US 20220038820A1

(19) United States

(12) Patent Application Publication

GRAHAM et al.

(10) Pub. No.: US 2022/0038820 A1

(43) Pub. Date: Feb. 3, 2022

(54) **WIRELESS HEADPHONE INTERACTIONS**

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(21) Appl. No.: **17/503,145**

(22) Filed: **Oct. 15, 2021**

Related U.S. Application Data

(63) Continuation of application No. 16/550,139, filed on Aug. 23, 2019, now Pat. No. 11,153,687.

(60) Provisional application No. 62/722,751, filed on Aug. 24, 2018.

Publication Classification

(51) **Int. Cl.**

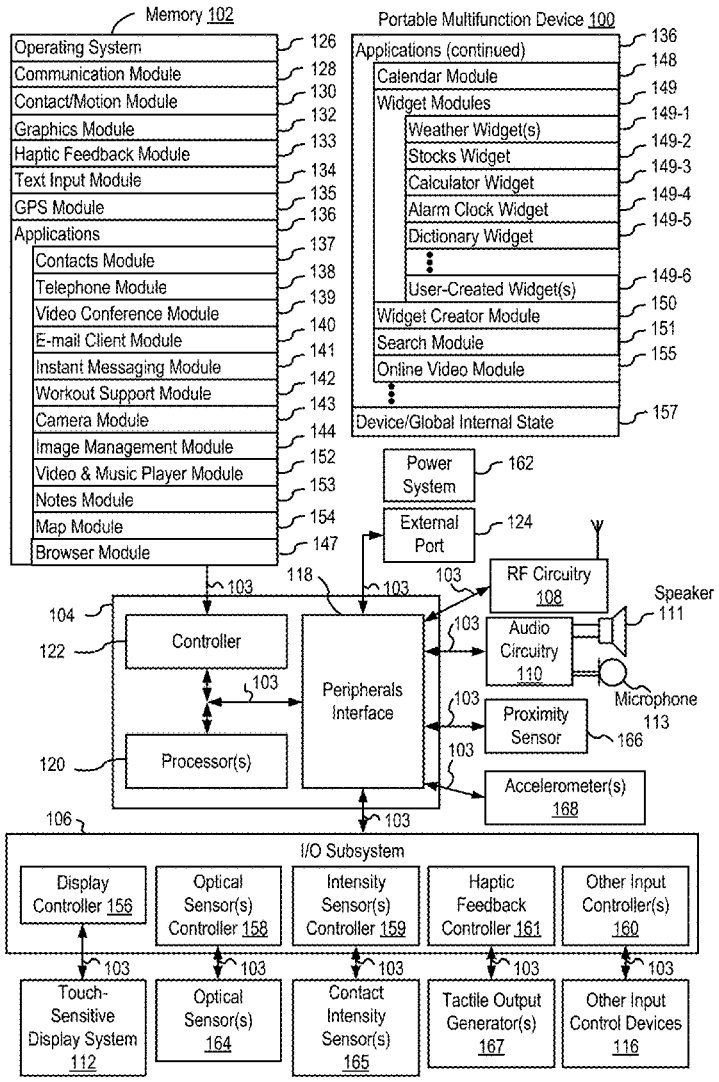
H04R 5/04	(2006.01)
H04R 5/033	(2006.01)
G06F 9/54	(2006.01)
G10L 21/0208	(2006.01)
G06F 3/01	(2006.01)
H04R 3/04	(2006.01)

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

CPC ***H04R 5/04*** (2013.01); ***H04R 5/033*** (2013.01); ***H04R 3/04*** (2013.01); ***G10L 21/0208*** (2013.01); ***G06F 3/017*** (2013.01); ***G06F 9/542*** (2013.01)

(57) **ABSTRACT**

The present disclosure generally relates to user interfaces for electronic audio devices. In some examples, the operating mode of the device changes to various states of sound transparency.



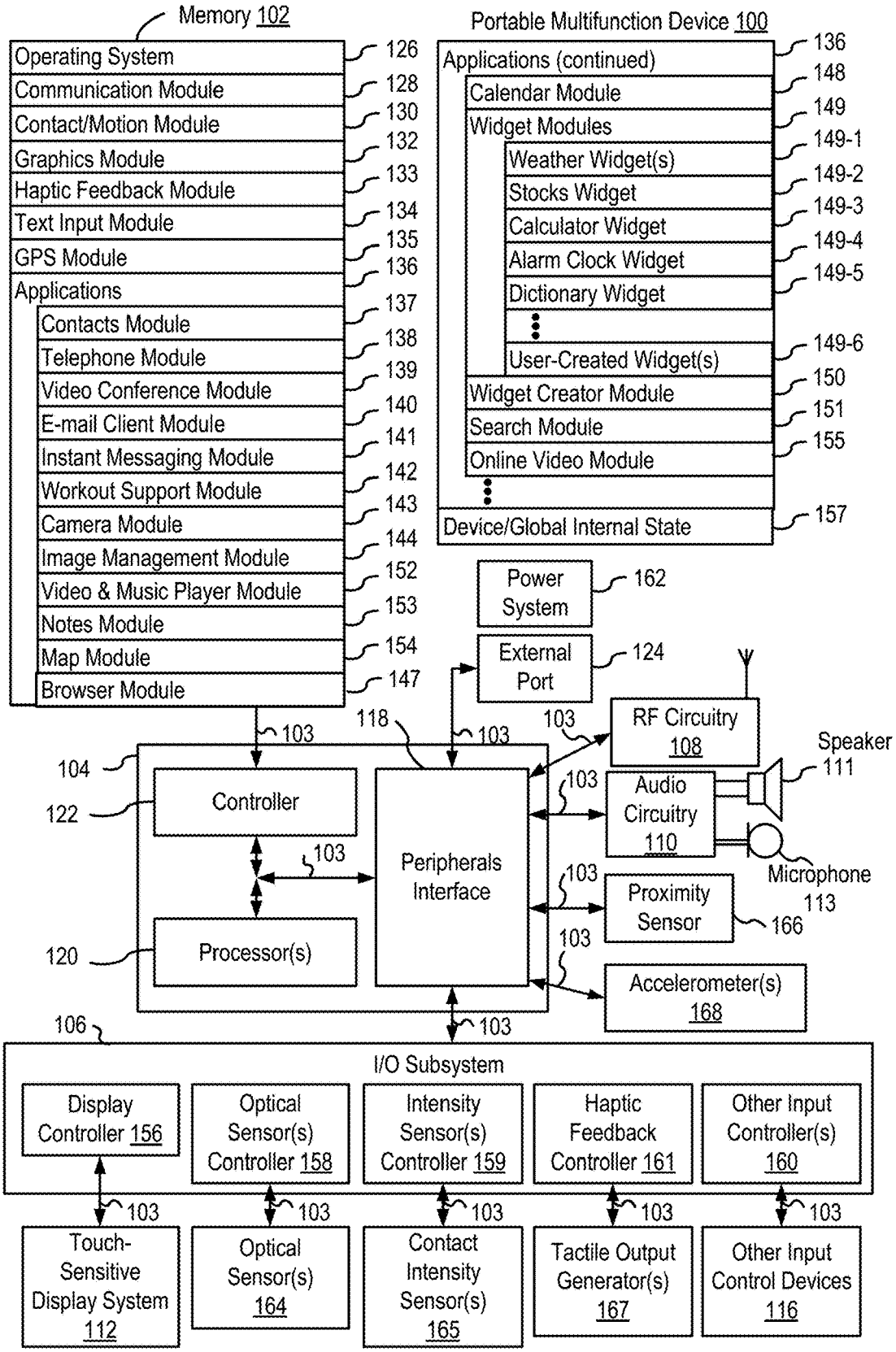

Memory 102
Operating System 126
Communication Module 128
Contact/Motion Module 130
Graphics Module 132
Haptic Feedback Module 133
Text Input Module 134
GPS Module 135
Applications 136
Contacts Module 137
Telephone Module 138
Video Conference Module 139
E-mail Client Module 140
Instant Messaging Module 141
Workout Support Module 142
Camera Module 143
Image Management Module 144
Video & Music Player Module 152
Notes Module 153
Map Module 154
Browser Module 147
Portable Multifunction Device 100
Applications (continued) 136
Calendar Module 148
Widget Modules 149
Weather Widget(s) 149-1
Stocks Widget 149-2
Calculator Widget 149-3
Alarm Clock Widget 149-4
Dictionary Widget 149-5
User-Created Widget(s) 149-6
Widget Creator Module 150
Search Module 151
Online Video Module 155
Device/Global Internal State 157
Power System 162
External Port 124
RF Circuitry 108
Speaker 111
Audio Circuitry 110
Microphone 113
Proximity Sensor 166
Accelerometer(s) 168
Controller 122
Processor(s) 120
Peripherals Interface 118
104
103
106
I/O Subsystem
Display Controller 156
Optical Sensor(s) Controller 158
Intensity Sensor(s) Controller 159
Haptic Feedback Controller 161
Other Input Controller(s) 160
Touch-Sensitive Display System 112
Optical Sensor(s) 164
Contact Intensity Sensor(s) 165
Tactile Output Generator(s) 167
Other Input Control Devices 116

FIG. 1A

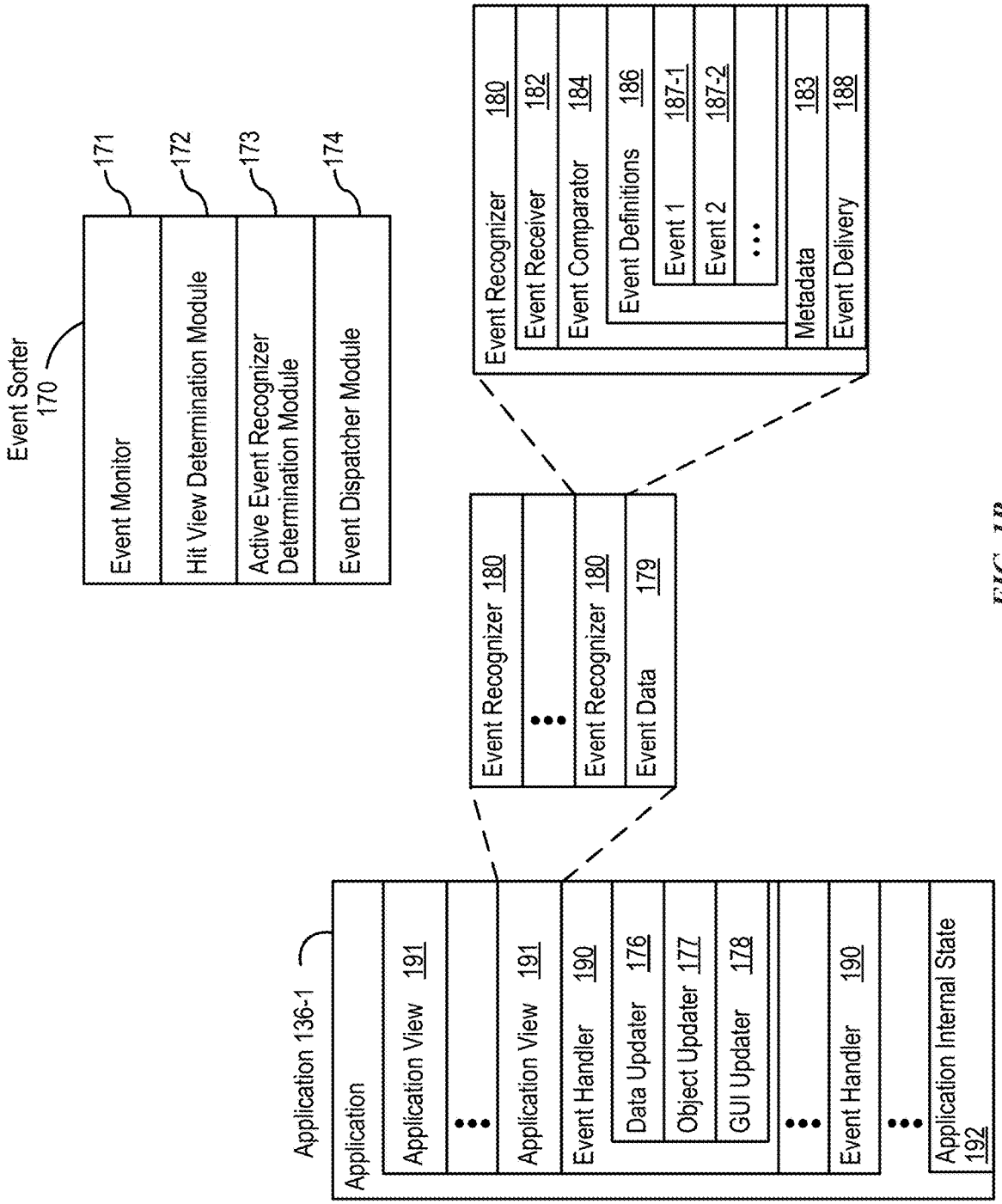

Event Sorter
170
171
Event Monitor
172
Hit View Determination Module
173
Active Event Recognizer Determination Module
174
Event Dispatcher Module
Event Recognizer 180
Event Receiver 182
Event Comparator 184
Event Definitions 186
Event 1 187-1
Event 2 187-2
...
Metadata 183
Event Delivery 188
Event Recognizer 180
...
Event Recognizer 180
Event Data 179
Application 136-1
Application
Application View 191
...
Application View 191
Event Handler 190
Data Updater 176
Object Updater 177
GUI Updater 178
...
Event Handler 190
...
Application Internal State 192

FIG. 1B

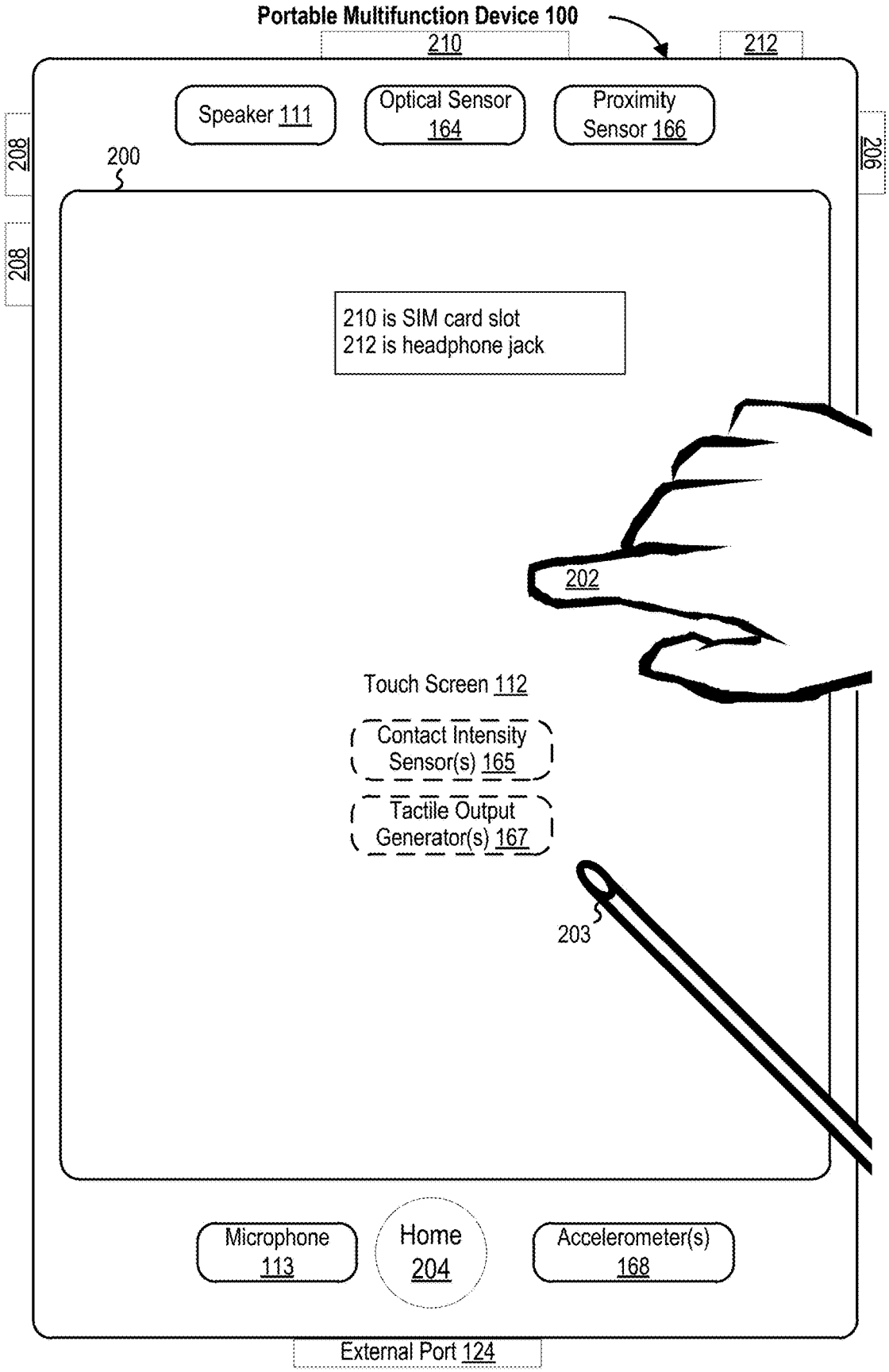

Portable Multifunction Device 100
210
212
Speaker 111
Optical Sensor 164
Proximity Sensor 166
208
206
200
208
210 is SIM card slot
212 is headphone jack
202
Touch Screen 112
Contact Intensity Sensor(s) 165
Tactile Output Generator(s) 167
203
Microphone 113
Home 204
Accelerometer(s) 168
External Port 124

FIG. 2

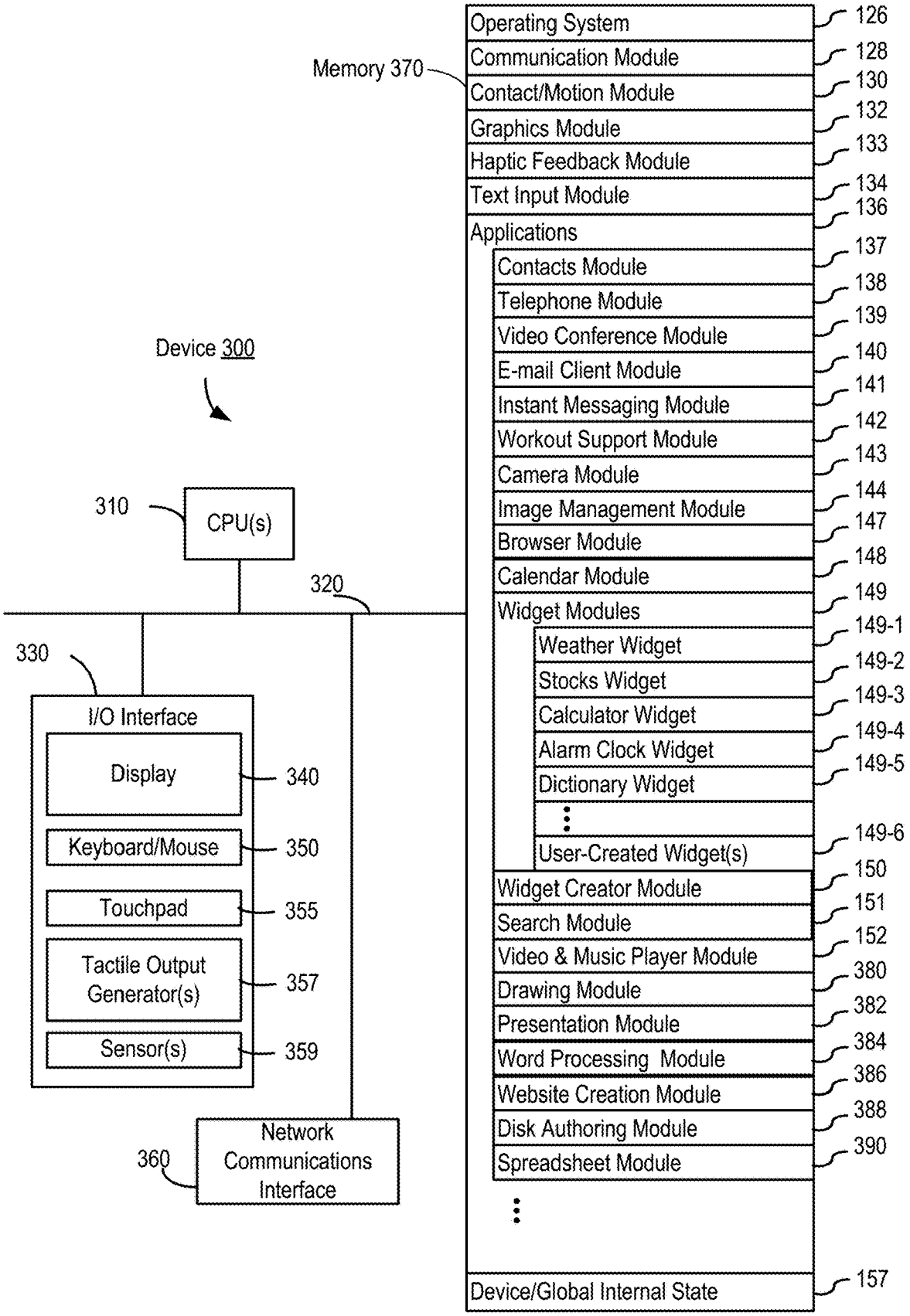

Memory 370
Operating System
126
Communication Module
128
Contact/Motion Module
130
Graphics Module
132
Haptic Feedback Module
133
Text Input Module
134
Applications
136
Contacts Module
137
Telephone Module
138
Video Conference Module
139
E-mail Client Module
140
Instant Messaging Module
141
Workout Support Module
142
Camera Module
143
Image Management Module
144
Browser Module
147
Calendar Module
148
Widget Modules
149
Weather Widget
149-1
Stocks Widget
149-2
Calculator Widget
149-3
Alarm Clock Widget
149-4
Dictionary Widget
149-5
User-Created Widget(s)
149-6
Widget Creator Module
150
Search Module
151
Video & Music Player Module
152
Drawing Module
380
Presentation Module
382
Word Processing Module
384
Website Creation Module
386
Disk Authoring Module
388
Spreadsheet Module
390
Device/Global Internal State
157
Device 300
310
CPU(s)
320
330
I/O Interface
Display
340
Keyboard/Mouse
350
Touchpad
355
Tactile Output Generator(s)
357
Sensor(s)
359
360
Network Communications Interface

FIG. 3

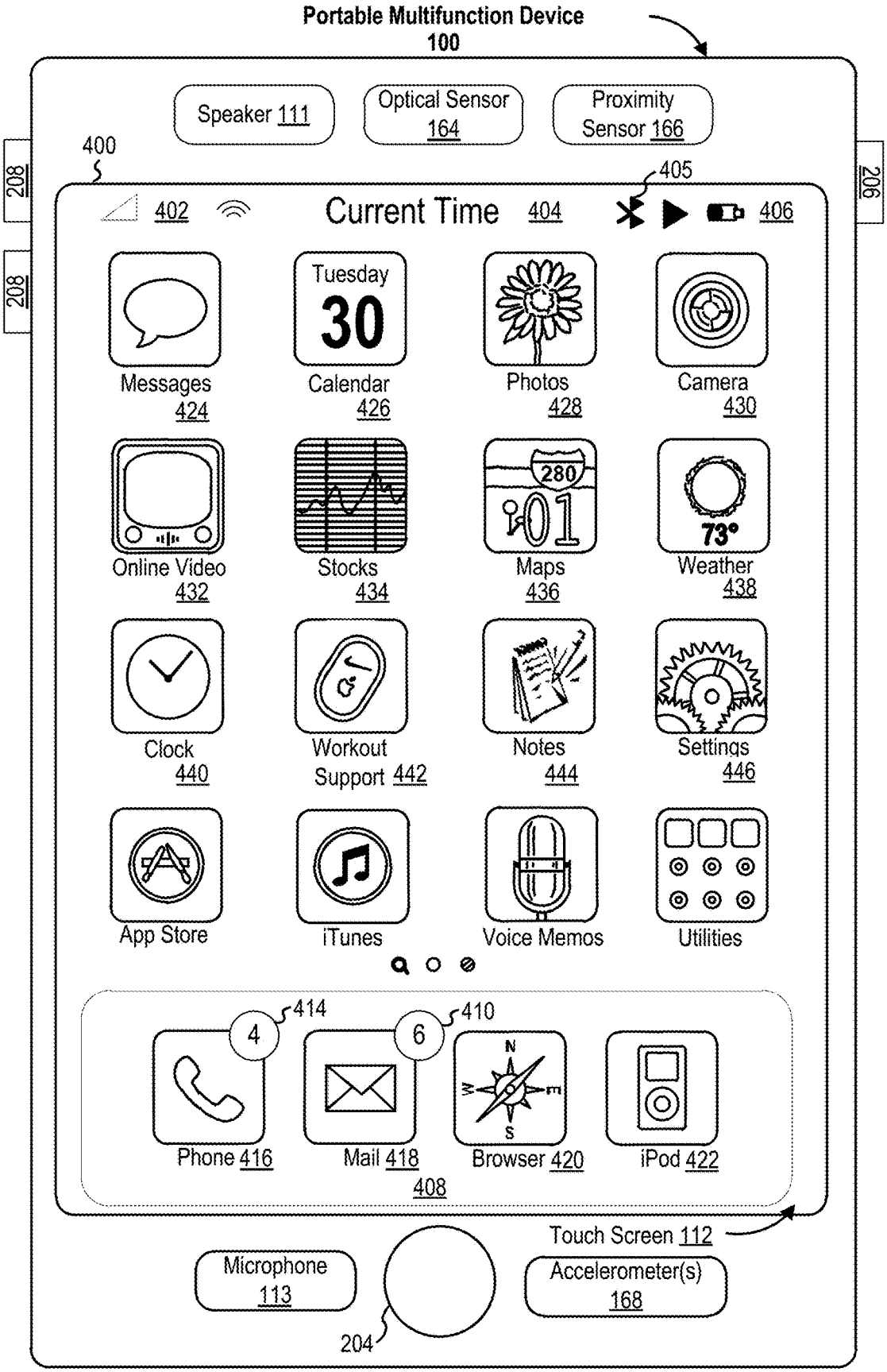
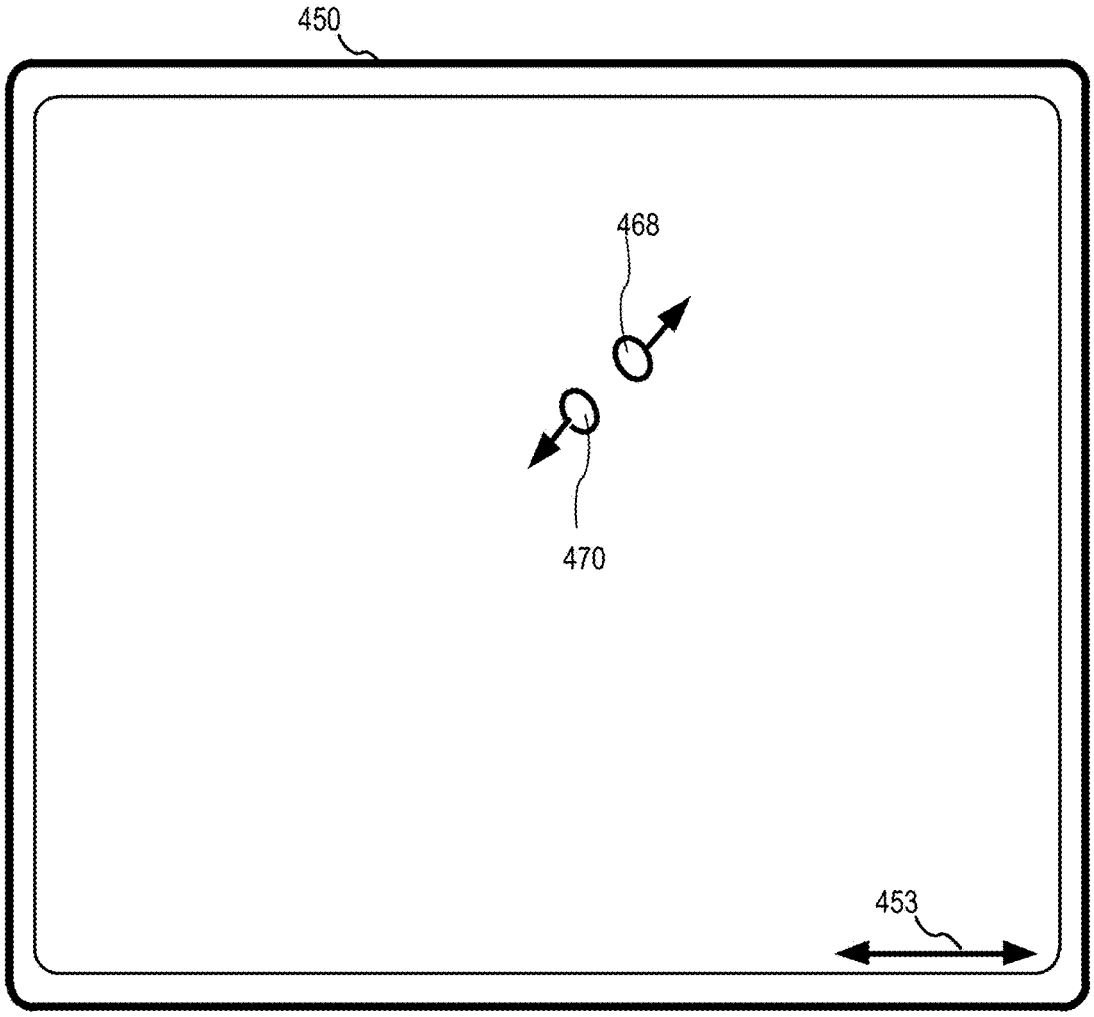

Portable Multifunction Device
100
Speaker 111
Optical Sensor 164
Proximity Sensor 166
400
405
208
208
206
402
Current Time 404
406
Tuesday
30
Messages 424
Calendar 426
Photos 428
Camera 430
Online Video 432
Stocks 434
280
Maps 436
73°
Weather 438
Clock 440
Workout Support 442
Notes 444
Settings 446
App Store
iTunes
Voice Memos
Utilities
414
410
4
6
N
W
E
S
Phone 416
Mail 418
Browser 420
iPod 422
408
Touch Screen 112
Microphone 113
Accelerometer(s) 168
204

FIG. 4A


450
468
470
453

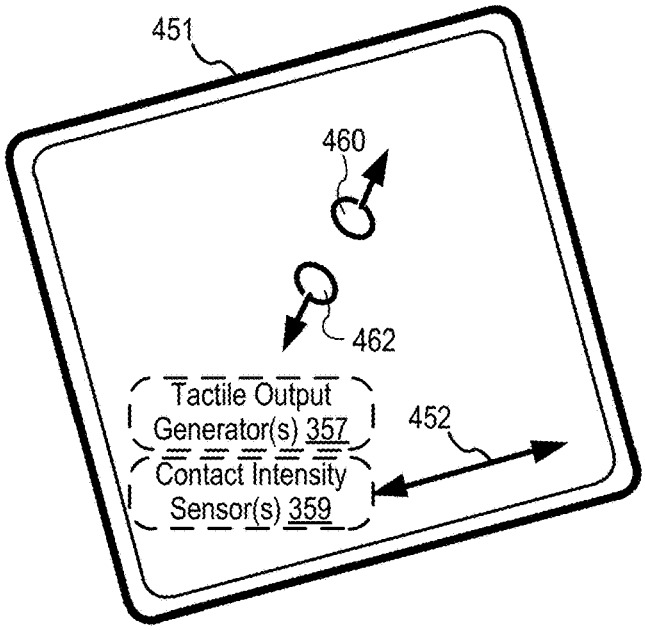

451
460
462
Tactile Output Generator(s) 357
Contact Intensity Sensor(s) 359
452

FIG. 4B

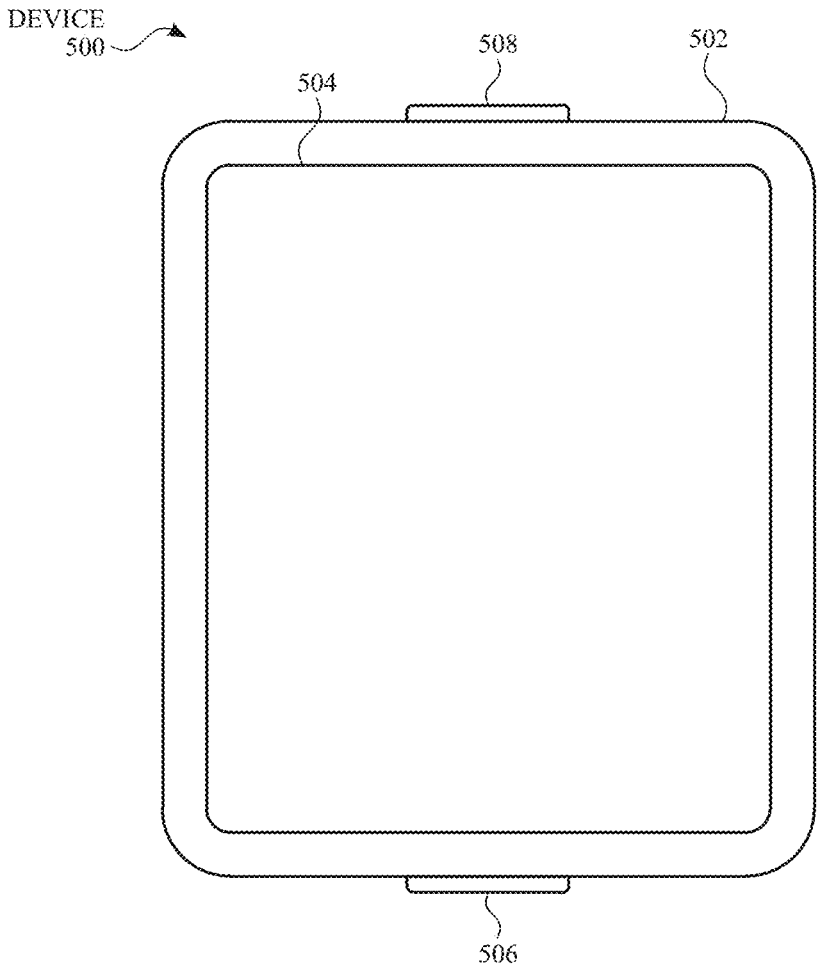


FIG. 5A

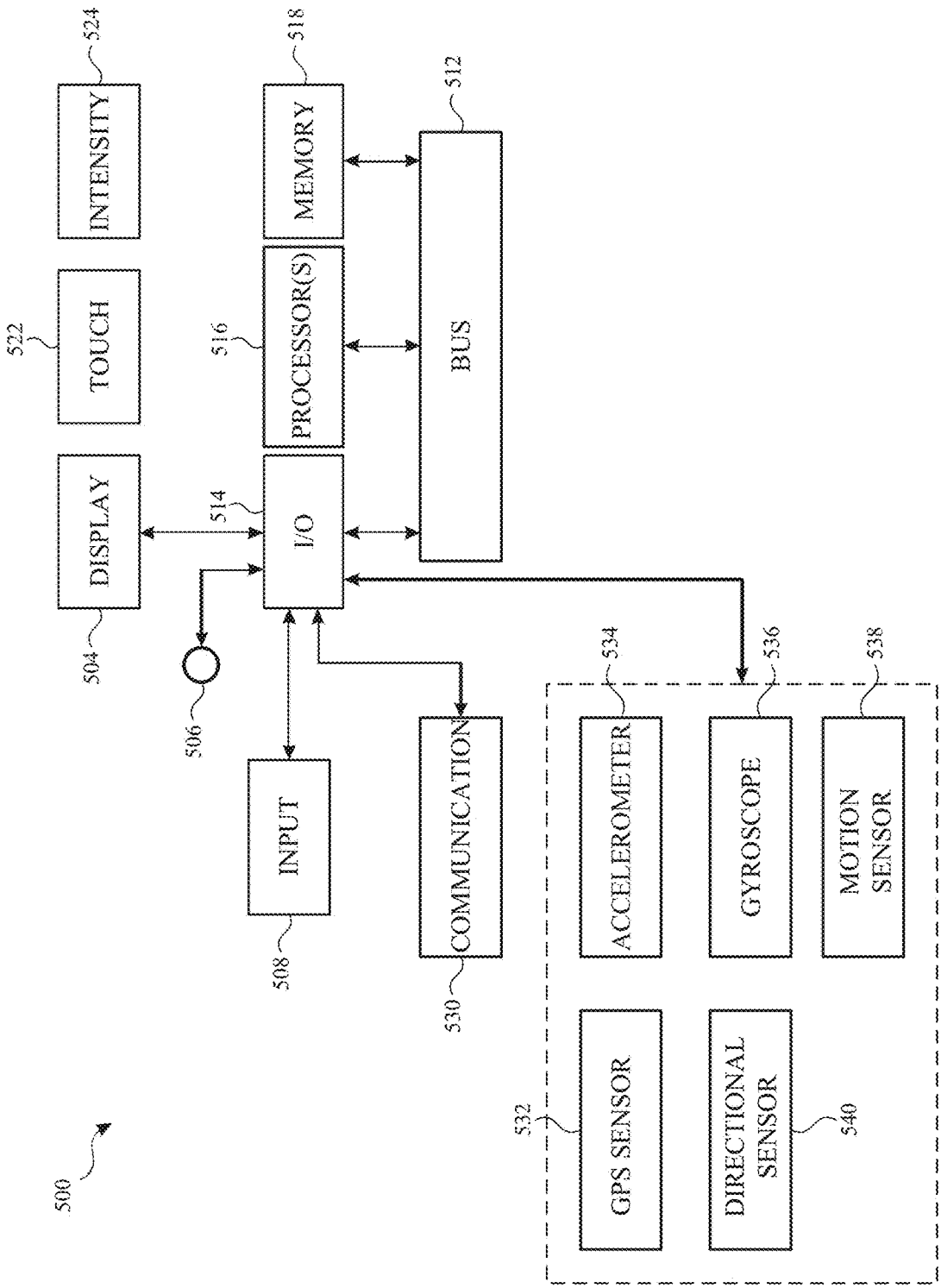

500
DISPLAY
504
TOUCH
522
INTENSITY
524
506
INPUT
508
I/O
514
PROCESSOR(S)
516
MEMORY
518
BUS
512
COMMUNICATION
530
GPS SENSOR
532
ACCELEROMETER
534
DIRECTIONAL SENSOR
540
GYROSCOPE
536
MOTION SENSOR
538

FIG. 5B

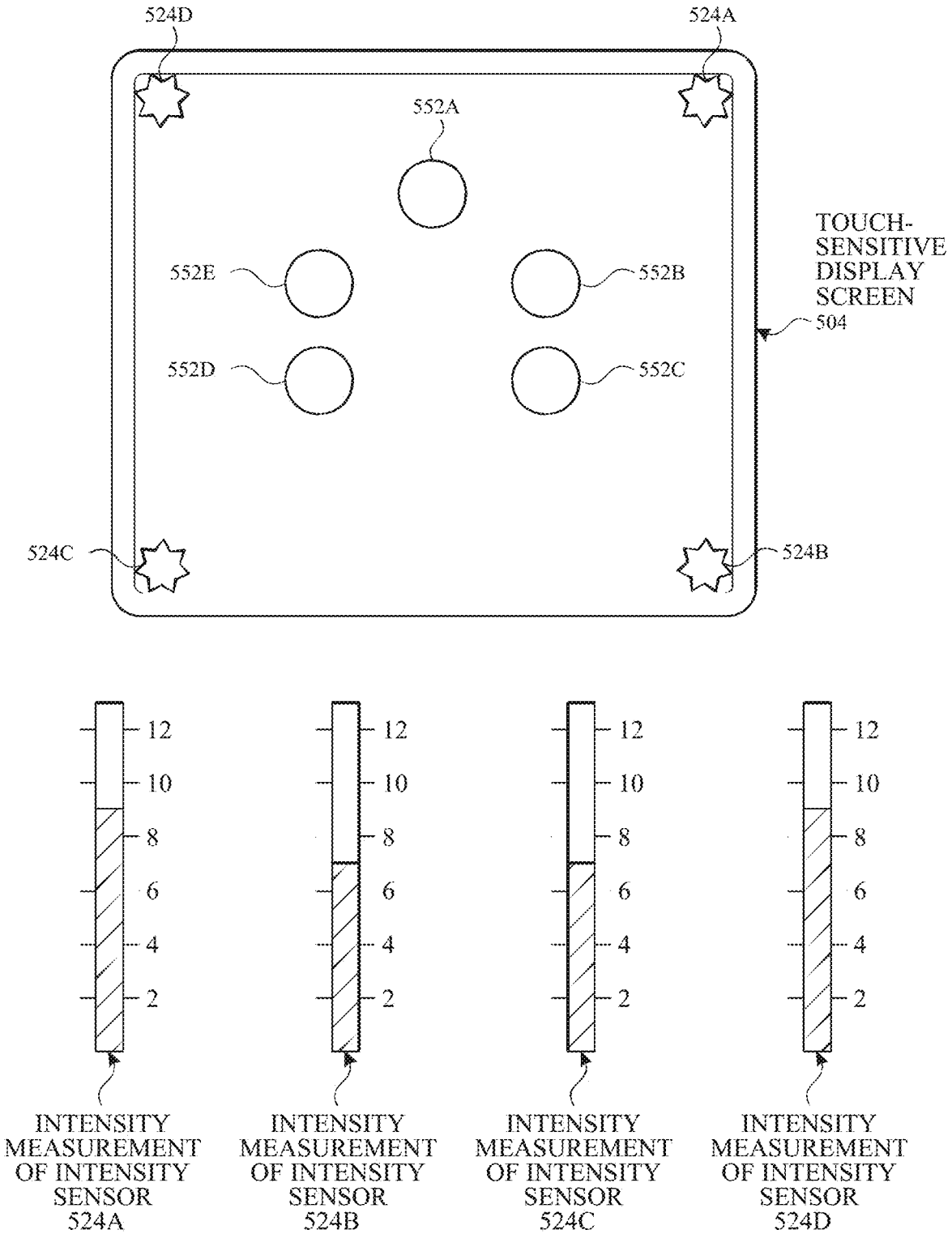

524D
524A
552A
552E
552B
552D
552C
TOUCH-SENSITIVE DISPLAY SCREEN
504
524C
524B
12
10
8
6
4
2
INTENSITY MEASUREMENT OF INTENSITY SENSOR 524A
INTENSITY MEASUREMENT OF INTENSITY SENSOR 524B
INTENSITY MEASUREMENT OF INTENSITY SENSOR 524C
INTENSITY MEASUREMENT OF INTENSITY SENSOR 524D

FIG. 5C

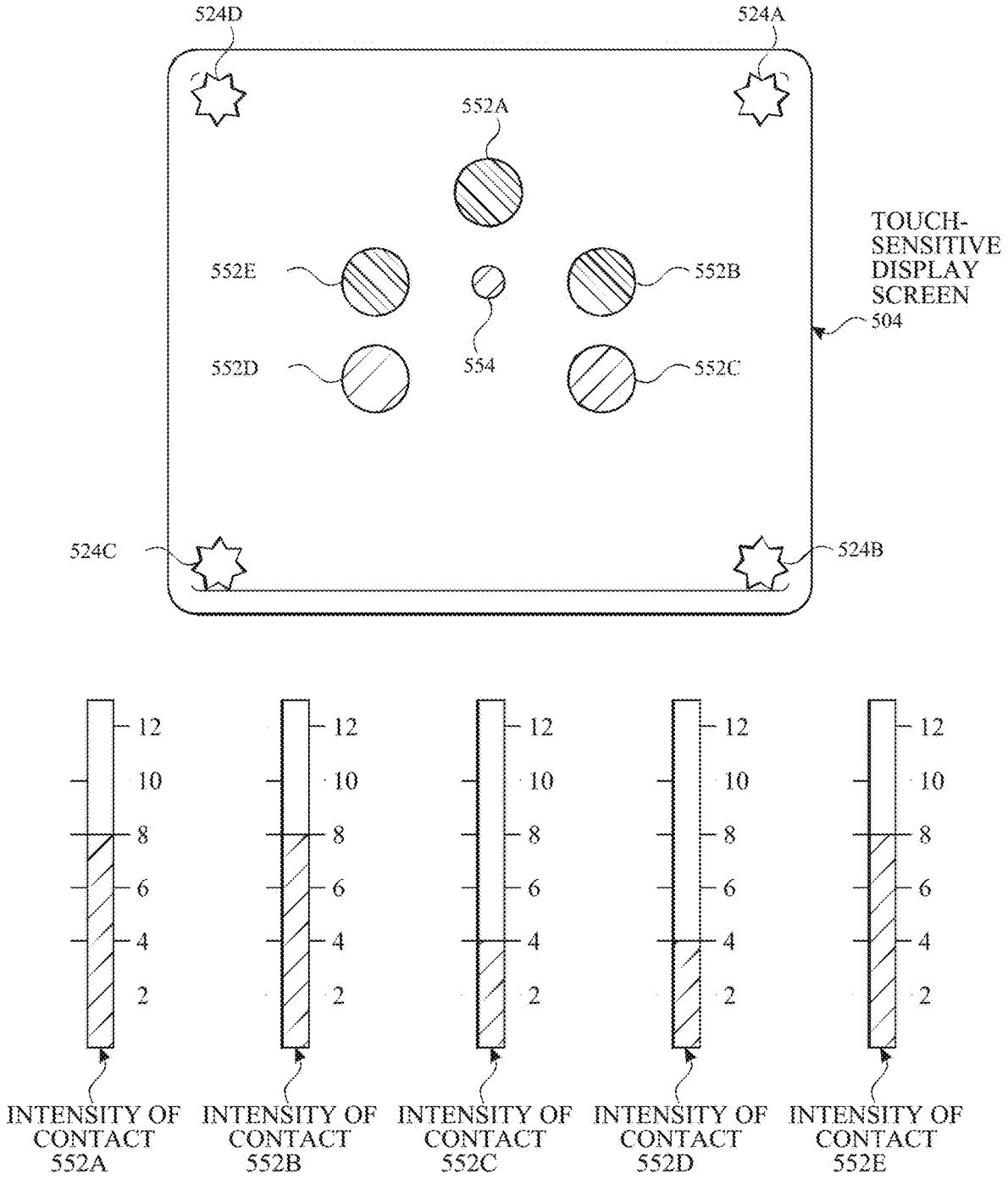

524D
524A
552A
552E
552B
554
552D
552C
TOUCH-SENSITIVE DISPLAY SCREEN
504
524C
524B
12
10
8
6
4
2
INTENSITY OF CONTACT 552A
INTENSITY OF CONTACT 552B
INTENSITY OF CONTACT 552C
INTENSITY OF CONTACT 552D
INTENSITY OF CONTACT 552E

FIG. 5D

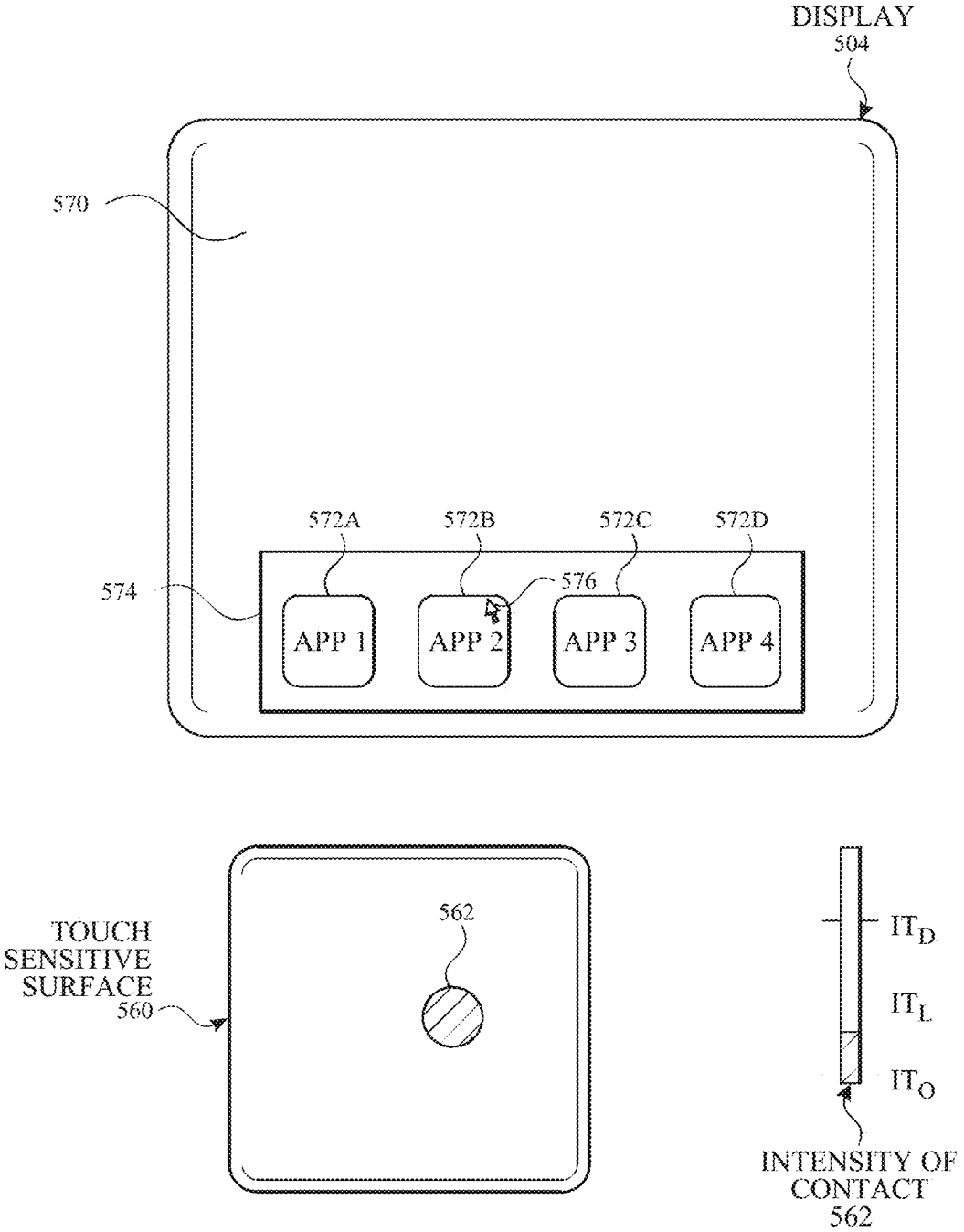

DISPLAY
504
570
572A
572B
572C
572D
574
576
APP 1
APP 2
APP 3
APP 4
TOUCH
SENSITIVE
SURFACE
560
562
IT_D
IT_L
IT_O
INTENSITY OF
CONTACT
562

FIG. 5E

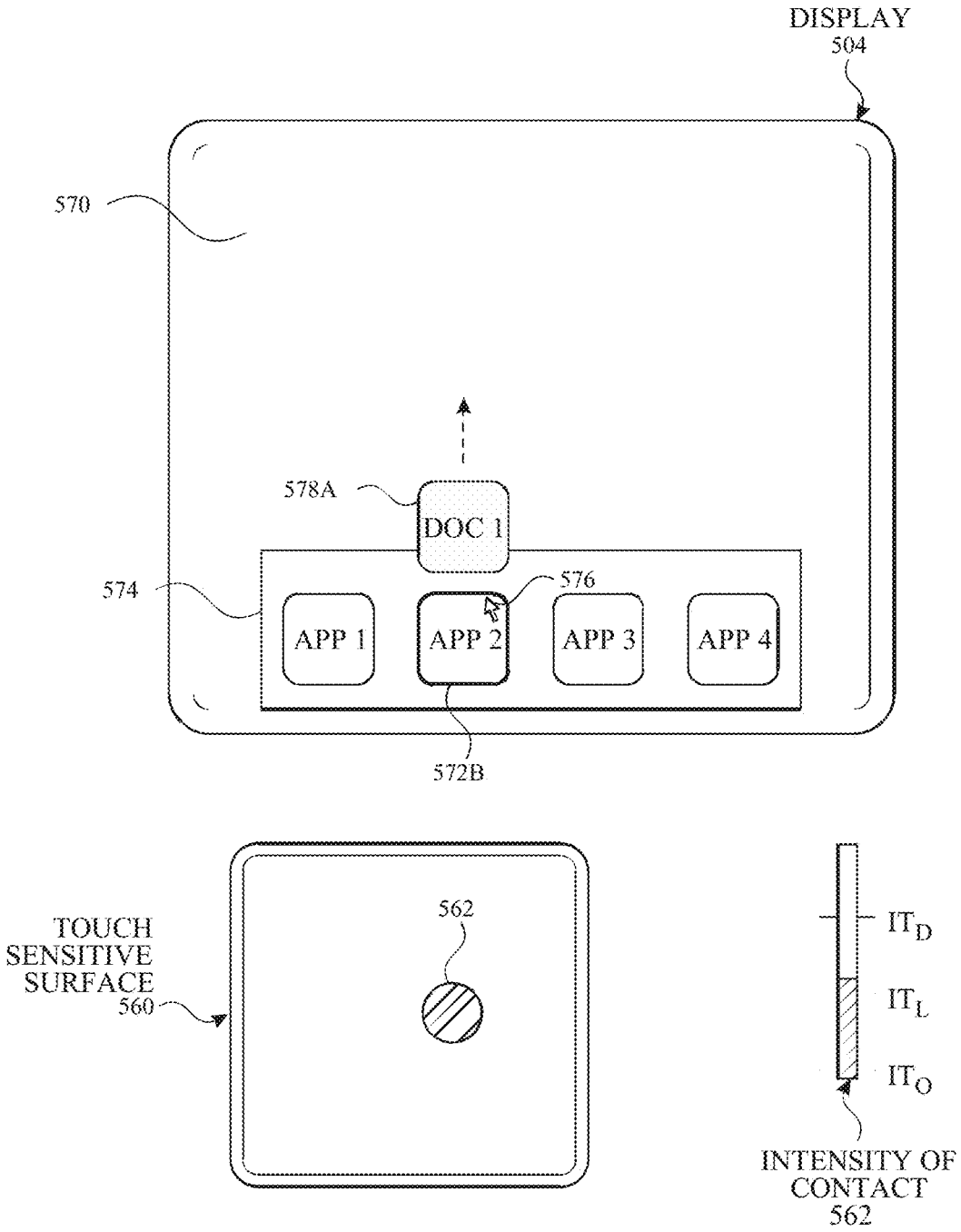

DISPLAY
504
570
578A
DOC 1
574
576
APP 1
APP 2
APP 3
APP 4
572B
TOUCH
SENSITIVE
SURFACE
560
562
IT_D
IT_L
IT_O
INTENSITY OF
CONTACT
562

FIG. 5F

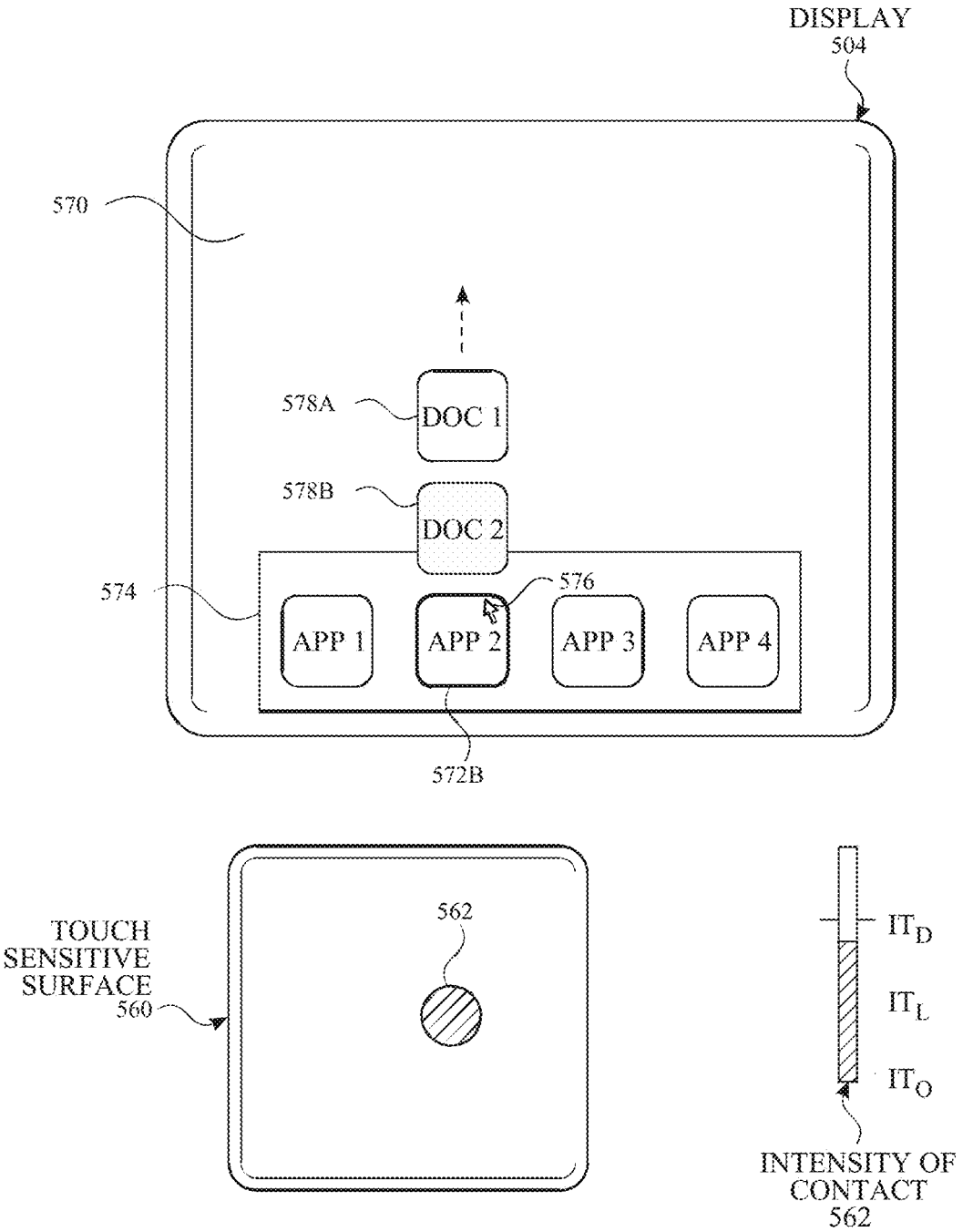

DISPLAY
504
570
578A
DOC 1
578B
DOC 2
574
576
APP 1
APP 2
APP 3
APP 4
572B
TOUCH
SENSITIVE
SURFACE
560
562
IT_D
IT_L
IT_O
INTENSITY OF
CONTACT
562

FIG. 5G

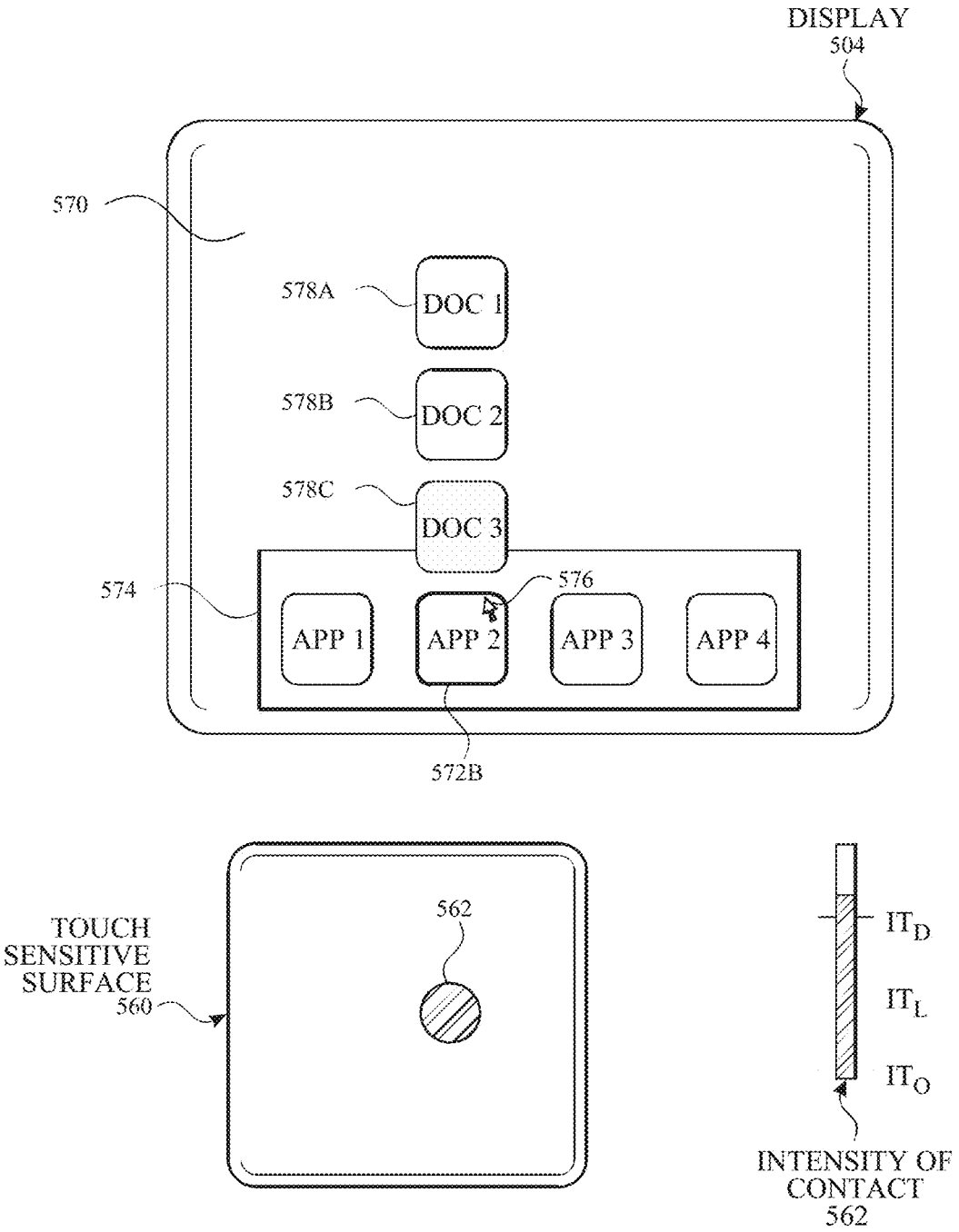

DISPLAY
504
570
578A
DOC 1
578B
DOC 2
578C
DOC 3
574
576
APP 1
APP 2
APP 3
APP 4
572B
TOUCH
SENSITIVE
SURFACE
560
562
IT_D
IT_L
IT_O
INTENSITY OF
CONTACT
562

FIG. 5H

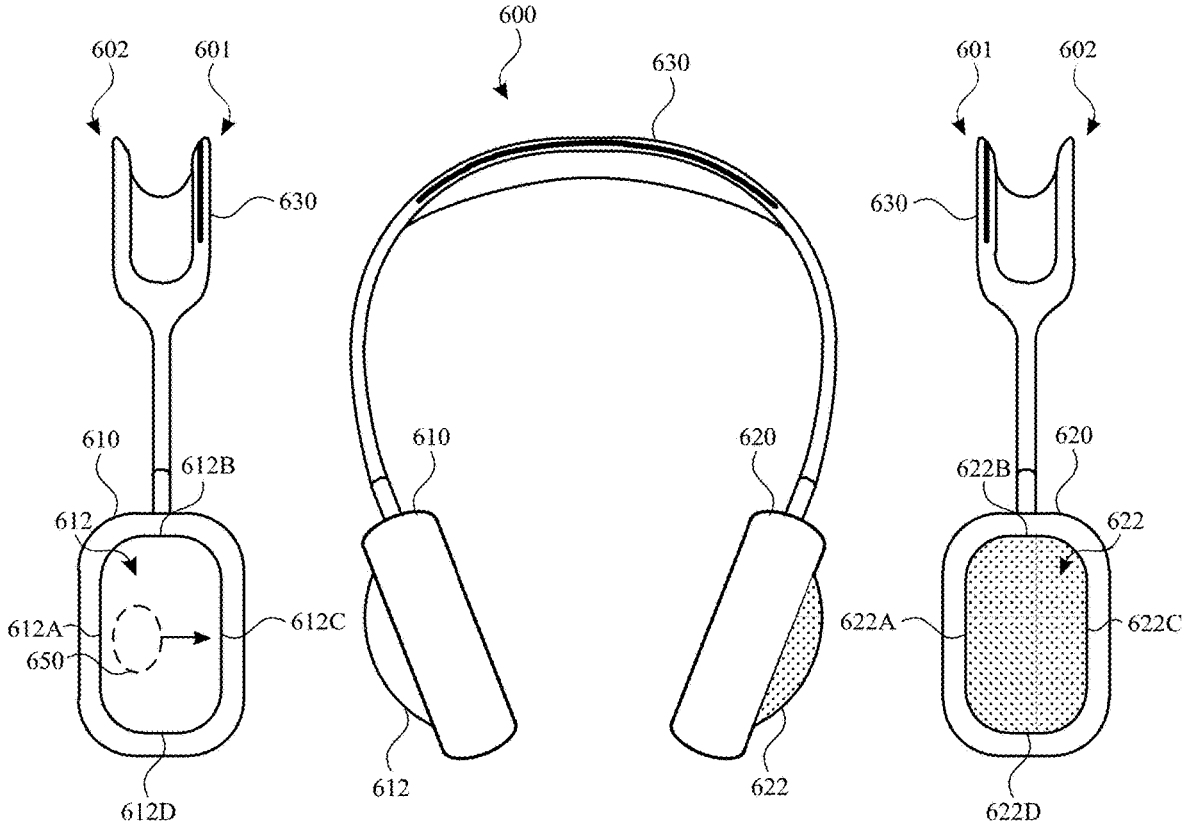
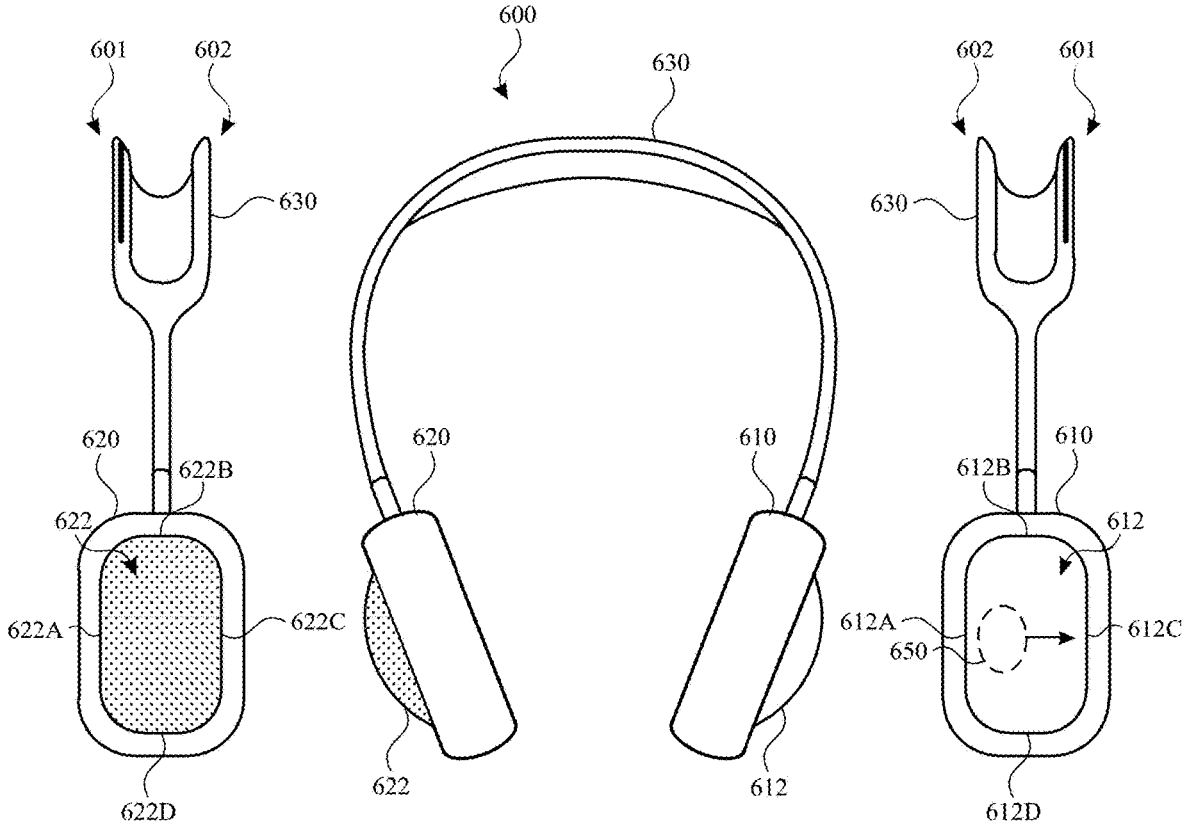

600
602
601
630
630
601
602
630
610
612B
610
620
620
612
612A
650
612C
612D
612
622
622B
622
622A
622C
622D

FIG. 6A


600
601
602
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630
602
601
630
620
622B
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610
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612B
622
612
622A
622C
612A
650
612C
622
612
622D
612D

FIG. 6B

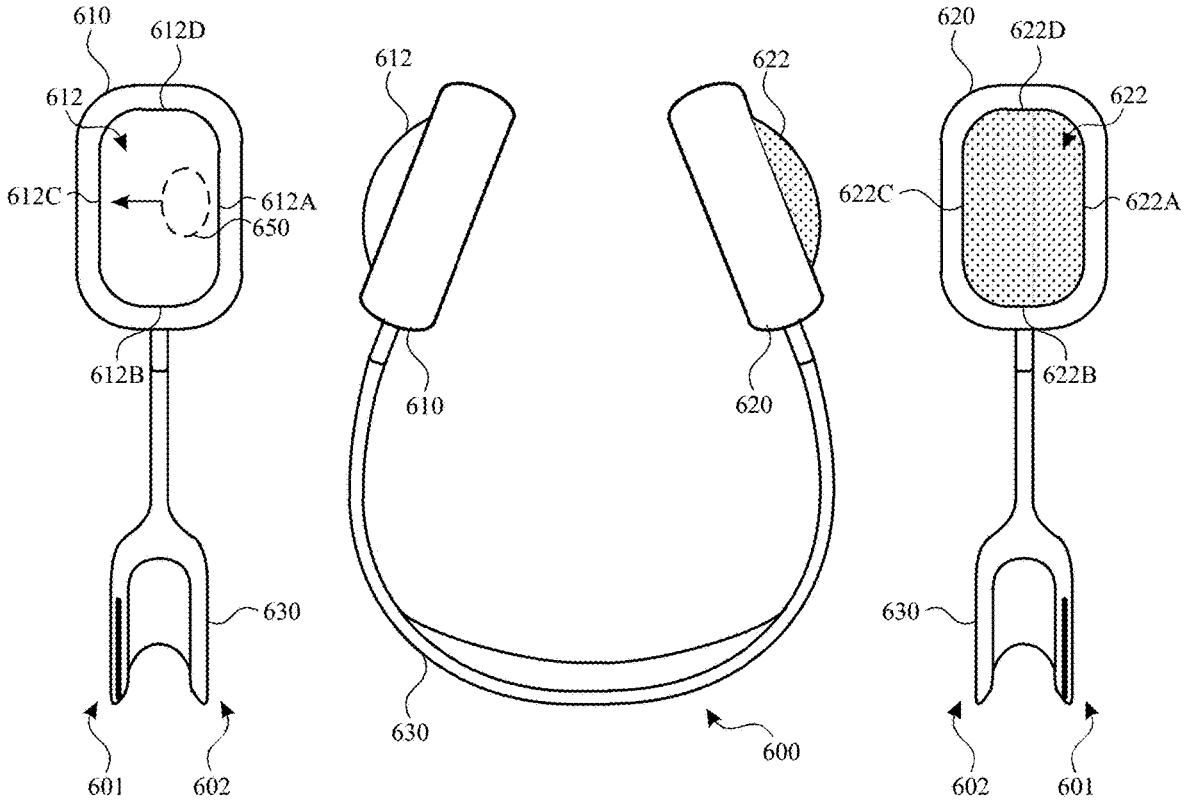

610
612D
612
612C
612A
650
612B
630
601
602
612
610
630
600
622
620
620
622D
622
622C
622A
622B
630
602
601

FIG. 6C

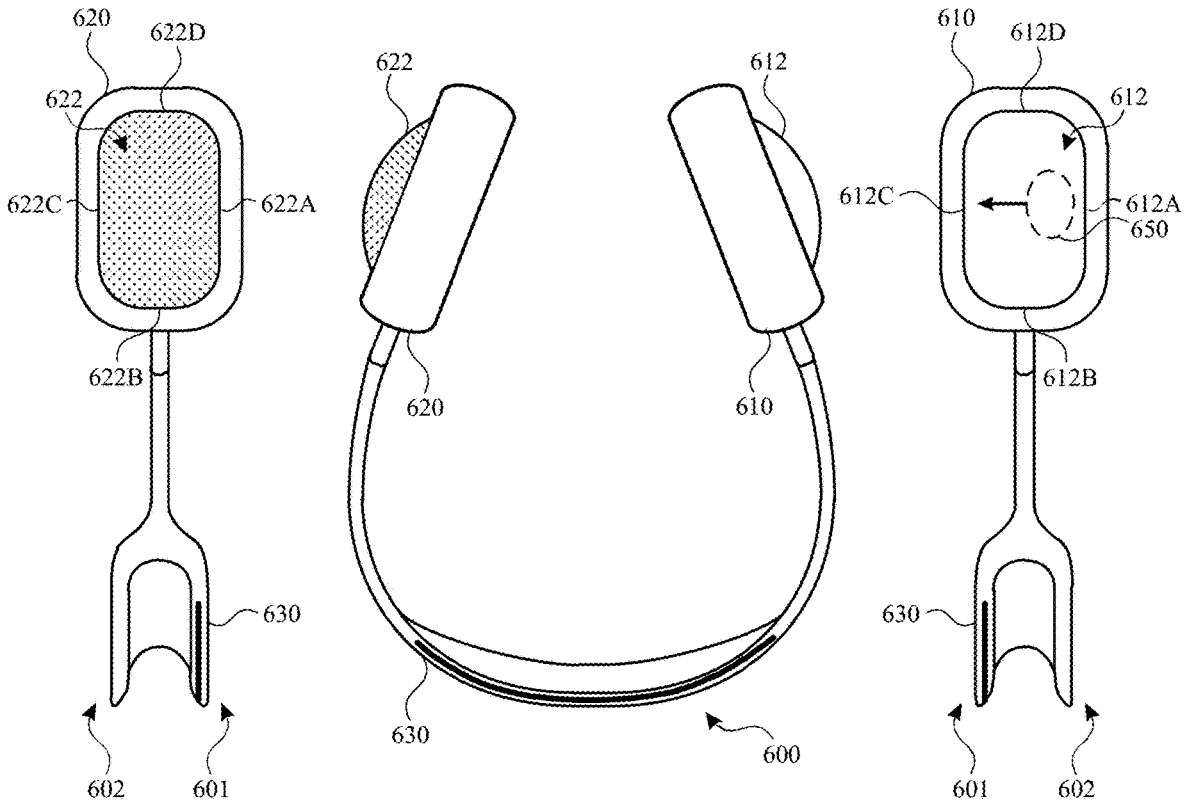
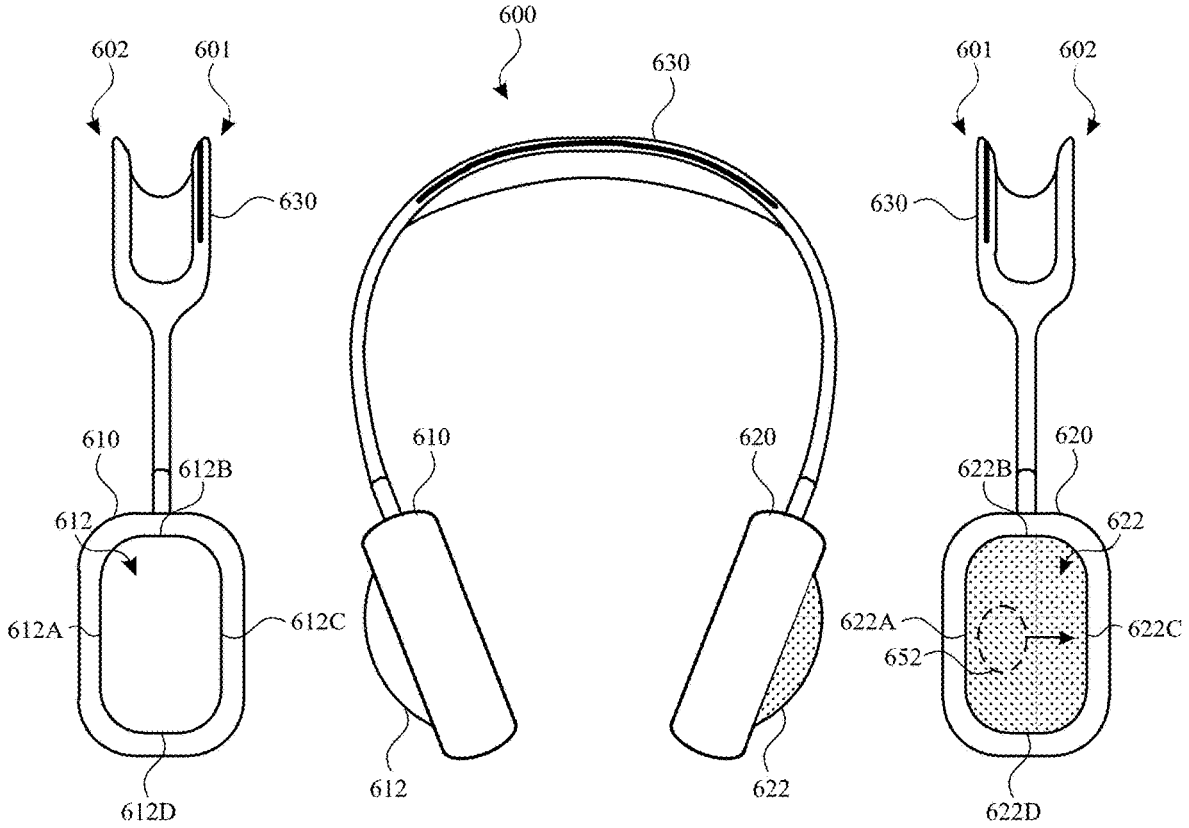

620
622D
622
622C
622A
622B
630
602
601
622
620
630
600
612
610
610
612D
612
612C
612A
650
612B
630
601
602

FIG. 6D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602
630
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612A
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612D
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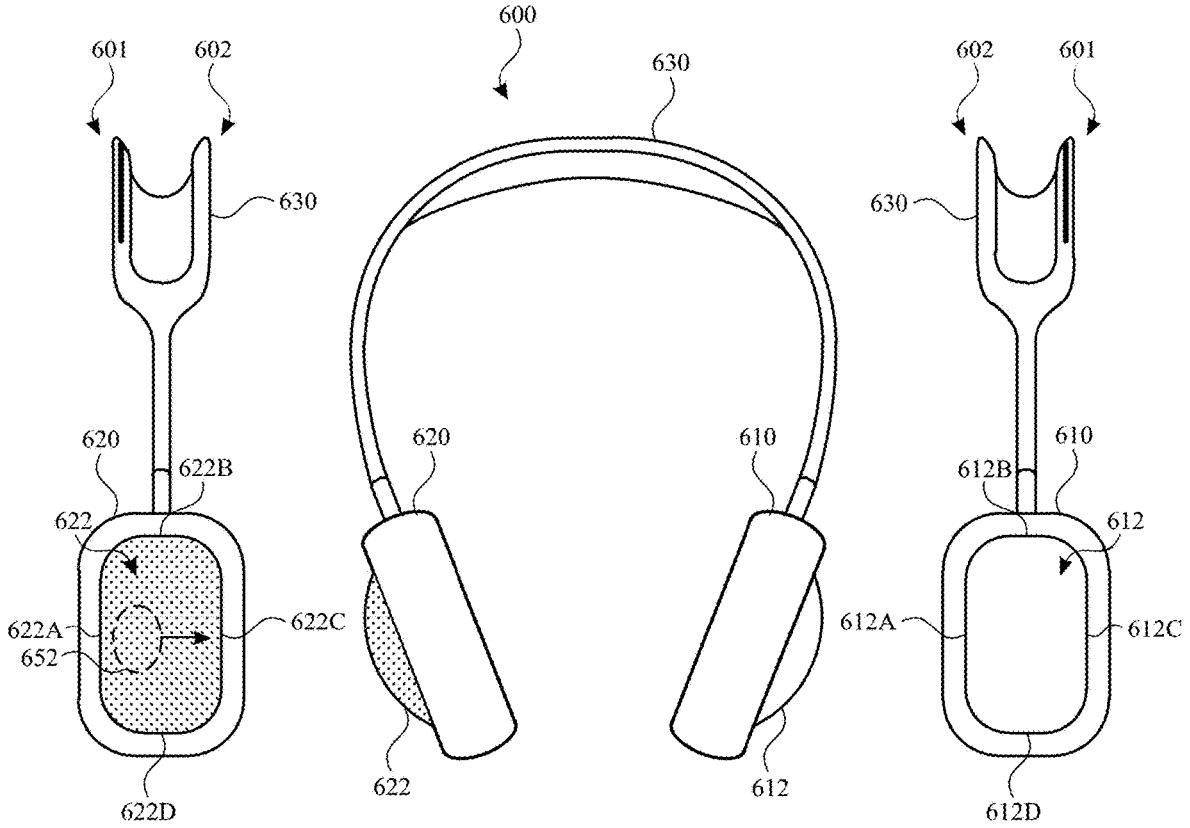
620
622B
622
622A
652
622C
622D

FIG. 6E


600
601
602
630
630
602
601
630
620
622B
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610
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612B
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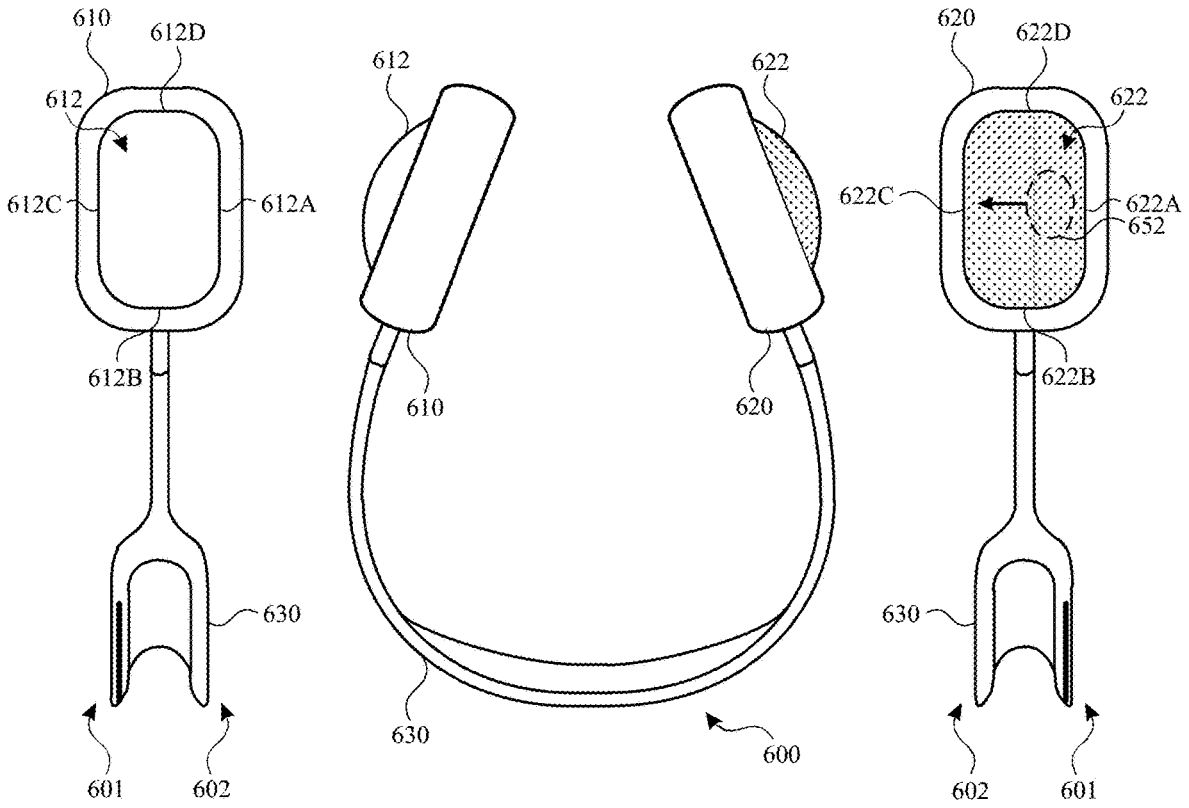
622A
652
622C
612A
612C
622
612
622D
612D

FIG. 6F


610
612D
612
612C
612A
612B
630
601
602
612
610
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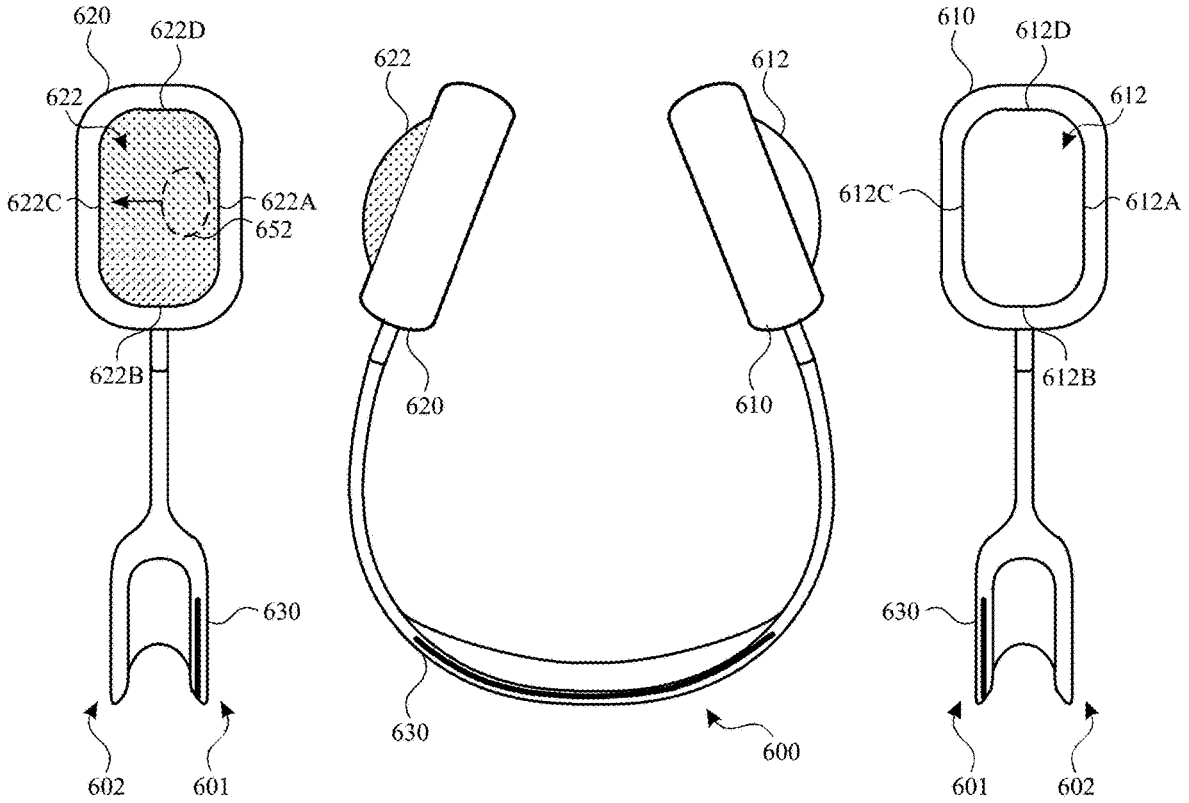
600
622
620
620
622D
622
622C
622A
652
622B
630
602
601

FIG. 6G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622D
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622C
622A
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622B
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612D
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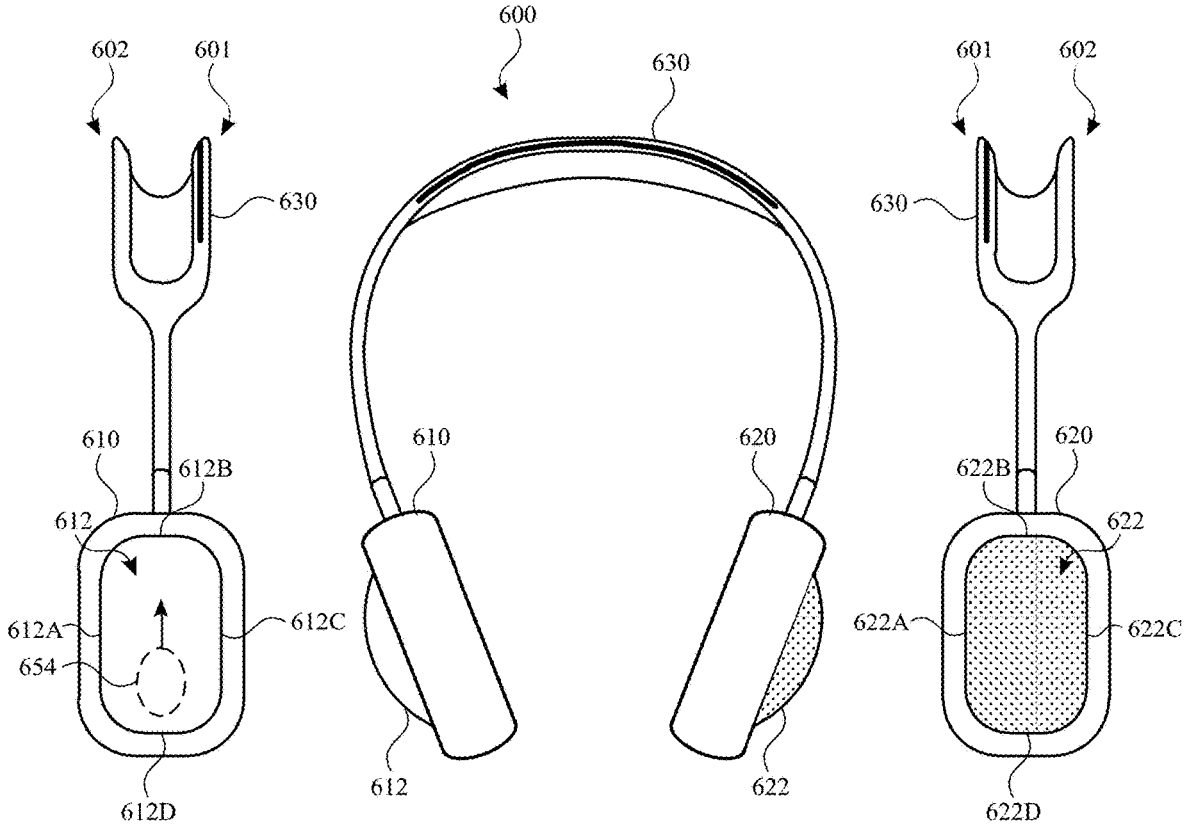
612C
612A
612B
630
601
602

FIG. 6H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602
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630
610
612B
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622B
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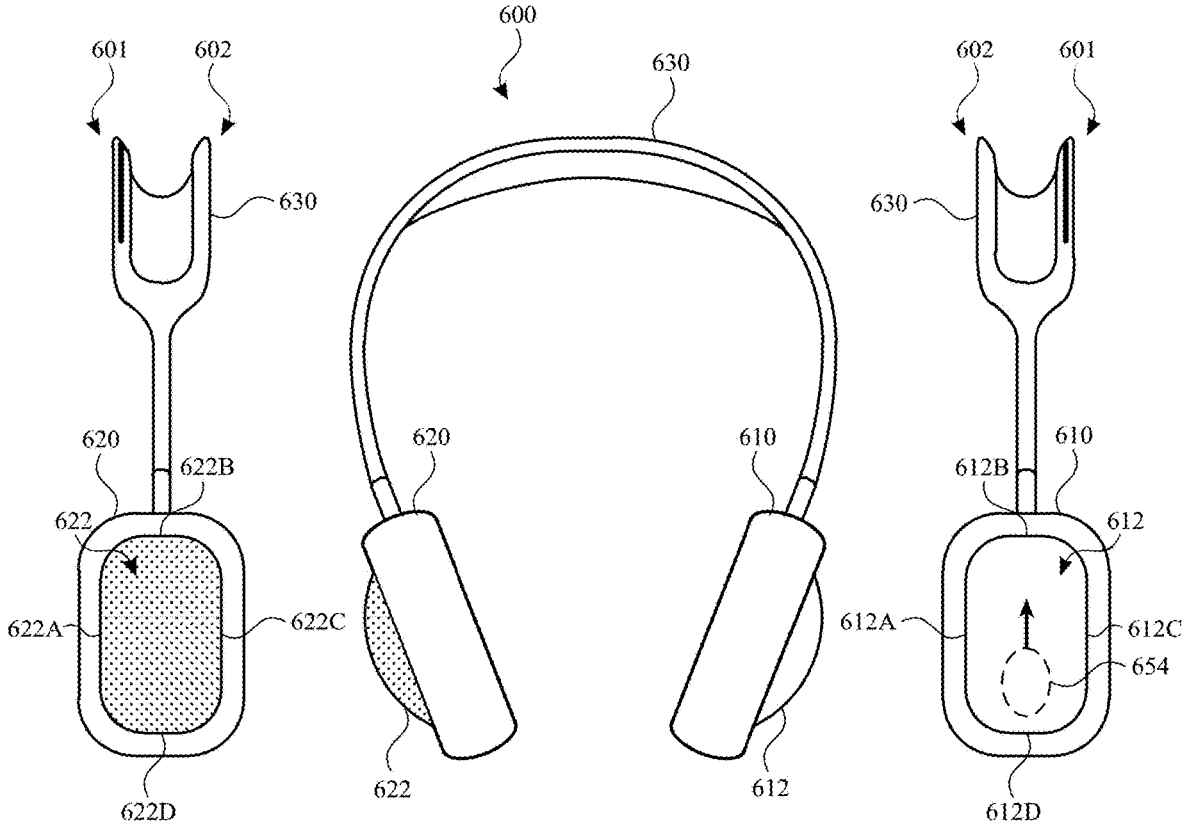
612A
612C
654
622A
622C
612D
612
622
622D

FIG. 61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622B
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610
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612B
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622A
622C
612A
612C
654
622
612
622D
612D

FIG. 6J

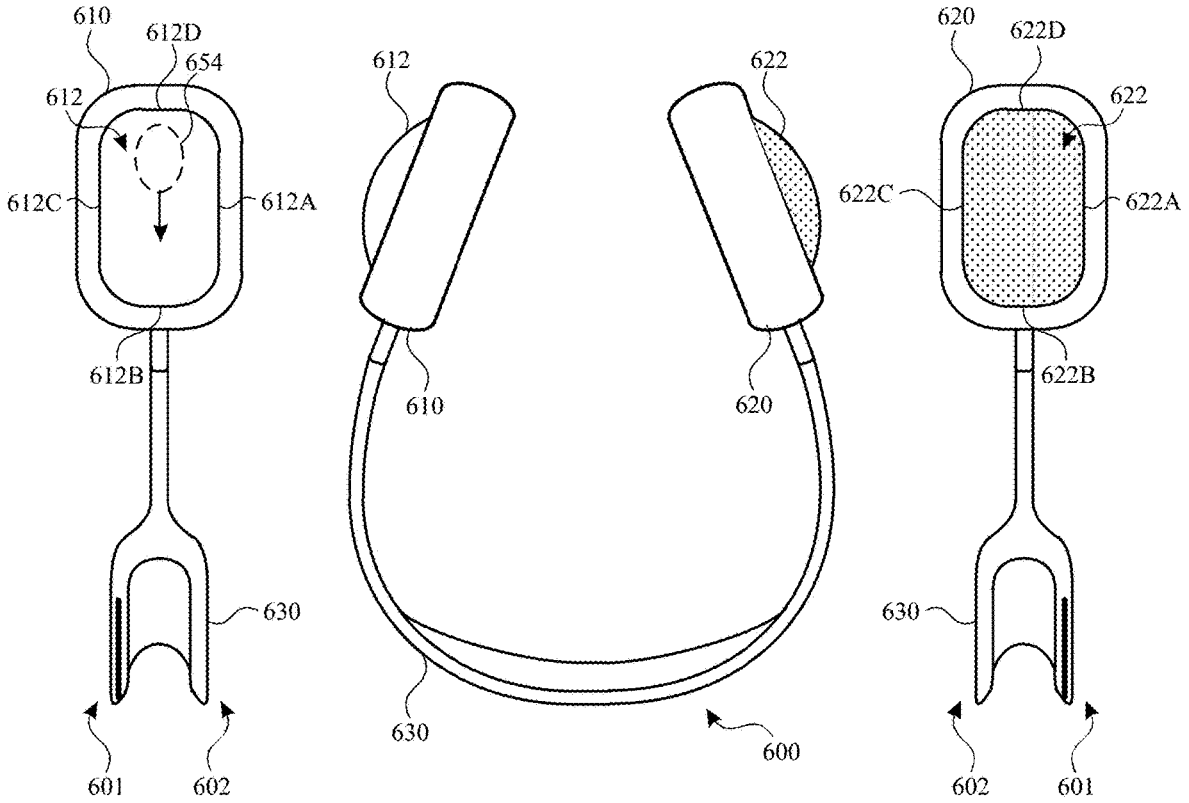

610
612D
654
612
612C
612A
612B
630
601
602
612
610
630
600
622
620
620
622D
622
622C
622A
622B
630
602
601

FIG. 6K

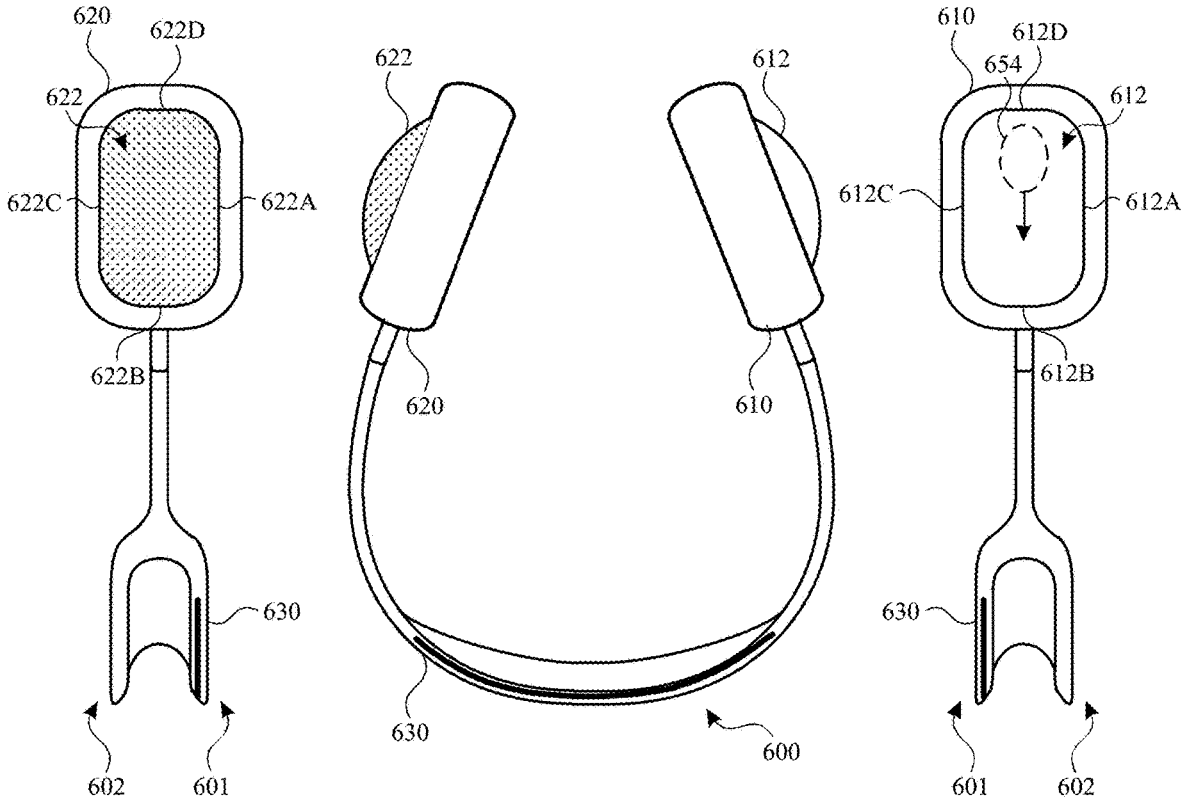
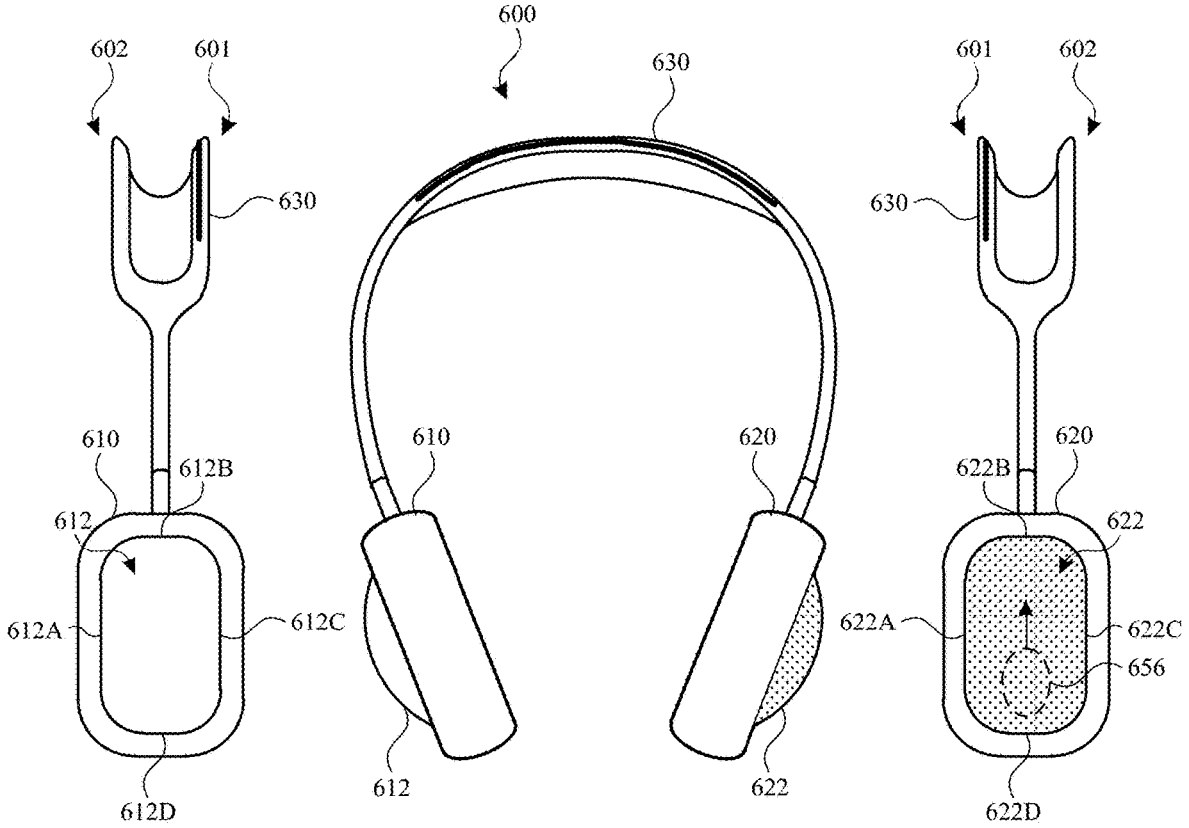

620
622D
622
622C
622A
622B
630
602
601
622
620
630
600
612
610
610
612D
654
612
612C
612A
612B
630
601
602

FIG. 6L


600
602
601
630
630
601
602
630
610
612B
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612A
612C
612D
610
612
620
622
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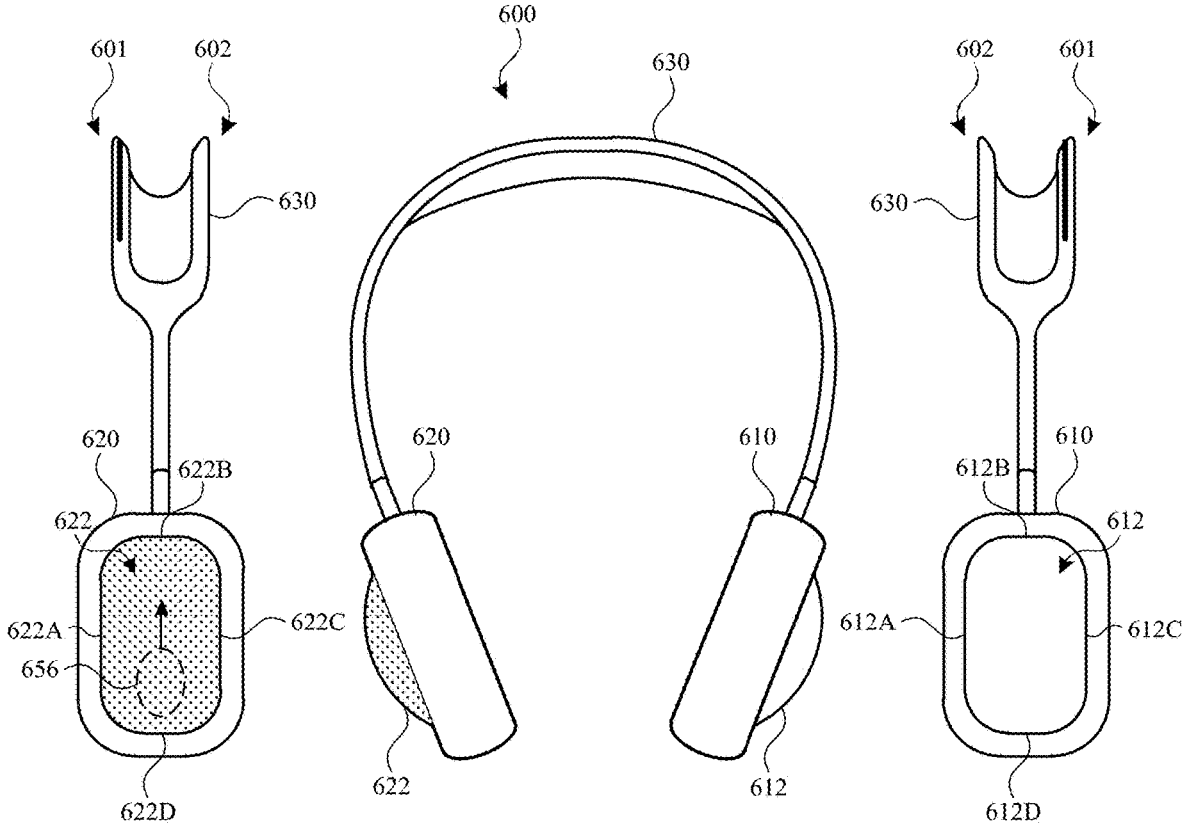
622B
622
622A
622C
656
622D

FIG. 6M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602
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602
601
630
620
622B
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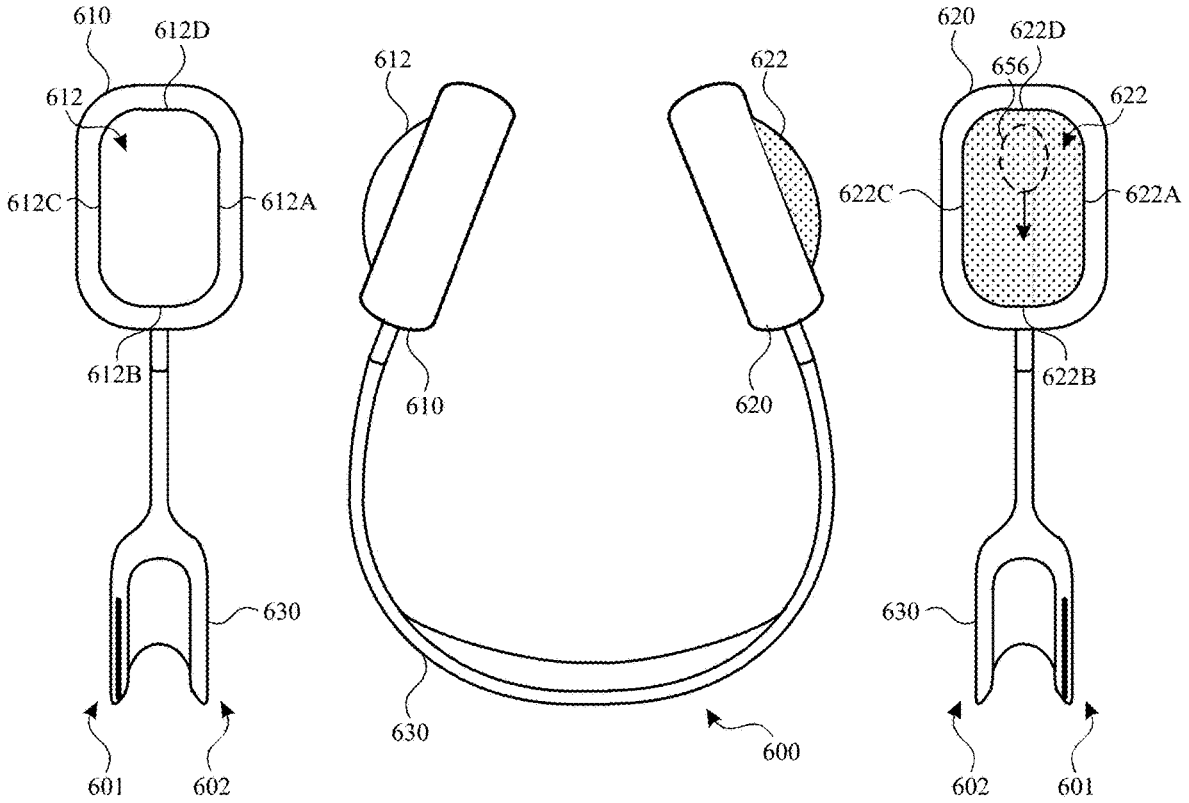
610
610
612B
622
612
622A
622C
612A
612C
656
622
612
622D
612D

FIG. 6N


610
612D
612
612C
612A
612B
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601
602
612
610
630
600
622
620
620
622D
656
622
622C
622A
622B
630
602
601

FIG. 6O

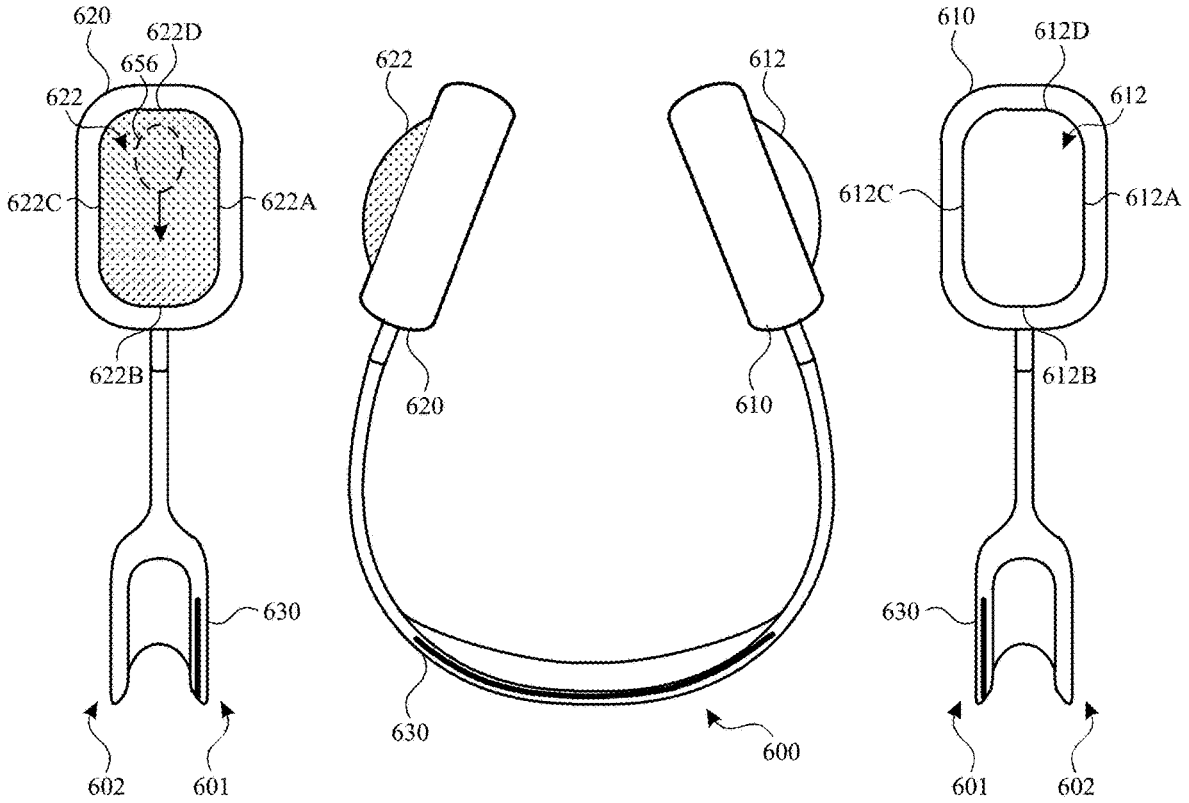
620
622D
656
622
622C
622A
622B
630
602
601
622
620
630
600
612
610
610
612D
612
612C
612A
612B
630
601
602

FIG. 6P

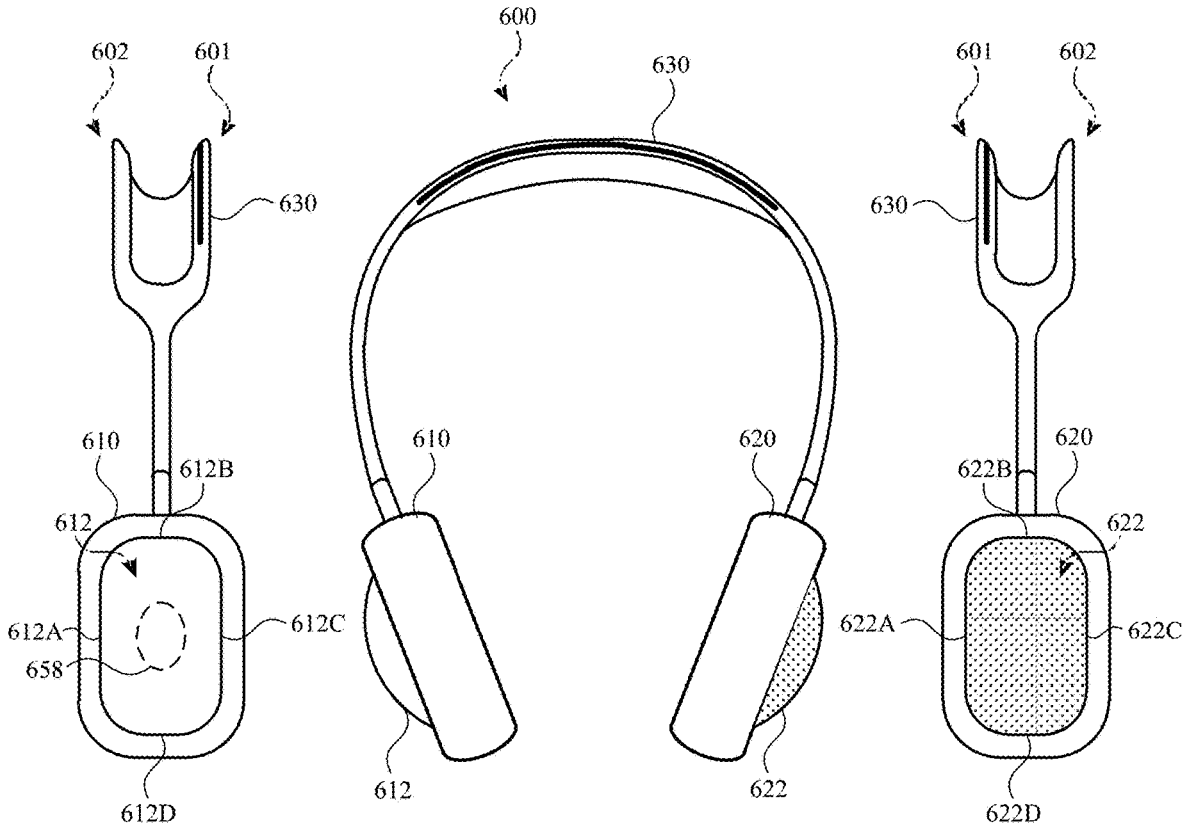
600
602
601
630
630
601
602
630
610
612B
610
620
620
622B
612
622
612A
612C
658
622A
622C
612
622
612D
622D

FIG. 6Q

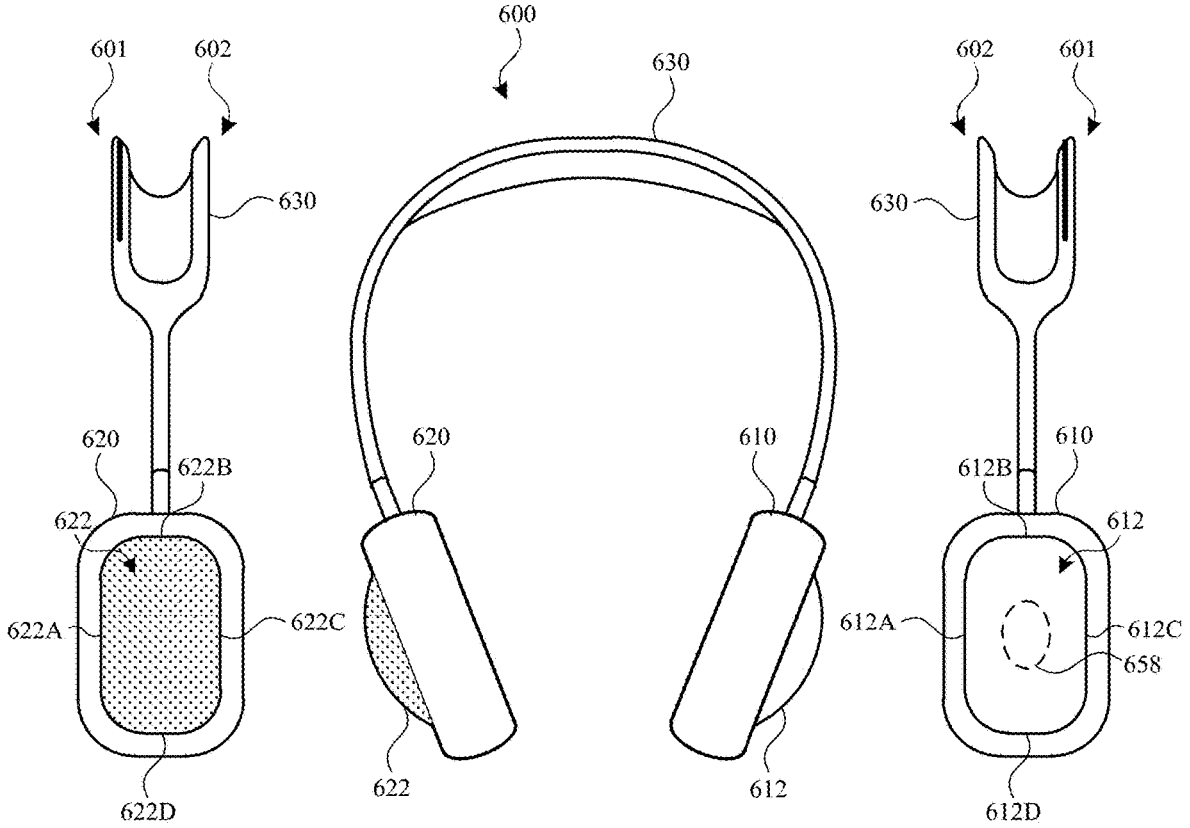
600
601
602
630
630
602
601
630
620
622B
620
610
610
612B
622
612
622A
622C
612A
612C
658
622D
622
612
612D

FIG. 6R

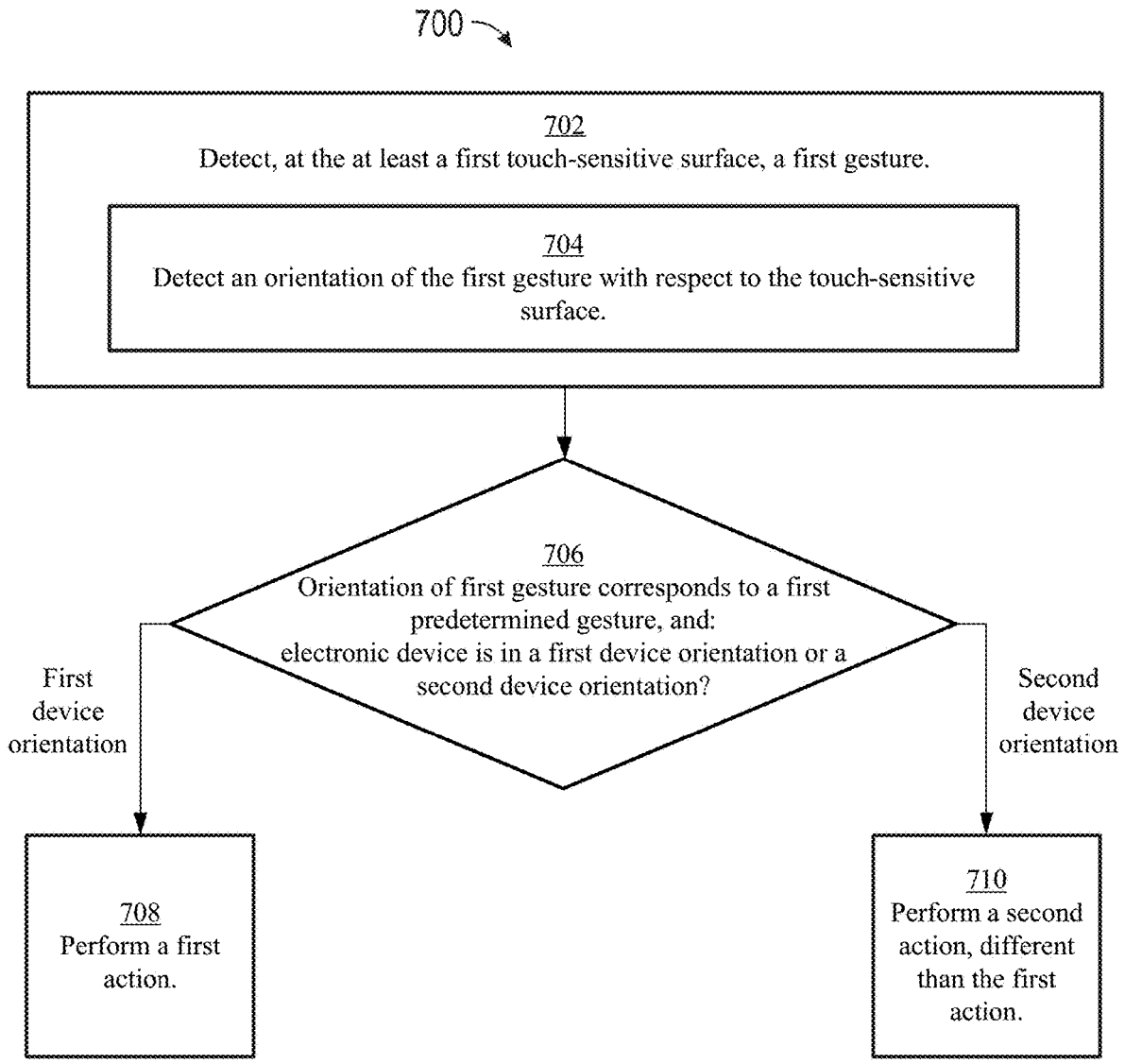
700
702
Detect, at the at least a first touch-sensitive surface, a first gesture.
704
Detect an orientation of the first gesture with respect to the touch-sensitive surface.
706
Orientation of first gesture corresponds to a first predetermined gesture, and:
electronic device is in a first device orientation or a second device orientation?
First device orientation
Second device orientation
708
Perform a first action.
710
Perform a second action, different than the first action.

FIG. 7

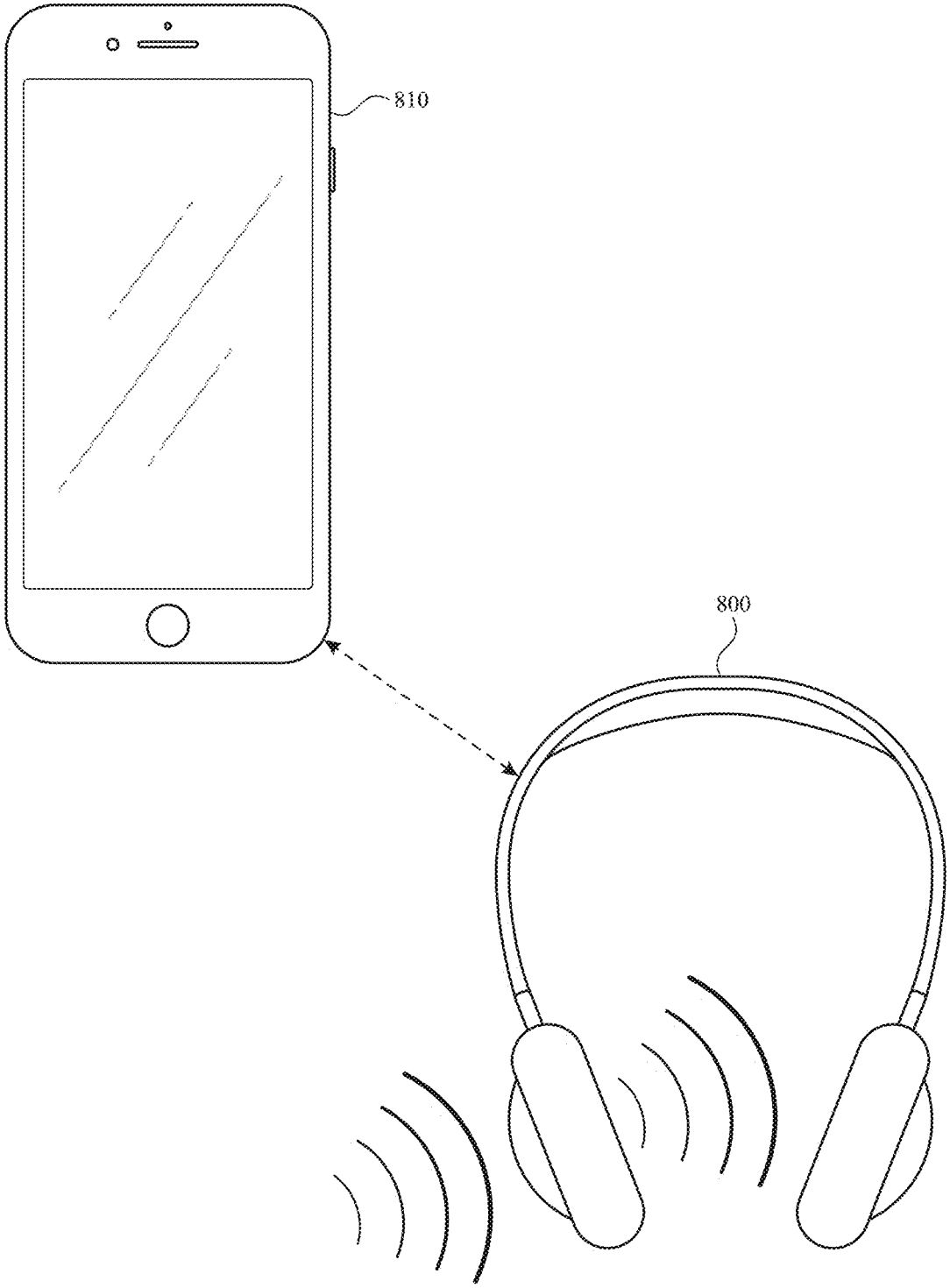

FIG. 8A

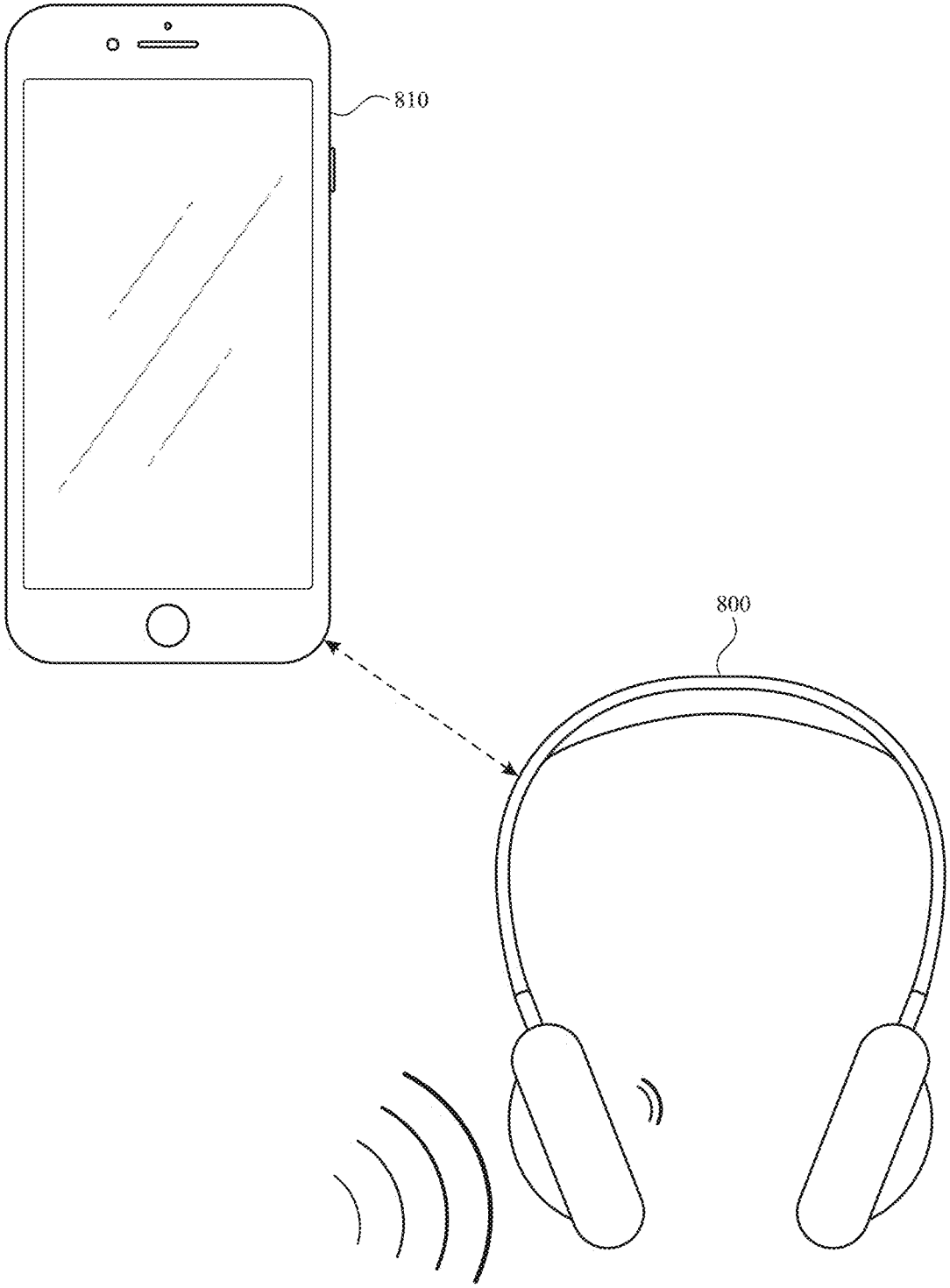

FIG. 8B

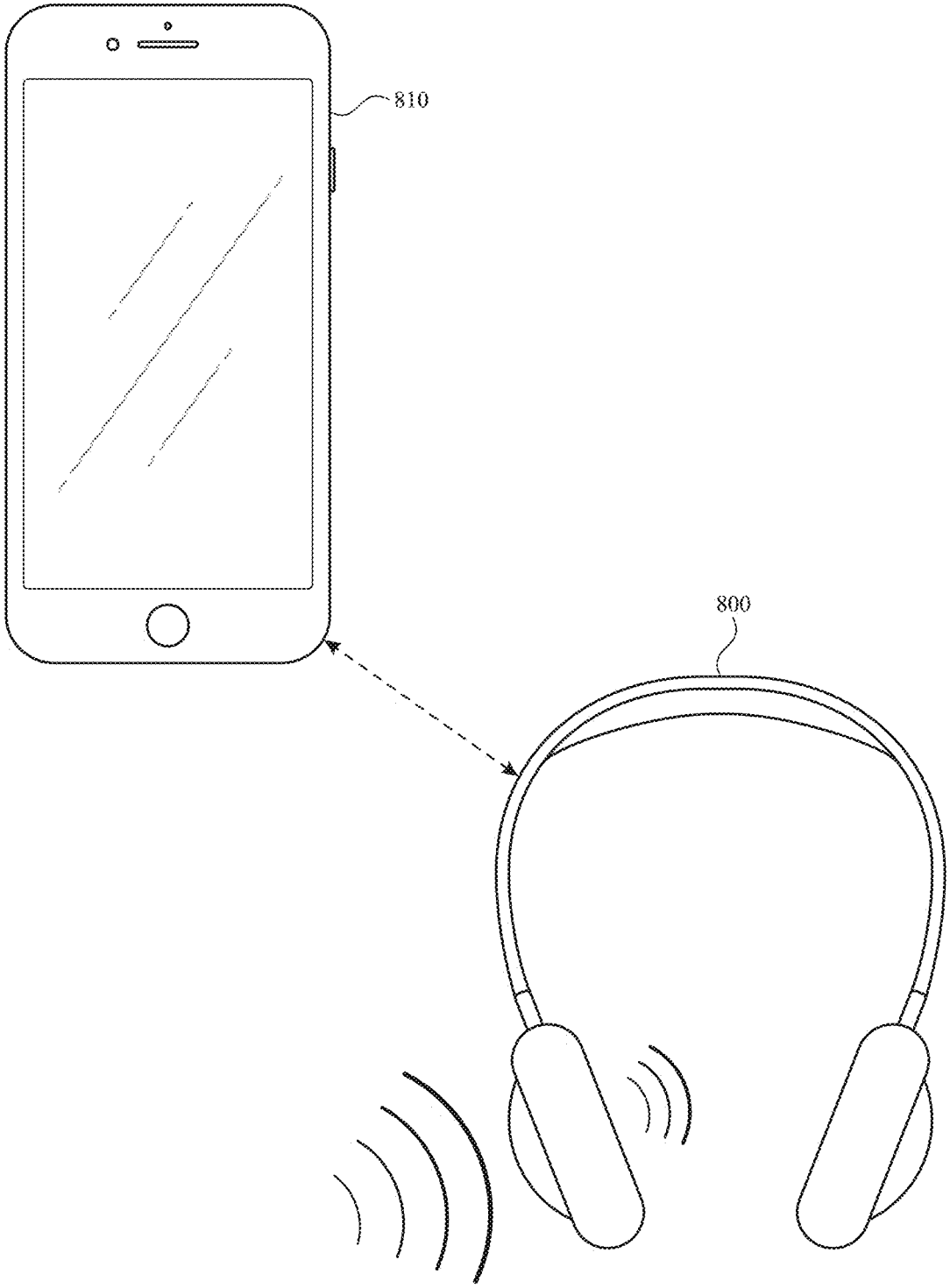

FIG. 8C

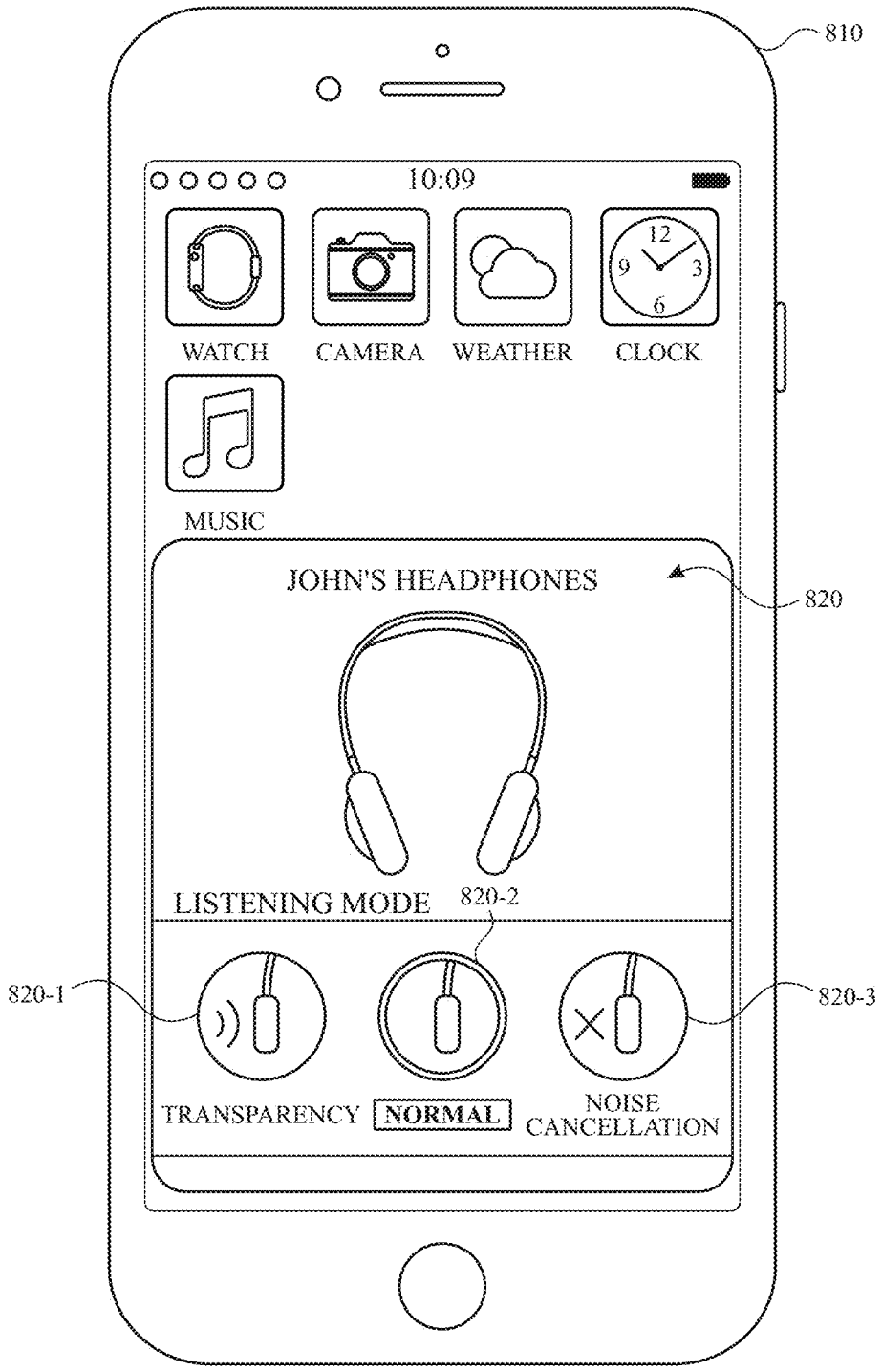
810
10:09
WATCH
CAMERA
WEATHER
CLOCK
MUSIC
JOHN'S HEADPHONES
820
LISTENING MODE
820-2
820-1
820-3
TRANSPARENCY
NORMAL
NOISE CANCELLATION

FIG. 8D

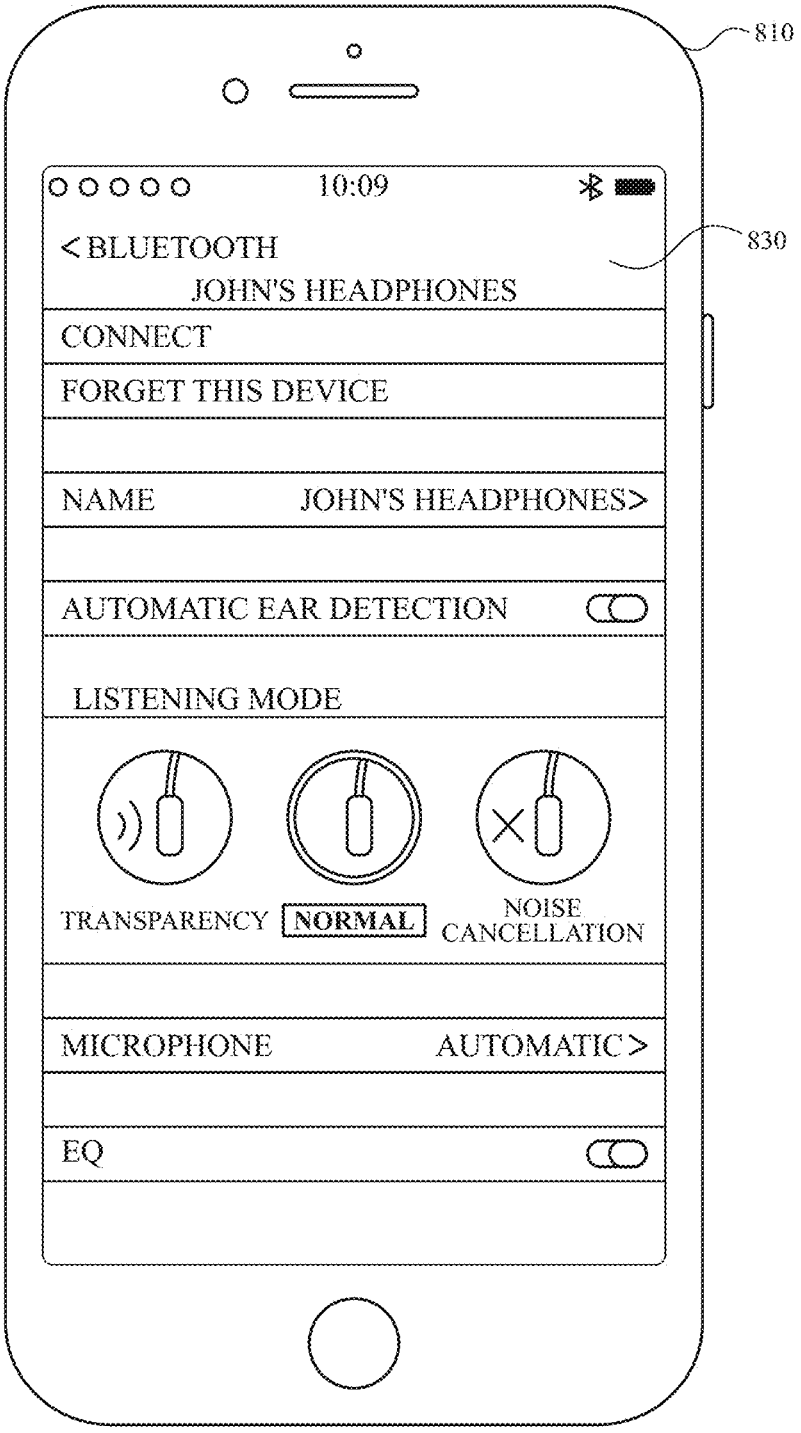
810
10:09
<BLUETOOTH
830
JOHN'S HEADPHONES
CONNECT
FORGET THIS DEVICE
NAME
JOHN'S HEADPHONES>
AUTOMATIC EAR DETECTION
LISTENING MODE
TRANSPARENCY
NORMAL
NOISE CANCELLATION
MICROPHONE
AUTOMATIC>
EQ

FIG. 8E

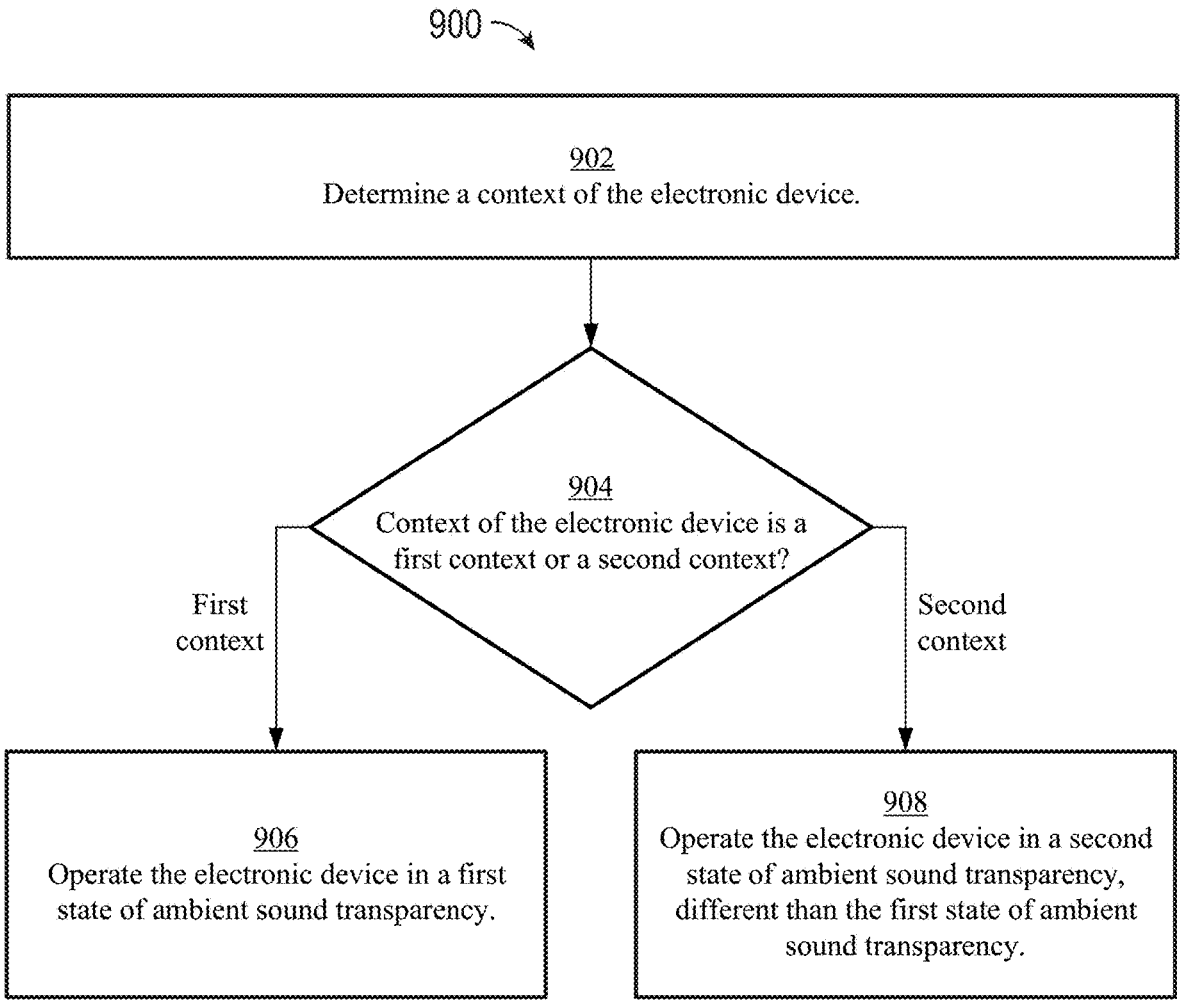
900
902
Determine a context of the electronic device.
904
Context of the electronic device is a first context or a second context?
First context
Second context
906
Operate the electronic device in a first state of ambient sound transparency.
908
Operate the electronic device in a second state of ambient sound transparency, different than the first state of ambient sound transparency.

FIG. 9

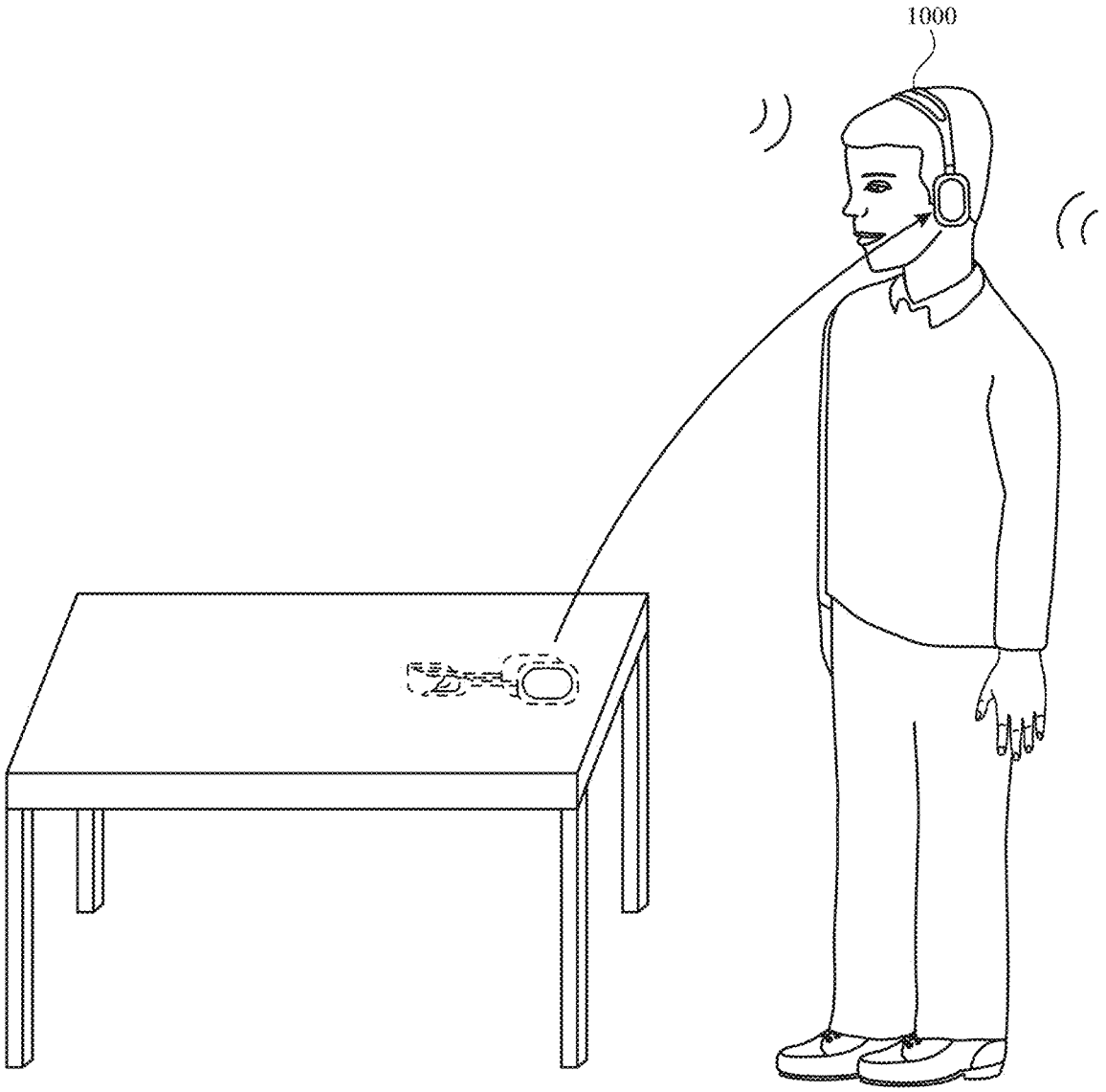

FIG. 10A

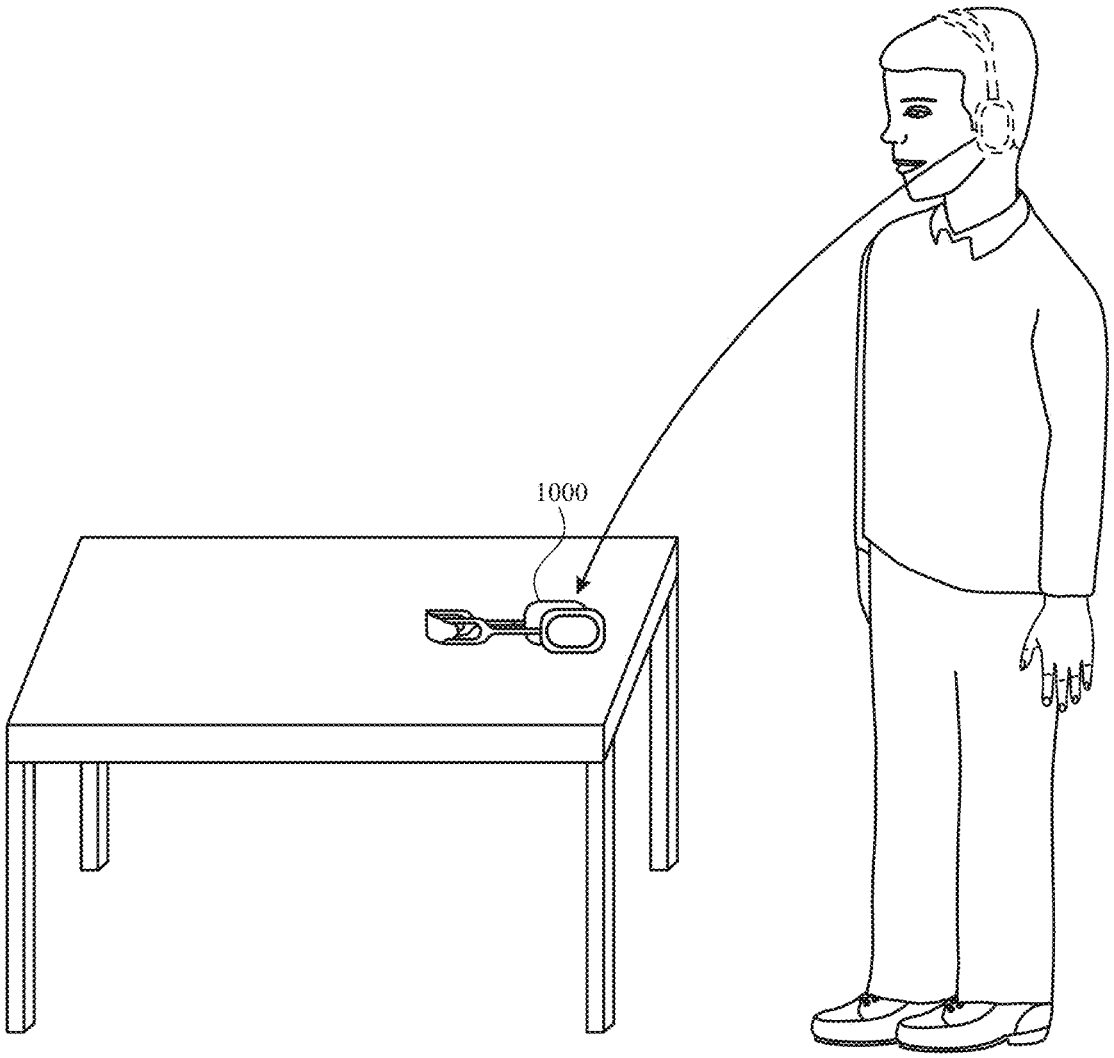

FIG. 10B

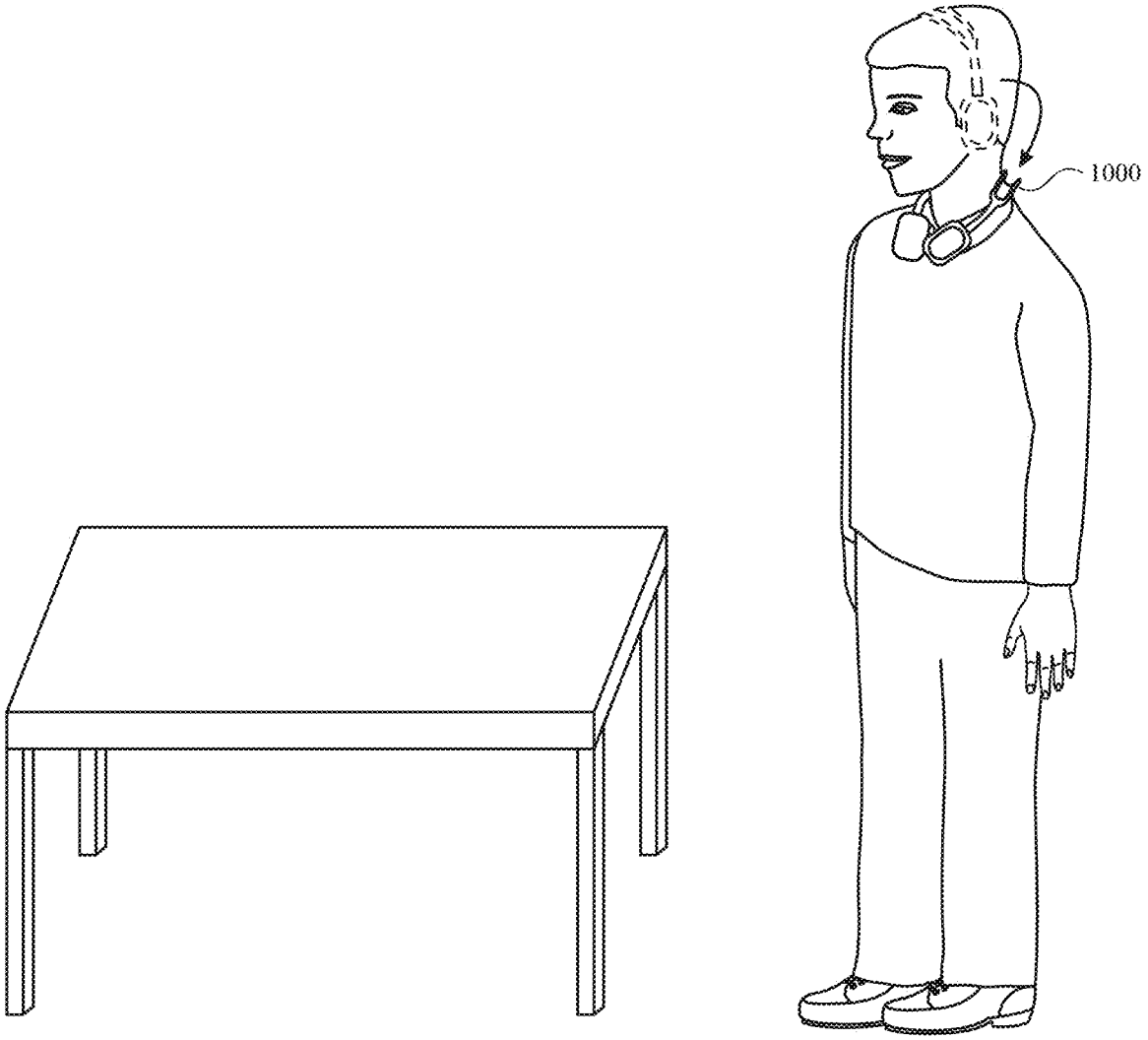

FIG. 10C

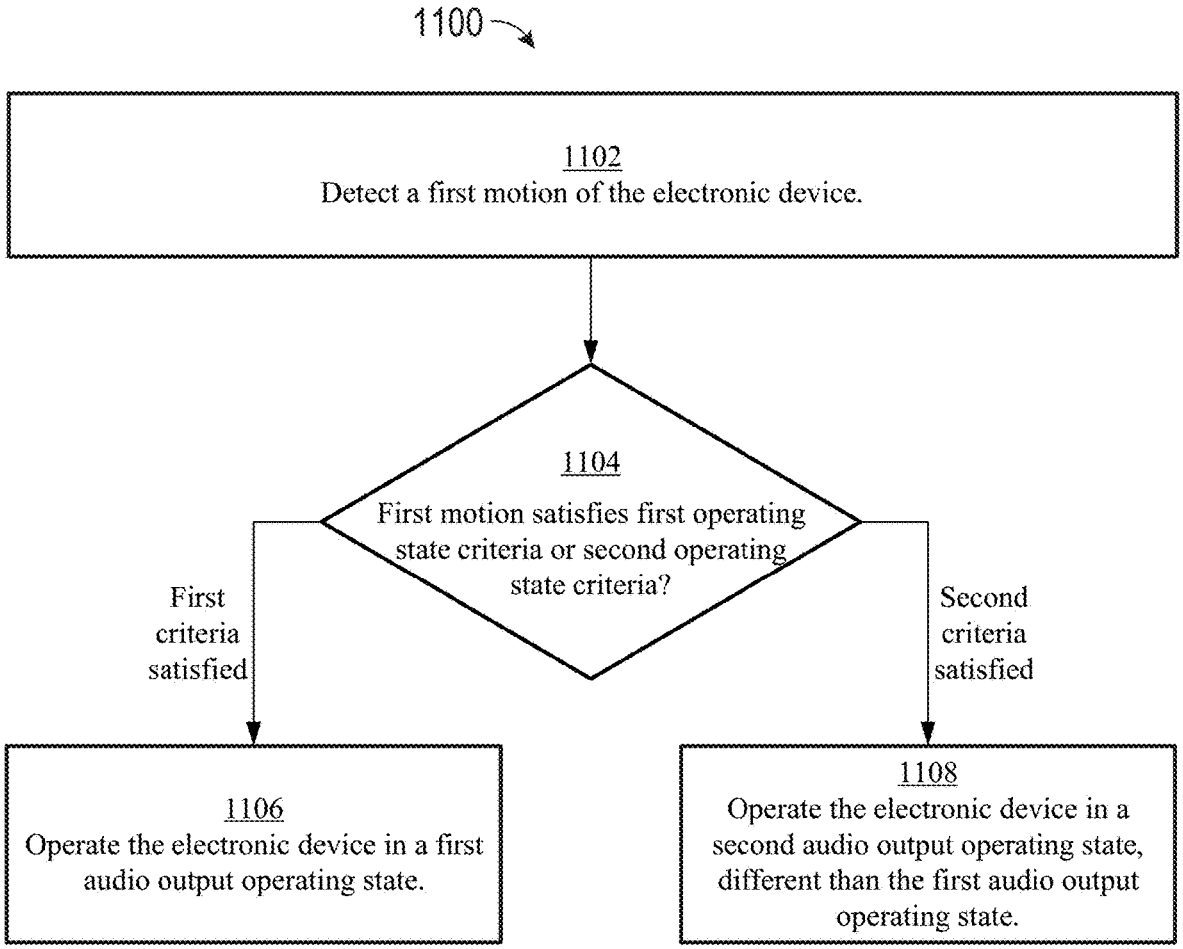
1100
1102
Detect a first motion of the electronic device.
1104
First motion satisfies first operating state criteria or second operating state criteria?
First criteria satisfied
Second criteria satisfied
1106
Operate the electronic device in a first audio output operating state.
1108
Operate the electronic device in a second audio output operating state, different than the first audio output operating state.

FIG. 11

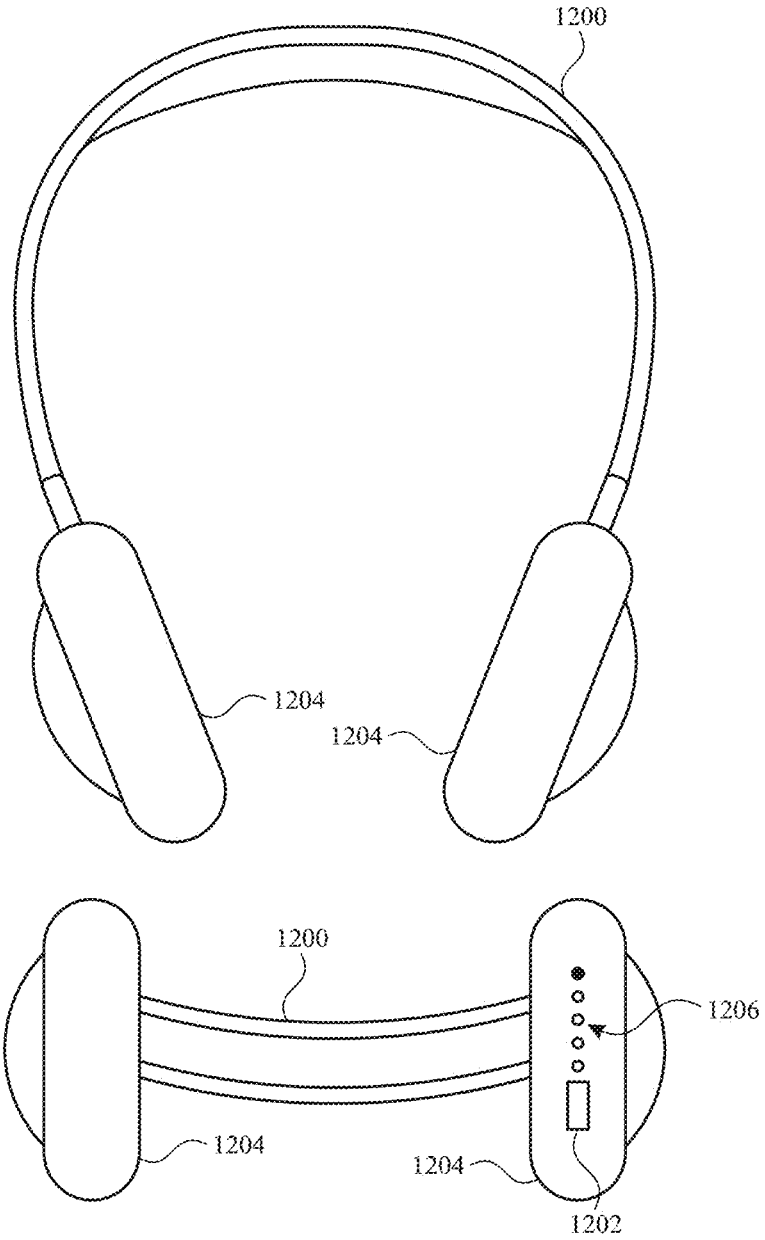

FIG. 12A

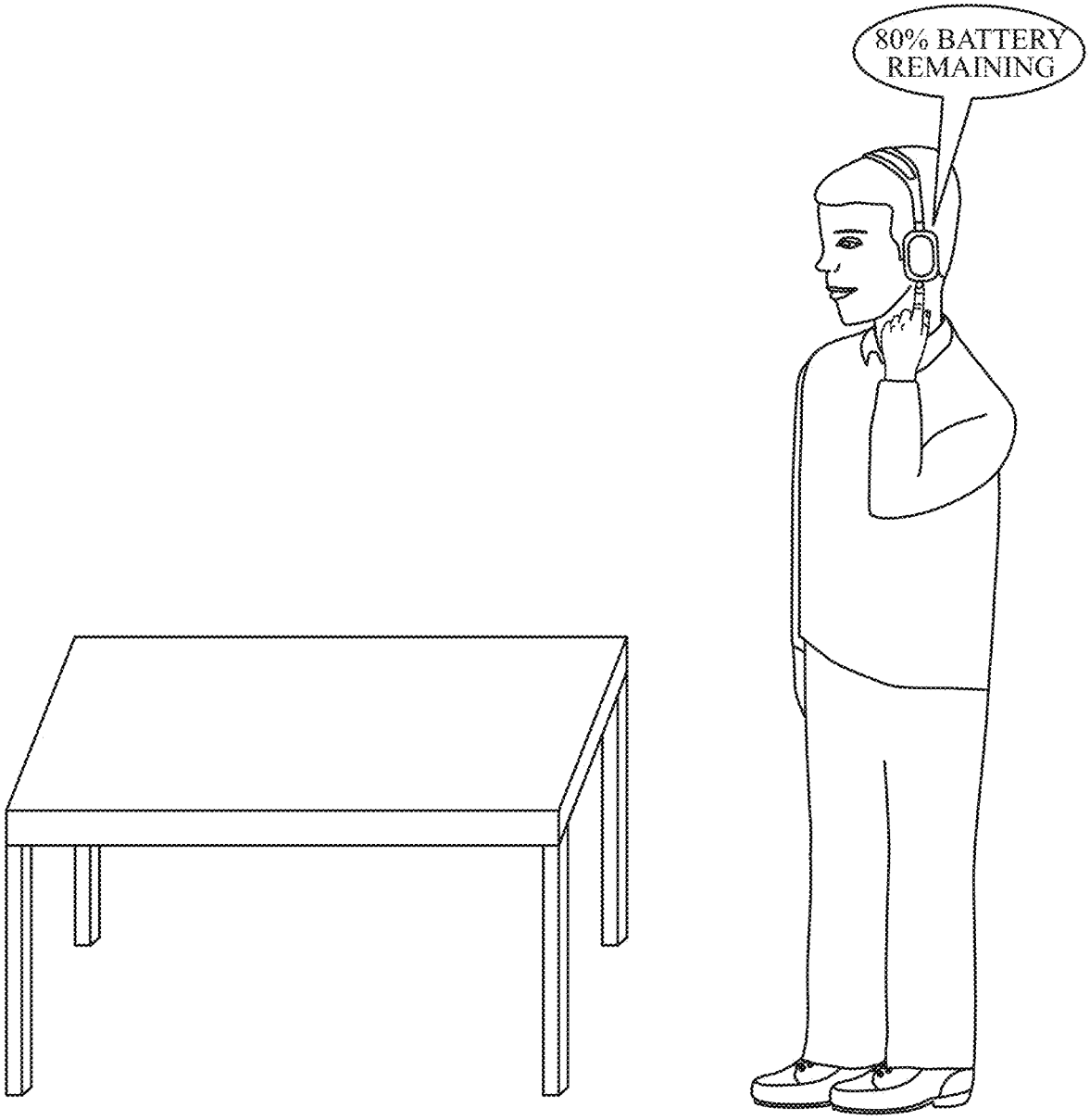

FIG. 12B

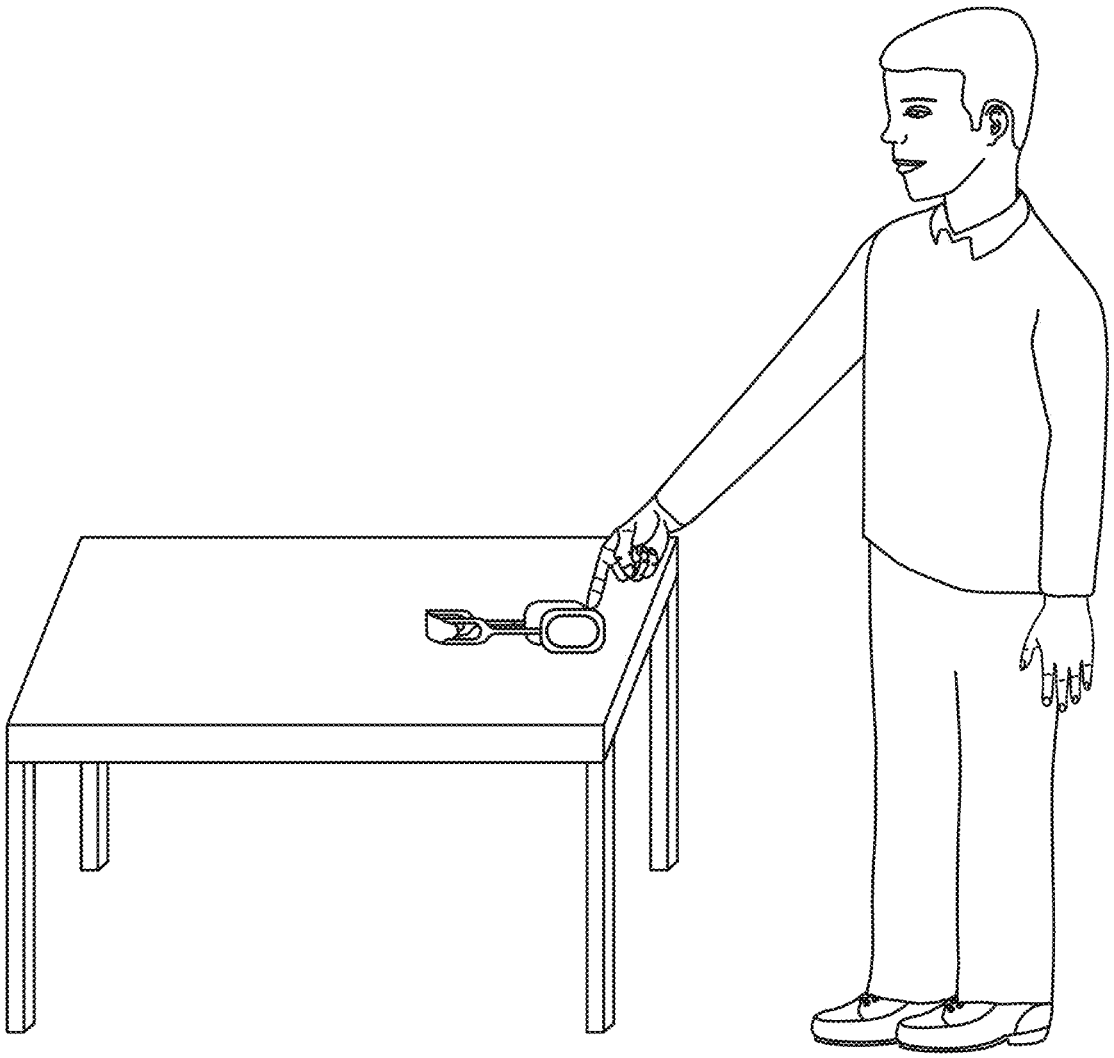

FIG. 12C

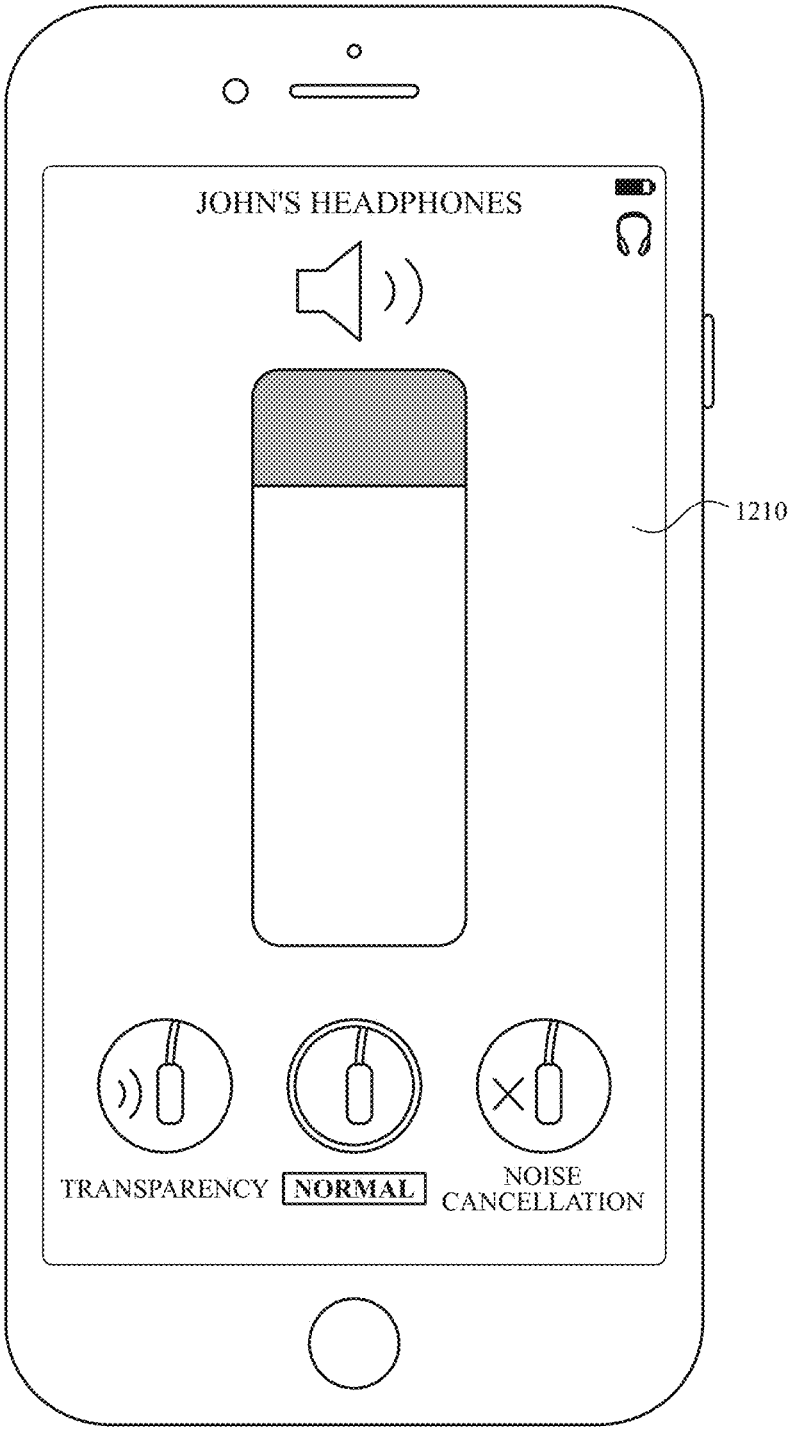
JOHN'S HEADPHONES
1210
TRANSPARENCY
NORMAL
NOISE CANCELLATION

FIG. 12D

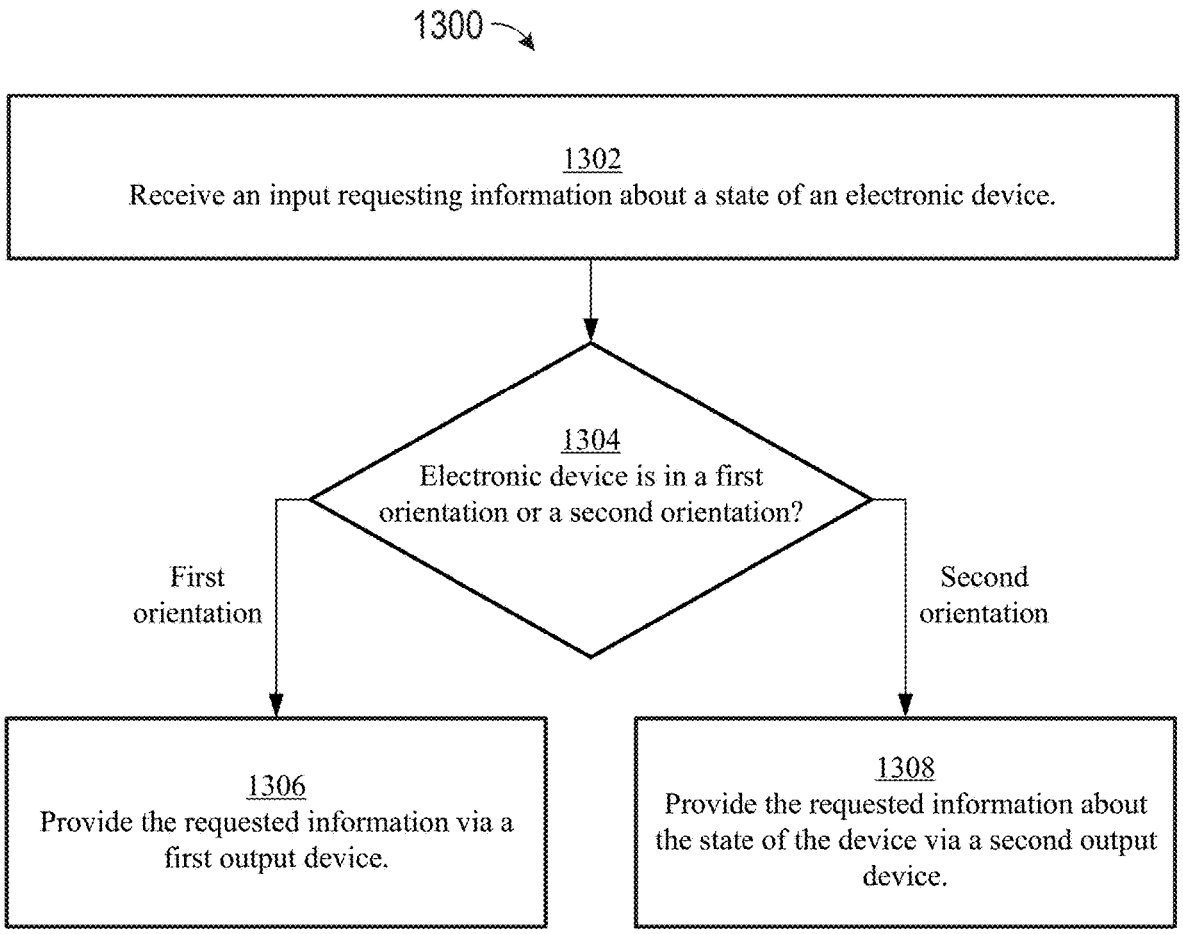
1300
1302
Receive an input requesting information about a state of an electronic device.
1304
Electronic device is in a first orientation or a second orientation?
First orientation
Second orientation
1306
Provide the requested information via a first output device.
1308
Provide the requested information about the state of the device via a second output device.

FIG. 13

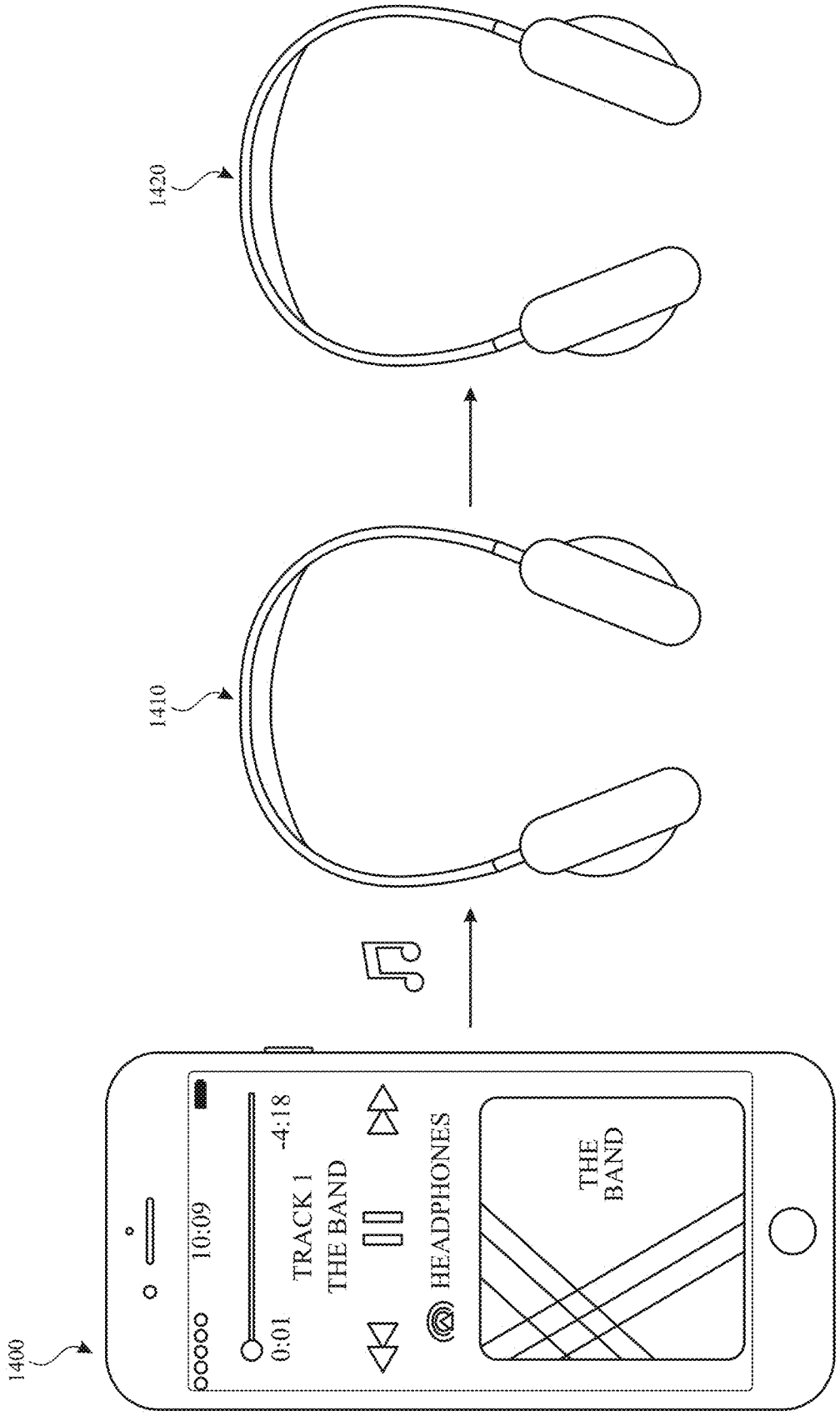
1400
10:09
0:01
-4:18
TRACK 1
THE BAND
HEADPHONES
THE
BAND
1410
1420

FIG. 14

WIRELESS HEADPHONE INTERACTIONS

RELATED APPLICATIONS

[0001] This application is a continuation of U.S. application Ser. No. 16/550,139, entitled "WIRELESS HEADPHONE INTERACTIONS", filed on Aug. 23, 2019, which claims priority to U.S. Provisional Patent Application Ser. No. 62/722,751, entitled "WIRELESS HEADPHONE INTERACTIONS", filed on Aug. 24, 2018, both of which are hereby incorporated by reference in their entireties.

FIELD

[0002] The present disclosure relates generally to user interfaces for electronic devices, and more specifically to techniques for interacting with and operating electronic audio devices such as wireless headphones.

BACKGROUND

[0003] Traditional headphones are connected via a wire to a device (e.g., a music player, phone, receiver, etc.) that provides audio signals, which the headphones use to produce audio output via speakers in or near the user's ear(s). Headphones often have few, if any, user input capabilities. The device to which the headphones are connected typically controls operations such as adjusting volume, changing an audio track, pausing the audio, and other features.

BRIEF SUMMARY

[0004] Some techniques for interacting with electronic audio devices such as wireless headphones, however, are generally cumbersome and inefficient. For example, some existing techniques use a complex and time-consuming user interface, which may include multiple key presses or keystrokes. Existing techniques require more time than necessary, wasting user time and device energy. This latter consideration is particularly important in battery-operated devices.

[0005] Accordingly, the present technique provides electronic devices with faster, more efficient methods and interfaces for electronic audio devices. Such methods and interfaces optionally complement or replace other methods for interacting with electronic audio devices. Such methods and interfaces reduce the cognitive burden on a user and produce a more efficient human-machine interface. For battery-operated computing devices, such methods and interfaces conserve power and increase the time between battery charges.

[0006] A method includes: at an electronic device including at least a first touch-sensitive surface: detecting, at the at least a first touch-sensitive surface, a first gesture, including detecting an orientation of the first gesture with respect to the touch-sensitive surface; and in response to detecting the first gesture: in accordance with a determination that the electronic device is in a first device orientation and that the orientation of the first gesture corresponds to a first predetermined orientation, performing a first action; and in accordance with a determination that the electronic device is in a second device orientation, different than the first device orientation and that the orientation of the first gesture corresponds to the first predetermined orientation, performing a second action, different than the first action.

[0007] A non-transitory computer-readable storage medium stores one or more programs configured to be executed by one or more processors of an electronic device with at least a first touch-sensitive surface, the one or more programs including instructions for: detecting, at the at least a first touch-sensitive surface, a first gesture, including detecting an orientation of the first gesture with respect to the touch-sensitive surface; and in response to detecting the first gesture: in accordance with a determination that the electronic device is in a first device orientation and that the orientation of the first gesture corresponds to a first predetermined orientation, performing a first action; and in accordance with a determination that the electronic device is in a second device orientation, different than the first device orientation and that the orientation of the first gesture corresponds to the first predetermined orientation, performing a second action, different than the first action.

[0008] A transitory computer-readable storage medium stores one or more programs configured to be executed by one or more processors of an electronic device with at least a first touch-sensitive surface, the one or more programs including instructions for: detecting, at the at least a first touch-sensitive surface, a first gesture, including detecting an orientation of the first gesture with respect to the touch-sensitive surface; and in response to detecting the first gesture: in accordance with a determination that the electronic device is in a first device orientation and that the orientation of the first gesture corresponds to a first predetermined orientation, performing a first action; and in accordance with a determination that the electronic device is in a second device orientation, different than the first device orientation and that the orientation of the first gesture corresponds to the first predetermined orientation, performing a second action, different than the first action.

[0009] An electronic device includes: at least a first touch-sensitive surface; one or more processors; and memory storing one or more programs configured to be executed by the one or more processors, the one or more programs including instructions for: detecting, at the at least a first touch-sensitive surface, a first gesture, including detecting an orientation of the first gesture with respect to the touch-sensitive surface; and in response to detecting the first gesture: in accordance with a determination that the electronic device is in a first device orientation and that the orientation of the first gesture corresponds to a first predetermined orientation, performing a first action; and in accordance with a determination that the electronic device is in a second device orientation, different than the first device orientation and that the orientation of the first gesture corresponds to the first predetermined orientation, performing a second action, different than the first action.

[0010] An electronic device includes: at least a first touch-sensitive surface; means for detecting, at the at least a first touch-sensitive surface, a first gesture, including detecting an orientation of the first gesture with respect to the touch-sensitive surface; and means, responsive to detecting the first gesture, for: in accordance with a determination that the electronic device is in a first device orientation and that the orientation of the first gesture corresponds to a first predetermined orientation, performing a first action; and in accordance with a determination that the electronic device is in a second device orientation, different than the first device orientation and that the orientation of the first gesture corresponds to the first predetermined orientation, performing a second action, different than the first action.

[0011] A method includes: at an electronic device having an audio output mechanism; determining a context of the electronic device; and in response to determining the context of the electronic device: in accordance with a determination that the context of the electronic device is a first context, operating the electronic device in a first state of ambient sound transparency; and in accordance with a determination that the context of the electronic device is a second context, different than the first context, operating the electronic device in a second state of ambient sound transparency, different than the first state of ambient sound transparency.

[0012] A non-transitory computer-readable storage medium stores one or more programs configured to be executed by one or more processors of an electronic device with an audio output mechanism, the one or more programs including instructions for: determining a context of the electronic device; and in response to determining the context of the electronic device: in accordance with a determination that the context of the electronic device is a first context, operating the electronic device in a first state of ambient sound transparency; and in accordance with a determination that the context of the electronic device is a second context, different than the first context, operating the electronic device in a second state of ambient sound transparency, different than the first state of ambient sound transparency.

[0013] A transitory computer-readable storage medium stores one or more programs configured to be executed by one or more processors of an electronic device with an audio output mechanism, the one or more programs including instructions for: determining a context of the electronic device; and in response to determining the context of the electronic device: in accordance with a determination that the context of the electronic device is a first context, operating the electronic device in a first state of ambient sound transparency; and in accordance with a determination that the context of the electronic device is a second context, different than the first context, operating the electronic device in a second state of ambient sound transparency, different than the first state of ambient sound transparency.

[0014] An electronic device includes: an audio output mechanism; one or more processors; and memory storing one or more programs configured to be executed by the one or more processors, the one or more programs including instructions for: determining a context of the electronic device; and in response to determining the context of the electronic device: in accordance with a determination that the context of the electronic device is a first context, operating the electronic device in a first state of ambient sound transparency; and in accordance with a determination that the context of the electronic device is a second context, different than the first context, operating the electronic device in a second state of ambient sound transparency, different than the first state of ambient sound transparency.

[0015] An electronic device includes: an audio output mechanism; means for determining a context of the electronic device; and means, responsive to determining the context of the electronic device, for: in accordance with a determination that the context of the electronic device is a first context, operating the electronic device in a first state of ambient sound transparency; and in accordance with a determination that the context of the electronic device is a second context, different than the first context, operating the electronic device in a second state of ambient sound transparency, different than the first state of ambient sound transparency.

[0016] A method includes: at an electronic device having one or more motion sensors and an audio output mechanism; detecting first motion of the electronic device; and in response to detecting the first motion of the electronic device: in accordance with a determination that the first motion satisfies first operating state criteria, operating the electronic device in a first audio output operating state; and in accordance with a determination that the first motion satisfies second operating state criteria, different than the first operating state criteria, operating the electronic device in a second audio output operating state, different than the first audio output operating state.

[0017] A non-transitory computer-readable storage medium stores one or more programs configured to be executed by one or more processors of an electronic device with one or more motion sensors and an audio output mechanism, the one or more programs including instructions for: detecting first motion of the electronic device; and in response to detecting the first motion of the electronic device: in accordance with a determination that the first motion satisfies first operating state criteria, operating the electronic device in a first audio output operating state; and in accordance with a determination that the first motion satisfies second operating state criteria, different than the first operating state criteria, operating the electronic device in a second audio output operating state, different than the first audio output operating state.

[0018] A transitory computer-readable storage medium stores one or more programs configured to be executed by one or more processors of an electronic device with one or more motion sensors and an audio output mechanism, the one or more programs including instructions for: detecting first motion of the electronic device; and in response to detecting the first motion of the electronic device: in accordance with a determination that the first motion satisfies first operating state criteria, operating the electronic device in a first audio output operating state; and in accordance with a determination that the first motion satisfies second operating state criteria, different than the first operating state criteria, operating the electronic device in a second audio output operating state, different than the first audio output operating state.

[0019] An electronic device includes: one or more motion sensors; an audio output mechanism; one or more processors; and memory storing one or more programs configured to be executed by the one or more processors, the one or more programs including instructions for: detecting first motion of the electronic device; and in response to detecting the first motion of the electronic device: in accordance with a determination that the first motion satisfies first operating state criteria, operating the electronic device in a first audio output operating state; and in accordance with a determination that the first motion satisfies second operating state criteria, different than the first operating state criteria, operating the electronic device in a second audio output operating state, different than the first audio output operating state.

[0020] An electronic device includes: one or more motion sensors; an audio output mechanism; means for detecting first motion of the electronic device; and means, responsive to detecting the first motion of the electronic device, for: in

accordance with a determination that the first motion satisfies first operating state criteria, operating the electronic device in a first audio output operating state; and in accordance with a determination that the first motion satisfies second operating state criteria, different than the first operating state criteria, operating the electronic device in a second audio output operating state, different than the first audio output operating state.

[0021] A method includes: at an electronic device including one or more orientation sensors, a first output device, and a second output device, different than the first output device: receiving an input requesting information about a state of the electronic device; and in response to receiving the input requesting the information about the state of the electronic device: in accordance with a determination, based on the one or more orientation sensors, that the electronic device is in a first orientation, providing the requested information via the first output device; and in accordance with a determination, based on the one or more orientation sensors, that the electronic device is in a second orientation, different than the first orientation, providing the requested information about the state of the device via the second output device.

[0022] A non-transitory computer-readable storage medium stores one or more programs configured to be executed by one or more processors of an electronic device with one or more orientation sensors, a first output device, and a second output device, different than the first output device, the one or more programs including instructions for: receiving an input requesting information about a state of the electronic device; and in response to receiving the input requesting the information about the state of the electronic device: in accordance with a determination, based on the one or more orientation sensors, that the electronic device is in a first orientation, providing the requested information via the first output device; and in accordance with a determination, based on the one or more orientation sensors, that the electronic device is in a second orientation, different than the first orientation, providing the requested information about the state of the device via the second output device.

[0023] A transitory computer-readable storage medium stores one or more programs configured to be executed by one or more processors of an electronic device with one or more orientation sensors, a first output device, and a second output device, different than the first output device, the one or more programs including instructions for: receiving an input requesting information about a state of the electronic device; and in response to receiving the input requesting the information about the state of the electronic device: in accordance with a determination, based on the one or more orientation sensors, that the electronic device is in a first orientation, providing the requested information via the first output device; and in accordance with a determination, based on the one or more orientation sensors, that the electronic device is in a second orientation, different than the first orientation, providing the requested information about the state of the device via the second output device.

[0024] An electronic device includes: one or more orientation sensors; a first output device; a second output device, different than the first output device; one or more processors; and memory storing one or more programs configured to be executed by the one or more processors, the one or more programs including instructions for: receiving an input requesting information about a state of the electronic device; and in response to receiving the input requesting the information about the state of the electronic device: in accordance with a determination, based on the one or more orientation sensors, that the electronic device is in a first orientation, providing the requested information via the first output device; and in accordance with a determination, based on the one or more orientation sensors, that the electronic device is in a second orientation, different than the first orientation, providing the requested information about the state of the device via the second output device.

[0025] An electronic device includes: one or more orientation sensors; a first output device; a second output device, different than the first output device; means for receiving an input requesting information about a state of the electronic device; and means, responsive to receiving the input requesting the information about the state of the electronic device, for: in accordance with a determination, based on the one or more orientation sensors, that the electronic device is in a first orientation, providing the requested information via the first output device; and in accordance with a determination, based on the one or more orientation sensors, that the electronic device is in a second orientation, different than the first orientation, providing the requested information about the state of the device via the second output device.

[0026] Executable instructions for performing these functions are, optionally, included in a non-transitory computer-readable storage medium or other computer program product configured for execution by one or more processors. Executable instructions for performing these functions are, optionally, included in a transitory computer-readable storage medium or other computer program product configured for execution by one or more processors.

[0027] Thus, devices are provided with faster, more efficient methods and interfaces for interacting with electronic audio devices, thereby increasing the effectiveness, efficiency, and user satisfaction with such devices. Such methods and interfaces can complement or replace other methods for interacting with electronic audio devices.

DESCRIPTION OF THE FIGURES

[0028] For a better understanding of the various described embodiments, reference should be made to the Description of Embodiments below, in conjunction with the following drawings in which like reference numerals refer to corresponding parts throughout the figures.

[0029] FIG. **1**A is a block diagram illustrating a portable multifunction device with a touch-sensitive display in accordance with some embodiments.

[0030] FIG. **1**B is a block diagram illustrating exemplary components for event handling in accordance with some embodiments.

[0031] FIG. **2** illustrates a portable multifunction device having a touch screen in accordance with some embodiments.

[0032] FIG. **3** is a block diagram of an exemplary multifunction device with a display and a touch-sensitive surface in accordance with some embodiments.

[0033] FIG. **4**A illustrates an exemplary user interface for a menu of applications on a portable multifunction device in accordance with some embodiments.

[0034] FIG. **4**B illustrates an exemplary user interface for a multifunction device with a touch-sensitive surface that is separate from the display in accordance with some embodiments.

[0035] FIG. **5**A illustrates a personal electronic device in accordance with some embodiments.

[0036] FIG. **5**B is a block diagram illustrating a personal electronic device in accordance with some embodiments.

[0037] FIGS. **5**C-**5**D illustrate exemplary components of a personal electronic device having a touch-sensitive display and intensity sensors in accordance with some embodiments.

[0038] FIGS. **5**E-**5**H illustrate exemplary components and user interfaces of a personal electronic device in accordance with some embodiments.

[0039] FIGS. **6**A-**6**R illustrate exemplary techniques for processing gestures on a touch-sensitive surface using an electronic device in accordance with some embodiments.

[0040] FIG. **7** is a flow diagram illustrating a method for processing gestures on a touch-sensitive surface using an electronic device in accordance with some embodiments.

[0041] FIGS. **8**A-**8**E illustrate exemplary techniques for context-dependent ambient sound transparency operation of an electronic device in accordance with some embodiments.

[0042] FIG. **9** is a flow diagram illustrating a method for context-dependent ambient sound transparency operation of an electronic device in accordance with some embodiments.

[0043] FIGS. **10**A-**10**C illustrate exemplary techniques for motion-dependent audio output operation of an electronic device in accordance with some embodiments.

[0044] FIG. **11** is a flow diagram illustrating a method for motion-dependent audio output operation of an electronic device in accordance with some embodiments.

[0045] FIG. **12**A-**12**D illustrate exemplary techniques for providing state information about an electronic device in accordance with some embodiments.

[0046] FIG. **13** is a flow diagram illustrating a method for providing state information about an electronic device in accordance with some embodiments.

[0047] FIG. **14** illustrates exemplary techniques for operating multiple sets of headphones in accordance with some embodiments.

DESCRIPTION OF EMBODIMENTS

[0048] The following description sets forth exemplary methods, parameters, and the like. It should be recognized, however, that such description is not intended as a limitation on the scope of the present disclosure but is instead provided as a description of exemplary embodiments.

[0049] There is a need for electronic devices that provide efficient methods and interfaces for electronic audio devices, such as wireless headphones. The orientation-dependent, context-dependent, and motion-dependent techniques described below provide for more efficient, intuitive, and user-friendly operation of an audio-enabled electronic device. Such techniques can reduce the cognitive burden on a user who uses electronic audio devices, thereby enhancing productivity. Further, such techniques can reduce processor and battery power otherwise wasted on redundant user inputs.

[0050] Below, FIGS. **1**A-**1**B, **2**, **3**, **4**A-**4**B, and **5**A-**5**H provide a description of exemplary devices for performing the techniques described below. FIGS. **6**A-**6**R illustrate exemplary techniques for processing gestures on a touch-sensitive surface using an electronic device. FIG. **7** is a flow diagram illustrating methods of processing gestures on a touch-sensitive surface using an electronic device in accordance with some embodiments. The illustrations in FIGS. **6**A-**6**R are used to illustrate the processes described below, including the processes in FIG. **7**. FIGS. **8**A-**8**E illustrate exemplary techniques for context-dependent ambient sound transparency operation of an electronic device. FIG. **9** is a flow diagram illustrating methods of context-dependent ambient sound transparency operation of an electronic device in accordance with some embodiments. The illustrations in FIGS. **8**A-**8**E are used to illustrate the processes described below, including the processes in FIG. **9**. FIGS. **10**A-**10**C illustrate exemplary techniques for motion-dependent audio output operation of an electronic device. FIG. **11** is a flow diagram illustrating methods of motion-dependent audio output operation of an electronic device in accordance with some embodiments. The illustrations in FIGS. **10**A-**10**C are used to illustrate the processes described below, including the processes in FIG. **11**. FIGS. **12**A-**12**D illustrate exemplary techniques for providing state information about an electronic device. FIG. **13** is a flow diagram illustrating methods of providing state information about an electronic device in accordance with some embodiments. The illustrations in FIGS. **12**A-**12**D are used to illustrate the processes described below, including the processes in FIG. **13**. FIG. **14** illustrates exemplary techniques for operating multiple sets of headphones in accordance with some embodiments

[0051] Although the following description uses terms "first," "second," etc. to describe various elements, these elements should not be limited by the terms. These terms are only used to distinguish one element from another. For example, a first touch could be termed a second touch, and, similarly, a second touch could be termed a first touch, without departing from the scope of the various described embodiments. The first touch and the second touch are both touches, but they are not the same touch.

[0052] The terminology used in the description of the various described embodiments herein is for the purpose of describing particular embodiments only and is not intended to be limiting. As used in the description of the various described embodiments and the appended claims, the singular forms "a," "an," and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will also be understood that the term "and/or" as used herein refers to and encompasses any and all possible combinations of one or more of the associated listed items. It will be further understood that the terms "includes," "including," "comprises," and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

[0053] The term "if" is, optionally, construed to mean "when" or "upon" or "in response to determining" or "in response to detecting," depending on the context. Similarly, the phrase "if it is determined" or "if [a stated condition or event] is detected" is, optionally, construed to mean "upon determining" or "in response to determining" or "upon detecting [the stated condition or event]" or "in response to detecting [the stated condition or event]," depending on the context.

[0054] Embodiments of electronic devices, user interfaces for such devices, and associated processes for using such devices are described. In some embodiments, the device is a portable communications device, such as a mobile telephone, that also contains other functions, such as PDA

and/or music player functions. Exemplary embodiments of portable multifunction devices include, without limitation, the iPhone®, iPod Touch®, and iPad® devices from Apple Inc. of Cupertino, Calif. Other portable electronic devices, such as laptops or tablet computers with touch-sensitive surfaces (e.g., touch screen displays and/or touchpads), are, optionally, used. It should also be understood that, in some embodiments, the device is not a portable communications device, but is a desktop computer with a touch-sensitive surface (e.g., a touch screen display and/or a touchpad).

[0055] In the discussion that follows, an electronic device that includes a display and a touch-sensitive surface is described. It should be understood, however, that the electronic device optionally includes one or more other physical user-interface devices, such as a physical keyboard, a mouse, and/or a joystick.

[0056] The device typically supports a variety of applications, such as one or more of the following: a drawing application, a presentation application, a word processing application, a website creation application, a disk authoring application, a spreadsheet application, a gaming application, a telephone application, a video conferencing application, an e-mail application, an instant messaging application, a workout support application, a photo management application, a digital camera application, a digital video camera application, a web browsing application, a digital music player application, and/or a digital video player application.

[0057] The various applications that are executed on the device optionally use at least one common physical user-interface device, such as the touch-sensitive surface. One or more functions of the touch-sensitive surface as well as corresponding information displayed on the device are, optionally, adjusted and/or varied from one application to the next and/or within a respective application. In this way, a common physical architecture (such as the touch-sensitive surface) of the device optionally supports the variety of applications with user interfaces that are intuitive and transparent to the user.

[0058] Attention is now directed toward embodiments of portable devices with touch-sensitive displays. FIG. **1**A is a block diagram illustrating portable multifunction device **100** with touch-sensitive display system **112** in accordance with some embodiments. Touch-sensitive display **112** is sometimes called a "touch screen" for convenience and is sometimes known as or called a "touch-sensitive display system." Device **100** includes memory **102** (which optionally includes one or more computer-readable storage mediums), memory controller **122**, one or more processing units (CPUs) **120**, peripherals interface **118**, RF circuitry **108**, audio circuitry **110**, speaker **111**, microphone **113**, input/output (I/O) subsystem **106**, other input control devices **116**, and external port **124**. Device **100** optionally includes one or more optical sensors **164**. Device **100** optionally includes one or more contact intensity sensors **165** for detecting intensity of contacts on device **100** (e.g., a touch-sensitive surface such as touch-sensitive display system **112** of device **100**). Device **100** optionally includes one or more tactile output generators **167** for generating tactile outputs on device **100** (e.g., generating tactile outputs on a touch-sensitive surface such as touch-sensitive display system **112** of device **100** or touchpad **355** of device **300**). These components optionally communicate over one or more communication buses or signal lines **103**.

[0059] As used in the specification and claims, the term "intensity" of a contact on a touch-sensitive surface refers to the force or pressure (force per unit area) of a contact (e.g., a finger contact) on the touch-sensitive surface, or to a substitute (proxy) for the force or pressure of a contact on the touch-sensitive surface. The intensity of a contact has a range of values that includes at least four distinct values and more typically includes hundreds of distinct values (e.g., at least 256). Intensity of a contact is, optionally, determined (or measured) using various approaches and various sensors or combinations of sensors. For example, one or more force sensors underneath or adjacent to the touch-sensitive surface are, optionally, used to measure force at various points on the touch-sensitive surface. In some implementations, force measurements from multiple force sensors are combined (e.g., a weighted average) to determine an estimated force of a contact. Similarly, a pressure-sensitive tip of a stylus is, optionally, used to determine a pressure of the stylus on the touch-sensitive surface. Alternatively, the size of the contact area detected on the touch-sensitive surface and/or changes thereto, the capacitance of the touch-sensitive surface proximate to the contact and/or changes thereto, and/or the resistance of the touch-sensitive surface proximate to the contact and/or changes thereto are, optionally, used as a substitute for the force or pressure of the contact on the touch-sensitive surface. In some implementations, the substitute measurements for contact force or pressure are used directly to determine whether an intensity threshold has been exceeded (e.g., the intensity threshold is described in units corresponding to the substitute measurements). In some implementations, the substitute measurements for contact force or pressure are converted to an estimated force or pressure, and the estimated force or pressure is used to determine whether an intensity threshold has been exceeded (e.g., the intensity threshold is a pressure threshold measured in units of pressure). Using the intensity of a contact as an attribute of a user input allows for user access to additional device functionality that can otherwise not be accessible by the user on a reduced-size device with limited real estate for displaying affordances (e.g., on a touch-sensitive display) and/or receiving user input (e.g., via a touch-sensitive display, a touch-sensitive surface, or a physical/mechanical control such as a knob or a button).

[0060] As used in the specification and claims, the term "tactile output" refers to physical displacement of a device relative to a previous position of the device, physical displacement of a component (e.g., a touch-sensitive surface) of a device relative to another component (e.g., housing) of the device, or displacement of the component relative to a center of mass of the device that will be detected by a user with the user's sense of touch. For example, in situations where the device or the component of the device is in contact with a surface of a user that is sensitive to touch (e.g., a finger, palm, or other part of a user's hand), the tactile output generated by the physical displacement will be interpreted by the user as a tactile sensation corresponding to a perceived change in physical characteristics of the device or the component of the device. For example, movement of a touch-sensitive surface (e.g., a touch-sensitive display or trackpad) is, optionally, interpreted by the user as a "down click" or "up click" of a physical actuator button. In some cases, a user will feel a tactile sensation such as an "down click" or "up click" even when there is no movement of a physical actuator button associated with the touch-sensitive

surface that is physically pressed (e.g., displaced) by the user's movements. As another example, movement of the touch-sensitive surface is, optionally, interpreted or sensed by the user as "roughness" of the touch-sensitive surface, even when there is no change in smoothness of the touch-sensitive surface. While such interpretations of touch by a user will be subject to the individualized sensory perceptions of the user, there are many sensory perceptions of touch that are common to a large majority of users. Thus, when a tactile output is described as corresponding to a particular sensory perception of a user (e.g., an "up click," a "down click," "roughness"), unless otherwise stated, the generated tactile output corresponds to physical displacement of the device or a component thereof that will generate the described sensory perception for a typical (or average) user.

[0061] It should be appreciated that device **100** is only one example of a portable multifunction device, and that device **100** optionally has more or fewer components than shown, optionally combines two or more components, or optionally has a different configuration or arrangement of the components. The various components shown in FIG. **1**A are implemented in hardware, software, or a combination of both hardware and software, including one or more signal processing and/or application-specific integrated circuits.

[0062] Memory **102** optionally includes high-speed random access memory and optionally also includes non-volatile memory, such as one or more magnetic disk storage devices, flash memory devices, or other non-volatile solid-state memory devices. Memory controller **122** optionally controls access to memory **102** by other components of device **100**.

[0063] Peripherals interface **118** can be used to couple input and output peripherals of the device to CPU **120** and memory **102**. The one or more processors **120** run or execute various software programs and/or sets of instructions stored in memory **102** to perform various functions for device **100** and to process data. In some embodiments, peripherals interface **118**, CPU **120**, and memory controller **122** are, optionally, implemented on a single chip, such as chip **104**. In some other embodiments, they are, optionally, implemented on separate chips.

[0064] RF (radio frequency) circuitry **108** receives and sends RF signals, also called electromagnetic signals. RF circuitry **108** converts electrical signals to/from electromagnetic signals and communicates with communications networks and other communications devices via the electromagnetic signals. RF circuitry **108** optionally includes well-known circuitry for performing these functions, including but not limited to an antenna system, an RF transceiver, one or more amplifiers, a tuner, one or more oscillators, a digital signal processor, a CODEC chipset, a subscriber identity module (SIM) card, memory, and so forth. RF circuitry **108** optionally communicates with networks, such as the Internet, also referred to as the World Wide Web (WWW), an intranet and/or a wireless network, such as a cellular telephone network, a wireless local area network (LAN) and/or a metropolitan area network (MAN), and other devices by wireless communication. The RF circuitry **108** optionally includes well-known circuitry for detecting near field communication (NFC) fields, such as by a short-range communication radio. The wireless communication optionally uses any of a plurality of communications standards, protocols, and technologies, including but not limited to Global System for Mobile Communications (GSM), Enhanced Data GSM Environment (EDGE), high-speed downlink packet access (HSDPA), high-speed uplink packet access (HSUPA), Evolution, Data-Only (EV-DO), HSPA, HSPA+, Dual-Cell HSPA (DC-HSPDA), long term evolution (LTE), near field communication (NFC), wideband code division multiple access (W-CDMA), code division multiple access (CDMA), time division multiple access (TDMA), Bluetooth, Bluetooth Low Energy (BTLE), Wireless Fidelity (Wi-Fi) (e.g., IEEE 802.11a, IEEE 802.11b, IEEE 802.11g, IEEE 802.11n, and/or IEEE 802.11ac), voice over Internet Protocol (VoIP), Wi-MAX, a protocol for e-mail (e.g., Internet message access protocol (IMAP) and/or post office protocol (POP)), instant messaging (e.g., extensible messaging and presence protocol (XMPP), Session Initiation Protocol for Instant Messaging and Presence Leveraging Extensions (SIMPLE), Instant Messaging and Presence Service (IMPS)), and/or Short Message Service (SMS), or any other suitable communication protocol, including communication protocols not yet developed as of the filing date of this document.

[0065] Audio circuitry **110**, speaker **111**, and microphone **113** provide an audio interface between a user and device **100**. Audio circuitry **110** receives audio data from peripherals interface **118**, converts the audio data to an electrical signal, and transmits the electrical signal to speaker **111**. Speaker **111** converts the electrical signal to human-audible sound waves. Audio circuitry **110** also receives electrical signals converted by microphone **113** from sound waves. Audio circuitry **110** converts the electrical signal to audio data and transmits the audio data to peripherals interface **118** for processing. Audio data is, optionally, retrieved from and/or transmitted to memory **102** and/or RF circuitry **108** by peripherals interface **118**. In some embodiments, audio circuitry **110** also includes a headset jack (e.g., **212**, FIG. **2**). The headset jack provides an interface between audio circuitry **110** and removable audio input/output peripherals, such as output-only headphones or a headset with both output (e.g., a headphone for one or both ears) and input (e.g., a microphone).

[0066] I/O subsystem **106** couples input/output peripherals on device **100**, such as touch screen **112** and other input control devices **116**, to peripherals interface **118**. I/O subsystem **106** optionally includes display controller **156**, optical sensor controller **158**, intensity sensor controller **159**, haptic feedback controller **161**, and one or more input controllers **160** for other input or control devices. The one or more input controllers **160** receive/send electrical signals from/to other input control devices **116**. The other input control devices **116** optionally include physical buttons (e.g., push buttons, rocker buttons, etc.), dials, slider switches, joysticks, click wheels, and so forth. In some alternate embodiments, input controller(s) **160** are, optionally, coupled to any (or none) of the following: a keyboard, an infrared port, a USB port, and a pointer device such as a mouse. The one or more buttons (e.g., **208**, FIG. **2**) optionally include an up/down button for volume control of speaker **111** and/or microphone **113**. The one or more buttons optionally include a push button (e.g., **206**, FIG. **2**).

[0067] A quick press of the push button optionally disengages a lock of touch screen **112** or optionally begins a process that uses gestures on the touch screen to unlock the device, as described in U.S. patent application Ser. No. 11/322,549, "Unlocking a Device by Performing Gestures on an Unlock Image," filed Dec. 23, 2005, U.S. Pat. No. 7,657,849, which is hereby incorporated by reference in its

entirety. A longer press of the push button (e.g., **206**) optionally turns power to device **100** on or off. The functionality of one or more of the buttons are, optionally, user-customizable. Touch screen **112** is used to implement virtual or soft buttons and one or more soft keyboards.

[0068] Touch-sensitive display **112** provides an input interface and an output interface between the device and a user. Display controller **156** receives and/or sends electrical signals from/to touch screen **112**. Touch screen **112** displays visual output to the user. The visual output optionally includes graphics, text, icons, video, and any combination thereof (collectively termed "graphics"). In some embodiments, some or all of the visual output optionally corresponds to user-interface objects.

[0069] Touch screen **112** has a touch-sensitive surface, sensor, or set of sensors that accepts input from the user based on haptic and/or tactile contact. Touch screen **112** and display controller **156** (along with any associated modules and/or sets of instructions in memory **102**) detect contact (and any movement or breaking of the contact) on touch screen **112** and convert the detected contact into interaction with user-interface objects (e.g., one or more soft keys, icons, web pages, or images) that are displayed on touch screen **112**. In an exemplary embodiment, a point of contact between touch screen **112** and the user corresponds to a finger of the user.

[0070] Touch screen **112** optionally uses LCD (liquid crystal display) technology, LPD (light emitting polymer display) technology, or LED (light emitting diode) technology, although other display technologies are used in other embodiments. Touch screen **112** and display controller **156** optionally detect contact and any movement or breaking thereof using any of a plurality of touch sensing technologies now known or later developed, including but not limited to capacitive, resistive, infrared, and surface acoustic wave technologies, as well as other proximity sensor arrays or other elements for determining one or more points of contact with touch screen **112**. In an exemplary embodiment, projected mutual capacitance sensing technology is used, such as that found in the iPhone® and iPod Touch® from Apple Inc. of Cupertino, Calif.

[0071] A touch-sensitive display in some embodiments of touch screen **112** is, optionally, analogous to the multi-touch sensitive touchpads described in the following U.S. Pat. No. 6,323,846 (Westerman et al.), **6,570,557** (Westerman et al.), and/or **6,677,932** (Westerman), and/or U.S. Patent Publication 2002/0015024A1, each of which is hereby incorporated by reference in its entirety. However, touch screen **112** displays visual output from device **100**, whereas touch-sensitive touchpads do not provide visual output.

[0072] A touch-sensitive display in some embodiments of touch screen **112** is described in the following applications: (1) U.S. patent application Ser. No. 11/381,313, "Multipoint Touch Surface Controller," filed May 2, 2006; (2) U.S. patent application Ser. No. 10/840,862, "Multipoint Touchscreen," filed May 6, 2004; (3) U.S. patent application Ser. No. 10/903,964, "Gestures For Touch Sensitive Input Devices," filed Jul. 30, 2004; (4) U.S. patent application Ser. No. 11/048,264, "Gestures For Touch Sensitive Input Devices," filed Jan. 31, 2005; (5) U.S. patent application Ser. No. 11/038,590, "Mode-Based Graphical User Interfaces For Touch Sensitive Input Devices," filed Jan. 18, 2005; (6) U.S. patent application Ser. No. 11/228,758, "Virtual Input Device Placement On A Touch Screen User Interface," filed Sep. 16, 2005; (7) U.S. patent application Ser. No. 11/228,700, "Operation Of A Computer With A Touch Screen Interface," filed Sep. 16, 2005; (8) U.S. patent application Ser. No. 11/228,737, "Activating Virtual Keys Of A Touch-Screen Virtual Keyboard," filed Sep. 16, 2005; and (9) U.S. patent application Ser. No. 11/367,749, "Multi-Functional Hand-Held Device," filed Mar. 3, 2006. All of these applications are incorporated by reference herein in their entirety.

[0073] Touch screen **112** optionally has a video resolution in excess of 100 dpi. In some embodiments, the touch screen has a video resolution of approximately 160 dpi. The user optionally makes contact with touch screen **112** using any suitable object or appendage, such as a stylus, a finger, and so forth. In some embodiments, the user interface is designed to work primarily with finger-based contacts and gestures, which can be less precise than stylus-based input due to the larger area of contact of a finger on the touch screen. In some embodiments, the device translates the rough finger-based input into a precise pointer/cursor position or command for performing the actions desired by the user.

[0074] In some embodiments, in addition to the touch screen, device **100** optionally includes a touchpad (not shown) for activating or deactivating particular functions. In some embodiments, the touchpad is a touch-sensitive area of the device that, unlike the touch screen, does not display visual output. The touchpad is, optionally, a touch-sensitive surface that is separate from touch screen **112** or an extension of the touch-sensitive surface formed by the touch screen.

[0075] Device **100** also includes power system **162** for powering the various components. Power system **162** optionally includes a power management system, one or more power sources (e.g., battery, alternating current (AC)), a recharging system, a power failure detection circuit, a power converter or inverter, a power status indicator (e.g., a light-emitting diode (LED)) and any other components associated with the generation, management and distribution of power in portable devices.

[0076] Device **100** optionally also includes one or more optical sensors **164**. FIG. **1**A shows an optical sensor coupled to optical sensor controller **158** in I/O subsystem **106**. Optical sensor **164** optionally includes charge-coupled device (CCD) or complementary metal-oxide semiconductor (CMOS) phototransistors. Optical sensor **164** receives light from the environment, projected through one or more lenses, and converts the light to data representing an image. In conjunction with imaging module **143** (also called a camera module), optical sensor **164** optionally captures still images or video. In some embodiments, an optical sensor is located on the back of device **100**, opposite touch screen display **112** on the front of the device so that the touch screen display is enabled for use as a viewfinder for still and/or video image acquisition. In some embodiments, an optical sensor is located on the front of the device so that the user's image is, optionally, obtained for video conferencing while the user views the other video conference participants on the touch screen display. In some embodiments, the position of optical sensor **164** can be changed by the user (e.g., by rotating the lens and the sensor in the device housing) so that a single optical sensor **164** is used along with the touch screen display for both video conferencing and still and/or video image acquisition.

[0077] Device **100** optionally also includes one or more contact intensity sensors **165**. FIG. **1**A shows a contact intensity sensor coupled to intensity sensor controller **159** in I/O subsystem **106**. Contact intensity sensor **165** optionally includes one or more piezoresistive strain gauges, capacitive force sensors, electric force sensors, piezoelectric force sensors, optical force sensors, capacitive touch-sensitive surfaces, or other intensity sensors (e.g., sensors used to measure the force (or pressure) of a contact on a touch-sensitive surface). Contact intensity sensor **165** receives contact intensity information (e.g., pressure information or a proxy for pressure information) from the environment. In some embodiments, at least one contact intensity sensor is collocated with, or proximate to, a touch-sensitive surface (e.g., touch-sensitive display system **112**). In some embodiments, at least one contact intensity sensor is located on the back of device **100**, opposite touch screen display **112**, which is located on the front of device **100**.

[0078] Device **100** optionally also includes one or more proximity sensors **166**. FIG. **1**A shows proximity sensor **166** coupled to peripherals interface **118**. Alternately, proximity sensor **166** is, optionally, coupled to input controller **160** in I/O subsystem **106**. Proximity sensor **166** optionally performs as described in U.S. patent application Ser. No. 11/241,839, "Proximity Detector In Handheld Device"; Ser. No. 11/240,788, "Proximity Detector In Handheld Device"; Ser. No. 11/620,702, "Using Ambient Light Sensor To Augment Proximity Sensor Output"; Ser. No. 11/586,862, "Automated Response To And Sensing Of User Activity In Portable Devices"; and Ser. No. 11/638,251, "Methods And Systems For Automatic Configuration Of Peripherals," which are hereby incorporated by reference in their entirety. In some embodiments, the proximity sensor turns off and disables touch screen **112** when the multifunction device is placed near the user's ear (e.g., when the user is making a phone call).

[0079] Device **100** optionally also includes one or more tactile output generators **167**. FIG. **1**A shows a tactile output generator coupled to haptic feedback controller **161** in I/O subsystem **106**. Tactile output generator **167** optionally includes one or more electroacoustic devices such as speakers or other audio components and/or electromechanical devices that convert energy into linear motion such as a motor, solenoid, electroactive polymer, piezoelectric actuator, electrostatic actuator, or other tactile output generating component (e.g., a component that converts electrical signals into tactile outputs on the device). Contact intensity sensor **165** receives tactile feedback generation instructions from haptic feedback module **133** and generates tactile outputs on device **100** that are capable of being sensed by a user of device **100**. In some embodiments, at least one tactile output generator is collocated with, or proximate to, a touch-sensitive surface (e.g., touch-sensitive display system **112**) and, optionally, generates a tactile output by moving the touch-sensitive surface vertically (e.g., in/out of a surface of device **100**) or laterally (e.g., back and forth in the same plane as a surface of device **100**). In some embodiments, at least one tactile output generator sensor is located on the back of device **100**, opposite touch screen display **112**, which is located on the front of device **100**.

[0080] Device **100** optionally also includes one or more accelerometers **168**. FIG. **1**A shows accelerometer **168** coupled to peripherals interface **118**. Alternately, accelerometer **168** is, optionally, coupled to an input controller **160** in I/O subsystem **106**. Accelerometer **168** optionally performs as described in U.S. Patent Publication No. 20050190059, "Acceleration-based Theft Detection System for Portable Electronic Devices," and U.S. Patent Publication No. 20060017692, "Methods And Apparatuses For Operating A Portable Device Based On An Accelerometer," both of which are incorporated by reference herein in their entirety. In some embodiments, information is displayed on the touch screen display in a portrait view or a landscape view based on an analysis of data received from the one or more accelerometers. Device **100** optionally includes, in addition to accelerometer(s) **168**, a magnetometer (not shown) and a GPS (or GLONASS or other global navigation system) receiver (not shown) for obtaining information concerning the location and orientation (e.g., portrait or landscape) of device **100**.

[0081] In some embodiments, the software components stored in memory **102** include operating system **126**, communication module (or set of instructions) **128**, contact/motion module (or set of instructions) **130**, graphics module (or set of instructions) **132**, text input module (or set of instructions) **134**, Global Positioning System (GPS) module (or set of instructions) **135**, and applications (or sets of instructions) **136**. Furthermore, in some embodiments, memory **102** (FIG. **1**A) or **370** (FIG. **3**) stores device/global internal state **157**, as shown in FIGS. **1**A and **3**. Device/global internal state **157** includes one or more of: active application state, indicating which applications, if any, are currently active; display state, indicating what applications, views or other information occupy various regions of touch screen display **112**; sensor state, including information obtained from the device's various sensors and input control devices **116**; and location information concerning the device's location and/or attitude.

[0082] Operating system **126** (e.g., Darwin, RTXC, LINUX, UNIX, OS X, iOS, WINDOWS, or an embedded operating system such as VxWorks) includes various software components and/or drivers for controlling and managing general system tasks (e.g., memory management, storage device control, power management, etc.) and facilitates communication between various hardware and software components.

[0083] Communication module **128** facilitates communication with other devices over one or more external ports **124** and also includes various software components for handling data received by RF circuitry **108** and/or external port **124**. External port **124** (e.g., Universal Serial Bus (USB), FIREWIRE, etc.) is adapted for coupling directly to other devices or indirectly over a network (e.g., the Internet, wireless LAN, etc.). In some embodiments, the external port is a multi-pin (e.g., 30-pin) connector that is the same as, or similar to and/or compatible with, the 30-pin connector used on iPod® (trademark of Apple Inc.) devices.

[0084] Contact/motion module **130** optionally detects contact with touch screen **112** (in conjunction with display controller **156**) and other touch-sensitive devices (e.g., a touchpad or physical click wheel). Contact/motion module **130** includes various software components for performing various operations related to detection of contact, such as determining if contact has occurred (e.g., detecting a finger-down event), determining an intensity of the contact (e.g., the force or pressure of the contact or a substitute for the force or pressure of the contact), determining if there is movement of the contact and tracking the movement across

the touch-sensitive surface (e.g., detecting one or more finger-dragging events), and determining if the contact has ceased (e.g., detecting a finger-up event or a break in contact). Contact/motion module **130** receives contact data from the touch-sensitive surface. Determining movement of the point of contact, which is represented by a series of contact data, optionally includes determining speed (magnitude), velocity (magnitude and direction), and/or an acceleration (a change in magnitude and/or direction) of the point of contact. These operations are, optionally, applied to single contacts (e.g., one finger contacts) or to multiple simultaneous contacts (e.g., "multitouch"/multiple finger contacts). In some embodiments, contact/motion module **130** and display controller **156** detect contact on a touchpad.

[0085] In some embodiments, contact/motion module **130** uses a set of one or more intensity thresholds to determine whether an operation has been performed by a user (e.g., to determine whether a user has "clicked" on an icon). In some embodiments, at least a subset of the intensity thresholds are determined in accordance with software parameters (e.g., the intensity thresholds are not determined by the activation thresholds of particular physical actuators and can be adjusted without changing the physical hardware of device **100**). For example, a mouse "click" threshold of a trackpad or touch screen display can be set to any of a large range of predefined threshold values without changing the trackpad or touch screen display hardware. Additionally, in some implementations, a user of the device is provided with software settings for adjusting one or more of the set of intensity thresholds (e.g., by adjusting individual intensity thresholds and/or by adjusting a plurality of intensity thresholds at once with a system-level click "intensity" parameter).

[0086] Contact/motion module **130** optionally detects a gesture input by a user. Different gestures on the touch-sensitive surface have different contact patterns (e.g., different motions, timings, and/or intensities of detected contacts). Thus, a gesture is, optionally, detected by detecting a particular contact pattern. For example, detecting a finger tap gesture includes detecting a finger-down event followed by detecting a finger-up (liftoff) event at the same position (or substantially the same position) as the finger-down event (e.g., at the position of an icon). As another example, detecting a finger swipe gesture on the touch-sensitive surface includes detecting a finger-down event followed by detecting one or more finger-dragging events, and subsequently followed by detecting a finger-up (liftoff) event.

[0087] Graphics module **132** includes various known software components for rendering and displaying graphics on touch screen **112** or other display, including components for changing the visual impact (e.g., brightness, transparency, saturation, contrast, or other visual property) of graphics that are displayed. As used herein, the term "graphics" includes any object that can be displayed to a user, including, without limitation, text, web pages, icons (such as user-interface objects including soft keys), digital images, videos, animations, and the like.

[0088] In some embodiments, graphics module **132** stores data representing graphics to be used. Each graphic is, optionally, assigned a corresponding code. Graphics module **132** receives, from applications etc., one or more codes specifying graphics to be displayed along with, if necessary, coordinate data and other graphic property data, and then generates screen image data to output to display controller **156**.

[0089] Haptic feedback module **133** includes various software components for generating instructions used by tactile output generator(s) **167** to produce tactile outputs at one or more locations on device **100** in response to user interactions with device **100**.

[0090] Text input module **134**, which is, optionally, a component of graphics module **132**, provides soft keyboards for entering text in various applications (e.g., contacts **137**, e-mail **140**, IM **141**, browser **147**, and any other application that needs text input).

[0091] GPS module **135** determines the location of the device and provides this information for use in various applications (e.g., to telephone **138** for use in location-based dialing; to camera **143** as picture/video metadata; and to applications that provide location-based services such as weather widgets, local yellow page widgets, and map/navigation widgets).

[0092] Applications **136** optionally include the following modules (or sets of instructions), or a subset or superset thereof:

- **[0093]** Contacts module **137** (sometimes called an address book or contact list);
- **[0094]** Telephone module **138**;
- **[0095]** Video conference module **139**;
- **[0096]** E-mail client module **140**;
- **[0097]** Instant messaging (IM) module **141**;
- **[0098]** Workout support module **142**;
- **[0099]** Camera module **143** for still and/or video images;
- **[0100]** Image management module **144**;
- **[0101]** Video player module;
- **[0102]** Music player module;
- **[0103]** Browser module **147**;
- **[0104]** Calendar module **148**;
- **[0105]** Widget modules **149**, which optionally include one or more of: weather widget **149-1**, stocks widget **149-2**, calculator widget **149-3**, alarm clock widget **149-4**, dictionary widget **149-5**, and other widgets obtained by the user, as well as user-created widgets **149-6**;
- **[0106]** Widget creator module **150** for making user-created widgets **149-6**;
- **[0107]** Search module **151**;
- **[0108]** Video and music player module **152**, which merges video player module and music player module;
- **[0109]** Notes module **153**;
- **[0110]** Map module **154**; and/or
- **[0111]** Online video module **155**.

[0112] Examples of other applications **136** that are, optionally, stored in memory **102** include other word processing applications, other image editing applications, drawing applications, presentation applications, JAVA-enabled applications, encryption, digital rights management, voice recognition, and voice replication.

[0113] In conjunction with touch screen **112**, display controller **156**, contact/motion module **130**, graphics module **132**, and text input module **134**, contacts module **137** are, optionally, used to manage an address book or contact list (e.g., stored in application internal state **192** of contacts module **137** in memory **102** or memory **370**), including: adding name(s) to the address book; deleting name(s) from the address book; associating telephone number(s), e-mail address(es), physical address(es) or other information with a name; associating an image with a name; categorizing and

sorting names; providing telephone numbers or e-mail addresses to initiate and/or facilitate communications by telephone **138**, video conference module **139**, e-mail **140**, or IM **141**; and so forth.

[0114] In conjunction with RF circuitry **108**, audio circuitry **110**, speaker **111**, microphone **113**, touch screen **112**, display controller **156**, contact/motion module **130**, graphics module **132**, and text input module **134**, telephone module **138** are optionally, used to enter a sequence of characters corresponding to a telephone number, access one or more telephone numbers in contacts module **137**, modify a telephone number that has been entered, dial a respective telephone number, conduct a conversation, and disconnect or hang up when the conversation is completed. As noted above, the wireless communication optionally uses any of a plurality of communications standards, protocols, and technologies.

[0115] In conjunction with RF circuitry **108**, audio circuitry **110**, speaker **111**, microphone **113**, touch screen **112**, display controller **156**, optical sensor **164**, optical sensor controller **158**, contact/motion module **130**, graphics module **132**, text input module **134**, contacts module **137**, and telephone module **138**, video conference module **139** includes executable instructions to initiate, conduct, and terminate a video conference between a user and one or more other participants in accordance with user instructions.

[0116] In conjunction with RF circuitry **108**, touch screen **112**, display controller **156**, contact/motion module **130**, graphics module **132**, and text input module **134**, e-mail client module **140** includes executable instructions to create, send, receive, and manage e-mail in response to user instructions. In conjunction with image management module **144**, e-mail client module **140** makes it very easy to create and send e-mails with still or video images taken with camera module **143**.

[0117] In conjunction with RF circuitry **108**, touch screen **112**, display controller **156**, contact/motion module **130**, graphics module **132**, and text input module **134**, the instant messaging module **141** includes executable instructions to enter a sequence of characters corresponding to an instant message, to modify previously entered characters, to transmit a respective instant message (for example, using a Short Message Service (SMS) or Multimedia Message Service (MMS) protocol for telephony-based instant messages or using XMPP, SIMPLE, or IMPS for Internet-based instant messages), to receive instant messages, and to view received instant messages. In some embodiments, transmitted and/or received instant messages optionally include graphics, photos, audio files, video files and/or other attachments as are supported in an MMS and/or an Enhanced Messaging Service (EMS). As used herein, "instant messaging" refers to both telephony-based messages (e.g., messages sent using SMS or MMS) and Internet-based messages (e.g., messages sent using XMPP, SIMPLE, or IMPS).

[0118] In conjunction with RF circuitry **108**, touch screen **112**, display controller **156**, contact/motion module **130**, graphics module **132**, text input module **134**, GPS module **135**, map module **154**, and music player module, workout support module **142** includes executable instructions to create workouts (e.g., with time, distance, and/or calorie burning goals); communicate with workout sensors (sports devices); receive workout sensor data; calibrate sensors used to monitor a workout; select and play music for a workout; and display, store, and transmit workout data.

[0119] In conjunction with touch screen **112**, display controller **156**, optical sensor(s) **164**, optical sensor controller **158**, contact/motion module **130**, graphics module **132**, and image management module **144**, camera module **143** includes executable instructions to capture still images or video (including a video stream) and store them into memory **102**, modify characteristics of a still image or video, or delete a still image or video from memory **102**.

[0120] In conjunction with touch screen **112**, display controller **156**, contact/motion module **130**, graphics module **132**, text input module **134**, and camera module **143**, image management module **144** includes executable instructions to arrange, modify (e.g., edit), or otherwise manipulate, label, delete, present (e.g., in a digital slide show or album), and store still and/or video images.

[0121] In conjunction with RF circuitry **108**, touch screen **112**, display controller **156**, contact/motion module **130**, graphics module **132**, and text input module **134**, browser module **147** includes executable instructions to browse the Internet in accordance with user instructions, including searching, linking to, receiving, and displaying web pages or portions thereof, as well as attachments and other files linked to web pages.

[0122] In conjunction with RF circuitry **108**, touch screen **112**, display controller **156**, contact/motion module **130**, graphics module **132**, text input module **134**, e-mail client module **140**, and browser module **147**, calendar module **148** includes executable instructions to create, display, modify, and store calendars and data associated with calendars (e.g., calendar entries, to-do lists, etc.) in accordance with user instructions.

[0123] In conjunction with RF circuitry **108**, touch screen **112**, display controller **156**, contact/motion module **130**, graphics module **132**, text input module **134**, and browser module **147**, widget modules **149** are mini-applications that are, optionally, downloaded and used by a user (e.g., weather widget **149-1**, stocks widget **149-2**, calculator widget **149-3**, alarm clock widget **149-4**, and dictionary widget **149-5**) or created by the user (e.g., user-created widget **149-6**). In some embodiments, a widget includes an HTML (Hypertext Markup Language) file, a CSS (Cascading Style Sheets) file, and a JavaScript file. In some embodiments, a widget includes an XML (Extensible Markup Language) file and a JavaScript file (e.g., Yahoo! Widgets).

[0124] In conjunction with RF circuitry **108**, touch screen **112**, display controller **156**, contact/motion module **130**, graphics module **132**, text input module **134**, and browser module **147**, the widget creator module **150** are, optionally, used by a user to create widgets (e.g., turning a user-specified portion of a web page into a widget).

[0125] In conjunction with touch screen **112**, display controller **156**, contact/motion module **130**, graphics module **132**, and text input module **134**, search module **151** includes executable instructions to search for text, music, sound, image, video, and/or other files in memory **102** that match one or more search criteria (e.g., one or more user-specified search terms) in accordance with user instructions.

[0126] In conjunction with touch screen **112**, display controller **156**, contact/motion module **130**, graphics module **132**, audio circuitry **110**, speaker **111**, RF circuitry **108**, and browser module **147**, video and music player module **152** includes executable instructions that allow the user to download and play back recorded music and other sound files stored in one or more file formats, such as MP3 or AAC files,

and executable instructions to display, present, or otherwise play back videos (e.g., on touch screen **112** or on an external, connected display via external port **124**). In some embodiments, device **100** optionally includes the functionality of an MP3 player, such as an iPod (trademark of Apple Inc.).

[0127] In conjunction with touch screen **112**, display controller **156**, contact/motion module **130**, graphics module **132**, and text input module **134**, notes module **153** includes executable instructions to create and manage notes, to-do lists, and the like in accordance with user instructions.

[0128] In conjunction with RF circuitry **108**, touch screen **112**, display controller **156**, contact/motion module **130**, graphics module **132**, text input module **134**, GPS module **135**, and browser module **147**, map module **154** are, optionally, used to receive, display, modify, and store maps and data associated with maps (e.g., driving directions, data on stores and other points of interest at or near a particular location, and other location-based data) in accordance with user instructions.

[0129] In conjunction with touch screen **112**, display controller **156**, contact/motion module **130**, graphics module **132**, audio circuitry **110**, speaker **111**, RF circuitry **108**, text input module **134**, e-mail client module **140**, and browser module **147**, online video module **155** includes instructions that allow the user to access, browse, receive (e.g., by streaming and/or download), play back (e.g., on the touch screen or on an external, connected display via external port **124**), send an e-mail with a link to a particular online video, and otherwise manage online videos in one or more file formats, such as H.264. In some embodiments, instant messaging module **141**, rather than e-mail client module **140**, is used to send a link to a particular online video. Additional description of the online video application can be found in U.S. Provisional Patent Application No. 60/936,562, "Portable Multifunction Device, Method, and Graphical User Interface for Playing Online Videos," filed Jun. 20, 2007, and U.S. patent application Ser. No. 11/968,067, "Portable Multifunction Device, Method, and Graphical User Interface for Playing Online Videos," filed Dec. 31, 2007, the contents of which are hereby incorporated by reference in their entirety.

[0130] Each of the above-identified modules and applications corresponds to a set of executable instructions for performing one or more functions described above and the methods described in this application (e.g., the computer-implemented methods and other information processing methods described herein). These modules (e.g., sets of instructions) need not be implemented as separate software programs, procedures, or modules, and thus various subsets of these modules are, optionally, combined or otherwise rearranged in various embodiments. For example, video player module is, optionally, combined with music player module into a single module (e.g., video and music player module **152**, FIG. **1**A). In some embodiments, memory **102** optionally stores a subset of the modules and data structures identified above. Furthermore, memory **102** optionally stores additional modules and data structures not described above.

[0131] In some embodiments, device **100** is a device where operation of a predefined set of functions on the device is performed exclusively through a touch screen and/or a touchpad. By using a touch screen and/or a touchpad as the primary input control device for operation of device **100**, the number of physical input control devices (such as push buttons, dials, and the like) on device **100** is, optionally, reduced.

[0132] The predefined set of functions that are performed exclusively through a touch screen and/or a touchpad optionally include navigation between user interfaces. In some embodiments, the touchpad, when touched by the user, navigates device **100** to a main, home, or root menu from any user interface that is displayed on device **100**. In such embodiments, a "menu button" is implemented using a touchpad. In some other embodiments, the menu button is a physical push button or other physical input control device instead of a touchpad.

[0133] FIG. **1**B is a block diagram illustrating exemplary components for event handling in accordance with some embodiments. In some embodiments, memory **102** (FIG. **1**A) or **370** (FIG. **3**) includes event sorter **170** (e.g., in operating system **126**) and a respective application **136-1** (e.g., any of the aforementioned applications **137-151**, **155**, **380-390**).

[0134] Event sorter **170** receives event information and determines the application **136-1** and application view **191** of application **136-1** to which to deliver the event information. Event sorter **170** includes event monitor **171** and event dispatcher module **174**. In some embodiments, application **136-1** includes application internal state **192**, which indicates the current application view(s) displayed on touch-sensitive display **112** when the application is active or executing. In some embodiments, device/global internal state **157** is used by event sorter **170** to determine which application(s) is (are) currently active, and application internal state **192** is used by event sorter **170** to determine application views **191** to which to deliver event information.

[0135] In some embodiments, application internal state **192** includes additional information, such as one or more of: resume information to be used when application **136-1** resumes execution, user interface state information that indicates information being displayed or that is ready for display by application **136-1**, a state queue for enabling the user to go back to a prior state or view of application **136-1**, and a redo/undo queue of previous actions taken by the user.

[0136] Event monitor **171** receives event information from peripherals interface **118**. Event information includes information about a sub-event (e.g., a user touch on touch-sensitive display **112**, as part of a multi-touch gesture). Peripherals interface **118** transmits information it receives from I/O subsystem **106** or a sensor, such as proximity sensor **166**, accelerometer(s) **168**, and/or microphone **113** (through audio circuitry **110**). Information that peripherals interface **118** receives from I/O subsystem **106** includes information from touch-sensitive display **112** or a touch-sensitive surface.

[0137] In some embodiments, event monitor **171** sends requests to the peripherals interface **118** at predetermined intervals. In response, peripherals interface **118** transmits event information. In other embodiments, peripherals interface **118** transmits event information only when there is a significant event (e.g., receiving an input above a predetermined noise threshold and/or for more than a predetermined duration).

[0138] In some embodiments, event sorter **170** also includes a hit view determination module **172** and/or an active event recognizer determination module **173**.

[0139] Hit view determination module **172** provides software procedures for determining where a sub-event has taken place within one or more views when touch-sensitive display **112** displays more than one view. Views are made up of controls and other elements that a user can see on the display.

[0140] Another aspect of the user interface associated with an application is a set of views, sometimes herein called application views or user interface windows, in which information is displayed and touch-based gestures occur. The application views (of a respective application) in which a touch is detected optionally correspond to programmatic levels within a programmatic or view hierarchy of the application. For example, the lowest level view in which a touch is detected is, optionally, called the hit view, and the set of events that are recognized as proper inputs are, optionally, determined based, at least in part, on the hit view of the initial touch that begins a touch-based gesture.

[0141] Hit view determination module **172** receives information related to sub-events of a touch-based gesture. When an application has multiple views organized in a hierarchy, hit view determination module **172** identifies a hit view as the lowest view in the hierarchy which should handle the sub-event. In most circumstances, the hit view is the lowest level view in which an initiating sub-event occurs (e.g., the first sub-event in the sequence of sub-events that form an event or potential event). Once the hit view is identified by the hit view determination module **172**, the hit view typically receives all sub-events related to the same touch or input source for which it was identified as the hit view.

[0142] Active event recognizer determination module **173** determines which view or views within a view hierarchy should receive a particular sequence of sub-events. In some embodiments, active event recognizer determination module **173** determines that only the hit view should receive a particular sequence of sub-events. In other embodiments, active event recognizer determination module **173** determines that all views that include the physical location of a sub-event are actively involved views, and therefore determines that all actively involved views should receive a particular sequence of sub-events. In other embodiments, even if touch sub-events were entirely confined to the area associated with one particular view, views higher in the hierarchy would still remain as actively involved views.

[0143] Event dispatcher module **174** dispatches the event information to an event recognizer (e.g., event recognizer **180**). In embodiments including active event recognizer determination module **173**, event dispatcher module **174** delivers the event information to an event recognizer determined by active event recognizer determination module **173**. In some embodiments, event dispatcher module **174** stores in an event queue the event information, which is retrieved by a respective event receiver **182**.

[0144] In some embodiments, operating system **126** includes event sorter **170**. Alternatively, application **136-1** includes event sorter **170**. In yet other embodiments, event sorter **170** is a stand-alone module, or a part of another module stored in memory **102**, such as contact/motion module **130**.

[0145] In some embodiments, application **136-1** includes a plurality of event handlers **190** and one or more application views **191**, each of which includes instructions for handling touch events that occur within a respective view of the application's user interface. Each application view **191** of the application **136-1** includes one or more event recognizers **180**. Typically, a respective application view **191** includes a plurality of event recognizers **180**. In other embodiments, one or more of event recognizers **180** are part of a separate module, such as a user interface kit (not shown) or a higher level object from which application **136-1** inherits methods and other properties. In some embodiments, a respective event handler **190** includes one or more of: data updater **176**, object updater **177**, GUI updater **178**, and/or event data **179** received from event sorter **170**. Event handler **190** optionally utilizes or calls data updater **176**, object updater **177**, or GUI updater **178** to update the application internal state **192**. Alternatively, one or more of the application views **191** include one or more respective event handlers **190**. Also, in some embodiments, one or more of data updater **176**, object updater **177**, and GUI updater **178** are included in a respective application view **191**.

[0146] A respective event recognizer **180** receives event information (e.g., event data **179**) from event sorter **170** and identifies an event from the event information. Event recognizer **180** includes event receiver **182** and event comparator **184**. In some embodiments, event recognizer **180** also includes at least a subset of: metadata **183**, and event delivery instructions **188** (which optionally include sub-event delivery instructions).

[0147] Event receiver **182** receives event information from event sorter **170**. The event information includes information about a sub-event, for example, a touch or a touch movement. Depending on the sub-event, the event information also includes additional information, such as location of the sub-event. When the sub-event concerns motion of a touch, the event information optionally also includes speed and direction of the sub-event. In some embodiments, events include rotation of the device from one orientation to another (e.g., from a portrait orientation to a landscape orientation, or vice versa), and the event information includes corresponding information about the current orientation (also called device attitude) of the device.

[0148] Event comparator **184** compares the event information to predefined event or sub-event definitions and, based on the comparison, determines an event or sub-event, or determines or updates the state of an event or sub-event. In some embodiments, event comparator **184** includes event definitions **186**. Event definitions **186** contain definitions of events (e.g., predefined sequences of sub-events), for example, event **1** (**187-1**), event **2** (**187-2**), and others. In some embodiments, sub-events in an event (**187**) include, for example, touch begin, touch end, touch movement, touch cancellation, and multiple touching. In one example, the definition for event **1** (**187-1**) is a double tap on a displayed object. The double tap, for example, comprises a first touch (touch begin) on the displayed object for a predetermined phase, a first liftoff (touch end) for a predetermined phase, a second touch (touch begin) on the displayed object for a predetermined phase, and a second liftoff (touch end) for a predetermined phase. In another example, the definition for event **2** (**187-2**) is a dragging on a displayed object. The dragging, for example, comprises a touch (or contact) on the displayed object for a predetermined phase, a movement of the touch across touch-sensitive display **112**, and liftoff of the touch (touch end). In some embodiments, the event also includes information for one or more associated event handlers **190**.

[0149] In some embodiments, event definition **187** includes a definition of an event for a respective user-interface object. In some embodiments, event comparator **184** performs a hit test to determine which user-interface object is associated with a sub-event. For example, in an application view in which three user-interface objects are displayed on touch-sensitive display **112**, when a touch is detected on touch-sensitive display **112**, event comparator **184** performs a hit test to determine which of the three user-interface objects is associated with the touch (sub-event). If each displayed object is associated with a respective event handler **190**, the event comparator uses the result of the hit test to determine which event handler **190** should be activated. For example, event comparator **184** selects an event handler associated with the sub-event and the object triggering the hit test.

[0150] In some embodiments, the definition for a respective event (**187**) also includes delayed actions that delay delivery of the event information until after it has been determined whether the sequence of sub-events does or does not correspond to the event recognizer's event type.

[0151] When a respective event recognizer **180** determines that the series of sub-events do not match any of the events in event definitions **186**, the respective event recognizer **180** enters an event impossible, event failed, or event ended state, after which it disregards subsequent sub-events of the touch-based gesture. In this situation, other event recognizers, if any, that remain active for the hit view continue to track and process sub-events of an ongoing touch-based gesture.

[0152] In some embodiments, a respective event recognizer **180** includes metadata **183** with configurable properties, flags, and/or lists that indicate how the event delivery system should perform sub-event delivery to actively involved event recognizers. In some embodiments, metadata **183** includes configurable properties, flags, and/or lists that indicate how event recognizers interact, or are enabled to interact, with one another. In some embodiments, metadata **183** includes configurable properties, flags, and/or lists that indicate whether sub-events are delivered to varying levels in the view or programmatic hierarchy.

[0153] In some embodiments, a respective event recognizer **180** activates event handler **190** associated with an event when one or more particular sub-events of an event are recognized. In some embodiments, a respective event recognizer **180** delivers event information associated with the event to event handler **190**. Activating an event handler **190** is distinct from sending (and deferred sending) sub-events to a respective hit view. In some embodiments, event recognizer **180** throws a flag associated with the recognized event, and event handler **190** associated with the flag catches the flag and performs a predefined process.

[0154] In some embodiments, event delivery instructions **188** include sub-event delivery instructions that deliver event information about a sub-event without activating an event handler. Instead, the sub-event delivery instructions deliver event information to event handlers associated with the series of sub-events or to actively involved views. Event handlers associated with the series of sub-events or with actively involved views receive the event information and perform a predetermined process.

[0155] In some embodiments, data updater **176** creates and updates data used in application **136-1**. For example, data updater **176** updates the telephone number used in contacts module **137**, or stores a video file used in video player module. In some embodiments, object updater **177** creates and updates objects used in application **136-1**. For example, object updater **177** creates a new user-interface object or updates the position of a user-interface object. GUI updater **178** updates the GUI. For example, GUI updater **178** prepares display information and sends it to graphics module **132** for display on a touch-sensitive display.

[0156] In some embodiments, event handler(s) **190** includes or has access to data updater **176**, object updater **177**, and GUI updater **178**. In some embodiments, data updater **176**, object updater **177**, and GUI updater **178** are included in a single module of a respective application **136-1** or application view **191**. In other embodiments, they are included in two or more software modules.

[0157] It shall be understood that the foregoing discussion regarding event handling of user touches on touch-sensitive displays also applies to other forms of user inputs to operate multifunction devices **100** with input devices, not all of which are initiated on touch screens. For example, mouse movement and mouse button presses, optionally coordinated with single or multiple keyboard presses or holds; contact movements such as taps, drags, scrolls, etc. on touchpads; pen stylus inputs; movement of the device; oral instructions; detected eye movements; biometric inputs; and/or any combination thereof are optionally utilized as inputs corresponding to sub-events which define an event to be recognized.

[0158] FIG. **2** illustrates a portable multifunction device **100** having a touch screen **112** in accordance with some embodiments. The touch screen optionally displays one or more graphics within user interface (UI) **200**. In this embodiment, as well as others described below, a user is enabled to select one or more of the graphics by making a gesture on the graphics, for example, with one or more fingers **202** (not drawn to scale in the figure) or one or more styluses **203** (not drawn to scale in the figure). In some embodiments, selection of one or more graphics occurs when the user breaks contact with the one or more graphics. In some embodiments, the gesture optionally includes one or more taps, one or more swipes (from left to right, right to left, upward and/or downward), and/or a rolling of a finger (from right to left, left to right, upward and/or downward) that has made contact with device **100**. In some implementations or circumstances, inadvertent contact with a graphic does not select the graphic. For example, a swipe gesture that sweeps over an application icon optionally does not select the corresponding application when the gesture corresponding to selection is a tap.

[0159] Device **100** optionally also include one or more physical buttons, such as "home" or menu button **204**. As described previously, menu button **204** is, optionally, used to navigate to any application **136** in a set of applications that are, optionally, executed on device **100**. Alternatively, in some embodiments, the menu button is implemented as a soft key in a GUI displayed on touch screen **112**.

[0160] In some embodiments, device **100** includes touch screen **112**, menu button **204**, push button **206** for powering the device on/off and locking the device, volume adjustment button(s) **208**, subscriber identity module (SIM) card slot **210**, headset jack **212**, and docking/charging external port **124**. Push button **206** is, optionally, used to turn the power on/off on the device by depressing the button and holding the button in the depressed state for a predefined time interval; to lock the device by depressing the button and releasing the

button before the predefined time interval has elapsed; and/or to unlock the device or initiate an unlock process. In an alternative embodiment, device **100** also accepts verbal input for activation or deactivation of some functions through microphone **113**. Device **100** also, optionally, includes one or more contact intensity sensors **165** for detecting intensity of contacts on touch screen **112** and/or one or more tactile output generators **167** for generating tactile outputs for a user of device **100**.

[0161] FIG. **3** is a block diagram of an exemplary multifunction device with a display and a touch-sensitive surface in accordance with some embodiments. Device **300** need not be portable. In some embodiments, device **300** is a laptop computer, a desktop computer, a tablet computer, a multimedia player device, a navigation device, an educational device (such as a child's learning toy), a gaming system, or a control device (e.g., a home or industrial controller). Device **300** typically includes one or more processing units (CPUs) **310**, one or more network or other communications interfaces **360**, memory **370**, and one or more communication buses **320** for interconnecting these components. Communication buses **320** optionally include circuitry (sometimes called a chipset) that interconnects and controls communications between system components. Device **300** includes input/output (I/O) interface **330** comprising display **340**, which is typically a touch screen display. I/O interface **330** also optionally includes a keyboard and/or mouse (or other pointing device) **350** and touchpad **355**, tactile output generator **357** for generating tactile outputs on device **300** (e.g., similar to tactile output generator(s) **167** described above with reference to FIG. **1**A), sensors **359** (e.g., optical, acceleration, proximity, touch-sensitive, and/or contact intensity sensors similar to contact intensity sensor(s) **165** described above with reference to FIG. **1**A). Memory **370** includes high-speed random access memory, such as DRAM, SRAM, DDR RAM, or other random access solid state memory devices; and optionally includes non-volatile memory, such as one or more magnetic disk storage devices, optical disk storage devices, flash memory devices, or other non-volatile solid state storage devices. Memory **370** optionally includes one or more storage devices remotely located from CPU(s) **310**. In some embodiments, memory **370** stores programs, modules, and data structures analogous to the programs, modules, and data structures stored in memory **102** of portable multifunction device **100** (FIG. **1**A), or a subset thereof. Furthermore, memory **370** optionally stores additional programs, modules, and data structures not present in memory **102** of portable multifunction device **100**. For example, memory **370** of device **300** optionally stores drawing module **380**, presentation module **382**, word processing module **384**, website creation module **386**, disk authoring module **388**, and/or spreadsheet module **390**, while memory **102** of portable multifunction device **100** (FIG. **1**A) optionally does not store these modules.

[0162] Each of the above-identified elements in FIG. **3** is, optionally, stored in one or more of the previously mentioned memory devices. Each of the above-identified modules corresponds to a set of instructions for performing a function described above. The above-identified modules or programs (e.g., sets of instructions) need not be implemented as separate software programs, procedures, or modules, and thus various subsets of these modules are, optionally, combined or otherwise rearranged in various embodiments. In some embodiments, memory **370** optionally stores a subset of the modules and data structures identified above. Furthermore, memory **370** optionally stores additional modules and data structures not described above.

[0163] Attention is now directed towards embodiments of user interfaces that are, optionally, implemented on, for example, portable multifunction device **100**.

[0164] FIG. **4**A illustrates an exemplary user interface for a menu of applications on portable multifunction device **100** in accordance with some embodiments. Similar user interfaces are, optionally, implemented on device **300**. In some embodiments, user interface **400** includes the following elements, or a subset or superset thereof:

- **[0165]** Signal strength indicator(s) **402** for wireless communication(s), such as cellular and Wi-Fi signals;
- **[0166]** Time **404**;
- **[0167]** Bluetooth indicator **405**;
- **[0168]** Battery status indicator **406**;
- **[0169]** Tray **408** with icons for frequently used applications, such as:
  - **[0170]** Icon **416** for telephone module **138**, labeled "Phone," which optionally includes an indicator **414** of the number of missed calls or voicemail messages;
  - **[0171]** Icon **418** for e-mail client module **140**, labeled "Mail," which optionally includes an indicator **410** of the number of unread e-mails;
  - **[0172]** Icon **420** for browser module **147**, labeled "Browser;" and
  - **[0173]** Icon **422** for video and music player module **152**, also referred to as iPod (trademark of Apple Inc.) module **152**, labeled "iPod;" and
- **[0174]** Icons for other applications, such as:
  - **[0175]** Icon **424** for IM module **141**, labeled "Messages;"
  - **[0176]** Icon **426** for calendar module **148**, labeled "Calendar;"
  - **[0177]** Icon **428** for image management module **144**, labeled "Photos;"
  - **[0178]** Icon **430** for camera module **143**, labeled "Camera;"
  - **[0179]** Icon **432** for online video module **155**, labeled "Online Video;"
  - **[0180]** Icon **434** for stocks widget **149-2**, labeled "Stocks;"
  - **[0181]** Icon **436** for map module **154**, labeled "Maps;"
  - **[0182]** Icon **438** for weather widget **149-1**, labeled "Weather;"
  - **[0183]** Icon **440** for alarm clock widget **149-4**, labeled "Clock;"
  - **[0184]** Icon **442** for workout support module **142**, labeled "Workout Support;"
  - **[0185]** Icon **444** for notes module **153**, labeled "Notes;" and
  - **[0186]** Icon **446** for a settings application or module, labeled "Settings," which provides access to settings for device **100** and its various applications **136**.

[0187] It should be noted that the icon labels illustrated in FIG. **4**A are merely exemplary. For example, icon **422** for video and music player module **152** is labeled "Music" or "Music Player." Other labels are, optionally, used for various application icons. In some embodiments, a label for a respective application icon includes a name of an application corresponding to the respective application icon. In some

embodiments, a label for a particular application icon is distinct from a name of an application corresponding to the particular application icon.

[0188] FIG. **4**B illustrates an exemplary user interface on a device (e.g., device **300**, FIG. **3**) with a touch-sensitive surface **451** (e.g., a tablet or touchpad **355**, FIG. **3**) that is separate from the display **450** (e.g., touch screen display **112**). Device **300** also, optionally, includes one or more contact intensity sensors (e.g., one or more of sensors **359**) for detecting intensity of contacts on touch-sensitive surface **451** and/or one or more tactile output generators **357** for generating tactile outputs for a user of device **300**.

[0189] Although some of the examples that follow will be given with reference to inputs on touch screen display **112** (where the touch-sensitive surface and the display are combined), in some embodiments, the device detects inputs on a touch-sensitive surface that is separate from the display, as shown in FIG. **4**B. In some embodiments, the touch-sensitive surface (e.g., **451** in FIG. **4**B) has a primary axis (e.g., **452** in FIG. **4**B) that corresponds to a primary axis (e.g., **453** in FIG. **4**B) on the display (e.g., **450**). In accordance with these embodiments, the device detects contacts (e.g., **460** and **462** in FIG. **4**B) with the touch-sensitive surface **451** at locations that correspond to respective locations on the display (e.g., in FIG. **4**B, **460** corresponds to **468** and **462** corresponds to **470**). In this way, user inputs (e.g., contacts **460** and **462**, and movements thereof) detected by the device on the touch-sensitive surface (e.g., **451** in FIG. **4**B) are used by the device to manipulate the user interface on the display (e.g., **450** in FIG. **4**B) of the multifunction device when the touch-sensitive surface is separate from the display. It should be understood that similar methods are, optionally, used for other user interfaces described herein.

[0190] Additionally, while the following examples are given primarily with reference to finger inputs (e.g., finger contacts, finger tap gestures, finger swipe gestures), it should be understood that, in some embodiments, one or more of the finger inputs are replaced with input from another input device (e.g., a mouse-based input or stylus input). For example, a swipe gesture is, optionally, replaced with a mouse click (e.g., instead of a contact) followed by movement of the cursor along the path of the swipe (e.g., instead of movement of the contact). As another example, a tap gesture is, optionally, replaced with a mouse click while the cursor is located over the location of the tap gesture (e.g., instead of detection of the contact followed by ceasing to detect the contact). Similarly, when multiple user inputs are simultaneously detected, it should be understood that multiple computer mice are, optionally, used simultaneously, or a mouse and finger contacts are, optionally, used simultaneously.

[0191] FIG. **5**A illustrates exemplary personal electronic device **500**. Device **500** includes body **502**. In some embodiments, device **500** can include some or all of the features described with respect to devices **100** and **300** (e.g., FIGS. **1**A-**4**B). In some embodiments, device **500** has touch-sensitive display screen **504**, hereafter touch screen **504**. Alternatively, or in addition to touch screen **504**, device **500** has a display and a touch-sensitive surface. As with devices **100** and **300**, in some embodiments, touch screen **504** (or the touch-sensitive surface) optionally includes one or more intensity sensors for detecting intensity of contacts (e.g., touches) being applied. The one or more intensity sensors of touch screen **504** (or the touch-sensitive surface) can provide output data that represents the intensity of touches. The user interface of device **500** can respond to touches based on their intensity, meaning that touches of different intensities can invoke different user interface operations on device **500**.

[0192] Exemplary techniques for detecting and processing touch intensity are found, for example, in related applications: International Patent Application Serial No. PCT/US2013/040061, titled "Device, Method, and Graphical User Interface for Displaying User Interface Objects Corresponding to an Application," filed May 8, 2013, published as WIPO Publication No. WO/2013/169849, and International Patent Application Serial No. PCT/US2013/069483, titled "Device, Method, and Graphical User Interface for Transitioning Between Touch Input to Display Output Relationships," filed Nov. 11, 2013, published as WIPO Publication No. WO/2014/105276, each of which is hereby incorporated by reference in their entirety.

[0193] In some embodiments, device **500** has one or more input mechanisms **506** and **508**. Input mechanisms **506** and **508**, if included, can be physical. Examples of physical input mechanisms include push buttons and rotatable mechanisms. In some embodiments, device **500** has one or more attachment mechanisms. Such attachment mechanisms, if included, can permit attachment of device **500** with, for example, hats, eyewear, earrings, necklaces, shirts, jackets, bracelets, watch straps, chains, trousers, belts, shoes, purses, backpacks, and so forth. These attachment mechanisms permit device **500** to be worn by a user.

[0194] FIG. **5**B depicts exemplary personal electronic device **500**. In some embodiments, device **500** can include some or all of the components described with respect to FIGS. **1**A, **1**B, and **3**. Device **500** has bus **512** that operatively couples I/O section **514** with one or more computer processors **516** and memory **518**. I/O section **514** can be connected to display **504**, which can have touch-sensitive component **522** and, optionally, intensity sensor **524** (e.g., contact intensity sensor). In addition, I/O section **514** can be connected with communication unit **530** for receiving application and operating system data, using Wi-Fi, Bluetooth, near field communication (NFC), cellular, and/or other wireless communication techniques. Device **500** can include input mechanisms **506** and/or **508**. Input mechanism **506** is, optionally, a rotatable input device or a depressible and rotatable input device, for example. Input mechanism **508** is, optionally, a button, in some examples.

[0195] Input mechanism **508** is, optionally, a microphone, in some examples. Personal electronic device **500** optionally includes various sensors, such as GPS sensor **532**, accelerometer **534**, directional sensor **540** (e.g., compass), gyroscope **536**, motion sensor **538**, and/or a combination thereof, all of which can be operatively connected to I/O section **514**.

[0196] Memory **518** of personal electronic device **500** can include one or more non-transitory computer-readable storage mediums, for storing computer-executable instructions, which, when executed by one or more computer processors **516**, for example, can cause the computer processors to perform the techniques described below, including processes **700**, **900**, **1100**, and **1300** (FIGS. **7**, **9**, **11**, and **13**). A computer-readable storage medium can be any medium that can tangibly contain or store computer-executable instructions for use by or in connection with the instruction execution system, apparatus, or device. In some examples, the storage medium is a transitory computer-readable storage medium. In some examples, the storage medium is a

non-transitory computer-readable storage medium. The non-transitory computer-readable storage medium can include, but is not limited to, magnetic, optical, and/or semiconductor storages. Examples of such storage include magnetic disks, optical discs based on CD, DVD, or Blu-ray technologies, as well as persistent solid-state memory such as flash, solid-state drives, and the like. Personal electronic device **500** is not limited to the components and configuration of FIG. **5**B, but can include other or additional components in multiple configurations.

[0197] As used here, the term "affordance" refers to a user-interactive graphical user interface object that is, optionally, displayed on the display screen of devices **100**, **300**, and/or **500** (FIGS. **1**A, **3**, and **5**A-**5**B). For example, an image (e.g., icon), a button, and text (e.g., hyperlink) each optionally constitute an affordance.

[0198] As used herein, the term "focus selector" refers to an input element that indicates a current part of a user interface with which a user is interacting. In some implementations that include a cursor or other location marker, the cursor acts as a "focus selector" so that when an input (e.g., a press input) is detected on a touch-sensitive surface (e.g., touchpad **355** in FIG. **3** or touch-sensitive surface **451** in FIG. **4**B) while the cursor is over a particular user interface element (e.g., a button, window, slider, or other user interface element), the particular user interface element is adjusted in accordance with the detected input. In some implementations that include a touch screen display (e.g., touch-sensitive display system **112** in FIG. **1**A or touch screen **112** in FIG. **4**A) that enables direct interaction with user interface elements on the touch screen display, a detected contact on the touch screen acts as a "focus selector" so that when an input (e.g., a press input by the contact) is detected on the touch screen display at a location of a particular user interface element (e.g., a button, window, slider, or other user interface element), the particular user interface element is adjusted in accordance with the detected input. In some implementations, focus is moved from one region of a user interface to another region of the user interface without corresponding movement of a cursor or movement of a contact on a touch screen display (e.g., by using a tab key or arrow keys to move focus from one button to another button); in these implementations, the focus selector moves in accordance with movement of focus between different regions of the user interface. Without regard to the specific form taken by the focus selector, the focus selector is generally the user interface element (or contact on a touch screen display) that is controlled by the user so as to communicate the user's intended interaction with the user interface (e.g., by indicating, to the device, the element of the user interface with which the user is intending to interact). For example, the location of a focus selector (e.g., a cursor, a contact, or a selection box) over a respective button while a press input is detected on the touch-sensitive surface (e.g., a touchpad or touch screen) will indicate that the user is intending to activate the respective button (as opposed to other user interface elements shown on a display of the device).

[0199] As used in the specification and claims, the term "characteristic intensity" of a contact refers to a characteristic of the contact based on one or more intensities of the contact. In some embodiments, the characteristic intensity is based on multiple intensity samples. The characteristic intensity is, optionally, based on a predefined number of intensity samples, or a set of intensity samples collected during a predetermined time period (e.g., 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10 seconds) relative to a predefined event (e.g., after detecting the contact, prior to detecting liftoff of the contact, before or after detecting a start of movement of the contact, prior to detecting an end of the contact, before or after detecting an increase in intensity of the contact, and/or before or after detecting a decrease in intensity of the contact). A characteristic intensity of a contact is, optionally, based on one or more of: a maximum value of the intensities of the contact, a mean value of the intensities of the contact, an average value of the intensities of the contact, a top 10 percentile value of the intensities of the contact, a value at the half maximum of the intensities of the contact, a value at the 90 percent maximum of the intensities of the contact, or the like. In some embodiments, the duration of the contact is used in determining the characteristic intensity (e.g., when the characteristic intensity is an average of the intensity of the contact over time). In some embodiments, the characteristic intensity is compared to a set of one or more intensity thresholds to determine whether an operation has been performed by a user. For example, the set of one or more intensity thresholds optionally includes a first intensity threshold and a second intensity threshold. In this example, a contact with a characteristic intensity that does not exceed the first threshold results in a first operation, a contact with a characteristic intensity that exceeds the first intensity threshold and does not exceed the second intensity threshold results in a second operation, and a contact with a characteristic intensity that exceeds the second threshold results in a third operation. In some embodiments, a comparison between the characteristic intensity and one or more thresholds is used to determine whether or not to perform one or more operations (e.g., whether to perform a respective operation or forgo performing the respective operation), rather than being used to determine whether to perform a first operation or a second operation.

[0200] FIG. **5**C illustrates detecting a plurality of contacts **552**A-**552**E on touch-sensitive display screen **504** with a plurality of intensity sensors **524**A-**524**D. FIG. **5**C additionally includes intensity diagrams that show the current intensity measurements of the intensity sensors **524**A-**524**D relative to units of intensity. In this example, the intensity measurements of intensity sensors **524**A and **524**D are each 9 units of intensity, and the intensity measurements of intensity sensors **524**B and **524**C are each 7 units of intensity. In some implementations, an aggregate intensity is the sum of the intensity measurements of the plurality of intensity sensors **524**A-**524**D, which in this example is 32 intensity units. In some embodiments, each contact is assigned a respective intensity that is a portion of the aggregate intensity. FIG. **5**D illustrates assigning the aggregate intensity to contacts **552**A-**552**E based on their distance from the center of force **554**. In this example, each of contacts **552**A, **552**B, and **552**E are assigned an intensity of contact of 8 intensity units of the aggregate intensity, and each of contacts **552**C and **552**D are assigned an intensity of contact of 4 intensity units of the aggregate intensity. More generally, in some implementations, each contact j is assigned a respective intensity Ij that is a portion of the aggregate intensity, A, in accordance with a predefined mathematical function, $Ij=A\cdot(Dj/\Sigma Di)$, where Dj is the distance of the respective contact j to the center of force, and ΣDi is the sum of the distances of all the respective contacts (e.g., i=1 to last) to the center

of force. The operations described with reference to FIGS. **5**C-**5**D can be performed using an electronic device similar or identical to device **100**, **300**, or **500**. In some embodiments, a characteristic intensity of a contact is based on one or more intensities of the contact. In some embodiments, the intensity sensors are used to determine a single characteristic intensity (e.g., a single characteristic intensity of a single contact). It should be noted that the intensity diagrams are not part of a displayed user interface, but are included in FIGS. **5**C-**5**D to aid the reader.

[0201] In some embodiments, a portion of a gesture is identified for purposes of determining a characteristic intensity. For example, a touch-sensitive surface optionally receives a continuous swipe contact transitioning from a start location and reaching an end location, at which point the intensity of the contact increases. In this example, the characteristic intensity of the contact at the end location is, optionally, based on only a portion of the continuous swipe contact, and not the entire swipe contact (e.g., only the portion of the swipe contact at the end location). In some embodiments, a smoothing algorithm is, optionally, applied to the intensities of the swipe contact prior to determining the characteristic intensity of the contact. For example, the smoothing algorithm optionally includes one or more of: an unweighted sliding-average smoothing algorithm, a triangular smoothing algorithm, a median filter smoothing algorithm, and/or an exponential smoothing algorithm. In some circumstances, these smoothing algorithms eliminate narrow spikes or dips in the intensities of the swipe contact for purposes of determining a characteristic intensity.

[0202] The intensity of a contact on the touch-sensitive surface is, optionally, characterized relative to one or more intensity thresholds, such as a contact-detection intensity threshold, a light press intensity threshold, a deep press intensity threshold, and/or one or more other intensity thresholds. In some embodiments, the light press intensity threshold corresponds to an intensity at which the device will perform operations typically associated with clicking a button of a physical mouse or a trackpad. In some embodiments, the deep press intensity threshold corresponds to an intensity at which the device will perform operations that are different from operations typically associated with clicking a button of a physical mouse or a trackpad. In some embodiments, when a contact is detected with a characteristic intensity below the light press intensity threshold (e.g., and above a nominal contact-detection intensity threshold below which the contact is no longer detected), the device will move a focus selector in accordance with movement of the contact on the touch-sensitive surface without performing an operation associated with the light press intensity threshold or the deep press intensity threshold. Generally, unless otherwise stated, these intensity thresholds are consistent between different sets of user interface figures.

[0203] An increase of characteristic intensity of the contact from an intensity below the light press intensity threshold to an intensity between the light press intensity threshold and the deep press intensity threshold is sometimes referred to as a "light press" input. An increase of characteristic intensity of the contact from an intensity below the deep press intensity threshold to an intensity above the deep press intensity threshold is sometimes referred to as a "deep press" input. An increase of characteristic intensity of the contact from an intensity below the contact-detection intensity threshold to an intensity between the contact-detection intensity threshold and the light press intensity threshold is sometimes referred to as detecting the contact on the touch-surface. A decrease of characteristic intensity of the contact from an intensity above the contact-detection intensity threshold to an intensity below the contact-detection intensity threshold is sometimes referred to as detecting liftoff of the contact from the touch-surface. In some embodiments, the contact-detection intensity threshold is zero. In some embodiments, the contact-detection intensity threshold is greater than zero.

[0204] In some embodiments described herein, one or more operations are performed in response to detecting a gesture that includes a respective press input or in response to detecting the respective press input performed with a respective contact (or a plurality of contacts), where the respective press input is detected based at least in part on detecting an increase in intensity of the contact (or plurality of contacts) above a press-input intensity threshold. In some embodiments, the respective operation is performed in response to detecting the increase in intensity of the respective contact above the press-input intensity threshold (e.g., a "down stroke" of the respective press input). In some embodiments, the press input includes an increase in intensity of the respective contact above the press-input intensity threshold and a subsequent decrease in intensity of the contact below the press-input intensity threshold, and the respective operation is performed in response to detecting the subsequent decrease in intensity of the respective contact below the press-input threshold (e.g., an "up stroke" of the respective press input).

[0205] FIGS. **5**E-**5**H illustrate detection of a gesture that includes a press input that corresponds to an increase in intensity of a contact **562** from an intensity below a light press intensity threshold (e.g., "IT_L") in FIG. **5**E, to an intensity above a deep press intensity threshold (e.g., "IT_D") in FIG. **5**H. The gesture performed with contact **562** is detected on touch-sensitive surface **560** while cursor **576** is displayed over application icon **572**B corresponding to App **2**, on a displayed user interface **570** that includes application icons **572**A-**572**D displayed in predefined region **574**. In some embodiments, the gesture is detected on touch-sensitive display **504**. The intensity sensors detect the intensity of contacts on touch-sensitive surface **560**. The device determines that the intensity of contact **562** peaked above the deep press intensity threshold (e.g., "IT_D"). Contact **562** is maintained on touch-sensitive surface **560**. In response to the detection of the gesture, and in accordance with contact **562** having an intensity that goes above the deep press intensity threshold (e.g., "IT_D") during the gesture, reduced-scale representations **578**A-**578**C (e.g., thumbnails) of recently opened documents for App **2** are displayed, as shown in FIGS. **5**F-**5**H. In some embodiments, the intensity, which is compared to the one or more intensity thresholds, is the characteristic intensity of a contact. It should be noted that the intensity diagram for contact **562** is not part of a displayed user interface, but is included in FIGS. **5**E-**5**H to aid the reader.

[0206] In some embodiments, the display of representations **578**A-**578**C includes an animation. For example, representation **578**A is initially displayed in proximity of application icon **572**B, as shown in FIG. **5**F. As the animation proceeds, representation **578**A moves upward and representation **578**B is displayed in proximity of application icon **572**B, as shown in FIG. **5**G. Then, representations **578**A

moves upward, **578**B moves upward toward representation **578**A, and representation **578**C is displayed in proximity of application icon **572**B, as shown in FIG. **5**H. Representations **578**A-**578**C form an array above icon **572**B. In some embodiments, the animation progresses in accordance with an intensity of contact **562**, as shown in FIGS. **5**F-**5**G, where the representations **578**A-**578**C appear and move upwards as the intensity of contact **562** increases toward the deep press intensity threshold (e.g., "IT_D"). In some embodiments, the intensity, on which the progress of the animation is based, is the characteristic intensity of the contact. The operations described with reference to FIGS. **5**E-**5**H can be performed using an electronic device similar or identical to device **100**, **300**, or **500**.

[0207] In some embodiments, the device employs intensity hysteresis to avoid accidental inputs sometimes termed "jitter," where the device defines or selects a hysteresis intensity threshold with a predefined relationship to the press-input intensity threshold (e.g., the hysteresis intensity threshold is X intensity units lower than the press-input intensity threshold or the hysteresis intensity threshold is 75%, 90%, or some reasonable proportion of the press-input intensity threshold). Thus, in some embodiments, the press input includes an increase in intensity of the respective contact above the press-input intensity threshold and a subsequent decrease in intensity of the contact below the hysteresis intensity threshold that corresponds to the press-input intensity threshold, and the respective operation is performed in response to detecting the subsequent decrease in intensity of the respective contact below the hysteresis intensity threshold (e.g., an "up stroke" of the respective press input). Similarly, in some embodiments, the press input is detected only when the device detects an increase in intensity of the contact from an intensity at or below the hysteresis intensity threshold to an intensity at or above the press-input intensity threshold and, optionally, a subsequent decrease in intensity of the contact to an intensity at or below the hysteresis intensity, and the respective operation is performed in response to detecting the press input (e.g., the increase in intensity of the contact or the decrease in intensity of the contact, depending on the circumstances).

[0208] For ease of explanation, the descriptions of operations performed in response to a press input associated with a press-input intensity threshold or in response to a gesture including the press input are, optionally, triggered in response to detecting either: an increase in intensity of a contact above the press-input intensity threshold, an increase in intensity of a contact from an intensity below the hysteresis intensity threshold to an intensity above the press-input intensity threshold, a decrease in intensity of the contact below the press-input intensity threshold, and/or a decrease in intensity of the contact below the hysteresis intensity threshold corresponding to the press-input intensity threshold. Additionally, in examples where an operation is described as being performed in response to detecting a decrease in intensity of a contact below the press-input intensity threshold, the operation is, optionally, performed in response to detecting a decrease in intensity of the contact below a hysteresis intensity threshold corresponding to, and lower than, the press-input intensity threshold.

[0209] Attention is now directed towards embodiments of user interfaces ("UI") and associated processes that are implemented on an electronic device, such as portable multifunction device **100**, device **300**, or device **500**, described above, or device **600** described below.

[0210] FIGS. **6**A-**6**R illustrate exemplary techniques for operating wireless headphones, in accordance with some embodiments. The user interfaces in these figures are used to illustrate the processes described below, including the processes in FIG. **7**.

[0211] FIG. **6**A illustrates a front view of exemplary headphones **600** having first ear cup **610**, second ear cup **620**, and overhead band **630**. In some embodiments, headphones **600** include one or more features of devices **100**, **300**, or **500**. Headphones **600** have a first side **601** and a second side **602**. For the purposes of discussion, first side **601** is considered to be the front side of headphones **600**, second side **602** is the back, and headband **630** is at the top. In FIGS. **6**A-**6**R, a solid dark stripe visually distinguishes first side **601** from second side **602**. When headphones **600** are worn by a user such that first ear cup **610** is on the user's right ear, second cup **620** is on the user's left ear, and headband **630** is on top of the user's head, then headphones **600** are considered to be upright and forward-facing, which is also referred to herein as the first device orientation.

[0212] In some embodiments, first ear cup **610** and/or second ear cup **620** include one or more sensors, such as imaging sensors that are able to image an ear of a user on which the ear cups are placed, for determining which ear a given ear cup is on. Based on output from the sensors, the orientation of the device can be determined (e.g., the first device orientation depicted in FIG. **6**A (mentioned above) or the second, third, and fourth device orientations depicted in FIGS. **6**B, **6**C, and **6**D, respectively (discussed below)). The determination about which ear a given cup are on is optionally made by headphones **600** themselves based on outputs from the imaging sensors. In some embodiments, the determination about which ear a given cup is on is made by an electronic device with which the headphones are in communication. In some embodiments, headphones **600** are in communication (e.g., wireless communication) with another electronic device, such as a smartphone, a tablet computer, a smartwatch, or any other electronic device. For example, headphones **600** are optionally in communication with the another electronic device via Bluetooth via which the headphones are able to play audio provided by the electronic device. In some embodiments, in addition to audio communication, the headphones and the another electronic device are able to communicate other information between them, such as headphone battery information, headphone orientation information, and information about touch inputs detected on the touch-sensitive surface of the headphones.

[0213] Referring again to FIG. **6**A, the outer surface (e.g., the surface opposite the user's ear) of first ear cup **610** includes first touch-sensitive surface **612**, and the outer surface of second ear cup **620** includes second touch-sensitive surface **622**, which has been stippled in FIGS. **6**A-**6**R to be visually distinguishable from first touch-sensitive surface **612**. Each touch-sensitive surface has, independent of any frame of reference from which the touch-sensitive surface is being observed or monitored, one or more locations on its surface that correspond to one or more fixed coordinates on the touch-sensitive surface. As illustrated in FIG. **6**A, touch-sensitive surfaces **612** and **622** have a rectangular shape with a first side, a second side (e.g., adjacent the first side), a third side (e.g., opposite the first side) and a fourth side (e.g., opposite the second side). In

FIG. **6**A, the sides of each touch-sensitive surface are labeled alphabetically, beginning with the left side and going clockwise, according to the view depicted in FIG. **6**A. Thus, the first (e.g., left) side of first touch-sensitive surface **612** is **612**A, the second (e.g., top) side is **612**B, the third (e.g., right) side is **612**C, and the fourth (e.g., bottom) side is **612**D. Similarly, the first (e.g., left) side of second touch-sensitive surface **622** is **622**A, the second (e.g., top) side is **622**B, the third (e.g., right) side is **622**C, and the fourth (e.g., bottom) side is **622**D. Since first touch-sensitive surface **612** and second touch-sensitive surface **622** are on opposite outward-facing sides of ear cups **610** and **620**, respectively, the left side **612**A of first touch-sensitive surface **612** is oriented toward second side **602** (e.g., the back) of headphones **600**, whereas the left side **622**A of second touch-sensitive surface **622** is oriented toward first side **601** (e.g., the front) of headphones **600**.

[0214] FIG. **6**A also illustrates input **650** as a touch input on first touch-sensitive surface **612**. Input **650** has a first input orientation with respect to first touch-sensitive surface **612**. Specifically, input **650** is a swipe gesture going from side **612**A toward opposite side **612**C of first touch-sensitive surface **612**. For the purposes of this disclosure, the orientation of the input (referred to herein as the input orientation) is relative to the touch-sensitive surfaces **612** and/or **622**, and is distinct from the orientation of the headphones **600** (referred to herein as the device orientation). From the perspective of a user wearing headphones **600** in the first device orientation, input **650** is a back-to-front, or forward, horizontal swipe on the user's right side.

[0215] In response to input **650** and in accordance with a determination that headphones **600** are oriented in the first device orientation, headphones **600** perform a first action. In some embodiments, the first action is skipping forward to the next music track in a playlist from a currently-playing music track in the playlist. Other exemplary actions include play, pause, volume up, volume down, previous song, fast forward, rewind, and enter ambient sound transparency mode (discussed in greater detail below).

[0216] In the illustrated embodiment, headphones **600** and/or ear cups **610** and **620** are symmetrical, such that headphones **600** can be worn by a user in multiple orientations (e.g., the first ear cup on the user's left ear, and the second ear cup on the user's right ear; or, the first ear cup on the user's right ear, and the second ear cup on the user's left ear). FIG. **6**B depicts headphones **600** in a second device orientation. Compared to the first device orientation depicted in FIG. **6**A, the second device orientation is rotated 180 degrees around a vertical axis such that first ear cup **610** is on the user's left ear and second ear cup **620** is on the user's right ear. Accordingly, in the second device orientation, the first (e.g., front) side **601** of headphones **600** faces toward the back of the user's head, and second side **602** is facing forward. The headband **630** remains above the user's head. Thus, from the user's perspective, headphones **600** are upright and backward-facing.

[0217] The same input, input **650**, is also depicted in FIG. **6**B. Again, input **650** is a swipe gesture on first touch-sensitive surface **612** going from side **612**A toward opposite side **612**C. However, since headphones **600** have been turned backwards, from the perspective of the user, input **650** corresponds to a front-to-back, or backward, horizontal swipe on the user's left side. Thus, compared to the first device orientation, input **650** is on the user's opposite side and in the opposite direction. In response to input **650** and in accordance with a determination that headphones **600** are oriented in the second device orientation, headphones **600** perform a second action. In some embodiments, since headphones **650** are in a different device orientation, the second action is different than the first action performed when headphones **600** are in the first device orientation. That is, although the input is the same from the perspective of the touch-sensitive surface of headphones **600**, the response is different due to headphones **600** being in a different device orientation. In some embodiments, headphones **600** are configured to perform opposite actions in response to gestures in opposite directions from the perspective of a user, regardless of the side of the user on which the input is received or in which device orientation headphones **600** are worn. In such embodiments, the action performed in response to the combination of input orientation and device orientation depicted in FIG. **6**B is the opposite of the response associated with the combination of input orientation and device orientation depicted in FIG. **6**A (e.g., the second action is skipping backward to a previous track in a playlist from a currently-playing music track in the playlist or returning to the beginning of the currently-playing track).

[0218] FIG. **6**C depicts headphones **600** in a third device orientation in which first ear cup **610** is on the user's right ear, second ear cup **620** is on the user's left ear, and the top of headphones **600** is pointed downward. The first side **601** is facing toward the back of the user's head, and second side **602** is facing forward. Thus, from the user's perspective, headphones **600** are upside down and backward-facing. The same input **650** (a swipe gesture on first touch-sensitive surface **612** going from side **612**A toward opposite side **612**C) is depicted again in FIG. **6**C. Now, since headphones **600** are upside down and facing backwards, from the perspective of the user, input **650** corresponds to a front-to-back, or backward, horizontal swipe on the user's right side. Thus, compared to the first device orientation, input **650** is on the user's same side, but in the opposite direction. And compared to the second device orientation, input **650** is on the user's opposite side, but in the same direction.

[0219] In response to input **650** and in accordance with a determination that headphones **600** are oriented in the third device orientation, headphones **600** perform a third action. In some embodiments, the third action is different than the response to input **650** when headphones **600** are in the first device orientation and/or different than the response to input **650** when headphones **600** are in the second device orientation. In some embodiments, headphones **600** are configured to perform an action based on the direction of the input with respect to the user, regardless of the side of the user on which the input is received or in which device orientation headphones **600** are worn. In such embodiments, the action performed in response to the combination of input orientation and device orientation depicted in FIG. **6**C is the same as the response associated with the combination of input orientation and device orientation depicted in FIG. **6**B (e.g., the third action is skipping to a previous track on an audio player or returning to the beginning of a current track), since both configurations correspond to a backward, horizontal swipe from the perspective of the user. Furthermore, in embodiments in which headphones **600** are configured to perform opposite actions in response to gestures in opposite directions (from the perspective of a user) whether or not the gestures are on the user's same side, the action performed in

response to the combination of input orientation and device orientation depicted in FIG. **6**C is the opposite of the response associated with the combination of input orientation and device orientation depicted in FIG. **6**A (e.g., the third action is skipping to a previous track on an audio player or returning to the beginning of a current track).

[0220] FIG. **6**D depicts headphones **600** in a fourth device orientation in which first ear cup **610** is on the user's left ear, second ear cup **620** is on the user's right ear, and the top of headphones **600** is pointed downward. The first side **601** is facing toward the front of the user's head, and second side **602** is facing forward. Thus, from the user's perspective, headphones **600** are upside down and forward-facing. The same input **650** (a swipe gesture on first touch-sensitive surface **612** going from side **612**A toward opposite side **612**C) is depicted again in FIG. **6**D. Now, since headphones **600** are upside down and facing forwards, from the perspective of the user, input **650** corresponds to a back-to-front, or forward, horizontal swipe on the user's left side. Thus, compared to the first device orientation, input **650** is on the user's opposite side, but in the same direction; compared to the second device orientation, input **650** is on the user's same side, but in the opposite direction; and compared to the third device orientation, input **650** is on the user's opposite side and in the opposite direction.

[0221] In response to input **650** and in accordance with a determination that headphones **600** are oriented in the fourth device orientation, headphones **600** perform a fourth action. In some embodiments, the fourth action is different than the response to input **650** when headphones **600** are in the first device orientation, the second device orientation, and/or the third device orientation. In embodiments in which headphones **600** are configured to perform an action based on the direction of a swipe gesture with respect to the user, regardless of the side of the user on which the input is received or in which device orientation headphones **600** are worn, the action performed in response to the combination of input orientation and device orientation depicted in FIG. **6**D is the same as the response associated with the combination of input orientation and device orientation depicted in FIG. **6**A (e.g., the fourth action is skipping to a next track on an audio player), since both configurations correspond to a forward, horizontal swipe from the perspective of the user. In embodiments in which headphones **600** are configured to perform opposite actions in response inputs of opposite direction (from the perspective of a user) on the user's same side, the action performed in response to the combination of input orientation and device orientation depicted in FIG. **6**D is the opposite of the response associated with the combinations of input orientation and device orientation depicted in FIG. **6**B. Further, if the headphones **600** are configured to perform opposite actions in response inputs of opposite direction (from the perspective of a user) regardless of the side of the user on which the input is received, the action performed in response to the combination of input orientation and device orientation depicted in FIG. **6**D is also the opposite of the response associated with the combinations of input orientation and device orientation depicted in and FIG. **6**C.

[0222] Turning now to FIGS. **6**E-**6**H, the response of headphones **600** to an input having the first input orientation, but on second touch-sensitive surface **622** instead of first touch-sensitive surface **612**, is described. Input **652** depicted in FIGS. **6**E-**6**H is different than input **650** in that input **652** is received on second touch-sensitive surface **622**, whereas input **650** is received on first touch-sensitive surface **612**. However, input **652** is similar to input **650** in the sense that it has the same input orientation with respect to second touch-sensitive surface **622** as the input orientation that input **650** has with respect to first touch-sensitive surface **612**. More specifically, input **652** is a swipe gesture going from side **622**A toward opposite side **622**C of second touch-sensitive surface **622**, and thus is a left-to-right horizontal swipe with respect to second touch-sensitive surface **622**. In FIGS. **6**E-**6**H, input **652** is the same (with respect to second touch-sensitive surface **622**), while headphones **600** are depicted in the first device orientation (FIG. **6**E), second device orientation (FIG. **6**F), third device orientation (FIG. **6**G), and fourth device orientation (FIG. **6**H), respectively.

[0223] Notably, from the perspective of the user, the combination of input **652** and first device orientation depicted in FIG. **6**E is the same as the combination of input **650** and second device orientation depicted in FIG. **6**B. In some embodiments, since the inputs are the same from the perspective of the user, headphones **600** perform the same action in response to the combination of input **652** and first device orientation as to the combination of input **650** and second device orientation (e.g., headphones **600** perform the second action in both cases). Similarly, headphones **600** perform the same action in response to the combination of input **652** and second device orientation (FIG. **6**F) as to the combination of input **650** and first device orientation (FIG. **6**A) (e.g., headphones **600** perform the first action in both cases); headphones **600** perform the same action in response to the combination of input **652** and third device orientation (FIG. **6**G) as to the combination of input **650** and fourth device orientation (FIG. **6**D) (e.g., headphones **600** perform the fourth action in both cases); and headphones **600** perform the same action in response to the combination of input **652** and fourth device orientation (FIG. **6**H) as to the combination of input **650** and third device orientation (FIG. **6**C) (e.g., headphones **600** perform the third action in both cases).

[0224] In some embodiments, for a given input orientation and device orientation, headphones **600** perform different actions depending on which touch-sensitive surface the input is received (e.g., headphones **600** perform different actions in response to the configurations depicted in FIG. **6**A and FIG. **6**E). In some embodiments, for a given input from the perspective of the user wearing headphones **600**, headphones **600** perform different actions depending on which touch-sensitive surface the input is received (e.g., headphones **600** perform different actions in response to the configurations depicted in FIG. **6**A and FIG. **6**F).

[0225] Turning now to FIGS. **6**I-**6**L, the response of headphones **600** to an input having a second input orientation is described. Input **654** depicted in FIGS. **6**I-**6**L is a swipe gesture on first touch-sensitive surface **612** going from side **612**D toward opposite side **612**B, and thus is a bottom-to-top, or upward, vertical swipe with respect to first touch-sensitive surface **612**. In FIGS. **6**I-**6**L, input **654** is the same (with respect to first touch-sensitive surface **612**), while headphones **600** are depicted in the first device orientation (FIG. **6**I), second device orientation (FIG. **6**J), third device orientation (FIG. **6**K), and fourth device orientation (FIG. **6**L), respectively. Headphones **600** perform fifth action, sixth action, seventh action, and eighth action in response to the combinations of input **654** and first device orientation (upward swipe on the user's right ear), input **654**

and second device orientation (upward swipe on the user's left ear), input **654** and third device orientation (downward swipe on the user's right ear), and input **654** and fourth device orientation (downward swipe on the user's left ear), respectively. In some embodiments, fifth action, sixth action, seventh action, and eighth action are all different from each other. In embodiments in which headphones **600** are configured to produce a response based on the direction of the swipe with respect to the user, regardless of the side on which the input is received, the fifth and sixth actions are the same (e.g., increasing a volume level of headphones **600**), and the seventh and eighth actions are the same (e.g., decreasing the volume level of headphones **600**).

[0226] Turning now to FIGS. **6**M-**6**P, the response of headphones **600** to an input having the second input orientation, but on second touch-sensitive surface **622** instead of first touch-sensitive surface **612**, is described. Input **656** depicted in FIGS. **6**M-**6**P is different than input **654** in that input **656** is received on second touch-sensitive surface **622**, whereas input **654** is received on first touch-sensitive surface **612**. However, input **656** is similar to input **654** in the sense that it has the same input orientation with respect to second touch-sensitive surface **622** as the input orientation that input **654** has with respect to first touch-sensitive surface **612**. More specifically, input **656** is a swipe gesture going from side **622**D toward opposite side **622**B of second touch-sensitive surface **622**, and thus is a bottom-to-top vertical swipe with respect to second touch-sensitive surface **622**. In FIGS. **6**M-**6**P, input **656** is the same (with respect to second touch-sensitive surface **622**), while headphones **600** are depicted in the first device orientation (FIG. **6**M), second device orientation (FIG. **6**N), third device orientation (FIG. **6**O), and fourth device orientation (FIG. **6**P), respectively.

[0227] From the perspective of the user, the combination of input **656** and first device orientation depicted in FIG. **6**M is the same as the combination of input **654** and second device orientation depicted in FIG. **6**J. In some embodiments, since the inputs are the same from the perspective of the user, headphones **600** perform the same action in response to the combination of input **656** and first device orientation as to the combination of input **654** and second device orientation (e.g., headphones **600** perform the sixth action in both cases). Similarly, headphones **600** perform the same action in response to the combination of input **656** and second device orientation (FIG. **6**N) as to the combination of input **654** and first device orientation (FIG. **6**I) (e.g., headphones **600** perform the fifth action in both cases); headphones **600** perform the same action in response to the combination of input **656** and third device orientation (FIG. **6**O) as to the combination of input **654** and fourth device orientation (FIG. **6**L) (e.g., headphones **600** perform the eighth action in both cases); and headphones **600** perform the same action in response to the combination of input **656** and fourth device orientation (FIG. **6**P) as to the combination of input **654** and third device orientation (FIG. **6**K) (e.g., headphones **600** perform the seventh action in both cases).

[0228] As mentioned above, in some embodiments, for a given input orientation and device orientation, headphones **600** perform different actions depending on which touch-sensitive surface the input is received (e.g., headphones **600** perform different actions in response to the configurations depicted in FIG. **6**I and FIG. **6**M). And in some embodiments, for a given input from the perspective of the user wearing headphones **600**, headphones **600** perform different actions depending on which touch-sensitive surface the input is received (e.g., headphones **600** perform different actions in response to the configurations depicted in FIG. **6**I and FIG. **6**N).

[0229] Turning now to FIGS. **6**Q-**6**R, the response to headphones **600** to an input that matches a predefined gesture pattern is described. In FIG. **6**Q, headphones **600** are in the first device orientation and receive a tap gesture on first touch-sensitive surface **612**, input **658**. In FIG. **6**R, headphones **600** receive the same input **658**, a tap gesture on first touch-sensitive surface **612**, while in the second device orientation. In both FIG. **6**Q and FIG. **6**R, headphones **600** determine that input **658** matches a predefined gesture pattern. In some embodiments, based on further determining that headphones **600** are in the first device orientation, headphones **600** perform a ninth action (e.g., a pause action on an audio player), and based on further determining that headphones **600** are in the second device orientation, headphones perform a tenth action (e.g., an answer call action). In some embodiments, headphones **600** perform the same action (e.g., a pause action on an audio player) in response to determining that input **658** matches a predefined gesture pattern, regardless of the device orientation. Other examples of a predefined gesture patterns include a two finger tap and a three finger tap.

[0230] Table 1 below shows a summary of some of the various exemplary configurations and corresponding responses described above. It should be recognized, however, that the configurations and corresponding responses in Table 1 are not the only possible combinations and that other configurations and/or responses are possible.

TABLE 1

Surface of Input	Gesture Orientation (with respect to input surface)	Device Orientation	Device Orientation (with respect to user)	Gesture Orientation (with respect to user)	Same response on both sides (with respect to user)	Action
612	Left-to-Right	First	Forward-Up	Right-Forward	NO	First
612	Left-to-Right	Second	Backward-Up	Left-Back	NO	Second
612	Left-to-Right	Third	Backward-Down	Right-Back	NO	Third
612	Left-to-Right	Fourth	Forward-Down	Left-Forward	NO	Fourth
612	Upward	First	Forward-Up	Right-Up	NO	Fifth
612	Upward	Second	Backward-Up	Left-Up	NO	Sixth
612	Upward	Third	Backward-Down	Right-Down	NO	Seventh
612	Upward	Fourth	Forward-Down	Left-Down	NO	Eighth
622	Left-to-Right	First	Forward-Up	Left-Back	NO	Second

TABLE 1-continued

Surface of Input	Gesture Orientation (with respect to input surface)	Device Orientation	Device Orientation (with respect to user)	Gesture Orientation (with respect to user)	Same response on both sides (with respect to user)	Action
622	Left-to-Right	Second	Backward-Up	Right-Forward	NO	First
622	Left-to-Right	Third	Backward-Down	Left-Forward	NO	Fourth
622	Left-to-Right	Fourth	Forward-Down	Right-Back	NO	Third
622	Upward	First	Forward-Up	Left-Up	NO	Sixth
622	Upward	Second	Backward-Up	Right-Up	NO	Fifth
622	Upward	Third	Backward-Down	Left-Down	NO	Eighth
622	Upward	Fourth	Forward-Down	Right-Down	NO	Seventh
612	Left-to-Right	First	Forward-Up	Right-Forward	YES	First
612	Left-to-Right	Second	Backward-Up	Left-Back	YES	Second
612	Left-to-Right	Third	Backward-Down	Right-Back	YES	Second
612	Left-to-Right	Fourth	Forward-Down	Left-Forward	YES	First
612	Upward	First	Forward-Up	Right-Up	YES	Fifth
612	Upward	Second	Backward-Up	Left-Up	YES	Fifth
612	Upward	Third	Backward-Down	Right-Down	YES	Seventh
612	Upward	Fourth	Forward-Down	Left-Down	YES	Seventh
622	Left-to-Right	First	Forward-Up	Left-Back	YES	Second
622	Left-to-Right	Second	Backward-Up	Right-Forward	YES	First
622	Left-to-Right	Third	Backward-Down	Left-Forward	YES	First
622	Left-to-Right	Fourth	Forward-Down	Right-Back	YES	Second
622	Upward	First	Forward-Up	Left-Up	YES	Fifth
622	Upward	Second	Backward-Up	Right-Up	YES	Fifth
622	Upward	Third	Backward-Down	Left-Down	YES	Seventh
622	Upward	Fourth	Forward-Down	Right-Down	YES	Seventh

[0231] FIG. **7** is a flow diagram illustrating a method for processing gestures on a touch-sensitive surface using an electronic device in accordance with some embodiments. Method **700** is performed at a device (e.g., **100**, **300**, **500**, **600**, **800**, **1000**, **1200**, or **1410**) with at least a first touch-sensitive surface (e.g., **612**). In some embodiments, the at least a first touch-sensitive surface includes a first touch-sensitive surface (e.g., **612**) and a second touch-sensitive surface (e.g., **622**), different than the first touch-sensitive surface. In some embodiments, the electronic device is a pair of headphones having a first ear cup (e.g., **610**) and a second ear cup (e.g., **620**), and where the first touch sensitive surface is on the first ear cup and the second touch sensitive surface is on the second ear cup. In some embodiments, headphones include a sensor (e.g., **164**, **359**) configured to capture an image of a user's ears, and the orientation of the electronic device is determined based on the image of the user's ears.

[0232] As described below, method **700** provides an intuitive way for processing gestures on a touch-sensitive surface. The method reduces the cognitive burden on a user for providing input gestures on a touch-sensitive surface, thereby creating a more efficient human-machine interface. For battery-operated computing devices, enabling a user to provide input gestures on a touch-sensitive surface faster and more efficiently conserves power and increases the time between battery charges. Some operations in method **700** are, optionally, combined, the orders of some operations are, optionally, changed, and some operations are, optionally, omitted.

[0233] In method **700**, the electronic device (e.g., headphones earbuds) detects (**702**), at the at least a first touch-sensitive surface (e.g., **612**), a first gesture (e.g., **650**), including detecting (**704**) an orientation of the first gesture with respect to the touch-sensitive surface (e.g., the touch-sensitive surface has, independent of any frame of reference from which the touch-sensitive surface is being observed or monitored, one or more locations on its surface that correspond to one or more fixed coordinates on the touch-sensitive surface). In some embodiments, the electronic device is a set of headphones that are in communication (e.g., wireless communication) with an external electronic device (e.g., **810**), such as a smartphone, a tablet computer, a smartwatch, or any other external electronic device. For example, the headphones are optionally in communication with the external electronic device via Bluetooth via which the headphones are able to play audio provided by the electronic device. In some embodiments, in addition to audio communication, the headphones and the external electronic device are able to communicate other information between them, such as headphone battery information, headphone orientation information, information about touch inputs detected on the touch-sensitive surface of the headphones, and so forth. The headphones optionally include two ear cups (e.g., "first ear cup" **610** and "second ear cup" **620**). The headphones and/or ear cups are optionally symmetrical, such that the headphones can be worn by a user in multiple orientations (e.g., the first ear cup on the user's left ear, and the second ear cup on the user's right ear; or, the first ear cup on the user's right ear, and the second ear cup on the user's left ear). In some embodiments, the first ear cup and/or the second ear cup include a touch-sensitive surface on their outer surfaces (e.g., the surfaces opposite the user's ears). For example, if the touch-sensitive surface has a shape that is a four-sided shape, it optionally has a first side (e.g., **612**A), a second side (e.g., **612**B adjacent the first side), a third side (e.g., **612**C opposite the first side) and a fourth side (e.g., **612**D opposite the second side). The first gesture optionally has an orientation with respect to those locations on the touch-sensitive surface. For example, the first gesture (e.g., **650**) is optionally a swipe from the first side of the touch-sensitive surface to the third side of the touch-sensitive surface.

[0234] The electronic device performs (**708**) a first action (e.g., a media-related action such as skip next track), in response to detecting the first gesture and in accordance with a determination (**706**) that the electronic device is in a first device orientation (e.g., forward, upright) and that the orientation of the first gesture corresponds to a first predetermined orientation (e.g., a determination that the first ear cup of the headphones is on the user's right ear, and that the second ear cup of the headphones is on the user's left ear; see the input orientation of input **650** and the device orientation of headphones **600** in FIG. **6**A). In some embodiments, the first or second ear cups include one or more sensors, such as imaging sensors that are able to image an ear on which the ear cups are placed, for determining which ear the ear cups are on. The determination about which ear a given cup is on is optionally made by the headphones themselves based on outputs from the imaging sensors, or made by the external electronic device (e.g., **810**) with which the headphones are in communication. For example, if the first ear cup is on the user's right ear and the second ear cup is on the user's left ear such that the first side of the touch-sensitive surface of the first ear cup is oriented toward the back of the user's head, and the third side of the touch-sensitive surface of the first ear cup is oriented toward the front of the user's head, a swipe detected from the first side of the touch-sensitive surface to the third side of the touch-sensitive surface on the first ear cup will be determined, by the headphones or the electronic device, to be a back-to-front swipe on the user's right side, which optionally causes the electronic device to skip forward to the next music track in a playlist from a currently-playing music track in that playlist.

[0235] The electronic device performs (**710**) a second action (e.g., a media-related action such as skip to previous track) that is different than the first action, in response to detecting the first gesture and in accordance with a determination (**706**) that the electronic device is in a second device orientation (e.g., backward, upright), different than the first device orientation (e.g., a determination that the first ear cup of the headphones is on the user's left ear, and that the second ear cup of the headphones is on the user's right ear) and that the orientation of the first gesture corresponds to the first predetermined orientation (e.g., the input orientation of input **650** and the device orientation of headphones **600** in FIG. **6**B). For example, if the first ear cup is on the user's left ear and the second ear cup is on the user's right ear such that the first side of the touch-sensitive surface of the first ear cup is oriented toward the front of the user's head, and the third side of the touch-sensitive surface of the first ear cup is oriented toward the back of the user's head, a swipe detected from the first side of the touch-sensitive surface to the third side of the touch-sensitive surface on the first ear cup will be determined, by the headphones or the electronic device, to be a front-to-back swipe on the user's left side, which optionally causes the electronic device to skip backward to the previous music track in a playlist from a currently-playing music track in that playlist. Performing actions selectively based on device and gesture orientation provides the user with the ability to interact with the device without having to monitor the device's orientation and to adapt their gesture orientation to the device's current orientation. Doing so improves the user's ability to provide input to the device quickly and efficiently. Providing improved and easy-to-use control options enhances the operability of the device and makes the user-device interface more efficient (e.g., by helping the user to provide proper inputs and reducing user mistakes when operating/interacting with the device) which, additionally, reduces power usage and improves battery life of the device by enabling the user to use the device more quickly and efficiently.

[0236] In some embodiments, the first action and the second action are multimedia control actions. In some embodiments, the multimedia control actions are one or more of: play, pause, volume up, volume down, next song, previous song, fast forward, rewind, and enter ambient sound transparency mode.

[0237] In some embodiments, the first predetermined orientation (that the gesture corresponds to) is a vertical direction with respect to the at least a first touch sensitive surface (e.g., the orientation of input **654** with respect to first touch sensitive surface **612**). In some such embodiments, the first action and the second action adjust a volume level of the electronic device. Further in some such embodiments, the first action increases the volume level and the second action decreases the volume level.

[0238] In some embodiments, the first predetermined orientation (that the gesture corresponds to) is a horizontal direction with respect to the at least a first touch sensitive surface (e.g., the orientation of input **650** with respect to first touch sensitive surface **612**). In some such embodiments, the first action and the second action control an audio track played by the electronic device. Further in some such embodiments, the first action skips to a subsequent audio track and the second action returns to a beginning of a current track or skips to a previous audio track.

[0239] In some embodiments, the first action is performed further in accordance with a determination that the first gesture is detected at the first touch-sensitive surface. In some such embodiments, further in response to detecting the first gesture and in accordance with a determination that the electronic device is in the first device orientation (e.g., a determination that the first ear cup of the headphones is on the user's right ear and the second ear cup of the headphones is on the user's left ear such that the first side of the touch-sensitive surface of the second ear cup is oriented toward the front of the user's head, and the third side of the touch-sensitive surface of the second ear cup is oriented toward the back of the user's head), that the orientation of the first gesture corresponds to the first predetermined orientation (e.g., a swipe detected from the first side of the touch-sensitive surface to the third side of the touch-sensitive surface on the second ear cup will be determined, by the headphones or the electronic device, to be a front-to-back swipe on the user's left side), and that the first gesture is detected at the second touch-sensitive surface (e.g., on the left ear cup), the electronic device performs the second action (e.g., headphones **600** perform the second action in response to the configuration of input **652** and device orientation shown in FIG. **6**E).

[0240] In some embodiments, the second action is performed further in accordance with a determination that the first gesture is detected at the first touch-sensitive surface. In some such embodiments, further in response to detecting the first gesture and in accordance with a determination that the electronic device is in the second device orientation (e.g., a determination that the first ear cup of the headphones is on the user's left ear and the second ear cup of the headphones is on the user's right ear such that the first side of the touch-sensitive surface of the second ear cup is oriented

toward the back of the user's head, and the third side of the touch-sensitive surface of the second ear cup is oriented toward the front of the user's head), that the orientation of the first gesture corresponds to the first predetermined orientation (e.g., a swipe detected from the first side of the touch-sensitive surface to the third side of the touch-sensitive surface on the second ear cup will be determined, by the headphones or the electronic device, to be a back-to-front swipe on the user's right side), and that the first gesture is detected at the second touch-sensitive surface (e.g., the right ear cup), the electronic device performs the first action (e.g., headphones **600** perform the first action in response to the configuration of input **652** and device orientation shown in FIG. **6**F).

[0241] In some embodiments, the electronic device performs a third action (e.g., a media-related action such as skip to previous track), in response to detecting the first gesture and in accordance with a determination that the electronic device is in a third device orientation (e.g., backward, upside-down), different than the first device orientation and the second device orientation, and that the orientation of the first gesture corresponds to the first predetermined orientation (e.g., headphones **600** perform the third action in response to the configuration of input **650** and device orientation shown in FIG. **6**C). For example, if the first ear cup of the headphones is on the user's right ear and the second ear cup of the headphones is on the user's left ear such that the first side of the touch-sensitive surface of the first ear cup is oriented toward the front of the user's head, and the third side of the touch-sensitive surface of the first ear cup is oriented toward the back of the user's head, a swipe detected from the first side of the touch-sensitive surface to the third side of the touch-sensitive surface on the first ear cup will be determined, by the headphones or the electronic device, to be a front-to-back swipe on the user's right side. In some such embodiments, a front-to-back swipe on the user's right side causes the electronic device to skip backward to the previous music track in a playlist from a currently-playing music track in that playlist. In some embodiments, the third action is the same as the second action.

[0242] In some embodiments, the electronic device performs a fourth action (e.g., a media-related action such as skip to next track), in response to detecting the first gesture and in accordance with a determination that the electronic device is in a fourth device orientation (e.g., forward, upside-down), different than the first device orientation, the second device orientation, and the third device orientation, and that the orientation of the first gesture corresponds to the first predetermined orientation (e.g., headphones **600** perform the fourth action in response to the configuration of input **650** and device orientation shown in FIG. **6**D). For example, if the first ear cup of the headphones is on the user's left ear and the second ear cup of the headphones is on the user's right ear such that the first side of the touch-sensitive surface of the first ear cup is oriented toward the back of the user's head, and the third side of the touch-sensitive surface of the first ear cup is oriented toward the front of the user's head, a swipe detected from the first side of the touch-sensitive surface to the third side of the touch-sensitive surface on the first ear cup will be determined, by the headphones or the electronic device, to be a back-to-front swipe on the user's left side. In some such embodiments, a back-to-front swipe on the user's left side causes the electronic device to skip forward to the next music track in a playlist from a currently-playing music track in that playlist). In some embodiments, the fourth action is the same as the first action.

[0243] In some embodiments, the third action is performed further in accordance with a determination that the first gesture is detected at the first touch-sensitive surface. In some such embodiments, further in response to detecting the first gesture and in accordance with a determination that the electronic device is in the third device orientation (e.g., a determination that the first ear cup of the headphones is on the user's right ear and the second ear cup of the headphones is on the user's left ear such that the first side of the touch-sensitive surface of the second ear cup is oriented toward the back of the user's head, and the third side of the touch-sensitive surface of the second ear cup is oriented toward the front of the user's head), that the orientation of the first gesture corresponds to the first predetermined orientation, and that the first gesture is detected at the second touch-sensitive surface (e.g., a swipe detected from the first side of the touch-sensitive surface to the third side of the touch-sensitive surface on the second ear cup will be determined, by the headphones or the electronic device, to be a back-to-front swipe on the user's left side), the electronic device performs the fourth action (e.g., headphones **600** perform the fourth action in response to the configuration of input **652** and device orientation shown in FIG. **6**G)). In some embodiments, the fourth action (e.g., response to back-to-front swipe on user's left side) is the same as the first action (e.g., response to back-to-front swipe on user's right side)

[0244] In some embodiments, the fourth action is performed further in accordance with a determination that the first gesture is detected at the first touch-sensitive surface. In some such embodiments, further in response to detecting the first gesture and in accordance with a determination that the electronic device is in the fourth device orientation (e.g., a determination that the first ear cup of the headphones is on the user's left ear and the second ear cup of the headphones is on the user's right ear such that the first side of the touch-sensitive surface of the second ear cup is oriented toward the front of the user's head, and the third side of the touch-sensitive surface of the second ear cup is oriented toward the back of the user's head), that the orientation of the first gesture corresponds to the first predetermined orientation, and that the first gesture is detected at the second touch-sensitive surface (e.g., a swipe detected from the first side of the touch-sensitive surface to the third side of the touch-sensitive surface on the second ear cup will be determined, by the headphones or the electronic device, to be a front-to-back swipe on the user's right side), the electronic device performs the third action (e.g., headphones **600** perform the third action in response to the configuration of input **652** and device orientation shown in FIG. **6**H). In some embodiments, the third action (e.g., response to front-to-back swipe on right side) is the same as the second action (e.g., response to front-to-back swipe on left side).

[0245] In some embodiments, the electronic device performs a fifth action (e.g., a media-related action such as increasing the playback volume), in response to detecting the first gesture and in accordance with a determination that the electronic device is in the first device orientation and that the first gesture corresponds to a second predetermined orientation (e.g., headphones **600** perform the fifth action in

response to the configuration of input **654** and device orientation shown in FIG. **6**I). For example, if the first ear cup of the headphones is on the user's right ear and the second ear cup of the headphones is on the user's left ear such that the second side of the touch-sensitive surface of the first ear cup is oriented toward the top of the user's head, and the fourth side of the touch-sensitive surface of the first ear cup is oriented toward the bottom of the user's head, a swipe detected from the fourth side of the touch-sensitive surface to the second side of the touch-sensitive surface on the first ear cup will be determined, by the headphones or the electronic device, to be an upward swipe on the user's right side. In some such embodiments, an upward swipe on the user's right side causes the electronic device to increase the volume.

[0246] In some embodiments, the electronic device performs a sixth action (e.g., a media-related action such as increasing the playback volume), in response to detecting the first gesture and in accordance with a determination that the electronic device is in the second device orientation and that the first gesture corresponds to the second predetermined orientation (e.g., headphones **600** perform the sixth action in response to the configuration of input **654** and device orientation shown in FIG. **6**J). For example, if the first ear cup of the headphones is on the user's left ear and the second ear cup of the headphones is on the user's right ear such that the second side of the touch-sensitive surface of the first ear cup is oriented toward the top of the user's head, and the fourth side of the touch-sensitive surface of the first ear cup is oriented toward the bottom of the user's head, a swipe detected from the fourth side of the touch-sensitive surface to the second side of the touch-sensitive surface on the first ear cup will be determined, by the headphones or the electronic device, to be an upward swipe on the user's left side). In some such embodiments, an upward swipe on the user's left side causes the electronic device to increase the volume. In some embodiments, the sixth action is the same as the fifth action.

[0247] In some embodiments, the fifth action is performed further in accordance with a determination that the first gesture is detected at the first touch-sensitive surface. In some such embodiments, further in response to detecting the first gesture and in accordance with a determination that the electronic device is in the first device orientation (e.g., a determination that the first ear cup of the headphones is on the user's right ear and the second ear cup of the headphones is on the user's left ear such that the second side of the touch-sensitive surface of the second ear cup is oriented toward the top of the user's head, and the fourth side of the touch-sensitive surface of the second ear cup is oriented toward the bottom of the user's head), that the orientation of the first gesture corresponds to the second predetermined orientation, and that the first gesture is detected at the second touch-sensitive surface (e.g., a swipe detected from the fourth side of the touch-sensitive surface to the second side of the touch-sensitive surface on the second ear cup will be determined, by the headphones or the electronic device, to be an upward swipe on the user's left side), the electronic device performs the sixth action (e.g., headphones **600** perform the sixth action in response to the configuration of input **656** and device orientation shown in FIG. **6**M). In some embodiments, the sixth action is the same as the fifth action (e.g., response to upward swipe on left side is the same as the response to an upward swipe on the right side).

[0248] In some embodiments, the sixth action is performed further in accordance with a determination that the first gesture is detected at the first touch-sensitive surface. In some such embodiments, further in response to detecting the first gesture and in accordance with a determination that the electronic device is in the second device orientation, that the first gesture corresponds to the second predetermined orientation, and that the first gesture is detected at the second touch-sensitive surface (e.g., a determination that the first ear cup of the headphones is on the user's left ear and the second ear cup of the headphones is on the user's right ear such that the second side of the touch-sensitive surface of the second ear cup is oriented toward the top of the user's head, and the fourth side of the touch-sensitive surface of the second ear cup is oriented toward the bottom of the user's head, a swipe detected from the fourth side of the touch-sensitive surface to the second side of the touch-sensitive surface on the second ear cup will be determined, by the headphones or the electronic device, to be an upward swipe on the user's right side), the electronic device performs the fifth action (e.g., headphones **600** perform the fifth action in response to the configuration of input **656** and device orientation shown in FIG. **6**N).

[0249] In some embodiments, the electronic device performs a seventh action (e.g., a media-related action such as decreasing the playback volume), in response to detecting the first gesture and in accordance with a determination that the electronic device is in the third device orientation and that the first gesture corresponds to the second predetermined orientation (e.g., headphones **600** perform the seventh action in response to the configuration of input **654** and device orientation shown in FIG. **6**K). For example, if the first ear cup of the headphones is on the user's left ear and the second ear cup of the headphones is on the user's right ear such that the second side of the touch-sensitive surface of the first ear cup is oriented toward the bottom of the user's head, and the fourth side of the touch-sensitive surface of the first ear cup is oriented toward the top of the user's head, a swipe detected from the fourth side of the touch-sensitive surface to the second side of the touch-sensitive surface on the first ear cup will be determined, by the headphones or the electronic device, to be a downward swipe on the user's left side. In some such embodiments, a downward swipe on the user's left side causes the electronic device to decrease the volume.

[0250] In some embodiments, the electronic device performs an eighth action (e.g., a media-related action such as decreasing the playback volume), in response to detecting the first gesture and in accordance with a determination that the electronic device is in the fourth device orientation and that the first gesture corresponds to the second predetermined orientation (e.g., headphones **600** perform the eighth action in response to the configuration of input **654** and device orientation shown in FIG. **6**L). For example, if the first ear cup of the headphones is on the user's left ear and the second ear cup of the headphones is on the user's right ear such that the second side of the touch-sensitive surface of the first ear cup is oriented toward the bottom of the user's head, and the fourth side of the touch-sensitive surface of the first ear cup is oriented toward the top of the user's head, a swipe detected from the fourth side of the touch-sensitive surface to the second side of the touch-sensitive surface on the first ear cup will be determined, by the headphones or the electronic device, to be a downward swipe on the user's left

side. In some such embodiments, a downward swipe on the user's left side causes the electronic device to decrease the volume. In some embodiments, the eight action is the same as the seventh action.

[0251] In some embodiments, the seventh action is performed further in accordance with a determination that the first gesture is detected at the first touch-sensitive surface. In some such embodiments, further in response to detecting the first gesture and in accordance with a determination that the electronic device is in the third device orientation, that the first gesture corresponds to the second predetermined orientation, and that the first gesture is detected at the second touch-sensitive surface (e.g., a determination that the first ear cup of the headphones is on the user's right ear and the second ear cup of the headphones is on the user's left ear such that the second side of the touch-sensitive surface of the second ear cup is oriented toward the bottom of the user's head, and the fourth side of the touch-sensitive surface of the second ear cup is oriented toward the top of the user's head, a swipe detected from the fourth side of the touch-sensitive surface to the second side of the touch-sensitive surface on the second ear cup will be determined, by the headphones or the electronic device, to be a downward swipe on the user's left side), the electronic device performs the eighth action (e.g., headphones **600** perform the eighth action in response to the configuration of input **656** and device orientation shown in FIG. **6**O). In some embodiments, the eighth action is the same as the seventh action (e.g., same response to downward swipe, regardless of side).

[0252] In some embodiments, the eighth action is performed further in accordance with a determination that the first gesture is detected at the first touch-sensitive surface. In some such embodiments, further in response to detecting the first gesture and in accordance with a determination that the electronic device is in the fourth device orientation, that the first gesture corresponds to the second predetermined orientation, and that the first gesture is detected at the second touch-sensitive surface (e.g., a determination that the first ear cup of the headphones is on the user's left ear and the second ear cup of the headphones is on the user's right ear such that the second side of the touch-sensitive surface of the second ear cup is oriented toward the bottom of the user's head, and the fourth side of the touch-sensitive surface of the second ear cup is oriented toward the top of the user's head, a swipe detected from the fourth side of the touch-sensitive surface to the second side of the touch-sensitive surface on the second ear cup will be determined, by the headphones or the electronic device, to be a downward swipe on the user's right side), the electronic device performs the seventh action (e.g., headphones **600** perform the seventh action in response to the configuration of input **656** and device orientation shown in FIG. **6**P).

[0253] In some embodiments in which the electronic device is a pair of headphones having a first ear cup and a second ear cup, and wherein the first touch sensitive surface is on the first ear cup and the second touch sensitive surface is on the second ear cup, the first ear cup has a first top side and a first bottom side, opposite the first top side, and the second ear cup has a second top side and a second bottom side, opposite the second top side. In some such embodiments, the electronic device is in the first device orientation when the first ear cup is on a user's right ear, the second ear cup is on the user's left ear, the first top side is above the first bottom side, and the second top side is above the second bottom side. In some embodiments, the electronic device is in the second device orientation when the first ear cup is on a user's left ear, the second ear cup is on the user's right ear, the first top side is above the first bottom side, and the second top side is above the second bottom side. In some embodiments, the electronic device is in the third device orientation when the first ear cup is on a user's right ear, the second ear cup is on the user's left ear, the first top side is below the first bottom side, and the second top side is below the second bottom side. In some embodiments, the electronic device is in the fourth device orientation when the first ear cup is on a user's left ear, the second ear cup is on the user's right ear, the first top side is below the first bottom side, and the second top side is below the second bottom side.

[0254] In some embodiments, the electronic device detects, at the at least a first touch sensitive surface, a second gesture (e.g., **658**). In some such embodiments, in response to receiving an indication of the second gesture and in accordance with a determination that that the second gesture matches a predefined gesture pattern, the electronic device performs one or more of the following processes: in accordance with the electronic device being in the first device orientation, the electronic device performs a ninth action, and in accordance with the electronic device being in the second device orientation, the electronic device performs the ninth action (e.g., the same action is performed regardless of device orientation).

[0255] Note that details of the processes described above with respect to method **700** (e.g., FIG. **7**) are also applicable in an analogous manner to the methods described below. For example, method **900** optionally includes one or more of the characteristics of the various methods described above with reference to method **700**. For example, method **700** can be performed on an electronic device that determines the current context of the device and operates in different states of ambient sound transparency, in accordance with the determined context. For another example, method **700** can be performed on a device that detects motion of the device and operates in different audio output states, based on the detected motion. For brevity, these details are not repeated below.

[0256] FIGS. **8**A-**8**E illustrate exemplary methods for operation of ambient sound transparency and noise cancellation modes of an electronic device, in accordance with some embodiments. The user interfaces in these figures are used to illustrate the processes described below, including the processes in FIG. **9**.

[0257] FIG. **8**A depicts an exemplary embodiment of headphones **800** and electronic device **810** in communication with the headphones **800**. Headphones **800** and electronic device **810** include one or more sensors—for example, microphones, location sensors such as GPS sensors—that are used to determine a current context of headphones **800** or electronic device **810**. Optionally, headphones **800** include one or more features of headphones **600** described above (e.g., image sensors to determine on which of the user's ears each ear cup is placed).

[0258] In some embodiments, the context is an audio context, a device usage context, or a location/movement context. Some examples of the context of headphones **800** include that the electronic device with which the headphones are in communication is receiving a phone call and the headphones are playing the ringtone for that phone call (e.g.,

a device usage context), the headphones/user are traveling at a high rate of speed (a location/movement context), or another person is talking to the user of the headphones (e.g., an audio context). In some embodiments, determining the context occurs in response to a context-changing (or potentially context-changing) event such as receipt of an incoming call. In some embodiments, determining the context occurs automatically (e.g., without user input) at the time the headphones **800** and/or device **810** is powered on.

[0259] Furthermore, headphones **800** have the ability to operate at multiple states of ambient sound transparency, corresponding to different levels of noise cancellation and sound transparency. For example, headphones **800** are optionally able to operate at a minimum ambient sound transparency level (e.g., full noise cancellation), a maximum ambient sound transparency level (e.g., a full sound transparency), and an intermediate ambient sound transparency level (e.g., no active noise cancellation nor active pass-through of ambient sounds). In some embodiments of a low state of ambient sound transparency (e.g., full noise cancellation), noises from outside of the headphones are fully (e.g., actively) suppressed, or suppressed as much as the headphones are able, so a user wearing headphones **800** cannot hear those noises. In some embodiments of a high state of ambient sound transparency (e.g., full ambient sound transparency), noises from outside of the headphones are fully (e.g., actively) passed through to the user or amplified (or passed through as much as the headphones are able) so the user can hear those noises. In some embodiments of an intermediate state of ambient sound transparency, there is no active noise cancellation and no active pass-through of ambient sounds (e.g., ambient sounds are allowed to passively (e.g., naturally) pass through the structure of headphones **800** to the user's ear). The full transparency level, full noise cancellation level, and intermediate level are illustrated in FIGS. **8**A-**8**C, respectively, which depict various levels of ambient sound reaching the user's ear. In some embodiments, headphones **800** are able to operate in any subset of the above levels and/or are able to operate in additional or alternative ambient sound transparency levels to those provided above.

[0260] As mentioned above, headphones **800** (which can include one or more features of devices **100**, **300**, or **500**) and electronic device **810** determine a current context. In accordance with a determination that the context is a first context, headphones **800** operate in a first state of ambient sound transparency, and in accordance with a determination that the context is a second context, headphones **800** operate in a second state of ambient sound transparency. For example, headphones **800** automatically, and without user input, operate in different levels of ambient sound transparency depending on the current context of headphones **800**. In some embodiments, the context is determined based on content playing on headphones **800**. If, for example, electronic device **810** is receiving a phone call and headphones **800** are playing the ringtone for that phone call, or headphones **800** are playing music, headphones **800** optionally operate in a low state of ambient sound transparency (e.g., high noise cancellation and/or low amount of ambient sound pass-through) to increase the ability of the user to hear the ringtone or music. Headphones **800** also optionally operate in a low state of ambient sound transparency if a notification (e.g., ringtone, beep, alarm, or the like) is being played through headphones **800**. Optionally, if no content is playing on headphones **800**, headphones **800** operate in a state of high ambient sound transparency (e.g., low noise cancellation and high pass-through).

[0261] The state of ambient sound transparency of the headphones optionally automatically changes over time based on the current context of the headphones. In some embodiments, the context is determined based on ambient sound. As an example, if another person is talking to the user of headphones **800** (e.g., the other person is calling the user's name, the person says "hey" to the user, etc.), headphones **800** optionally operate in a high state of ambient sound transparency to increase the ability of the user to hear the other person. Optionally, headphones **800** optionally operate in a high state of ambient sound transparency if headphones **800** and/or electronic device **810** detect ambient sounds indicating a dangerous situation (e.g., sirens, car horns, screaming, etc.).

[0262] In some embodiments, the context is based on the locational characteristics of headphones **800** and/or electronic device **810**. For example, if the user of headphones **800** is determined to be moving at a speed that exceeds a threshold speed, headphones **800** optionally operate in a state of high ambient sound transparency so that the user can be more aware of the surroundings.

[0263] FIG. **8**D illustrates an embodiment of user interface **820** for selecting operational settings of headphones **800**, displayed on electronic device **810**. User interface **820** includes affordances **820-1**, **820-2**, and **820-3** that can be selected to operate headphones **800** in states of high ambient sound transparency, intermediate ambient sound transparency, and low ambient sound transparency, respectively. In some embodiments, headphones **800** include an interface (e.g., buttons) that can be selected to operate headphones **800** in states of high ambient sound transparency, intermediate ambient sound transparency, and low ambient sound transparency. In some embodiments, headphones **800** and/or electronic device **810** includes an interface for selecting levels of ambient sound transparency between the states of high ambient sound transparency and intermediate ambient sound transparency, and between the states of intermediate sound transparency and low ambient sound transparency. In FIG. **8**D, user interface **820** is displayed on a home screen of electronic device **810**. FIG. **8**E illustrates an embodiment of a user interface **830** in a settings menu for selecting a larger set of operational settings of headphones **800**.

[0264] FIG. **9** is a flow diagram illustrating a method for methods for operation of ambient sound transparency using an electronic device in accordance with some embodiments. Method **900** is performed at a device (e.g., **100**, **300**, **500**, **600**, **800**, **1000**, **1200**, or **1410**) with an audio output mechanism (e.g., **111**).

[0265] As described below, method **900** provides an intuitive way for transitioning the electronic device between transparency (e.g., ambient sound transparency) and noise cancellation, based on the electronic device's context. The method reduces the cognitive burden on a user for transitioning the electronic device between transparency and noise cancellation, thereby creating a more efficient human-machine interface. For battery-operated computing devices, enabling a user to transition the electronic device between and noise cancellation faster and more efficiently conserves power and increases the time between battery charges. Some operations in method **900** are, optionally, combined, the

orders of some operations are, optionally, changed, and some operations are, optionally, omitted.

[0266] In method **900**, the electronic device determines (**902**) a context of the electronic device (e.g., determining, by the headphones or by an electronic device (e.g., **810**) in communication with the headphones, a current context of the headphones). In some embodiments, the headphones and/or the electronic device include one or more sensors—for example, microphones (e.g., **113**), location sensors such as GPS sensors (e.g., **135**), etc.—that are used in making this determination. In some embodiments, the context is an audio context, a device usage context, or a location/movement context. Some examples of the context of the headphones include that the electronic device (e.g., **810**) with which the headphones are in communication is receiving a phone call and the headphones are playing the ringtone for that phone call (e.g., a device usage context), the headphones/user are traveling at a high rate of speed (a location/movement context), another person is talking to the user of the headphones (e.g., an audio context), etc. In some embodiments, determining the context occurs in response to a context-changing (or potentially context-changing) event such as receipt of an incoming call. In some embodiments, determining the context occurs automatically at the time the device is powered on.

[0267] In response to determining the context of the electronic device and in accordance with a determination (e.g., an automatic determination, a determination made without user input) that the context of the electronic device is a first context (**904**), the electronic device operates (**906**) in a first state of ambient sound transparency (e.g., the state illustrated in FIG. **8**A). In some embodiments, the headphones optionally have the ability to operate at multiple levels of noise cancellation/transparency. For example, the headphones are optionally able to operate at a full noise cancellation level (e.g., as illustrated in FIG. **8**B, noises from outside of the headphones are fully suppressed, or suppressed as much as the headphones are able, so the user cannot hear those noises—thus, a low state of noise transparency), a full transparency level (e.g., as illustrated in FIG. **8**A, noises from outside of the headphones are fully passed through to the user, or passed through as much as the headphones are able, so the user can hear those noises—thus, a high state of noise transparency), and an intermediate level that includes no noise cancellation and no transparency (e.g., thus, a moderate state of noise transparency, as illustrated in FIG. **8**C). In some embodiments, the headphones are able to operate in any subset of the above levels and/or are able to operate in additional or alternative noise transparency levels to those provided above).

[0268] In response to determining the context of the electronic device and in accordance with a determination that the context of the electronic device is a second context (**904**), different than the first context, the electronic device operates (**908**) in a second state of ambient sound transparency, different than the first state of ambient sound transparency (e.g., the state illustrated in FIG. **8**B or **8**C, as compared to the state illustrated in FIG. **8**A). In some embodiments, the headphones automatically, and without user input, operate in different levels of noise transparency depending on the current context of the headphones. For example, if the electronic device with which the headphones are in communication is receiving a phone call and the headphones are playing the ringtone for that phone call, the headphones optionally operate in a low state of noise transparency to increase the ability of the user to hear the ringtone. As another example, if another person is talking to the user of the headphones, the headphones optionally operate in a high state of noise transparency to increase the ability of the user to hear the other person. As such, the state of noise transparency of the headphones optionally automatically changes over time based on the current context of the headphones). Operating the device in different states of ambient sound transparency based on the context of the device provides the user with a device that adapts ambient sound transparency, without the need for user action. Performing an operation when a set of conditions has been met without requiring further user input enhances the operability of the device and makes the user-device interface more efficient (e.g., by helping the user to provide proper inputs and reducing user mistakes when operating/interacting with the device) which, additionally, reduces power usage and improves battery life of the device by enabling the user to use the device more quickly and efficiently.

[0269] In some embodiments, the electronic device is configured to operate in a plurality of states (e.g., the states illustrated in FIGS. **8**A-**8**C), each state corresponding to an ambient sound transparency level and an ambient sound cancellation level, the plurality of states having a state corresponding to a state of maximum ambient sound cancellation and minimum ambient sound transparency (e.g., FIG. **8**B) and a state corresponding to a state of minimum ambient sound cancellation and maximum ambient sound transparency (e.g., FIG. **8**A). In some such embodiments, the electronic device includes a control (e.g., **820**) for changing the state of the electronic device between the plurality of states. Further in some such embodiments, the plurality of states includes a state corresponding to a state of minimum ambient sound cancellation and minimum ambient sound transparency (e.g., the state illustrated in FIG. **8**C).

[0270] In some embodiments, the context of the electronic device is determined based on at least content (e.g., audio content) playing on the electronic device. In some such embodiments, the first context is a phone call playing on the electronic device, and the first state of ambient sound transparency corresponds to maximum ambient sound cancellation and minimum ambient sound transparency. In some such embodiments, the first context is music playing on the electronic device, and the first state of ambient sound transparency corresponds to maximum ambient sound cancellation and minimum ambient sound transparency. In some such embodiments, the first context is a notification playing on the electronic device, and the first state of ambient sound transparency corresponds to maximum ambient sound cancellation and minimum ambient sound transparency. In some embodiments, the first context is no content playing on the electronic device, and the first state of ambient sound transparency corresponds to minimum ambient sound cancellation and maximum ambient sound transparency.

[0271] In some embodiments, the context of the electronic device is determined based on at least ambient sound of the electronic device (e.g., the ambient sound of the environment of the electronic device). In some such embodiments, first context is ambient sound indicating a dangerous situation, and the first state of ambient sound transparency corresponds to minimum ambient sound cancellation and maximum ambient sound transparency. In some such

embodiments, the first context is ambient sound indicating a person talking to the user, and the first state of ambient sound transparency corresponds to minimum ambient sound cancellation and maximum ambient sound transparency. In some such embodiments, the first context is ambient sound including a user's name, and the first state of ambient sound transparency corresponds to minimum ambient sound cancellation and maximum ambient sound transparency.

[0272] In some embodiments, the context of the electronic device is determined based on at least a location of the electronic device. In some such embodiments, the first context is movement of the electronic device exceeding a threshold speed, and the first state of ambient sound transparency corresponds to minimum ambient sound cancellation and maximum ambient sound transparency.

[0273] In some embodiments, the state of ambient sound transparency in which the electronic device is operated is selected from the group consisting of: a state that passively passes ambient sound through the electronic device, a state that actively cancels ambient sound, and a state that actively amplifies ambient sound.

[0274] Note that details of the processes described above with respect to method **900** (e.g., FIG. **9**) are also applicable in an analogous manner to the methods described below and above. For example, method **900** optionally includes one or more of the characteristics of the various methods described above with reference to method **700**. For example, method **900** can be performed on an electronic device that detects a first gesture, including detecting an orientation of the first gesture with respect to a touch-sensitive surface of the device and performs different actions (e.g., media-related actions) depending on the orientation of the first gesture and the orientation of the device. For another example, method **900** can be performed on a device that detects motion of the device and operates in different audio output states, based on the detected motion (e.g., per method **1100**). For brevity, these details are not repeated below.

[0275] FIGS. **10**A-**10**C illustrate exemplary user interfaces for setting the audio output of an electronic device based on motion of the electronic device, in accordance with some embodiments. The user interfaces in these figures are used to illustrate the processes described below, including the processes in FIG. **11**.

[0276] Turning now to FIGS. **10**A-**10**C, techniques for setting the audio output of an electronic device based on motion of the electronic device are described.

[0277] FIG. **10**A depicts a user interacting with exemplary headphones **1000** (which can include one or more features of devices **100**, **300**, or **500**). Headphones **1000** include one or more sensors (e.g., inertial measurement units including accelerometers, gyroscopes, or magnetometers) for detecting motion of headphones **1000**. Optionally, headphones **1000** include positional sensors (e.g., sensors for determining the position of headphones **1000** relative to a user). Optionally, headphones **1000** include one or more features of headphones **600** or headphones **800** described above (e.g., image sensors to determine on which of the user's ears each ear cup is placed).

[0278] FIG. **10**A indicates that headphones **1000** were previously resting on the table in front of the user and that the user picks up headphones **1000** and places them on his ears. Headphones **1000** (or an electronic device in communication with headphones **1000**) detect the motion. In response to detecting the motion, headphones **1000** are operated in an audio output state that is based on the characteristics of the detected motion. For example, headphones **1000** determine that the user picked up headphones **1000** from the surface of the table, and in accordance with this determination, headphones **100** are powered on (if headphones were in a powered off state prior to being picked up) or transition from a standby operating state to a normal operating state. In some embodiments, the standby operating state includes the sensors for detecting motion of headphones **1000** being powered on (so that headphones **1000** can detect motion) without speaker drivers in headphones **1000** being powered on, while the normal operating state includes the sensors and the speaker drivers being powered on. As such, the operating state of the headphones optionally automatically changes based on the motion of headphones **1000**. In some embodiments, headphones **1000** are determined to be picked up based on headphones **1000** being raised, re-oriented from a horizontal orientation to a vertical orientation, placed on a user's ears (e.g., the device detects the user's ears), or contacted by the user, or some combination thereof.

[0279] FIG. **10**B illustrates the user removing headphones **1000** and placing them down on the surface of the table. In response to detecting the motion and determining that the motion corresponds to headphones **1000** being placed down, headphones **1000** operated according to a different state than the state in which headphones **1000** operated in response to being picked up. For example, when headphones **1000** are removed and/or placed down, headphones **1000** power off or transition from a normal operating state to a standby operating state. In some embodiments, headphones **1000** are determined to have been placed down based on headphones **1000** being lowered, re-oriented from a vertical orientation to a horizontal orientation, removed from a user's ears (e.g., the device no longer detects the user's ears), or no longer in contact with the user, or some combination thereof.

[0280] Turning to FIG. **10**C, the user is depicted as removing headphones **1000** from his ears and placing headphones **1000** around his neck. In some embodiments, in response to determining that headphones **1000** are placed around the user's neck, headphones **1000** play white noise, pause currently-playing content, or are placed in a power standby mode. Optionally, in response to determining that headphones **1000** are placed around the user's neck, headphones **1000** operate in a state in which notification sounds are amplified so that the user can hear the notifications even though the headphones are not on the user's ears. Optionally, headphones **1000** do not amplify sounds other than notification sounds (e.g., only notification sounds are amplified). Optionally, both notification sounds and non-notification sounds are amplified.

[0281] Other responses to various other motions and/or positions are possible. For example, in response to a determination that the orientation of headphones **1000** is changed from a first orientation with a first ear cup on a user's first ear and a second ear cup on the user's second ear (e.g., the final configuration depicted in FIG. **10**A) to a second orientation with the first ear cup on the user's second ear and the second ear cup on the user's first ear, headphones **1000** are operated in a stereo channel configuration corresponding to the second orientation.

[0282] FIG. **11** is a flow diagram illustrating a method for operating an electronic device in different audio states based on motion of the electronic device in accordance with some

embodiments. Method **1100** is performed at an electronic device (e.g., **100**, **300**, **500**, **600**, **800**, **1000**, **1200**, or **1410**) (e.g., headphones) having one or more motion sensors (e.g., **538**) and an audio output mechanism (e.g., **113**). In some embodiments, the electronic device further includes positional sensors (e.g., sensors **164** and **166** for determining the position of the device relative to a user).

[0283] As described below, method **1100** provides an intuitive way for operating an electronic device in different audio states based on motion of the electronic device. The method reduces the cognitive burden on a user for operating an electronic device in different audio states based on motion of the electronic device, thereby creating a more efficient human-machine interface. For battery-operated computing devices, enabling a user to operate an electronic device in different audio states based on motion of the electronic device faster and more efficiently conserves power and increases the time between battery charges. Some operations in method **1100** are, optionally, combined, the orders of some operations are, optionally, changed, and some operations are, optionally, omitted.

[0284] In method **1100**, the electronic device detects (**1102**) first motion (e.g., a change in position of the electronic device, a change in position of the electronic device with reference to a user of the electronic device (e.g., motion or change in position resulting from being around the user's neck to being on the user's head) of the electronic device (e.g., detecting, by the electronic device (e.g., headphones) or by an external electronic device in communication with the headphones, a current motion (e.g., a change in position or orientation) of the headphones). In some embodiments, the headphones and/or the external electronic device include one or more sensors—for example, inertial measurement units including accelerometers, gyroscopes, magnetometers, etc.—that are used in making this detection. Some examples of the motion of the headphones that is detected includes the headphones being picked up from a surface (e.g., as depicted in FIG. **10**A), the headphones being put down on a surface (e.g., as depicted in FIG. **10**B), the headphones being placed around a user's neck (e.g., as depicted in FIG. **10**C), etc.

[0285] In response to detecting the first motion (e.g., motion depicted in FIG. **10**A) of the electronic device and in accordance with a determination (**1104**) that the first motion satisfies first operating state criteria (e.g., one or more criteria that are satisfied when the motion of the headphones indicates that the headphones are being picked up from a surface), the electronic device operates (**1106**) in a first audio output operating state (e.g., powering on the headphones if they were powered off before being picked up, transitioning the headphones from a standby operating state to a normal operating state if the headphones were in the standby operating state before being picked up, etc. In some embodiments, the standby operating state of the headphones includes powering one or more sensors for detecting motion of the headphones without powering one or more speaker drivers in the headphones, while the normal operating state includes powering the one or more sensors and the one or more speaker drivers). Operating the device in different audio output states based on the motion of the device provides the user with a device that adapts audio output, without the need for user action. Performing an operation when a set of conditions has been met without requiring further user input enhances the operability of the device and makes the user-device interface more efficient (e.g., by helping the user to provide proper inputs and reducing user mistakes when operating/interacting with the device) which, additionally, reduces power usage and improves battery life of the device by enabling the user to use the device more quickly and efficiently.

[0286] In some embodiments, the first operating state criteria are met when the electronic device is placed around a user's neck, and wherein operating the electronic device in the first audio output operating state includes playing white noise.

[0287] In some embodiments, the first operating state criteria are met when the orientation of the electronic device is changed from a first orientation with a first ear cup on a user's first ear and a second ear cup on the user's second ear to a second orientation with the first ear cup on the user's second ear and the second ear cup on the user's first ear, and the first audio output operating state includes a stereo channel configuration corresponding to the second orientation.

[0288] In some embodiments, the first operating state criteria are met when the electronic device is placed around a user's neck, and wherein operating the electronic device in the first audio output operating state includes pausing content or placing the electronic device in a power standby mode.

[0289] In some embodiments, the first operating state criteria are met when the electronic device is placed around a user's neck, and wherein operating the electronic device in the first audio output operating state includes amplifying notification sounds. In some such embodiments, operating the electronic device in the first audio output operating state includes not amplifying sounds other than notification sounds. In some such examples, wherein operating the electronic device in the first audio output operating state includes amplifying sounds other than notification sounds.

[0290] In some embodiments, the first operating state criteria are met when the electronic device is put down (e.g., in some embodiments, the device is characterized as being "put down" based on the device being lowered, re-oriented from a vertical orientation to a horizontal orientation, removed from a user's ears (e.g., the device no longer detects the user's ears), or no longer in contact with the user, or some combination thereof), and operating the electronic device in the first audio output operating state includes pausing content or placing the electronic device in a power standby mode.

[0291] In some embodiments, the first operating state criteria are met when the electronic device is picked up (e.g., in some embodiments, the device is characterized as being "picked up" based on the device being raised, re-oriented from a horizontal orientation to a vertical orientation, placed on a user's ears (e.g., the device detects the user's ears), or contacted by the user, or some combination thereof), and operating the electronic device in the first audio output operating state includes placing the electronic device in an on mode.

[0292] In response to detecting the first motion of the electronic device and in accordance with a determination (**1104**) that the first motion satisfies second operating state criteria (e.g., criteria satisfied by the motion depicted in FIG. **10**B), different than the first operating state criteria (e.g., one or more criteria that are satisfied when the motion of the headphones indicates that the headphones are being put down onto a surface), the electronic device operates (**1108**)

in a second audio output operating state, different than the first audio output operating state (e.g., powering off the headphones if they were powered on before being put down, transitioning the headphones from a normal operating state to a standby operating state if the headphones were in the normal operating state before being put down, etc.). In some such embodiments, the operating state of the headphones optionally automatically changes over time based on the current motion of the headphones.

[0293] Note that details of the processes described above with respect to method **1100** (e.g., FIG. **11**) are also applicable in an analogous manner to the methods described below/above. For example, method **1100** optionally includes one or more of the characteristics of the various methods described above with reference to method **700**. For example, method **1100** can be performed on an electronic device that detects a first gesture, including detecting an orientation of the first gesture with respect to a touch-sensitive surface of the device and performs different actions (e.g., media-related actions) depending on the orientation of the first gesture and the orientation of the device. For another example, method **1100** can be performed on an electronic device that determines the current context of the device and operates in different states of ambient sound transparency, in accordance with the determined context (e.g., per method **900**). For brevity, these details are not repeated below.

[0294] FIGS. **12**A-**12**D illustrate exemplary user interfaces for providing battery level information of an electronic device, in accordance with some embodiments. The user interfaces in these figures are used to illustrate the processes described below, including the processes in FIG. **13**.

[0295] FIG. **12**A depicts an exemplary embodiment of headphones **1200** (which can include one or more features of devices **100**, **300**, or **500**). Headphones **1200** include an input device (e.g., button **1201**), a first output device for providing audio output (e.g., speakers **1204** in the ear cups), and a second output device **1206** (e.g., a display, LED array, or other light-emitting device) for providing visible output. Headphones **1200** also include one or more orientation sensors (e.g., orientation context sensors or positional sensors). Optionally, the orientation sensors determine the position of headphones **1200** relative to a user. Optionally, headphones **1200** include one or more features of headphones **600**, **800**, and/or **1000** described above (e.g., image sensors to determine on which of the user's ears each ear cup is placed).

[0296] In FIG. **12**B, headphones **1200** receive an input (e.g., depression of a button on headphones **1200**) requesting information about a state of headphones **1200**. Exemplary states of headphones **1200** for which information is requested include a battery level, a connection status of headphones **1200** with another electronic device, a volume level, and/or an ambient sound transparency state. In some embodiments, the input requesting information about the state of headphones **1200** includes selection of an affordance displayed on a touch screen of an electronic device (e.g., device **810**) in communication with headphones **1200**, or a voice input (e.g., received by headphones **1200** or an electronic device in communication with headphones **1200**) requesting the information about the headphones.

[0297] In response to receiving the input requesting the information about the state of headphones **1200**, headphones **1200** provides the requested information via either the first output device or the second output device based on a current orientation of headphones **1200** when the input is received. The orientation of headphones **120** is optionally based on both the absolute orientation of headphones **1200** and the relative position of headphones **1200** (e.g., relative position with respect to a user). Optionally, the orientation is determined by headphones **1200** or by an electronic device in communication with headphones **1200**. In some embodiments, the headphones and/or the electronic device include one or more sensors—for example, inertial measurement units including accelerometers, gyroscopes, magnetometers; imaging sensors in the ear cups of the headphones that are able to image an ear on which the ear cups are placed for determining which ear the ear cups are on and/or whether the ear cups are on an ear at all; etc.—that are used in making this determination.

[0298] In FIG. **12**B, headphones **1200** determine that headphones **1200** are oriented on the user's head when the input is received (e.g., headphones **1200** determine that the ear cups are on the user's left and/or right ears). Since the user can hear audio from headphones **1200** but cannot view the visible output from the second output device while wearing headphones **1200**, headphones **1200** provide an audio output representing the state information using the first output device. Optionally, headphones **1200** do not provide output via the second output device while wearing headphones **1200** in response to the input.

[0299] In FIG. **12**C, headphones **1200** determine that headphones **1200** are not on the user's head when the input is received (e.g., headphones **1200** determine that neither ear cup of headphones **1200** is on the user's ears). Since the user can view the visible output from the second output device but may not be able to hear audio output while headphones **1200** are not being worn, headphones **1200** provide a visible (e.g., light) output representing the state information using the second output device. Accordingly, headphones **1200** provide output via different output devices for different device orientations. Optionally, headphones **1200** do not provide output via the first output device while not wearing headphones **1200** in response to the input. In some embodiments, the status information is provided by an electronic device in communication with headphones **1200**. FIG. **12**D illustrates an embodiment of a user interface **1210** that provides a visual display of the volume level, connection status, battery level, and ambient sound transparency mode of headphones **1200**.

[0300] FIG. **13** is a flow diagram illustrating a method for contextually outputting battery level of an electronic device in accordance with some embodiments. Method **1300** is performed at an electronic device (e.g., **100**, **300**, **500**, **600**, **800**, **1000**, **1200**, or **1410**) (e.g., headphones) with one or more orientation sensors (e.g., **168**), a first output device (e.g., **1204**), and a second output device (e.g., **1206**) that is different than the first output device. In some embodiments, the first output device outputs audio and the second output device outputs light.

[0301] As described below, method **1300** provides an intuitive way for contextually outputting battery level of an electronic device. The method reduces the cognitive burden on a user for contextually outputting battery level of an electronic device, thereby creating a more efficient human-machine interface. For battery-operated computing devices, enabling a user to receive the battery level of an electronic device, based on device context, faster and more efficiently conserves power and increases the time between battery

charges. Some operations in method **1300** are, optionally, combined, the orders of some operations are, optionally, changed, and some operations are, optionally, omitted.

[0302] In method **1300**, the electronic device receives (**1302**) an input (e.g., as depicted in FIG. **12**B) corresponding to a requests for information about a state of the electronic device (e.g., detecting, by the headphones, depression of a button on the headphones for requesting the information about the headphones; detecting, by an electronic device in communication with the headphones, selection of an affordance displayed on a touch screen of the electronic device for requesting the information about the headphones; receiving, at the headphones or at the electronic device, a voice input requesting the information about the headphones, etc.).

[0303] In some embodiments, the input corresponding to the request for information about the state of the electronic device includes a depression of a button (e.g., **1202**) on the electronic device.

[0304] In some embodiments, the input corresponding to the request for information about the state of the electronic device is detected at an external device (e.g., **810**) in communication with the electronic device.

[0305] In some embodiments, the state of the electronic device includes battery status or a connection status (e.g., as depicted on interface **1210**).

[0306] In response to receiving the input corresponding to the request for information about the state of the electronic device and in accordance with a determination (**1304**), based on the one or more orientation sensors, that the electronic device is in a first orientation (e.g., a first orientation context based on both the absolute orientation of the device and the relative position of the device (e.g., relative position with respect to a user)), the electronic device provides (**1306**) the requested information via the first output device (e.g., without providing it via the second output device). In some embodiments, if the headphones are on the user's head (e.g., at least one ear cup of the headphones is on at least one of the user's ears as depicted in FIG. **12**B), the requested information is optionally provided as audio via one or more speaker drivers in the ear cups of the headphones). In some embodiments, the electronic device (e.g., headphones) or an external electronic device in communication with the headphones (e.g., **810**), determines a current orientation of the headphones when the input requesting the information is received. In some embodiments, the headphones and/or the electronic device include one or more sensors—for example, inertial measurement units including accelerometers, gyroscopes, magnetometers; imaging sensors in the ear cups of the headphones that are able to image an ear on which the ear cups are placed for determining which ear the ear cups are on and/or whether the ear cups are on an ear at all; etc.—that are used in making this determination. Some examples of the orientation of the headphones include that the headphones are on a user's head (e.g., the ear cups of the headphones are on the user's left and/or right ears), that the headphones are not on the user's head (e.g., neither ear cup of the headphones is on the user's ears), etc.

[0307] In some embodiments, the first orientation (e.g., the orientation depicted in FIG. **12**B) is on a user's head and the second orientation (e.g., the orientation depicted in FIG. **12**C) is not on the user's head.

[0308] In response to receiving the input corresponding to the request for information about the state of the electronic device and in accordance with a determination, based on the one or more orientation sensors, that the electronic device is in a second orientation (e.g., the orientation depicted in FIG. **12**C), different than the first orientation, providing the requested information about the state of the device via the second output device(e.g., without providing it via the first output device). In some embodiments, if the headphones are not on the user's head, the requested information is optionally provided visually via a display or other light-emitting device on the headphones. For example, if the request for information is a request for the battery level of the headphones, if the headphones are on the user's head, the headphones optionally provide the battery level information audibly via the headphones' speakers, but if the headphones are not on the user's head, the headphones optionally provide the battery level information visually via an LED array built into the headphones. Providing information selectively via different output devices based on the orientation information provides the user with the information using a modality that is appropriate for the user's current relationship to the device. Doing so improves the user's ability to receive the information by using an output type that is more likely to be perceivable by the user. Providing feedback using a more ideal output mechanism enhances the operability of the device and makes the user-device interface more efficient (e.g., by helping the user to provide proper inputs and reducing user mistakes when operating/interacting with the device) which, additionally, reduces power usage and improves battery life of the device by enabling the user to use the device more quickly and efficiently.

[0309] Note that details of the processes described above with respect to method **1300** (e.g., FIG. **13**) are also applicable in an analogous manner to the methods described below/above. For example, method **1300** optionally includes one or more of the characteristics of the various methods described above with reference to method **700**. For example, method **1300** can be performed on an electronic device that detects a first gesture, including detecting an orientation of the first gesture with respect to a touch-sensitive surface of the device and performs different actions (e.g., media-related actions) depending on the orientation of the first gesture and the orientation of the device. For another example, method **1300** can be performed on an electronic device that determines the current context of the device and operates in different states of ambient sound transparency, in accordance with the determined context (e.g., per method **900**). For brevity, these details are not repeated below. For brevity, these details are not repeated below.

[0310] Turning now to FIG. **14**, techniques for operating multiple sets of headphones are described. FIG. **14** depicts electronic device **1400** (e.g., phone), first headphones **1410**, and second headphones **1420**. Electronic device **1400** is connected (e.g., paired via a wireless communication link) with first headphones **1410** and provides content (e.g., music audio) to headphones **1410** via the connection. In FIG. **14**, first headphones **1410** plays the content received from device **1400**. Further, first headphones **1410** is connected (e.g., paired via a wireless communication link) with second headphones **1420**. Optionally, second headphones **1420** are not connection with device **1400**. First headphones **1410** forward the content from device **1400** to second headphones **1420** via the connection between first headphones **1410** and second headphones **1420**. Accordingly, first headphones **1410** act like a repeater. In this way, content provided by a

single source is provided to multiple devices. For example, music originating from device **1400** is sent to first headphones **1410** and then forwarded to second headphones **1420** so that the music is played on first headphones **1410** and second headphones **1420** together.

[0311] The foregoing description, for purpose of explanation, has been described with reference to specific embodiments. However, the illustrative discussions above are not intended to be exhaustive or to limit the invention to the precise forms disclosed. Many modifications and variations are possible in view of the above teachings. The embodiments were chosen and described in order to best explain the principles of the techniques and their practical applications. Others skilled in the art are thereby enabled to best utilize the techniques and various embodiments with various modifications as are suited to the particular use contemplated.

[0312] Although the disclosure and examples have been fully described with reference to the accompanying drawings, it is to be noted that various changes and modifications will become apparent to those skilled in the art. Such changes and modifications are to be understood as being included within the scope of the disclosure and examples as defined by the claims.

What is claimed is:

1. An electronic device, comprising:
one or more motion sensors;
an audio output mechanism;
one or more processors; and
memory storing one or more programs configured to be executed by the one or more processors, the one or more programs including instructions for:
detecting a first motion of the electronic device; and
in response to detecting the first motion of the electronic device:
in accordance with a determination that the first motion satisfies first operating state criteria, operating the electronic device in a first audio output operating state; and
in accordance with a determination that the first motion satisfies second operating state criteria, different than the first operating state criteria, operating the electronic device in a second audio output operating state, different than the first audio output operating state.

2. The electronic device of claim **1**, wherein the first operating state criteria are met when the electronic device is placed around a user's neck, and wherein operating the electronic device in the first audio output operating state includes playing white noise.

3. The electronic device of claim **1**, wherein the first operating state criteria are met when an orientation of the electronic device is changed from a first orientation with a first ear cup on a user's first ear and a second ear cup on the user's second ear to a second orientation with the first ear cup on the user's second ear and the second ear cup on the user's first ear, and wherein the first audio output operating state includes a stereo channel configuration corresponding to the second orientation.

4. The electronic device of claim **1**, wherein the first operating state criteria are met when the electronic device is placed around a user's neck, and wherein operating the electronic device in the first audio output operating state includes pausing content or placing the electronic device in a power standby mode.

5. The electronic device of claim **1**, wherein the first operating state criteria are met when the electronic device is placed around a user's neck, and wherein operating the electronic device in the first audio output operating state includes amplifying notification sounds.

6. The electronic device of claim **5**, wherein operating the electronic device in the first audio output operating state includes not amplifying sounds other than notification sounds.

7. The electronic device of claim **5**, wherein operating the electronic device in the first audio output operating state includes amplifying sounds other than notification sounds.

8. The electronic device of claim **1**, wherein the first operating state criteria are met when the electronic device is put down, and wherein operating the electronic device in the first audio output operating state includes pausing content or placing the electronic device in a power standby mode.

9. The electronic device of claim **1**, wherein the first operating state criteria are met when the electronic device is picked up, and wherein operating the electronic device in the first audio output operating state includes placing the electronic device in an on mode.

10. A non-transitory computer-readable storage medium storing one or more programs configured to be executed by one or more processors of an electronic device with one or more motion sensors and an audio output mechanism, the one or more programs including instructions for:
detecting a first motion of the electronic device; and
in response to detecting the first motion of the electronic device:
in accordance with a determination that the first motion satisfies first operating state criteria, operating the electronic device in a first audio output operating state; and
in accordance with a determination that the first motion satisfies second operating state criteria, different than the first operating state criteria, operating the electronic device in a second audio output operating state, different than the first audio output operating state.

11. A method comprising:
at an electronic device having one or more motion sensors and an audio output mechanism:
detecting a first motion of the electronic device; and
in response to detecting the first motion of the electronic device:
in accordance with a determination that the first motion satisfies first operating state criteria, operating the electronic device in a first audio output operating state; and
in accordance with a determination that the first motion satisfies second operating state criteria, different than the first operating state criteria, operating the electronic device in a second audio output operating state, different than the first audio output operating state.

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