US010387106B2

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

(10) **Patent No.: US 10,387,106 B2**
(45) **Date of Patent: Aug. 20, 2019**

(54) **MEDIA CONTENT SYSTEM FOR ENHANCING REST**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 696 days.

(21) Appl. No.: **15/090,184**

(22) Filed: **Apr. 4, 2016**

(65) **Prior Publication Data**

US 2017/0286536 A1 Oct. 5, 2017

(51) **Int. Cl.**

G06F 3/16	(2006.01)
A61B 5/024	(2006.01)
A61M 21/02	(2006.01)
H04N 21/422	(2011.01)
A61B 5/00	(2006.01)
A61M 21/00	(2006.01)

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

CPC ***G06F 3/165*** (2013.01); ***A61B 5/024*** (2013.01); ***A61B 5/02416*** (2013.01); ***A61B 5/486*** (2013.01); ***A61M 21/02*** (2013.01); ***H04N 21/42201*** (2013.01); *A61B 5/6898* (2013.01); *A61M 2021/0027* (2013.01); *A61M 2021/0061* (2013.01); *A61M 2205/3553* (2013.01); *A61M 2205/3592* (2013.01); *A61M 2205/505* (2013.01); *A61M 2205/52* (2013.01); *A61M 2205/581* (2013.01); *A61M 2205/582* (2013.01); *A61M 2205/584* (2013.01); *A61M 2230/06* (2013.01); *G10H 2210/021* (2013.01); *G10H 2210/076* (2013.01)

(58) **Field of Classification Search**

CPC G06F 3/165
USPC 84/612
See application file for complete search history.

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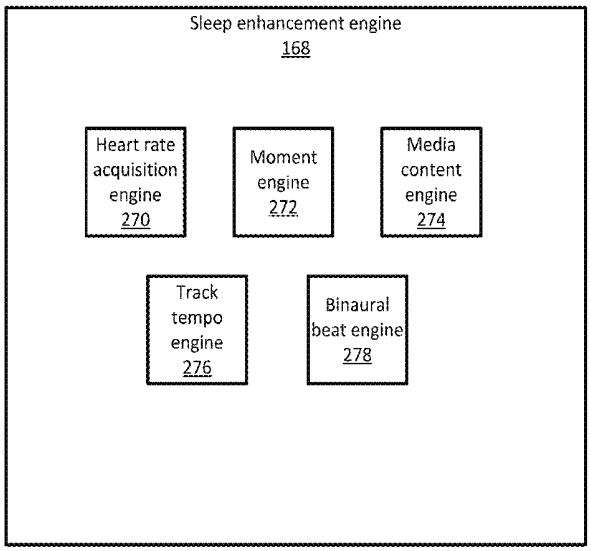
(74) *Attorney, Agent, or Firm* — Merchant & Gould P.C.

(57) **ABSTRACT**

A media-playback device acquires a heart rate, selects a song with a first tempo, and initiates playback of the song. The song meets a set of qualification criteria and the first tempo is based on the heart rate, such as being equal to or less than the heart rate. The media-playback device also initiates playback of a binaural beat at a first frequency. Over a period of time, the binaural beat's first frequency is changed to a second frequency. Over the period of time, the first tempo can also be changed to a second tempo, where the second tempo is slower than the first tempo.

19 Claims, 12 Drawing Sheets



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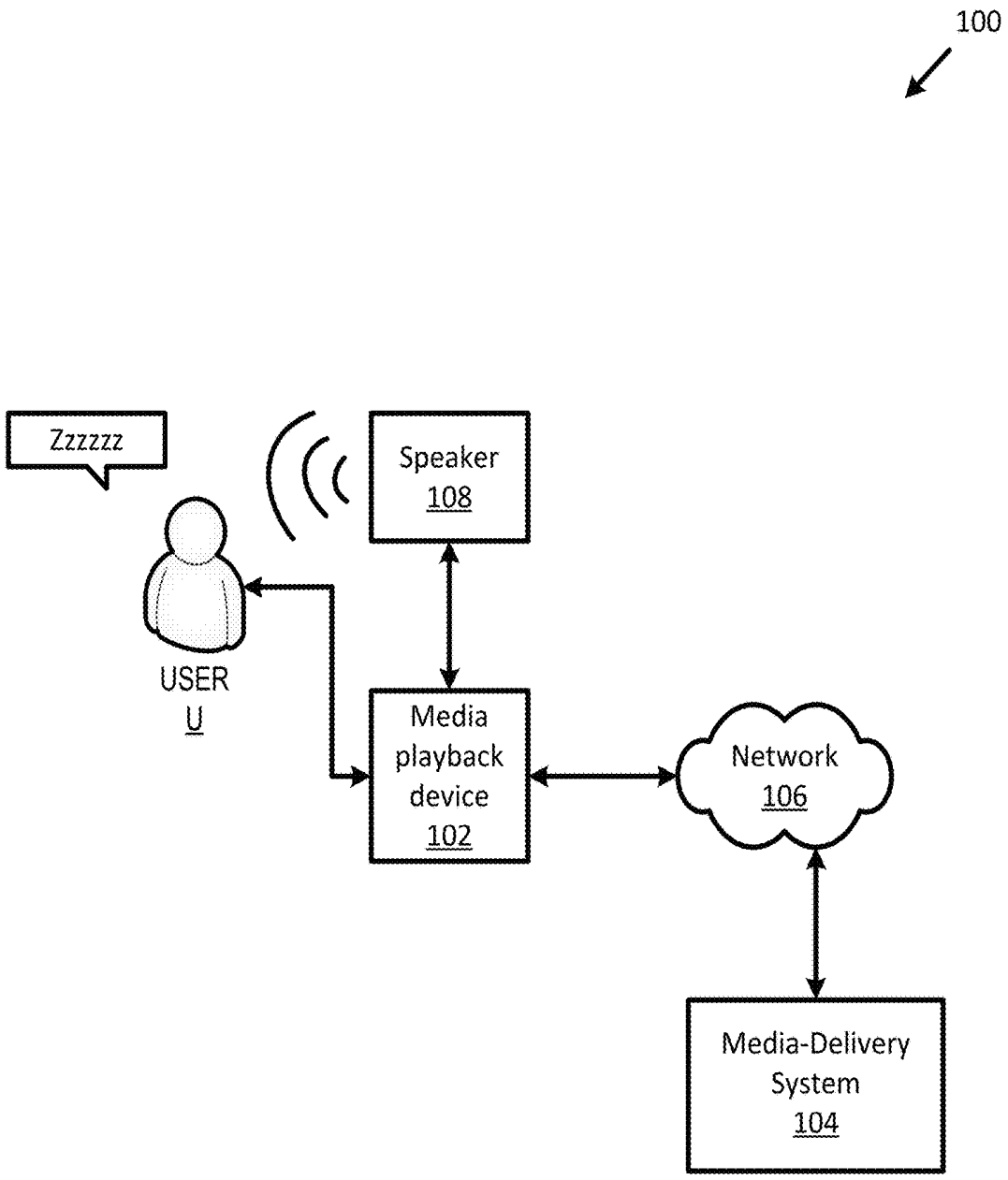
100
Zzzzzz
Speaker
108
USER
U
Media
playback
device
102
Network
106
Media-Delivery
System
104

FIG. 1

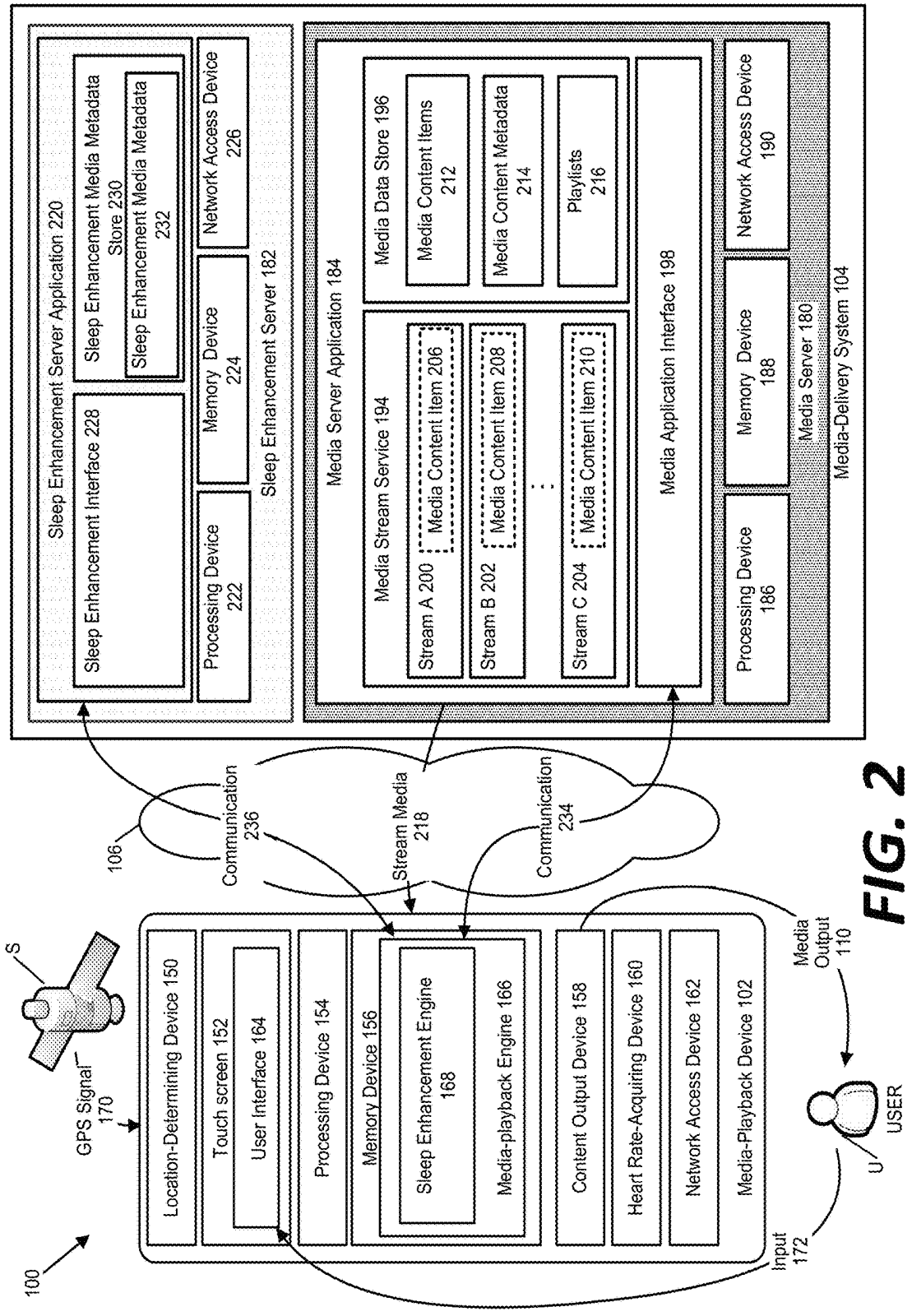
Sleep Enhancement Server Application 220
Sleep Enhancement Interface 228
Sleep Enhancement Media Metadata Store 230
Sleep Enhancement Media Metadata 232
Processing Device 222
Memory Device 224
Network Access Device 226
Sleep Enhancement Server 182
Media Server Application 184
Media Stream Service 194
Stream A 200
Media Content Item 206
Stream B 202
Media Content Item 208
Stream C 204
Media Content Item 210
Media Data Store 196
Media Content Items 212
Media Content Metadata 214
Playlists 216
Media Application Interface 198
Processing Device 186
Memory Device 188
Network Access Device 190
Media Server 180
Media-Delivery System 104
106
Communication 236
Stream Media 218
Communication 234
S
GPS Signal 170
100
Location-Determining Device 150
Touch screen 152
User Interface 164
Processing Device 154
Memory Device 156
Sleep Enhancement Engine 168
Media-playback Engine 166
Content Output Device 158
Heart Rate-Acquiring Device 160
Network Access Device 162
Media-Playback Device 102
Input 172
Media Output 110
U
USER

FIG. 2

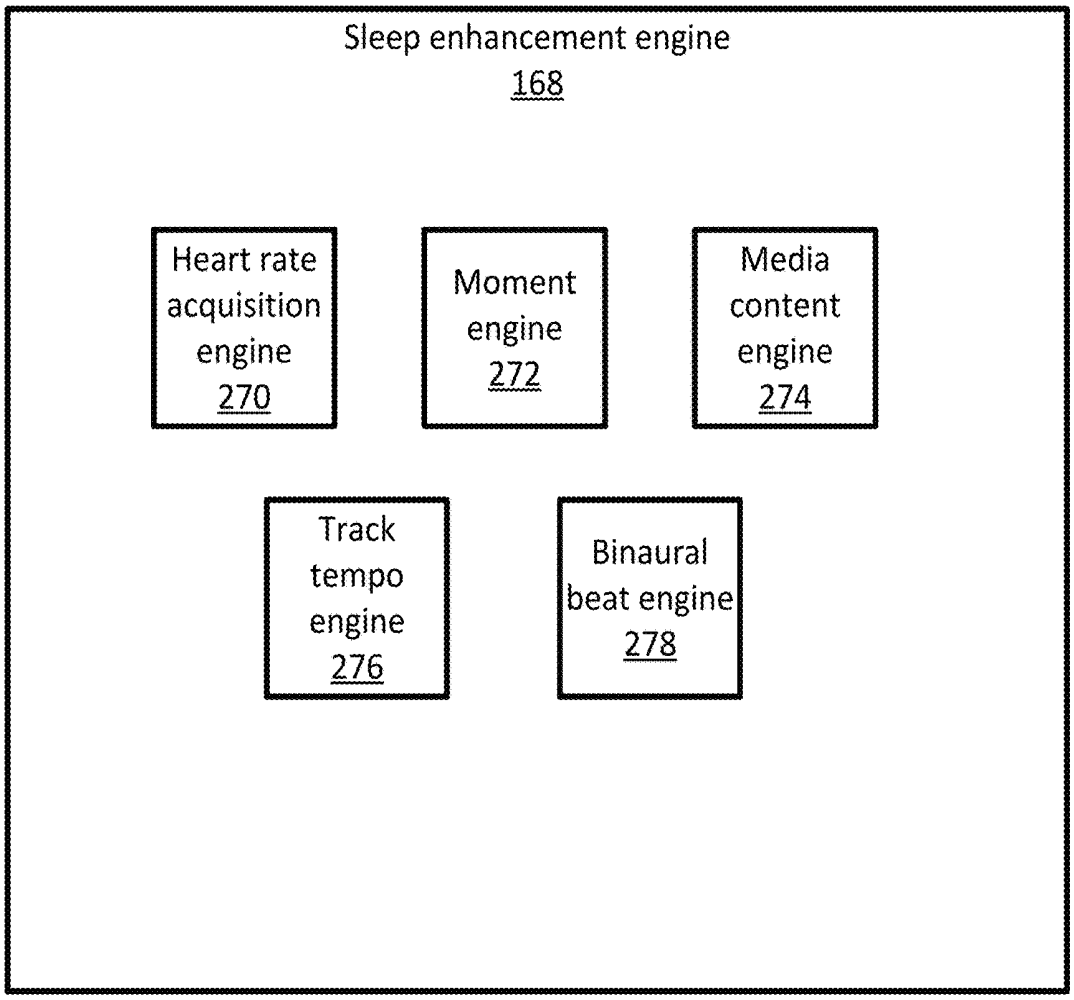
Sleep enhancement engine
168
Heart rate acquisition engine
270
Moment engine
272
Media content engine
274
Track tempo engine
276
Binaural beat engine
278

FIG. 3

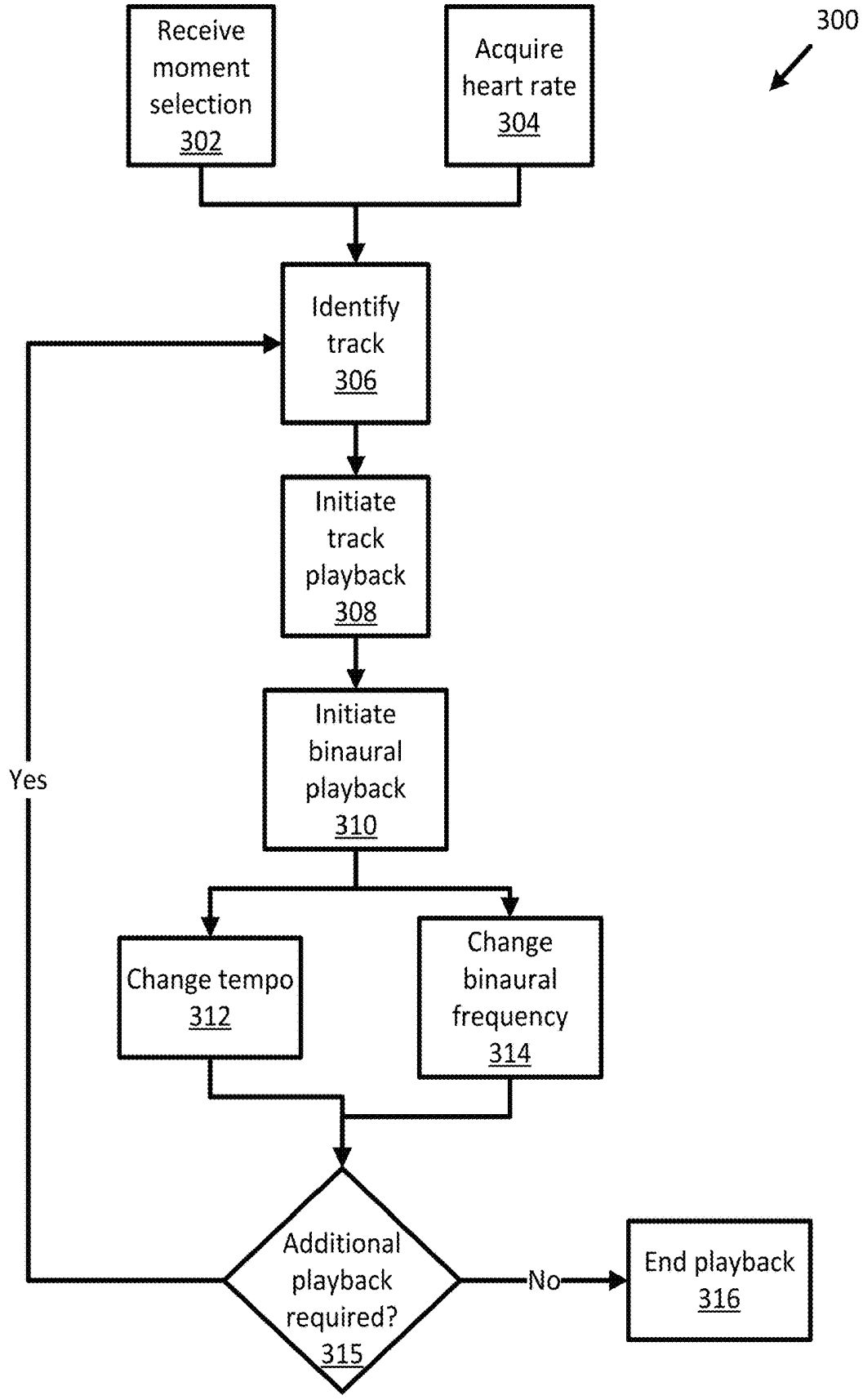
300
Receive moment selection 302
Acquire heart rate 304
Identify track 306
Initiate track playback 308
Initiate binaural playback 310
Change tempo 312
Change binaural frequency 314
Additional playback required? 315
Yes
No
End playback 316

FIG. 4

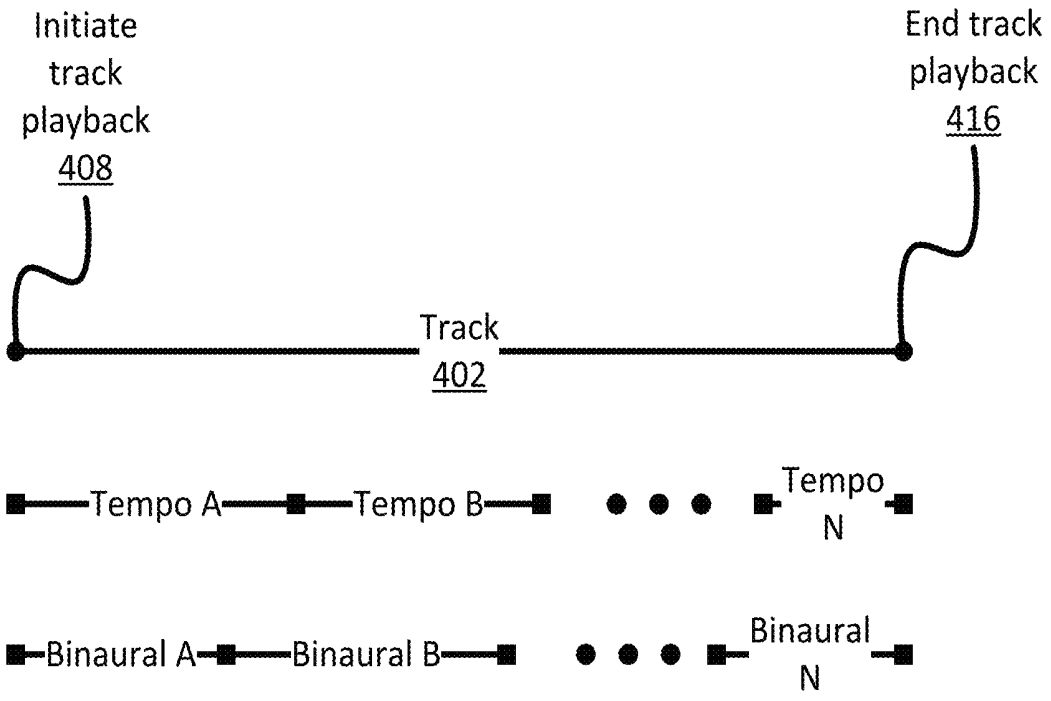
Initiate track playback 408
End track playback 416
Track 402
Tempo A
Tempo B
Tempo N
Binaural A
Binaural B
Binaural N

FIG. 5

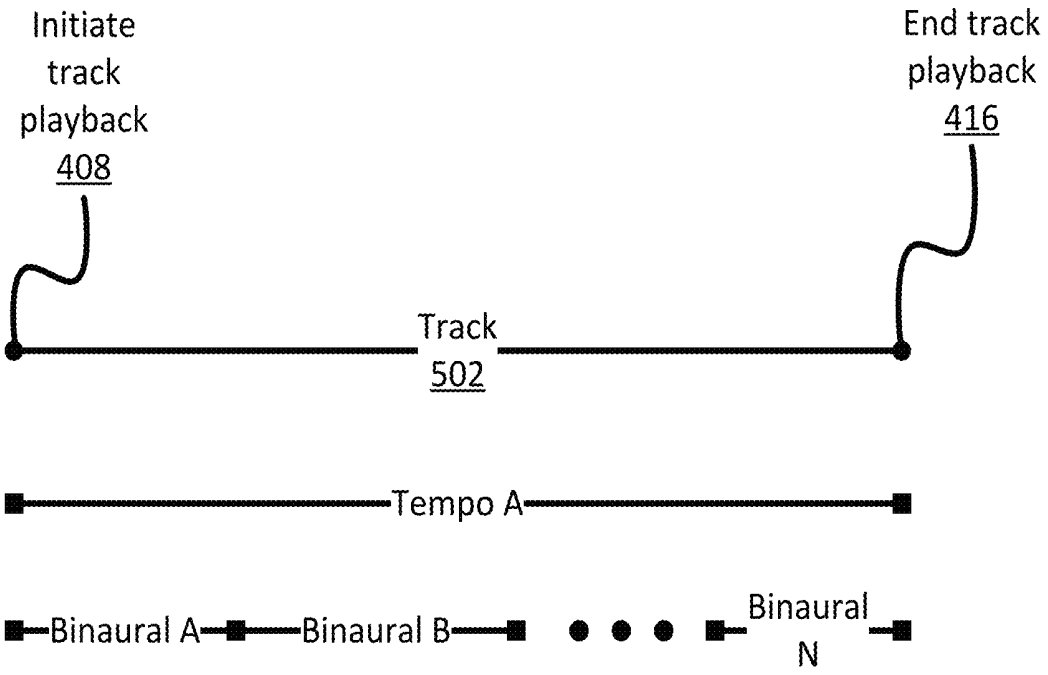
Initiate track playback 408
End track playback 416
Track 502
Tempo A
Binaural A
Binaural B
Binaural N

FIG. 6

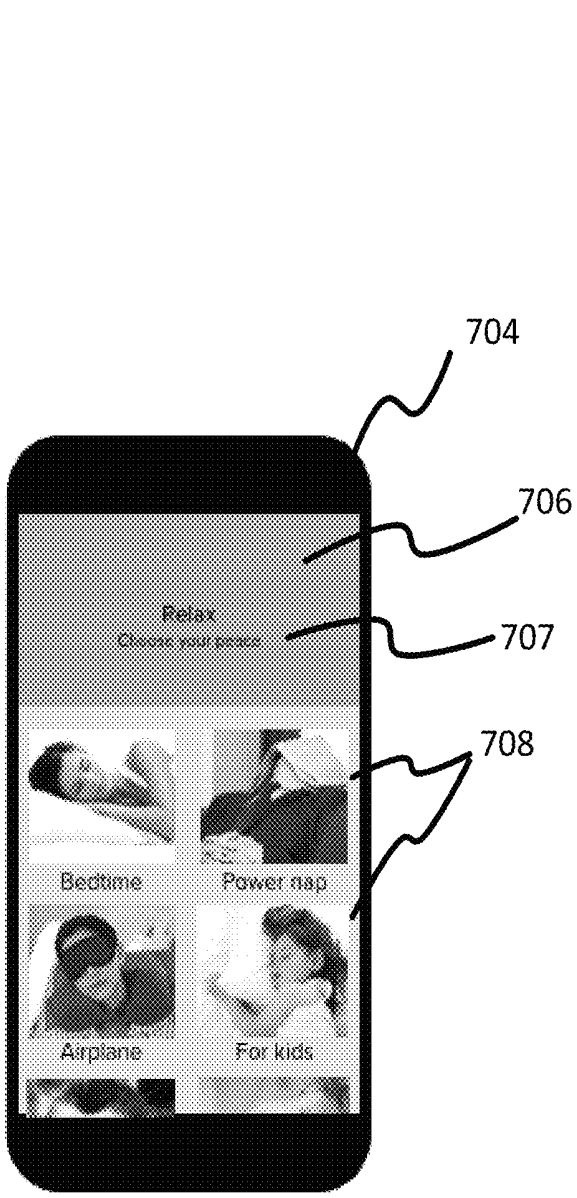
702
704
706
707
708
Relax
Bedtime
Power nap
Airplane
For kids

FIG. 7

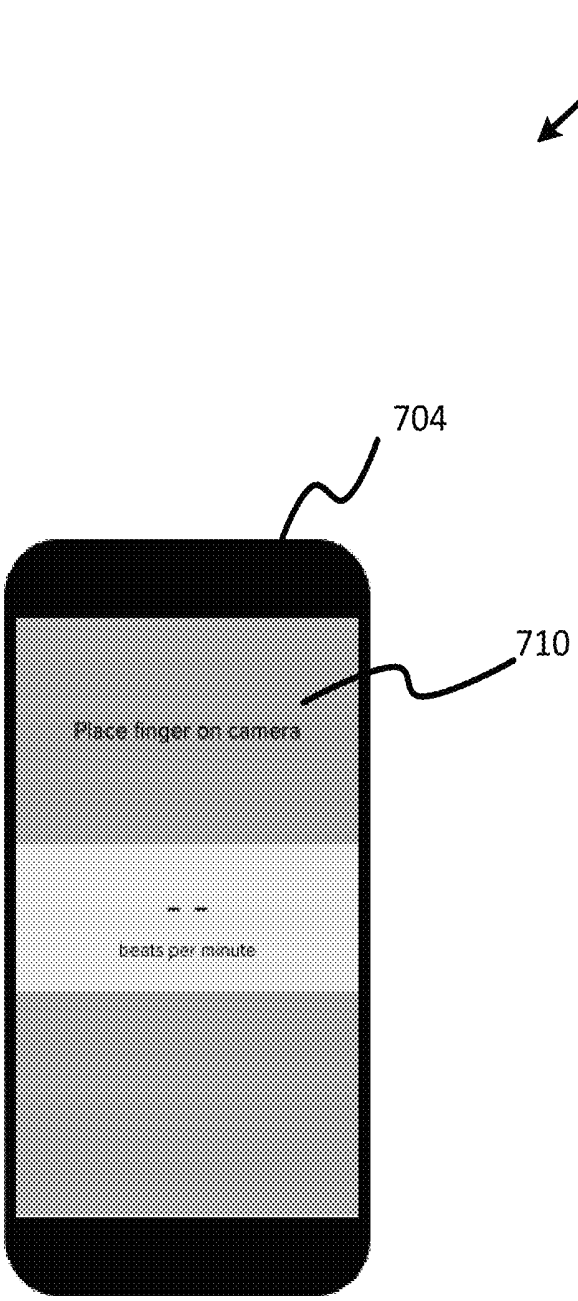

FIG. 8

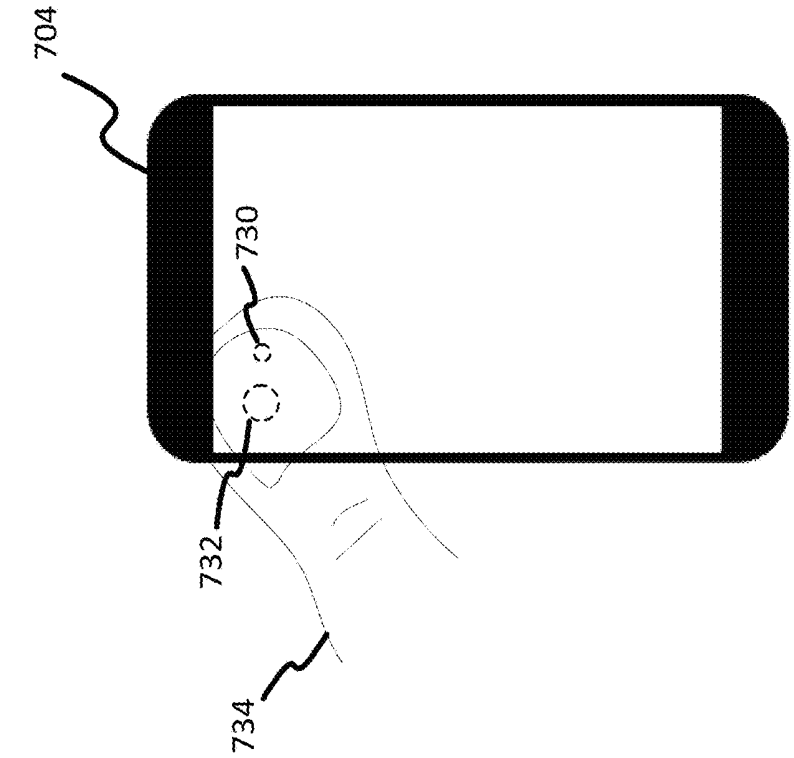

FIG. 9B

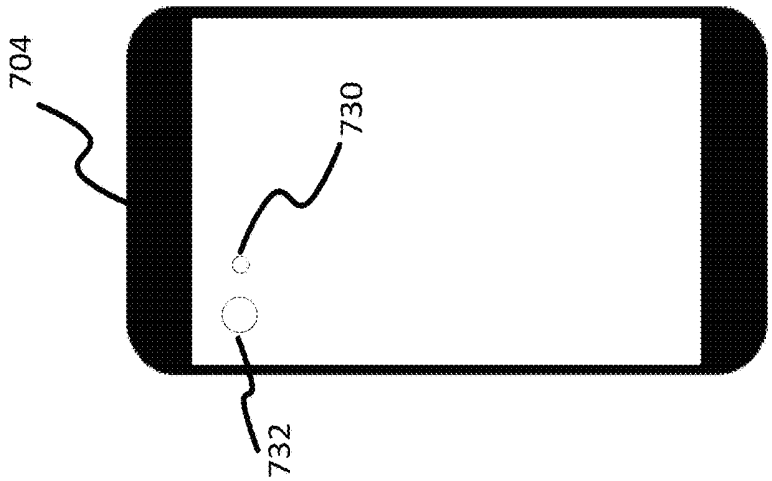

FIG. 9A

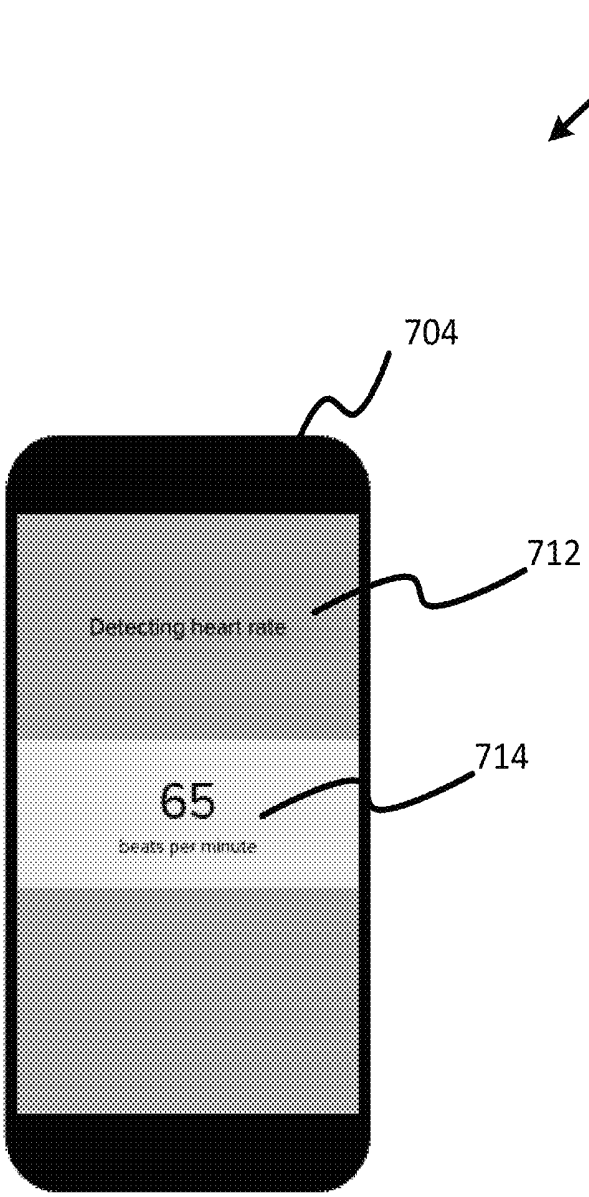

FIG. 10

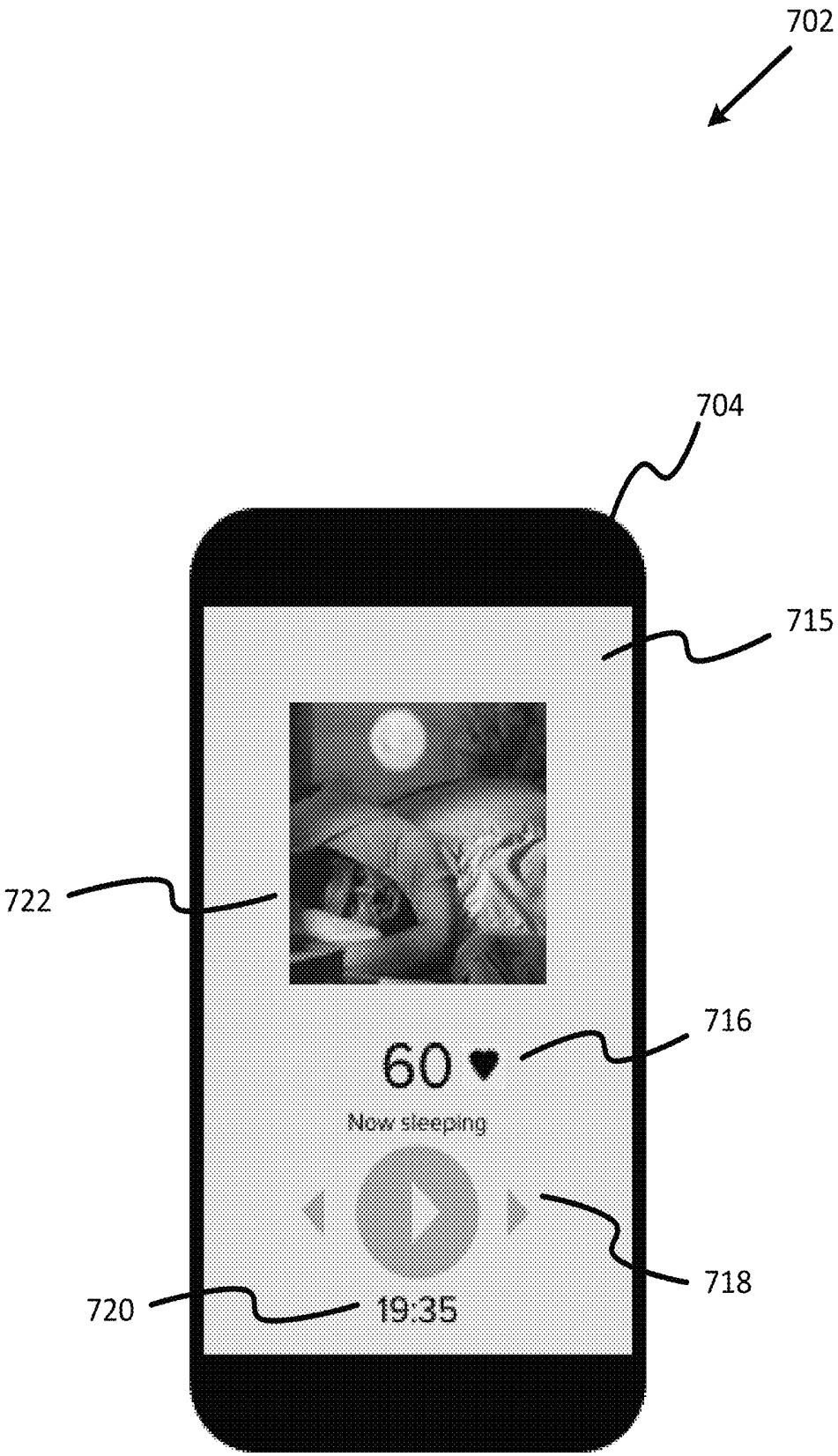

FIG. 11

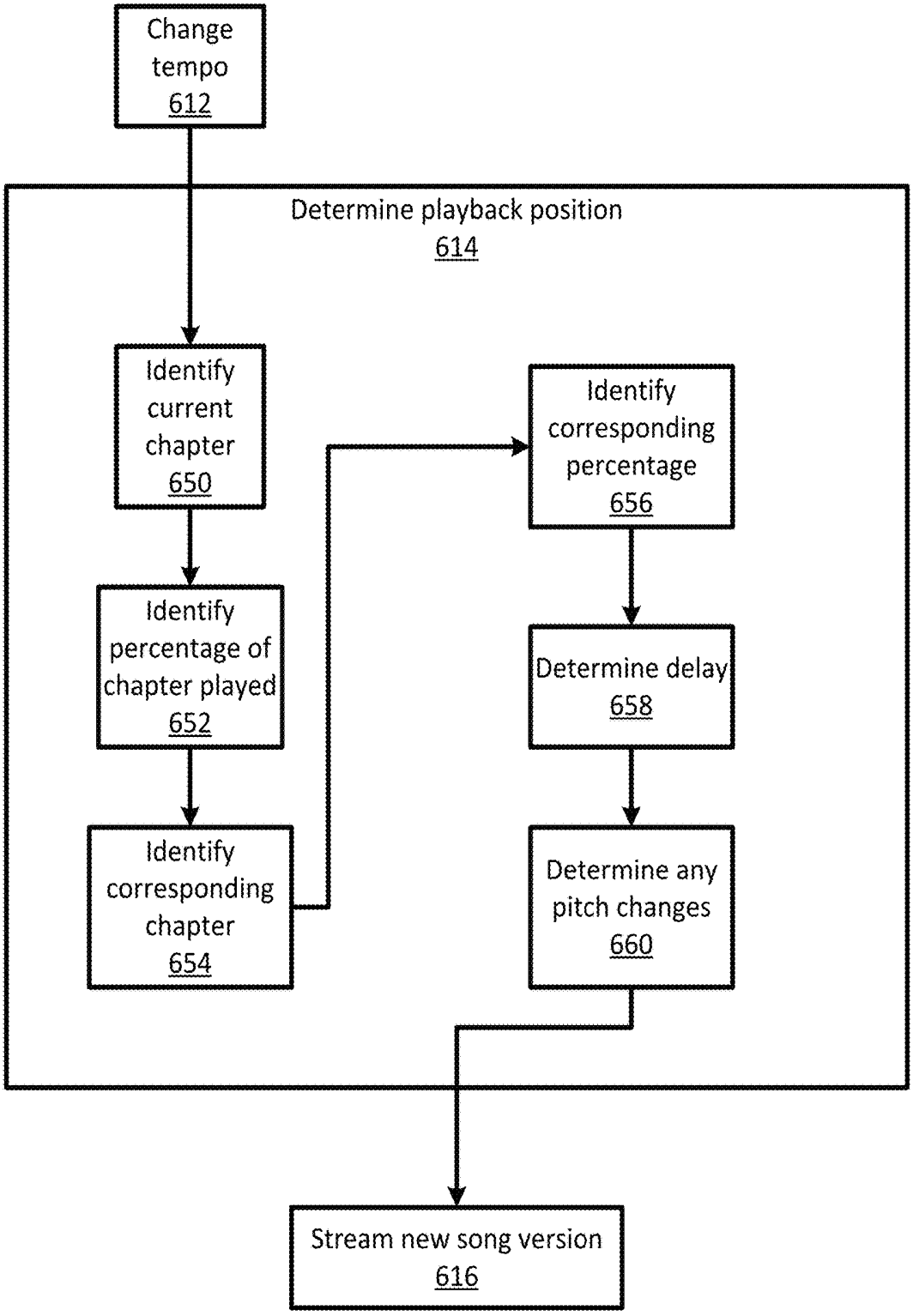
Change tempo 612
Determine playback position 614
Identify current chapter 650
Identify percentage of chapter played 652
Identify corresponding chapter 654
Identify corresponding percentage 656
Determine delay 658
Determine any pitch changes 660
Stream new song version 616

FIG. 12

MEDIA CONTENT SYSTEM FOR ENHANCING REST

BACKGROUND

Some people enjoy listening to music to relax or before sleeping. Common musical genres used to induce relaxation include classical, jazz, and reggae. Other people may enjoy listening to relaxation-focused musical genres, such as downtempo electronic or new age.

SUMMARY

In general terms, this disclosure is directed to a media content system. In some embodiments, and by non-limiting example, the media content system is for enhancing rest.

One aspect is a computing device, where the computing device includes at least one processing device and at least one computer readable data storage device storing instructions. The instructions, when executed by the at least one processing device, cause a media-playback device to: acquire a heart rate, select at least one media content item with a first tempo, where the at least one media content item meets a set of qualification criteria and where the first tempo is based on the heart rate. The instructions also cause the media-playback device to initiate playback of the at least one media content item. Over a period of time during the playback of the at least one media content item, the first tempo is changed to a second tempo, the second tempo being slower than the first tempo. The instructions also cause the media-playback device to initiate playback of a binaural beat at a first frequency during the playback of the at least one media content item and, over the period of time during the playback of the at least one media content item, change the binaural beat to a second frequency.

Another aspect is a method for selecting and playing a song. The method includes, using a computing device: acquiring a heart rate, acquiring a moment selection, selecting at least one song with a first tempo, where the at least one song meets a set of qualification criteria and where the first tempo is based on the heart rate and the moment selection. The method also includes, using the computing device: initiating playback of the at least one song, initiating playback of a binaural beat at a first frequency at least partially during the playback of the at least one song, and causing the binaural beat to change to a second frequency during the playback of the at least one song.

A further aspect is a media server. The media server includes a database, at least one processing device in data communication with the database, and at least one computer readable storage device storing data instructions. The database stores at least a plurality of songs that meet a set of qualification criteria, the set of qualification criteria including: a major key and an absence of lyrics. The instructions, when executed by the at least one processing device, cause the media server to: acquire a heart rate, select a song from the plurality of songs, where the song has a first tempo and wherein the first tempo is based on the heart rate, initiate playback of the song, initiate playback of a binaural beat at a first frequency during the playback of the song, and over a period of time during the playback of the song, change the binaural beat to a second frequency.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates an example system for restful media content selection.

FIG. **2** illustrates a schematic diagram of an example system for heart rate determination and media content selection.

FIG. **3** illustrates a block diagram of an embodiment of the example rest enhancement engine shown in FIG. **2**.

FIG. **4** illustrates a block flow diagram of an embodiment of an example method for rest enhancement.

FIG. **5** illustrates a schematic diagram of an embodiment of a first example track.

FIG. **6** illustrates a schematic diagram of an embodiment of a second example track.

FIG. **7** illustrates a first user interface of an embodiment of an example screen shown on a mobile device.

FIG. **8** illustrates a second user interface of the embodiment of an example screen shown on a mobile device of FIG. **7**.

FIG. **9**A illustrates a rear portion of an example media device.

FIG. **9**B illustrates a user's finger positioned near the rear portion of the example media device shown in FIG. **9**A.

FIG. **10** illustrates a third user interface of the embodiment of an example screen shown on a mobile device of FIG. **7**.

FIG. **11** illustrates a fourth user interface of the embodiment of an example screen shown on a mobile device of FIG. **7**.

FIG. **12** illustrates a block flow diagram of an example method for determining playback position of a second track.

DETAILED DESCRIPTION

Various embodiments will be described in detail with reference to the drawings, wherein like reference numerals represent like parts and assemblies throughout the several views. Reference to various embodiments does not limit the scope of the claims attached hereto. Additionally, any examples set forth in this specification are not intended to be limiting and merely set forth some of the many possible embodiments for the appended claims.

Users of media-playback devices often consume media content while engaging in various activities, including while resting. For example, users may choose to unwind after work or have a massage while listening to relaxing music. Additionally, as an example, users may choose to listen to music before or during a nap or their nighttime rest. Consuming media content may include one or more of listening to audio content, watching video content, or consuming other types of media content. For ease of explanation, the embodiments described in this application are presented using specific examples. For example, audio content (and in particular music) is described as an example of one form of media content. As another example, nighttime sleeping is described as an example of one form of rest. However, it should be understood that the same concepts are equally applicable to other forms of media consumption and to other forms of rest, and at least some embodiments include other forms of media consumption and/or other forms of rest.

FIG. **1** illustrates an example system **100** for restful media content selection. The example system **100** includes a media-playback device **102**, a media-delivery system **104**, and a speaker **108**. The system **100** communicates across a network **106**. Also shown is a user U who desires to listen to relaxing or sleep-related music. Other embodiments can include more or fewer components.

The media-playback device **102** operates to play media content items **105** to produce media output **110**. In some embodiments, the media content items **105** are provided by

the media-delivery system **104** and transmitted to the media-playback device using the network **106**. A media content item **105** is an item of media content, including audio, video, or other types of media content, which may be stored in any format suitable for storing media content. Non-limiting examples of media content items **105** include songs, albums, music videos, movies, television episodes, podcasts, other types of audio or video content, and portions or combinations thereof.

In some embodiments, the media-playback device **102** plays media content for the user U based on the user's input and heart rate. The media-playback device **102** can acquire the user's U heart rate via, for example, user input, peripheral device, or its own hardware and software. The tempo (or rhythm) of music refers to the frequency of the beat and is typically measured in beats per minute (bpm). The beat is the basic unit of rhythm in a musical composition (as determined by the time signature of the music). Accordingly, in the example shown, the user's U heart rate is related to the tempo of the music. Selecting one or more tempos is discussed in more detail with reference to FIGS. **3-6**, below.

Speaker **108** generates audible sounds to audibly reproduce the media content item **105** received from the media-playback device **102** as media output **110**. In some embodiments, speaker **108** is integral with media-playback device **102**. In other embodiments, speaker **108** is a separate component from the media-playback device **102**. In embodiments, media-playback device **102** and speaker **108** communicate wirelessly. For example, speaker **108** is a portable stereo, a clock radio, a stereo receiver, headphones, or a stand-alone speaker. Additionally, speaker **108** can be a device compatible with Spotify Connect™, Bluetooth™, Apple™ AirPlay™, and Google™ Cast™.

FIG. **2** is a schematic illustration of another example of the system **100** for restful media content selection shown in FIG. **1**. In FIG. **2**, the media-playback device **102**, the media-delivery system **104**, and the network **106** are shown. Also shown are the user U and a satellite S.

As noted above, the media-playback device **102** operates to play media content items **105**. In some embodiments, the media-playback device **102** operates to play media content items **105** that are provided (e.g., streamed, transmitted, etc.) by a system external to the media-playback device such as the media-delivery system **104**, another system, or a peer device. Alternatively, in some embodiments, the media-playback device **102** operates to play media content items **105** stored locally on the media-playback device **102**. Further, in at least some embodiments, the media-playback device **102** operates to play media content items **105** that are stored locally as well as media content items **105** provided by other systems.

In some embodiments, the media-playback device **102** is a computing device, handheld entertainment device, smartphone, tablet, watch, wearable device, or any other type of device capable of playing media content. In some embodiments, the media-playback device **102** is a laptop computer, desktop computer, television, gaming console, set-top box, network appliance, blue-ray or DVD player, media player, stereo, or radio. Commercially-available examples include the Apple™ iPod™, Apple™ iPad™, Apple™ iPhone, Apple™ TV™, a Roku™ device such as Roku™ 3, Sony™ Playstation 4™, and Microsoft™ Xbox™.

In at least some embodiments, the media-playback device **102** includes a location-determining device **150**, a touch screen **152**, a processing device **154**, a memory device **156**, a content output device **158**, a heart rate-acquiring device **160**, and a network access device **162**. Other embodiments of the media-playback device **102** may include additional, different, or fewer components than the example shown in FIG. **2**. For example, some embodiments may include a recording device such as a microphone or camera that operates to record audio or video content. As another example, some embodiments do not include one or more of the location-determining device **150** and the touch screen **152**.

The location-determining device **150** is a device that determines the location of the media-playback device **102**. In some embodiments, the location-determining device **150** uses one or more of the following technologies: Global Positioning System (GPS) technology which may receive GPS signals **170** from satellites S, cellular triangulation technology, network-based location identification technology, Wi-Fi positioning systems technology, and combinations thereof.

The touch screen **152** operates to receive an input **172** from a selector (e.g., a finger, stylus etc.) controlled by the user U. In some embodiments, the touch screen **152** operates as both a display device and a user input device. In some embodiments, the touch screen **152** detects inputs based on one or both of touches and near-touches. In some embodiments, the touch screen **152** displays a user interface **164** for interacting with the media-playback device **102**. As noted above, some embodiments do not include a touch screen **152**. Some embodiments include a display device and one or more separate user interface devices. Further, some embodiments do not include a display device.

In some embodiments, the processing device **154** comprises one or more central processing units (CPU). In other embodiments, the processing device **154** additionally or alternatively includes one or more digital signal processors, field-programmable gate arrays, or other electronic circuits.

The memory device **156** operates to store data and instructions. In some embodiments, the memory device **156** stores instructions for a media-playback engine **166** that includes a rest enhancement engine **168**. In some embodiments, the media-playback engine **166** operates to playback media content and the rest enhancement engine **168** operates to select media content for playback based on a heart rate.

The memory device **156** typically includes at least some form of computer-readable media. Computer readable media includes any available media that can be accessed by the media-playback device **102**. By way of example, computer-readable media include computer readable storage media and computer readable communication media.

Computer readable storage media includes volatile and nonvolatile, removable and non-removable media implemented in any device configured to store information such as computer readable instructions, data structures, program modules, or other data. Computer readable storage media includes, but is not limited to, random access memory, read only memory, electrically erasable programmable read only memory, flash memory and other memory technology, compact disc read only memory, blue ray discs, digital versatile discs or other optical storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or any other medium that can be used to store the desired information and that can be accessed by the media-playback device **102**. In some embodiments, computer readable storage media is non-transitory computer readable storage media.

Computer readable communication media typically embodies computer readable instructions, data structures, program modules or other data in a modulated data signal such as a carrier wave or other transport mechanism and

includes any information delivery media. The term "modulated data signal" refers to a signal that has one or more of its characteristics set or changed in such a manner as to encode information in the signal. By way of example, computer readable communication media includes wired media such as a wired network or direct-wired connection, and wireless media such as acoustic, radio frequency, infrared, and other wireless media. Combinations of any of the above are also included within the scope of computer readable media.

The content output device **158** operates to output media content. In some embodiments, the content output device **158** generates media output **110** for the user U. Examples of the content output device **158** include a speaker **108**, an audio output jack, a Bluetooth transmitter, a display panel, and a video output jack. Other embodiments are possible as well. For example, the content output device **158** may transmit a signal through the audio output jack or Bluetooth transmitter that can be used to reproduce an audio signal by a connected or paired device such as headphones or a speaker.

The heart rate-acquiring device **160** operates to acquire a heart rate associated with the user U. In at least some embodiments, the heart rate-acquiring device **160** operates to determine heart rate directly. One example of the heart rate-acquiring device **160** (illustrated and described in more detail with reference to FIGS. **9**A and **9**B) detects the user's U heart rate by having the user U position a finger over a camera lens on the media-playback device **102**. Then, an application stored on media-playback device **102** analyzes the images received to determine the pulse rate (heart rate) of user U. In some embodiments, the application detects changes in color and associates the rate of change in color to the movement of blood through the finger, which is related to the user's U pulse rate. Additionally, some media-playback devices **102** currently available include a heart rate monitor, such as the Samsung Galaxy S5.

Alternatively, the heart rate-acquiring device **160** operates to receive data representing a heart rate associated with the user U. For example, in some embodiments, the heart rate-acquiring device **160** operates to receive data from a watch, wrist band, chest strap, or other device for determining or measuring heart rate. Further, in some embodiments, the heart rate-acquiring device **160** operates to receive a heart rate value input by the user U or another person.

The network access device **162** operates to communicate with other computing devices over one or more networks, such as the network **106**. Examples of the network access device include wired network interfaces and wireless network interfaces. Wireless network interfaces includes infrared, BLUETOOTH® wireless technology, 802.11a/b/g/n/ac, and cellular or other radio frequency interfaces in at least some possible embodiments.

The network **106** is an electronic communication network that facilitates communication between the media-playback device **102** and the media-delivery system **104**. An electronic communication network includes a set of computing devices and links between the computing devices. The computing devices in the network **106** use the links to enable communication among the computing devices in the network **106**. The network **106** can include routers, switches, mobile access points, bridges, hubs, intrusion detection devices, storage devices, standalone server devices, blade server devices, sensors, desktop computers, firewall devices, laptop computers, handheld computers, mobile telephones, and other types of computing devices.

In various embodiments, the network **106** includes various types of links. For example, the network **106** can include wired and/or wireless links, including Bluetooth, ultra-wideband (UWB), 802.11, ZigBee, cellular, and other types of wireless links. Furthermore, in various embodiments, the network **106** is implemented at various scales. For example, the network **106** can be implemented as one or more local area networks (LANs), metropolitan area networks, subnets, wide area networks (such as the Internet), or can be implemented at another scale. Further, in some embodiments, the network **106** includes multiple networks, which may be of the same type or of multiple different types.

The media-delivery system **104** comprises one or more computing devices and operates to provide media content items **105** to the media-playback devices **102** and, in some embodiments, other media-playback devices as well. In some embodiments, the media-delivery system **104** includes a media server **180** and a rest enhancement server **182**. In at least some embodiments, the media server **180** and the rest enhancement server **182** are provided by separate computing devices. In other embodiments, the media server **180** and the rest enhancement server **182** are provided by the same one or more computing devices. Further, in some embodiments, one or both of the media servers **180** and the rest enhancement server **182** are provided by multiple computing devices. For example, the media server **180** and the rest enhancement server **182** may be provided by multiple redundant servers located in multiple geographic locations.

The media server **180** operates to transmit stream media **218** to media-playback devices such as the media-playback device **102**. In some embodiments, the media server **180** includes a media server application **184**, a processing device **186**, a memory device **188**, and a network access device **190**. The processing device **186**, memory device **188**, and network access device **190** may be similar to the processing device **154**, memory device **156**, and network access device **162** respectively, which have each been previously described.

In some embodiments, the media server application **184** operates to stream music or other audio, video, or other forms of media content. The media server application **184** includes a media stream service **194**, a media data store **196**, and a media application interface **198**. The media stream service **194** operates to buffer media content such as media content **206**, **208**, and **210**, for streaming to one or more streams **200**, **202**, and **204**.

The media application interface **198** can receive requests or other communication from media-playback devices or other systems, to retrieve media content items **105** from the media server **180**. For example, in FIG. **2**, the media application interface **198** receives communication **234** from the media-playback engine **166**.

In some embodiments, the media data store **196** stores media content items **210**, media content metadata **212**, and playlists **214**. The media data store **196** may comprise one or more databases and file systems. Other embodiments are possible as well. As noted above, the media content items **210** may be audio, video, or any other type of media content, which may be stored in any format for storing media content.

The media content metadata **212** operates to provide various information associated with the media content items **210**. In some embodiments, the media content metadata **212** includes one or more of title, artist name, album name, length, genre, mood, era, etc. The playlists **214** operate to identify one or more of the media content items **210**. In some embodiments, the playlists **214** identify a group of the media

content items **210** in a particular order. In other embodiments, the playlists **214** merely identify a group of the media content items **210** without specifying a particular order. Some, but not necessarily all, of the media content items **210** included in a playlist **214** are associated with a common characteristic such as a common genre, mood, or era.

The rest enhancement server **182** operates to provide rest enhancement-specific information about media content items to media-playback devices. In some embodiments, the rest enhancement server **182** includes a rest enhancement server application **220**, a processing device **222**, a memory device **224**, and a network access device **226**. The processing device **222**, memory device **224**, and network access device **226** may be similar to the processing device **154**, memory device **156**, and network access device **162** respectively, which have each been previously described.

In some embodiments, rest enhancement server application **220** operates to transmit information about the suitability of one or more media content items for playback during a particular rest enhancement. The rest enhancement server application **220** includes a rest enhancement interface **228** and a rest enhancement media metadata store **230**.

In some embodiments, the rest enhancement server application **220** provides a list of media content items at a particular tempo to a media-playback device in response to a request that includes a particular heart rate value. Further, in some embodiments, the media content items included in the returned list are particularly relevant for the mood and rest enhancement in which the user is engaged (for example, if the user is taking a power nap, the returned list of media content items may include only media content items that have been identified as being useful for power naps).

The rest enhancement interface **228** operates to receive requests or other communication from media-playback devices or other systems, to retrieve information about media content items from the rest enhancement server **182**. For example, in FIG. **2**, the rest enhancement interface **228** receives communication **234** from the media-playback engine **166**.

In some embodiments, the rest enhancement media metadata store **230** stores rest enhancement media metadata **232**. The rest enhancement media metadata store **230** may comprise one or more databases and file systems. Other embodiments are possible as well.

The rest enhancement media metadata **232** operates to provide various information associated with media content items, such as the media content items **210**. In some embodiments, the rest enhancement media metadata **232** provides information that may be useful for selecting media content items for playback during a rest enhancement. For example, in some embodiments, the rest enhancement media metadata **232** stores restability scores for media content items that correspond to the suitability of particular media content items for playback during resting or relaxation. As another example, in some embodiments, the rest enhancement media metadata **232** stores timestamps (e.g., start and end points) that identify portions of media content items that are particularly well-suited for playback during rest enhancement.

Each of the media-playback device **102** and the media-delivery system **104** can include additional physical computer or hardware resources. In at least some embodiments, the media-playback device **102** communicates with the media-delivery system **104** via the network **106**.

Although in FIG. **2** only a single media-playback device **102** and media-delivery system **104** are shown, in accordance with some embodiments, the media-delivery system **104** can support the simultaneous use of multiple media-playback devices, and the media-playback device can simultaneously access media content from multiple media-delivery systems. Additionally, although FIG. **2** illustrates a streaming media based system for heart rate determination and media content selection, other embodiments are possible as well. For example, in some embodiments, the media-playback device **102** includes a media data store **196** and the media-playback device **102** is configured to perform heart rate determination and media content selection without accessing the media-delivery system **104**. Further in some embodiments, the media-playback device **102** operates to store previously streamed media content items in a local media data store.

In at least some embodiments, the media-delivery system **104** can be used to stream, progressively download, or otherwise communicate music, other audio, video, or other forms of media content items to the media-playback device **102** based on a heart rate acquired by the heart rate-acquiring device **160** of the media-playback device **102**. In accordance with an embodiment, a user U can direct the input **172** to the user interface **164** to issue requests, for example, to play a selected location-based playlist on the media-playback device **102** or to tag a media content item with location data.

FIG. **3** is a schematic block diagram of the rest enhancement engine **168**. The embodiment shown includes a heart rate acquisition engine **270**, a moment engine **272**, a media content engine **274**, a track tempo engine **276**, and a binaural beat engine **278**. Other embodiments can include more or fewer components.

The heart rate acquisition engine **270** operates to acquire a user's U heart rate. Example methods performed by some embodiments of the heart rate acquisition engine **270** are illustrated and described with reference to at least FIG. **4**.

The moment engine **272** operates to receive a user's U selection of a moment and determine one or more tracks corresponding to the selected moment. Example methods performed by some embodiments of the moment engine **272** are illustrated and described with reference to at least FIG. **4**.

The media content engine **274** operates to select media for playback during rest enhancement. Example methods performed by some embodiments of media content engine **274** are illustrated and described with reference to at least FIG. **4**.

The track tempo engine **276** operates to monitor and adjust the tempo of a track playing during rest enhancement. In embodiments, track tempo engine changes the tempo by transitioning between tracks having different tempos. Example methods performed by some embodiments of track tempo engine **276** are illustrated and described with reference to at least FIG. **4**.

The binaural beat engine **278** operates to control any binaural beats played by media-playback device **102**. Example methods performed by some embodiments of binaural beat engine **278** are illustrated and described with reference to at least FIG. **4**.

FIG. **4** is a flow chart illustrating an example method **300** for rest enhancement. As used herein, rest enhancement includes non-sleep activities, such as relaxation, meditation, or an activity such as receiving a massage. The example method **300** includes receiving a moment selection (operation **302**), acquiring a heart rate (operation **304**), identifying a track (operation **306**), initiating track playback (operation **308**), initiating binaural playback (operation **310**), changing tempo (operation **312**), changing binaural frequency (operation **314**), determining whether additional playback is

required (operation **315**), and ending playback (operation **316**). Other embodiments can include more or fewer operations.

The example method **300** begins by receiving a moment selection (operation **302**). Other embodiments do not include moment selection (operation **302**). During operation **302**, the media-playback device **102** receives a user's selection of a moment from a collection of moments. For example, moments can include bedtime, power nap, long nap, airplane, kids, commuting, meditation, massage, and prayer.

Various parameters are associated with each moment, such as music type, track playback duration, and additional white noise. For example, white noise can be added to the track playback when the moment received is likely to be associated with extraneous, ambient noise, such as when on an airplane or commuting. Also, as an example, tracks with particular musical instruments can be selected depending upon the moment received.

In some embodiments, the media-playback device **102** presents, and receives a selection of, a content theme, such as nature, symphony, electronic, ambient, atmospheric, white noise, ocean, etc. This selection further defines the types of tracks to play.

In embodiments, some moments include a wake-up component. For example, the commuting moment prompts the user to enter the time until wake up. A user commuting on public transportation, such as a bus, subway, light rail, etc., can be woken up prior to their stop after a period of time has elapsed.

In embodiments, a moment is identified in operation **302** based on contextual information. For example, when a user initiates a sleep function on the mobile device, global positioning satellite (GPS) data may indicate that the user is on a known public transportation route, such as a light rail line, and is moving. Additionally, the time of day might be during normal commuting hours. In that instance, a commuting moment is inferred from the context and offered to the user. As another example, the GPS data may indicate that the user is near his or her home, the device is not moving, and the time is near a normal bedtime. In that instance, a bedtime moment is inferred from the context and offered to the user. Other data can be used to infer context and identify moments.

Example method **300** can also begin by acquiring a heart rate (operation **304**). As discussed above with reference to FIG. **2**, the media-playback device **102** acquires the heart rate from an external or internal heart rate-acquiring device. Additionally, the user's heart rate can be acquired by the user manually entering their heart rate. If, after acquiring the user's heart rate (operation **304**), a moment has not been received, the system **100** can prompt the user to select a moment.

Based on the received moment selection (operation **302**) and the acquired heart rate (operation **304**), a track is next identified (operation **306**). During operation **306**, one or more possible tracks are selected from available tracks and filtered according to heart rate and moment tags.

For example, a heart rate of 65 beats per minute (bpm) is received during operation **304** and a selection of a "bedtime" moment is received during operation **302**. Based on the heart rate, all tracks not within +/−10% of 65 bpm are filtered out (i.e., those below about 58 bpm and those above about 72 bpm). Additionally, the tracks can be filtered by eliminating any track without a "bedtime" tag, where the tracks stored on media-delivery system **104** have one or more tags.

In embodiments where additional selection criteria are received, those criteria, such as a time duration of the track, can also be used to select applicable tracks.

After qualifying tracks are identified (operation **306**), track playback is initiated (operation **308**). The track played is a track with a tempo matching the heart rate acquired in operation **304**. In embodiments, the system can slow down playback of a track that has a slightly higher tempo than the user's heart rate. For example, if the user's heart rate is 65 bpm, a track with a tempo of 70 bpm may be selected but slowed down to be played at 65 bpm. Then the tempo of the track is slowed until playback ends (operation **316**).

Alternatively, a track is played that has a tempo slower than the user's heart rate. For example, if the user's heart rate is 65 bpm, a track with a tempo of 60 bpm is played (operation **308**). That track can be played at that tempo until playback ends (operation **316**) or the track tempo can be further slowed down during playback.

In some embodiments, a track from the filtered list of tracks is randomly selected for playback. Alternatively, all tracks meeting the filter criteria are presented to the user and the user selects a particular track for playback.

During track playback (operation **308**), the audio of the track is played for the user through one or more speakers in the media-playback device, or the audio is played through one or more speakers in communication with the media-playback device.

In some embodiments, binaural beat playback (operation **310**) is initiated concurrent with, or shortly after, track playback initiation (operation **308**). Generally, binaural beats are perceived sounds created by playback of two different tones at different frequencies. Generally, "binaural" refers to the difference in frequencies of each tone. For example, if a tone with a frequency of 300 Hz was played in one ear, and a second tone with a frequency of 310 Hz was played in the other ear, then the binaural beat would have a frequency of 10 Hz.

At the beginning of binaural beat playback (operation **310**), alpha binaural beats are played, which are typically close to the user's starting dominant frequency. Generally, alpha binaural beats have a frequency of about 7 Hz to about 13 Hz. In embodiments, a binaural beat of 12 Hz is initially played back during operation **310**. In embodiments, the binaural beat is mixed with the track audio. In other embodiments, the track already includes the binaural beat.

In some embodiments, during track playback, the tempo is changed (operation **312**) and the binaural frequency is changed (operation **314**). In embodiments, these changes occur at the same relative rate.

In some embodiments, only the binaural frequency is changed (operation **314**), i.e., the tempo remains constant. That is, at least some embodiments of example method **300** do not include changing tempo operation **312**. In those embodiments, the track playback begins at a tempo that is less than the acquired heart rate by about 4%; about 5%; about 6%; about 7%; about 8%; about 9%; about 10%; about 11%; or about 12%. For example, if a heart rate of 60 bpm is acquired in operation **304**, then the track is played at 55 bpm, or about 8% less than the acquired heart rate.

Operation **312** includes decreasing the tempo of the track by about 4%; about 5%; about 6%; about 7%; about 8%; about 9%; about 10%; about 11%; or about 12%. These decreases in tempo can be achieved in multiple ways, such as mechanically slowing a track, playing multiple tracks with different tempos, playing different versions of the same track recorded at different tempos, or playing a track whose tempo decreases. As an example, if heart rate acquired in

operation **304** is 65 bpm, and a track with a tempo of 65 bpm is played in operation **308**, then during playback the tempo is slowed to 60 bpm.

In some embodiments, more than one track is played before ending playback (operation **316**). There, the track tempo can be decreased with each new track played, such as first playing a track with a tempo of 65 bpm, then playing a track with a tempo of 60 bpm, and then playing a track with a tempo of 55 bpm.

In some embodiments, the track selected for playback slowly has a decreasing tempo, that is, the tempo at the beginning of the track is faster than the tempo at the end of the track.

In some embodiments, a given track is recorded at a plurality of different tempos. For example, a track with a particular melody is recorded at each of 45 bpm, 50 bpm, 55 bpm, 60 bpm, 65 bpm, 70 bpm, and 75 bpm. Then, during playback, the tempo of the track is changed by cross-fading between tracks. For example, a track with a tempo of 65 bpm is initially played and slowed to 62 bpm. Then that track is cross-faded with a second track having a tempo of 60 bpm that has been sped up to 62 bpm. After cross-fading, the second track is slowed down to 60 bpm or slower. An example of changing the tempo is shown and described in detail with reference to FIG. **12**, below.

As the track is played (operation **308**), the binaural frequency is changed (operation **314**). As mentioned above, an alpha binaural beat is played at the beginning of track playback. Then, during track playback, the binaural beat is changed (operation **314**) to be theta binaural beats, that is, binaural beats in the 4 Hz to 7 Hz range, for example.

In some embodiments, the track selected for playback in operation **306** is not long enough to play the entire duration of restful time. After the track ends, or is close to ending, operation **315** determines whether additional playback is required. For example, if the moment has a 20-minute playback time period, and the track ends after 8 minutes, then 12 more minutes of track playback are needed. If additional track playback is needed, then the example method **300** may return to operation **306** to select another track. The example method **300** continues this loop until there has been enough track playback for the given moment. In some embodiments, the track is extended by finding loop-able sections and seamlessly jumping back in time until the entire track plays for the requested duration. If no additional playback is required, then playback ends (operation **316**).

FIG. **5** is a schematic illustration of an example track **402** during music playback. The beginning of track **402** corresponds to the initiation of track playback (operation **308**). The end of track **402** corresponds to end of playback (operation **316**). That is, in this example, only a single track **402** is played during the entire restful period.

Track **402** has a tempo A at the beginning of the track. As discussed with respect to example method **300**, in one example the tempo A corresponds to a user's heart rate. During track playback, the tempo of track **402** is changed to have N tempos, where N is greater than or equal to 1. As an example, tempo A is 72 bpm, tempo B is 68 bpm, and tempo N is 64 bpm.

As shown in FIG. **5**, the track can be played at a first tempo, tempo A, for a given period of time. Then, the track tempo is adjusted to a new tempo, tempo B, which plays for a second given period of time. In some embodiments, as discussed above, a given track **402** may have multiple recordings at different tempos. In those embodiments, the track tempo is altered by cross-fading to a different version of the same track recorded at a different tempo.

In other embodiments, track tempo A is changed throughout playback at a constant rate. For example, the track tempo is reduced by 0.4 bpm every minute. In embodiments where the track playback duration is 20 minutes, then, the track tempo would be 8 bpm slower at end track playback (operation **316**).

Also shown in FIG. **5** are the binaural beats, binaural A, binaural B, up to binaural N, played during track **402**. As shown, a plurality of binaural beats are played during track playback and the beats are changed at different times than the tempo is changed. In some embodiments, the initial binaural beat A is decreased at a constant rate, for example, at 0.3 Hz per minute. In other embodiments, the binaural beat frequency is altered by a given amount every time period, such as a 1 Hz decrease every 3 minutes.

FIG. **6** illustrates an embodiment of an example track **502** during music playback. In the embodiment shown, a single track is played from initiating track playback (operation **308**) until ending track playback (operation **316**).

As shown, track **502** is played at the same tempo, Tempo A, throughout playback. This tempo corresponds to the acquired heart rate of the user. For example, if the acquired user heart rate is 75 bpm, then tempo A is lower than that heart rate, for example, 70 bpm. In other embodiments, multiple tracks can be played at the same tempo, tempo A.

Also shown in FIG. **6** is the binaural beats, binaural A, binaural B, up to binaural N, played during track **502**. As shown, a plurality of binaural beats are played during track playback. In some embodiments, the beats are changed at different times than the tempo is changed. In some embodiments, the initial binaural beat A is decreased at a constant rate, for example, at 0.3 Hz per minute. In other embodiments, the binaural beat frequency is altered by a given amount every time period, such as a 1 Hz decrease every 3 minutes.

FIGS. **7**, **8**, **10**, and **11** illustrate an example series **702** of user interface screens shown on a mobile device **704** during example method **300**, illustrated and described with reference to FIG. **3**. The mobile device **704** is, for example, a smart mobile phone, a tablet computer, or a smart watch.

FIG. **7** illustrates an embodiment of a moment selection screen **706**. The moment selection screen **706** includes instructions **707** and moments **708**. Example moments **708** shown include bedtime, power nap, airplane, and for kids. The user can scroll down to reveal additional moments **708**, such as those listed above with reference to FIGS. **1-6**.

FIG. **8** indicates an embodiment of a heart rate acquisition screen **710**. As discussed above, mobile device **704** can acquire the user's heart rate using internal hardware and/or from external devices. In the embodiment shown, heart rate acquisition screen **710** instructs the user to place his or her finger on the mobile device's camera.

FIGS. **9**A and **9**B illustrate an embodiment of the example mobile device **704** acquiring a heart rate. FIG. **9**A illustrates a surface of example mobile device **704** that includes a camera **732** and light source **730**. Camera **732** and light source **730** are positioned relatively adjacent to each other so they can both be covered by a single finger at the same time. Also, camera **732** and light source **730** are in communication with the processing device and memory device of the mobile device **704**.

FIG. **9**B illustrates a user's finger **734** positioned over the camera **732** and light source **730**. During heart rate acquisition, the light source **730** generates light and illuminates the user's finger. The camera **732** receives the light from the

user's illuminated finger. The mobile device **704** analyzes the images to determine a heart rate of the user by tracking color changes in the user's illuminated finger.

The heart rate acquisition screen **710** can additionally include instructions for the user to hold his or her finger **734** over the camera **732** and light source **730** until a heart rate is acquired. Upon heart rate acquisition or determination, the mobile device **704** can provide visual, audio, or haptic notification that the user can remove his or her finger **734**.

FIG. **10** illustrates an embodiment of a heart rate display screen **712**. The heart rate display screen **712** indicates the acquired user heart rate **714**, shown in beats per minute.

FIG. **11** illustrates an embodiment of a playback screen **715**. The playback screen **715** includes a tempo display **716**, a track navigation **718** section, a playback time indicator **720**, and a moment indicator **722**. Playback screen **715** is displayed on mobile device **704** after acquiring a heart rate and determining a moment. Other embodiments can include more or fewer components, such as options for changing the moment or tempo.

The tempo display **716** shows the tempo of the current track. The track navigation **718** section includes user-selectable controls that enable the user to start, stop, or pause the track, to select a different track, to return to the start of the track, or to return to the previous track.

Playback time indicator **720** shows the time remaining until playback ends. Alternatively, playback time indicator **720** shows the time elapsed since playback began. Moment indicator **722** displays a representation of the moment selected by the user.

FIG. **12** illustrates an example method **614** of determining a playback position. In this example, the method **614** includes operations **650**, **652**, **654**, **656**, **658**, and **660**. Also shown is a change tempo input (operation **612**) and a stream new song version operation **616**. In some embodiments, the change tempo input (operation **612**) corresponds to the change tempo operation **312** shown and discussed with reference to FIG. **3**. Other embodiments can include more or fewer operations.

The tracks played during the example method **614** shown in FIG. **12** have more than one version recorded at different tempos. Each track version can include one or more chapters and the chapters are consistent across track versions for a particular track.

After receiving a change tempo input (operation **612**), a chapter of the currently-playing track version is identified (operation **650**). Operation **650** can include retrieving metadata, for example, chapters, duration of the track version, duration of the chapters, etc., about the track versions. Additionally, operation **650** can include retrieving metadata that includes the relationship between related track versions. For example, a playback position of the currently-playing track version is 14:30, or fourteen minutes thirty seconds, and is in chapter 4.

Next, the percentage of the chapter played is identified (operation **652**). Using the example above, the playback position of the currently-playing track version is 14:30 and is in chapter four, which started at 12:00 and ends at 16:30 in the track version. That is, the current chapter is 4:30 in length and 2:30 have played, thus the percentage of the chapter played is about 56%. In some embodiments where the track versions are not divided into chapters, the percentage of the track version played can be determined after operation **610**, for example, rather than the percentage of the chapter (operation **652**).

After determining the current chapter and percentage of the chapter played, a corresponding chapter (operation **654**) and corresponding percentage of the chapter (operation **656**) are determined for the next track version. Using the example discussed with reference to operation **650**, the currently-playing track version is in chapter four. Thus, the corresponding chapter for beginning playback of the next track version is chapter four.

Next, about 56% of chapter 4 has been played in the currently-playing track version. Thus, playback of the next track version will begin at about 56% of chapter 4 of the next track version. If the next track version's chapter 4 starts at 11:00 and ends at 15:00, which is four minutes in length, then playback will begin about two minutes and fourteen seconds into the fourth chapter, or at about 13:14 of the entire track version. This starting position might be modified depending on any delay or cross-fading determination in operation **658**.

Any delays to accommodate transitioning to the next track version are determined in operation **658**. For example, any cross-fading times can be accounted for during operation **658**.

Also, the beats of the currently-playing track version and the next track version can be aligned. As an example, an alignment includes any adjustments to make the first beat of each measure in the currently-playing track version align with the first beat of each measure in the next track version. This alignment can include temporarily adjusting the tempo of the currently-playing track version, the tempo of the next track version, or both, such that they match when the next track version is streamed.

After determining the playback location of the next track version, any pitch changes are next determined (operation **660**). For example, when transitioning from a currently-playing track version at a tempo of 65 bpm to a next track version at a tempo of 55 bpm, the pitch of the next track version is lowered during the cross-fading. This pitch change can potentially correct any changes in pitch when the tempo of one or both of the track versions is adjusted. After or during cross-fading, the pitch is increased again, for example, over about 0.5 second, about 1 second, about 2 seconds, about 3 seconds, about 4 seconds, or about 5 seconds until it is back at the original pitch. Alternatively, or in combination, the pitch of the currently-playing track version is increased during cross-fading.

In some embodiments, pitch is managed, for example, by decreasing tempo without decreasing pitch, selecting only songs that match in pitch, or slowly adapting the pitch over a long period of time to detune in a manner unnoticeable to the listener. Each of these transformations can be continuous, as opposed to steps, over periods of time, including tempo and pitch. Further, crossfading can also include beat-matching.

The various embodiments described above are provided by way of illustration only and should not be construed to limit the claims attached hereto. Those skilled in the art will readily recognize various modifications and changes that may be made without following the example embodiments and applications illustrated and described herein, and without departing from the true spirit and scope of the following claims.

The invention claimed is:

1. A computing device comprising:

at least one processing device; and

at least one computer readable data storage device storing instructions that, when executed by the at least one processing device, cause a media-playback device to:

acquire a heart rate;

select at least one media content item with a first tempo,

wherein the at least one media content item meets a set of qualification criteria, the set of qualification criteria including: a major key and an absence of lyrics; and

wherein the first tempo is based on the heart rate;

initiate playback of the at least one media content item;

over a period of time during the playback of the at least one media content item, change the first tempo to a second tempo, the second tempo being slower than the first tempo;

initiate playback of a binaural beat at a first frequency during the playback of the at least one media content item; and

over the period of time during the playback of the at least one media content item, change the binaural beat to a second frequency.

2. The computing device of claim **1**, wherein playback of the at least one media content item continues for at least 15 minutes.

3. The computing device of claim **2**, wherein the media-playback device acquires the heart rate.

4. The computing device of claim **2**, wherein the media-playback device acquires the heart rate from an external device.

5. The computing device of claim **1**, further comprising instructions that, when executed by the at least one processing device, cause the media-playback device to:

receive an environment selection; and

based on the environment selection, initiate playback of white noise.

6. The computing device of claim **5**, wherein the first frequency is about 12 Hertz (Hz) and wherein the second frequency is about 7 Hz.

7. The computing device of claim **1**, wherein the period of time is at least about 90 seconds.

8. The computing device of claim **1**, wherein the period of time is at least about 5 minutes.

9. A method for selecting and playing a song, the method comprising:

using a computing device:

acquiring a heart rate;

acquiring a moment selection;

selecting at least one song with a first tempo,

wherein the at least one song meets a set of qualification criteria; and

wherein the first tempo is based on the heart rate and the moment selection;

initiating playback of the at least one song;

initiating playback of a binaural beat at a first frequency at least partially during the playback of the at least one song; and

causing the binaural beat to change to a second frequency during the playback of the at least one song.

10. The method of claim **9**, further comprising: during the playback of the at least one song, decreasing continuously the first tempo to a second tempo, wherein playback of the at least one song continues for at least 15 minutes.

11. The method of claim **10**, wherein the set of qualification criteria includes: a major key and an absence of lyrics.

12. The method of claim **11**, wherein the first frequency is about 12 Hertz (Hz) and wherein the second frequency is about 7 Hz.

13. The method of claim **9**, wherein the first tempo matches the heart rate.

14. The method of claim **13**, wherein the set of qualification criteria includes: a major key and an absence of lyrics in the song.

15. A media server comprising:

a database storing at least a plurality of songs that meet a set of qualification criteria, the set of qualification criteria including: a major key and an absence of lyrics;

at least one processing device in data communication with the database; and

at least one computer readable storage device storing data instructions which, when executed by the at least one processing device, cause the media server to:

acquire a heart rate;

select a song from the plurality of songs, wherein the song has a first tempo and wherein the first tempo is based on the heart rate;

initiate playback of the song;

initiate playback of a binaural beat at a first frequency during the playback of the song; and

over a period of time during the playback of the song, change the binaural beat to a second frequency.

16. The media server of claim **15**, wherein the instructions further cause the media server to:

over the period of time during the playback of the song, change the first tempo to a second tempo, the second tempo being slower than the first tempo;

receive a moment selection;

based on the moment selection, initiate playback of white noise in addition to the playback of the song;

wherein playback of the song continues for at least 10 minutes; and

wherein a media-playback device acquires the heart rate, the media-playback device being in communication with the media server.

17. The media server of claim **16**, wherein the first frequency is about 12 Hertz (Hz) and wherein the second frequency is about 7 Hz; and wherein the period of time is at least about 90 seconds.

18. The media server of claim **17**, wherein the first tempo matches the heart rate.

19. The media server of claim **18**, wherein the song has a first duration; and wherein a second song is selected for playback when the first duration is less than 10 minutes.

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专利名称(译)	媒体内容系统，以增强休息		
公开(公告)号	US10387106	公开(公告)日	2019-08-20
申请号	US15/090184	申请日	2016-04-04
[标]申请(专利权)人(译)	斯波帝范公司		
申请(专利权)人(译)	Spotify的AB		
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IPC分类号	G06F3/16 A61B5/00 A61B5/024 A61M21/02 H04N21/422 A61M21/00		
CPC分类号	G06F3/165 A61B5/02416 A61B5/486 A61M21/02 H04N21/42201 A61B5/024 G10H2210/076 A61B5/6898 A61M2021/0027 A61M2021/0061 A61M2205/3553 A61M2205/3592 A61M2205/505 A61M2205/52 A61M2205/581 A61M2205/582 A61M2205/584 A61M2230/06 G10H2210/021		
代理机构(译)	商户德律P.C.		
审查员(译)	WARREN，戴维家		
其他公开文献	US20170286536A1		
外部链接	Espacenet		

摘要(译)

媒体回放设备获取心率，选择具有第一速度的歌曲，并启动歌曲的回放。该歌曲符合一组资格标准，并且第一节奏基于心率，例如等于或小于心率。媒体回放设备还以第一频率启动双耳节拍的回放。在一段时间内，双耳节拍的第一频率被改变为第二频率。在一段时间内，第一个速度也可以改变为第二速度，其中第二速度比第一速度慢。