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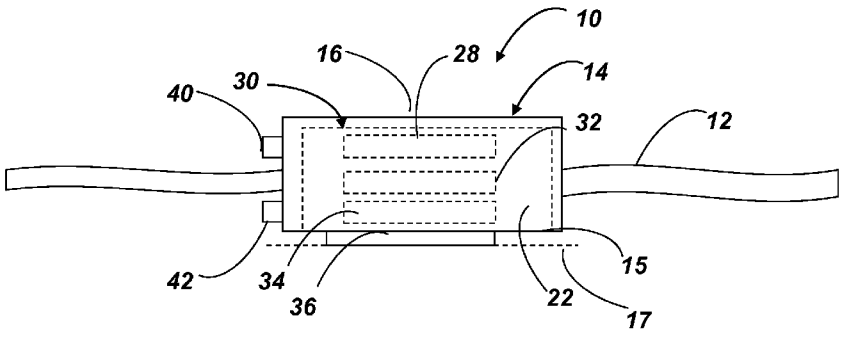

Fig. 1

(57) Abstract: An apparatus for managing time may include a substantially optically passive and substantially kinetically inert housing having an interior volume; a signal emitter disposed in the interior volume, the signal emitter generating primarily a vibratory signal; and a controller controlling the signal emitter. The controller may be programmed to operate the signal emitter in at least a pace mode.

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TITLE: TIME MANAGEMENT DEVICE

BACKGROUND OF THE DISCLOSURE

1. Field of the Disclosure

[0001] This disclosure relates generally to devices, systems, and methods to manage time.

2. Background of the Art

[0002] Time management is a critical skill for a multitude of personal and professional activities. In some aspects, the present disclosure addresses the need for effective time management.

SUMMARY OF THE DISCLOSURE

[0003] In aspects, the present disclosure provides an apparatus for managing time for a user. The apparatus may include a substantially optically passive and substantially kinetically inert housing having an interior volume; a signal emitter disposed in the interior volume, the signal emitter generating primarily a vibratory signal; and a controller controlling the signal emitter. The controller may be programmed to operate the signal emitter in at least a pace mode.

[0004] Examples of certain features of the disclosure have been summarized rather broadly in order that the detailed description thereof that follows may be better understood and in order that the contributions they represent to the art may be appreciated. There are, of course, additional features of the disclosure that will be described hereinafter and which will form the user of the claims appended hereto.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] For a detailed understanding of the present disclosure, reference should be made to the following detailed description of the embodiments, taken in

conjunction with the accompanying drawings, in which like elements have been given like numerals, wherein:

FIG. 1 illustrates one embodiment of a time management device in accordance with the present disclosure that uses pressure pulses;

FIG. 2 illustrates one embodiment of a time management device in accordance with the present disclosure that uses emitters distributed in a band;

FIG. 3 is a graph showing illustrative methodologies for selecting stimulus strength in accordance with the present disclosure;

FIG. 4 illustrates another embodiment of a time management device in accordance with the present disclosure;

FIG. 5 illustrates a sectional view of the **Fig. 4** embodiment; and

FIG. 6 illustrates another embodiment of a time management device in accordance with the present disclosure.

DETAILED DESCRIPTION OF THE DISCLOSURE

[0006] Referring to **Fig. 1**, there is shown one embodiment of a pulse module **10** according to the present disclosure. The module **10** includes a band **12** and a pulser **14**. The module **10** may be secured to a user, which may be a human or non-human. When activated, the module **10** applies a signal, which may be a pulse. The signal may be a generally silent vibration.

[0007] The band **12** may be sized to surround a human or animal limb. The band **12** may be elastic or inelastic. The band **12** may have a fixed dimension or an adjustable dimension. The band **12** may be made of one or more of metals, plastics, natural materials such as leather, ceramics, or composites. In some embodiments, the band **12** is connected to the pulser **14** at a location offset from a contact surface **15** of the pulser **14**. By moving the connection point away from the contact surface **15**, the band **12** may be able to better press the pulser **14** against a body surface **17** (e.g., skin) of the user.

[0008] The pulser **14** emits a predetermined signal to a selected location of the body of the user. In one embodiment, the signal is primarily felt by the user and is not heard by the user. Parameters such as amplitude, duration of a pulse, and / or frequency of the signal may be varied or selected to obtain the desired response.

Thus, for instance, the strength of the signal can be varied by adjusting one or more of the amplitude, duration, and the frequency. In one arrangement, the pulser **14** emits a pressure pulse to a surface of the body of the user. For example, the pressure pulse may be applied to a skin of the user. The emitter includes a housing **16** that has opposing ends that connect to the band **12** and an interior chamber **22**.

[0009] A signal generator **30** is positioned in the interior chamber **22** and is configured to apply a desired signal to the user. The signal may be a vibration or pressure that is continuous or pulsed. The signal generator **30** includes a power source **28**, a processor **32**, a signal emitter **34**, and a pressure applying member **36**. The power source **30** may be one or more batteries, a capacitor, or any other energy storage device. The pressure applying member **36** may directly contact the skin or body of the user. For example, the pressure applying member **36** may be a wall of the housing **16**. The pressure applying member **36** may also be a button or membrane attached to the housing **16**.

[0010] In the embodiment shown, the signal emitter **34** may be an electrically activator vibrator that rotates an eccentrically arranged weight to generate a motion that can be felt by the user. The pressure applying member **36** may be a portion of the housing **16** or a separate element that moves relative to the housing **16**. In some embodiments, the pulser **14** may include a printed circuit board (not shown). The signal emitter **34** may be fixed to the printed circuit board or can move relative to the printed circuit board. For example, the processor **32** may be fixed to the printed circuit board and the signal emitter **34** may be fixed to an inner surface of the housing **16**. In this arrangement, the signal emitter **34** "floats" relative to the printed circuit board because it move relative to the printed circuit board. Suitable electrical connectors (not shown) may be used to transmit signals from the printed circuit board to the signal emitter **34**. In some embodiments, an intermediate vibration conducting layer (not shown) may be used to convey the signals to the user. Such a layer may be formed of a pliant material such as an elastomer.

[0011] The processor **32** and signal emitter **34** cooperate to pulse the pressure applying member **36** at a desired frequency. The processor **32** may be a microprocessor (digital) and / or an electrical circuit (analog). In one embodiment the signal emitter **34** may be a solenoid that generates a magnetic field at a desired

frequency. In response to the generated magnetic field, the pressure applying member **36** moves (pulse). In embodiments, the processor **32** may be pulse the pressure applying member **36** in a frequency range between about fifty-five pulses per minute to about eight-five pulses per minute. In other embodiments, the signal emitter **34** may be an electric motor.

[0012] In still other embodiments, the signal emitter **34** may include a piezoelectric body. For example, a piezoelectric buzzer may be used as the signal emitter **34**. The piezoelectric buzzer may vibrate at a desired frequency. It should be noted that there are two different frequencies in such an embodiment. The first frequency is the frequency of vibration (*e.g.*, 60HZ). The second frequency is the frequency at which the vibration is imparted to the user (*e.g.*, one vibration event per second). Thus, in a non-limiting embodiment, the piezoelectric buzzer may vibrate at 60HZ for one-tenth of a second every second. Depending on the signal emitter **34**, the signal generator **30** may include a power inverter to convert DC power to AC power.

[0013] The signal generator **30** may include electrical peripherals such as a power switch **40** to energize and de-energize the signal generator **30** and a tuner switch **42**. The tuner switch **42** may be used to reprogram the processor **32** to provide a desired operating pulse frequency and / or to increase or decrease (adjust) a strength of the pulse. An electrical peripheral is any energy consuming component that does not need to operate when the signal emitter **34** is generating a vibration.

[0014] In certain embodiments, the signal generator **30** may include an acoustic isolator (not shown) that at least partially encloses the signal emitter **34**. The acoustic isolator may be used to ensure that the signal emitter **34** applies the signal (pulses) without creating any perceptible sounds.

[0015] Referring now to **Fig. 2**, there is shown an end view of a pulse module **10**. In this embodiment, the band **12** and the pulser **14** may be constructed in the form of a conventional wristwatch. The pulser **14** may include a signal generator **150** that is figured to apply a desired signal (e.g., pressure, electrical signal, etc.) that is continuous or periodic / pulsed. Parameters such as amplitude and frequency of the signal may be varied or selected to obtain the desired response. However, the signal generator **150** is positioned in the band **12**. As shown, the signal generator **150** may

have one or more distributed vibrating elements **152**. The vibrating elements **152** may be connected to the pulser **14** via an electrical conductor (not shown) embedded in the band **12**. Moreover, the signal generator **150** may be incorporated into a clasp or buckle (not shown) that is associated with the band **12**. Thus, the signal generator **150** may be considered as being external to the housing **16** of the pulser **14**.

[0016] In certain embodiments, the pulser **14** may include a timer (not shown). The timer, which may be programmable, may be set to operate the pulser **14** for a fixed or adjustable duration of time. Alternatively or additionally, the timer may be programmed to operate the pulser **14** after a fixed or adjustable amount of time has expired. In still other embodiments, the signal may be "ramped" up and or down. That is, the signal may begin by being indiscernible and gradually increase in strength. This arrangement may help make the signal less intrusive and distracting. The signal may also gradually ramp down in strength.

[0017] It should be understood that the **Fig. 1 – 2** embodiments are only illustrative in nature and that the features shown there in may be modified and / or supplemented. For example, in certain embodiments the modules may be constructed to appear as ornamental jewelry such as a bracelet. Also, in certain embodiments, the modules may be formed to appear as wrist watches. In such embodiments, the modules may include circuitry or hardware (e.g., clock face, digital display, analog display) for keeping and displaying time, operating as a stop watch, etc.

[0018] Referring now to **Fig. 3**, there is shown non-limiting illustrative methodologies for applying the signal in a pulsed fashion. **Fig. 3** illustrates a graph **240** having time along the x-axis and signal strength along the y-axis. In one illustrative methodology is shown by signal **242**. The signal strength is selected at a tactile level **244**, which allows the user to feel the signal. That is, the user is always conscious of a tactile signal. However, the value or magnitude of the signal **242** is selected to be lower than the audio level **246**. Thus, the user cannot hear the signal **242**. It should be appreciated that the width or duration of each pulse **242** can also be varied as shown by relatively longer pulse **243**. Thus, the strength of the pulse **242** can be controlled by controlling the amplitude, frequency, and or the duration. As used herein, a signal is considered inaudible if the signal has a strength of less than 20 decibels with respect to the user. Twenty decibels is roughly equivalent to whispering

or a ticking of a watch. Thus, an inaudible signal is one that cannot be heard but can be felt.

[0019] In embodiments, the pulse module **10** may be used to assist users that are taking tests. For example, many tests that are administered to individuals are timed. Therefore, time management may be helpful to perform well on these tests. Also, the test protocols for these tests may discourage the use of any devices that make a distracting visual and /or audible signal. Embodiments of the present disclosure may be useful for pacing a user during a test to increase the likelihood that the user allocates the appropriate amount of time for each question and therefore has the opportunity to answer more questions.

[0020] Referring to **Fig. 4**, there is shown one embodiment of a module **10** configured for pacing a user. The module **10** may include a housing **300**, a vibrator **310**, a controller **320**, and a battery **330**. A strap **340** may be used to secure the module **10** onto a wrist of a user. The module **10** includes a signal strength switch **350** that controls the amplitude or strength of the signal generated by the vibrator **310**. The signal strength switch **350** may be used to select the appropriate signal strength as shown in **Fig. 3**; *i.e.*, the signal is tactile and not audible. The module **10** also includes a timer select switch **360** that controls the frequency of the signal generated by the vibrator **310**.

[0021] The timer select switch **360** may be used to set the controller **320** to a desired operating mode. As shown, the timer select switch **360** has four modes, which is illustrative and not limiting. The fours modes may be: (1) a pulse frequency of one pulse per sixty seconds; (2) a pulse frequency of one pulse per ninety seconds; (3) a pulse frequency of one pulse per one-hundred twenty seconds; and (4) a pulse frequency of variable pulses every fifteen minutes. Thus, the first three modes may be considered pace mode because the signals only provide a relative time duration reference. That is, the user only knows the amount of time that has passed between two signals.

[0022] The fourth mode is an elapsed time mode. The variable pulses may be order to assist in identifying how much cumulative time has passed relative to a start point. For example, the first variable pulse may be one pulse, which is generated after fifteen minutes. The second variable pulse may be two pulses, which is

generated after thirty minutes. The third variable pulse may be three pulses, which is generated at forty five minutes. When the fourth mode is configured to track elapsed time over an hour, the fourth variable pulse resets to one pulse after one hour. The mode 4 may also be used by persons as a reminder to correct or maintain a particular habit. For example, users may use mode 4 to remind themselves to not slouch, to periodically blink, or to check on emails or other periodic task.

[0023] It should be appreciated that in some embodiments, the pace mode may be merged with an elapsed time mode. Thus, a two-minute pace mode may be combined with a mode that emits a variable signal every twenty minutes. Thus, the user has both a pace signal and an elapsed time signal.

[0024] In one illustrative use, the user may have to take a thirty minute test. If the test has thirty questions, then the user may select the first mode. If the test has twenty questions, then the user may select the second mode. If the test has fifteen questions, then the user may select the third mode. However, it is not necessary that the user select a time sequence that allocates the same time for each question. For example, if the test has thirty questions, then the user may select the second mode. In this mode, the user is seeking to ensure that no single question absorbs a significantly disproportionate amount of time. Also, some tests may have easy questions at the beginning and harder questions toward the end. In such a situation, the user may switch modes during the test.

[0025] In another illustrative use, the user may have one hour to take an essay type of test. The user may select mode 4 for such a test. This may allow the user to allocate time to read the question, outline an answer, and then write the essay.

[0026] The mode **4** may also be useful for any individual that seeks to conduct an activity according to a preset pace. For example, teachers, therapists, meeting moderators, public speakers, and sales persons, are illustrative of individuals that may need to accomplish a task or tasks within a preset amount of time. The mode 4 may be useful for such individuals in pacing their activities to ensure that the tasks are completed within the allocated time.

[0027] Referring now to **Fig. 5**, there is sectionally the **Fig. 4** embodiment of the module **10**. As discussed above, the module **10** may include a housing **300**, a vibrator **310**, a controller **320**, and a battery **330**.

[0028] The housing **300** may be formed to have optically passive exterior surfaces **301** during operation in an operating mode. By "optically passive," it is meant that these surfaces and any parts attached to these surfaces, at best, reflect light from an exterior source (a source outside of the housing **300**), but does not emit light (e.g. electromagnetic waves) and does not allow any light from within the housing **300** to escape while the vibrator **310** is in any of the operating modes. In contrast, a display (e.g., an LED light) is an "optically active" exterior surface. Thus, digital watches that display time are "optically active." In some embodiments, all the exterior surfaces **301** are "optically passive." In other embodiments, only selected exterior surfaces **301** are "optically passive." Further, the exterior surface **301** is "kinetically inert." As is known, kinetic energy is the energy associated with a moving object. Thus, by "kinetically inert," it is meant that the exterior surface **301** and any parts fixed to the exterior surface do not move while the vibrator **310** is in any of the operating modes. An analogy watch that has one or more moving hands has a "kinetically active" surface.

[0029] The housing **300** may be optically active and kinetically active during a programming mode. A programming mode is when a user turns the device off or on and / or selects any of the operating modes.

[0030] In one arrangement, the housing **300** has a casing **302**, a cover **303**, and a base **304**. In embodiments, the materials of making up the components of the housing **300** may be selected to provide a contrast in the modulus of elasticity. The casing **302** and the cover **303** may be formed of a relatively rigid material selected to prevent human perceptible sounds made by the vibrator **310** from escaping the housing **300**. The base **304** may be formed of a material that is more flexible that the material of the casing **203**. For example, the base **304** may be formed of an elastomer. In other embodiments, the arrangement is reversed. That is, the base **304** is formed of a material that has a modulus of elasticity that is greater than that of the casing **302** and the cover **303**. The modulus of elasticity of the housing **300** should be varied and arranged as needed to direct the energy released by the vibrator **310** downward into the body of the user as opposed to outward into the ambient air, which can create noise. Thus, the base **304** acts as "energy window" and the remainder of the housing **300** acts as an "energy wall."

[0031] Also, the vibrator **310** may be positioned to contact the base **304**. It should be appreciated that in this arrangement, the energy from the vibrator **310** may be directly imparted to the base **304**. However, because of the contrast in the modulus of elasticity, the base **304** attenuates this energy as it reaches the remainder of the housing **300**. Thus, during operation, the motion of the vibrator **310** will displace or deform the base **304**, which will then be felt by the user. Optionally, the interior **305** of the housing **300** may be partially or completely filled by a sound isolation material.

[0032] In another arrangement, the housing may be formed of a relatively soft material as opposed to a hard plastic or a metal. In embodiments, the housing may be formed of a synthetic or natural rubber or another pliant material that can be molded over the signal generator **30** (**Fig. 1**). For the present disclosure, a pliant material is a material having a Young's Modulus of less that 1 (10^9 N/m^2, GPa). The pliancy will allow the vibrations to be effectively transferred to the user's body while absorbing the energy that would otherwise be transmitted as sound. It should be noted that such an arrangement will allow the electrical components to be molded into the body. The signal generator may be fixed to a printed circuit board or float free of the printed circuit board by being positioned elsewhere in the body.

[0033] In some embodiments, all of the exterior surfaces of the housing **300** are optically passive and kinetically inert. In other embodiments, the housing **300** is substantially optically passive and substantially kinetically inert. By substantially, it is meant that only the surfaces not in contact with the body of the sure are optically passive and kinetically inert. For example, only the outer surface of the cover **303** and outer side surfaces of the casing **302** are optically passive and kinetically inert. In still other embodiments, the housing **300** may be partially optically passive and partially kinetically inert. For example, only the outer surface of the cover **303** are optically passive and kinetically inert.

[0034] The vibrator **310** may be any device that imparts an oscillatory movement. The oscillations may be primarily parallel **312** to a skin surface **370** of the user. Alternatively, the oscillations may be primarily orthogonal **314** to the skin surface **370** of the user. In **Fig. 6**, there is shown a variant, wherein the vibrator **310** is positioned in an opening **309** in the casing **302**. Thus, in the **Fig. 6** embodiment, there is no base

304. However, optionally a pliant layer may be applied to the surfaces of the vibrator **310** that may contact the skin **370** of the user.

[0035] It should be understood that all of the time durations listed above are merely illustrative. Thus, any number of modes and any value of time durations may be used for the pacing / timer operation; e.g., **30** seconds, three minutes, eight minutes, twenty minutes, thirty minutes, one hour, etc. Also, any variable pattern may be used to identify how much time has passed; e.g. decreasing counts instead of increasing counts (four pulses, three pulses, two pulses, one pulse), different signal patterns, etc.

[0036] In some embodiments, the battery **330** is replaceable. In other embodiments, the batter **330** may be rechargeable using a using a suitable power port **332**.

[0037] In embodiments, the controller may be programmed to optimize batter power. In one arrangement, the controller, which may include a microprocessor, may be programmed with a low power mode wherein that de-energizes one, some, or all peripheral energy consuming components during operation. Additionally, the controller may be programmed to be interrupt driven such that power supplied on for the periods of time during operation. Additionally, motor may be drive using pulse width modulation (PWM) to obtain vibration level at lower power levels. Also, the controller may be programmed to minimize leakage currents by disabling inputs and outputs when possible.

[0038] Embodiments of the present disclosure may be constructed in forms other than devices to be strapped on a limb using a band. For example, the module may be held in a hand or attached to a cushion or other surface that is to be placed in intimate contact with the user, which may be a human or non-human. The module may include a shell formed of a pliant material that allows the signals generated by the emitter to be felt by the user.

[0039] In aspects, the teachings of the present disclosure may be used to develop instruction modules for tutoring individuals.

[0040] The methods may include: studying actual tests; preparing simulated test questions based on the study of actual tests; determining a desired pace for answering test questions; setting a pacing device to emit a signal at a desired interval; instructing

at least one student to adjust the pacing device to emit the signal at a non-disruptive intensity; and instructing the at least one student to take the test questions while operating the pacing device. Determining an average pace, and setting the interval and a value less than the average pace.

[0041] In certain embodiments for managing nausea suffered by human users, the pressure applying component may be positioned to apply signal to a location intermediate the groove between the two large tendons of a human wrist. Parameters such as amplitude and frequency of the signal may be varied or selected to obtain the desired response. In certain fields, this location is referred to as "the P6 point." Parameters such as amplitude and frequency of the signal may be varied or selected to obtain the desired response.

[0042] Embodiments of the present disclosure include using the disclosed devices to manage stress. In one non-limiting method, a heart rate of the user is estimated during a time when the user is not experiencing stress. In one embodiment, the heart rate is the "rest" heart rate, that is when the user is awake, but not physical exerting and does have an elevated heart rate. In embodiments, the heart rate is selected as the rate for applying the signal because the heart rate is felt throughout nearly the entire body. The heart rate is both common to nearly all users, but can is also specific to a particular user. That is, most human users have a rest heart rate between sixty and ninety beats per minute. But individual heart rates can vary considerably within that rate. Moreover, the heart rate has a frequency that can be better perceived by a user. In other embodiments, the breathing rate (i.e., breaths per minute) may also be used.

[0043] Next, the pulse module is programmed to emit a signal at a rate approximate to or less than the estimated rest heart rate. In one embodiment, the programmed rate is within about ten percent of the estimated heart rate. In another embodiment, the programmed rate is no greater than the estimated heart rate. In some situations, it may be adequate that the programmed rate is only lower than the heart rate when encountering a stress event.

[0044] After programming the pulse module, the user may be conditioned with the module. For conditioning, the user should be engaging in a relaxation activity wherein the user experiences a relaxation response. Illustrative relaxation activities include, but are not limited to, reading a book, watching television, surfing the web,

mediating, performing breathing exercises, performing yoga, painting, and like relaxation activities. In some instances, the user selects an activity that induces an "alpha wave" relaxation response. To begin conditioning, the module may be secured to the user and then engages in the relaxation activity. The module may be positioned to apply the signal applied directly to the skin of the user at an extremity such as the wrists or ankles. The module may be operated anywhere from a few minutes to an hour or more. In some methods, the conditioning may be repeated on a daily or nearly daily basis to condition the user to associate the signal with a relaxation response.

[0045] The user may then use the pulse module when a stress inducing situation is encountered. This stress inducing situation may cause the user to have one or more stress responses. The user activates the module. The module applies the signal to the body of the user. Due to the conditioning, the signal causes the user to at least subconsciously associate the signal to a physical and / or mental state existing during a relatively stress-free environment. Thus, the user's physical and /or mental state is induced to a lower magnitude of the stress response.

[0046] While the foregoing disclosure is directed to the one mode embodiments of the disclosure, various modifications will be apparent to those skilled in the art. It is intended that all variations within the scope of the appended claims be embraced by the foregoing disclosure.

THE CLAIMS

We Claim:

1. An apparatus for managing time for a user, comprising:

- a substantially optically passive and substantially kinetically inert housing having an interior volume;

- a signal emitter disposed in the interior volume, the signal emitter generating primarily a vibratory signal; and

- a controller controlling the signal emitter, the controller programmed to operate the signal emitter at one of a plurality of modes, wherein each mode has a different frequency at which the vibrator signal is emitted.

2. The apparatus of claim 1, wherein the controller is further programmed to reduce a strength of the vibratory signal to an inaudible level while the vibratory signal is being generated.

3. The apparatus of claims 1-2, wherein the plurality of modes includes a first mode wherein a pulse is generated at a specified frequency, and a second mode wherein an variable pulse is generated at a specified frequency, wherein the number of variable pulses increases from an initial number of pulses over time.

4. The apparatus of claim 3, wherein the number of variable pulses resets to the initial number of pulses after a predetermined number of variable pulses have been generated.

5. The apparatus of claims 1-4, further comprising:

- a printed circuit board on which the processor is mounted; and

- a non-rechargeable battery energizing the processor and the signal emitter,

wherein the signal emitter is a vibrator having an eccentrically positioned rotating weight.

6. The apparatus of claims 1-4, further comprising a printed circuit board on which the signal emitter is fixed, and wherein the housing is formed of a material that is molded over the signal emitter and the controller.

7. The apparatus of claims 1-4, further comprising a printed circuit board on which the processor is fixed, and signal emitter floats relative to the printed circuit board.

8. The apparatus of claims 1-7, wherein the controller is programmed with at least one of (i) a low power mode wherein at least one peripheral energy consuming component is de-energized when the signal emitter is generating the vibratory signal, (ii) an interrupt driven mode wherein power is supplied only when the signal emitter is generating the vibratory signal; (iii) a peripheral disabling mode wherein inputs and outputs are disabled.

9. The apparatus of claims 1-8, wherein a motor associated with the signal emitter is driven using pulse width modulation (PWM) mode to drive.

10. An apparatus for managing time for a user, comprising:

- a substantially optically passive and substantially kinetically inert housing having an interior volume;

- a signal emitter disposed in the interior volume, the signal emitter generating primarily a vibratory signal, the signal emitter having a motor that rotates an eccentrically positioned mass; and

- a controller controlling the signal emitter, the controller being

programmed to:

(i) to reduce a strength of the vibratory signal to an inaudible level while the vibratory signal is being generated;

(ii) to operate the signal emitter at one of a plurality of modes, wherein each mode has a different frequency at which the vibrator signal is emitted, wherein the plurality of modes includes a first mode wherein a pulse is generated at a specified frequency, and a second mode wherein an variable pulse is generated at a specified frequency, wherein the number of variable pulses increases from an initial number of pulses over time, and wherein the number of variable pulses resets to the initial number of pulses after a predetermined number of variable pulses have been generated; and

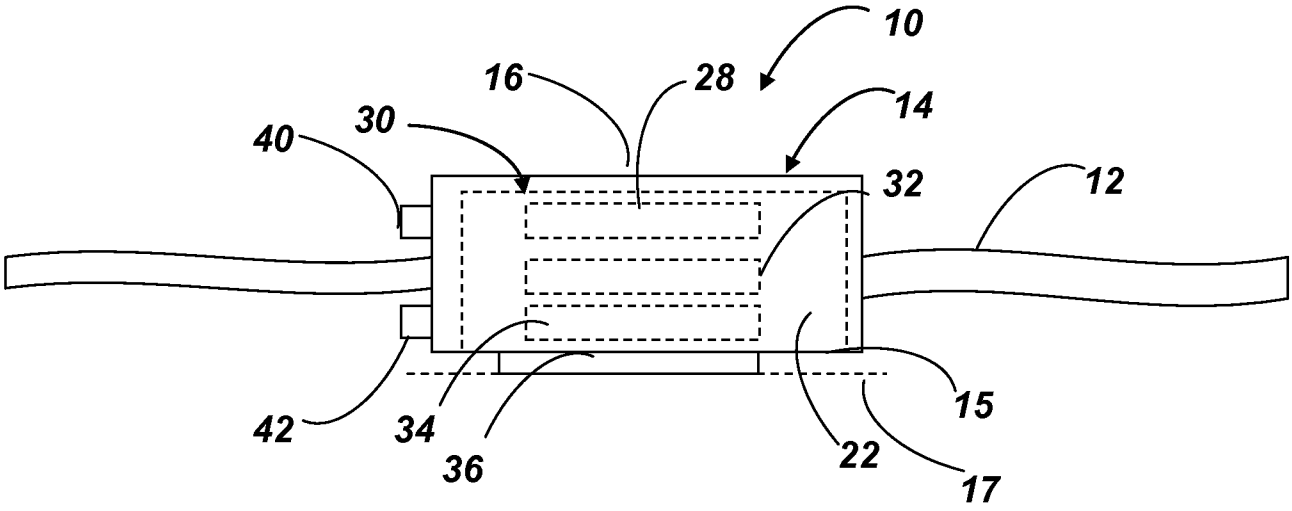
(iii) to drive the motor using pulse width modulation.

11. The apparatus of claims 10, wherein the controller is further programmed with at least one of (i) a low power mode wherein at least one peripheral energy consuming component is de-energized when the signal emitter is generating the vibratory signal, and (ii) an interrupt driven mode wherein power is supplied only when the signal emitter is generating the vibratory signal.

12. The apparatus of claims 10-11, further comprising:

- a printed circuit board on which the processor is mounted, wherein the signal emitter floats relative to the printed circuit board; and

- a non-rechargeable battery energizing the processor and the signal emitter.


10
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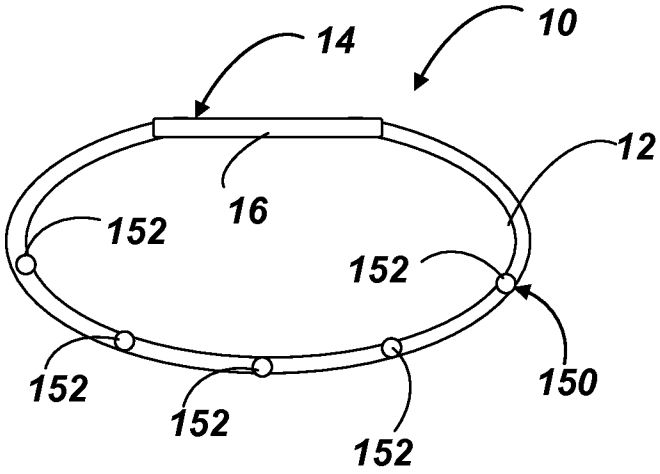
40
32
12
42
34
36
22
15
17

Fig. 1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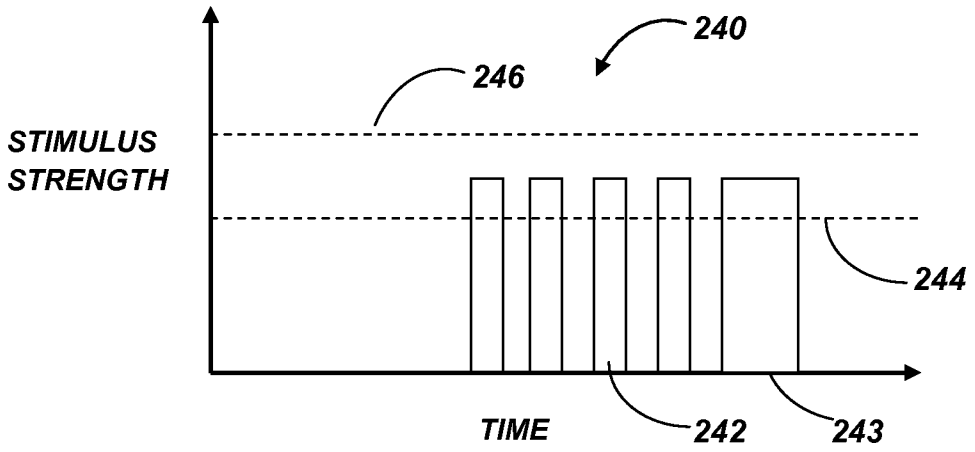
12
16
152
152
152
152
152
150

Fig. 2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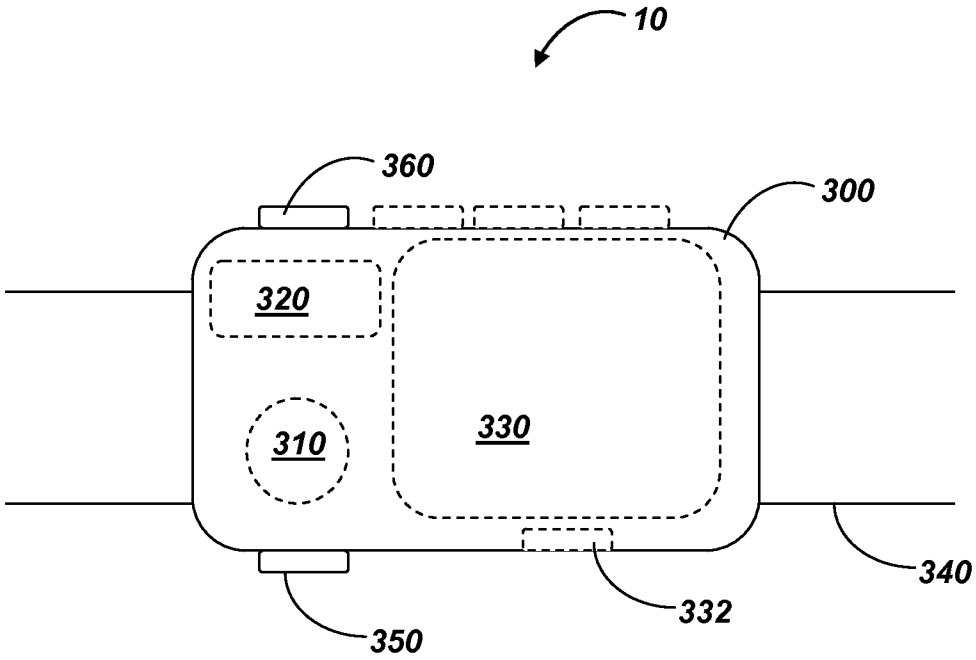
STIMULUS
STRENGTH
244
TIME
242
243

Fig. 3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332
350

Fig. 4

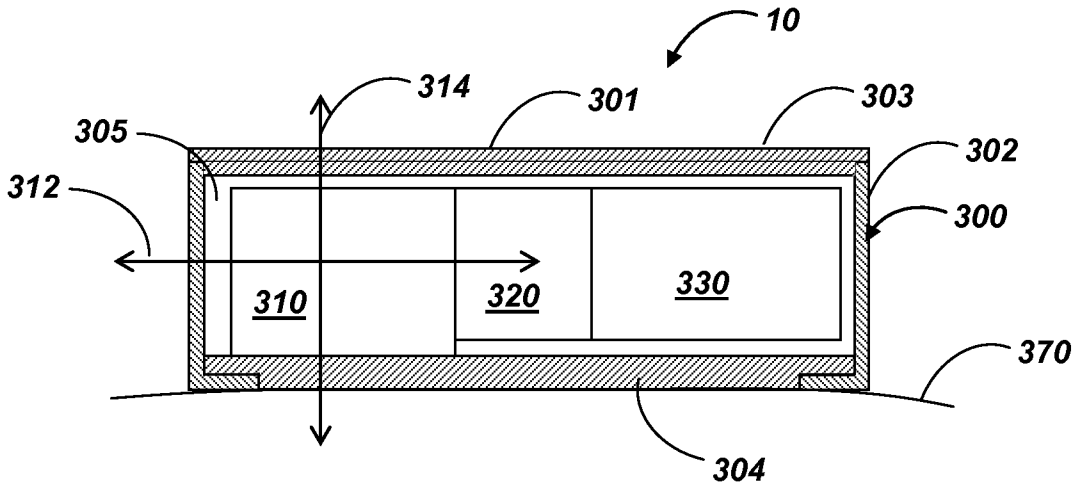
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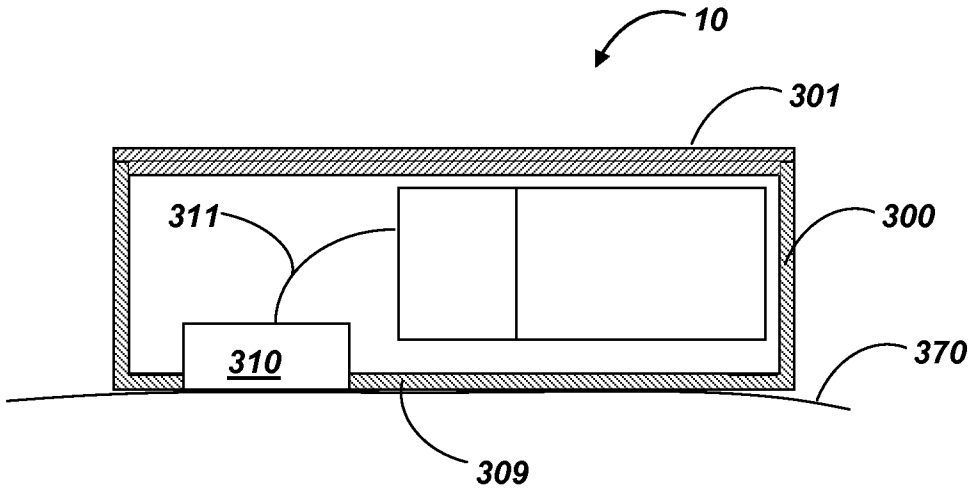
Fig. 5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300
310
370
309

Fig. 6

INTERNATIONAL SEARCH REPORT PCT/US2013/074150 21.04.2014

International application No.
PCT/US13/74150

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G04B 25/00, 25/02, 25/04 (2014.01)
USPC - 368/73, 2230, 244
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) Classification(s): H01L 41/047, 41/053; G04G 15/00, 99/00; G04B 25/00, 25/02, 25/04 (2014.01)
USPC Classification(s): 310/348, 365; 368/68, 73, 74, 187, 230, 244

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
MicroPatent (US Granted, US Applications, EP-A, EP-B, WO, JP, DE-G, DE-A, DE-T, DE-U, GB-A, FR-A); ProQuest (Derwent, INSPEC, NTIS, PASCAL, Current Contents Search, Dissertation Abstracts Online, Inside Conferences); IP.com; Google Scholar; KEYWORDS: time*, manag*, watch*, deaf*, blind*, alarm*, frequenc*, vibrat*, silent*, notif*, PCB, control*, variable, pulse

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2007/0076530 A1 (ROBINETT, M) April 5, 2007; abstract; figures 1-8; paragraphs [0014, 0017, 0020, 0030, 0032, 0034, 0038]	1-3/2 --- 4/3/1, 4/3/2,10-12/11
Y	US 2005/0282132 A1 (BRITO, D) December 22, 2005; abstract; figures 1-9; paragraphs [0019 and 0046-0049]	4/3/1, 4/3/2,10-12/11
P, X	US 2013/0170329 A1 (ESTRADA, J et al.) July 4, 2013; entire document	1-4/3/2, 10-12/11
A	US 6,211,775 B1 (LEE, I et al.) April 3, 2001; entire document	1-4/3/2, 10-12/11
A	US 5,559,761 A (FRENKEL, E et al.) September 24, 1996; entire document	1-4/3/2, 10-12/11

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 March 2014 (14.03.2014)	21 APR 2014
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Shane Thomas PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

International application No.
PCT/US13/74150

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☒ Claims Nos.: 5-9
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.