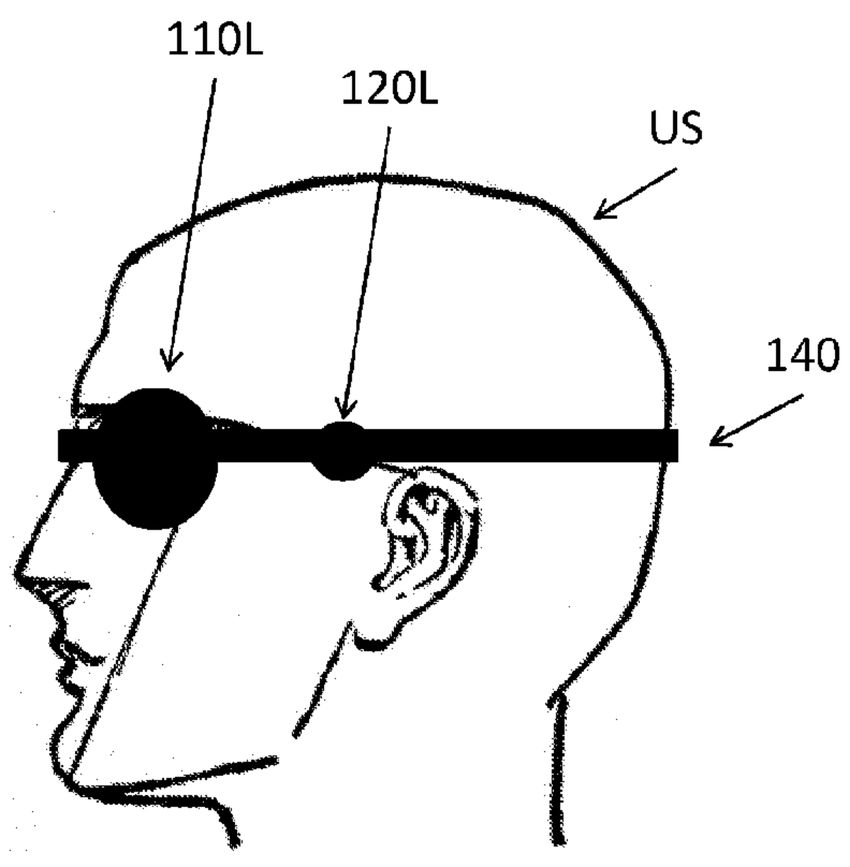

FIG. 3B

(57) Abrégé/Abstract:
Visual and auditory stimuli are provided to a patient to treat various neurological disorders or conditions. The visual and auditory stimuli are provided by a wearable headset or sleep mask that may be comfortably worn by a user, such as in bed to induce sleep. The wearable headset or sleep mask is operated by a personal computing device of the user, such as smartphone, having downloaded and active thereon a control application or app for the therapy. The wearable headset or sleep mask also concurrently provides tactile stimuli, and the tactile stimulus is provided from bone conduction transducers that concurrently provides the auditory stimuli.

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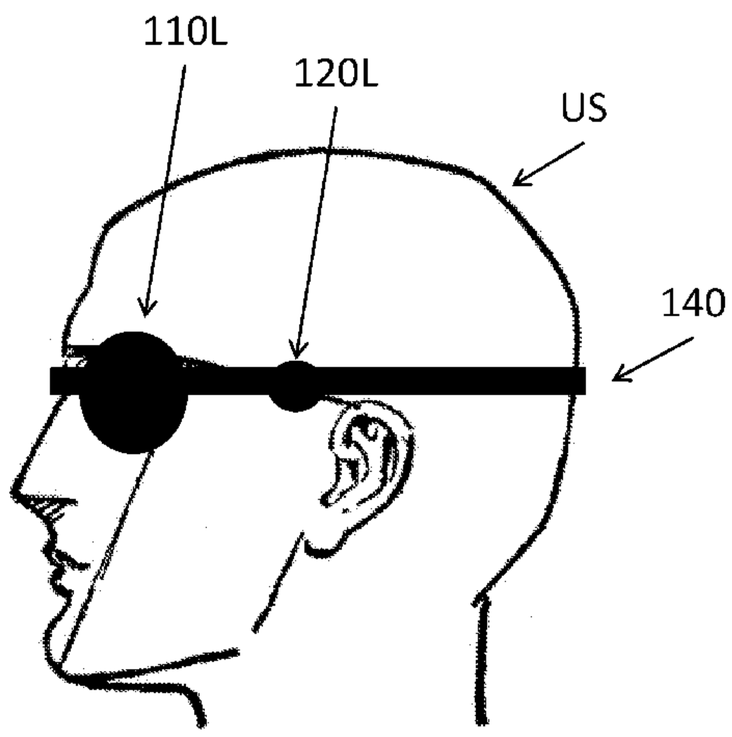

FIG. 3B

(57) **Abstract**: Visual and auditory stimuli are provided to a patient to treat various neurological disorders or conditions. The visual and auditory stimuli are provided by a wearable headset or sleep mask that may be comfortably worn by a user, such as in bed to induce sleep. The wearable headset or sleep mask is operated by a personal computing device of the user, such as smartphone, having downloaded and active thereon a control application or app for the therapy. The wearable headset or sleep mask also concurrently provides tactile stimuli, and the tactile stimulus is provided from bone conduction transducers that concurrently provides the auditory stimuli.

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METHODS AND SYSTEMS FOR PROVIDING STIMULI TO THE BRAIN

TECHNICAL FIELD

[0001] The present disclosure relates to medical devices and methods. In particular, the present disclosure relates to providing stimuli to a subject to treat various neurological disorders or conditions and/or to provide performance enhancement.

BACKGROUND ART

[0002] Sensory stimulation has been applied to treat various disorders. For example, binaural beats have applied to induce various mental states to encourage sleep, relaxation, meditation, creativity, and other desirable mental states. Combinations of auditory and visual stimuli have been applied to encourage such mental states as well. The application of such therapy, however, has been less than ideal in many circumstances. Equipment to provide the stimulus can be bulky, expensive, generally inaccessible, and below the critical efficacy threshold for widespread use, typically only helping subsets of the population. Users may find the use of such equipment difficult in many circumstances, such as when trying to sleep in a bedroom or an airplane cabin.

[0003] To treat various neurological disorders and conditions, pharmaceuticals and/or supplements are often used instead of sensory stimulation. The use of pharmaceuticals, however, can be less than ideal in many circumstances. Often, pharmaceuticals are expensive, rely on patient-compliance, and may require a prescription from a medical professional. Pharmaceuticals may be effective in only a small, less than ideal portion of the general population. To treat insomnia, for example, pharmaceuticals and supplements such as melatonin and Zolpidem (e.g., Ambien™) have questionable efficacy. Pharmaceuticals often lead to undesirable side effects. For example, some pharmaceutical for treating insomnia can lead to deprivation in certain ranges of deep sleep and increases in mortality rates.

[0004] For at least these reasons, improved methods and systems to treat neurological disorders and other conditions that overcome at least some of the aforementioned challenges are desired.

DISCLOSURE OF INVENTION

[0005] The present disclosure relates to medical devices and methods which may be used, for example, to provide stimulus to a subject to treat various neurological disorders or conditions, where the stimulus provided may include one or more of an auditory, a visual, or a tactile stimulus. Examples of neurological disorders which may be treated with devices and methods may include, but are not limited to, insomnia, post-traumatic stress disorder (PTSD), brain

injuries including, but not limited to traumatic brain injury (TBI), mild traumatic brain injury (mTBI), or injury from oxygen deprivation of the brain from strokes, depression, anxiety, mood disorders, personality disorders, eating disorders, psychotic disorders, and balance disorders, to name a few. Alternatively or in combination, the stimulus provided by the medical devices and methods described herein may provide cognitive benefits and/or enhancement, including, but not limited to, improving neuroplasticity, motor skills, coordination, reaction times, alertness, energy, working memory, mood, and feelings of wellbeing.

[0006] In certain embodiments, stimuli may be provided to the wearer of a headset or sleep mask that may be comfortably worn by a user, such as in bed to induce sleep. The wearable headset or sleep mask may be operated by a personal computing device of the user, such as smartphone, having downloaded and active thereon a control application or "app" for the therapy. The wearable headset or sleep mask may also concurrently provide tactile stimuli, and the tactile stimuli may be provided from bone conduction transducer that may concurrently provide the auditory stimuli. Various patterns of the stimuli to induce different user responses are also disclosed.

[0007] In certain embodiments, a device is provided that produces an output that may be perceived by a user of the device as a visual, auditory or tactile stimuli at one or more frequencies, or in one or more frequency ranges. In certain embodiments, the stimuli may be turned on and off at frequencies that are believed to induce one or more frequencies of electrical activity in the brain, which are generally accepted as being delta waves (1.0 to 3.0 Hz), theta waves (3.0 to 7.0 Hz), alpha waves (7.0 to 12 Hz), beta waves (12 to 38 Hz), and gamma waves (38 to 42 Hz).

[0008] Thus, for example, one embodiment device produces an output that may be perceived by a user of the device as a stimuli at sequential frequencies, such as sequences of alpha waves, theta waves, and delta waves. In certain embodiments, the stimuli is a coordinated auditory and visual stimulation, providing right and left eyes and ears to pulsed light and pulsed auditory in each of the ranges listed above. As one example, the coordinated stimulation may be: 1) both eyes and both ears being stimulated at the same time; 2) the left eye and ear being stimulated at the same time, followed by the right eye and ear being stimulated at the same time; 3) both eyes being stimulated at the same time, followed by both ears being stimulated at the same time; or 4) the right eye and left ear being stimulated at the same time, followed by the left eye and right eye being stimulated at the same time. In each case, the stimulation may include, for example,

sequentially stimulating in the alpha wave range, followed by the theta wave range, followed by the delta wave range. The stimulation can last for a period of one minute up to an hour.

[0009] It is one aspect to provide a method to provide stimulation to a user. The method includes: providing a headset to be worn by the user; applying, with the headset, a left visual stimulus pattern to the left eye of the user; applying, with the headset, a right visual stimulus pattern to the right eye of the user; applying, with the headset, a left auditory stimulus pattern to the left side of a head of the user; and applying, with the headset, a right auditory stimulus pattern to the right side of the head. The applications of the left visual stimulus pattern, the right visual stimulus pattern, the left auditory stimulus pattern, and the right auditory stimulus pattern are coordinated with one another.

[0010] It is another aspect to provide a method of treating a neurological disease or condition or providing performance enhancement using the method of providing stimulation to a user. The method includes: providing a headset to be worn by the user; applying, with the headset, a left visual stimulus pattern to the left eye of the user; applying, with the headset, a right visual stimulus pattern to the right eye of the user; applying, with the headset, a left auditory stimulus pattern to the left side of a head of the user; and applying, with the headset, a right auditory stimulus pattern to the right side of the head. The applications of the left visual stimulus pattern, the right visual stimulus pattern, the left auditory stimulus pattern, and the right auditory stimulus pattern are coordinated with one another.

[0011] It is one aspect to provide an apparatus to provide stimulation to a user. The apparatus includes: a frame configured to be worn on a head of a user; a left light source configured to generate a left visual stimulus pattern; a right light source configured to generate a right visual stimulus pattern; a left auditory source configured to generate a left auditory stimulus pattern; a right auditory source configured to generate a right auditory stimulus pattern; and a controller coupled to the left light source, the right light source, the left auditory source, and the right auditory source, The applications of the left visual stimulus pattern, the right visual stimulus pattern, the left auditory stimulus pattern, and the right auditory stimulus pattern are independently controlled from one another but coordinated with one another by the controller.

[0012] It is yet another aspect to provide a method to provide stimulation to a user, the method includes: concurrently providing a left-side light stimulus to a left eye of the user, a right-side light stimulus to a right eye of the user, a left-side auditory stimulus to a left side of the user, and a right-side auditory stimulus to a right side of the user for a first time interval; alternating providing the left-side light stimulus and left-side auditory stimulus with providing the right-side

light stimulus and right-side auditory stimulus for a second time interval; alternating providing the left-side and right-side light stimuli with providing the left-side and right-side auditory stimuli for a third time interval; and alternating providing the left-side light stimulus and right-side auditory stimulus with providing the right-side light stimulus and left-side auditory stimulus for a fourth time interval.

[0013] It is one aspect to provide a method of treating a neurological disease or condition or providing performance enhancement using the method of concurrently providing a left-side light stimulus to a left eye of the user, a right-side light stimulus to a right eye of the user, a left-side auditory stimulus to a left side of the user, and a right-side auditory stimulus to a right side of the user for a first time interval; alternating providing the left-side light stimulus and left-side auditory stimulus with providing the right-side light stimulus and right-side auditory stimulus for a second time interval; alternating providing the left-side and right-side light stimuli with providing the left-side and right-side auditory stimuli for a third time interval; and alternating providing the left-side light stimulus and right-side auditory stimulus with providing the right-side light stimulus and left-side auditory stimulus for a fourth time interval.

[0014] It is another aspect to provide a method of providing stimulation to a user, The method includes: providing a headset to be worn by the user; applying, with the headset, a left auditory stimulus pattern to the left side of a head of the user; and applying, with the headset, a right auditory stimulus pattern to the right side of the head, The applications of the left auditory stimulus pattern and the right auditory stimulus pattern are coordinated with one another.

[0015] These features together with the various ancillary provisions and features which will become apparent to those skilled in the art from the following detailed description, are attained by the methods and system for providing stimulation to a user of the present invention, embodiments thereof being shown with reference to the accompanying drawings, by way of example only, wherein:

BRIEF DESCRIPTION OF DRAWINGS

[0016] FIGS. 1A and 1B show schematic diagrams of therapeutic systems to provide therapeutic auditory, visual, and/or tactile stimulus, according to many embodiments of the present disclosure;

[0017] FIGS. 2A and 2B show schematic diagrams of the controller for the therapeutic systems of FIGS. 1A and 1B;

[0018] FIG. 3A shows an exemplary therapeutic wearable headset or sleep mask, according to many embodiments;

[0019] FIG. 3B shows a user wearing the therapeutic wearable headset and sleep mask of FIG. 3A; and

[0020] FIG. 4 shows a flow chart of a therapeutic method of providing therapeutic auditory, visual, and/or tactile stimulus, according to several embodiments.

MODES FOR CARRYING OUT THE INVENTION

[0021] FIGURE 1A is a schematic diagram of a first embodiment therapeutic system **100**. Therapeutic system **100** provides one or more outputs that a person wearing the therapeutic system may experience as auditory, visual, and/or tactile stimulus. Thus, in one embodiment, therapeutic system may comprise a left light source **110L**, a right light source **110R**, a left vibration source **120L**, a right vibration source **120R**, and a controller **130** for independently controlling and coordinating the action of the light and vibration sources. Thus, for example, therapeutic system **100** may be positioned on the head of a user with left light source **110L** positioned over the left eye to provide a left visual stimuli, right light source **110R** positioned over the right eye to provide a right visual stimuli, left vibration source **120L** positioned to provide left ear auditory stimuli, and right vibration source **120R** positioned to provide right ear auditory stimuli.

[0022] In one embodiment, left and right light sources **110L**, **110R** may each comprise light-emitting diodes, an incandescent light source having a wavelength filter, a fluorescent light source, a backlit LCD panel, or other light source configured to provide to the user light at a desired, predetermined wavelength or wavelength range.

[0023] In another embodiment, left and right vibration sources **120L, 120R** may each comprise earbuds, miniature speakers, or other vibration sources that can provide auditory stimuli to a user. In certain other embodiments, left and right vibration sources **120L**, **120R** may comprise bone conduction transducers in the audible frequency range to provide vibrations to the user's skull bone that is sensed as auditory by the user's ear. Optionally, one or more of left and right vibration sources **120L, 120R** may also produce vibrations that are sensed as tactile stimuli. Thus, for example, controller **130** may provide first signals to bone conduction transducers that vibrate or oscillate at a first frequency that can be interpreted by the user as auditory stimuli and may provide second signals at a second, lower frequency that can be interpreted as a tactile

sensation by the user. In other words, bone conduction transducers may be adapted to provide both auditory and tactile stimulus to the user.

[0024] In certain embodiments, left and right vibration sources **120L, 120R** provide output at specific one or more frequencies or a range of frequencies, and are turned on and off at a stimulation frequency. Thus, for example, a vibration source may be programmed to provide an output at an audio frequency of 256 Hz for some period of time, followed by no output for the following period of time. Thus, the vibration source is the product of an audio frequency and a square wave.

[0025] FIGURE 1B is a schematic diagram of a second embodiment therapeutic system **100'**. Second embodiment therapeutic system **100'** is generally similar to first embodiment therapeutic system **100'**, except as explicitly noted. Specifically, second embodiment therapeutic system **100'** includes a left tactile stimulus source **121L** and a right tactile stimulus source **121R**, each of which may be individually controlled and coordinated with the controller **130** to provide tactile stimuli to a user of therapeutic system **100'.**

[0026] FIGURES 2A and 2B show schematic diagrams of the controller **130** of therapeutic system **100** or **100'**. As shown in FIG. 2A, therapeutic system **100** or **100'** may optionally include an external control unit **130a** that may wirelessly communicate with a wireless receiver/transmitter **130c** of the controller **130** through a wireless connection **131a**. The wireless connection **131a** may comprise a Bluetooth connection, a Bluetooth LE connection, a WiFi connection, a ZigBee connection, an infrared (IR) connection, a radiofrequency (RF) connection, or an inaudible auditory signal connection, to name a few examples. The external control unit **130a** may comprise a custom-built, electronic controller. In many embodiments, the external control unit **130a** may comprise a personal computing device of the user that may have downloaded onto and operating, a custom computer application or "app" to operate the system **100** or **100'** to provide a therapeutic regimen. For example, the personal computing device may comprise a personal computer, a personal laptop computer, a tablet computer (such as an Apple iPad, a Samsung Galaxy Tab, a Microsoft Surface, or an Amazon Fire, to name a few examples), a smartphone (such as an Apple iPhone, a Samsung Galaxy phone, or a Google Nexus phone, to name a few examples), and the custom computer application or "app" may be an application or "app" downloadable from an application distribution platform such as Apple iTunes, Apple Store, Google Play, Google Chrome Web Store, Amazon App Store, or Microsoft Windows Store, to name a few examples. The application may include one or more therapeutic regimens that the user may select for implementation by the therapeutic system **100** or **100'**. In some

embodiments, the application may allow the user to provide feedback information about the efficacy of the therapeutic regimen(s), the feedback may be uploaded and collected by a central server(s) in communication with the application, and the therapeutic regimen(s) may be improved or optimized based on the feedback from the one or more users. Alternatively or in combination, as shown in FIG. 2B, the system **100** or **100'** may further comprise an external control unit **130a**, such as a custom-built controller, that may communicate with the controller **130** through a wired connection **131a**, for example, a USB, FireWire, or Lightning connection, to name a few examples.

[0027] FIGURE 3A shows one embodiment of the therapeutic system **100** as including therapeutic wearable headset or sleep mask **140** which integrates the light, vibration, and, optionally, tactile sources into a single form factor for presentation to a user. Thus, for example, when a user places wearable headset or sleep mask **140** on their head, left light source **110L** is positioned over the left eye to provide a left visual stimuli, right light source **110R** is positioned over the right eye to provide a right visual stimuli, left vibration source **120L** is positioned to provide left ear auditory stimuli, and right vibration source **120R** is positioned to provide right ear auditory stimuli.

[0028] As discussed above and herein, the left vibration source **120L** and the right vibration source **120R** may each comprise bone conduction transducer that may provide both auditory and tactile stimulus. Alternatively, wearable headset or sleep mask **140** is therapeutic system **100'** which includes left tactile stimulus source **121L** and right tactile stimulus source **121R**, each of which may be individually controlled and coordinated with the controller **130**, as described above regarding FIG. 1B.

[0029] As discussed above and herein, the therapeutic wearable headset or sleep mask **140** may be operated with an external controller **130a** (e.g., a smartphone) in communication with the controller **130** through a wireless connection **131a**, for example. The user US may have an option to turn tactile stimulation on or off, for example. FIG. 3B shows a user US wearing the therapeutic wearable headset or sleep mask **140**.

[0030] FIGURE 4 shows a flow chart of an exemplary therapeutic method **400** for providing therapeutic auditory, visual, and/or tactile stimulus. In a step **410**, a subject having a neurological disorder or condition may be identified. Examples of neurological disorders may include, but are not limited to, insomnia, post-traumatic stress disorder (PTSD), brain injuries such as traumatic brain injury (TBI), mild traumatic brain injury (mTBI), or injuries to the brain due to oxygen deprivation, such as strokes, depression, anxiety, mood disorders, personality disorders, eating

disorders, and psychotic disorders. Alternatively, a subject may be selected to undergo a therapeutic method **400** for the purpose of performance enhancement of mental and/or physical tasks for to aid the subject in napping or sleeping. In a step **420**, the subject may be provided the therapeutic system or headwear, such as the system **100** or **100'** described above. In a step **430**, the subject may wear the therapeutic system or headwear, such as wearable headset or sleep mask **140**. In a step **440**, headset **140** executes programming **450** provided in controller **130** to provide stimuli to the subject. The programming provides two or more of auditory, video, and/or tactile stimulus are concurrently provided by headset **140** to the subject, and thus, for example, may provide power to activate left light source **110L**, right light source **110R**, left vibration source **120L** and or right vibration source **120R**.

[0031] As discussed above and herein, the left vibration source **120L** and the right vibration source **120R** may each comprise bone conduction transducer that may provide both auditory and tactile stimulus. Alternatively, wearable headset or sleep mask **140** is therapeutic system **100**' which includes left tactile stimulus source **121L** and right tactile stimulus source **121R**, each of which may be individually controlled and coordinated with the controller **130**, as described above regarding FIG. 1B.

[0032] In certain embodiments, providing two or more of auditory, video, and/or tactile stimulus concurrently may provide improved therapeutic benefits as compared to providing only one of auditory, video, or tactile stimulus at one time. The two or more auditory, video, and/or tactile stimulus may thus combine to provide the improved therapeutic benefits, for example (i.e., the two or more auditory, video, and/or tactile stimulus may synergize in a way to provide improved results over providing two of the stimuli individually.)

[0033] Exemplary instructions for providing stimuli may be provided, for example, by programming **450**, such as a subroutine **450a**, which includes the simultaneous activation of all active auditory, video, and/or tactile stimulus sources. Optionally, the activation of all sources may include the activation of tactile stimulation to run throughout all subsequent auditory and/or visual stimulation. Another exemplary subroutine **450b** may comprise alternating the left auditory, video, and/or tactile stimulus sources with the right auditory, video, and/or tactile stimulus sources (i.e., the left stimuli and right stimuli take turns being active.) Another exemplary subroutine **450c** may comprise alternating the visual sources with the auditory and/or tactile sources (i.e., the visual stimuli and the auditory/tactile stimuli take turns being active.) Another exemplary subroutine **450d** may comprise alternating the left auditory and/or tactile source and the right visual source with the right auditory and/or tactile source and the left visual

source (i.e., opposite auditory/tactile stimuli take turns being active.) Such programming is further described below.

[0034] In step **440**, programming **450,** including by not limited to subroutines **450a**, **450b**, **450c**, and **450d**, may each be applied one or more times, individually or in combination with one another. The programming may, in addition, provide sequences of output in subroutines **450a**, **450b**, **450c**, and **450d** at different frequencies and/or timings. Thus for example the subroutines may provide output at specific frequencies that change as the subroutine is repeated. Thus for example, subroutine **450a** may provide auditory output to vibration source **120R** or **120L** at a frequency of 256 Hz that is turned on and off, that is it is pulsed, at a pulse frequency of 1 Hz for 2 minutes. This square pulse auditory signal thus generates signals at a frequency of 1 Hz in addition to higher harmonics. At a subsequent time the output at 256 Hz is pulsed at twice the previous pulse frequency for 2 minutes. In this manner, the auditory frequency of 256 Hz may be modulated over a wide range, including frequencies corresponding to brain wave frequencies.

[0035] In addition, by alerting the output between left and right channels, the brain may be stimulated in a way that it is forced to communicate between the left and right sides of the brain. This forced communication, for example, can allow PTSD memories to be wired to both sides of the brain, thereby stopping undesirable flashbacks.

[0036] Although the above steps show method **400** of treating a patient in accordance with embodiments, a person of ordinary skill in the art will recognize many variations based on the teaching described herein. The steps may be completed in a different order. Steps may be added or deleted. Some of the steps may comprise sub-steps. Many of the steps may be repeated as often as beneficial to the treatment.

[0037] One or more of the steps of the method **400** may be performed with the circuitry as described herein, for example, circuitry of the controller **130** or the external control unit **130a** such as one or more of a processor or logic circuitry such as a central processing unit (CPU) or a programmable array logic for field programmable gate array. The circuitry may be programmed to provide one or more of the steps of the method **400**, and the program may comprise program instructions stored on a computer readable memory or programmed steps of the logic circuitry such as the programmable array logic or the field programmable gate array, for example.

EXAMPLE 1

[0038] The following describes an example of a stimulation pattern that has been found by empirical studies to be effective for inducing sleep, including napping, increasing neuroplasticity,

treating brain injuries from strokes, TBI, or mTBI, improving balance, including improving fine motor control and reaction times, and treating PTSD, to name a few indications.

[0039] Light and auditory stimulus at a first frequency may be provided for a first time segment, then at a second lower frequency for a second time segment, and then at a third lower frequency for a third time segment. Each time segment may include one or more sub-segments of light and auditory stimulus, each sub-segment comprising one of the subroutines described above, for example. The light and auditory stimulus may end after a pre-determined time period, such as 20 minutes. The light and auditory stimulus may be ramped back up (i.e., starting from the third frequency, then transitioning to the second frequency, and finally transitioning to the third frequency), such as to wake the user. Alternatively or in combination, the light and auditory stimulus may be maintained at the second frequency such as to maintain a sleep state of the user. As described above, tactile stimulus may be provided concurrently with the auditory stimulus. The light may be provided at a wavelength of 580 nm and the auditory having a frequency of 256 Hz may be provided, or any of a number of auditory frequencies or combinations thereof that the subject can select as they wish.

[0040] Table 1 below describes an exemplary treatment regimen for this example. The stimulation provided in Table 1 first cycles through a block of four Segment A outputs, then cycles through a block of four Segment B outputs, then cycles through seven blocks of four Segment C outputs, and lastly repeats the block of four Segment A outputs. For Segment A outputs (A1, A2, A3, and A4), the auditory and light outputs cycle 115 or 116 times between being on for 0.1277 seconds and then being off for 0.1277 seconds (that is, at a pulse frequency of 3.9 Hz), followed by no output for 0.5 seconds. For Segment B outputs (B1, B2, B3 and B4), the auditory and light outputs cycle 44 or 45 times between being on for 0.3333 seconds and then being off for 0.3333 seconds (that is, at a pulse frequency of 1.5 Hz) followed by no output for 0.5 seconds. For Segment C outputs (C1, C2, C3 and C4), the auditory and light outputs cycle 14 or 15 times between being on for 1 second and then being off for 1 second (that is, a pulse frequency of 0.5 Hz), followed by no output for 1 second. Segments A1, B1, and C1 pulse the right and left sides of both the light and auditory together, with all outputs are synchronized to be on or off at the same time, as provided by subroutine **450a**. Segments A2, B2, and C2 synchronize the left side light and auditory output, and the right side light and auditory output to be opposite to one another, as provided by subroutine **450b**. Segments A3, B3, and C3 synchronize both lights together to be opposite to both auditory outputs, as provided by subroutine **450c**. Segments A4, B4, and C4 synchronize the right auditory and light to be opposite to the left auditory and light outputs, as provided by subroutine **450d**.

TABLE 1

	Auditory Left	Auditory Right	Light Left	Light Right
Segments A1-A4 for 120s				
Segment A1 (Light and Auditory both sides pulse together) Repeat 116 times, followed by 0.5 sec gap	On 0.1277s	On 0.1277s	On 0.1277s	On 0.1277s
	Off 0.1277s	Off 0.1277s	Off 0.1277s	Off 0.1277s
Segment A2 (light and auditory on left side, alternating light and auditory on Right). Repeat 116 times, followed by 0.5 sec gap	On 0.1277s	Off 0.1277s	On 0.1277s	Off 0.1277s
	Off 0.1277s	On 0.1277s	Off 0.1277s	On 0.1277s
Segment A3 (both lights together, alternating with both auditories together) Repeat 115 times, followed by 0.5 sec gap	On 0.1277s	On 0.1277s	Off 0.1277s	Off 0.1277s
	Off 0.1277s	Off 0.1277s	On 0.1277s	On 0.1277s
Segment A4 (auditory left and light right together, alternating auditory right and light left together) Repeat 115 times, followed by 0.5 sec gap	On 0.1277s	Off 0.1277s	Off 0.1277s	On 0.1277s
	Off 0.1277s	On 0.1277s	On 0.1277s	Off 0.1277s
Segments B1-B4 for 120s				
Segment B1 (Light and Auditory both sides pulse together) Repeat 45 times, followed by 0.5 sec gap	On 0.3333s	On 0.3333s	On 0.3333s	On 0.3333s
	Off 0.3333s	Off 0.3333s	Off 0.3333s	Off 0.3333s
Segment B2 (light and auditory on left side, alternating light and auditory on Right) Repeat 44 times, followed by 0.5 sec gap	On 0.3333s	Off 0.3333s	On 0.3333s	Off 0.3333s
	Off 0.3333s	On 0.3333s	Off 0.3333s	On 0.3333s
Segment B3 (both lights together, alternating with both auditories together) Repeat 44 times, followed by 0.5 sec gap	On 0.3333s	On 0.3333s	Off 0.3333s	Off 0.3333s
	Off 0.3333s	Off 0.3333s	On 0.3333s	On 0.3333s
Segment B4 (auditory left and light right together, alternating auditory right and light left together) Repeat 44 times, followed by 0.5 sec gap	On 0.3333s	Off 0.3333s	Off 0.3333s	On 0.3333s
	Off 0.3333s	On 0.3333s	On 0.3333s	Off 0.3333s
Repeat the following Segments C1-C4 7 times for a total of 14 minutes				

Segment C1 (Light and Auditory both sides pulse together) Repeat 15 times, followed by 1 sec gap	On 1 sec	On 1 sec	On 1 sec	On 1 sec
	Off 1 sec	Off 1 sec	Off 1 sec	Off 1 sec
Segment C2 (light and auditory on left side, alternating light and auditory on Right) Repeat 15 times, followed by 1 sec gap	On 1 sec	Off 1 sec	On 1 sec	Off 1 sec
	Off 1 sec	On 1 sec	Off 1 sec	On 1 sec
Segment C3 (both lights together, alternating with both auditories together) Repeat 14 times, followed by 1 sec gap	On 1 sec	On 1 sec	Off 1 sec	Off 1 sec
	Off 1 sec	Off 1 sec	On 1 sec	On 1 sec
Segment C4 (auditory left and light right together, alternating auditory right and light left together) Repeat 14 times, followed by 1 sec gap	On 1 sec	Off 1 sec	Off 1 sec	On 1 sec
	Off 1 sec	On 1 sec	On 1 sec	Off 1 sec
	Off 1 sec	On 1 sec	On 1 sec	Off 1 sec
Segments A1-A4 for 120s				
Segment A1 (Light and Auditory both sides pulse together) Repeat 116 times, followed by 0.5 sec gap	On 0.1277	On 0.1277	On 0.1277	On 0.1277
	Off 0.1277	Off 0.1277	Off 0.1277	Off 0.1277
Segment A2 (light and auditory on left side, alternating light and auditory on Right) Repeat 116 times, followed by 0.5 sec gap	On 0.1277	Off 0.1277	On 0.1277	Off 0.1277
	Off 0.1277	On 0.1277	Off 0.1277	On 0.1277
Segment A3 (both lights together, alternating with both auditories together) Repeat 115 times, followed by 0.5 sec gap	On 0.1277	On 0.1277	Off 0.1277	Off 0.1277
	Off 0.1277	Off 0.1277	On 0.1277	On 0.1277
Segment A4 (auditory left and light right together, alternating auditory right and light left together) Repeat 115 times, followed by 0.5 sec gap	On 0.1277	Off 0.1277	Off 0.1277	On 0.1277
	Off 0.1277	On 0.1277	On 0.1277	Off 0.1277

EXAMPLE 2

[0041] The following describes an example of a stimulation pattern that has been found by empirical studies to be effective for inducing sleep. The stimulation pattern of Example 2 includes the part of the treatment regimen shown in Table 1. Specifically, the stimulation first cycles through a block of four Segment A outputs, then cycles through a block of four Segment B

outputs, and then cycles through seven blocks of four Segment C outputs. The repetition of the last block of four Segment A outputs is not provided in Example 2.

EXAMPLE 3

[0042] The following described example of a stimulation pattern that has been found by empirical studies to be effective for increasing alpha wave brain activity, inducing neuroplasticity, treating stroke or other brain injuries such as TBI, mTBI, including improving balance, improving fine motor control and reaction times, and treating PTSD, to name a few indications.

[0043] In this example, the four subroutines described above and herein are applied and repeated for multiple time segments, each at a predetermined stimulation (repetition) frequency. The four subroutines may be repeated, such as with each segment of the four subroutines lasting 120 seconds, for example. As described above, tactile stimulus may be provided concurrently with the auditory stimulus. The light may be provided at a wavelength of 580 nm and the auditory having a frequency of 432 Hz may be provided.

[0044] Table 2 below describes an exemplary treatment regimen for this example. The stimulation provided in Table 2 cycles through a block of four Segment A outputs 10 times. For Segment A1, A2, A3, and A4, the auditory and light outputs cycle 115 or 116 times between being on for 0.1277 seconds and then being off for 0.1277 seconds, followed by no output for 0.5 seconds. Segments A1 pulses the right and left sides of both the light and auditory together, with all outputs are synchronized to be on or off at the same time, as provided by subroutine **450a**. Segment A2 synchronizes the left side light and auditory output, and the right side light and auditory output to be opposite to one another, as provided by subroutine **450b**. Segment A3 synchronizes both lights together to be opposite to both auditory outputs, as provided by subroutine **450c**. Segment A4 synchronizes the right auditory and light to be opposite to the left auditory and light outputs, as provided by subroutine **450d**.

TABLE 2

	Auditory Left	Auditory Right	Light Left	Light Right
Repeat the following Segments A1-A4 10 times for a total time of 20 minutes				
Segment A1 (Light and Auditory both sides pulse together) Repeat 116 times, followed by 0.5 sec gap	On 0.1277s	On 0.1277s	On 0.1277s	On 0.1277s
	Off 0.1277s	Off 0.1277s	Off 0.1277s	Off 0.1277s

Segment A2 (light and auditory on left side, alternating light and auditory on Right) Repeat 116 times, followed by 0.5 sec gap	On 0.1277s	Off 0.1277s	On 0.1277s	Off 0.1277s
	Off 0.1277s	On 0.1277s	Off 0.1277s	On 0.1277s
Segment A3 (both lights together, alternating with both auditories together) Repeat 115 times, followed by 0.5 sec gap	On 0.1277s	On 0.1277s	Off 0.1277s	Off 0.1277s
	Off 0.1277s	Off 0.1277s	On 0.1277s	On 0.1277s
Segment A4 (auditory left and light right together, alternating auditory right and light left together) Repeat 115 times, followed by 0.5 sec gap	On 0.1277s	Off 0.1277s	Off 0.1277s	On 0.1277s
	Off 0.1277s	On 0.1277s	On 0.1277s	Off 0.1277s

EXAMPLE 4

[0045] The following described yet another example of a stimulation pattern that has been found by empirical studies to be effective for increasing energy levels in the subject. Light and auditory stimulus at a first frequency may be provided for a first time segment, then at a second higher frequency for a second time segment, then back at the first frequency for a subsequent time segment, and so forth. Each time segment may include one or more sub-segments of light and auditory stimulus, each sub-segment comprising one of the subroutines described above, for example. The light and auditory stimulus may end after a pre-determined time period, such as 20 minutes. As described above, tactile stimulus may be provided concurrently with the auditory stimulus. The light may be provided at a wavelength of 580 nm and the auditory having a frequency of 432 Hz may be provided.

[0046] Table 3 below describes an exemplary treatment regimen for this example. The stimulation provided in Table 3 cycles ten times first through a block of four Segment A outputs, then through a block of four Segment D outputs. For Segment A outputs (A1, A2, A3, and A4), the auditory and light outputs cycle 115 or 116 times between being on for 0.1277 seconds and then being off for 0.1277 seconds, followed by no output for 0.5 seconds. For Segment D outputs (D1, D2, D3 and D4), the auditory and light outputs cycle 44 or 45 times between being on for 0.0667 seconds and then being off for 0. 0667 seconds, followed by no output for 0.5 seconds. Segments A1 and D1 pulse the right and left sides of both the light and auditory together, with all outputs are synchronized to be on or off at the same time, as provided by subroutine **450a**. Segments A2 and D2 synchronize the left side light and auditory output, and the right side light and auditory output to be opposite to one another, as provided by subroutine **450b**. Segments A3 and D3 synchronize both lights together to be opposite to both auditory outputs, as provided by

subroutine **450c**. Segments A4 and D4 synchronize the right auditory and light to be opposite to the left auditory and light outputs, as provided by subroutine **450d**.

TABLE 3

	Auditory Left	Auditory Right	Light Left	Light Right
Repeat 10 times: Segments A1-A4 followed by Segments D1-D4, for a total time of 20 minutes				
Segment A1 (Light and Auditory both sides pulse together) Repeat 116 times, followed by 0.5 sec gap	On 0.1277s	On 0.1277s	On 0.1277s	On 0.1277s
	Off 0.1277s	Off 0.1277s	Off 0.1277s	Off 0.1277s
Segment A2 (light and auditory on left side, alternating light and auditory on Right) Repeat 116 times, followed by 0.5 sec gap	On 0.1277s	Off 0.1277s	On 0.1277s	Off 0.1277s
	Off 0.1277s	On 0.1277s	Off 0.1277s	On 0.1277s
Segment A3 (both lights together, alternating with both auditories together) Repeat 115 times, followed by 0.5 sec gap	On 0.1277s	On 0.1277s	Off 0.1277s	Off 0.1277s
	Off 0.1277s	Off 0.1277s	On 0.1277s	On 0.1277s
Segment A4 (auditory left and light right together, alternating auditory right and light left together) Repeat 115 times, followed by 0.5 sec gap	On 0.1277s	Off 0.1277s	Off 0.1277s	On 0.1277s
	Off 0.1277s	On 0.1277s	On 0.1277s	Off 0.1277s
Segment D1 (Light and Auditory both sides pulse together) Repeat 221 times, followed by 0.5 sec gap	On 0.0667s	On 0.0667s	On 0.0667s	On 0.0667s
	Off 0.0667s	Off 0.0667s	Off 0.0667s	Off 0.0667s
Segment D2 (light and auditory on left side, alternating light and auditory on Right) Repeat 221 times, followed by 0.5 sec gap	On 0.0667s	Off 0.0667s	On 0.0667s	Off 0.0667s
	Off 0.0667s	On 0.0667s	Off 0.0667s	On 0.0667s
Segment D3 (both lights together, alternating with both auditories together) Repeat 221 times, followed by 0.5 sec gap	On 0.0667s	On 0.0667s	Off 0.0667s	Off 0.0667s
	Off 0.0667s	Off 0.0667s	On 0.0667s	On 0.0667s

Segment D4 (auditory left and light right together, alternating auditory right and light left together) Repeat 221 times, followed by 0.5 sec gap	On 0.0667s	Off 0.0667s	Off 0.0667s	On 0.0667s
	Off 0.0667s	On 0.0667s	On 0.0667s	Off 0.0667s

EXAMPLE 5

[0047] The following Table 4 lists experimental results for the use of the inventive methods. The table lists what was being tested or treated, details of the conditions, the number of subjects, and the results of the tests. In each case, the stimulation in Example 1 for treating non-sleep related problems and for inducing a short sleep, and the stimulation in Example 2 was used for all other treatments.

[0048] Several of the treatments provided improvements in physical and/or mental performance, such as improving fine motor control and reaction times. This may be due to the device providing improved neuroplasticity in the days after treatment. Other treatments provided improvements in performing tasks and recovery from brain injury, such as injuries resulting from oxygen deprivation (strokes) and for those suffering from traumatic brain injury (TBI) or mild traumatic brain injury, and my provide improving balance, improving fine motor control. Other treatments provided relief to sufferers of PTSD by reducing the subject's response to triggering stimuli.

TABLE 4

Treatment For	Details	No. of subjects	Results
Pain Management	Reduction of chronic nerve damage pain and improvement of sleep on self. Use of device for 3 months with 20 min/day of use of device	1	Eliminated chronic nerve damage pain for the time the device was used.
PTSD	Treating PTSD. Device use time of 5 hours.	3	Reduced flashbacks, nightmares and hypervigilance in all 3 subjects
Performance Enhancement	Marksmanship (rifles and pistols), endurance and speed driving (advanced surveillance, coordination and evasion). 6 hours training each subject.	20	Significant improvements in marksmanship in all participants and ease of concentration during speed driving, faster times on endurance trials for 19/20 subjects

Performance Enhancement	Fine motor skills on bomb disposal personnel 3 hours training with device	3	Improved performance of fine motor skills on bomb disposal VR simulation for all subjects
Performance Enhancement	Fine motor skills of surgeons- 3 hours training each	3	Improved performance of fine motor skills on surgical procedures VR simulation for all subjects.
Performance Enhancement	Pistol use and marksmanship. 3 hours training	2	10% and 30% respectively increased speed in stripping and reassembling weapons. (average each of 5 tests, pre and post training) 6% average improvement in marksmanship scores - highly significant for such level of skill for all subjects
Performance Enhancement and PTSD	Performance by anti-terror and anti-drug squads of an elite firearms unit of a police force. 3 hours training each.	5	10% average improvement in scores. Total absence of any PTSD
Performance Enhancement	Marksmanship. 2 hours training	1	average grouping shrunk from 5 inches to 1 inch at 200 yds.
Brain State	Increasing alpha activity. 4 hours total training time per subject. Group 1 L&S stimulation and biofeedback. Group 2 - just L&S stimulation Group 3 just biofeedback, Group 4 control. Double blinded - those administering had no idea of what was predicted to happen	20	Results as predicted. Group 1 greatest change, followed by group 2, Group 3 least change of active groups. Group 4 no change.
Performance Enhancement	Marksmanship.	3 + 15	Significant improvement for all subjects.
Mental Performance Enhancement	Attention, learning and resistance to interrogation - 4 hours each person. Conduct after Capture course.	3	positive reports from all subjects
Performance Enhancement	Motion sickness for fixed wing aircraft pilots who have developed problems. 4 hours training per subject	4	Dramatic improvements in half of subjects. Small improvements in remaining half of subjects
PTSD	PTSD symptoms - test to remove neurological symptoms of flashbacks, nightmares and cold sweats	33	Successful in 31/33 subjects
Performance Enhancement	Driver performance using VR simulators for reaction speeds and performance under stress	2	Immediate increase in reaction speeds and improved performance for all subjects
Performance Enhancement	Professional soccer player performance. Trained for 4 hours. Battery of 21 tests	1	5-25% increase in speeds to complete tests

Inducing Sleep	Sleep patterning and circadian rhythm adjustment for crews setting endurance records. members each year. Also used for improving safety drills when parachuting	6	All subjects fell asleep using the device during training, including one subject that was ill with a virus and couldn't otherwise sleep.
Performance Enhancement	Race car driver performance. Ten days of training for 30 minutes per day.	1	Subject won his first Grand Prix of the season.
Performance Enhancement	Soccer player kicking performance. 5 days of 1 hour each day	1	Subject went from 5th ranked to highest ranked
Stroke Recovery	Use on 6 year post stroke subjects. four hours training.	10	Observable balance improvement in 7/10 subjects. 3 subjects had had dramatic improvements in their sleep.
Epilepsy Seizure Reduction	Effect on seizures of photosensitive epileptics. 4 hours training	3	One subject was found to not be epileptic. The other two subjects had a reduction in both severity and frequency of seizures, for at least a period of at least one month.
Concussion Recovery	Effect on concussions	18	All subjects appeared to have recovery happen at very fast speed.
Performance Enhancement	Effect on musical ability of a jazz musician.	1	Greatly improved performance speed
PTSD	PTSD. Treatment protocol lasting 3 sessions of 2 hours each	22	19 individuals saw a cessation of major symptoms - flashbacks, nightmares, cold sweats and hypervigilance. the remaining 3 appeared to be calmer after treatment, but did not stop the major neurological symptoms
Sleep	Insomnia	1	Goes to sleep 4 times in 45 mins
Pain Management	Chronic Regional Pain Syndrome	1	Subject had constant pain on touching arms with no relief in 3 years Subject saw immediate pain relief on first use of the device. Continued use over the following weeks results in periods of time without pain grow up to four hours following each use. Averaging at two hours.
Pain Management and Sleep	Chronic pain	1	After six months of use, the subject continues getting 30% more sleep, and a significant reduction in pain. Device continues to be used 3-4 times a week for 20 min.

[0049] While preferred embodiments of the present invention have been shown and described herein, it will be obvious to those skilled in the art that such embodiments are provided

by way of example only. Numerous variations, changes, and substitutions will now occur to those skilled in the art without departing from the invention. It should be understood that various alternatives to the embodiments of the invention described herein may be employed in practicing the invention. It is intended that the following claims define the scope of the invention and that methods and structures within the scope of these claims and their equivalents be covered thereby.

[0050] It is to be understood that the invention includes all of the different combinations embodied herein. Throughout this specification, the term "comprising" shall be synonymous with "including," "containing," or "characterized by," is inclusive or open-ended and does not exclude additional, unrecited elements or method steps. "Comprising" is a term of art which means that the named elements are essential, but other elements may be added and still form a construct within the scope of the statement. "Comprising" leaves open for the inclusion of unspecified ingredients even in major amounts.

CLAIMS

WHAT IS CLAIMED IS:

1. A method of providing stimulation to a user, the method comprising:

providing a headset to be worn by the user;

applying, with the headset, a left visual stimulus pattern to the left eye of the user;

applying, with the headset, a right visual stimulus pattern to the right eye of the user;

applying, with the headset, a left auditory stimulus pattern to the left side of a head of the user; and

applying, with the headset, a right auditory stimulus pattern to the right side of the head,

wherein the applications of the left visual stimulus pattern, the right visual stimulus pattern, the left auditory stimulus pattern, and the right auditory stimulus pattern are coordinated with one another.

2. The method of claim 1, wherein applying, with the headset, the left auditory stimulus pattern comprises applying, with the headset, a left tactile stimulus pattern, and wherein applying, with the headset, the right auditory stimulus pattern comprises applying, with the headset, a right tactile stimulus pattern.

3. The method of claim 2, wherein the left tactile stimulus pattern and the right tactile stimulus pattern are configured to produce a plurality of concurrent left and right tactile signals.

4. The method of claim 2, wherein the left tactile stimulus pattern and the right tactile stimulus pattern are configured to produce a plurality of alternating left and right tactile signals.

5. The method of claim 2, wherein the left tactile stimulus pattern is coordinated with the left auditory stimulus pattern, and wherein the right tactile stimulus pattern is coordinated with the right auditory stimulus pattern.

6. The method of claim 5, wherein the left tactile stimulus pattern comprises a left-side vibration at a first frequency generated concurrently with auditory during the left auditory stimulus pattern, and wherein the right tactile stimulus pattern comprises a right-side vibration at a second frequency generated concurrently with auditory during the right auditory stimulus pattern.

7. The method of claim 6, wherein one or more of the left-side or right-side vibration is a vibration of from 0.5 Hz to 1.5 Hz.

8. The method of any one of claims 1 through 7, wherein applying, with the headset, the left auditory stimulus pattern comprises generating the left tactile stimulus pattern with a left bone conduction transducer of the headset, and wherein applying, with the headset, the right auditory

stimulus pattern comprises generating the left tactile stimulus pattern with a left bone conduction transducer of the headset.

9. The method of any one of claims 1 through 7, wherein the left visual stimulus pattern and the right visual stimulus pattern are configured to produce a plurality of concurrent left and right light signals.

10. The method of any one of claims 1 through 7, wherein the left visual stimulus pattern and the right visual stimulus pattern are configured to produce a plurality of alternating left and right light signals.

11. The method of any one of claims 1 through 7, wherein the left auditory stimulus pattern and the right auditory stimulus pattern are configured to produce a plurality of concurrent left and right auditory signals.

12. The method of any one of claims 1 through 7, wherein the left auditory stimulus pattern and the right auditory stimulus pattern are configured to produce a plurality of alternating left and right auditory signals.

13. The method of any one of claims 1 through 12, wherein one or more of the left or right visual stimulus pattern has a light wavelength of from 550nm to 610 nm.

14. The method of any one of claims 1 through 13, wherein one or more of the left or right visual stimulus pattern has a light wavelength of 580 nm.

15. The method of any one of claims 1 through 14, wherein one or more of the left or right auditory stimulus pattern includes an auditory frequency of from 240 Hz to 480 Hz.

16. The method of any one of claims 1 through 15, wherein one or more of the left or right auditory stimulus pattern includes an auditory frequency of 256 Hz or 432 Hz.

17. The method of any one of claims 1 through 16, wherein one or more of the left visual stimulus pattern comprises repeatedly pulsing a light at one or more of a first frequency, a second frequency less than the first frequency, or a third frequency less than the first and second frequencies.

18. The method of any one of claims 1 through 17, wherein the first frequency is between 3.75 Hz and 4.25 Hz, the second frequency is between 1.25 Hz and 1.75 Hz, and the third frequency is between 0.25 Hz and 0.75 Hz.

19. The method of claim 19, wherein the first frequency is 3.9 Hz, the second frequency is 1.5 Hz, and the third frequency is 1 Hz.

20. The method of any one of claims 18 and 19, wherein repeatedly pulsing the light comprises pulsing the light for a predetermined time interval.

21. The method of claim 20, wherein the predetermined time interval is 25-35 seconds.

22. The method of any one of claims 20 and 21, wherein the predetermined time interval is 30 seconds.

23. The method of any one of claims 1 through 22, wherein one or more of the left or right auditory stimulus pattern comprises a sequence stimulus patterns each having a pulse frequency having a pulse period, said repeating temporal signals including a portion of the pulse period with including an auditory frequency of from 240 Hz to 480 Hz and a portion of the pulse period.

24. The method of claim 23, wherein said portion of said pulse period is one half of the pulse period.

25. The method of any one of claims 23 and 24, wherein said sequence of stimulus patterns includes a first stimulus pattern having a first pulse frequency, a second stimulus pattern having a second pulse frequency less than the first pulse frequency, and a third stimulus pattern having a third pulse frequency less than the second pulse frequency.

26. The method of claim 25, wherein the first pulse frequency is between 3.75 Hz and 4.25 Hz, the second pulse frequency is between 1.25 Hz and 1.75 Hz, and the third pulse frequency is between 0.25 Hz and 0.75 Hz.

27. The method of claim 25 wherein the first pulse frequency is 3.9 Hz, the second pulse frequency is 1.5 Hz, and the third pulse frequency is 1 Hz.

28. The method of any one of claims 25 through 27, wherein said first stimulus pattern, said second stimulus pattern, or said third stimulus pattern stimulates for a predetermined time interval.

29. The method of claims 28, wherein the predetermined time interval is 25-35 seconds.

30. The method of any one of claims 28 and 29, wherein the predetermined time interval is 30 seconds.

31. The method of any one of claims 1 through 30, wherein the headset is in operative communication with an external control device.

32. A method of treating a neurological disease or condition or providing performance enhancement using the method of Claim 1.

33. The method of claim 32, where said neurological disease or condition comprises insomnia, post-traumatic stress disorder (PTSD) and/or brain injury.

34. The method of claim 32, where said treating provides increase alpha wave activity in the brain.

35. The method of claim 32, where said performance enhancement is providing sleep, the improvement of mental capabilities, or the improvement of physical capabilities.

36. An apparatus to provide stimulation to a user, the apparatus comprising:

a frame configured to be worn on a head of the user;

a left light source configured to generate a left visual stimulus pattern;

a right light source configured to generate a right visual stimulus pattern;

a left auditory source configured to generate a left auditory stimulus pattern;

a right auditory source configured to generate a right auditory stimulus pattern; and

a controller coupled to the left light source, the right light source, the left auditory source, and the right auditory source,

wherein applications of the left visual stimulus pattern, the right visual stimulus pattern, the left auditory stimulus pattern, and the right auditory stimulus pattern are independently controlled from one another but coordinated with one another by the controller.

37. The apparatus of claim 36, wherein the left auditory source is further configured to generate a left tactile stimulus pattern, and wherein the right auditory source is further configured to generate a right tactile stimulus pattern.

38. The apparatus of any one of claims 36 and 37, wherein one or more of the left or right auditory source comprises a bone conduction transducer.

39. The apparatus of any one of claims 36 through 38, wherein the controller is configured to be in communication with and operated by an external control unit.

40. The apparatus of claim 39, wherein the external control unit is in wireless communication with the controller.

41. The apparatus of any one of claims 39 and 40, wherein the external control unit comprises one or more of a personal computer, a laptop computer, a tablet computer, a smartphone, or a wearable computer.

42. The apparatus of any one of claims 38 through 41, wherein the external control unit has operating thereon an application configured to interface with and operate the controller.

43. The apparatus of any one of claims 35 through 42, wherein one or more of the left or right light source comprises a light-emitting diode (LED).

44. The apparatus of any one of claims 36 through 43, wherein one or more of the left or right light source is configured to generate light at 550-610 nm.

45. The apparatus of any one of claims 36 through 44, wherein one or more of the left or right light source is configured to generate light at 580nm.

46. A method to provide stimulation to a user, the method comprising:

concurrently providing a left-side light stimulus to a left eye of the user, a right-side light stimulus to a right eye of the user, a left-side auditory stimulus to a left side of the user, and a right-side auditory stimulus to a right side of the user for a first time interval;

alternating providing the left-side light stimulus and left-side auditory stimulus with providing the right-side light stimulus and right-side auditory stimulus for a second time interval;

alternating providing the left-side and right-side light stimuli with providing the left-side and right-side auditory stimuli for a third time interval; and

alternating providing the left-side light stimulus and right-side auditory stimulus with providing the right-side light stimulus and left-side auditory stimulus for a fourth time interval.

47. The method of claim 46, wherein the second time interval is after the first time interval, the third time interval is after the second time interval, and the fourth time interval is after the third time interval.

48. The method of any one of claims 46 and 47, wherein one or more of the left-side or right-side light stimuli comprises pulsing a light at a predetermined pulsing frequency for one or more of the first, second, third, or fourth time intervals.

49. The method of any one of claims 46 through 48, wherein one or more of the left-side or right-side auditory stimuli comprises generating a auditory at a predetermined generation frequency for one or more of the first, second, third, or fourth time intervals.

50. The method of any one of claims 46 through 49, wherein the left-side light stimulus, the right-side light stimulus, the left-side auditory stimulus, and the right-side auditory stimulus are generated with a wearable headset.

51. The method of any one of claims 46 through 50, further comprising providing a left-side tactile stimulus concurrently with the left-side auditory stimulus and providing a right-side tactile stimulus concurrently with the right-side auditory stimulus.

52. A method of treating a neurological disease or condition or providing performance enhancement using the method of Claim 46.

53. The method of claim 52, where said neurological disease or condition comprises insomnia, post-traumatic stress disorder (PTSD) and/or brain injury.

54. The method of claim 52, where said treating provides increase alpha wave activity in the brain.

55. The method of claim 52, where said performance enhancement is providing sleep, the improvement of mental capabilities, or the improvement of physical capabilities.

56. A method to provide stimulation to a user, the method comprising:

providing a headset to be worn by the user;

applying, with the headset, a left auditory stimulus pattern to the left side of a head of the user; and

applying, with the headset, a right auditory stimulus pattern to the right side of the head,

wherein the applications of the left auditory stimulus pattern and the right auditory stimulus pattern are coordinated with one another.

57. The method of claim 56, wherein the left auditory stimulus pattern and the right auditory stimulus pattern are configured to produce a plurality of concurrent left and right auditory signals.

58. The method of claim 56, wherein the left auditory stimulus pattern and the right auditory stimulus pattern are configured to produce a plurality of alternating left and right auditory signals.

59. The method of any one of claims 56 through 58, wherein one or more of the left or right auditory stimulus pattern includes an auditory frequency of from 240 Hz to 480 Hz.

60. The method of any one of claims 56 through 59, wherein one or more of the left or right auditory stimulus pattern includes an auditory frequency of 256 Hz or 432 Hz.

61. The method of any one of claims 56 through 60, wherein one or more of the left or right auditory stimulus pattern comprises a sequence stimulus patterns each having a pulse frequency having a pulse period, said repeating temporal signals including a portion of the pulse period with including an auditory frequency of from 240 Hz to 480 Hz and a portion of the pulse period.

62. The method of claim 61, wherein said portion of said pulse period is one half of the pulse period.

63. The method of any one of claims 61 and 62, wherein said sequence of stimulus patterns includes a first stimulus pattern having a first pulse frequency, a second stimulus pattern having a second pulse frequency less than the first pulse frequency, and a third stimulus pattern having a third pulse frequency less than the second pulse frequency.

64. The method of claim 63, wherein the first pulse frequency is between 3.75 Hz and 4.25 Hz, the second pulse frequency is between 1.25 Hz and 1.75 Hz, and the third pulse frequency is between 0.25 Hz and 0.75 Hz.

65. The method of claim 63, wherein the first pulse frequency is 3.9 Hz, the second pulse frequency is 1.5 Hz, and the third pulse frequency is 1 Hz.

66. The method of any one of claims 60 through 65, wherein said first stimulus pattern, said second stimulus pattern, or said third stimulus pattern stimulates for a predetermined time interval.

67. The method of claim 66, wherein the predetermined time interval is 25-35 seconds.

68. The method of claim 66, wherein the predetermined time interval is 30 seconds.

69. The method of any one of claims 56 through 68, wherein the headset is in operative communication with an external control device.

70. A method of treating a neurological disease or condition or providing performance enhancement using the method of Claim 56.

71. The method of claim 70, where said neurological disease or condition comprises insomnia, post-traumatic stress disorder (PTSD) and/or brain injury.

72. The method of claim 70, where said treating provides increase alpha wave activity in the brain.

73. The method of claim 70, where said performance enhancement is providing sleep, the improvement of mental capabilities, or the improvement of physical capabilities.

74. A method of treating a neurological disease or condition or providing performance enhancement using the apparatus of Claim 36.

75. The method of claim 74, where said neurological disease or condition comprises insomnia, post-traumatic stress disorder (PTSD) and/or brain injury.

76. The method of claim 74, where said treating provides increase alpha wave activity in the brain.

77. The method of claim 74, where said performance enhancement is providing sleep, the improvement of mental capabilities, or the improvement of physical capabilities.

78. The apparatus substantially as herein described.

79. The method substantially as herein described.

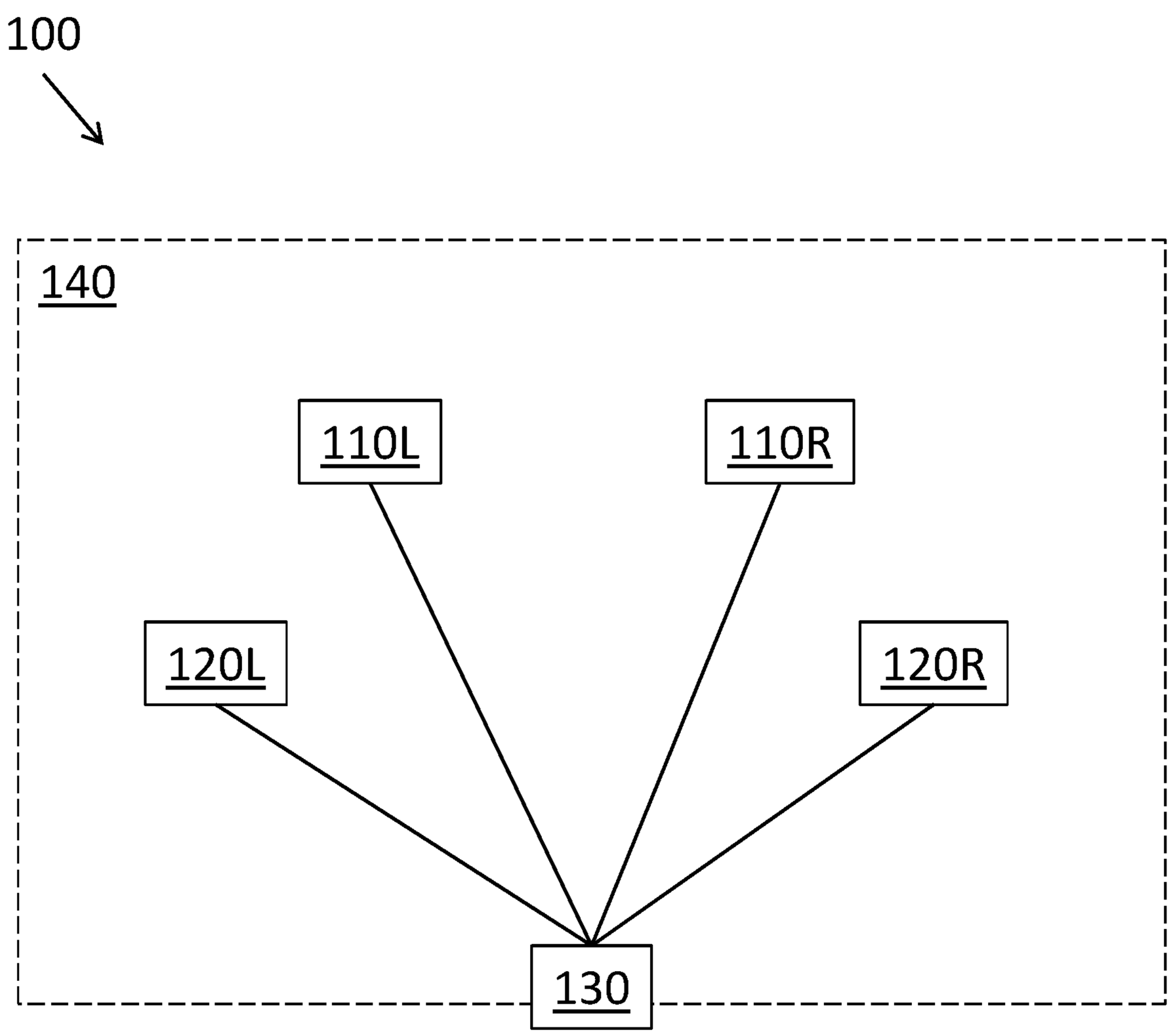

FIG. 1A

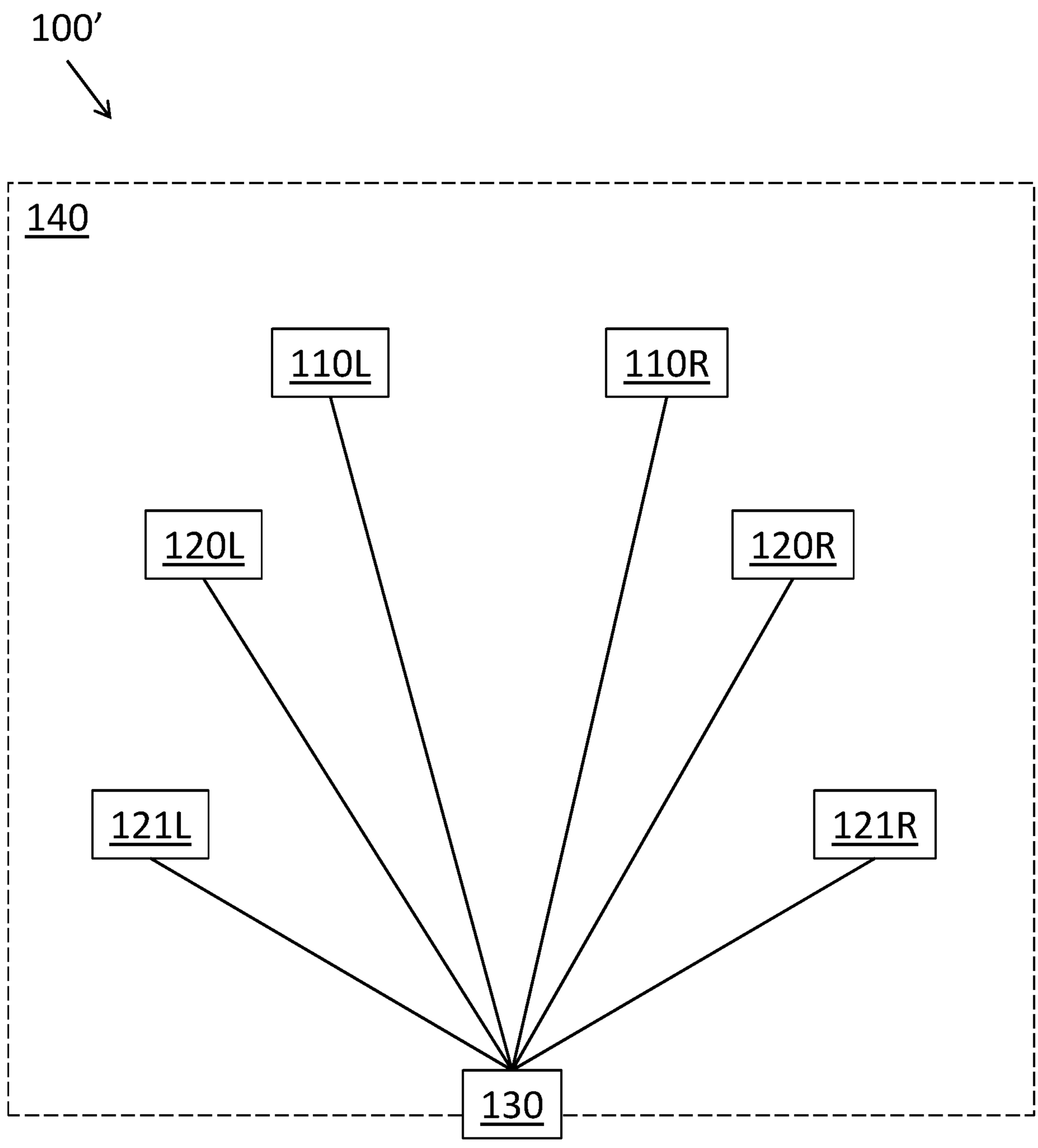

FIG. 1B

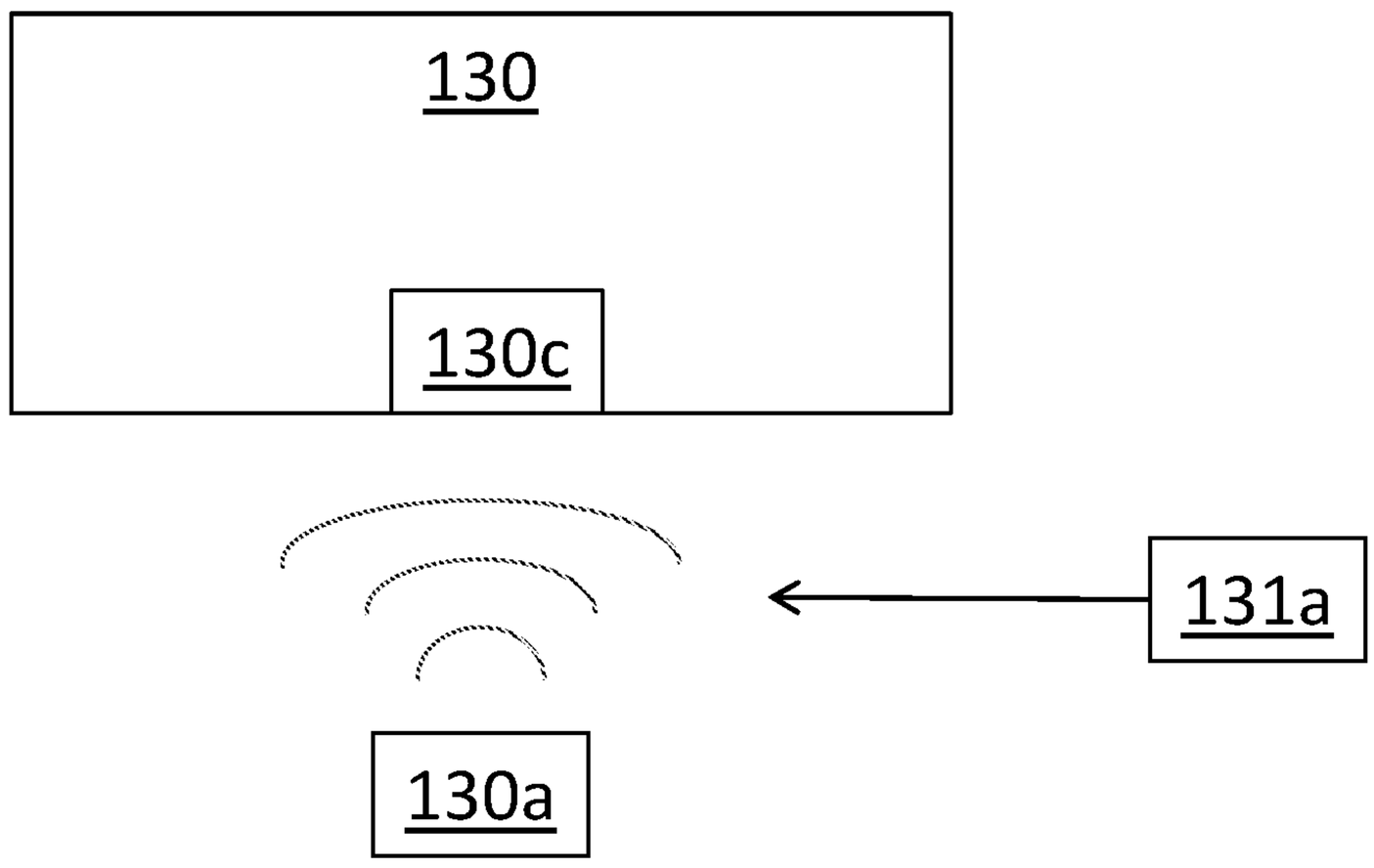

FIG. 2A

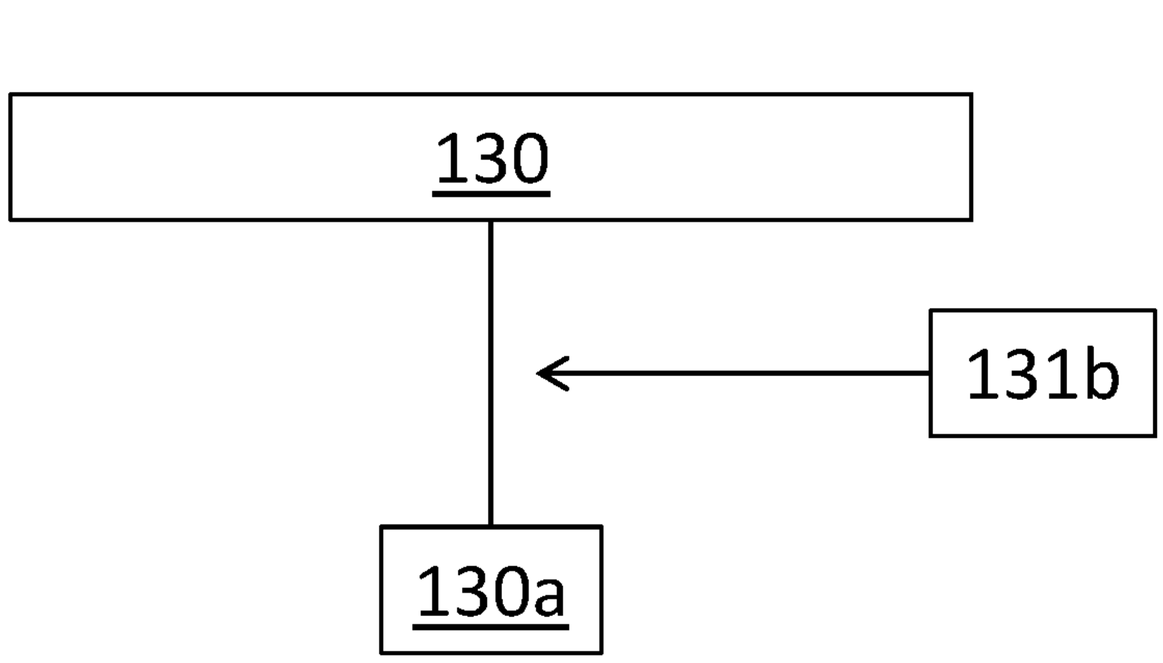

FIG. 2B

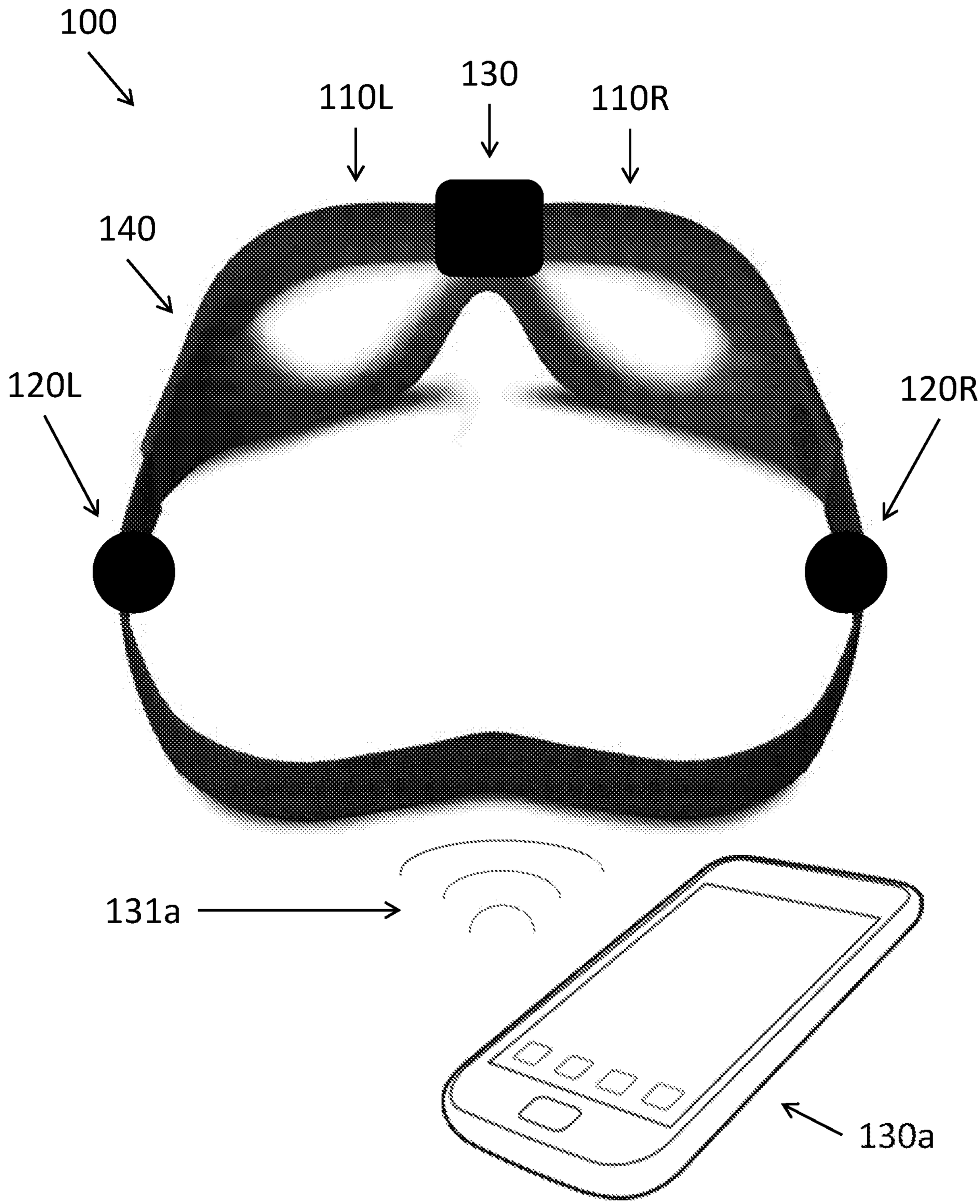

FIG. 3A

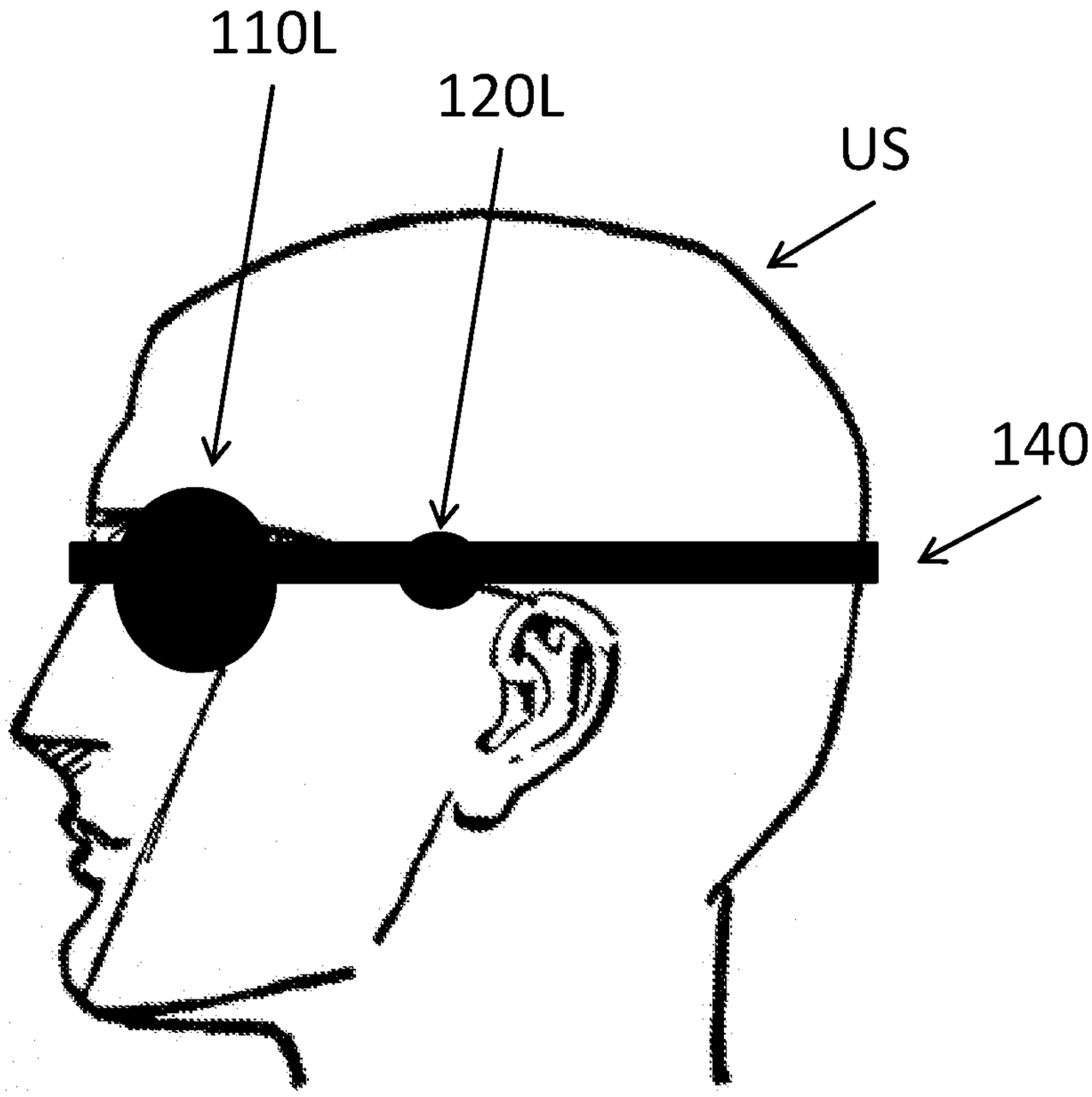

FIG. 3B

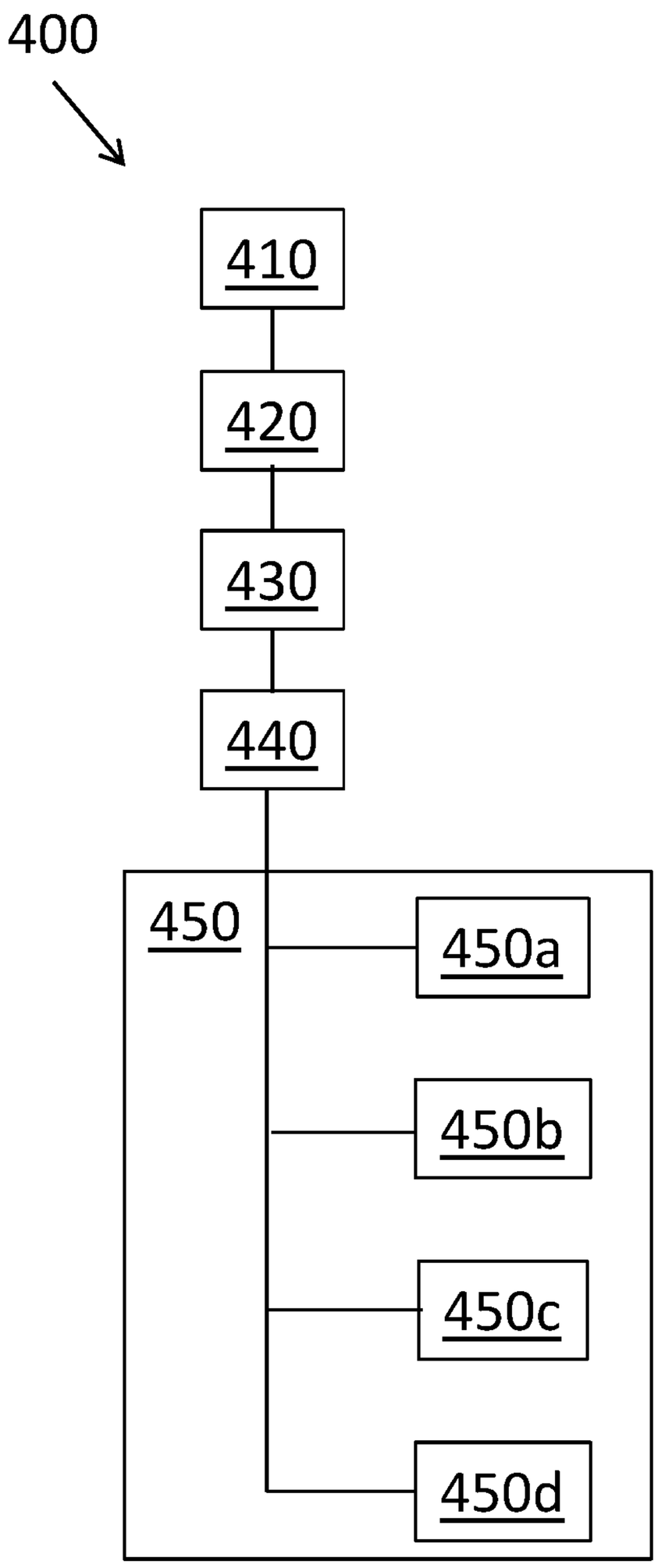

FIG. 4

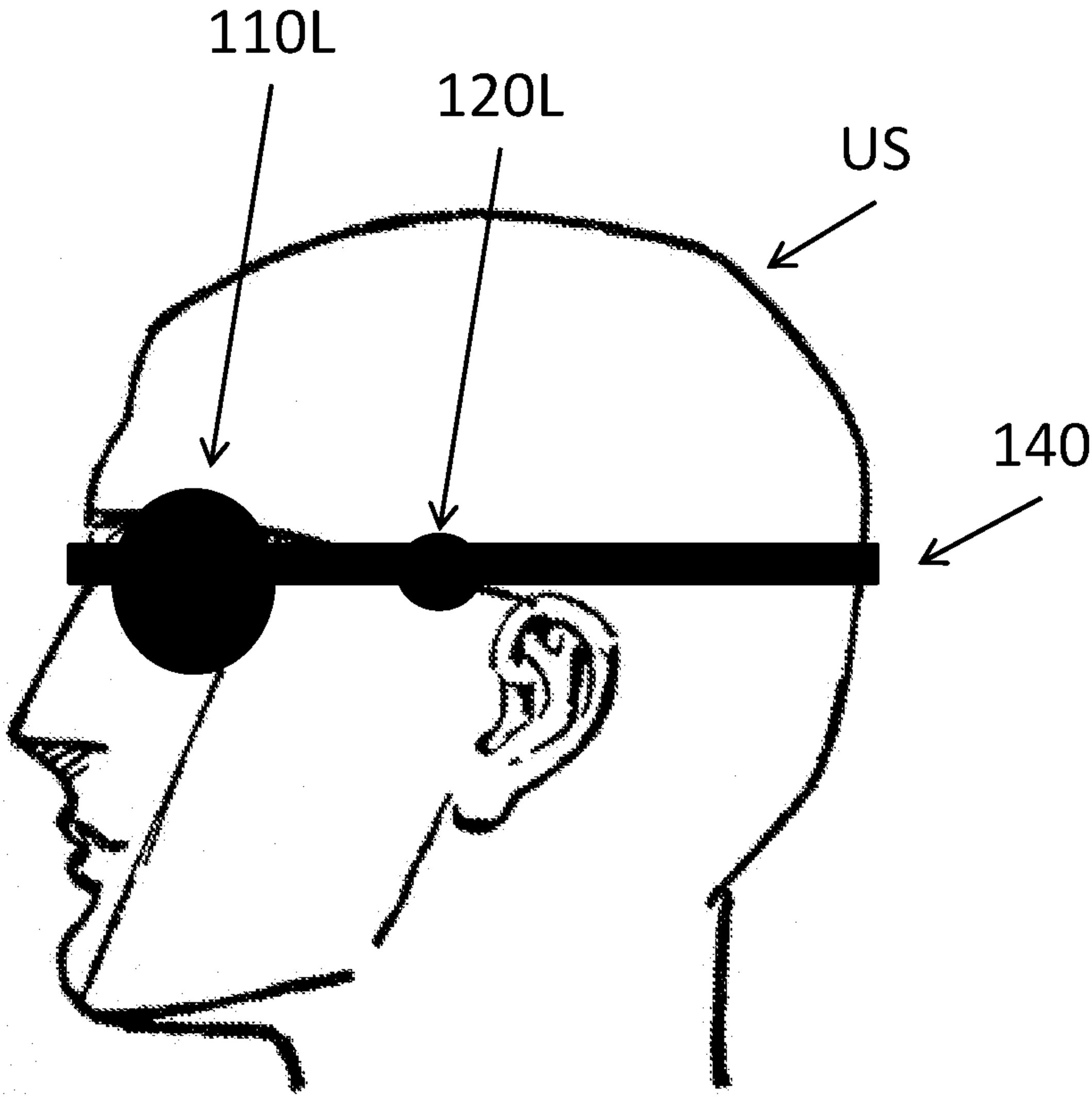

FIG. 3B