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Missig et al. (43) Pub. Date: Dec. 26, 2019

(54) DEVICE, METHOD, AND GRAPHICAL USER INTERFACE FOR FORGOING GENERATION OF TACTILE OUTPUT FOR A MULTI-CONTACT GESTURE

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(21) Appl. No.: **16/563,505**

(22) Filed: **Sep. 6, 2019**

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(60) Provisional application No. 61/778,239, filed on Mar. 12, 2013, provisional application No. 61/747,278, filed on Dec. 29, 2012.

Publication Classification

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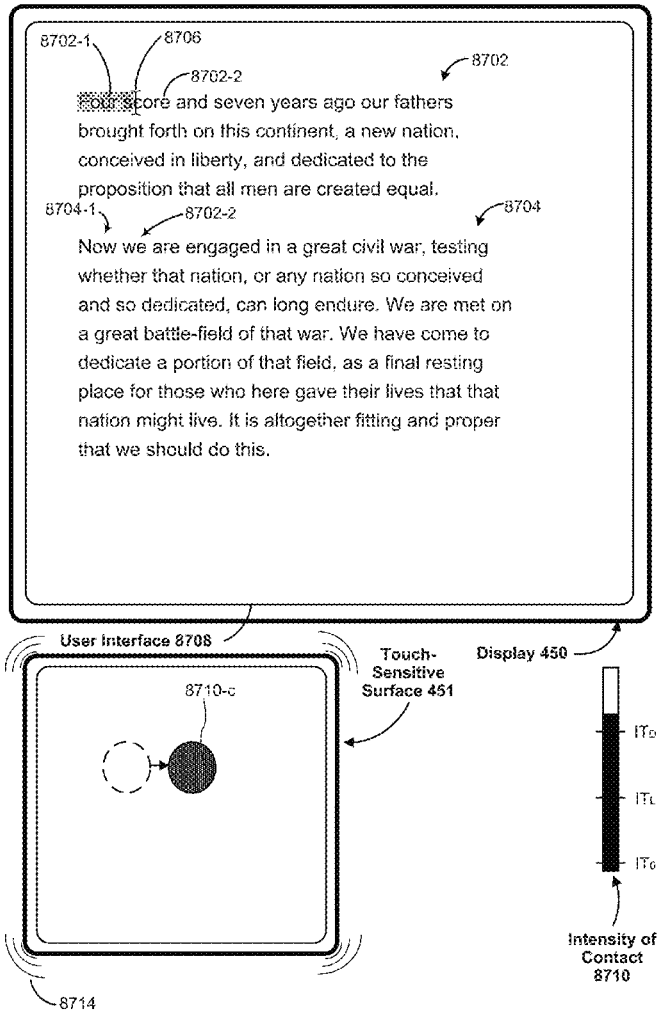
G06F 3/041	(2006.01)
G06F 3/0488	(2006.01)

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

CPC ***G06F 3/016*** (2013.01); *G06F 2203/04105* (2013.01); ***G06F 3/0488*** (2013.01); ***G06F 3/0414*** (2013.01)

(57) **ABSTRACT**

An electronic device with a display, a touch-sensitive surface, and one or more sensors to detect intensity of contacts with the touch-sensitive surface: detects, on the touch-sensitive surface, a gesture that includes an increase of intensity of a contact above a respective intensity threshold. In response to detecting the gesture: in accordance with a determination that the gesture includes a first number of contacts, the device generates a tactile output on the touch-sensitive surface; and in accordance with a determination that the gesture includes a second number of contacts different from the first number, the device forgoes generating the tactile output on the touch-sensitive surface.



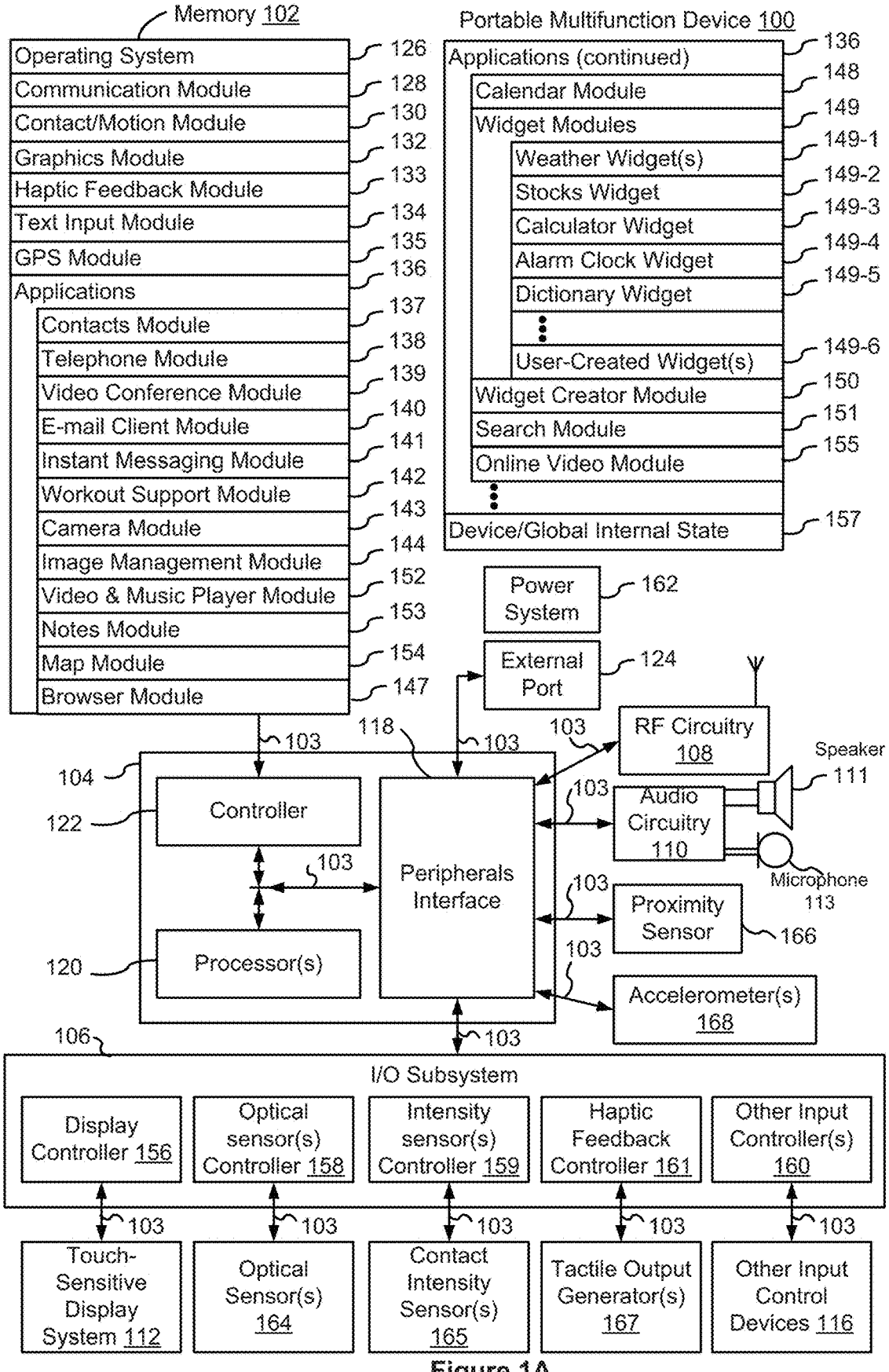

Memory 102
Operating System
126
Communication Module
128
Contact/Motion Module
130
Graphics Module
132
Haptic Feedback Module
133
Text Input Module
134
GPS Module
135
Applications
136
Contacts Module
137
Telephone Module
138
Video Conference Module
139
E-mail Client Module
140
Instant Messaging Module
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
Peripherals Interface
Controller
Processor(s)
104
122
120
118
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

Figure 1A

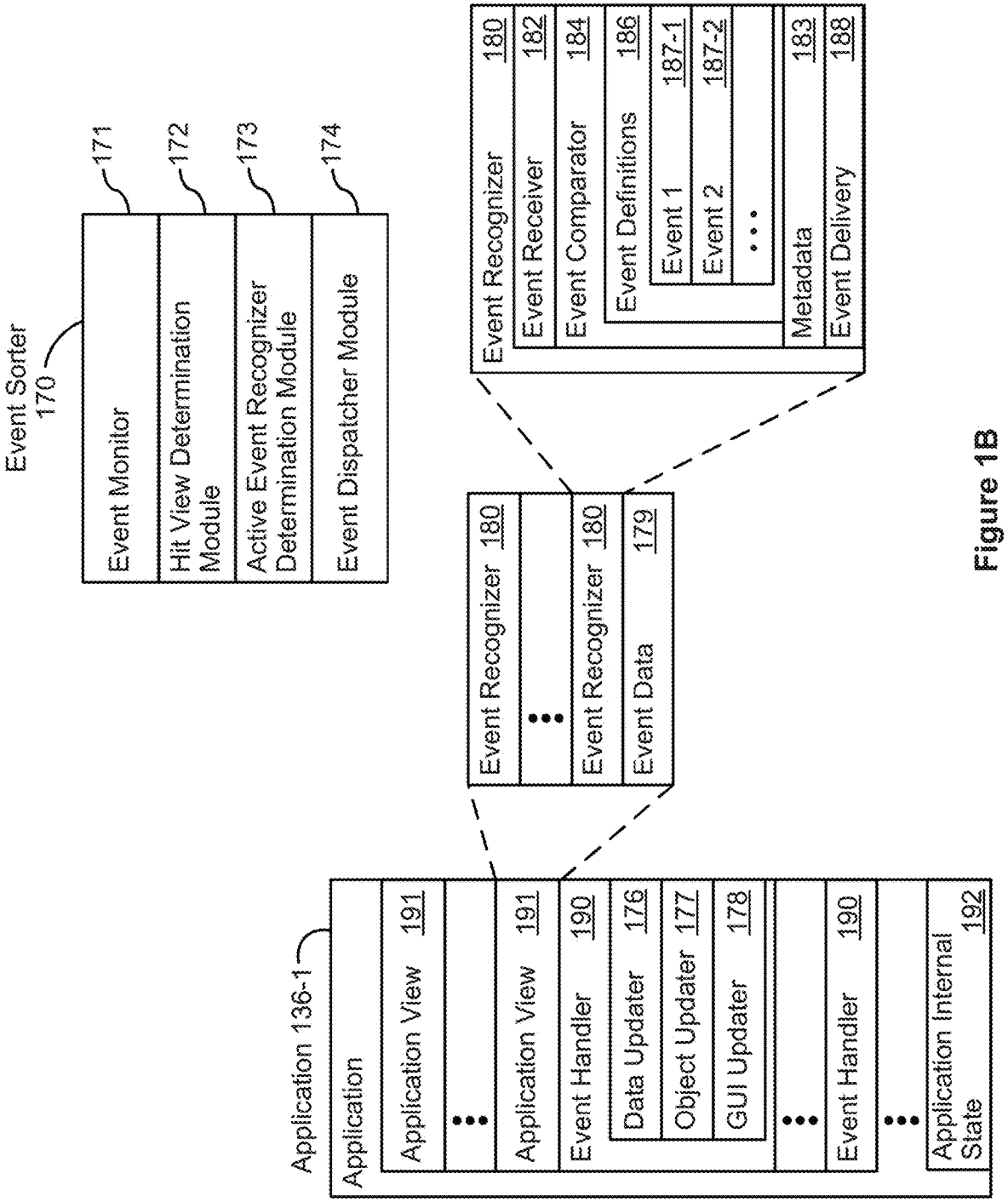

Event Sorter
170
Event Monitor
171
Hit View Determination Module
172
Active Event Recognizer Determination Module
173
Event Dispatcher Module
174
Application 136-1
Application
Application View 191
Application View 191
Event Handler 190
Data Updater 176
Object Updater 177
GUI Updater 178
Event Handler 190
Application Internal State 192
Event Recognizer 180
Event Recognizer 180
Event Data 179
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

Figure 1B

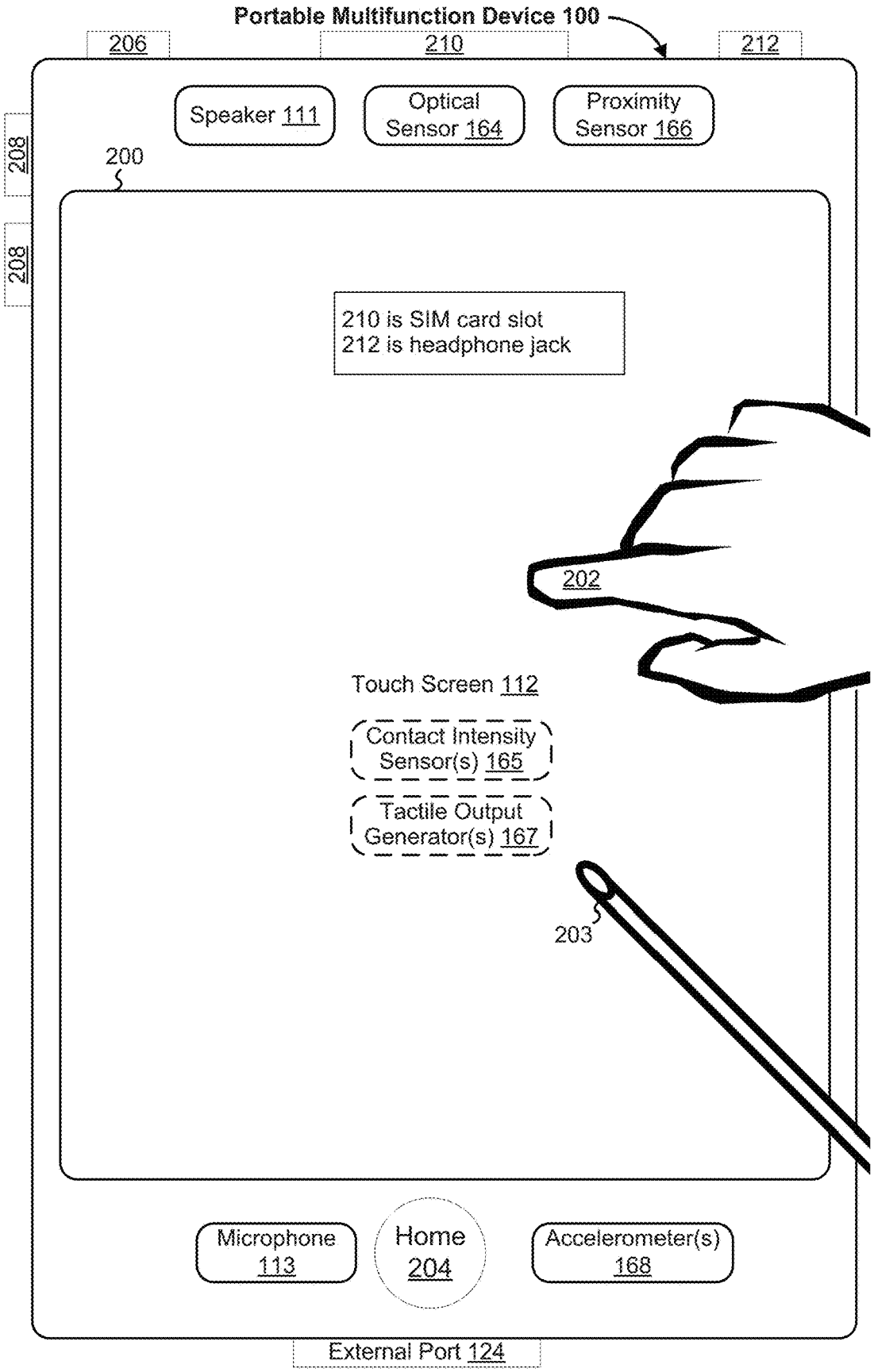
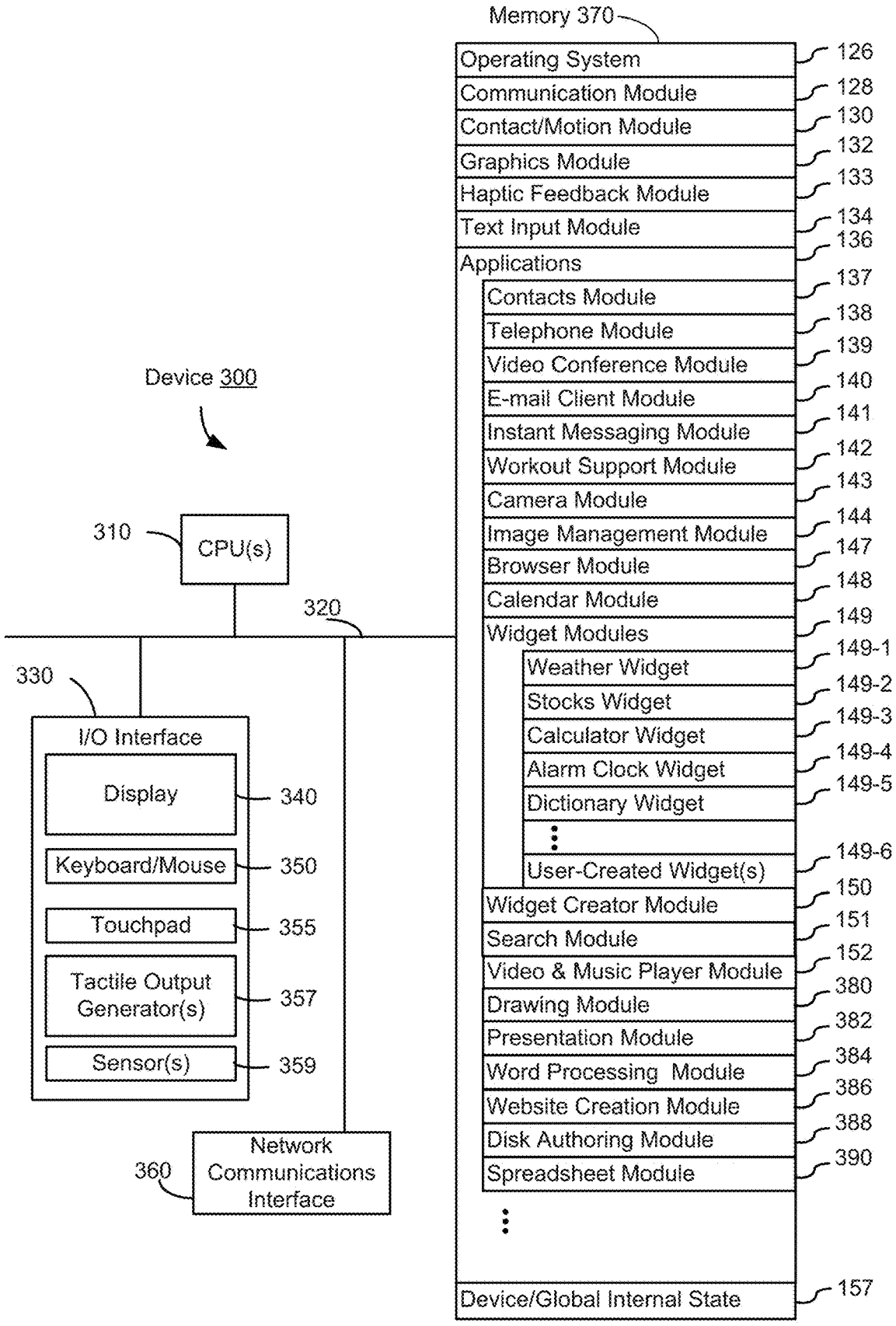

Portable Multifunction Device 100
206
210
212
Speaker 111
Optical Sensor 164
Proximity Sensor 166
208
208
200
210 is SIM card slot
212 is headphone jack
202
Touch Screen 112
Contact Intensity Sensor(s) 165
Tactile Output Generator(s) 167
203
Microphone 113
Home 204
Accelerometer(s) 168
External Port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

Figure 2


Memory 370
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126
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128
Contact/Motion Module
130
Graphics Module
132
Haptic Feedback Module
133
Text Input Module
134
Applications
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Telephone Module
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E-mail Client Module
140
Instant Messaging Module
141
Workout Support Module
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Camera Module
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Image Management Module
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Browser Module
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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

Figure 3

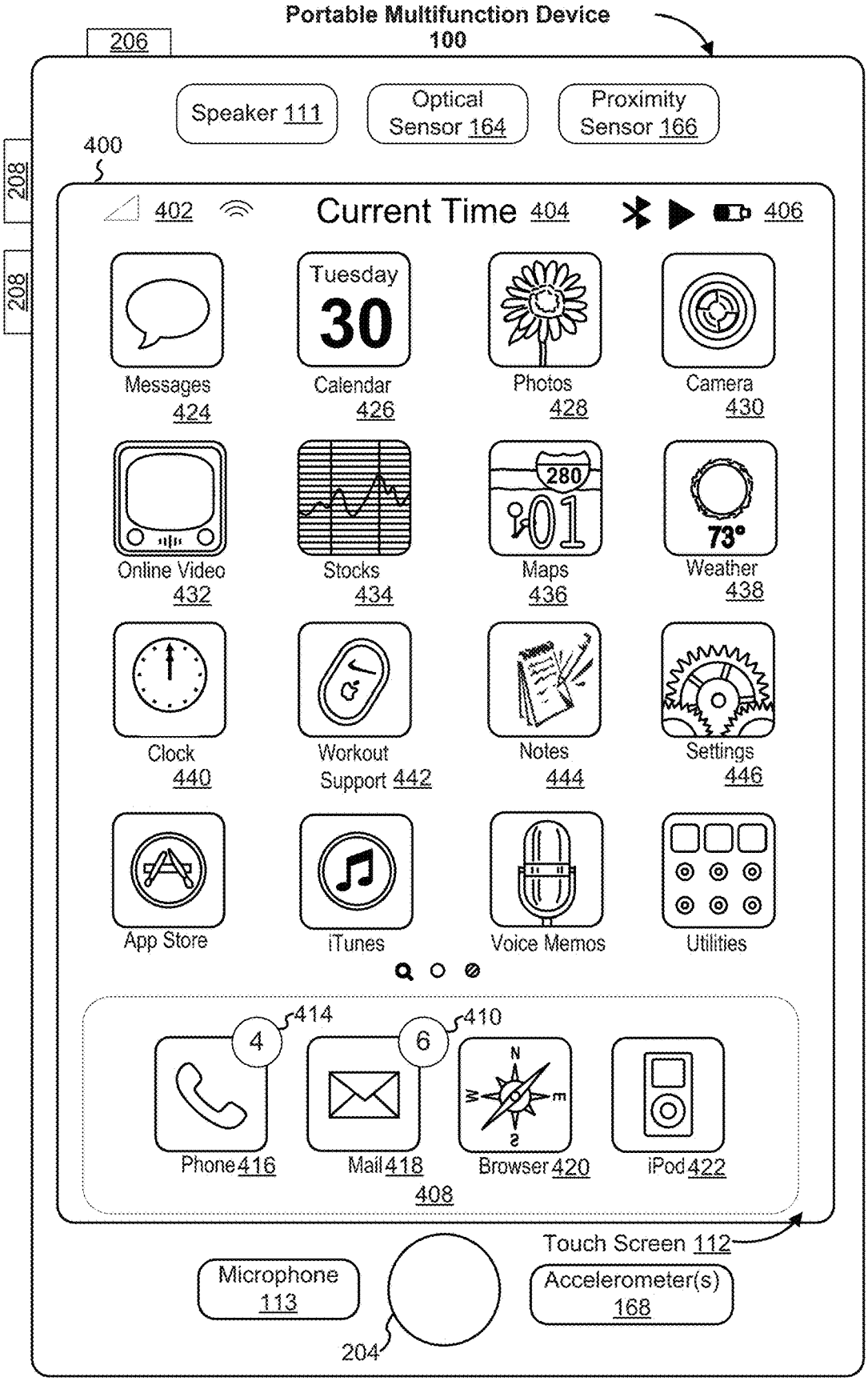
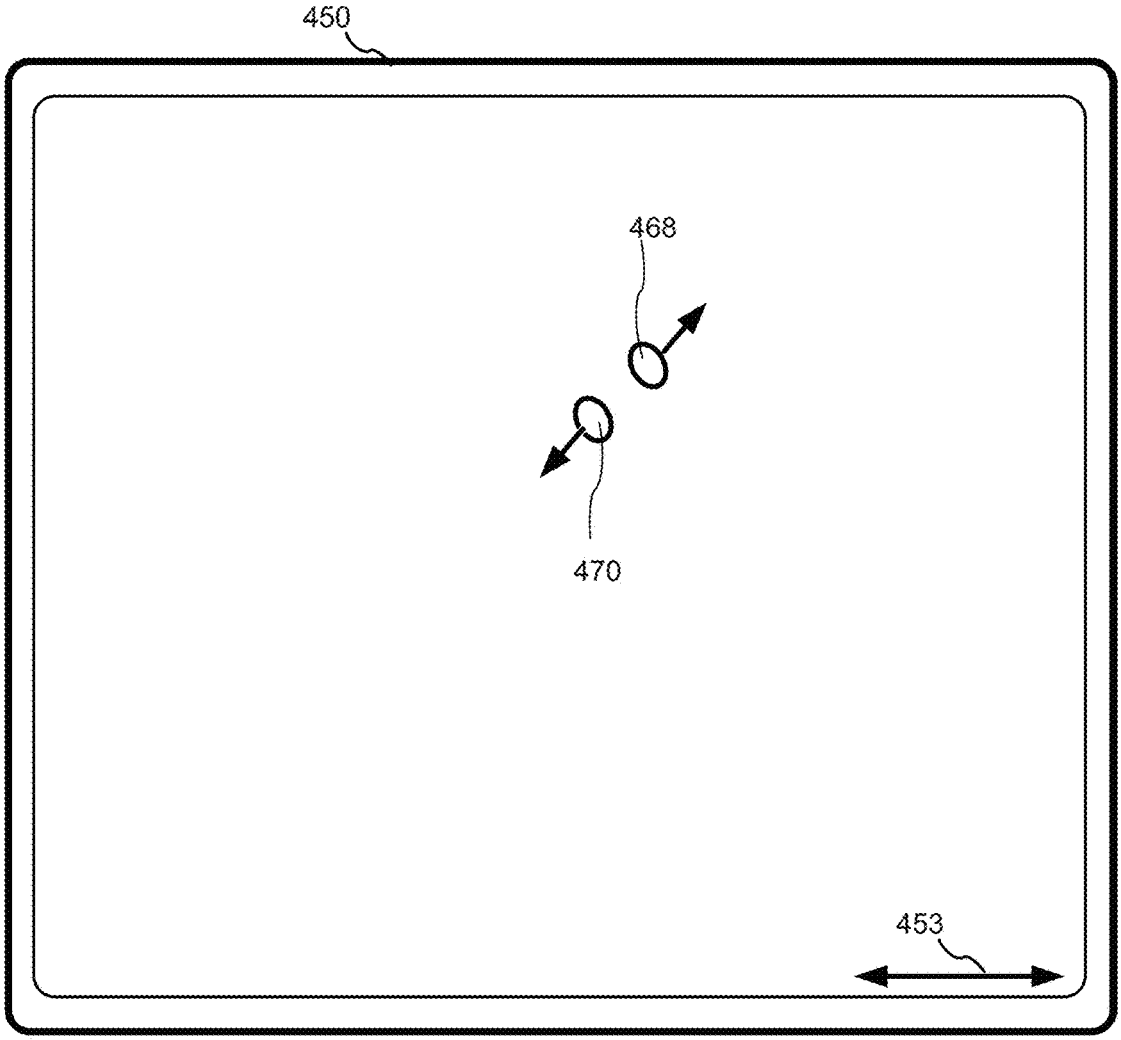

Portable Multifunction Device
100
206
Speaker 111
Optical Sensor 164
Proximity Sensor 166
400
208
208
402
Current Time 404
406
Messages 424
Tuesday
30
Calendar 426
Photos 428
Camera 430
Online Video 432
Stocks 434
280
Maps 436
73°
Weather 438
Clock 440
Workout Support 442
Notes 444
Settings 446
App Store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

Figure 4A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468
470
453

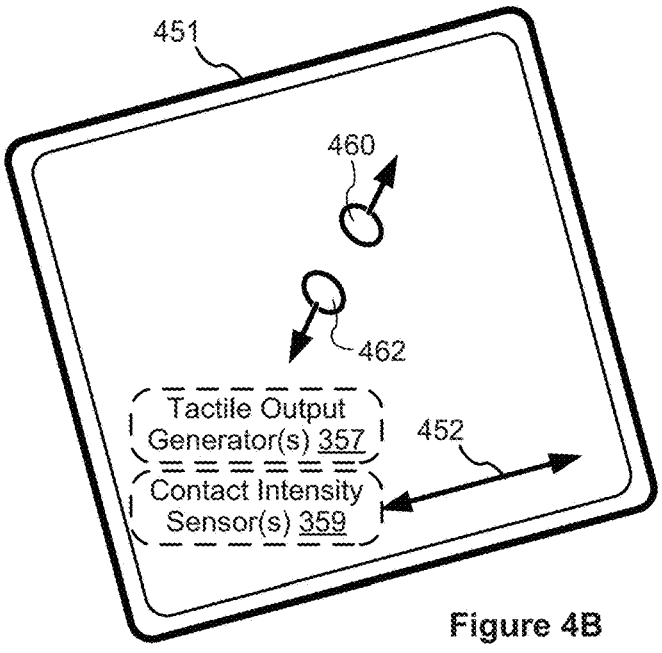

451
460
462
Tactile Output Generator(s) 357
Contact Intensity Sensor(s) 359
452

Figure 4B

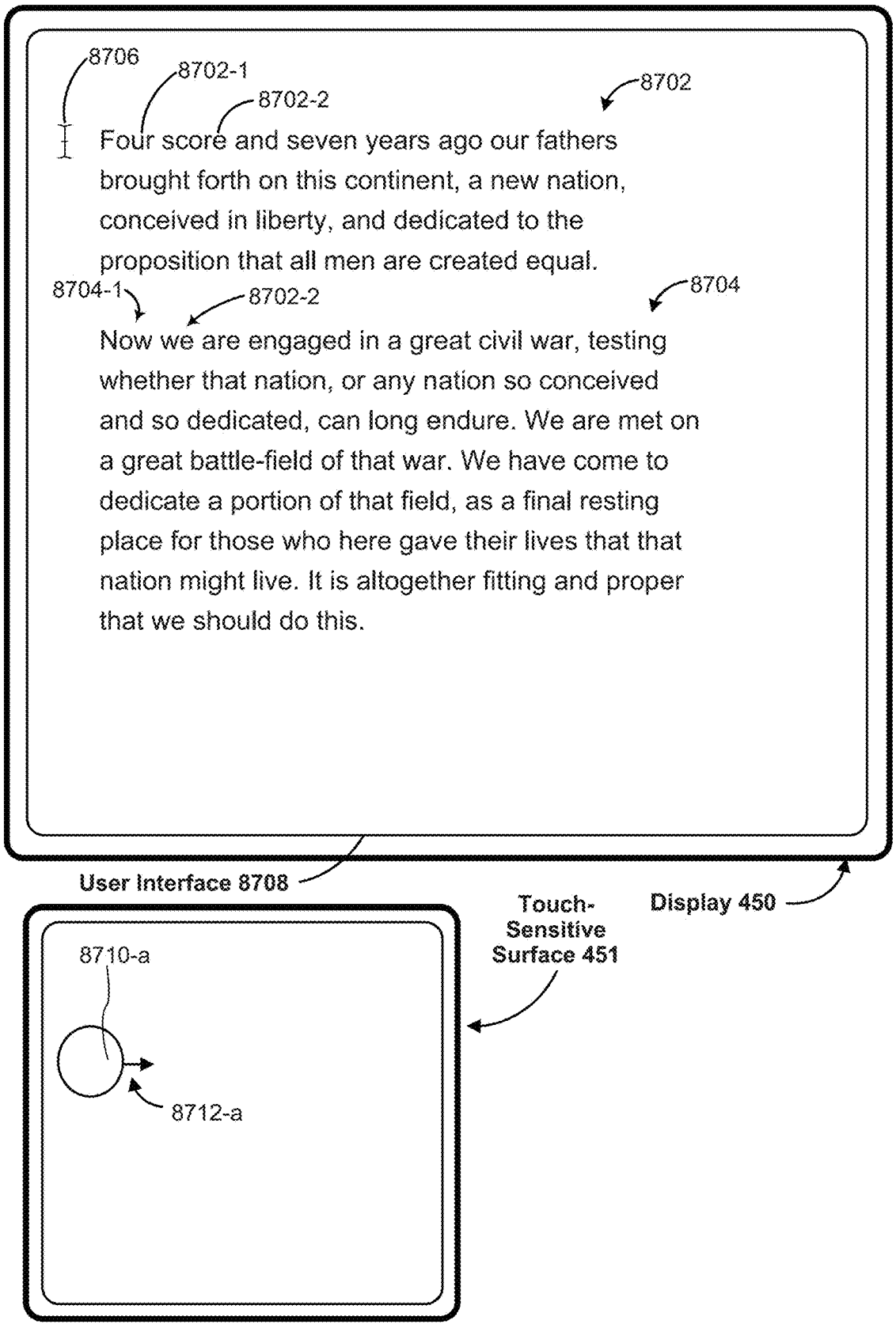
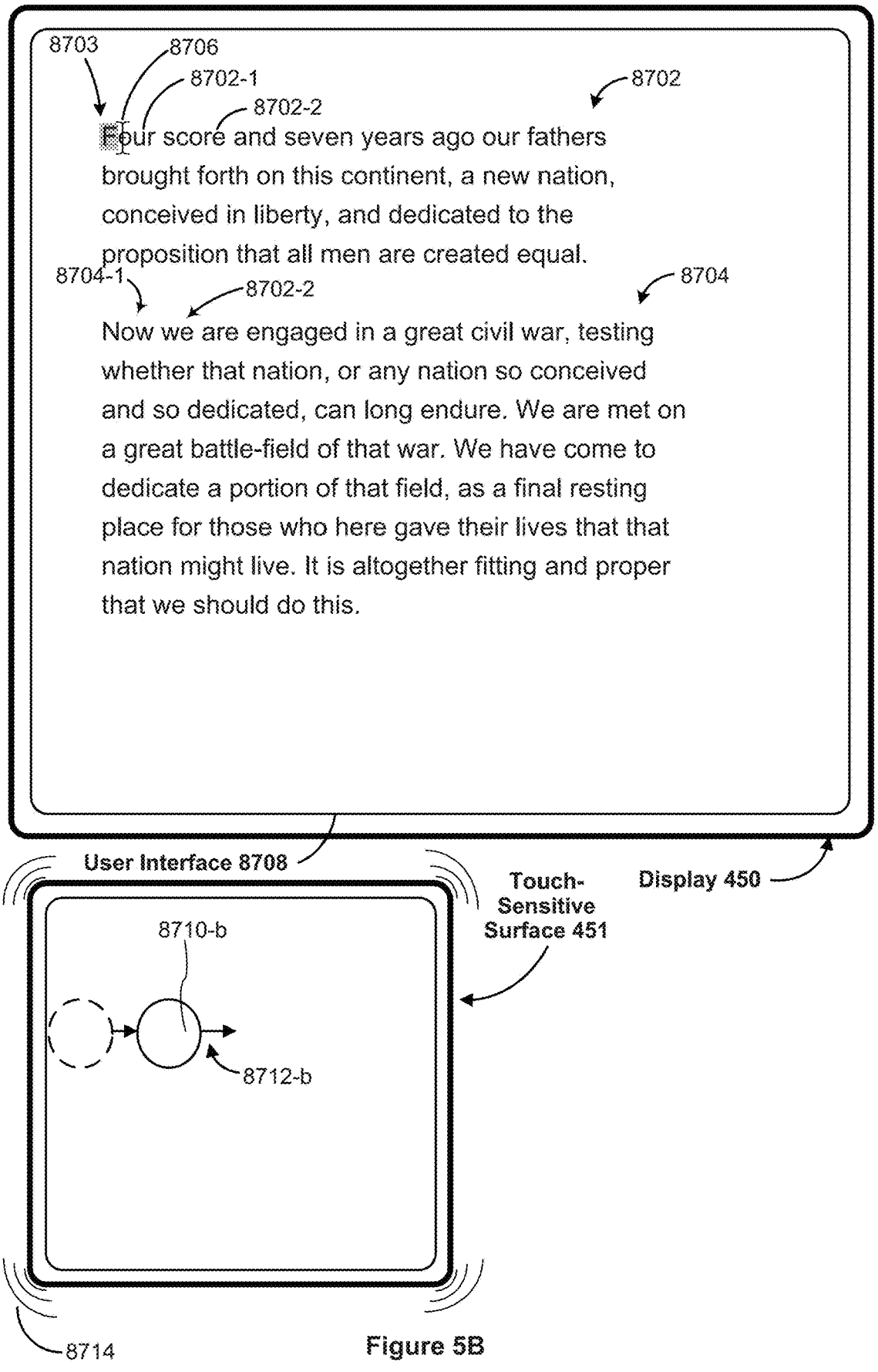

8706
8702-1
8702-2
8702
Four score and seven years ago our fathers brought forth on this continent, a new nation, conceived in liberty, and dedicated to the proposition that all men are created equal.
8704-1
8702-2
8704
Now we are engaged in a great civil war, testing whether that nation, or any nation so conceived and so dedicated, can long endure. We are met on a great battle-field of that war. We have come to dedicate a portion of that field, as a final resting place for those who here gave their lives that that nation might live. It is altogether fitting and proper that we should do this.
User Interface 8708
Touch-Sensitive Surface 451
Display 450
8710-a
8712-a

Figure 5A


8703
8706
8702-1
8702-2
8702
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8704-1
8702-2
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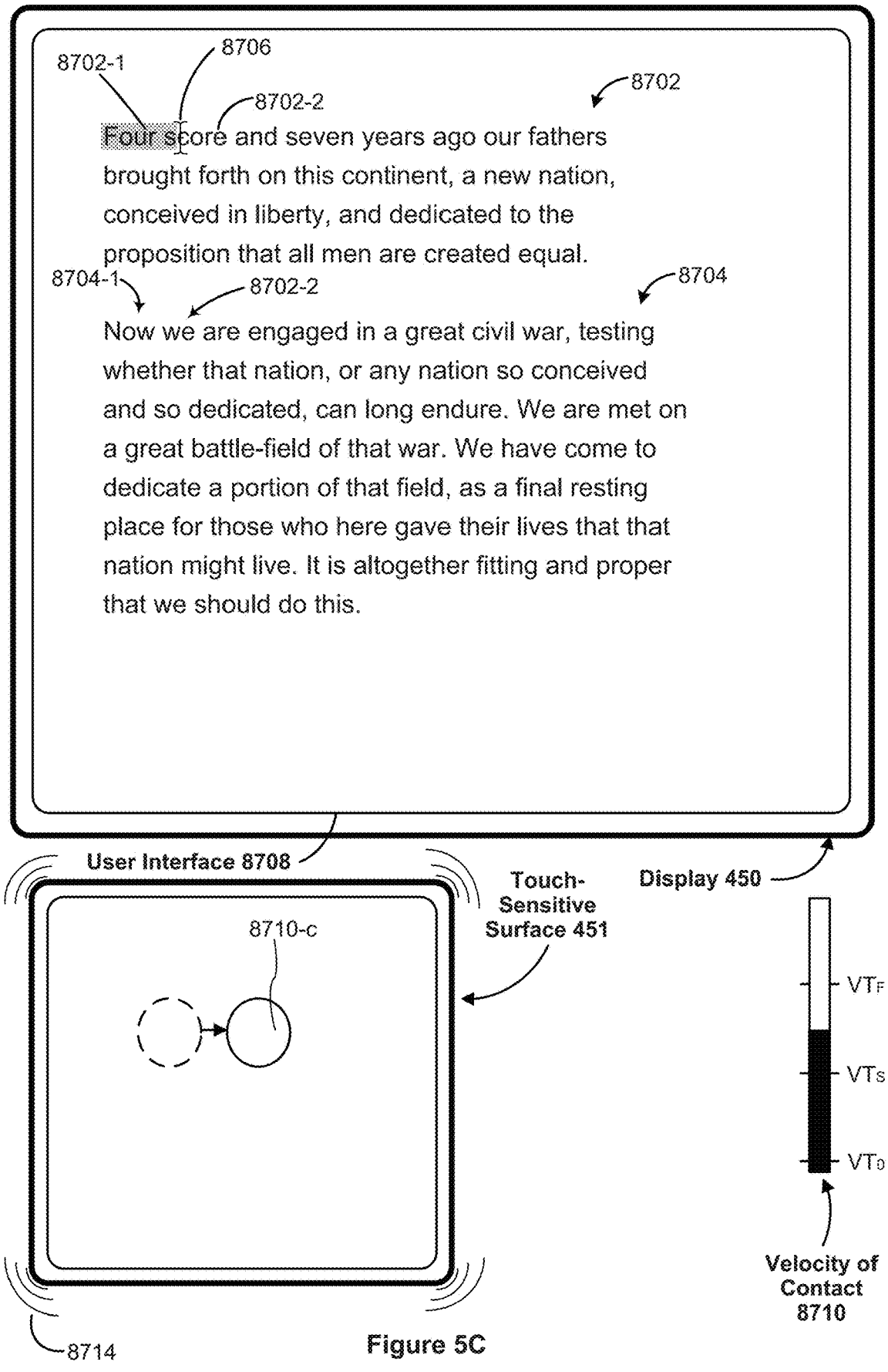
User Interface 8708
Touch-Sensitive Surface 451
Display 450
8710-b
8712-b
8714

Figure 5B


8702-1
8706
8702-2
8702
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8704-1
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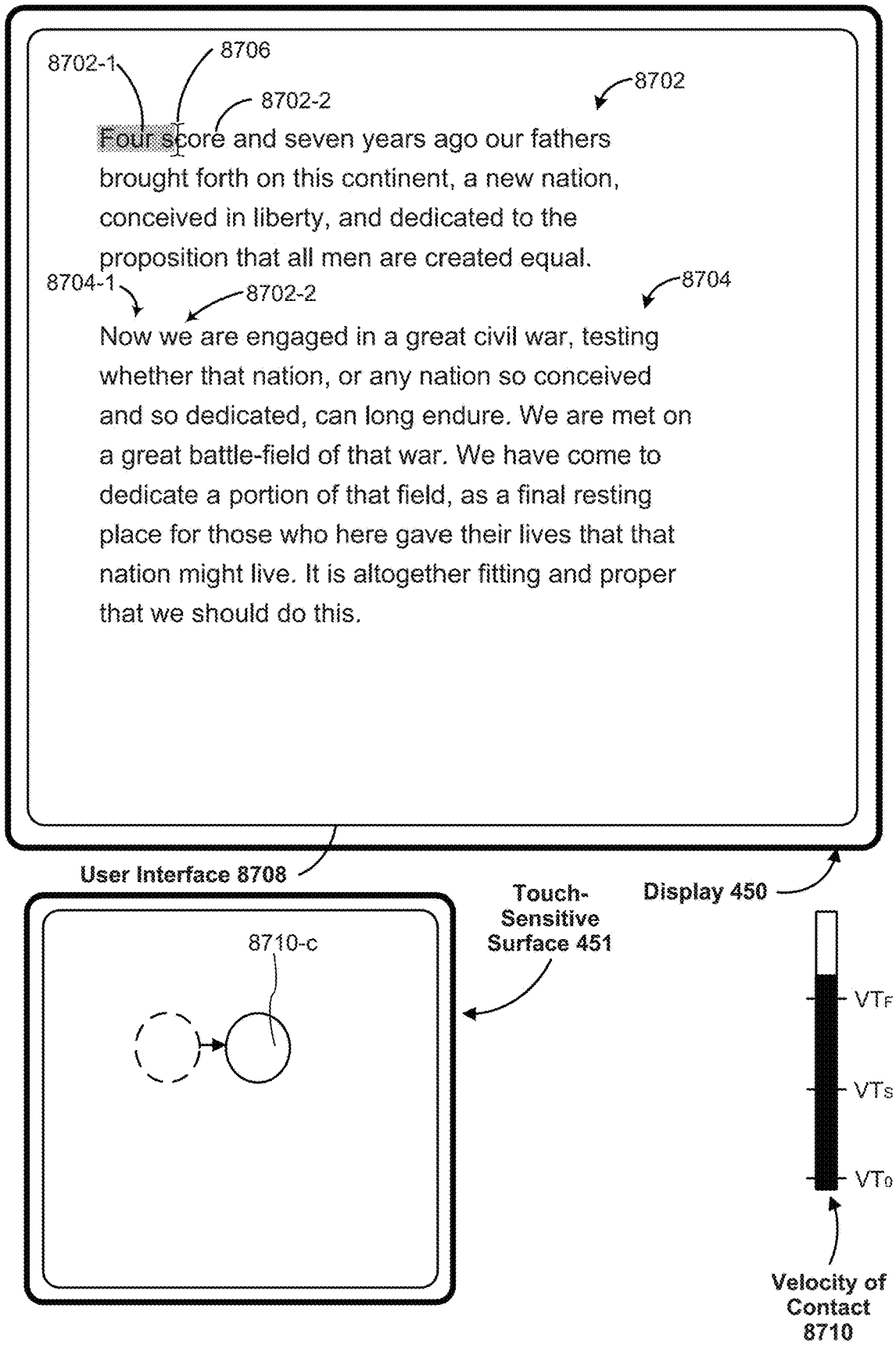
User Interface 8708
Touch-Sensitive Surface 451
Display 450
8710-c
VTF
VTS
VTD
Velocity of Contact 8710
8714

Figure 5C


8702-1
8706
8702-2
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8702-2
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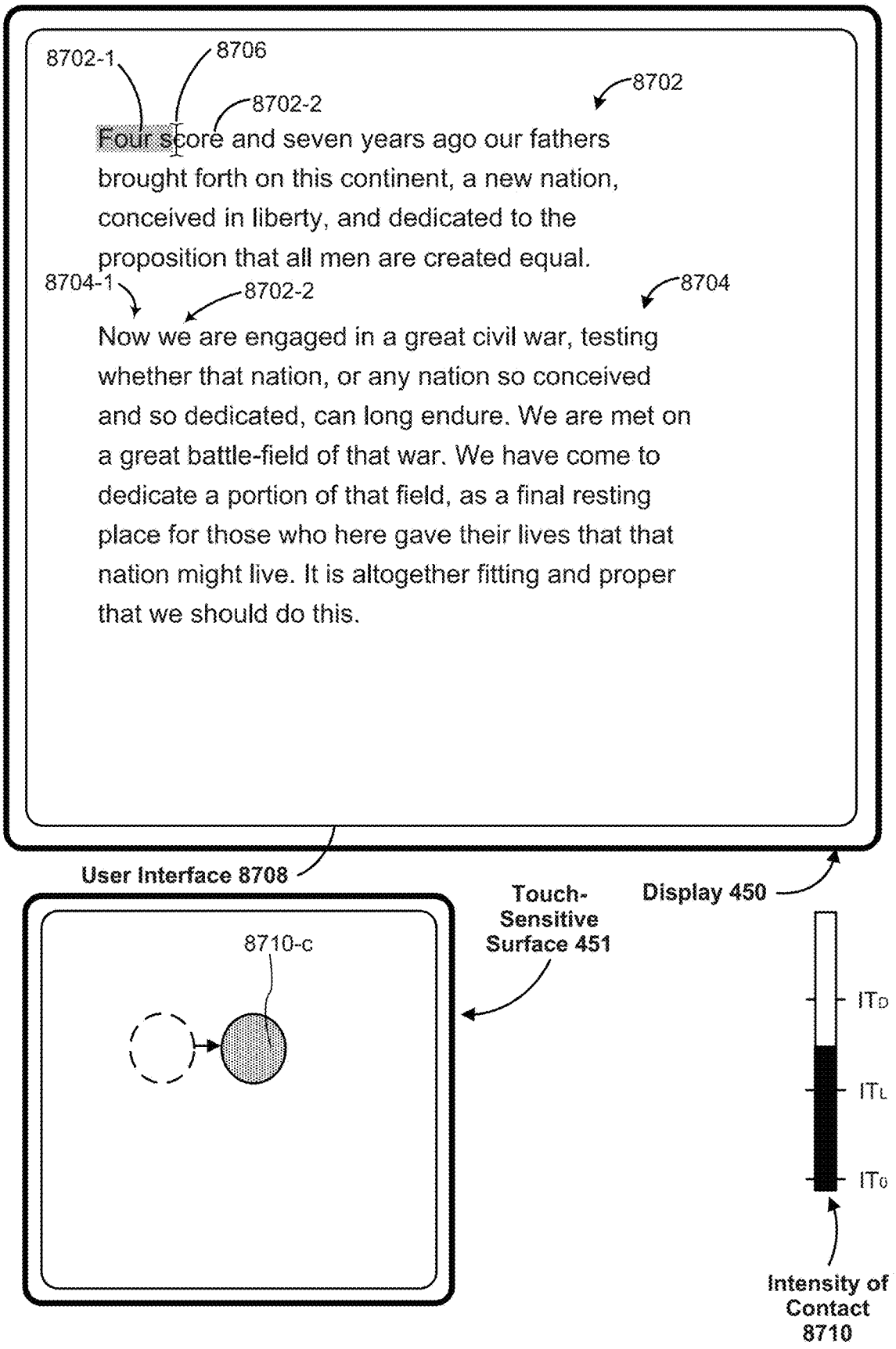
User Interface 8708
Touch-Sensitive Surface 451
Display 450
8710-c
VTF
VTS
VT0
Velocity of Contact 8710

Figure 5D


8702-1
8706
8702-2
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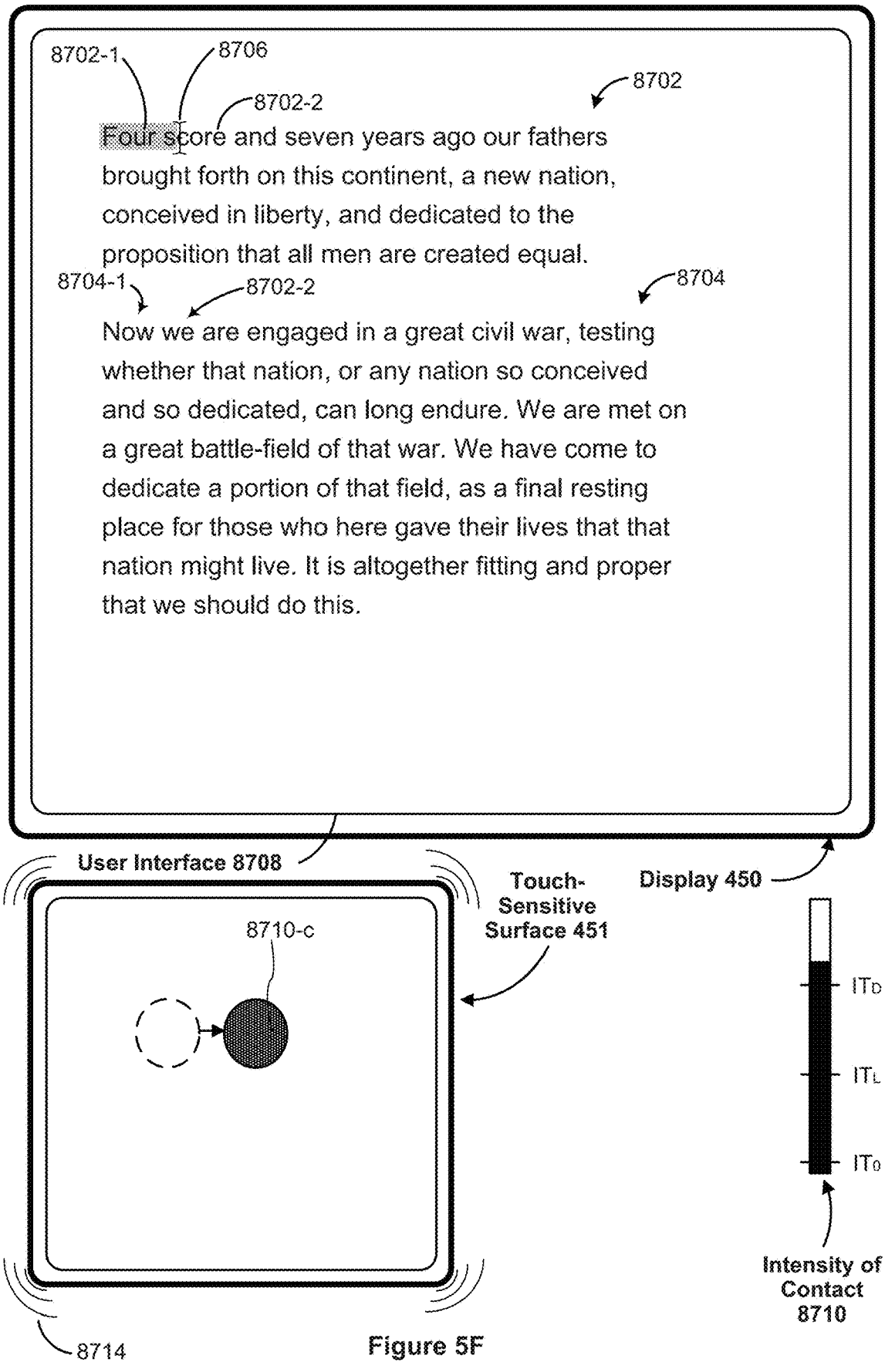
User Interface 8708
Touch-Sensitive Surface 451
Display 450
8710-c
ITD
ITL
IT0
Intensity of Contact 8710

Figure 5E


8702-1
8706
8702-2
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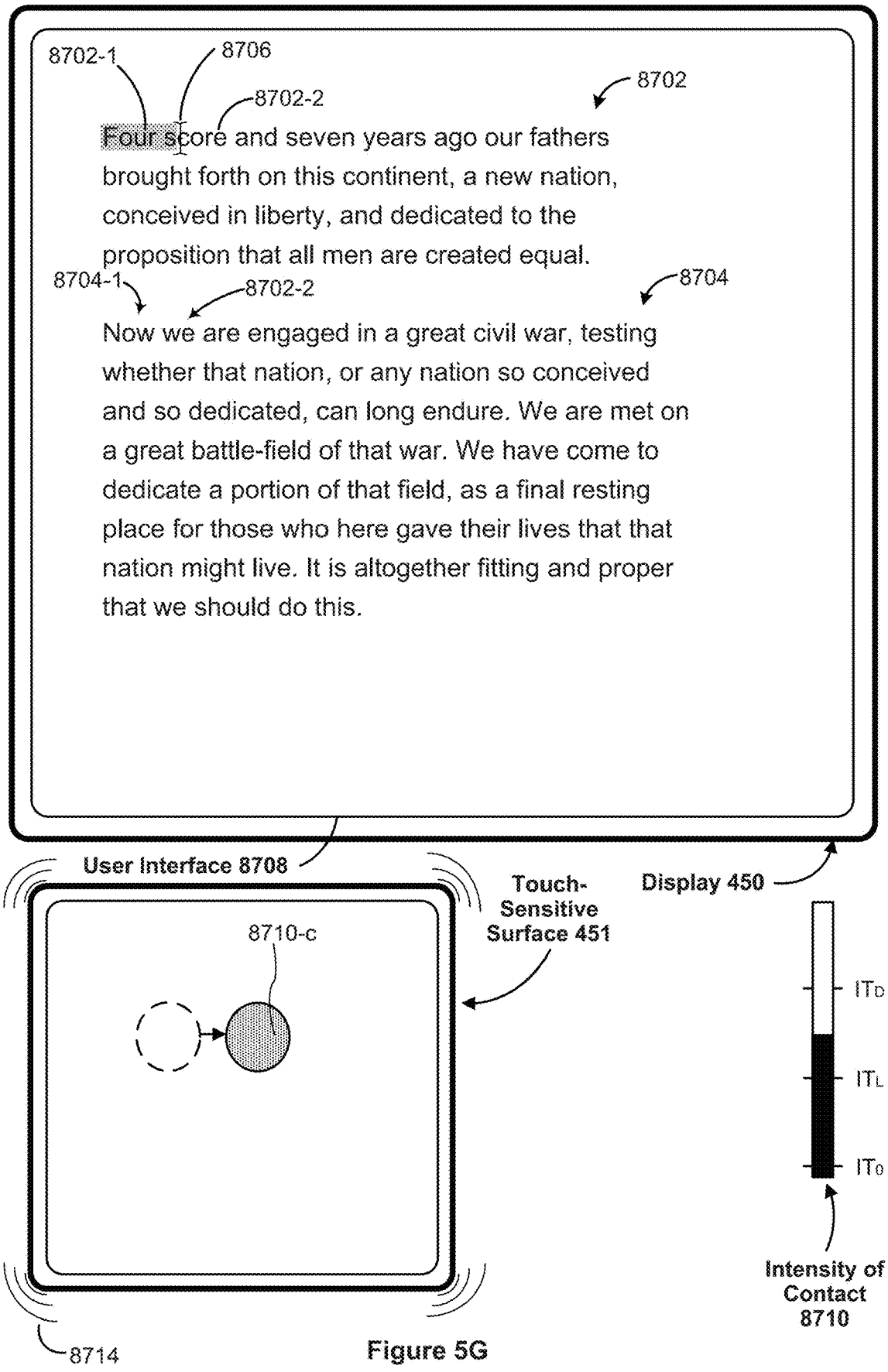
User Interface 8708
Touch-Sensitive Surface 451
Display 450
8710-c
ITD
ITL
IT0
Intensity of Contact 8710
8714

Figure 5F


8702-1
8706
8702-2
8702
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8704-1
8702-2
8704
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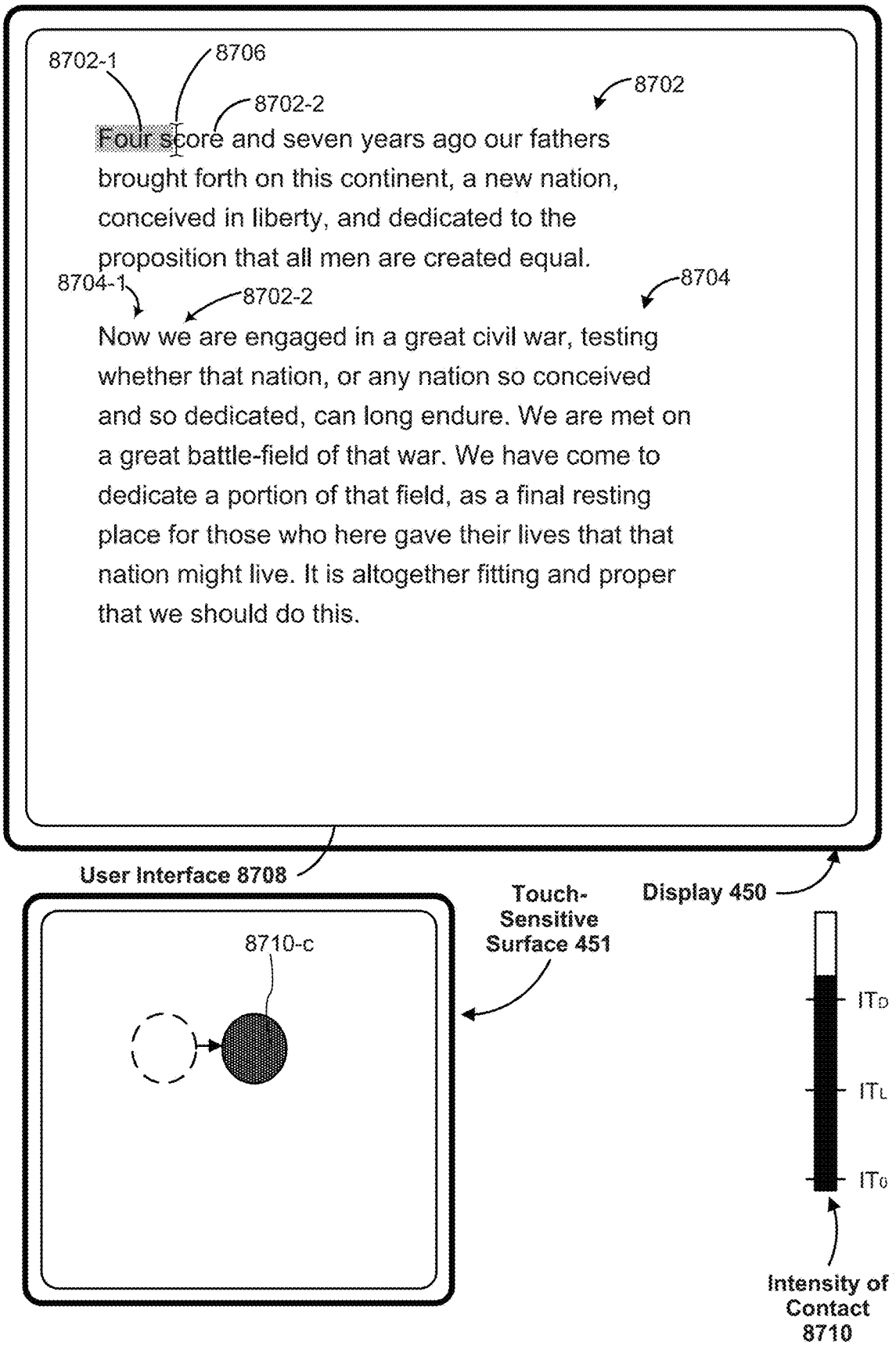
User Interface 8708
Touch-Sensitive Surface 451
Display 450
8710-c
ITD
ITL
IT0
Intensity of Contact 8710
8714

Figure 5G


8702-1
8706
8702-2
8702
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8704-1
8702-2
8704
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User Interface 8708
Touch-Sensitive Surface 451
Display 450
8710-c
ITD
ITL
IT0
Intensity of Contact 8710

Figure 5H

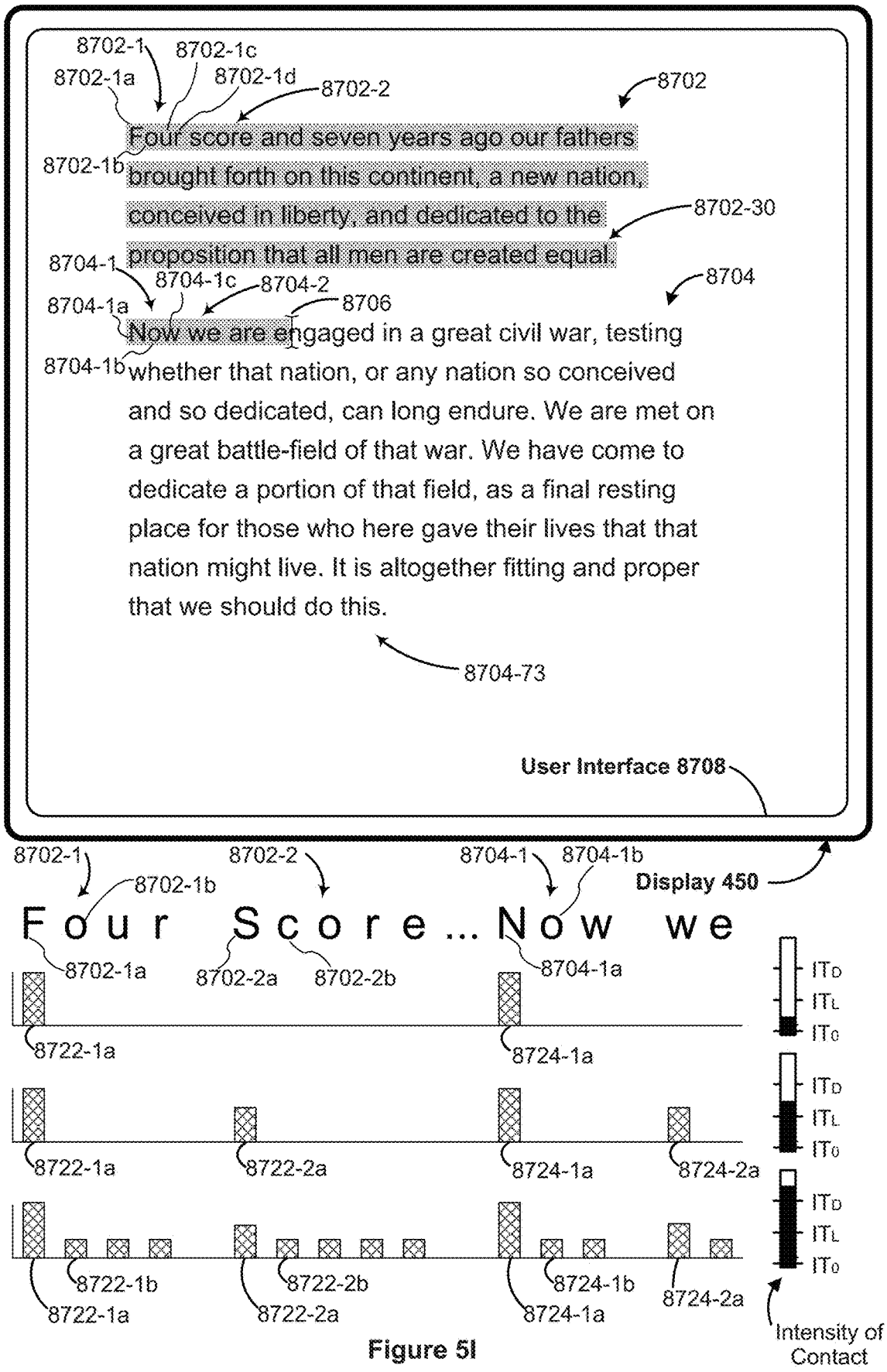
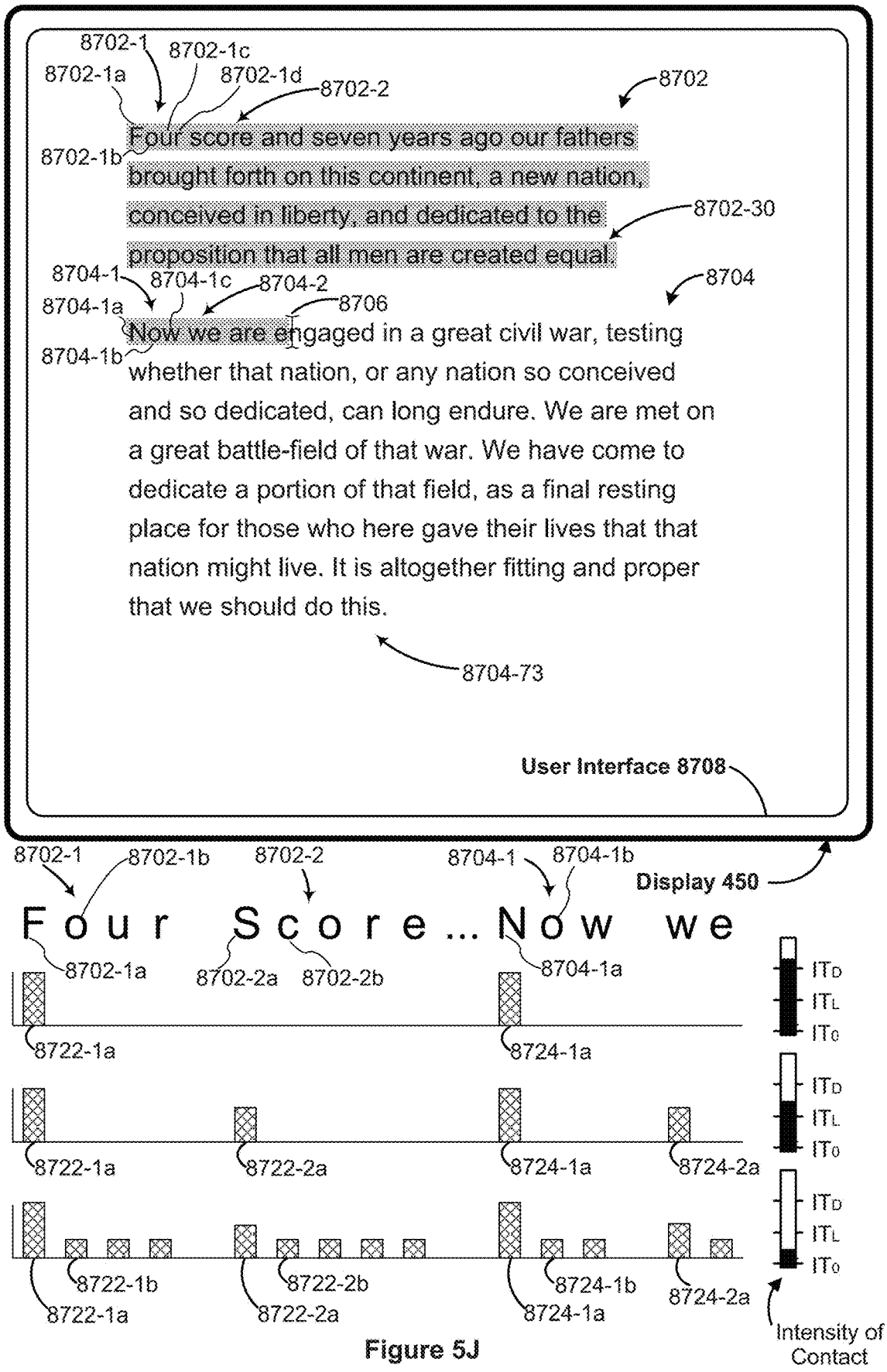

8702-1
8702-1c
8702-1a
8702-1d
8702-2
8702
Four score and seven years ago our fathers
8702-1b
brought forth on this continent, a new nation,
conceived in liberty, and dedicated to the
8702-30
proposition that all men are created equal.
8704-1
8704-1c
8704-2
8704
8704-1a
8706
Now we are engaged in a great civil war, testing
8704-1b
whether that nation, or any nation so conceived
and so dedicated, can long endure. We are met on
a great battle-field of that war. We have come to
dedicate a portion of that field, as a final resting
place for those who here gave their lives that that
nation might live. It is altogether fitting and proper
that we should do this.
8704-73
User Interface 8708
8702-1
8702-2
8704-1
8704-1b
Display 450
8702-1b
Four Score ... Now we
8702-1a
8702-2a
8702-2b
8704-1a
8722-1a
8724-1a
8722-1a
8722-2a
8724-1a
8724-2a
8722-1b
8722-2b
8724-1b
8722-1a
8722-2a
8724-1a
8724-2a
ITD
ITL
ITO
ITD
ITL
ITO
ITD
ITL
ITO
Intensity of Contact

Figure 5I


8702-1
8702-1c
8702-1a
8702-1d
8702-2
8702
8702-1b
Four score and seven years ago our fathers brought forth on this continent, a new nation, conceived in liberty, and dedicated to the proposition that all men are created equal.
8702-30
8704-1
8704-1c
8704-2
8704
8704-1a
8706
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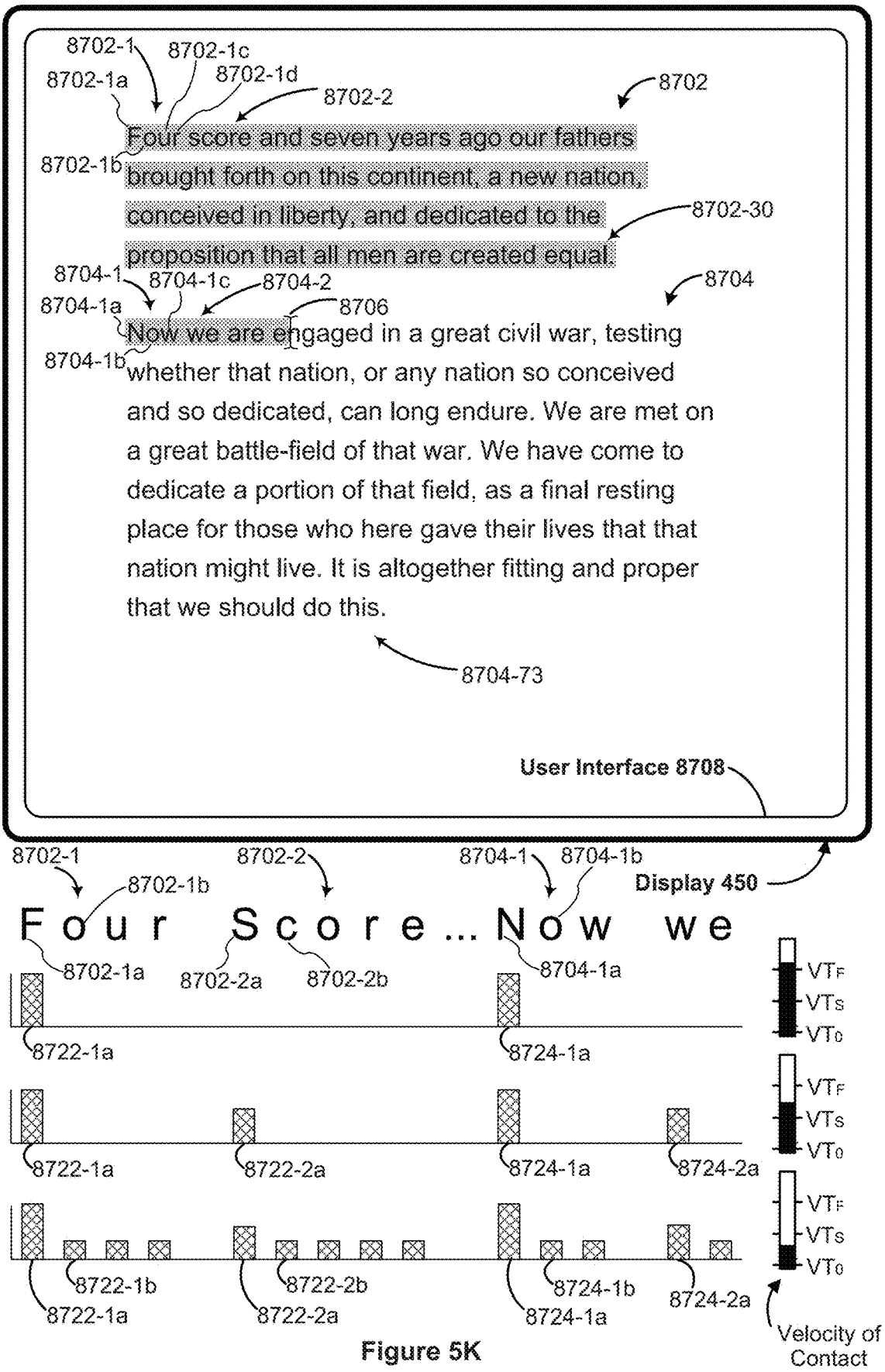
8704-1b
8704-73
User Interface 8708
8702-1
8702-1b
8702-2
8704-1
8704-1b
Display 450
F o u r S c o r e ... N o w w e
8702-1a
8702-2a
8702-2b
8704-1a
8722-1a
8724-1a
8722-1a
8722-2a
8724-1a
8724-2a
8722-1b
8722-2b
8724-1b
8722-1a
8722-2a
8724-1a
8724-2a
ITD
ITL
IT0
ITD
ITL
IT0
ITD
ITL
IT0
Intensity of Contact

Figure 5J


8702-1
8702-1c
8702-1d
8702-1a
8702-2
8702
8702-1b
Four score and seven years ago our fathers brought forth on this continent, a new nation, conceived in liberty, and dedicated to the proposition that all men are created equal.
8702-30
8704-1
8704-1c
8704-2
8704
8704-1a
8706
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8704-1b
8704-73
User Interface 8708
8702-1
8702-2
8704-1
8704-1b
Display 450
8702-1b
Four Score ... Now we
8702-1a
8702-2a
8702-2b
8704-1a
VTF
VTS
VT0
8722-1a
8724-1a
8722-2a
8724-2a
8722-1b
8722-2b
8724-1b
Velocity of Contact

Figure 5K

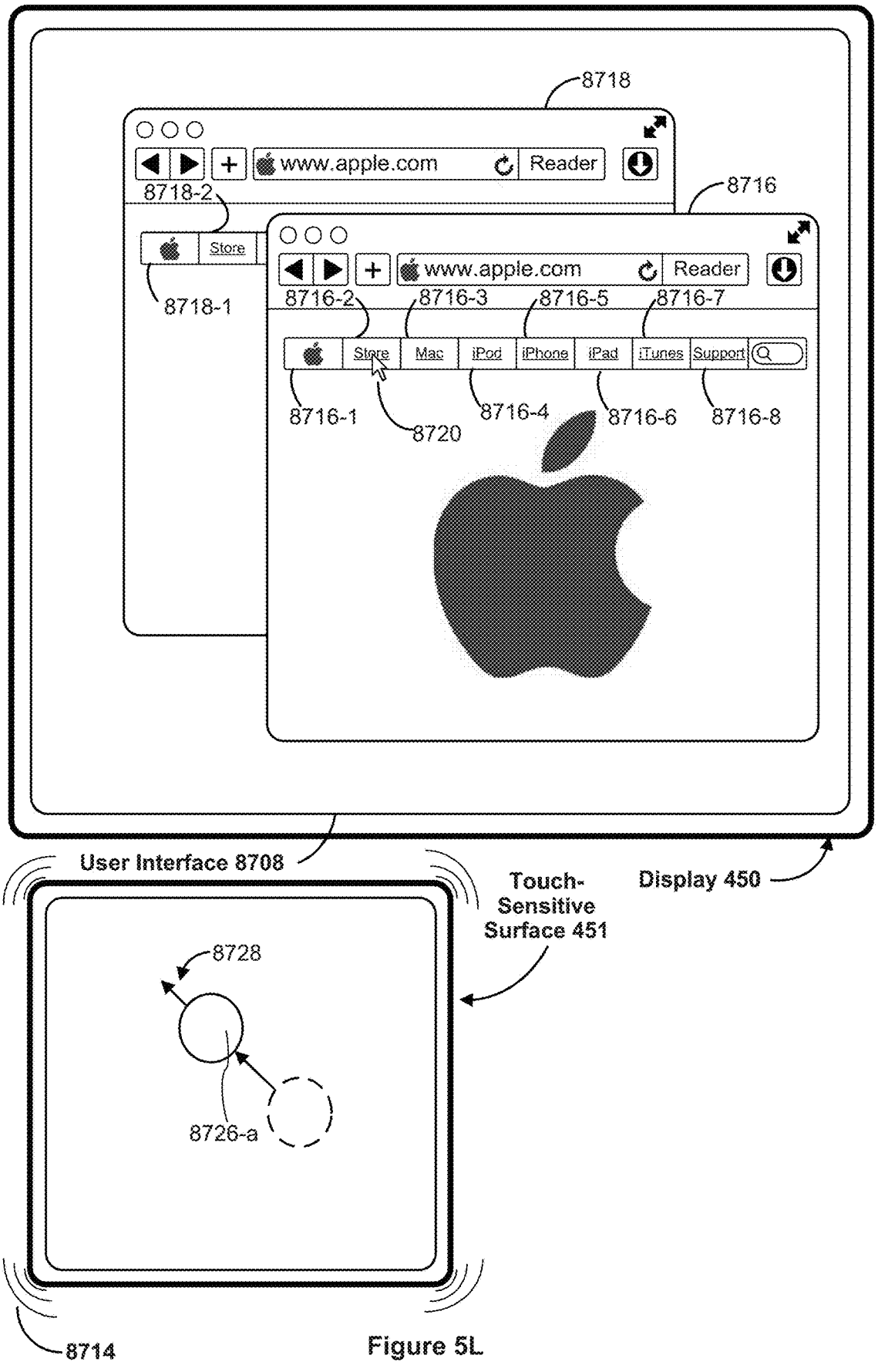

8718
www.apple.com
Reader
8718-2
8716
Store
8718-1
www.apple.com
Reader
8716-2
8716-3
8716-5
8716-7
Store
Mac
iPod
iPhone
iPad
iTunes
Support
8716-1
8720
8716-4
8716-6
8716-8
User Interface 8708
Display 450
Touch-Sensitive Surface 451
8728
8726-a
8714

Figure 5L

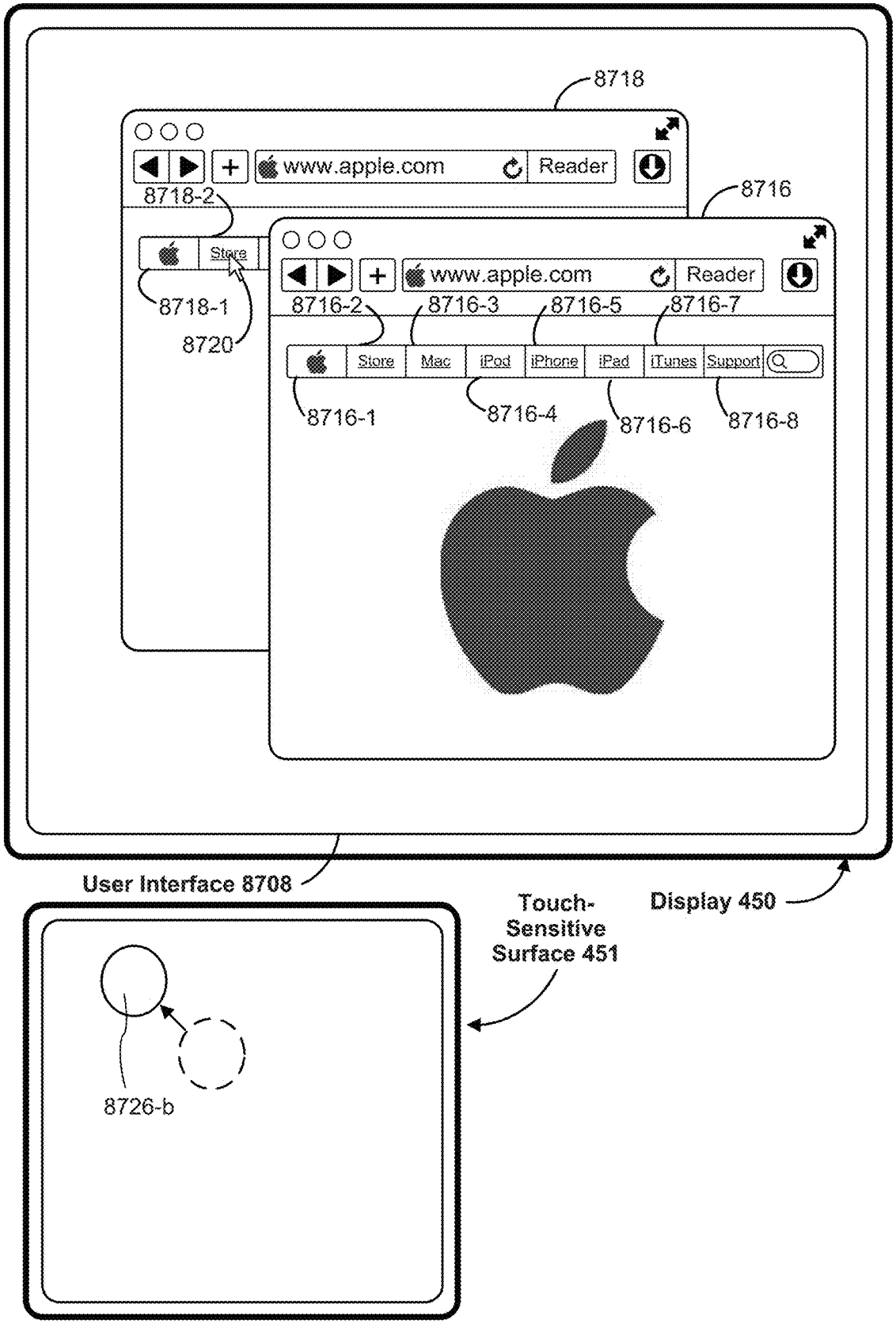

8718
www.apple.com
Reader
8718-2
8716
Store
8718-1
8720
www.apple.com
Reader
8716-2
8716-3
8716-5
8716-7
Store
Mac
iPod
iPhone
iPad
iTunes
Support
8716-1
8716-4
8716-6
8716-8
User Interface 8708
Display 450
Touch-Sensitive Surface 451
8726-b

Figure 5M

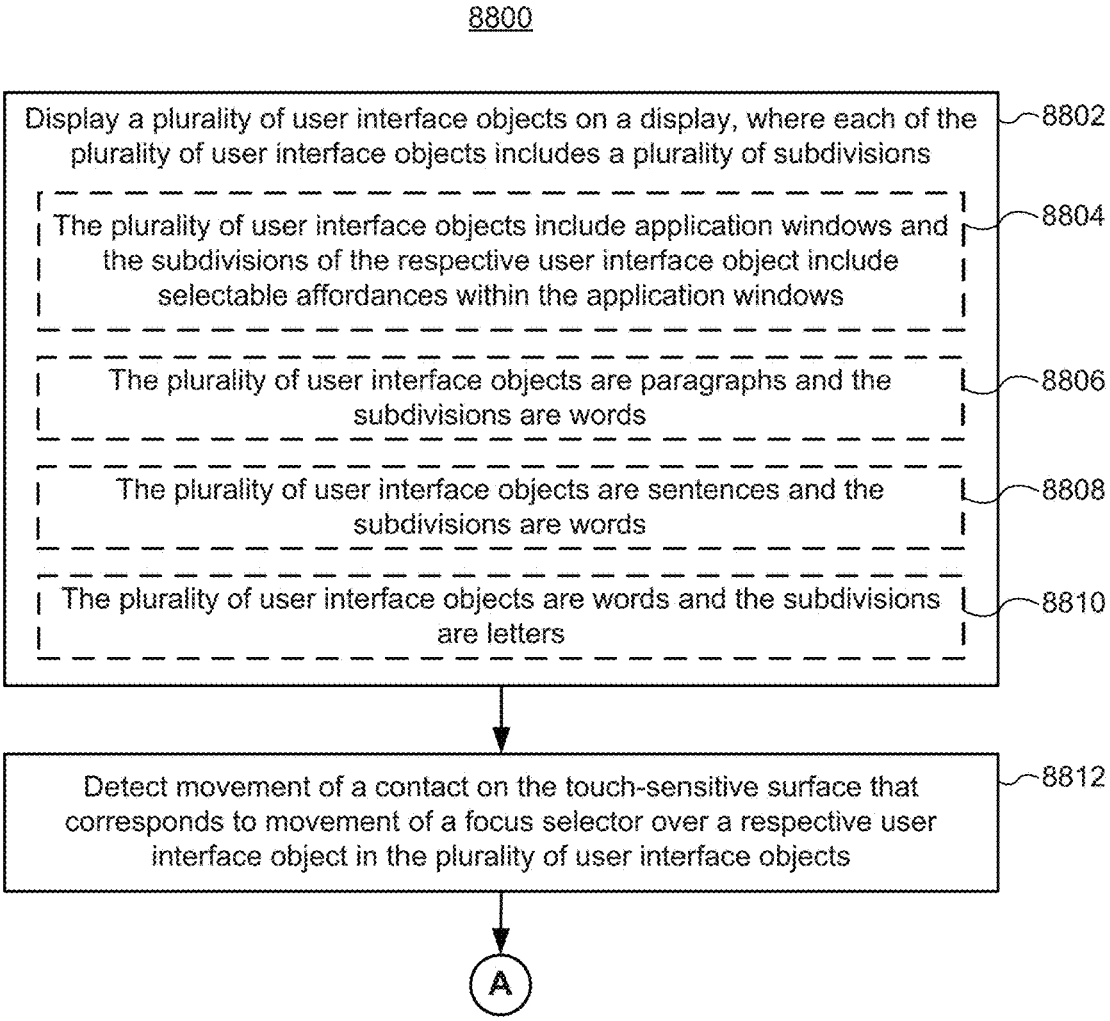

8800
Display a plurality of user interface objects on a display, where each of the plurality of user interface objects includes a plurality of subdivisions
8802
The plurality of user interface objects include application windows and the subdivisions of the respective user interface object include selectable affordances within the application windows
8804
The plurality of user interface objects are paragraphs and the subdivisions are words
8806
The plurality of user interface objects are sentences and the subdivisions are words
8808
The plurality of user interface objects are words and the subdivisions are letters
8810
Detect movement of a contact on the touch-sensitive surface that corresponds to movement of a focus selector over a respective user interface object in the plurality of user interface objects
8812
A

Figure 6A

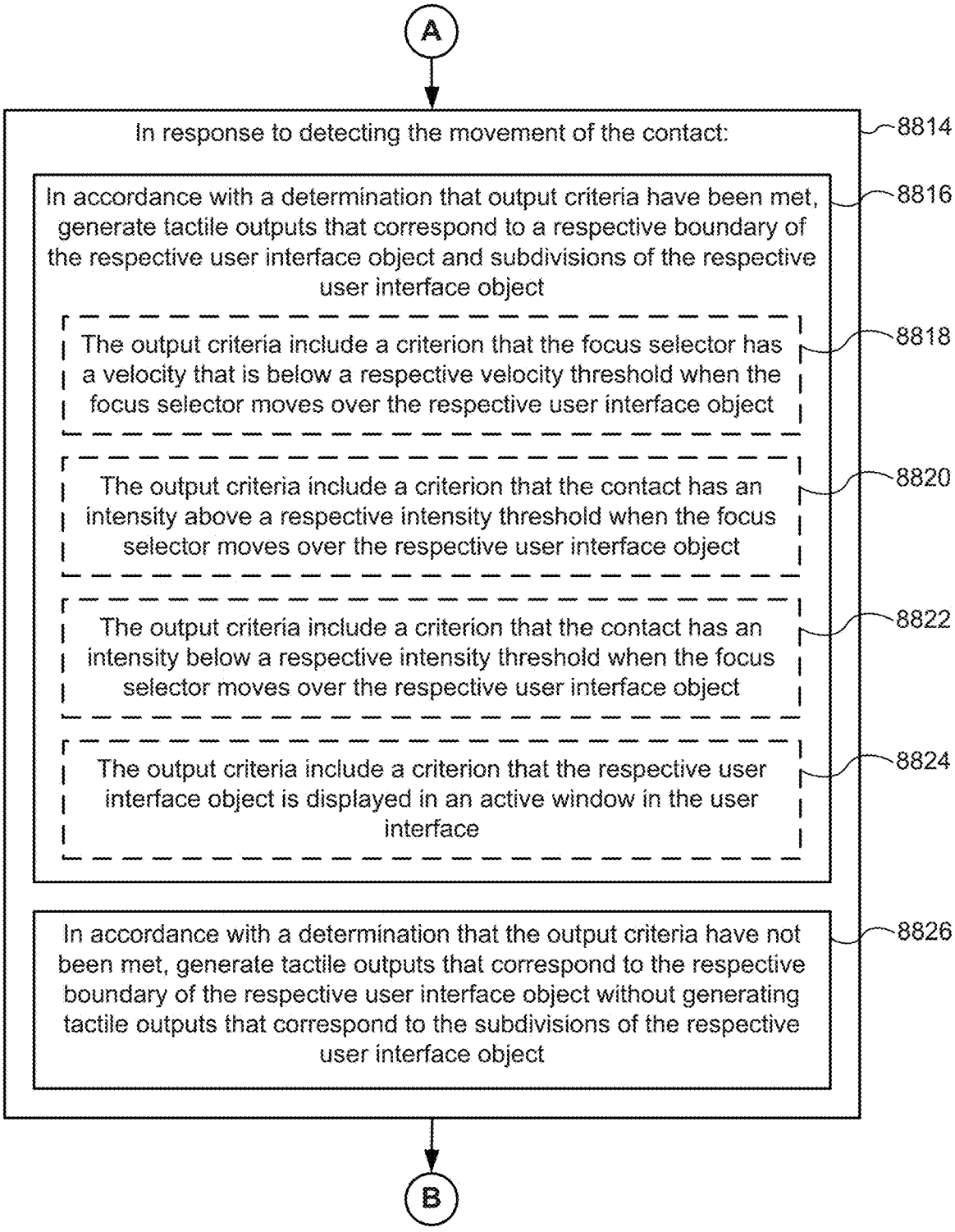

A
In response to detecting the movement of the contact:
8814
In accordance with a determination that output criteria have been met, generate tactile outputs that correspond to a respective boundary of the respective user interface object and subdivisions of the respective user interface object
8816
The output criteria include a criterion that the focus selector has a velocity that is below a respective velocity threshold when the focus selector moves over the respective user interface object
8818
The output criteria include a criterion that the contact has an intensity above a respective intensity threshold when the focus selector moves over the respective user interface object
8820
The output criteria include a criterion that the contact has an intensity below a respective intensity threshold when the focus selector moves over the respective user interface object
8822
The output criteria include a criterion that the respective user interface object is displayed in an active window in the user interface
8824
In accordance with a determination that the output criteria have not been met, generate tactile outputs that correspond to the respective boundary of the respective user interface object without generating tactile outputs that correspond to the subdivisions of the respective user interface object
8826
B

Figure 6B

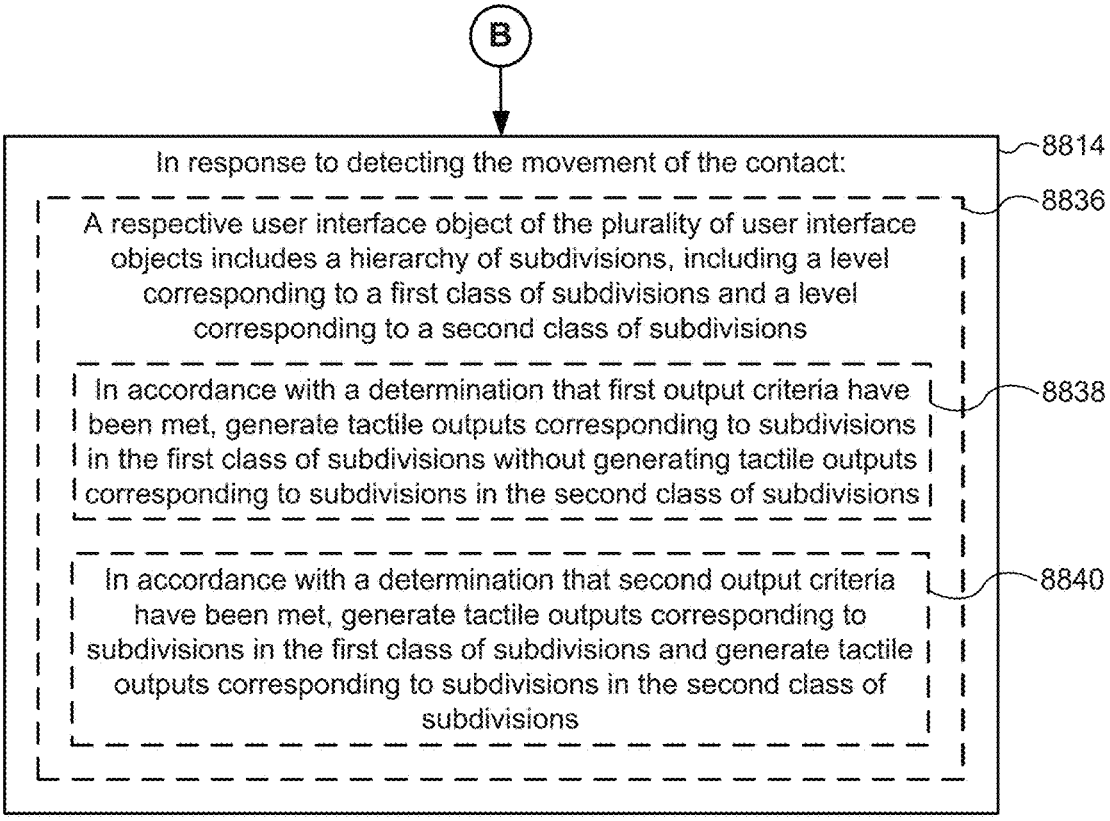

B
In response to detecting the movement of the contact:
8814
A respective user interface object of the plurality of user interface objects includes a hierarchy of subdivisions, including a level corresponding to a first class of subdivisions and a level corresponding to a second class of subdivisions
8836
In accordance with a determination that first output criteria have been met, generate tactile outputs corresponding to subdivisions in the first class of subdivisions without generating tactile outputs corresponding to subdivisions in the second class of subdivisions
8838
In accordance with a determination that second output criteria have been met, generate tactile outputs corresponding to subdivisions in the first class of subdivisions and generate tactile outputs corresponding to subdivisions in the second class of subdivisions
8840

Figure 6C

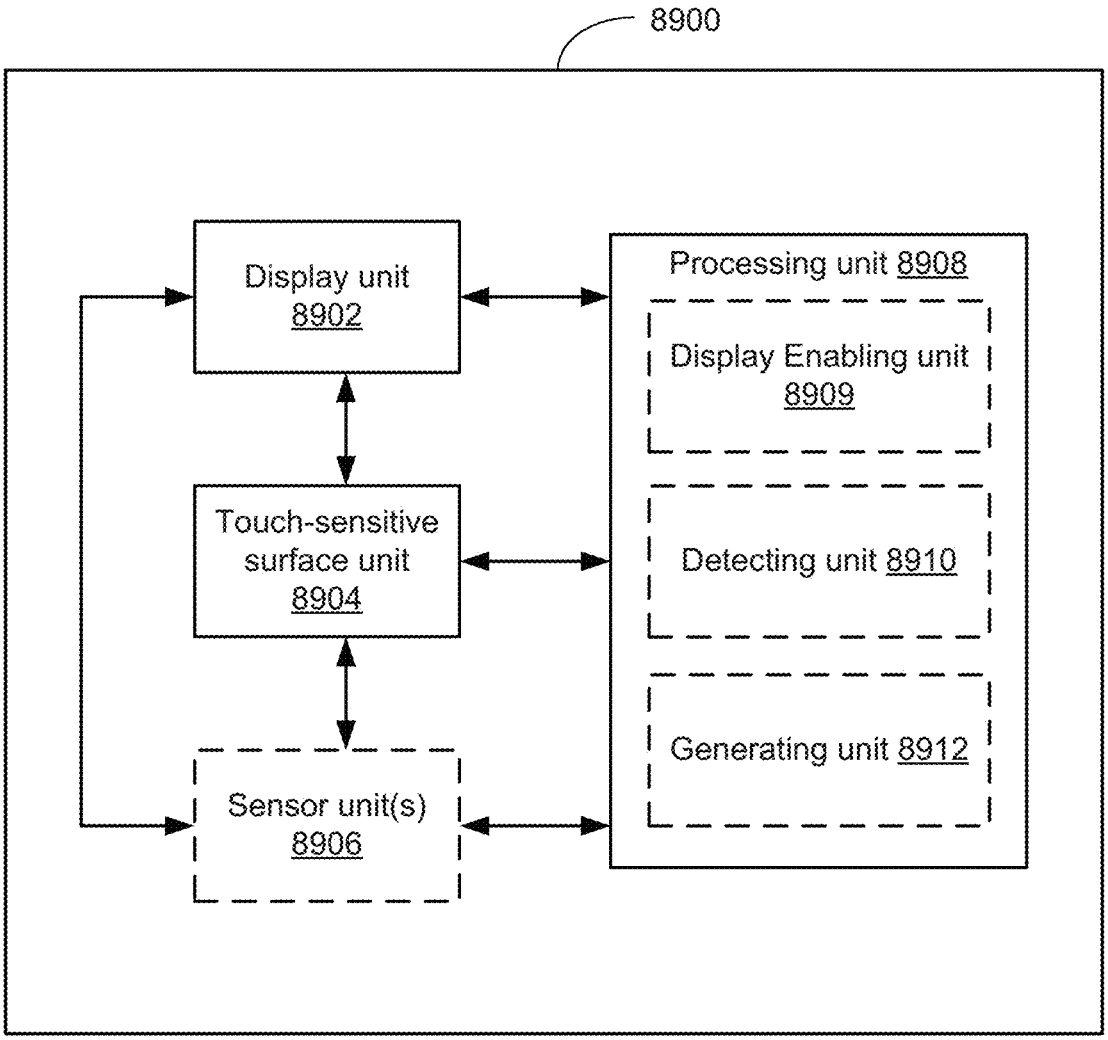

8900
Display unit 8902
Touch-sensitive surface unit 8904
Sensor unit(s) 8906
Processing unit 8908
Display Enabling unit 8909
Detecting unit 8910
Generating unit 8912

Figure 7

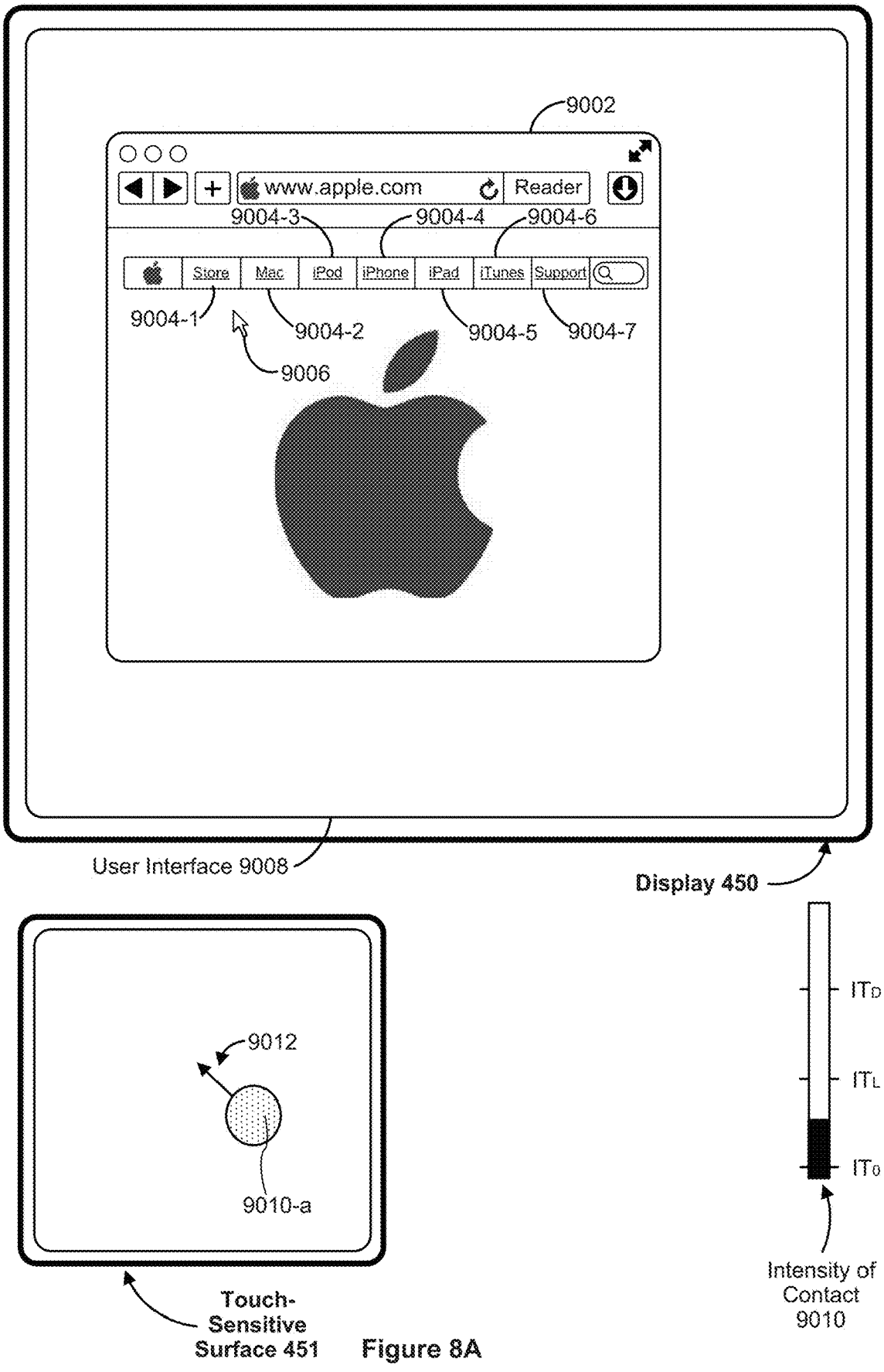

9002
www.apple.com
Reader
9004-3
9004-4
9004-6
Store
Mac
iPod
iPhone
iPad
iTunes
Support
9004-1
9004-2
9004-5
9004-7
9006
User Interface 9008
Display 450
9012
9010-a
Touch-Sensitive Surface 451
ITD
ITL
IT0
Intensity of Contact 9010

Figure 8A

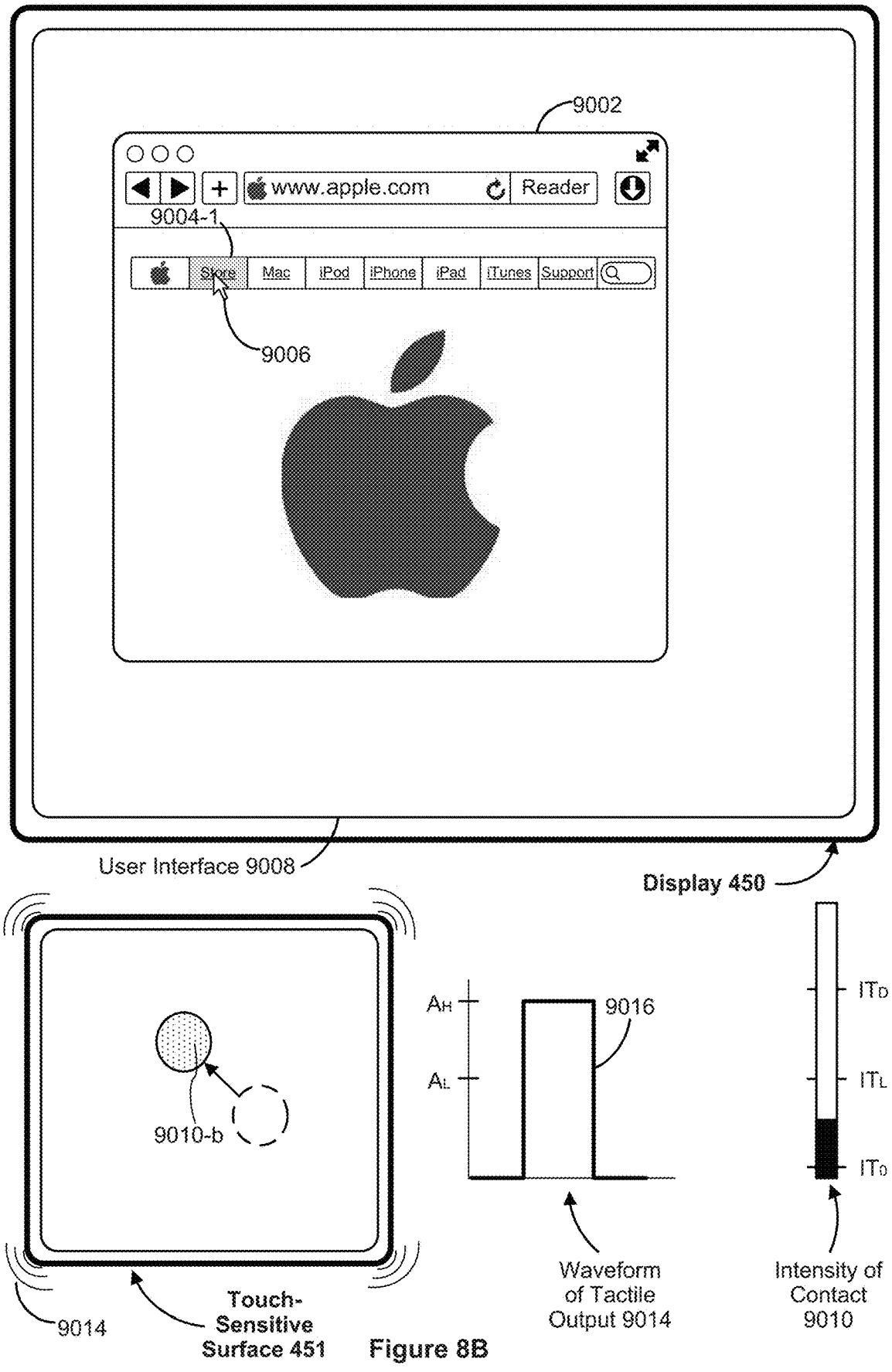

9002
www.apple.com
Reader
9004-1
Store
Mac
iPod
iPhone
iPad
iTunes
Support
9006
User Interface 9008
Display 450
9010-b
9014
Touch-Sensitive Surface 451
AH
AL
9016
Waveform of Tactile Output 9014
ITD
ITL
ITD
Intensity of Contact 9010

Figure 8B

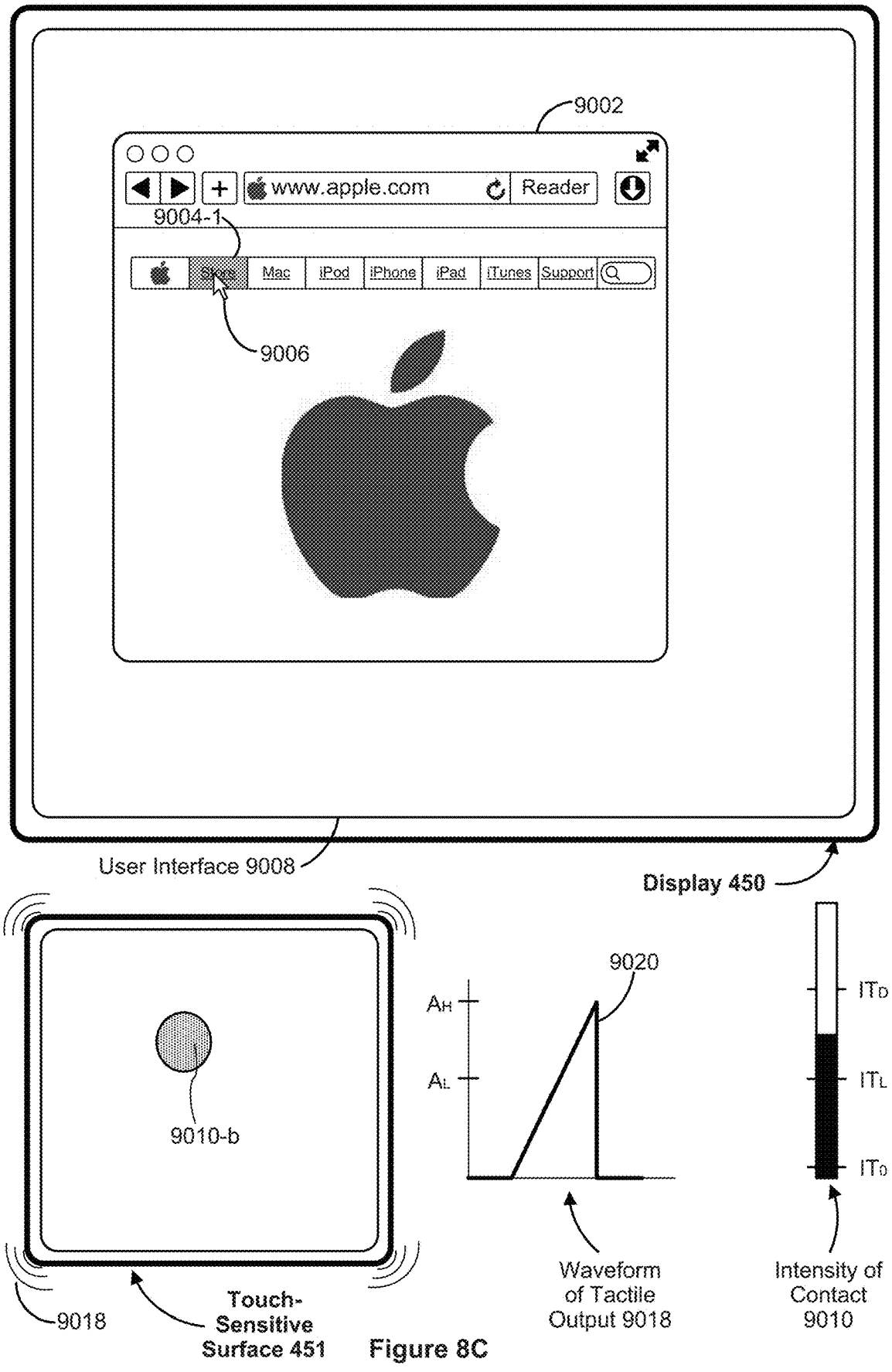

9002
www.apple.com
Reader
9004-1
Mac
iPod
iPhone
iPad
iTunes
Support
9006
User Interface 9008
Display 450
9010-b
9018
Touch-Sensitive Surface 451
9020
AH
AL
Waveform of Tactile Output 9018
ITD
ITL
ITD
Intensity of Contact 9010

Figure 8C

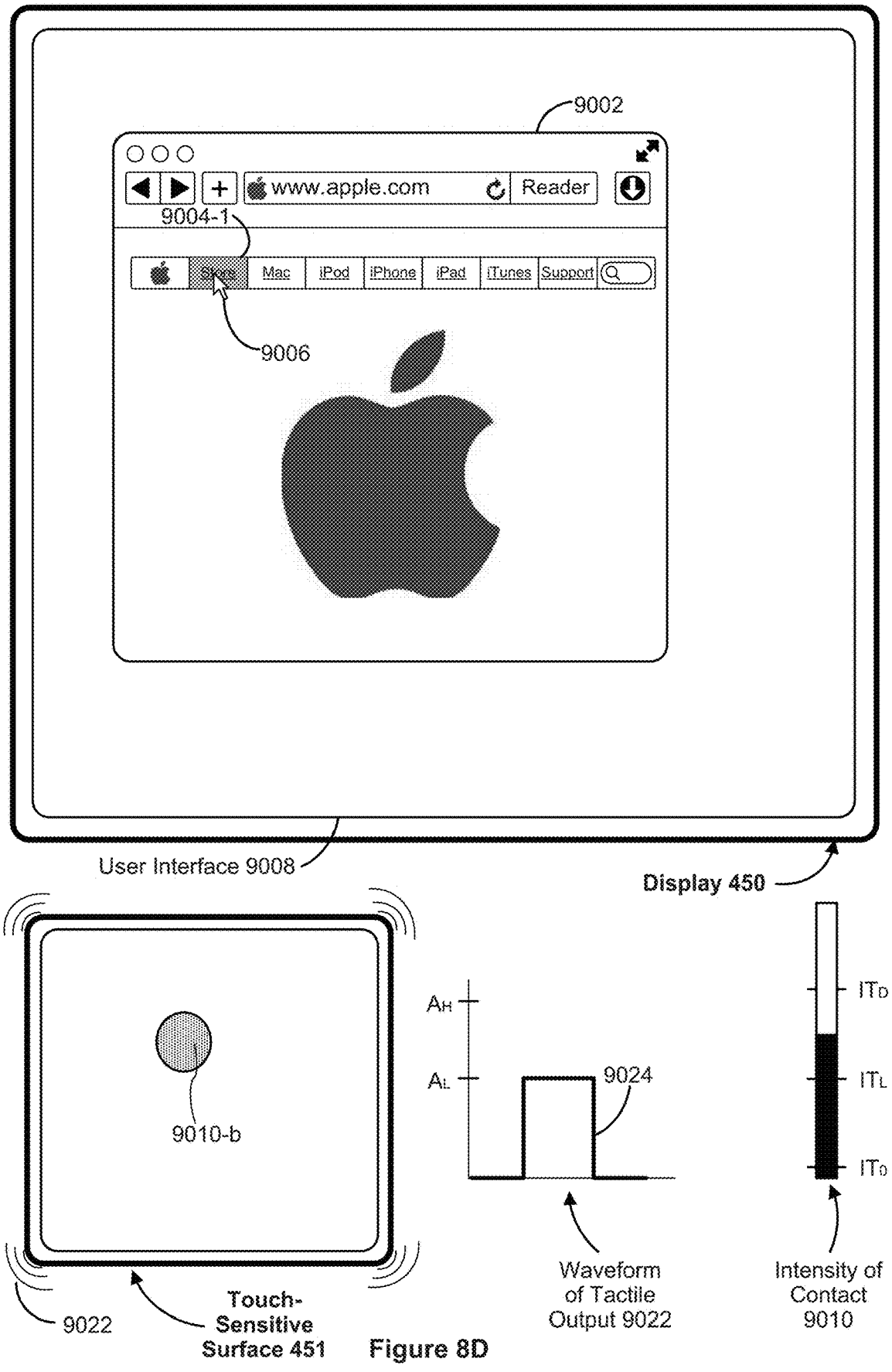
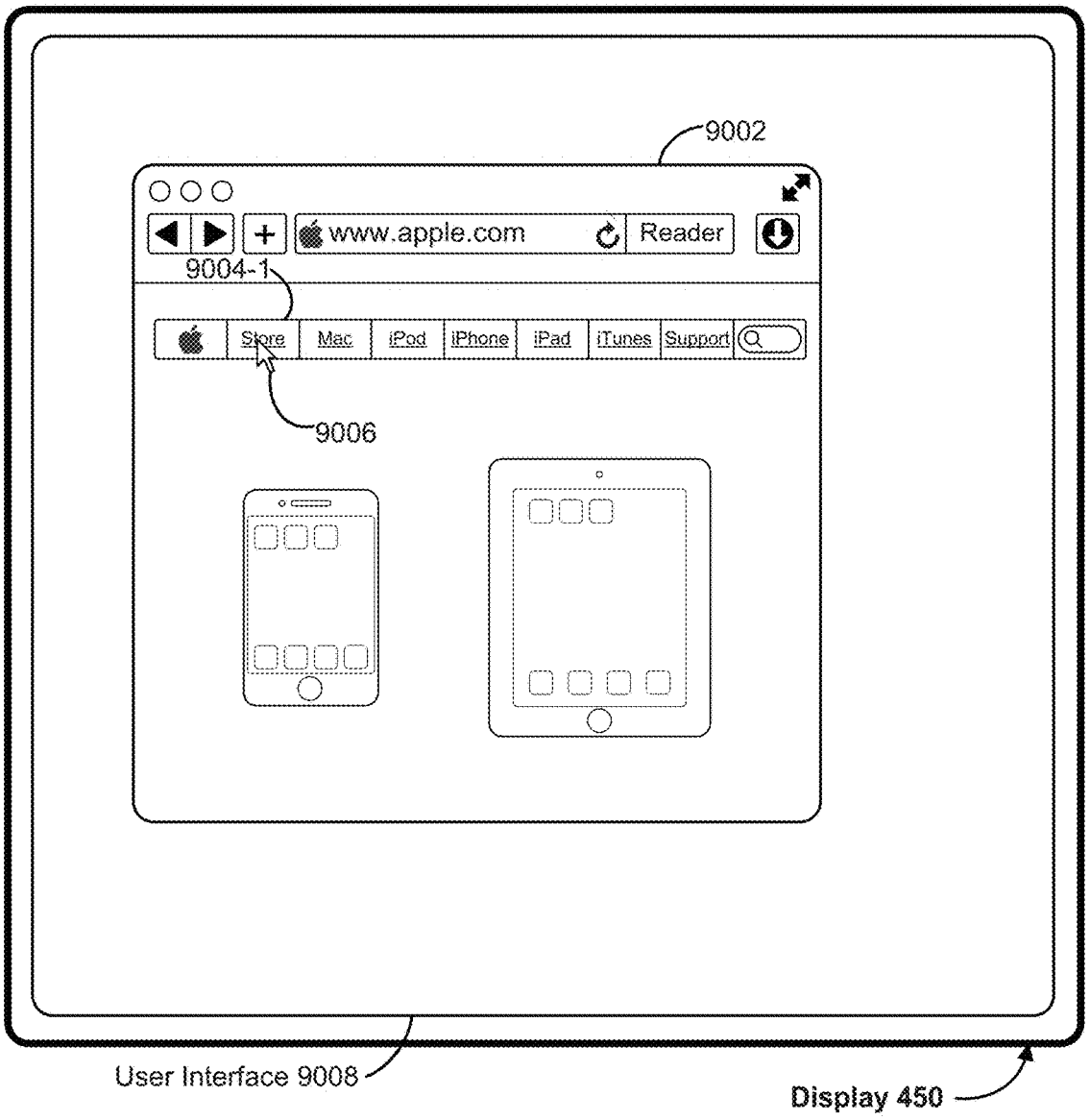

9002
www.apple.com
Reader
9004-1
Store
Mac
iPod
iPhone
iPad
iTunes
Support
9006
User Interface 9008
Display 450
9010-b
9022
Touch-Sensitive Surface 451
A_H
A_L
9024
Waveform of Tactile Output 9022
IT_D
IT_L
IT_0
Intensity of Contact 9010

Figure 8D


9002
www.apple.com
Reader
9004-1
Store
Mac
iPod
iPhone
iPad
iTunes
Support
9006
User Interface 9008
Display 450

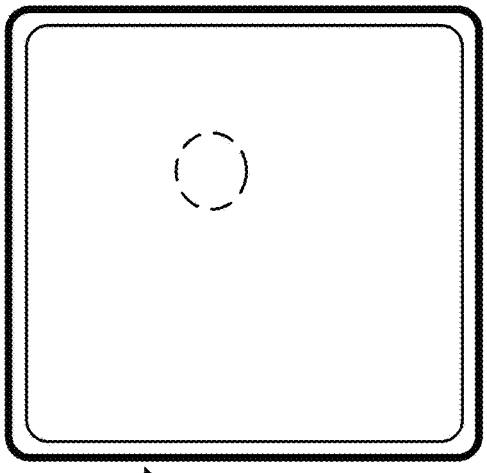

Touch-Sensitive Surface 451

Figure 8E

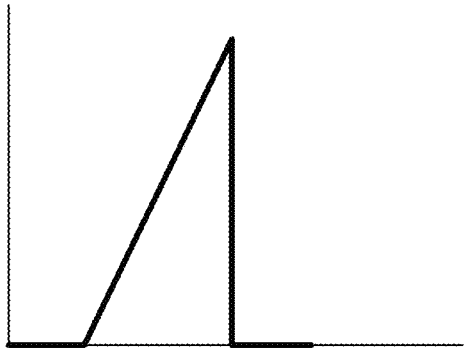


Figure 8F

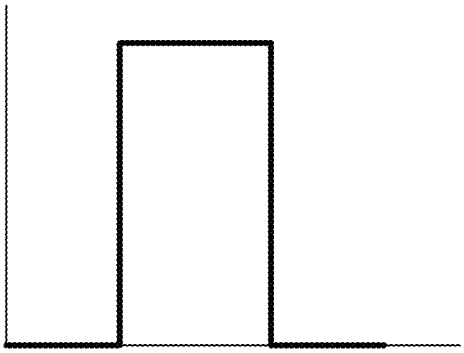


Figure 8G

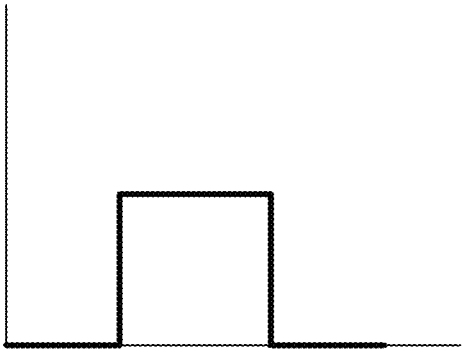


Figure 8H

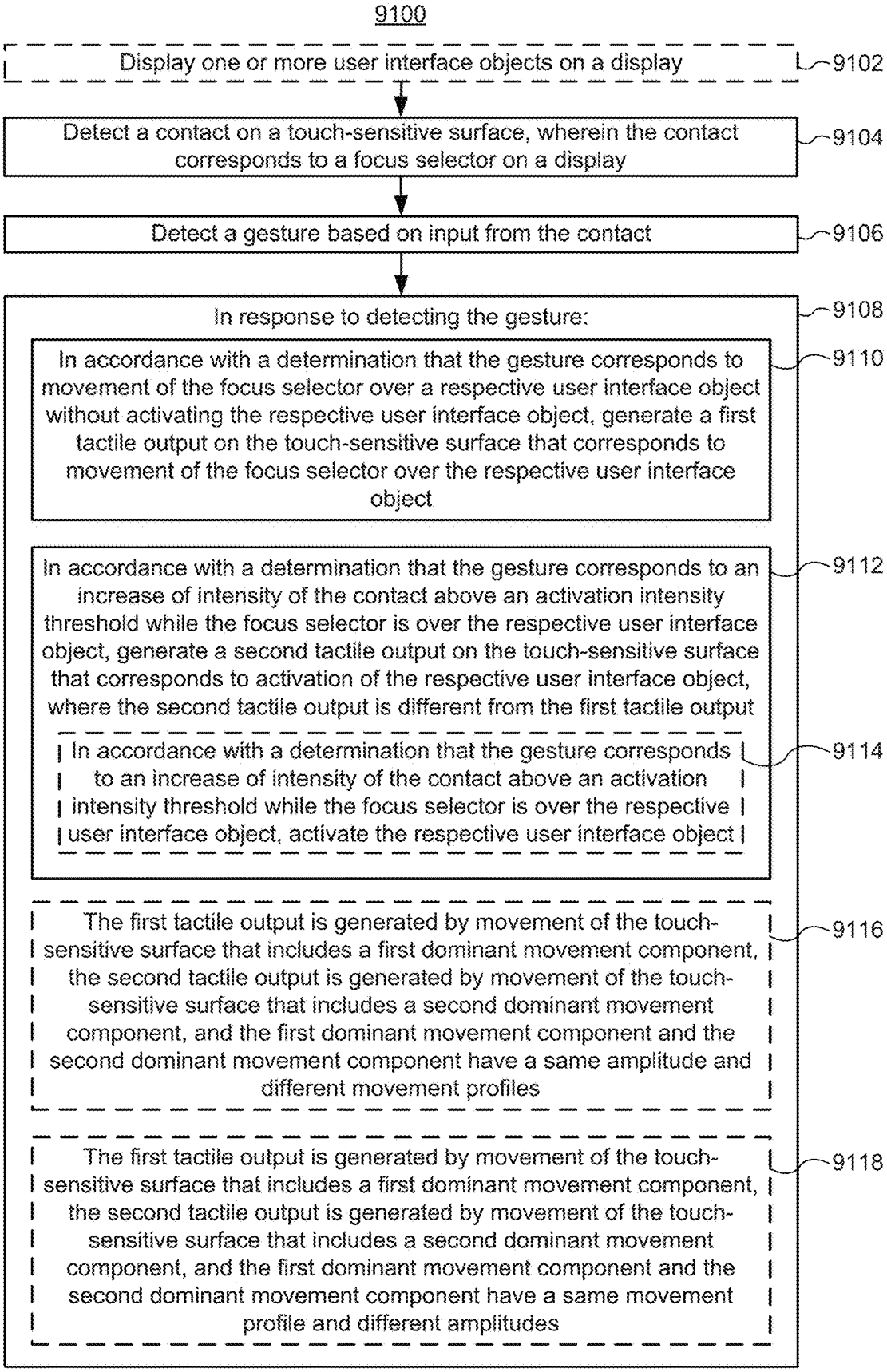

9100
Display one or more user interface objects on a display
9102
Detect a contact on a touch-sensitive surface, wherein the contact corresponds to a focus selector on a display
9104
Detect a gesture based on input from the contact
9106
In response to detecting the gesture:
9108
In accordance with a determination that the gesture corresponds to movement of the focus selector over a respective user interface object without activating the respective user interface object, generate a first tactile output on the touch-sensitive surface that corresponds to movement of the focus selector over the respective user interface object
9110
In accordance with a determination that the gesture corresponds to an increase of intensity of the contact above an activation intensity threshold while the focus selector is over the respective user interface object, generate a second tactile output on the touch-sensitive surface that corresponds to activation of the respective user interface object, where the second tactile output is different from the first tactile output
9112
In accordance with a determination that the gesture corresponds to an increase of intensity of the contact above an activation intensity threshold while the focus selector is over the respective user interface object, activate the respective user interface object
9114
The first tactile output is generated by movement of the touch-sensitive surface that includes a first dominant movement component, the second tactile output is generated by movement of the touch-sensitive surface that includes a second dominant movement component, and the first dominant movement component and the second dominant movement component have a same amplitude and different movement profiles
9116
The first tactile output is generated by movement of the touch-sensitive surface that includes a first dominant movement component, the second tactile output is generated by movement of the touch-sensitive surface that includes a second dominant movement component, and the first dominant movement component and the second dominant movement component have a same movement profile and different amplitudes
9118

Figure 9

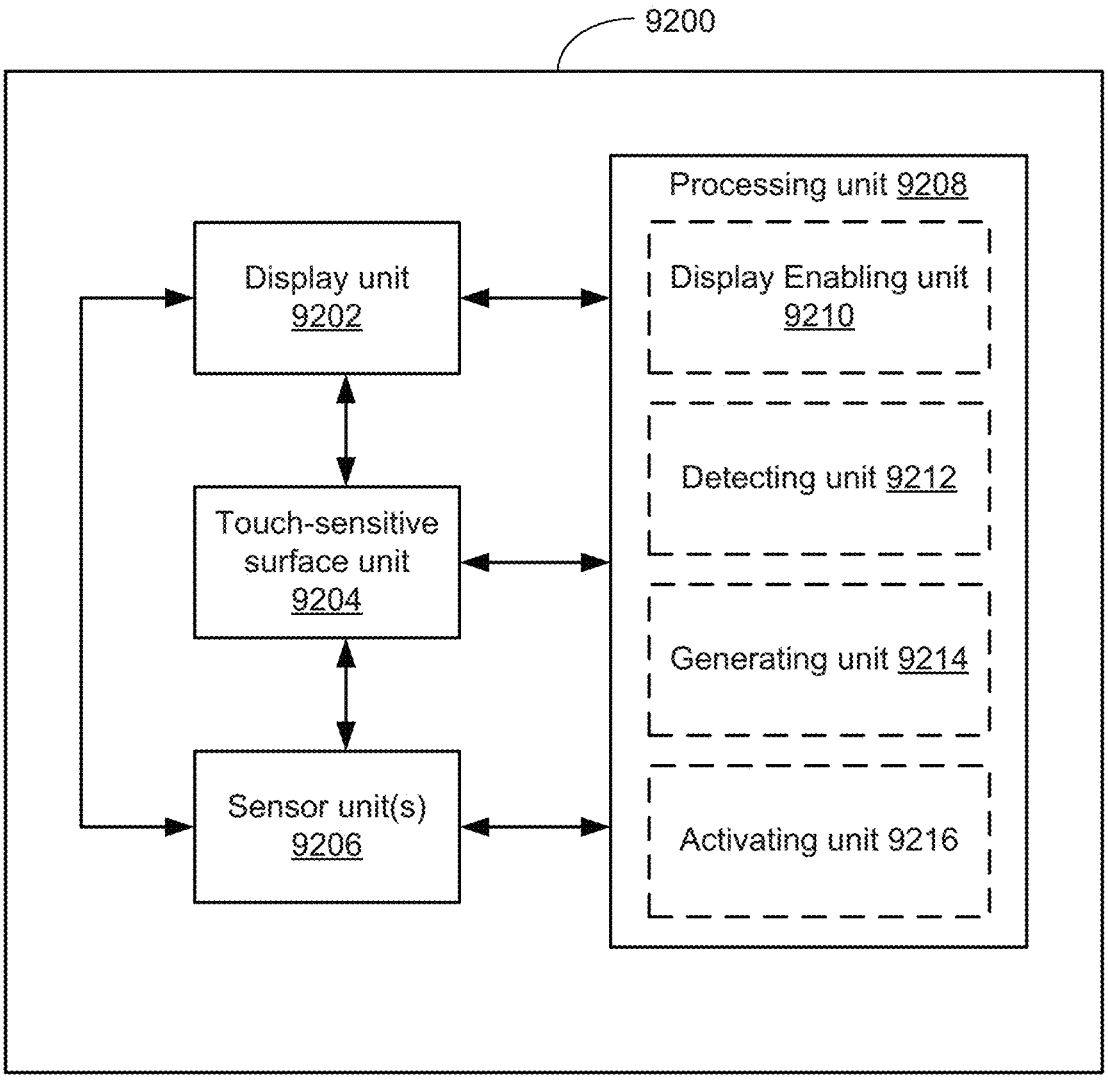
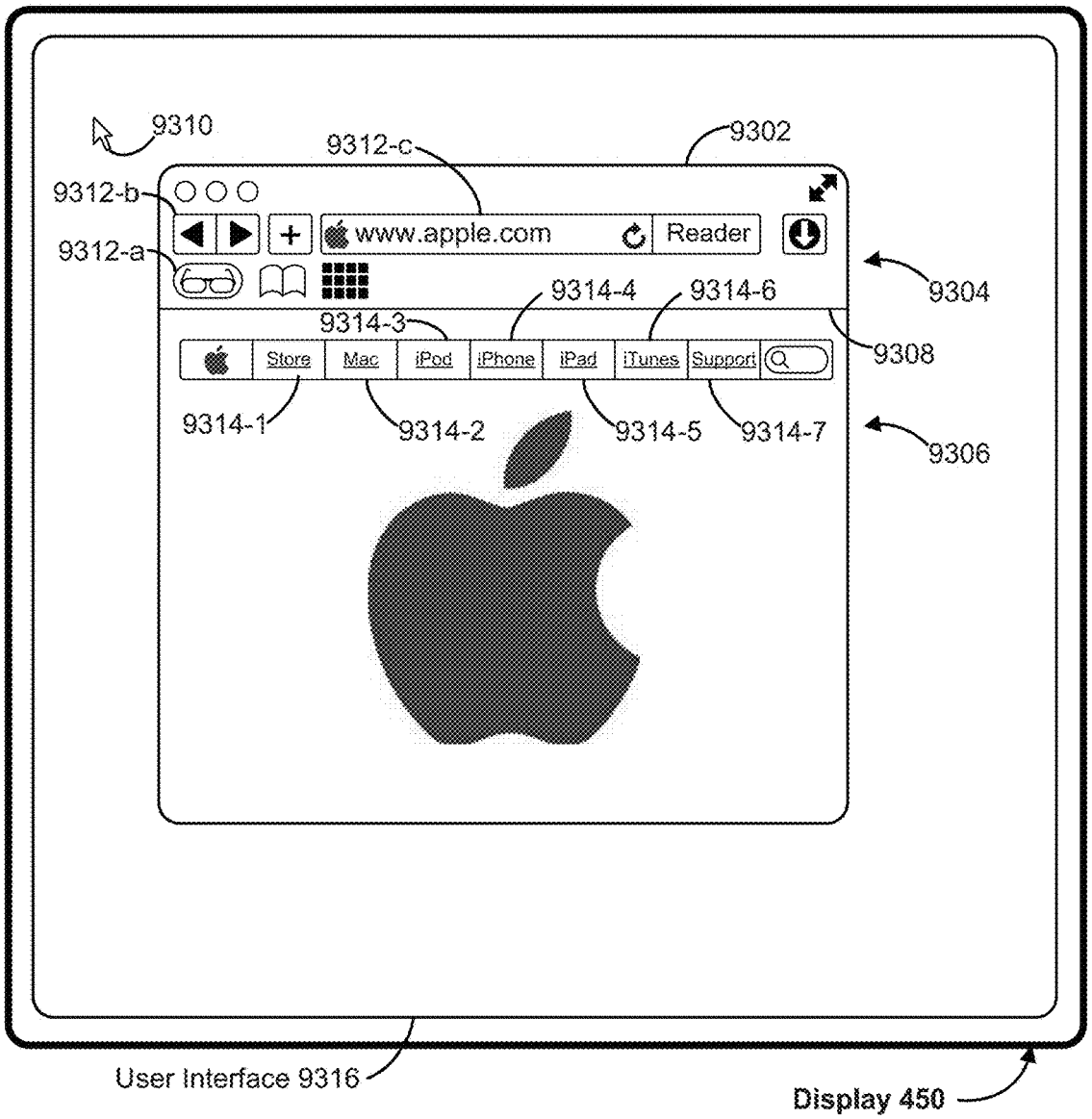
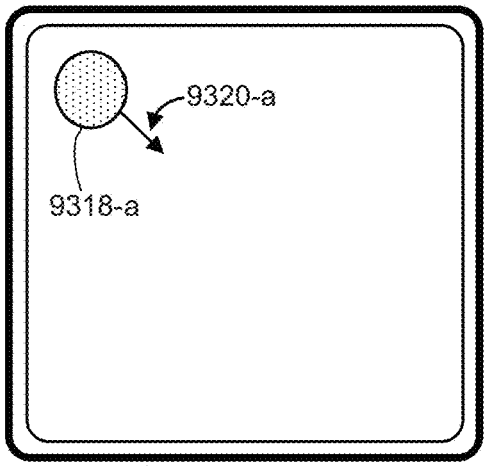

9200
Processing unit 9208
Display unit 9202
Display Enabling unit 9210
Detecting unit 9212
Touch-sensitive surface unit 9204
Generating unit 9214
Sensor unit(s) 9206
Activating unit 9216

Figure 10


9310
9312-c
9302
9312-b
9312-a
www.apple.com
Reader
9304
9314-4
9314-6
9314-3
9308
Store
Mac
iPod
iPhone
iPad
iTunes
Support
9314-1
9314-2
9314-5
9314-7
9306
User Interface 9316
Display 450


9320-a
9318-a
Touch-Sensitive Surface 451

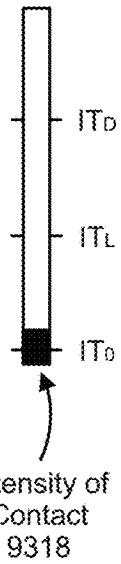

ITD
ITL
IT0
Intensity of Contact 9318

Figure 11A

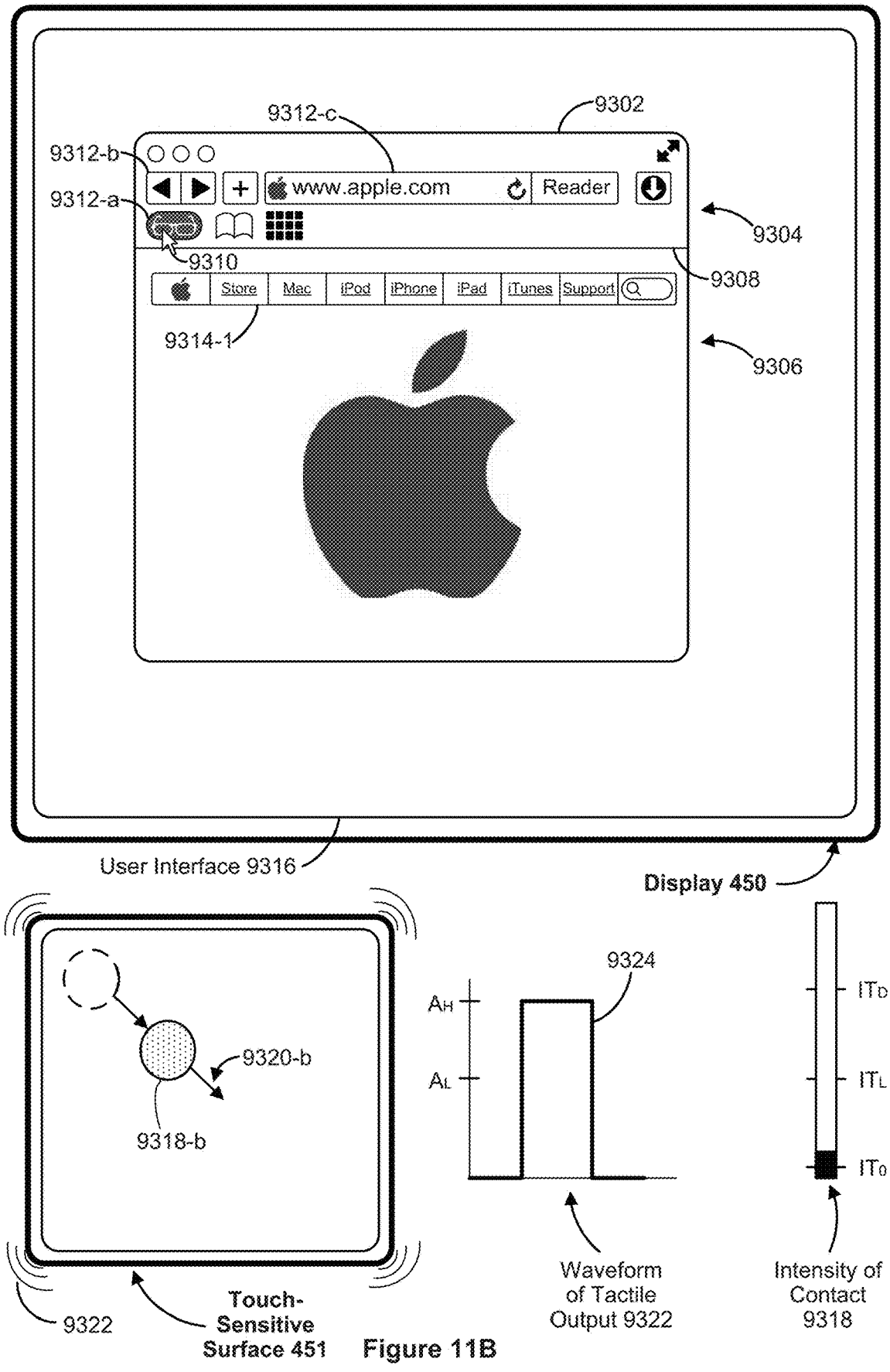

9312-c
9302
9312-b
9312-a
www.apple.com
Reader
9304
9310
9308
Store
Mac
iPod
iPhone
iPad
iTunes
Support
9314-1
9306
User Interface 9316
Display 450
9320-b
9318-b
9322
Touch-Sensitive Surface 451
9324
AH
AL
Waveform of Tactile Output 9322
ITD
ITL
IT0
Intensity of Contact 9318

Figure 11B

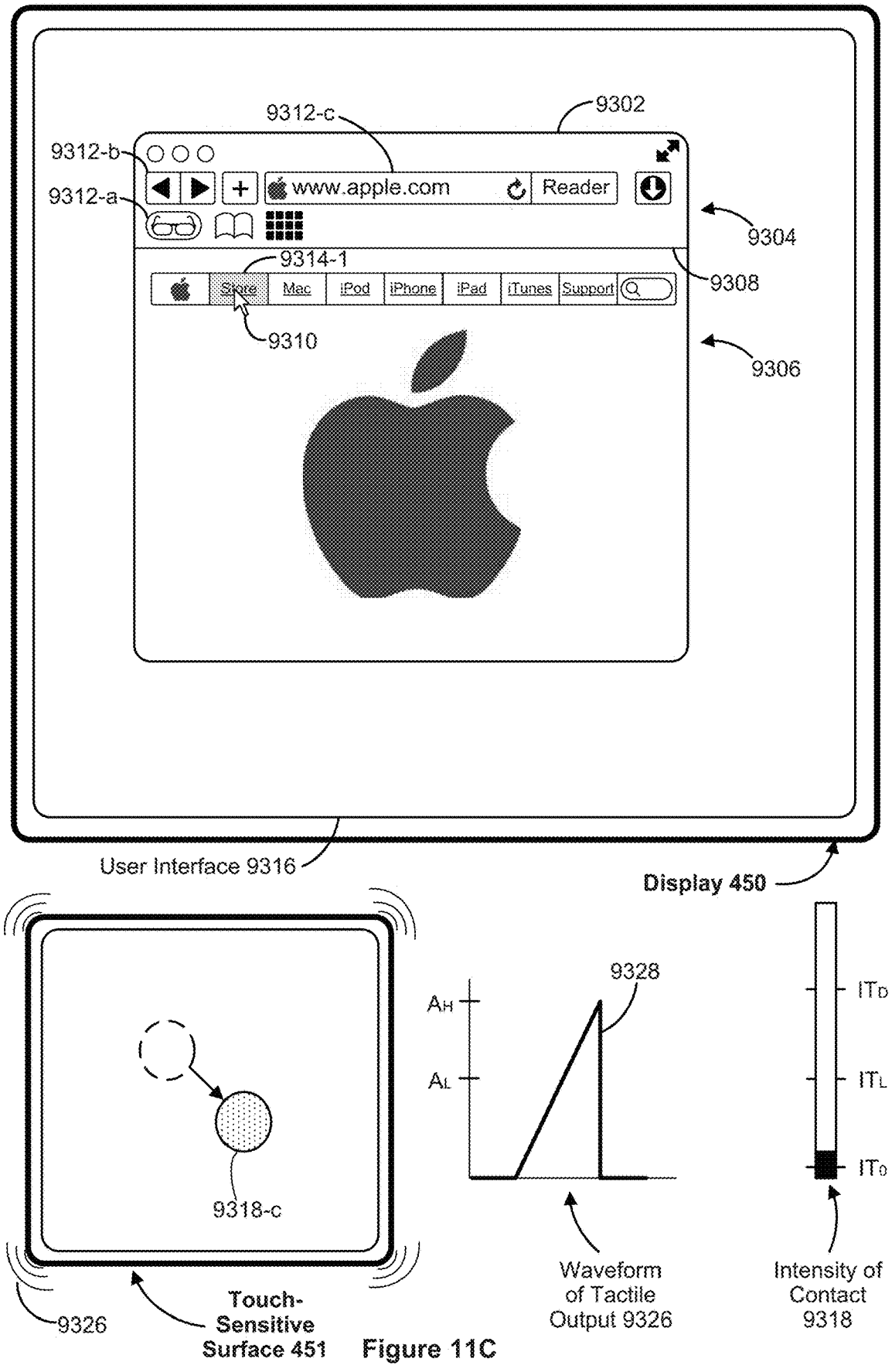

9312-c
9302
9312-b
9312-a
www.apple.com
Reader
9304
9314-1
9308
Store
Mac
iPod
iPhone
iPad
iTunes
Support
9310
9306
User Interface 9316
Display 450
9318-c
9326
Touch-Sensitive Surface 451
9328
AH
AL
Waveform of Tactile Output 9326
ITD
ITL
IT0
Intensity of Contact 9318

Figure 11C

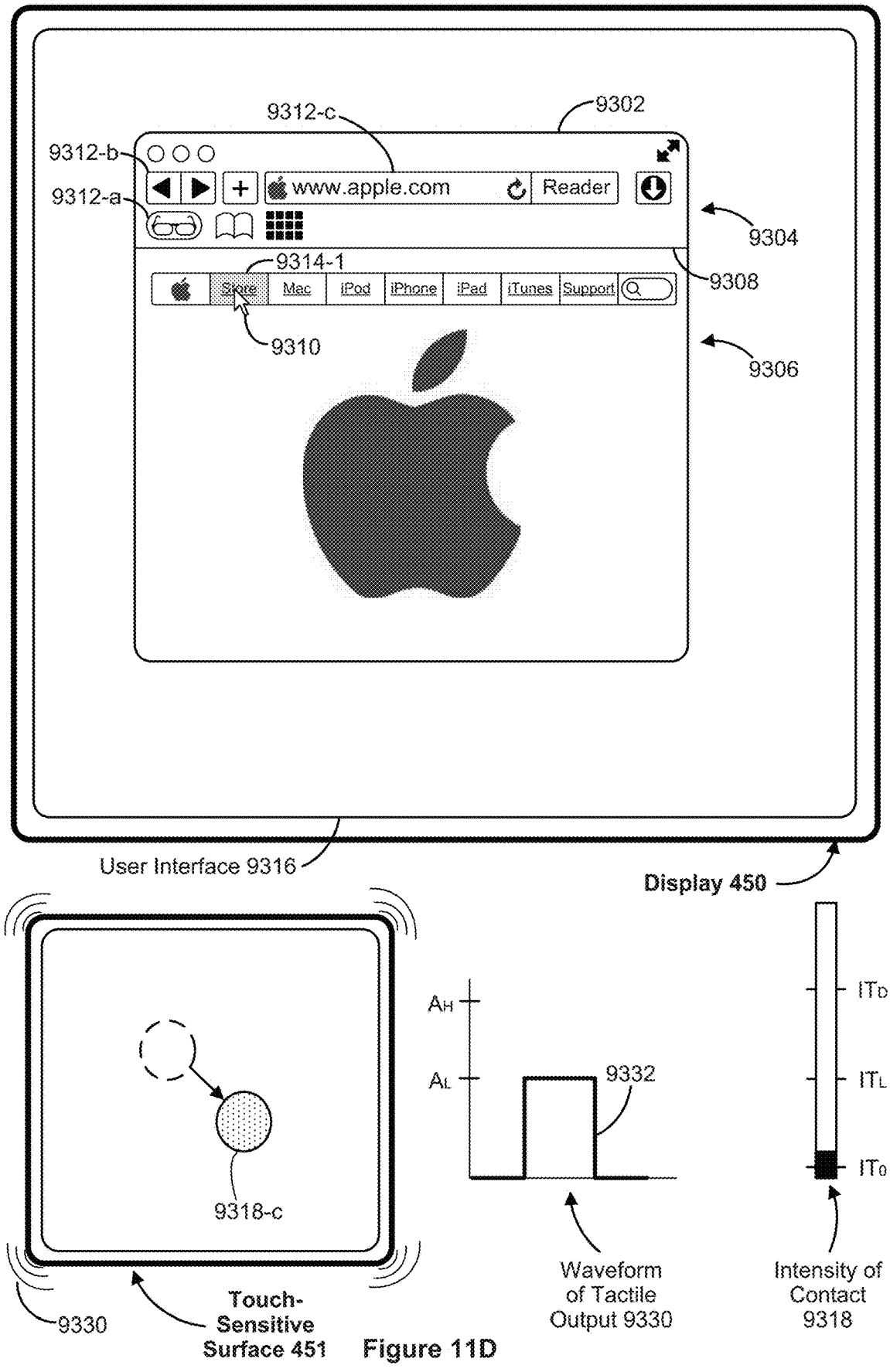

9312-c
9302
9312-b
9312-a
www.apple.com
Reader
9304
9314-1
9308
Store
Mac
iPod
iPhone
iPad
iTunes
Support
9310
9306
User Interface 9316
Display 450
9318-c
9330
Touch-Sensitive Surface 451
AH
AL
9332
Waveform of Tactile Output 9330
ITD
ITL
IT0
Intensity of Contact 9318

Figure 11D

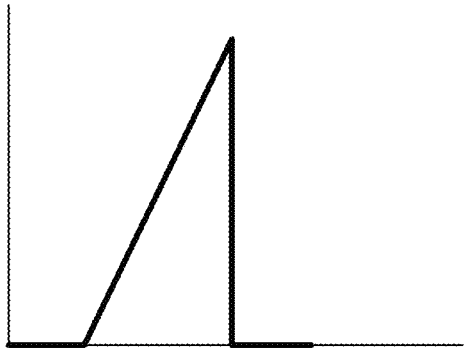


Figure 11E

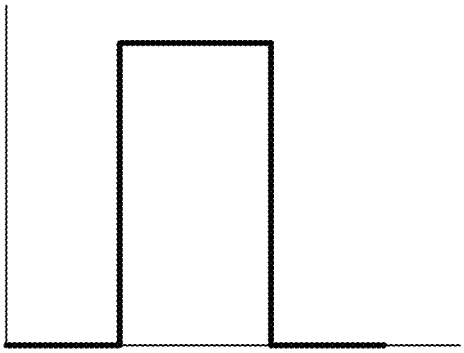


Figure 11F

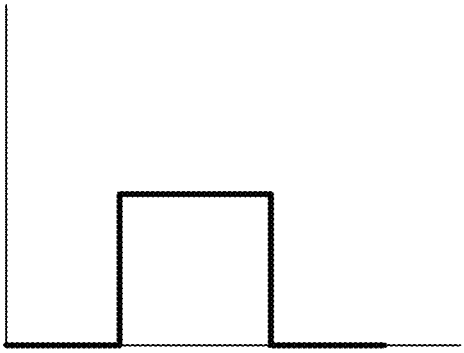


Figure 11G

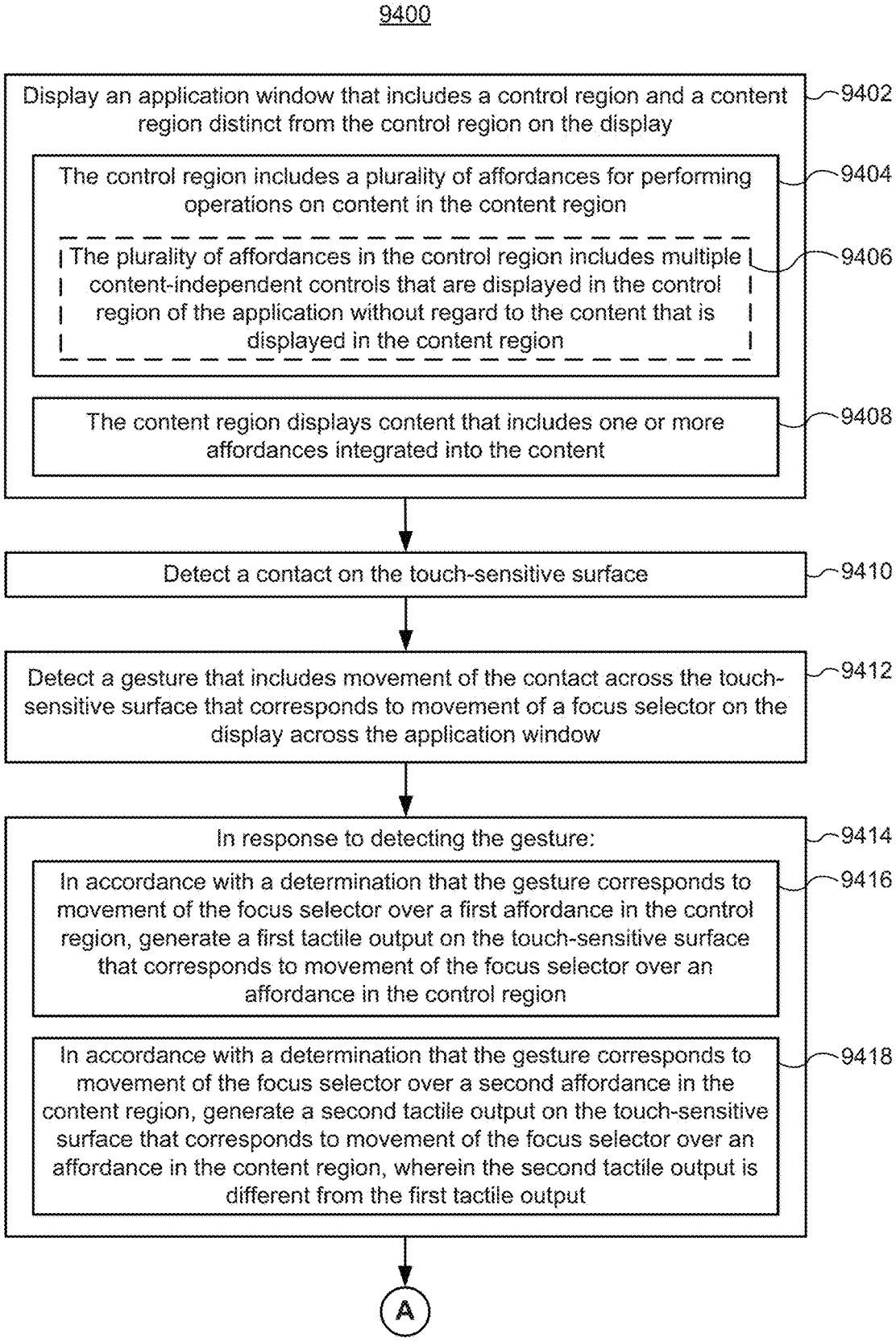

9400
Display an application window that includes a control region and a content region distinct from the control region on the display
9402
The control region includes a plurality of affordances for performing operations on content in the content region
9404
The plurality of affordances in the control region includes multiple content-independent controls that are displayed in the control region of the application without regard to the content that is displayed in the content region
9406
The content region displays content that includes one or more affordances integrated into the content
9408
Detect a contact on the touch-sensitive surface
9410
Detect a gesture that includes movement of the contact across the touch-sensitive surface that corresponds to movement of a focus selector on the display across the application window
9412
In response to detecting the gesture:
9414
In accordance with a determination that the gesture corresponds to movement of the focus selector over a first affordance in the control region, generate a first tactile output on the touch-sensitive surface that corresponds to movement of the focus selector over an affordance in the control region
9416
In accordance with a determination that the gesture corresponds to movement of the focus selector over a second affordance in the content region, generate a second tactile output on the touch-sensitive surface that corresponds to movement of the focus selector over an affordance in the content region, wherein the second tactile output is different from the first tactile output
9418
A

Figure 12A

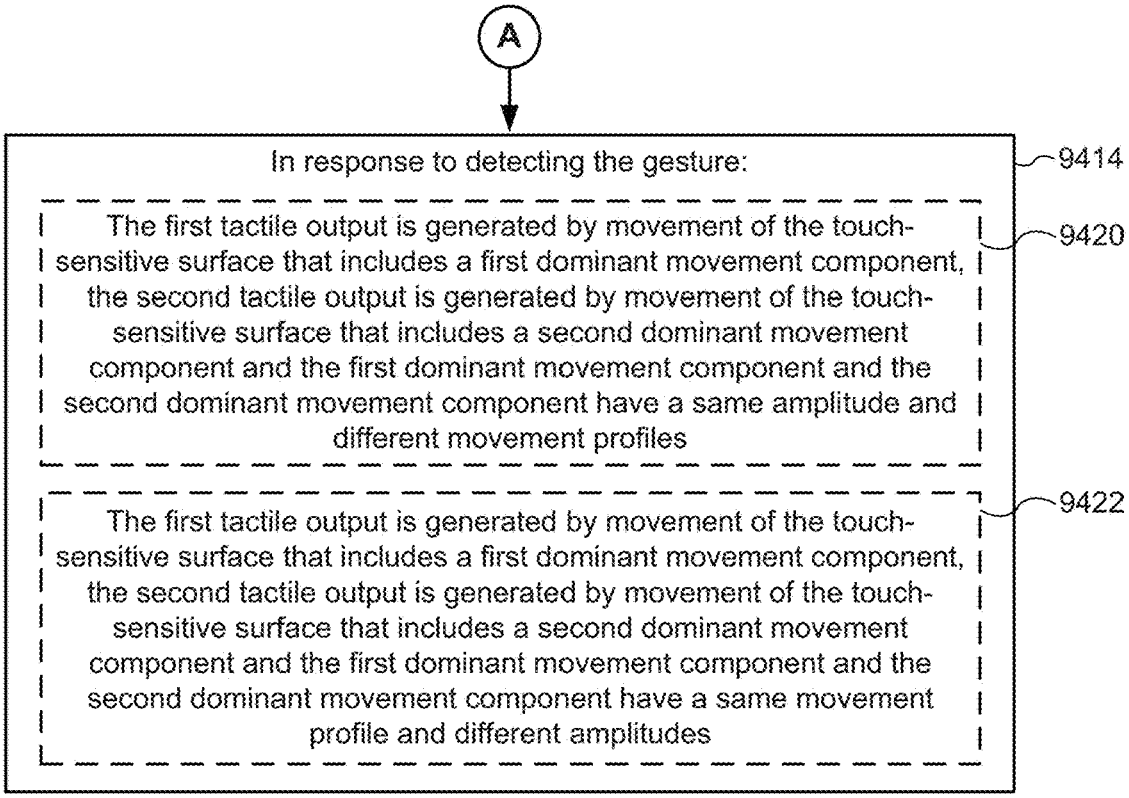

A
In response to detecting the gesture:
9414
The first tactile output is generated by movement of the touch-sensitive surface that includes a first dominant movement component, the second tactile output is generated by movement of the touch-sensitive surface that includes a second dominant movement component and the first dominant movement component and the second dominant movement component have a same amplitude and different movement profiles
9420
The first tactile output is generated by movement of the touch-sensitive surface that includes a first dominant movement component, the second tactile output is generated by movement of the touch-sensitive surface that includes a second dominant movement component and the first dominant movement component and the second dominant movement component have a same movement profile and different amplitudes
9422

Figure 12B

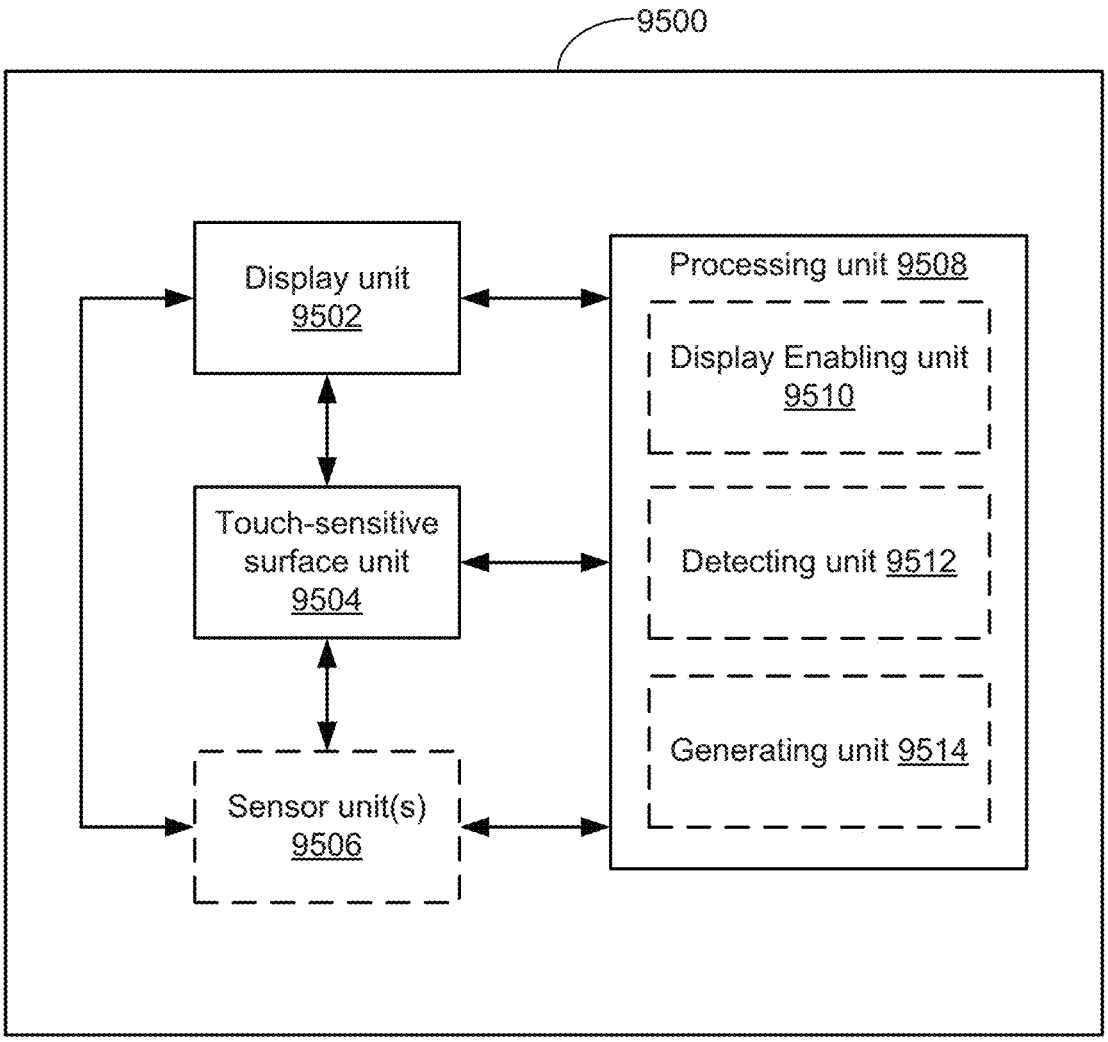

9500
Display unit 9502
Touch-sensitive surface unit 9504
Sensor unit(s) 9506
Processing unit 9508
Display Enabling unit 9510
Detecting unit 9512
Generating unit 9514

Figure 13

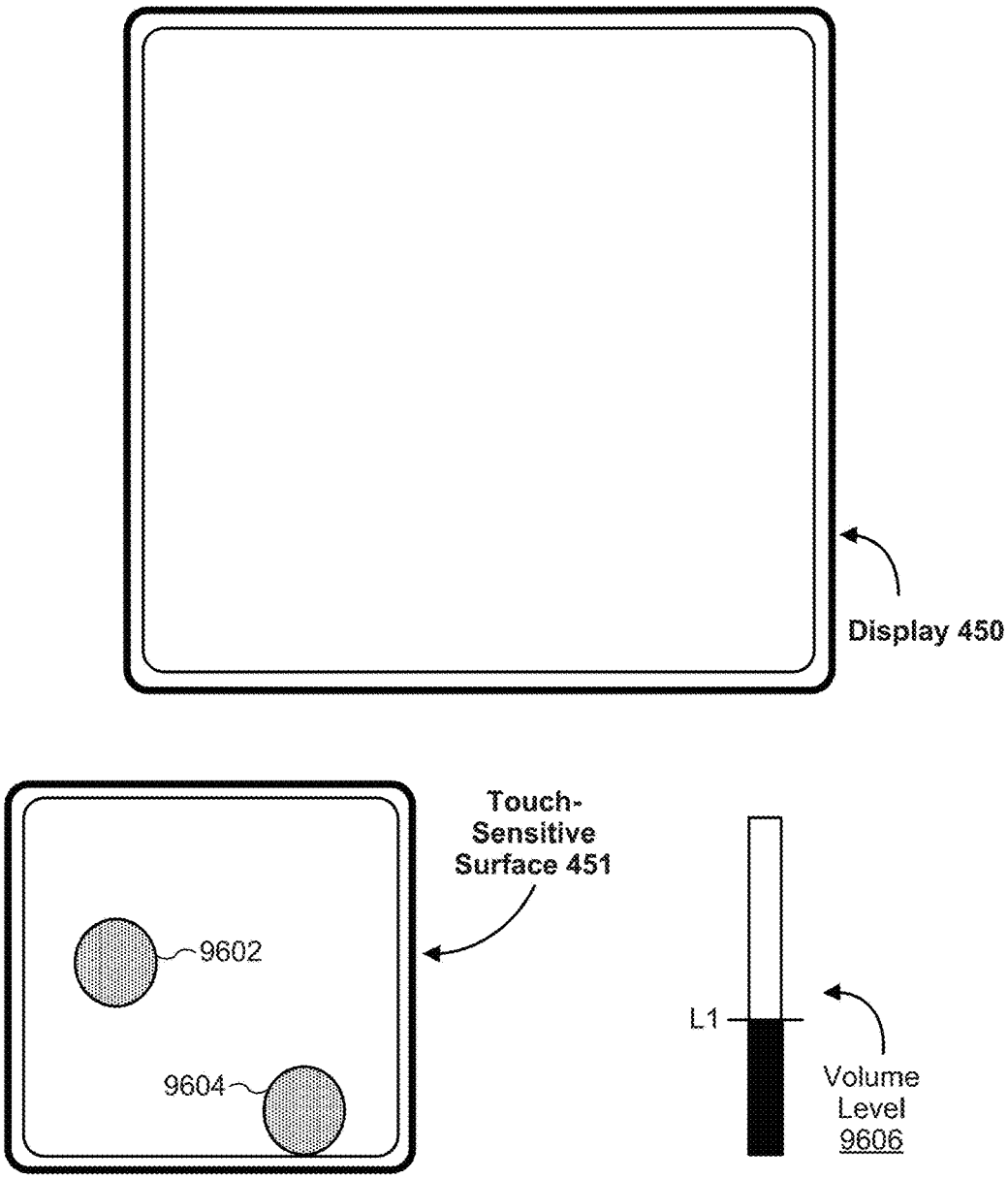

Display 450
Touch-Sensitive Surface 451
9602
9604
L1
Volume Level 9606

Figure 14A

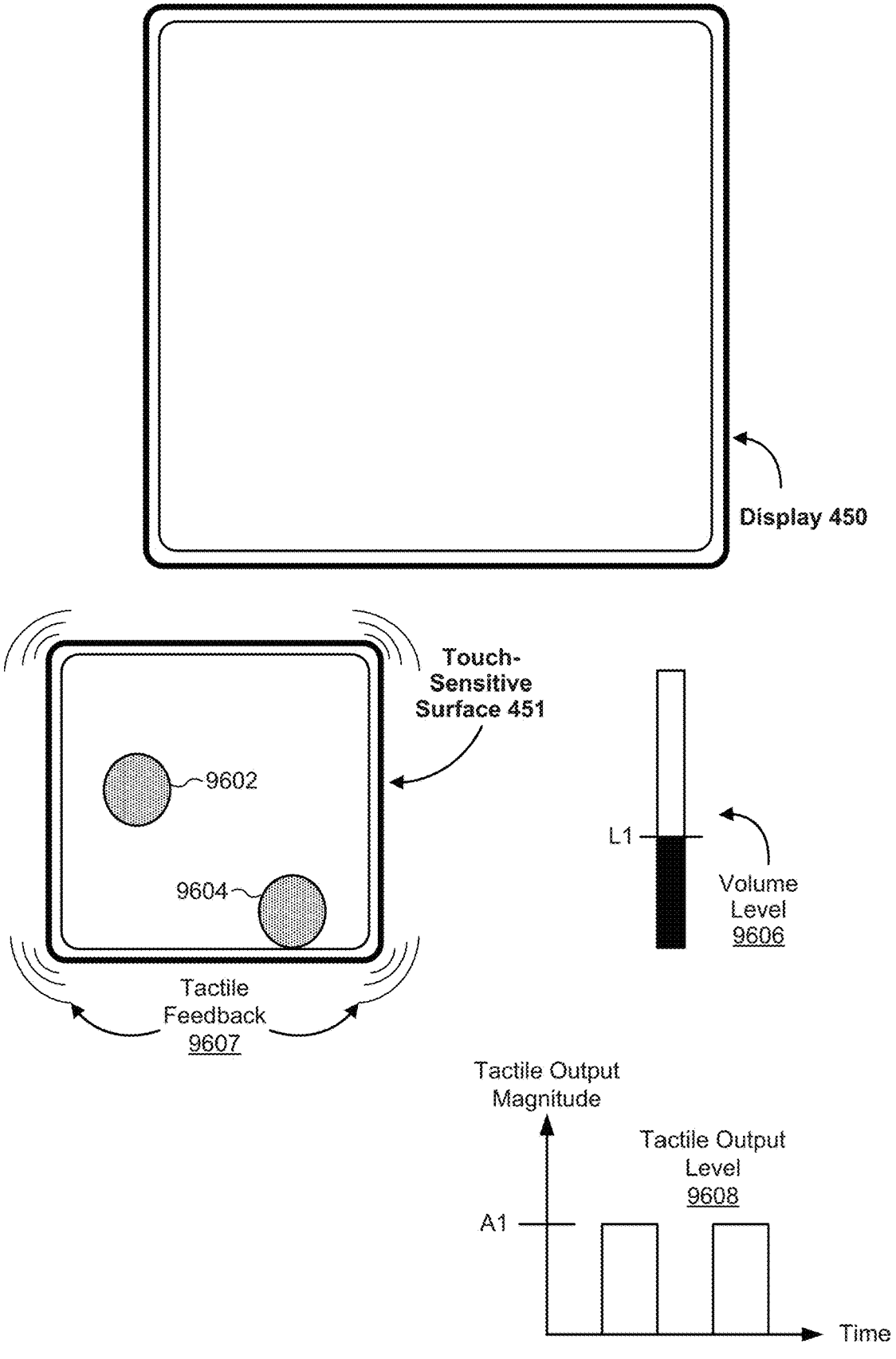

Display 450
Touch-Sensitive Surface 451
9602
9604
Tactile Feedback 9607
L1
Volume Level 9606
Tactile Output Magnitude
Tactile Output Level 9608
A1
Time

Figure 14B

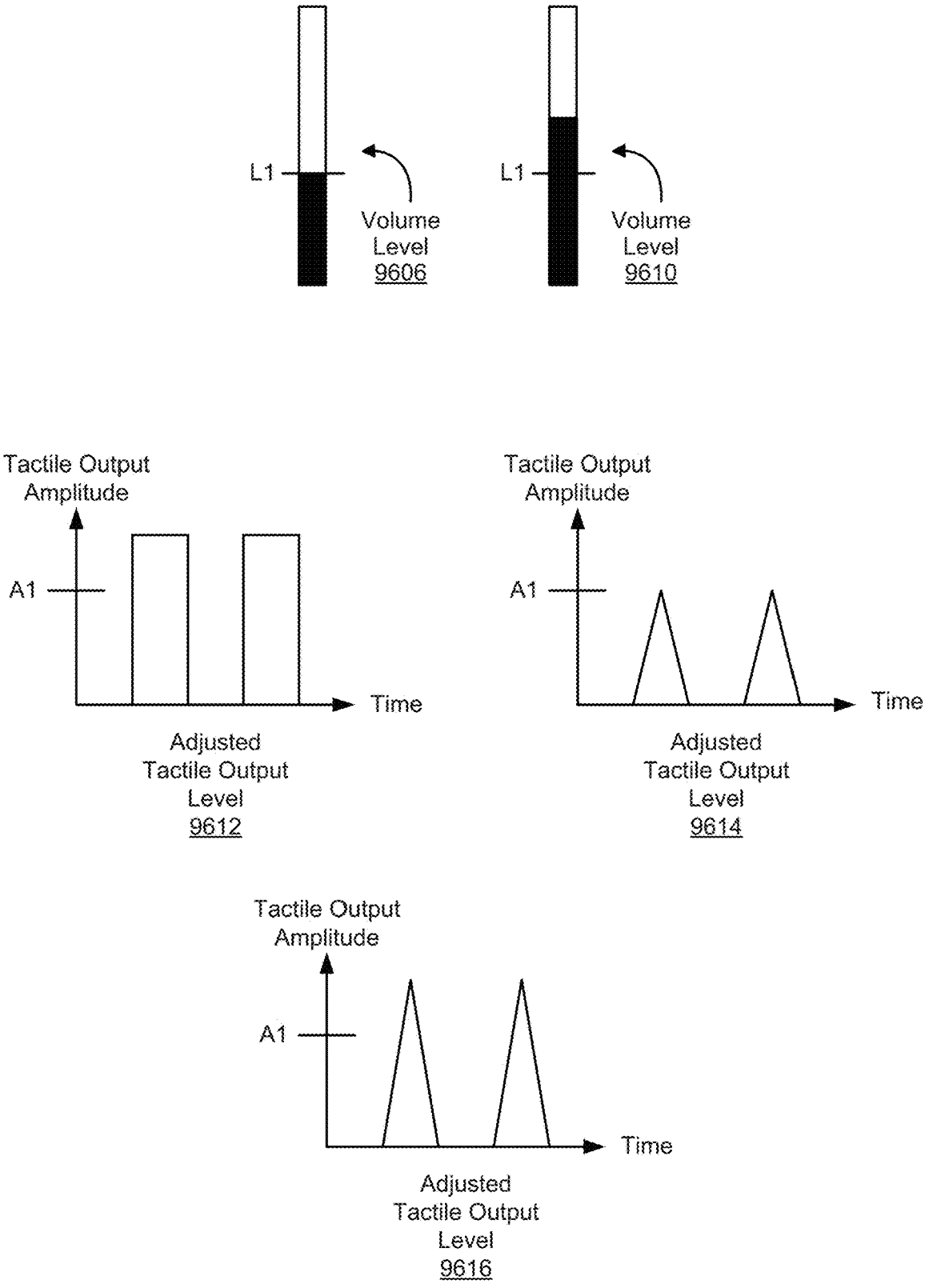

L1
Volume Level 9606
L1
Volume Level 9610
Tactile Output Amplitude
A1
Time
Adjusted Tactile Output Level 9612
Tactile Output Amplitude
A1
Time
Adjusted Tactile Output Level 9614
Tactile Output Amplitude
A1
Time
Adjusted Tactile Output Level 9616

Figure 14C

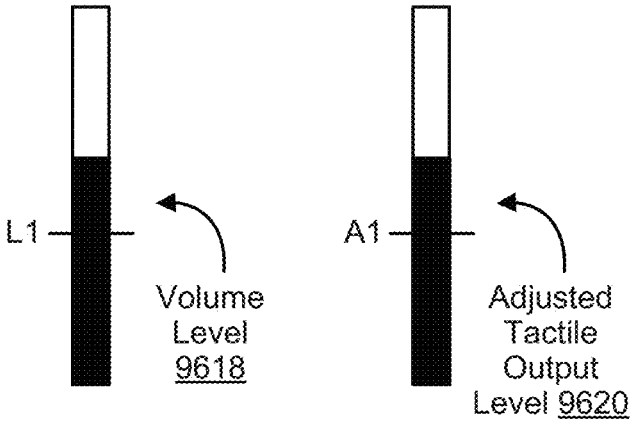


Figure 14D

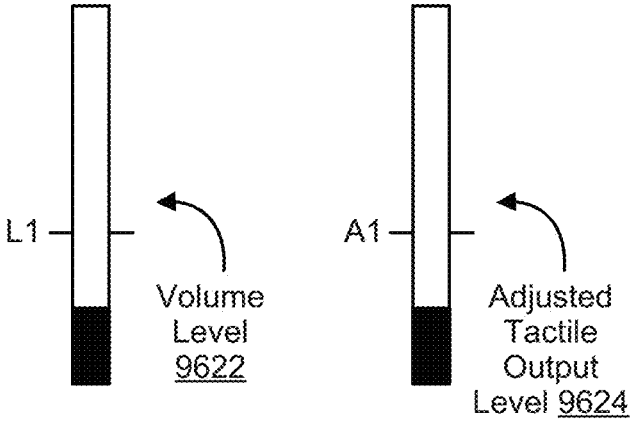


Figure 14E

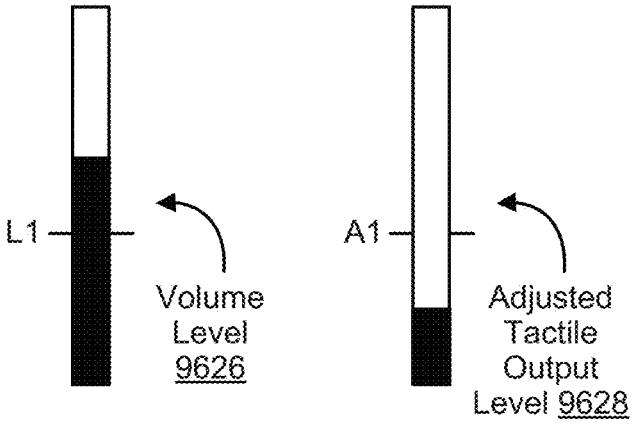


Figure 14F

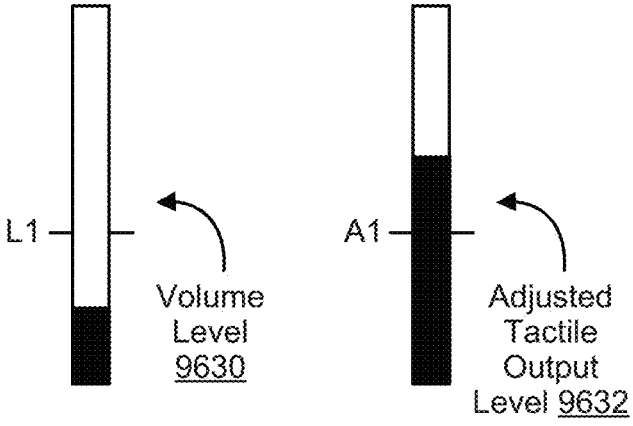


Figure 14G

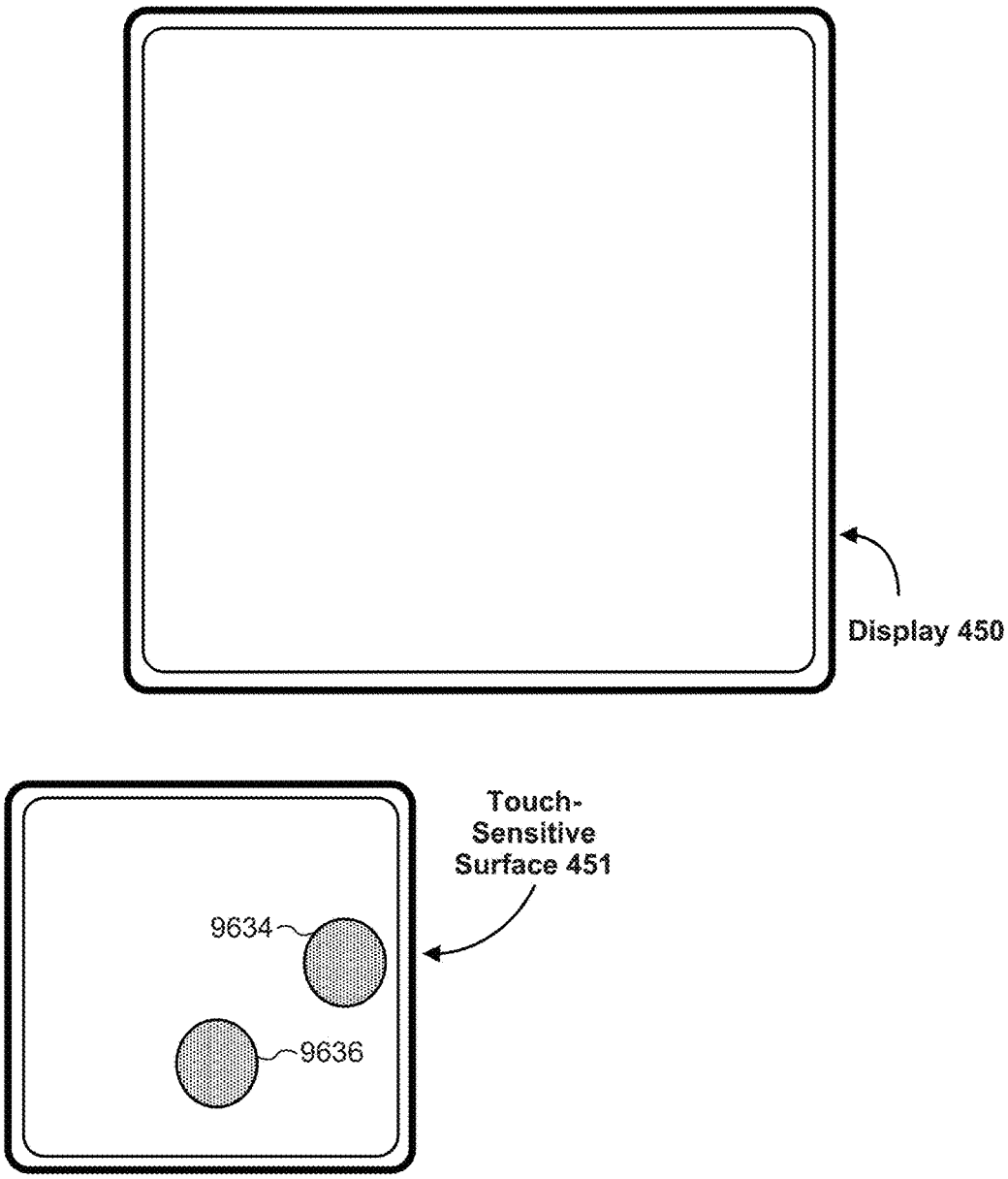


Figure 14H

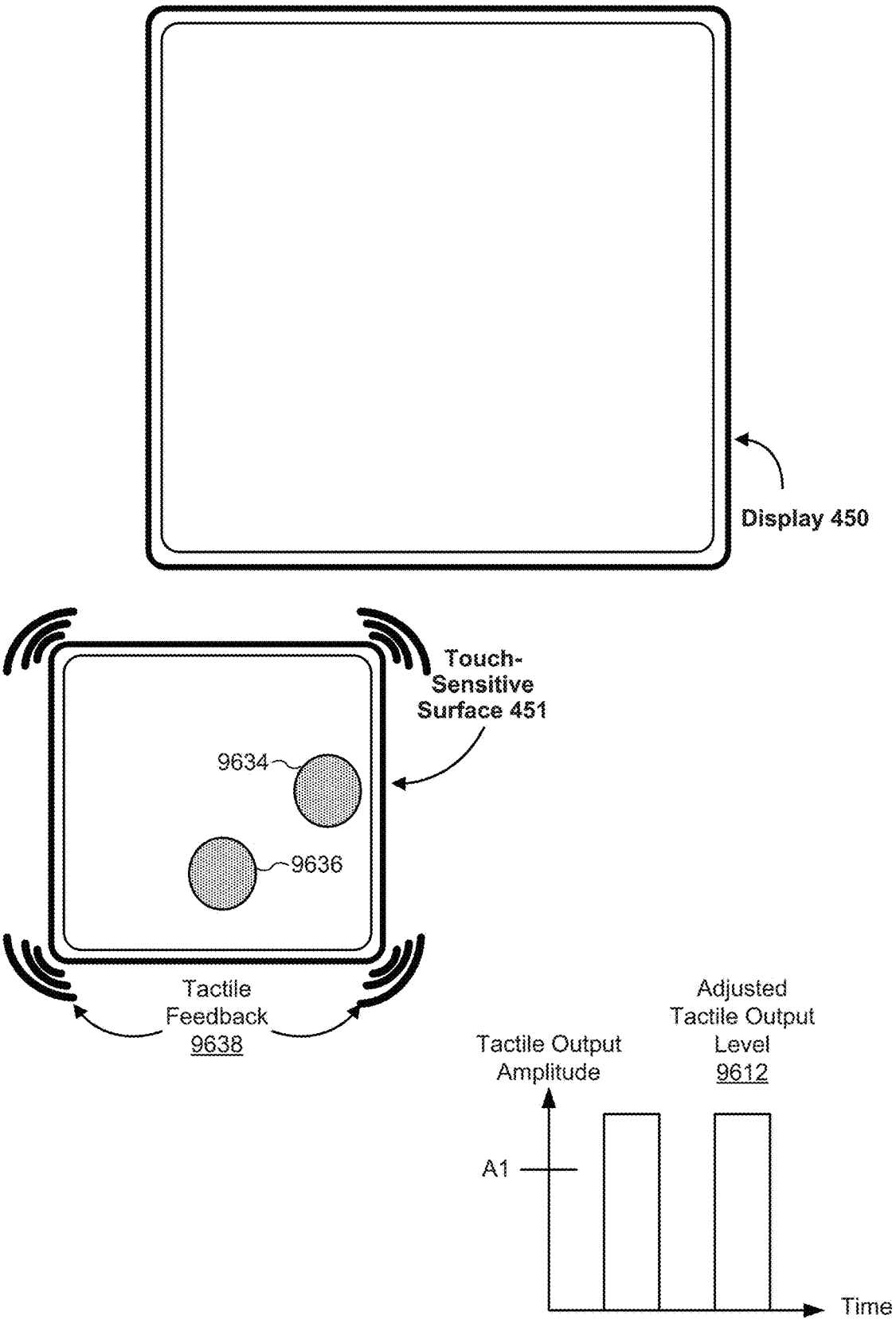

Display 450
Touch-Sensitive Surface 451
9634
9636
Tactile Feedback 9638
Adjusted Tactile Output Level 9612
Tactile Output Amplitude
A1
Time

Figure 14I

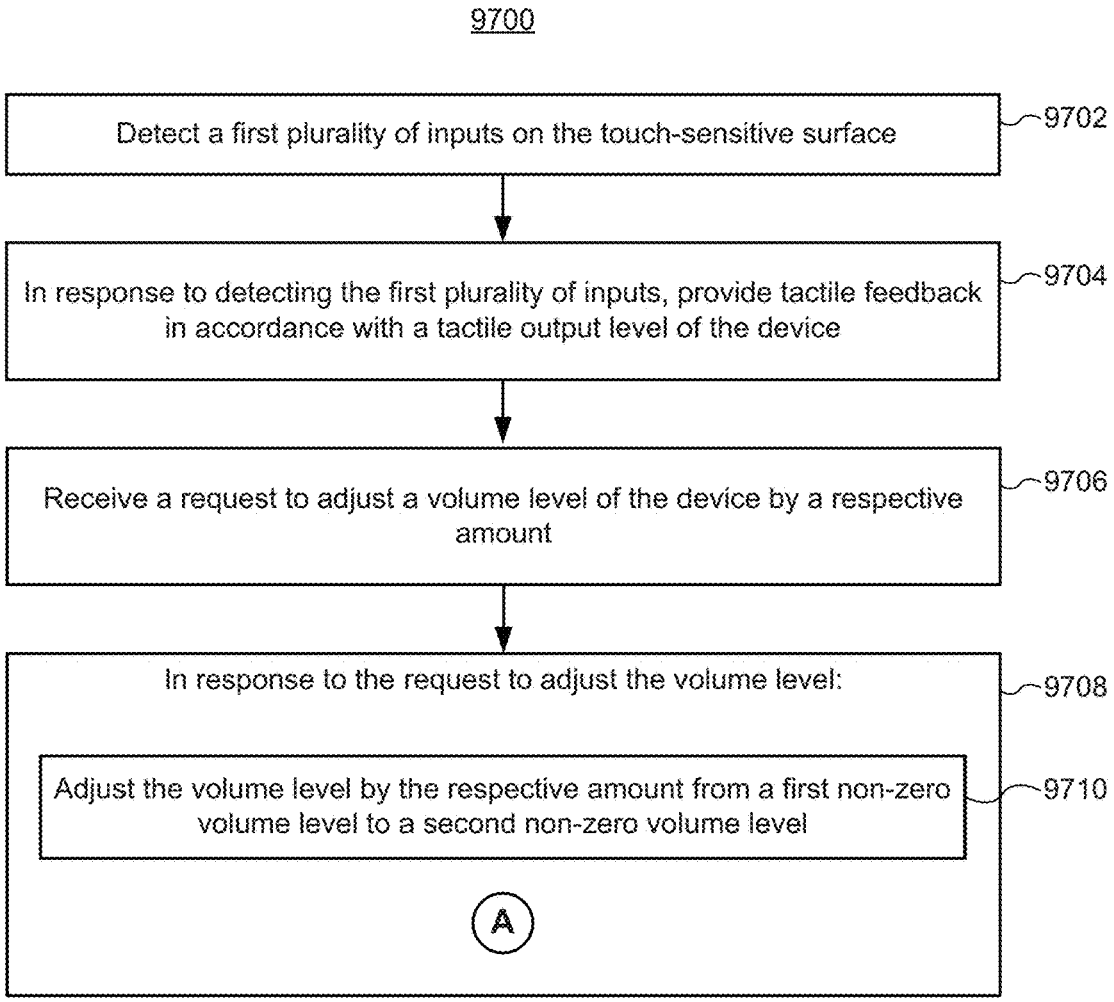

9700
Detect a first plurality of inputs on the touch-sensitive surface
9702
In response to detecting the first plurality of inputs, provide tactile feedback in accordance with a tactile output level of the device
9704
Receive a request to adjust a volume level of the device by a respective amount
9706
In response to the request to adjust the volume level:
9708
Adjust the volume level by the respective amount from a first non-zero volume level to a second non-zero volume level
9710
A

Figure 15A

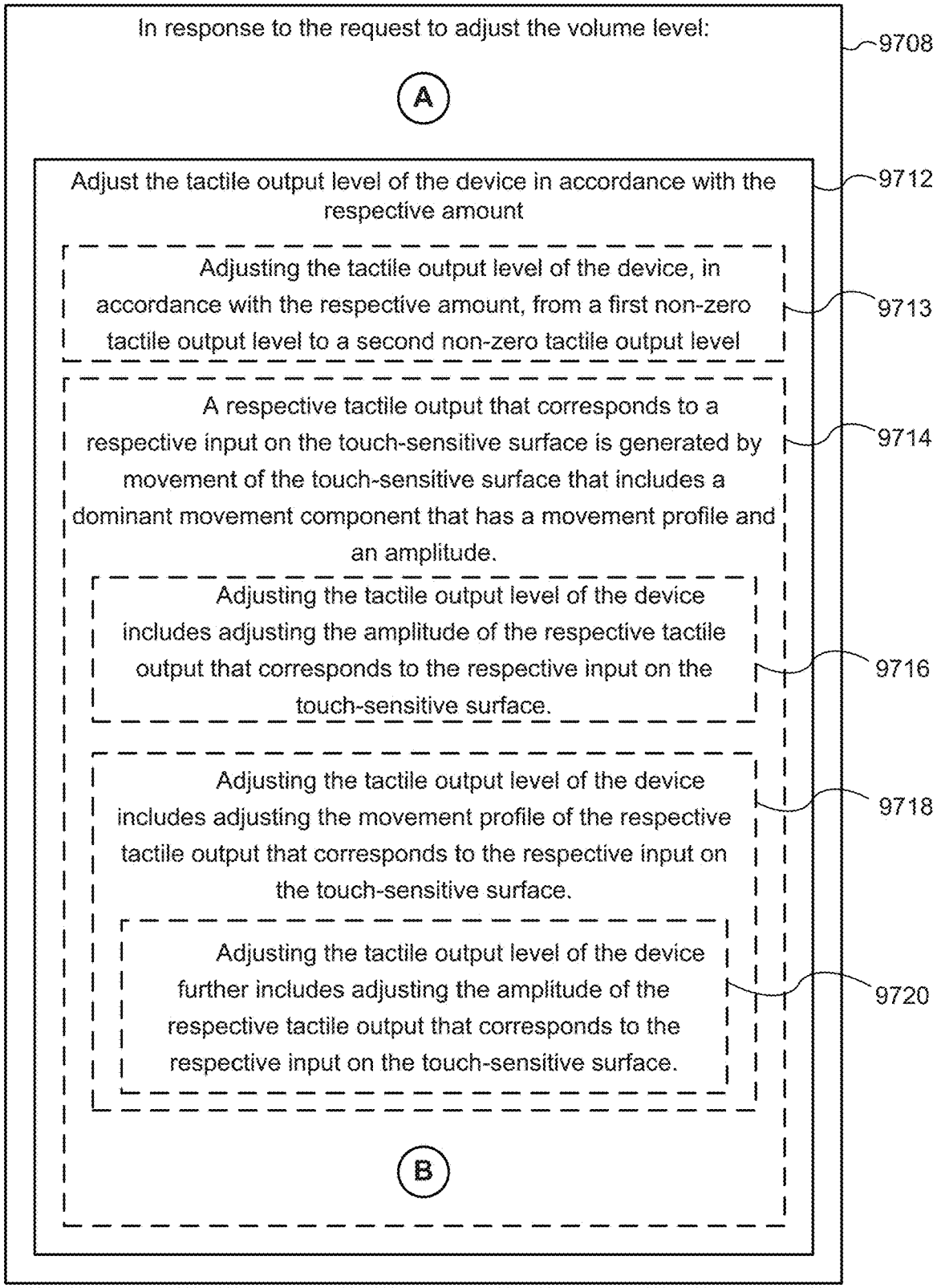

In response to the request to adjust the volume level:
9708
A
Adjust the tactile output level of the device in accordance with the respective amount
9712
Adjusting the tactile output level of the device, in accordance with the respective amount, from a first non-zero tactile output level to a second non-zero tactile output level
9713
A respective tactile output that corresponds to a respective input on the touch-sensitive surface is generated by movement of the touch-sensitive surface that includes a dominant movement component that has a movement profile and an amplitude.
9714
Adjusting the tactile output level of the device includes adjusting the amplitude of the respective tactile output that corresponds to the respective input on the touch-sensitive surface.
9716
Adjusting the tactile output level of the device includes adjusting the movement profile of the respective tactile output that corresponds to the respective input on the touch-sensitive surface.
9718
Adjusting the tactile output level of the device further includes adjusting the amplitude of the respective tactile output that corresponds to the respective input on the touch-sensitive surface.
9720
B

Figure 15B

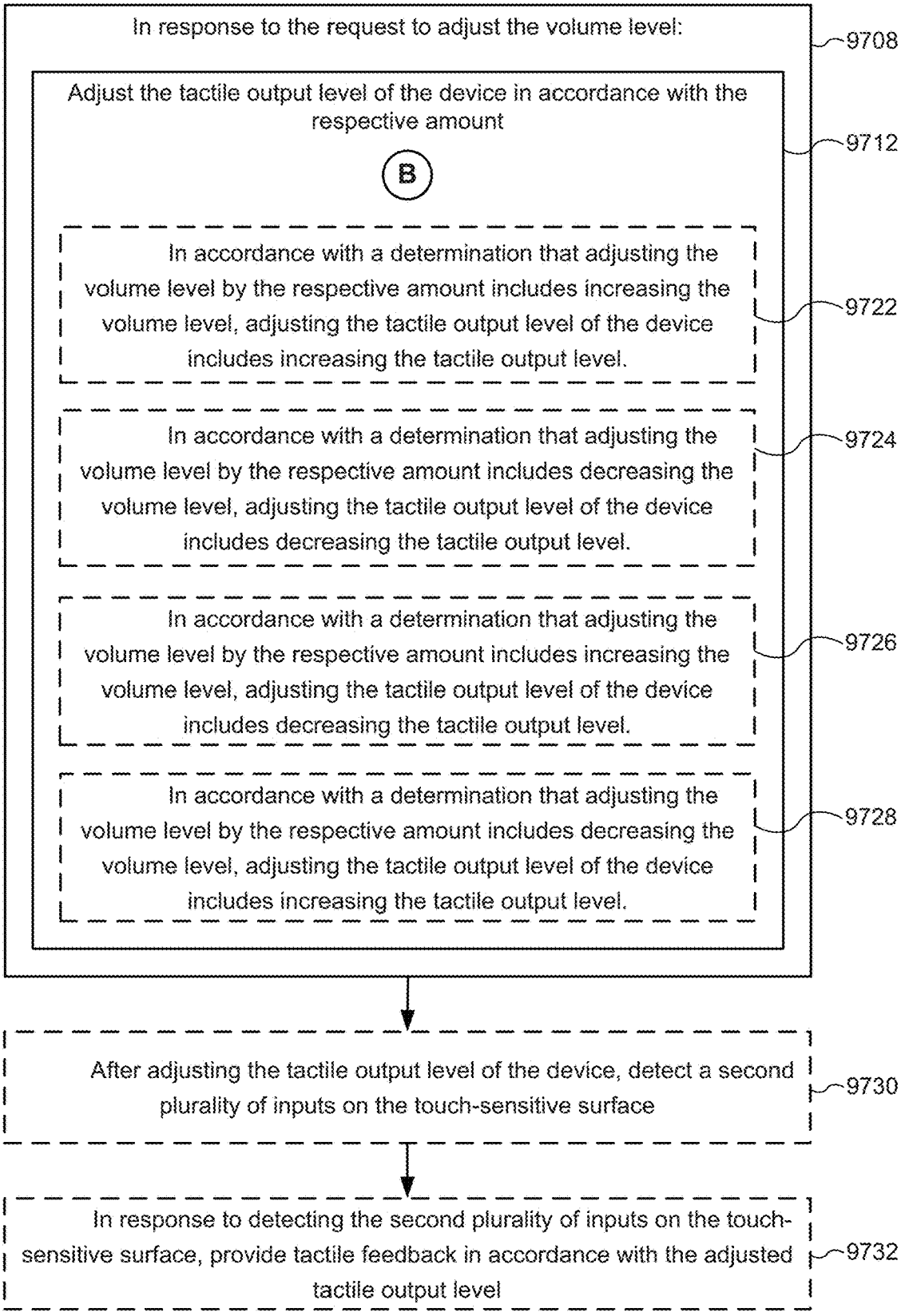

In response to the request to adjust the volume level:
9708
Adjust the tactile output level of the device in accordance with the respective amount
9712
B
In accordance with a determination that adjusting the volume level by the respective amount includes increasing the volume level, adjusting the tactile output level of the device includes increasing the tactile output level.
9722
In accordance with a determination that adjusting the volume level by the respective amount includes decreasing the volume level, adjusting the tactile output level of the device includes decreasing the tactile output level.
9724
In accordance with a determination that adjusting the volume level by the respective amount includes increasing the volume level, adjusting the tactile output level of the device includes decreasing the tactile output level.
9726
In accordance with a determination that adjusting the volume level by the respective amount includes decreasing the volume level, adjusting the tactile output level of the device includes increasing the tactile output level.
9728
After adjusting the tactile output level of the device, detect a second plurality of inputs on the touch-sensitive surface
9730
In response to detecting the second plurality of inputs on the touch-sensitive surface, provide tactile feedback in accordance with the adjusted tactile output level
9732

Figure 15C

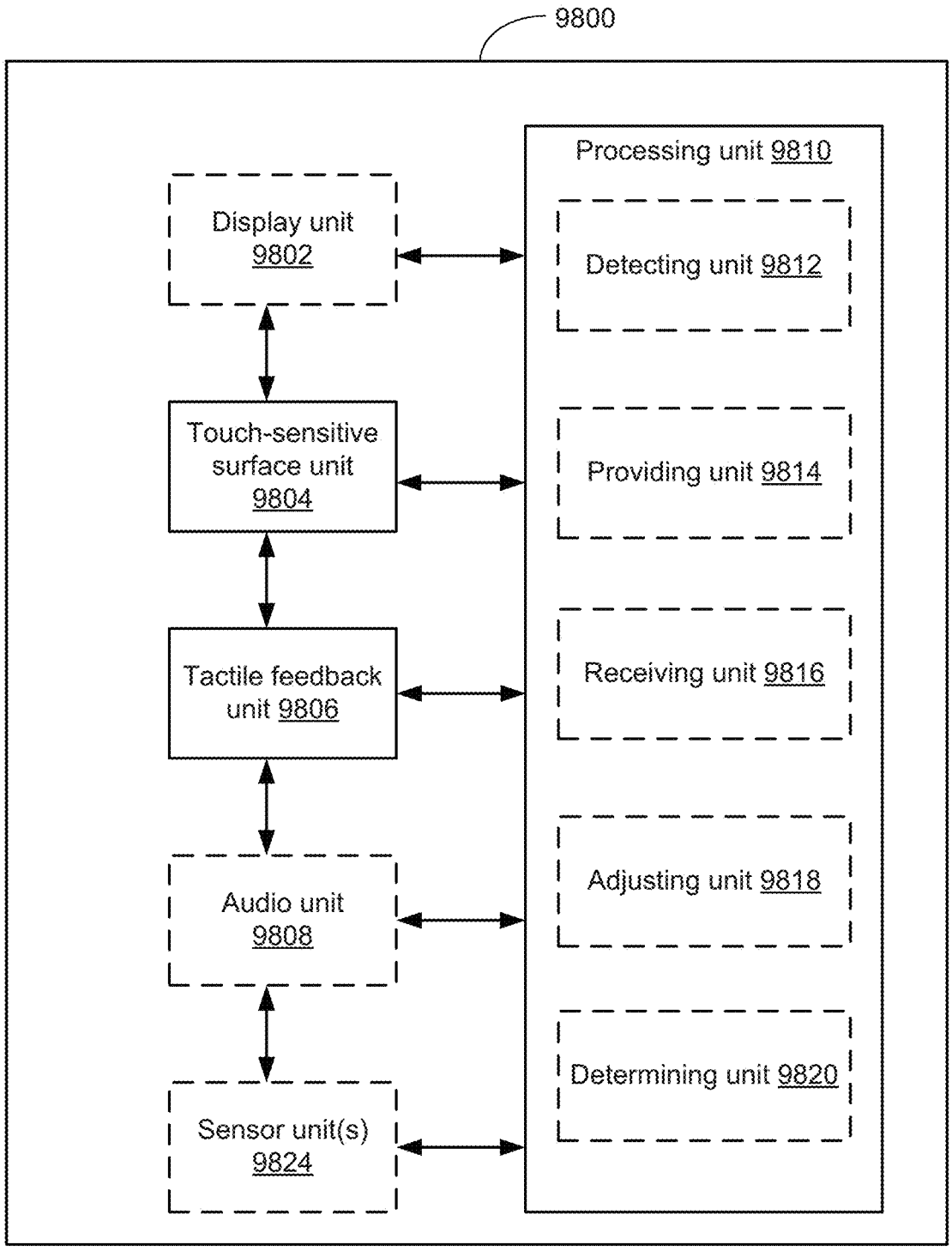

9800
Processing unit 9810
Display unit 9802
Detecting unit 9812
Touch-sensitive surface unit 9804
Providing unit 9814
Tactile feedback unit 9806
Receiving unit 9816
Audio unit 9808
Adjusting unit 9818
Determining unit 9820
Sensor unit(s) 9824

Figure 16

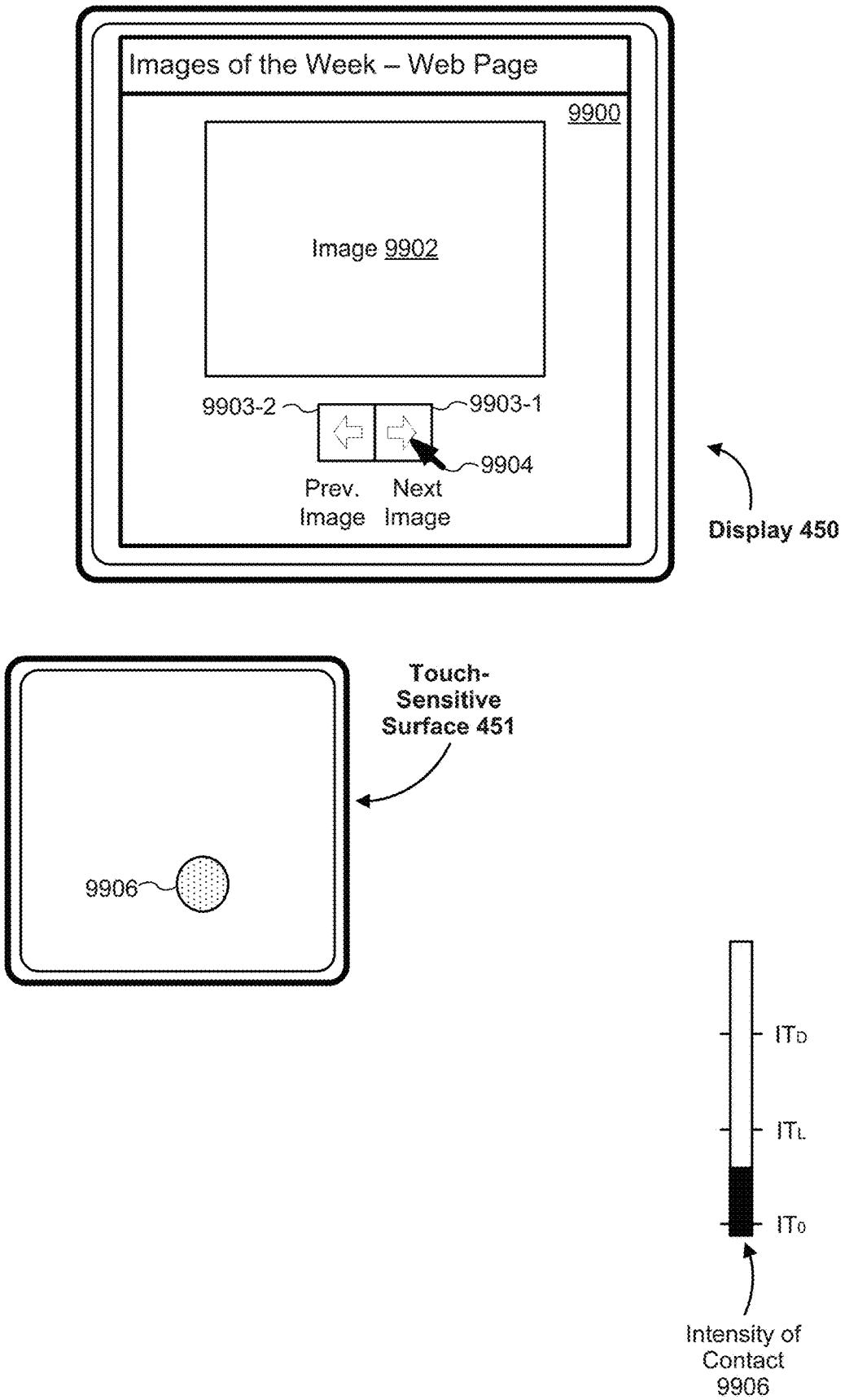

Images of the Week – Web Page
9900
Image 9902
9903-2
9903-1
9904
Prev. Image
Next Image
Display 450
Touch-Sensitive Surface 451
9906
ITD
ITL
ITD
Intensity of Contact 9906

Figure 17A

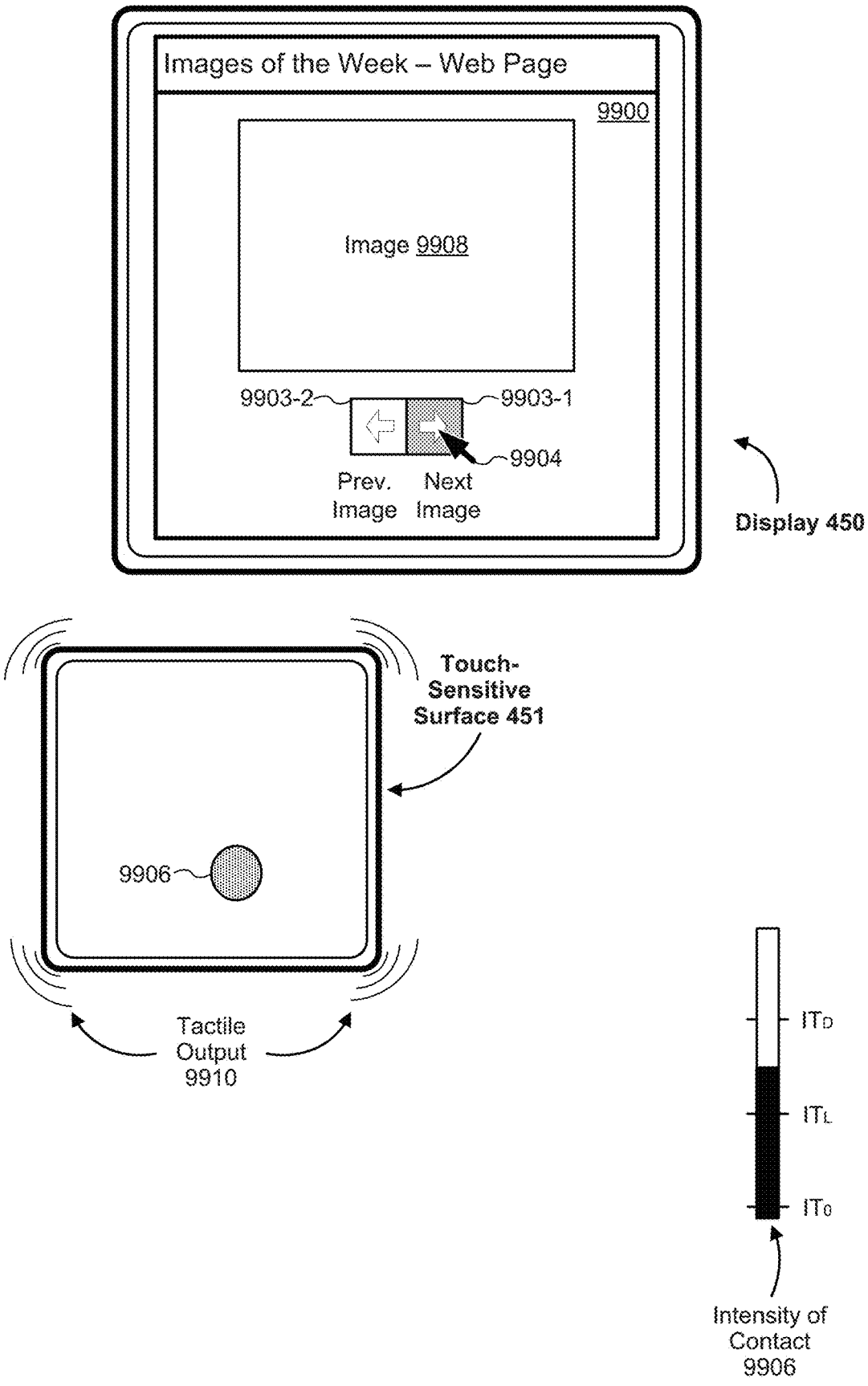
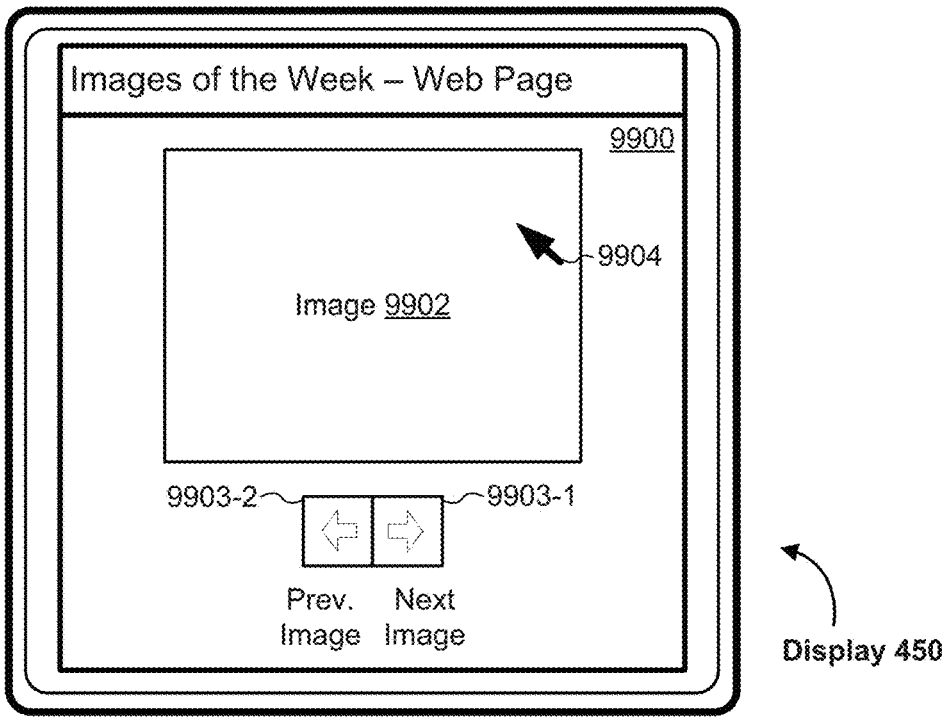
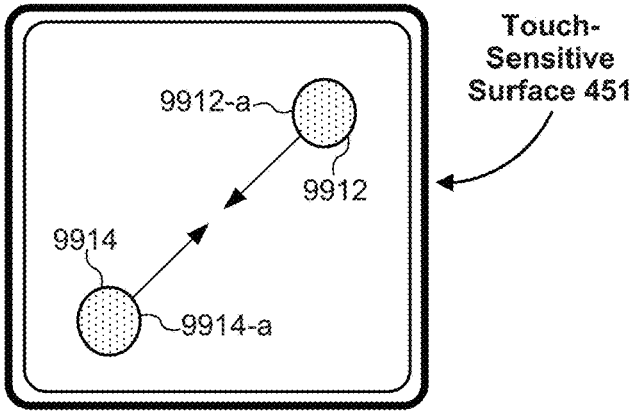

Images of the Week – Web Page
9900
Image 9908
9903-2
9903-1
9904
Prev. Image
Next Image
Display 450
Touch-Sensitive Surface 451
9906
Tactile Output 9910
ITD
ITL
IT0
Intensity of Contact 9906

Figure 17B


Images of the Week – Web Page
9900
9904
Image 9902
9903-2
9903-1
Prev. Image
Next Image
Display 450


Touch-Sensitive Surface 451
9912-a
9912
9914
9914-a

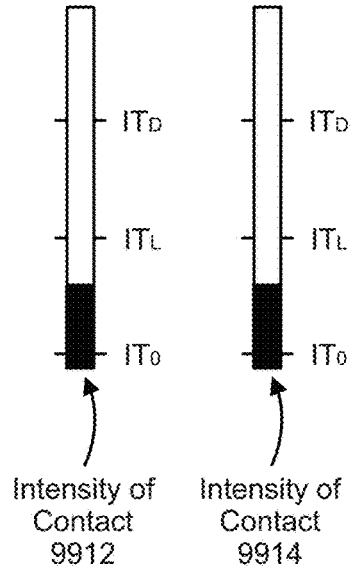
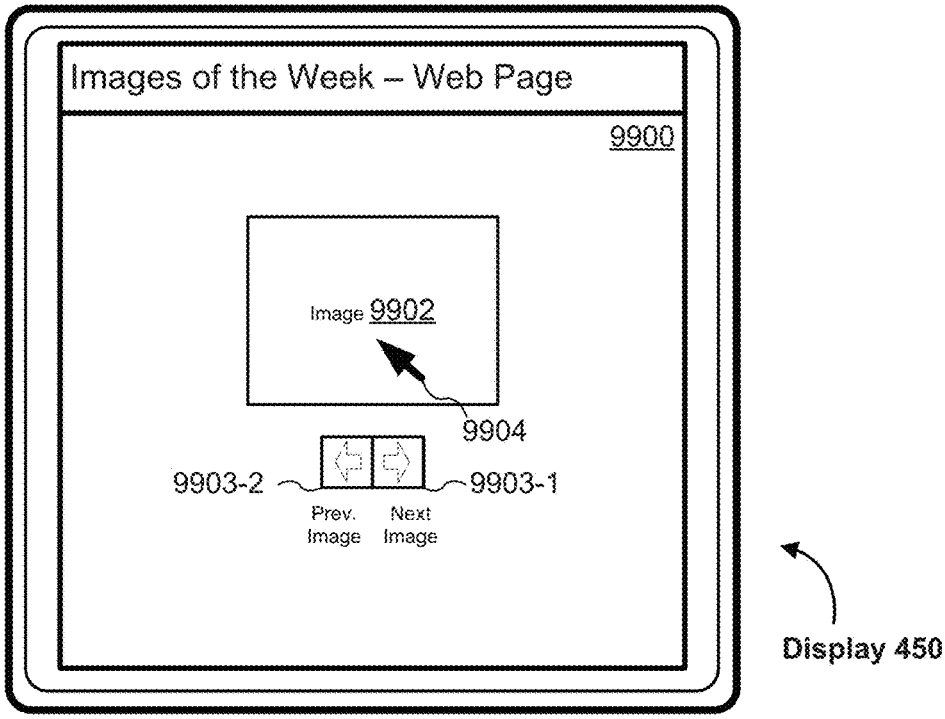
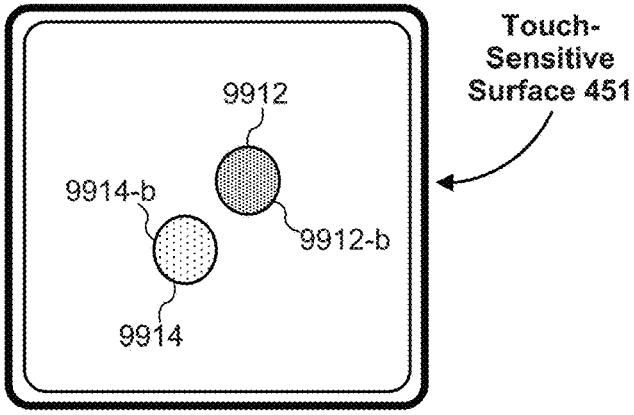

ITD
ITL
IT0
ITD
ITL
IT0
Intensity of Contact 9912
Intensity of Contact 9914

Figure 17C


Images of the Week – Web Page
9900
Image 9902
9904
9903-2
9903-1
Prev. Image
Next Image
Display 450


Touch-Sensitive Surface 451
9912
9914-b
9912-b
9914

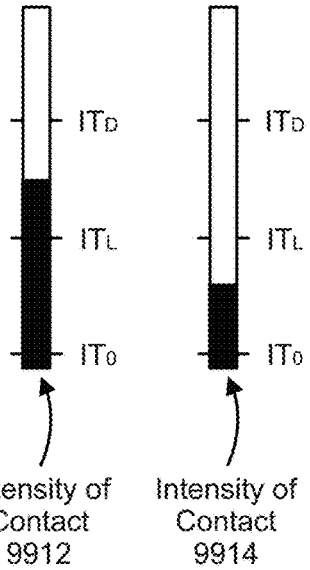

ITD
ITL
IT0
ITD
ITL
IT0
Intensity of Contact 9912
Intensity of Contact 9914

Figure 17D

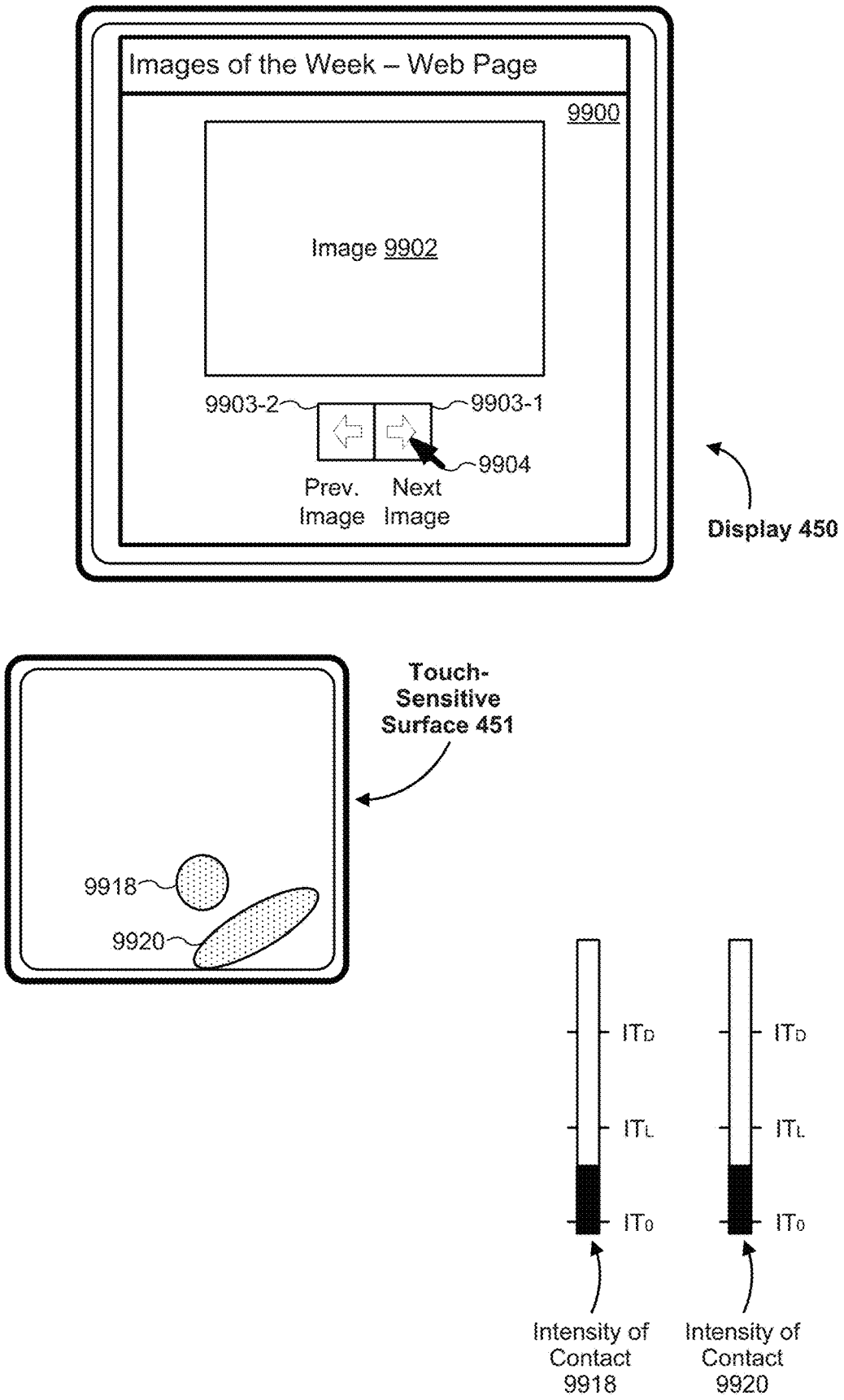

Images of the Week – Web Page
9900
Image 9902
9903-2
9903-1
9904
Prev. Image
Next Image
Display 450
Touch-Sensitive Surface 451
9918
9920
ITD
ITL
IT0
Intensity of Contact 9918
Intensity of Contact 9920

Figure 17E

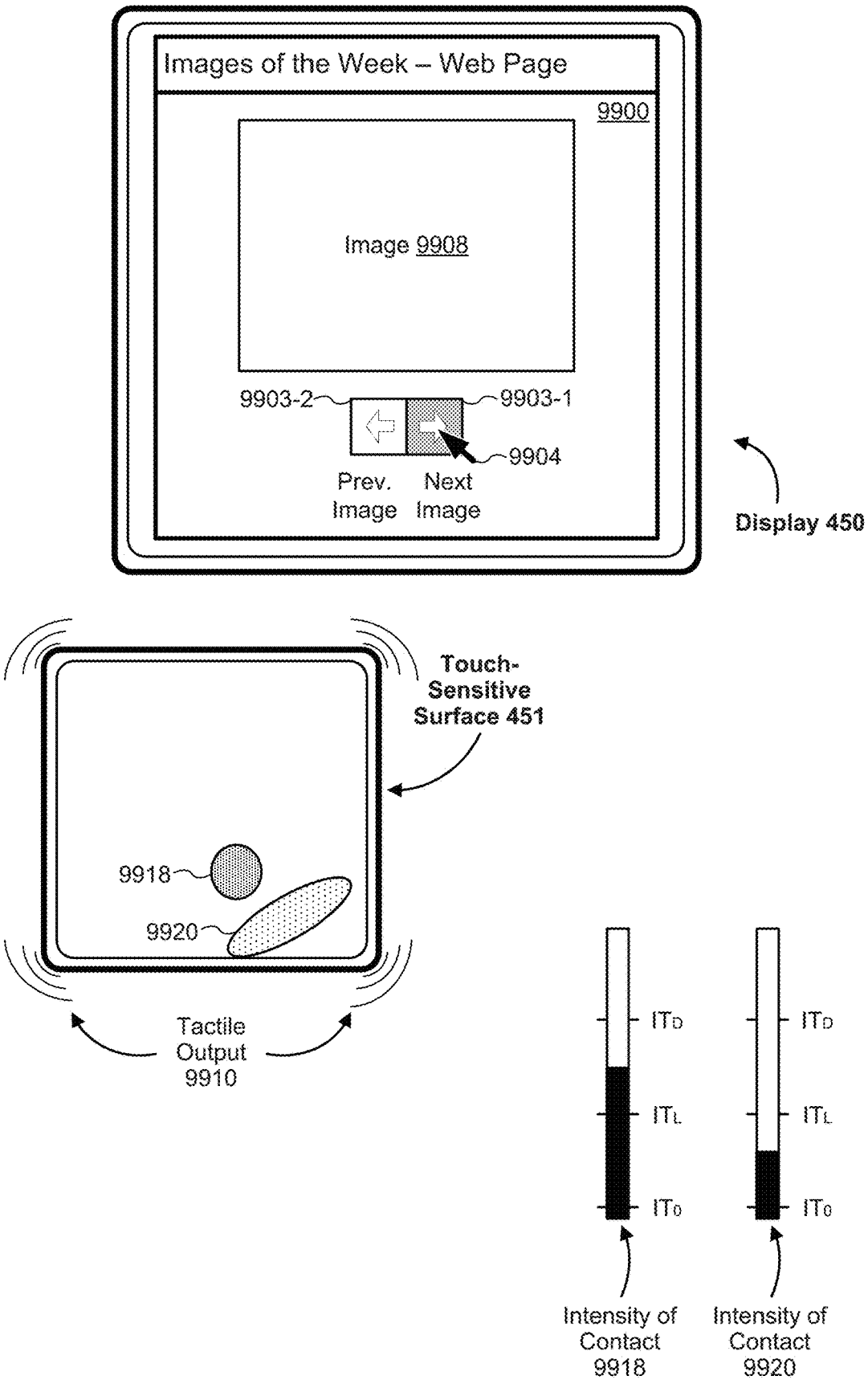

Images of the Week – Web Page
9900
Image 9908
9903-2
9903-1
9904
Prev. Image
Next Image
Display 450
Touch-Sensitive Surface 451
9918
9920
Tactile Output 9910
ITD
ITL
IT0
Intensity of Contact 9918
Intensity of Contact 9920

Figure 17F

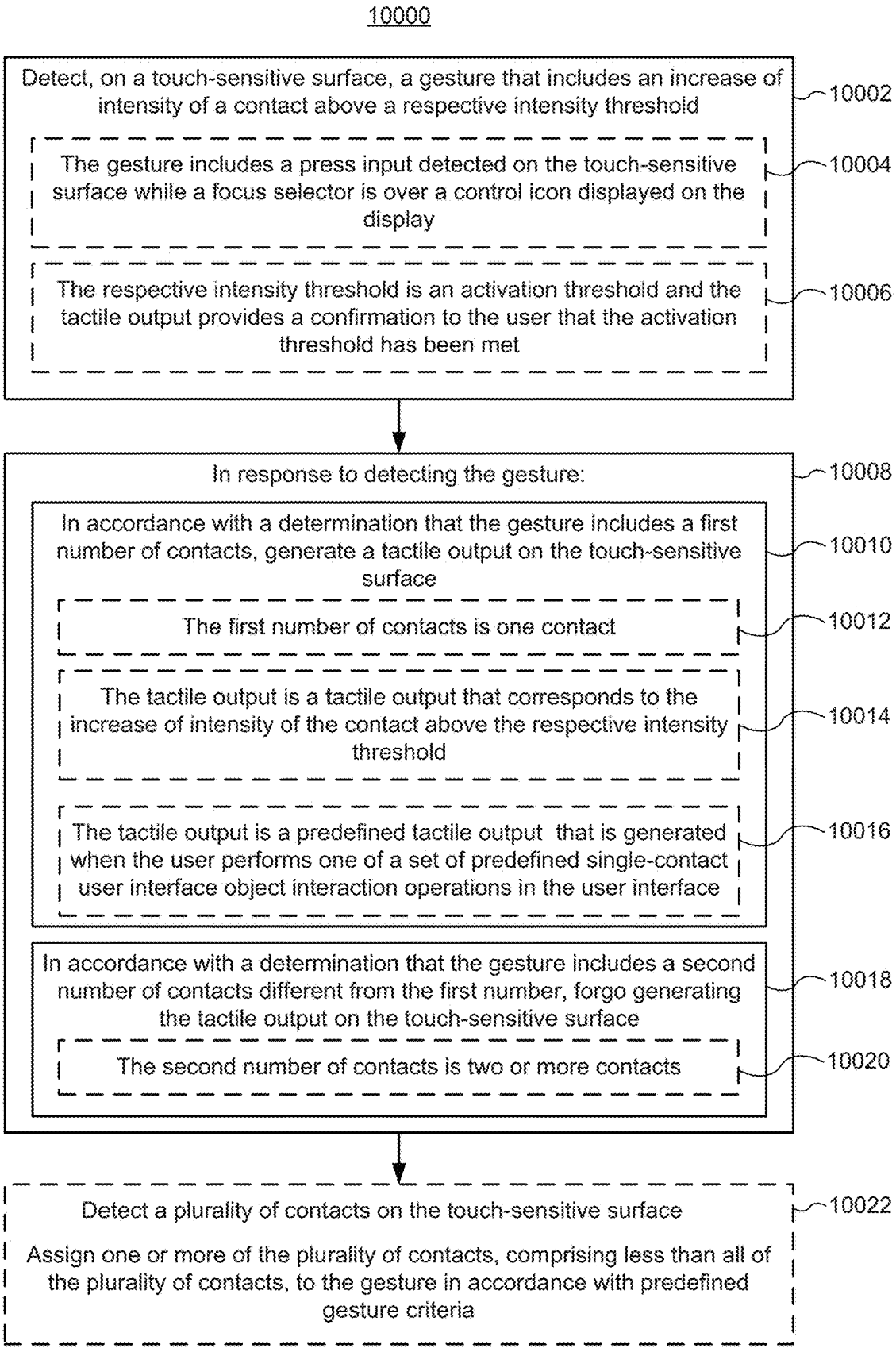

10000
Detect, on a touch-sensitive surface, a gesture that includes an increase of intensity of a contact above a respective intensity threshold
10002
The gesture includes a press input detected on the touch-sensitive surface while a focus selector is over a control icon displayed on the display
10004
The respective intensity threshold is an activation threshold and the tactile output provides a confirmation to the user that the activation threshold has been met
10006
In response to detecting the gesture:
10008
In accordance with a determination that the gesture includes a first number of contacts, generate a tactile output on the touch-sensitive surface
10010
The first number of contacts is one contact
10012
The tactile output is a tactile output that corresponds to the increase of intensity of the contact above the respective intensity threshold
10014
The tactile output is a predefined tactile output that is generated when the user performs one of a set of predefined single-contact user interface object interaction operations in the user interface
10016
In accordance with a determination that the gesture includes a second number of contacts different from the first number, forgo generating the tactile output on the touch-sensitive surface
10018
The second number of contacts is two or more contacts
10020
Detect a plurality of contacts on the touch-sensitive surface
Assign one or more of the plurality of contacts, comprising less than all of the plurality of contacts, to the gesture in accordance with predefined gesture criteria
10022

Figure 18

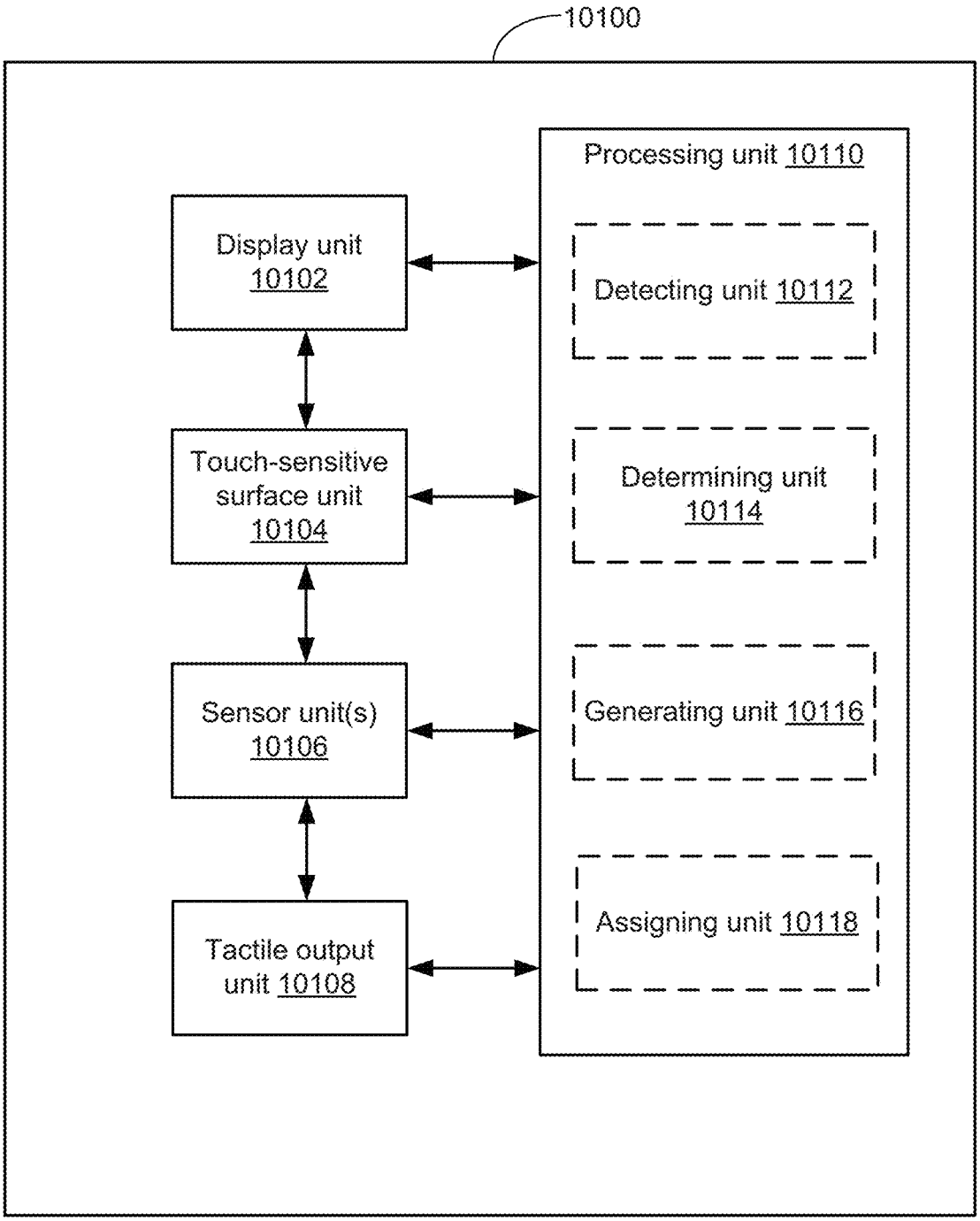

10100
Processing unit 10110
Display unit 10102
Detecting unit 10112
Touch-sensitive surface unit 10104
Determining unit 10114
Sensor unit(s) 10106
Generating unit 10116
Tactile output unit 10108
Assigning unit 10118

Figure 19

DEVICE, METHOD, AND GRAPHICAL USER INTERFACE FOR FORGOING GENERATION OF TACTILE OUTPUT FOR A MULTI-CONTACT GESTURE

RELATED APPLICATIONS

[0001] This application is a continuation of U.S. patent application Ser. No. 14/608,926, filed Jan. 29, 2015, which is continuation of PCT Patent Application Serial No. PCT/US2013/069479, filed on Nov. 11, 2013, which claims the benefit of and priority to U.S. Provisional Patent Application Ser. No. 61/778,239, filed on Mar. 12, 2013, and U.S. Provisional Patent Application No. 61/747,278, filed Dec. 29, 2012, which applications are incorporated by reference herein in their entireties.

[0002] This application is also related to the following: U.S. Provisional Patent Application Ser. No. 61/778,092, filed on Mar. 12, 2013, entitled "Device, Method, and Graphical User Interface for Selecting Object within a Group of Objects;" U.S. Provisional Patent Application Ser. No. 61/778,125, filed on Mar. 12, 2013, entitled "Device, Method, and Graphical User Interface for Navigating User Interface Hierarchies;" U.S. Provisional Patent Application Ser. No. 61/778,156, filed on Mar. 12, 2013, entitled "Device, Method, and Graphical User Interface for Manipulating Framed Graphical Objects;" U.S. Provisional Patent Application Ser. No. 61/778,179, filed on Mar. 12, 2013, entitled "Device, Method, and Graphical User Interface for Scrolling Nested Regions;" U.S. Provisional Patent Application Ser. No. 61/778,171, filed on Mar. 12, 2013, entitled "Device, Method, and Graphical User Interface for Displaying Additional Information in Response to a User Contact;" U.S. Provisional Patent Application Ser. No. 61/778,191, filed on Mar. 12, 2013, entitled "Device, Method, and Graphical User Interface for Displaying User Interface Objects Corresponding to an Application;" U.S. Provisional Patent Application Ser. No. 61/778,211, filed on Mar. 12, 2013, entitled "Device, Method, and Graphical User Interface for Facilitating User Interaction with Controls in a User Interface;" U.S. Provisional Patent Application Ser. No. 61/778,284, filed on Mar. 12, 2013, entitled "Device, Method, and Graphical User Interface for Providing Tactile Feedback for Operations Performed in a User Interface;" U.S. Provisional Patent Application Ser. No. 61/778,287, filed on Mar. 12, 2013, entitled "Device, Method, and Graphical User Interface for Providing Feedback for Changing Activation States of a User Interface Object;" U.S. Provisional Patent Application Ser. No. 61/778,363, filed on Mar. 12, 2013, entitled "Device, Method, and Graphical User Interface for Transitioning between Touch Input to Display Output Relationships;" U.S. Provisional Patent Application Ser. No. 61/778,367, filed on Mar. 12, 2013, entitled "Device, Method, and Graphical User Interface for Moving a User Interface Object Based on an Intensity of a Press Input;" U.S. Provisional Patent Application Ser. No. 61/778,265, filed on Mar. 12, 2013, entitled "Device, Method, and Graphical User Interface for Transitioning between Display States in Response to a Gesture;" U.S. Provisional Patent Application Ser. No. 61/778,373, filed on Mar. 12, 2013, entitled "Device, Method, and Graphical User Interface for Managing Activation of a Control Based on Contact Intensity;" U.S. Provisional Patent Application Ser. No. 61/778,412, filed on Mar. 13, 2013, entitled "Device, Method, and Graphical User Interface for Displaying Content Associated with a Corresponding Affordance;" U.S. Provisional Patent Application Ser. No. 61/778,413, filed on Mar. 13, 2013, entitled "Device, Method, and Graphical User Interface for Selecting User Interface Objects;" U.S. Provisional Patent Application Ser. No. 61/778,414, filed on Mar. 13, 2013, entitled "Device, Method, and Graphical User Interface for Moving and Dropping a User Interface Object;" U.S. Provisional Patent Application Ser. No. 61/778,416, filed on Mar. 13, 2013, entitled "Device, Method, and Graphical User Interface for Determining Whether to Scroll or Select Content;" and U.S. Provisional Patent Application Ser. No. 61/778,418, filed on Mar. 13, 2013, entitled "Device, Method, and Graphical User Interface for Switching between User Interfaces," which are incorporated herein by reference in their entireties.

[0003] This application is also related to the following: U.S. Provisional Patent Application Ser. No. 61/645,033, filed on May 9, 2012, entitled "Adaptive Haptic Feedback for Electronic Devices;" U.S. Provisional Patent Application Ser. No. 61/665,603, filed on Jun. 28, 2012, entitled "Adaptive Haptic Feedback for Electronic Devices;" and U.S. Provisional Patent Application Ser. No. 61/681,098, filed on Aug. 8, 2012, entitled "Adaptive Haptic Feedback for Electronic Devices," which are incorporated herein by reference in their entireties.

TECHNICAL FIELD

[0004] This relates generally to electronic devices with touch-sensitive surfaces, including but not limited to electronic devices with touch-sensitive surfaces that detect inputs for manipulating user interfaces.

BACKGROUND

[0005] The use of touch-sensitive surfaces as input devices for computers and other electronic computing devices has increased significantly in recent years. Exemplary touch-sensitive surfaces include touch pads and touch screen displays. Such surfaces are widely used to manipulate user interface objects on a display.

[0006] Exemplary manipulations include adjusting the position and/or size of one or more user interface objects or activating buttons or opening files/applications represented by user interface objects, as well as associating metadata with one or more user interface objects or otherwise manipulating user interfaces. Exemplary user interface objects include digital images, video, text, icons, control elements such as buttons and other graphics. A user will, in some circumstances, need to perform such manipulations on user interface objects in a file management program (e.g., Finder from Apple Inc. of Cupertino, Ca.), an image management application (e.g., Aperture or iPhoto from Apple Inc. of Cupertino, Ca.), a digital content (e.g., videos and music) management application (e.g., iTunes from Apple Inc. of Cupertino, Ca.), a drawing application, a presentation application (e.g., Keynote from Apple Inc. of Cupertino, Ca.), a word processing application (e.g., Pages from Apple Inc. of Cupertino, Ca.), a website creation application (e.g., iWeb from Apple Inc. of Cupertino, Ca.), a disk authoring application (e.g., iDVD from Apple Inc. of Cupertino, Ca.), or a spreadsheet application (e.g., Numbers from Apple Inc. of Cupertino, Ca.).

[0007] But existing methods for performing these manipulations are cumbersome and inefficient. In addition, existing methods take longer than necessary, thereby wasting energy. This latter consideration is particularly important in battery-operated devices.

SUMMARY

[0008] Accordingly, there is a need for electronic devices with faster, more efficient methods and interfaces for manipulating user interfaces. Such methods and interfaces optionally complement or replace conventional methods for manipulating user interfaces. Such methods and interfaces reduce the cognitive burden on a user and produce a more efficient human-machine interface. For battery-operated devices, such methods and interfaces conserve power and increase the time between battery charges.

[0009] The above deficiencies and other problems associated with user interfaces for electronic devices with touch-sensitive surfaces are reduced or eliminated by the disclosed devices. In some embodiments, the device is a desktop computer. In some embodiments, the device is portable (e.g., a notebook computer, tablet computer, or handheld device). In some embodiments, the device has a touchpad. In some embodiments, the device has a touch-sensitive display (also known as a "touch screen" or "touch screen display"). In some embodiments, the device has a graphical user interface (GUI), one or more processors, memory and one or more modules, programs or sets of instructions stored in the memory for performing multiple functions. In some embodiments, the user interacts with the GUI primarily through finger contacts and gestures on the touch-sensitive surface. In some embodiments, the functions optionally include image editing, drawing, presenting, word processing, website creating, disk authoring, spreadsheet making, game playing, telephoning, video conferencing, e-mailing, instant messaging, workout support, digital photographing, digital videoing, web browsing, digital music playing, and/or digital video playing. 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.

[0010] There is a need for electronic devices with more efficient methods and interfaces for providing feedback when a focus selector moves over a user interface object. Such methods and interfaces may complement or replace conventional methods for providing feedback when a focus selector moves over a user interface object. Such methods and interfaces reduce the cognitive burden on a user and produce a more efficient human-machine interface.

[0011] In accordance with some embodiments, a method is performed at an electronic device with a display, a touch-sensitive surface. The method includes: displaying, on the display, a plurality of user interface objects, where each of the plurality of user interface objects includes a plurality of subdivisions. The method further includes, detecting movement of a contact on the touch-sensitive surface that corresponds to movement of a focus selector over a respective user interface object in the plurality of user interface objects. The method further includes, in response to detecting the movement of the contact: in accordance with a determination that output criteria have been met, generating tactile outputs that correspond to a respective boundary of the respective user interface object and subdivisions of the respective user interface object; and in accordance with a determination that the output criteria have not been met, generating tactile outputs that correspond to the respective boundary of the respective user interface object without generating tactile outputs that correspond to the subdivisions of the respective user interface object.

[0012] In accordance with some embodiments, an electronic device includes a display unit configured to display one or more user interface objects; a touch-sensitive surface unit configured to receive user contacts; and a processing unit coupled to the display unit and the touch-sensitive surface unit. The processing unit is configured to: enable display of a plurality of user interface objects on the display unit, where each of the plurality of user interface objects includes a plurality of subdivisions; and detect movement of a contact on the touch-sensitive surface that corresponds to movement of a focus selector over a respective user interface object in the plurality of user interface objects. The processing unit is further configured to, in response to detecting the movement of the contact: in accordance with a determination that output criteria have been met, generate tactile outputs that correspond to a respective boundary of the respective user interface object and subdivisions of the respective user interface object; and in accordance with a determination that the output criteria have not been met, generate tactile outputs that correspond to the respective boundary of the respective user interface object without generating tactile outputs that correspond to the subdivisions of the respective user interface object.

[0013] Thus, electronic devices with displays and touch-sensitive surfaces are provided with faster, more efficient methods and interfaces for providing feedback when a focus selector moves over a subdivision of a user interface object, thereby increasing the effectiveness, efficiency, and user satisfaction with such devices. Such methods and interfaces may complement or replace conventional methods for providing feedback when a focus selector moves over a subdivision of a user interface object.

[0014] There is a need for electronic devices with faster, more efficient methods and interfaces for providing feedback when interacting with a user interface object, for example, to more efficiently differentiate feedback corresponding to a selection event from feedback corresponding to an activation event. Such methods and interfaces may complement or replace conventional methods for providing feedback when interacting with a user interface object. Such methods and interfaces reduce the cognitive burden on a user and produce a more efficient human-machine interface. For battery-operated devices, such methods and interfaces conserve power and increase the time between battery charges.

[0015] In accordance with some embodiments, a method is performed at an electronic device with a display, a touch-sensitive surface and one or more sensors to detect intensity of contacts with the touch-sensitive surface. The method includes: detecting a contact on the touch-sensitive surface, where the contact corresponds to a focus selector on the display. The method further includes: detecting a gesture based on input from the contact. The method further includes, in response to detecting the gesture: in accordance with a determination that the gesture corresponds to movement of the focus selector over a respective user interface object without activating the respective user interface object, generating a first tactile output on the touch-sensitive surface

that corresponds to movement of the focus selector over the respective user interface object; and in accordance with a determination that the gesture corresponds to an increase of intensity of the contact above an activation intensity threshold while the focus selector is over the respective user interface object, generating a second tactile output on the touch-sensitive surface that corresponds to activation of the respective user interface object, where the second tactile output is different from the first tactile output.

[0016] In accordance with some embodiments, an electronic device includes a display unit configured to display one or more user interface objects; a touch-sensitive surface unit configured to receive user contacts; and a processing unit coupled to the display unit and the touch-sensitive surface unit. The processing unit is configured to: enable display of one or more user interface objects on the display unit; detect a contact on the touch-sensitive surface unit, where the contact corresponds to a focus selector on the display unit; and detect a gesture based on input from the contact. The processing unit is further configured to, in response to detecting the gesture: in accordance with a determination that the gesture corresponds to movement of the focus selector over a respective user interface object without activating the respective user interface object, generating a first tactile output on the touch-sensitive surface that corresponds to movement of the focus selector over the respective user interface object; and in accordance with a determination that the gesture corresponds to an increase of intensity of the contact above an activation intensity threshold while the focus selector is over the respective user interface object, generating a second tactile output on the touch-sensitive surface that corresponds to activation of the respective user interface object, where the second tactile output is different from the first tactile output.

[0017] Thus, electronic devices with displays, touch-sensitive surfaces and one or more sensors to detect intensity of contacts with the touch-sensitive surface are provided with faster, more efficient methods and interfaces for providing feedback when interacting with a user interface object, thereby increasing the effectiveness, efficiency, and user satisfaction with such devices. Such methods and interfaces may complement or replace conventional methods for providing feedback when interacting with a user interface object.

[0018] There is a need for electronic devices with faster, more efficient methods and interfaces for providing feedback when a focus selector moves over a user interface object. Such methods and interfaces may complement or replace conventional methods for providing feedback when a focus selector moves over a user interface object. Such methods and interfaces reduce the cognitive burden on a user and produce a more efficient human-machine interface. For battery-operated devices, such methods and interfaces conserve power and increase the time between battery charges.

[0019] In accordance with some embodiments, a method is performed at an electronic device with a display, a touch-sensitive surface. The method includes displaying an application window that includes a control region and a content region distinct from the control region on the display, where the control region includes a plurality of affordances for performing operations on content in the content region and the content region displays content that includes one or more affordances integrated into the content. The method further includes detecting a contact on the touch-sensitive surface. The method further includes detecting a gesture that includes movement of the contact across the touch-sensitive surface that corresponds to movement of a focus selector on the display across the application window. The method further includes, in response to detecting the gesture: in accordance with a determination that the gesture corresponds to movement of the focus selector over a first affordance in the control region, generating a first tactile output on the touch-sensitive surface that corresponds to movement of the focus selector over an affordance in the control region; and in accordance with a determination that the gesture corresponds to movement of the focus selector over a second affordance in the content region, generating a second tactile output on the touch-sensitive surface that corresponds to movement of the focus selector over an affordance in the content region, where the second tactile output is different from the first tactile output.

[0020] In accordance with some embodiments, an electronic device includes a display unit configured display an application window; a touch-sensitive surface unit configured to receive user contacts; and a processing unit coupled to the display unit and the touch-sensitive surface unit. The processing unit is configured to: enable display of an application window that includes a control region and a content region distinct from the control region on the display, where: the control region includes a plurality of affordances for performing operations on content in the content region; and the content region displays content that includes one or more affordances integrated into the content. The processing unit is further configured to detect a contact on the touch-sensitive surface unit. The processing unit is further configured to detect a gesture that includes movement of the contact across the touch-sensitive surface unit that corresponds to movement of a focus selector on the display across the application window. The processor unit is further configured to, in response to detecting the gesture: in accordance with a determination that the gesture corresponds to movement of the focus selector over a first affordance in the control region, generate a first tactile output on the touch-sensitive surface unit that corresponds to movement of the focus selector over an affordance in the control region; and in accordance with a determination that the gesture corresponds to movement of the focus selector over a second affordance in the content region, generate a second tactile output on the touch-sensitive surface unit that corresponds to movement of the focus selector over an affordance in the content region, where the second tactile output is different from the first tactile output.

[0021] Thus, electronic devices with displays, touch-sensitive surfaces are provided with faster, more efficient methods and interfaces for providing feedback when a focus selector moves over a user interface object, thereby increasing the effectiveness, efficiency, and user satisfaction with such devices. Such methods and interfaces may complement or replace conventional methods for providing feedback when a focus selector moves over a user interface object.

[0022] There is a need for electronic devices with faster, more efficient methods and interfaces for adjusting a tactile output level in accordance with an adjustment of a volume level. Such methods and interfaces may complement or replace conventional methods for adjusting a tactile output level. Such methods and interfaces reduce the cognitive burden on a user and produce a more efficient human-

machine interface. For battery-operated devices, such methods and interfaces conserve power and increase the time between battery charges.

[0023] In accordance with some embodiments, a method is performed at an electronic device with a display and a touch-sensitive surface. The method includes: detecting a first plurality of inputs on the touch-sensitive surface; in response to detecting the first plurality of inputs, providing tactile feedback in accordance with a tactile output level of the device; and receiving a request to adjust a volume level of the device by a respective amount. The method further includes, in response to the request to adjust the volume level: adjusting the volume level by the respective amount from a first non-zero volume level to a second non-zero volume level; and adjusting the tactile output level of the device in accordance with the respective amount.

[0024] In accordance with some embodiments, an electronic device includes a display unit configured to display information; a touch-sensitive surface unit configured to receive contacts; a tactile feedback unit configured to provide tactile feedback; an audio unit configured to produce an audio signal and an audio control signal in accordance with at least a volume level; and a processing unit coupled to the display unit, the touch-sensitive surface unit, the tactile feedback unit, and the audio unit. The processing unit is configured to: detect a first plurality of inputs on the touch-sensitive surface unit; in response to detecting the first plurality of inputs, provide tactile via the tactile feedback unit feedback in accordance with a tactile output level of the device; and receive a request to adjust a volume level of the device by a respective amount. The processing unit is further configured to, in response to the request to adjust the volume level: adjust the volume level by the respective amount; and adjust the tactile output level of the device in accordance with the respective amount.

[0025] Thus, electronic devices with displays and touch-sensitive surfaces are provided with faster, more efficient methods and interfaces for adjusting a tactile output level in accordance with an adjustment of a volume level, thereby increasing the effectiveness, efficiency, and user satisfaction with such devices. Such methods and interfaces may complement or replace conventional methods for adjusting a tactile output level.

[0026] There is a need for electronic devices with more efficient methods and interfaces for generating a tactile output for a gesture having a first number of contacts (e.g., a single contact gesture) and forgoing generation of a tactile output for a gesture having a second number of contacts (e.g., a multi-contact gesture). Such methods and interfaces may complement or replace conventional methods for tactile output generation. Such methods and interfaces reduce the cognitive burden on a user and produce a more efficient human-machine interface. For battery-operated devices, such methods and interfaces conserve power and increase the time between battery charges.

[0027] In accordance with some embodiments, a method is performed at an electronic device with a display and a touch-sensitive surface, where the device includes one or more sensors to detect intensity of contacts with the touch-sensitive surface. The method includes: detecting, on the touch-sensitive surface, a gesture that includes an increase of intensity of a contact above a respective intensity threshold. The method further includes, in response to detecting the gesture: in accordance with a determination that the gesture includes a first number of contacts, generating a tactile output on the touch-sensitive surface; and in accordance with a determination that the gesture includes a second number of contacts different from the first number, forgoing generating the tactile output on the touch-sensitive surface.

[0028] In accordance with some embodiments, an electronic device includes a display unit configured to display a graphical user interface; a touch-sensitive surface unit configured to receive contacts; one or more sensor units configured to detect intensity of contacts with the touch-sensitive surface unit; a tactile output unit configured to generate a tactile output; and a processing unit coupled to the display unit, the touch-sensitive surface unit, the one or more sensor units, and the tactile output unit. The processing unit is configured to detect, on the touch-sensitive surface unit, a gesture that includes an increase of intensity of a contact above a respective intensity threshold. The processing unit is further configured to, in response to detecting the gesture: in accordance with a determination that the gesture includes a first number of contacts, generate a tactile output via the tactile output unit on the touch-sensitive surface unit; and in accordance with a determination that the gesture includes a second number of contacts different from the first number, forgo generating the tactile output on the touch-sensitive surface unit.

[0029] Thus, electronic devices with displays, touch-sensitive surfaces, and one or more sensors to detect intensity of contacts with the touch-sensitive surface are provided with more efficient methods and interfaces for generating a tactile output for a gesture having a first number of contacts and forgoing generation of a tactile output for a gesture having a second number of contacts, thereby increasing the effectiveness, efficiency, and user satisfaction with such devices. Such methods and interfaces may complement or replace conventional methods for generating a tactile output for a gesture having a first number of contacts and forgoing generation of a tactile output for a gesture having a second number of contacts.

[0030] In accordance with some embodiments, an electronic device includes a display, a touch-sensitive surface, optionally one or more sensors to detect intensity of contacts with the touch-sensitive surface, one or more processors, memory, and one or more programs; the one or more programs are stored in the memory and configured to be executed by the one or more processors and the one or more programs include instructions for performing the operations of any of the methods referred to in the fifth paragraph of the Description of Embodiments. In accordance with some embodiments, a graphical user interface on an electronic device with a display, a touch-sensitive surface, optionally one or more sensors to detect intensity of contacts with the touch-sensitive surface, a memory, and one or more processors to execute one or more programs stored in the memory includes one or more of the elements displayed in any of the methods referred to in the fifth paragraph of the Description of Embodiments, which are updated in response to inputs, as described in any of the methods referred to in the fifth paragraph of the Description of Embodiments. In accordance with some embodiments, a computer readable storage medium has stored therein instructions which when executed by an electronic device with a display, a touch-sensitive surface, and optionally one or more sensors to detect intensity of contacts with the touch-sensitive surface, cause the device to perform the operations of any of the

methods referred to in the fifth paragraph of the Description of Embodiments. In accordance with some embodiments, an electronic device includes: a display, a touch-sensitive surface, and optionally one or more sensors to detect intensity of contacts with the touch-sensitive surface; and means for performing the operations of any of the methods referred to in the fifth paragraph of the Description of Embodiments. In accordance with some embodiments, an information processing apparatus, for use in an electronic device with a display and a touch-sensitive surface, optionally one or more sensors to detect intensity of contacts with the touch-sensitive surface, includes means for performing the operations of any of the methods referred to in the fifth paragraph of the Description of Embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031] 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.

[0032] FIG. **1**A is a block diagram illustrating a portable multifunction device with a touch-sensitive display in accordance with some embodiments.

[0033] FIG. **1**B is a block diagram illustrating exemplary components for event handling in accordance with some embodiments.

[0034] FIG. **2** illustrates a portable multifunction device having a touch screen in accordance with some embodiments.

[0035] FIG. **3** is a block diagram of an exemplary multifunction device with a display and a touch-sensitive surface in accordance with some embodiments.

[0036] FIG. **4**A illustrates an exemplary user interface for a menu of applications on a portable multifunction device in accordance with some embodiments.

[0037] 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.

[0038] FIGS. **5**A-**5**M illustrate exemplary user interfaces for providing feedback when a focus selector moves over a user interface object in accordance with some embodiments.

[0039] FIGS. **6**A-**6**C are flow diagrams illustrating a method of providing feedback when a focus selector moves over a user interface object in accordance with some embodiments.

[0040] FIG. **7** is a functional block diagram of an electronic device in accordance with some embodiments.

[0041] FIGS. **8**A-**8**E illustrate exemplary user interfaces for providing feedback when interacting with a user interface object in accordance with some embodiments.

[0042] FIGS. **8**F-**8**H illustrate exemplary waveforms of movement profiles for generating tactile outputs in accordance with some embodiments.

[0043] FIG. **9** is a flow diagram illustrating a method of providing feedback when interacting with a user interface object in accordance with some embodiments.

[0044] FIG. **10** is a functional block diagram of an electronic device in accordance with some embodiments.

[0045] FIGS. **11**A-**11**D illustrate exemplary user interfaces for providing feedback when a focus selector moves over a user interface object in accordance with some embodiments.

[0046] FIGS. **11**E-**11**G illustrate exemplary waveforms of movement profiles for generating tactile outputs in accordance with some embodiments.

[0047] FIGS. **12**A-**12**B are flow diagrams illustrating a method of providing feedback when a focus selector moves over a user interface object in accordance with some embodiments.

[0048] FIG. **13** is a functional block diagram of an electronic device in accordance with some embodiments.

[0049] FIGS. **14**A-**14**I illustrate exemplary user interfaces for adjusting a tactile output level in accordance with an adjustment of a volume level in accordance with some embodiments.

[0050] FIGS. **15**A-**15**C are flow diagrams illustrating a method of adjusting a tactile output level in accordance with an adjustment of a volume level in accordance with some embodiments.

[0051] FIG. **16** is a functional block diagram of an electronic device in accordance with some embodiments.

[0052] FIGS. **17**A-**17**F illustrate exemplary user interfaces for generating a tactile output for a gesture having a first number of contacts and forgoing generation of a tactile output for a gesture having a second number of contacts in accordance with some embodiments.

[0053] FIG. **18** is a flow diagram illustrating a method of generating a tactile output for a gesture having a first number of contacts and forgoing generation of a tactile output for a gesture having a second number of contacts in accordance with some embodiments.

[0054] FIG. **19** is a functional block diagram of an electronic device in accordance with some embodiments.

DESCRIPTION OF EMBODIMENTS

[0055] The methods, devices and GUIs described herein provide visual and/or haptic feedback that makes manipulation of user interface objects more efficient and intuitive for a user. For example, in a system where the clicking action of a trackpad is decoupled from the contact intensity (e.g., contact force, contact pressure, or a substitute therefore) that is needed to reach an activation threshold, the device can generate different tactile outputs (e.g., "different clicks") for different activation events (e.g., so that clicks that accomplish a particular result are differentiated from clicks that do not produce any result or that accomplish a different result from the particular result). Additionally, tactile outputs can be generated in response to other events that are not related to increasing intensity of a contact, such as generating a tactile output (e.g., a "detent") when a user interface object is moved to a particular position, boundary or orientation, or when an event occurs at the device.

[0056] Additionally, in a system where a trackpad or touch-screen display is sensitive to a range of contact intensity that includes more than one or two specific intensity values (e.g., more than a simple on/off, binary intensity determination), the user interface can provide responses (e.g., visual or tactile cues) that are indicative of the intensity of the contact within the range. In some implementations, a pre-activation-threshold response and/or a post-activation-threshold response to an input are displayed as continuous animations. As one example of such a response, a preview of an operation is displayed in response to detecting an increase in contact intensity that is still below an activation threshold for performing the operation. As another example of such a response, an animation associated with an opera-

tion continues even after the activation threshold for the operation has been reached. Both of these examples provide a user with a continuous response to the force or pressure of a user's contact, which provides a user with visual and/or haptic feedback that is richer and more intuitive. More specifically, such continuous force responses give the user the experience of being able to press lightly to preview an operation and/or press deeply to push "past" or "through" a predefined user interface state corresponding to the operation.

[0057] Additionally, for a device with a touch-sensitive surface that is sensitive to a range of contact intensity, multiple contact intensity thresholds can be monitored by the device and different functions can be mapped to different contact intensity thresholds. This serves to increase the available "gesture space" providing easy access to advanced features for users who know that increasing the intensity of a contact at or beyond a second "deep press" intensity threshold will cause the device to perform a different operation from an operation that would be performed if the intensity of the contact is between a first "activation" intensity threshold and the second "deep press" intensity threshold. An advantage of assigning additional functionality to a second "deep press" intensity threshold while maintaining familiar functionality at a first "activation" intensity threshold is that inexperienced users who are, in some circumstances, confused by the additional functionality can use the familiar functionality by just applying an intensity up to the first "activation" intensity threshold, whereas more experienced users can take advantage of the additional functionality by applying an intensity at the second "deep press" intensity threshold.

[0058] Additionally, for a device with a touch-sensitive surface that is sensitive to a range of contact intensity, the device can provide additional functionality by allowing users to perform complex operations with a single continuous contact. For example, when selecting a group of objects, a user can move a continuous contact around the touch-sensitive surface and can press while dragging (e.g., applying an intensity greater than a "deep press" intensity threshold) to add additional elements to a selection. In this way, a user can intuitively interact with a user interface where pressing harder with a contact causes objects in the user interface to be "stickier."

[0059] A number of different approaches to providing an intuitive user interface on a device where a clicking action is decoupled from the force that is needed to reach an activation threshold and/or the device is sensitive to a wide range of contact intensities are described below. Using one or more of these approaches (optionally in conjunction with each other) helps to provide a user interface that intuitively provides users with additional information and functionality, thereby reducing the user's cognitive burden and improving the human-machine interface. Such improvements in the human-machine interface enable users to use the device faster and more efficiently. For battery-operated devices, these improvements conserve power and increase the time between battery charges. For ease of explanation, systems, methods and user interfaces for including illustrative examples of some of these approaches are described below, as follows:

[0060] methods and user interfaces described below improve upon this visual feedback by providing tactile feedback indicating that the user has scrolled over or selected a particular subdivision (e.g., individual words, letters or spaces) of the larger user interface object (e.g., a block of text)In particular, FIGS. **5**A-**5**M illustrate exemplary user interfaces for providing feedback when a focus selector moves over a user interface object. FIGS. **6**A-**6**C are flow diagrams illustrating a method of providing feedback when a focus selector moves over a user interface object. The user interfaces in FIGS. **5**A-**5**M are used to illustrate the processes in FIGS. **6**A-**6**C.by providing different tactile feedback to the user when a focus selector moves over a respective user interface object than when the user subsequently activates the respective user interface object. In particular, FIGS. **8**A-**8**E illustrate exemplary user interfaces for providing feedback when interacting with a user interface object. FIG. **9** is a flow diagram illustrating a method of providing feedback when interacting with a user interface object. The user interfaces in FIGS. **8**A-**8**E are used to illustrate the processes in FIG. **9**.Many electronic devices have graphical user interfaces that display application windows having separate regions for displaying content-independent affordances such as control affordances. The embodiments described below provide improved methods and user interfaces for generating feedback to a user navigating a complex user interface environment by providing different tactile feedback to the user when a focus selector moves over an affordance displayed in a control region and an affordance displayed in a content region of an application window. In particular, FIGS. **11**A-**11**D illustrate exemplary user interfaces for providing feedback when a focus selector moves over a user interface object. FIGS. **12**A-**12**B are flow diagrams illustrating a method of providing feedback when a focus selector moves over a user interface object. The user interfaces in FIGS. **11**A-**11**D are used to illustrate the processes in FIGS. **12**A-**12**B.

[0061] Many electronic devices change output levels of sensory properties of the device in response to the enablement of a setting or mode of the device. However, there are sometimes a large number of sensory properties to adjust and adjusting output levels of these sensory properties separately can be confusing and difficult for users. The embodiments below provide a more convenient and intuitive user interface by adjusting a tactile output level of a device in tandem with an adjustment of a volume level of the device. In particular, FIGS. **14**A-**14**I illustrate exemplary user interfaces for adjusting a tactile output level in accordance with an adjustment of a volume level. FIGS. **15**A-**15**C are flow diagrams illustrating a method of adjusting a tactile output level in accordance with an adjustment of a volume level. The user interfaces in FIGS. **14**A-**14**I are used to illustrate the processes in FIGS. **15**A-**15**C.

[0062] Many electronic devices provide a form of confirmation to a user in response to an event being triggered by a user action. For example, when a user clicks on an affordance (e.g., an icon button) corresponding to respective content (e.g., an electronic document, an image, or a video), an audio output is provided via a speaker to the user to confirm that the user is clicking on the affordance. However, this confirmation or feedback can be distracting or confusing to a user when it occurs in response to inputs that do not

correspond to the feedback. The embodiments described below provide a more convenient and intuitive interface by generating a tactile output in response to detecting a gesture that includes a first number of contacts (e.g., one contact) and forging generating the tactile output if the gesture includes a second number of contacts (e.g., two or more contacts). In particular, FIGS. **17**A-**17**F illustrate exemplary user interfaces for generating a tactile output for a gesture having a first number of contacts and forgoing generation of a tactile output for a gesture having a second number of contacts. FIG. **18** is a flow diagram illustrating a method of generating a tactile output for a gesture having a first number of contacts and forgoing generation of a tactile output for a gesture having a second number of contacts. The user interfaces in FIGS. **17**A-**17**F are used to illustrate the processes in FIG. **18**.

EXEMPLARY DEVICES

[0063] Reference will now be made in detail to embodiments, examples of which are illustrated in the accompanying drawings. In the following detailed description, numerous specific details are set forth in order to provide a thorough understanding of the various described embodiments. However, it will be apparent to one of ordinary skill in the art that the various described embodiments may be practiced without these specific details. In other instances, well-known methods, procedures, components, circuits, and networks have not been described in detail so as not to unnecessarily obscure aspects of the embodiments.

[0064] It will also be understood that, although the terms first, second, etc. are, in some instances, used herein to describe various elements, these elements should not be limited by these terms. These terms are only used to distinguish one element from another. For example, a first contact could be termed a second contact, and, similarly, a second contact could be termed a first contact, without departing from the scope of the various described embodiments. The first contact and the second contact are both contacts, but they are not the same contact.

[0065] 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.

[0066] As used herein, 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.

[0067] 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, Ca. Other portable electronic devices, such as laptops or tablet computers with touch-sensitive surfaces (e.g., touch screen displays and/or touch pads), 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 touch pad).

[0068] 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.

[0069] 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.

[0070] 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.

[0071] 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 displays **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 (CPU's) **120**, peripherals interface **118**, RF circuitry **108**, audio circuitry **110**, speaker **111**, microphone **113**, input/output (I/O) subsystem **106**, other input or control devices **116**, and external port **124**. Device **100** optionally includes one or more optical sensors **164**. Device **100** optionally includes one or more 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**.

[0072] 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).

[0073] 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.

[0074] 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.

[0075] 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. Access to memory **102** by other components of device **100**, such as CPU **120** and the peripherals interface **118**, is, optionally, controlled by memory controller **122**.

[0076] 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.

[0077] 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.

[0078] 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 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 (HSDPA), 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, Wireless Fidelity (Wi-Fi) (e.g., IEEE 802.11a, IEEE 802.11b, IEEE 802.11g and/or IEEE 802.11n), 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.

[0079] 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).

[0080] 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 or 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, infrared port, 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**).

[0081] 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 corresponds to user-interface objects.

[0082] 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 converts 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.

[0083] 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®, iPod Touch®, and iPad® from Apple Inc. of Cupertino, Ca.

[0084] 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.

[0085] 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.

[0086] 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.

[0087] Device **100** optionally also includes one or more optical sensors **164**. FIG. **1A** 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 lens, 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, another optical sensor is located on the front of the device so that the user's image is, optionally, obtained for videoconferencing while the user views the other video conference participants on the touch screen display.

[0088] 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**.

[0089] 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 coupled to input controller **160** in I/O subsystem **106**. 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).

[0090] 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**.

[0091] 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**. 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**.

[0092] 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** 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.

[0093] Operating system **126** (e.g., Darwin, RTXC, LINUX, UNIX, OS X, 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.

[0094] 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.

[0095] 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.

[0096] 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 thresholds 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).

[0097] Contact/motion module **130** optionally detects a gesture input by a user. Different gestures on the touch-sensitive surface have different contact patterns and intensities. 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 (lift off) 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 (lift off) event.

[0098] 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.

[0099] 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**.

[0100] 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**.

[0101] 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).

[0102] 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).

[0103] Applications **136** optionally include the following modules (or sets of instructions), or a subset or superset thereof:

[0104] contacts module **137** (sometimes called an address book or contact list);

[0105] telephone module **138**;

[0106] video conferencing module **139**;

[0107] e-mail client module **140**;

[0108] instant messaging (IM) module **141**;

[0109] workout support module **142**;

[0110] camera module **143** for still and/or video images;

[0111] image management module **144**;

[0112] browser module **147**;

[0113] calendar module **148**;

[0114] 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**;

[0115] widget creator module **150** for making user-created widgets **149-6**;

[0116] search module **151**;

[0117] video and music player module **152**, which is, optionally, made up of a video player module and a music player module;

[0118] notes module **153**;

[0119] map module **154**; and/or

[0120] online video module **155**.

[0121] 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.

[0122] In conjunction with touch screen **112**, display controller **156**, contact 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 **139**, e-mail **140**, or IM **141**; and so forth.

[0123] In conjunction with RF circuitry **108**, audio circuitry **110**, speaker **111**, microphone **113**, touch screen **112**, display controller **156**, contact module **130**, graphics module **132**, and text input module **134**, telephone module **138** are, optionally, used to enter a sequence of characters corre-

sponding to a telephone number, access one or more telephone numbers in address book **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.

[0124] 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 module **130**, graphics module **132**, text input module **134**, contact list **137**, and telephone module **138**, videoconferencing 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.

[0125] In conjunction with RF circuitry **108**, touch screen **112**, display controller **156**, contact 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**.

[0126] In conjunction with RF circuitry **108**, touch screen **112**, display controller **156**, contact 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 a 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).

[0127] In conjunction with RF circuitry **108**, touch screen **112**, display controller **156**, contact module **130**, graphics module **132**, text input module **134**, GPS module **135**, map module **154**, and music player module **146**, 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.

[0128] In conjunction with touch screen **112**, display controller **156**, optical sensor(s) **164**, optical sensor controller **158**, contact 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**.

[0129] In conjunction with touch screen **112**, display controller **156**, contact 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.

[0130] In conjunction with RF circuitry **108**, touch screen **112**, display system controller **156**, contact 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.

[0131] In conjunction with RF circuitry **108**, touch screen **112**, display system controller **156**, contact 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.

[0132] In conjunction with RF circuitry **108**, touch screen **112**, display system controller **156**, contact 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).

[0133] In conjunction with RF circuitry **108**, touch screen **112**, display system controller **156**, contact 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).

[0134] In conjunction with touch screen **112**, display system controller **156**, contact 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.

[0135] In conjunction with touch screen **112**, display system controller **156**, contact 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.).

[0136] In conjunction with touch screen **112**, display controller **156**, contact 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.

[0137] In conjunction with RF circuitry **108**, touch screen **112**, display system controller **156**, contact 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.

[0138] In conjunction with touch screen **112**, display system controller **156**, contact 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.

[0139] Each of the above identified modules and applications correspond 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 (i.e., 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 re-arranged in various embodiments. 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.

[0140] 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.

[0141] 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.

[0142] FIG. **1**B is a block diagram illustrating exemplary components for event handling in accordance with some embodiments. In some embodiments, memory **102** (in FIGS. **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**).

[0143] 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.

[0144] 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.

[0145] 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.

[0146] 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, peripheral 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).

[0147] In some embodiments, event sorter **170** also includes a hit view determination module **172** and/or an active event recognizer determination module **173**.

[0148] 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.

[0149] 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.

[0150] 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 (i.e., 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, 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.

[0151] 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.

[0152] 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 module **182**.

[0153] 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**.

[0154] 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** includes 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**.

[0155] 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).

[0156] 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.

[0157] 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 lift-off (touch end) for a predetermined phase, a second touch (touch begin) on the displayed object for a predetermined phase, and a second lift-off (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 lift-off of the touch (touch end). In some embodiments, the event also includes information for one or more associated event handlers **190**.

[0158] 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.

[0159] 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.

[0160] 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.

[0161] 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.

[0162] 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.

[0163] 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.

[0164] 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 **145**. In some embodiments, object updater **177** creates and updates objects used in application **136-1**. For example, object updater **176** 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.

[0165] 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.

[0166] 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 touch-pads; 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.

[0167] 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.

[0168] Device **100** optionally also includes 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**.

[0169] In one embodiment, 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**, head set 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**.

[0170] 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 (CPU's) **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.

[0171] Each of the above identified elements in FIG. **3** are, 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 (i.e., 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 re-arranged 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.

[0172] Attention is now directed towards embodiments of user interfaces ("UI") that is, optionally, implemented on portable multifunction device **100**.

[0173] 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:

[0174] Signal strength indicator(s) **402** for wireless communication(s), such as cellular and Wi-Fi signals;

[0175] Time **404**;

[0176] Bluetooth indicator **405**;

[0177] Battery status indicator **406**;

[0178] Tray **408** with icons for frequently used applications, such as:

[0179] Icon **416** for telephone module **138**, labeled "Phone," which optionally includes an indicator **414** of the number of missed calls or voicemail messages;

[0180] Icon **418** for e-mail client module **140**, labeled "Mail," which optionally includes an indicator **410** of the number of unread e-mails;

[0181] Icon **420** for browser module **147**, labeled "Browser;" and

[0182] Icon **422** for video and music player module **152**, also referred to as iPod (trademark of Apple Inc.) module **152**, labeled "iPod;" and

[0183] Icons for other applications, such as:

[0184] Icon **424** for IM module **141**, labeled "Text;"

[0185] Icon **426** for calendar module **148**, labeled "Calendar;"

[0186] Icon **428** for image management module **144**, labeled "Photos;"

[0187] Icon **430** for camera module **143**, labeled "Camera;"

[0188] Icon **432** for online video module **155**, labeled "Online Video"

[0189] Icon **434** for stocks widget **149-2**, labeled "Stocks;"

[0190] Icon **436** for map module **154**, labeled "Map;"

[0191] Icon **438** for weather widget **149-1**, labeled "Weather;"

[0192] Icon **440** for alarm clock widget **149-4**, labeled "Clock;"

[0193] Icon **442** for workout support module **142**, labeled "Workout Support;"

[0194] Icon **444** for notes module **153**, labeled "Notes;" and

[0195] Icon **446** for a settings application or module, which provides access to settings for device **100** and its various applications **136**.

[0196] 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** are 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.

[0197] 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 **357**) for detecting intensity of contacts on touch-sensitive surface **451** and/or one or more tactile output generators **359** for generating tactile outputs for a user of device **300**.

[0198] Although some of the examples which 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.

[0199] 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.

[0200] 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).

[0201] The user interface figures described below include various intensity diagrams that show the current intensity of the contact on the touch-sensitive surface relative to one or more intensity thresholds (e.g., a contact detection intensity threshold IT_0, a light press intensity threshold IT_L, a deep press intensity threshold IT_D, and/or one or more other intensity thresholds). This intensity diagram is typically not part of the displayed user interface, but is provided to aid in the interpretation of the figures. 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 an intensity below the light press intensity threshold (e.g., and above a nominal contact-detection intensity threshold IT_0 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.

[0202] An increase of intensity of the contact from an intensity below the light press intensity threshold IT_L to an intensity between the light press intensity threshold IT_L and the deep press intensity threshold IT_D is sometimes referred to as a "light press" input. An increase of intensity of the contact from an intensity below the deep press intensity threshold IT_D to an intensity above the deep press intensity threshold IT_D is sometimes referred to as a "deep press" input. An increase of intensity of the contact from an intensity below the contact-detection intensity threshold IT_0 to an intensity between the contact-detection intensity threshold IT_0 and the light press intensity threshold IT_L is sometimes referred to as detecting the contact on the touch-surface. A decrease of intensity of the contact from an intensity above the contact-detection intensity threshold IT_0 to an intensity below the contact intensity threshold IT_0 is sometimes referred to as detecting liftoff of the contact from the touch-surface. In some embodiments IT_0 is zero. In some embodiments IT_0 is greater than zero. In some illustrations a shaded circle or oval is used to represent intensity of a contact on the touch-sensitive surface. In some illustrations a circle or oval without shading is used represent a respective contact on the touch-sensitive surface without specifying the intensity of the respective contact.

[0203] 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).

[0204] 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).

[0205] For ease of explanation, the description 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.

USER INTERFACES AND ASSOCIATED PROCESSES

Conditionally Providing Tactile Feedback Corresponding to Subdivisions of a User Interface Object

[0206] Many electronic devices have graphical user interfaces that display a plurality of user interface object at the same time. For example, a graphical user interface will, in some circumstances, simultaneously display any combination of multiple blocks of text, web browsers, menus, application windows, toolbars, status bars and the like, providing the user with a large number of potential inputs and functionalities. Moreover, many of these user interface objects will have a number of selectable or activatable user interface objects displayed therein, e.g., subdivisions of the larger user interface object. Given the complexity of a user interface environment that arises from displaying multiple user interface objects having a number of functional subdivisions displayed therein, there is a need to provide feedback that enables the user to more efficiently and conveniently navigate through the user interface environment.

[0207] The embodiments described below provide improved methods and user interfaces for generating feedback to a user navigating a complex user interface. More specifically, these methods and user interfaces provide tactile feedback to the user when a focus selector moves over a user interface object. The tactile feedback allows the user to more efficiently discern between subdivisions of a user interface object, instead of or in addition to audible and/or visual feedback. For example, existing methods for selecting a sub-set of text within a larger block of text requires the user drag a focus selector over the text, causing a change in the visual appearance of individual words, letters and/or spaces selected. These approaches only provide visual confirmation that the desired sub-set of text has been selected prior to further manipulation (e.g., copying, editing, deleting, pasting or formatting). Advantageously, the methods and user interfaces described below improve upon this visual feedback by providing tactile feedback indicating that the user has scrolled over or selected a particular subdivision (e.g., individual words, letters or spaces) of the larger user interface object (e.g., a block of text).

[0208] Moreover, the methods and user interfaces described below allow the tactile feedback to be conditional upon a particular action performed by the user. That is, the tactile outputs are, optionally, selectively quieted, as desired. For example, when scrolling over or selecting a large sub-set of text, the tactile output are, optionally, conditionally suppressed when the focus selector is moved rapidly over the text, when the user does not require a high level of feedback from the user interface, and then generated again when the focus selector is moved more slowly. In this fashion, the user is provided additional feedback when trying to determine the precise endpoint of the desired text, providing increased productivity and an overall more efficient user experience. Although exemplified by the selection of a sub-set of text, the methods and user interfaces described below are useful for improving a user's efficiency when working with any number of user interface objects and subdivisions thereof. For example, web browsers displaying multiple hyperlinks, directory menus displaying multiple folders, application icons and/or application icons, and spreadsheets containing multiple individual cells.

[0209] FIGS. **5**A-**5**L illustrate exemplary user interfaces for providing feedback when a focus selector moves over a user interface object in accordance with some embodiments. The user interfaces in these figures are used to illustrate the processes described below, including the processes in FIGS. **6**A-**6**C.

[0210] FIGS. **5**E-**5**I include intensity diagrams that show the current intensity of the contact on the touch-sensitive

surface relative to a plurality of intensity thresholds including a first intensity threshold (e.g., light press intensity threshold "IT_L") and a second threshold (e.g., deep press intensity threshold "IT_D"). FIGS. **5**C, **5**D, and **5**K include velocity diagrams that show the current velocity of the contact on the touch-sensitive surface relative to a first velocity threshold (e.g., a fast velocity threshold "VT_F") and a second threshold (e.g., a slow velocity threshold VT_S"). In some embodiments, the second velocity threshold is higher than the first velocity threshold. These velocity diagrams are typically not part of the displayed user interface, but are provided to aid in the interpretation of the figures.

[0211] FIG. **5**A illustrates exemplary user interface **8708** displaying text that includes multiple user interface objects (e.g., paragraphs) in accordance with some embodiments. In FIG. **5**A, user interface **8708** is displayed on display **450** of an electronic device that also includes touch-sensitive surface **451** and one or more sensors for detecting intensity of contacts with touch-sensitive surface **451**. In some embodiments, touch-sensitive surface **451** is a touch screen display that is optionally display **450** or a separate display. User interface **8708** displays a plurality of user interface objects, including first user interface object **8702** and second user interface object **8704**, where the first user interface object **8702** and second user interface object **8704** include a plurality of subdivisions. For example, first user interface object **8702**, e.g., the first paragraph displayed on display **450**, includes a plurality of subdivisions (e.g., individual words), including first user interface object subdivision **8702-1** (i.e., the word "Four") and second user interface object subdivision **8702-2** (i.e., the word "score"). In FIG. **5**A, user interface **8708** also displays cursor **8706**, controllable by the user through contacts on touch-sensitive surface **451**. For example, detection of movement of a contact on touch-sensitive surface **451** corresponds to movement of cursor **8706** on user interface **8708**. While paragraphs **8702** and **8704** are described above as user interface objects with subdivisions, in some embodiments, the words (or sentences) of these paragraphs are considered to be user interface objects with subdivisions (e.g., the sentences are user interface objects with words as subdivisions, or the words are user interface objects with letters as subdivisions).

[0212] In some embodiments, the device is an electronic device with a separate display (e.g., display **450**) and a separate touch-sensitive surface (e.g., touch-sensitive surface **451**). In some embodiments, the device is portable multifunction device **100**, the display is touch-sensitive display system **112**, and the touch-sensitive surface includes tactile output generators **167** on the display (FIG. **1**A). For convenience of explanation, the embodiments described with reference to FIGS. **5**A-**5**M and FIGS. **6**A-**6**C will be discussed with reference to display **450** and a separate touch-sensitive surface **451**, however analogous operations are, optionally, performed on a device with a touch-sensitive display system **112** in response to detecting movement of the contacts described in FIGS. **5**A-**5**M on the touch-sensitive display system **112** while displaying the user interfaces shown in FIGS. **5**A-**5**M on the touch-sensitive display system **112**; in such embodiments, the focus selector is, optionally: a respective contact, a representative point corresponding to a contact (e.g., a centroid of a respective contact or a point associated with a respective contact), or a centroid of two or more contacts detected on the touch-sensitive display system **112**, in place of cursor **8706**.

[0213] FIGS. **5**A-**5**K illustrate that contact **8710** and gesture **8712** are detected on touch-sensitive surface **451** (e.g., movement **8712**-*a* of contact **8710** from location **8710**-*a* in FIG. **5**A to location **8710**-*b* in FIG. **5**B; movement **8712**-*b* of contact **8710** from location **8710**-*b* in FIG. **5**B to location **8710**-*c* in FIG. **5**C; movement **8712**-*b* of contact **8710** from location **8710**-*b* in FIG. **5**B to location **8710**-*c* in FIG. **5**D; movement **8712**-*b* of contact **8710** from location **8710**-*b* in FIG. **5**B to location **8710**-*c* in FIG. **5**E; movement **8712**-*b* of contact **8710** from location **8710**-*b* in FIG. **5**B to location **8710**-*c* in FIG. **5**F; movement **8712**-*b* of contact **8710** from location **8710**-*b* in FIG. **5**B to location **8710**-*c* in FIG. **5**G; and/or movement **8712**-*b* of contact **8710** from location **8710**-*b* in FIG. **5**B to location **8710**-*c* in FIG. **5**H. Contact **8710** occurs at a position on touch-sensitive surface **451** corresponding to an area on display **450** occupied by first user interface object **8702** (e.g., contact **8710** corresponds to a focus selector on the display, such as cursor **8706** which is at or near a location of user interface object **8702**). Gesture **8712** includes movement of contact **8710** on touch-sensitive surface **451** that corresponds to movement of focus selector (e.g., a cursor **8706**) on display **450** (e.g., as illustrated in FIGS. **5**A-**5**F).

[0214] FIG. **5**B illustrates that continuation of gesture **8712** includes movement of contact **8710** on touch-sensitive surface **451** that corresponds to movement of cursor **8706** over user interface object **8702** displayed on display **450** (e.g., movement of the cursor **8706** into a respective area of the display that is occupied by a first paragraph of text). In response to detecting movement of contact **8710** on touch-sensitive surface **451** that corresponds to movement of cursor **8706** over user interface object **8702**, tactile output generators **167** generate tactile outputs **8714** that correspond to boundary **8703** of user interface object **8702** (e.g., a beginning of paragraph **8702**).

[0215] FIGS. **5**B-**5**C illustrate an example where, in accordance with a determination that output criteria have been met, tactile output generators **167** generate tactile outputs **8714** that correspond to boundary **8703** of the user interface object **8702**, as in FIG. **5**B, and subdivision **8702-2** (i.e., the word "score) of user interface object **8702**, as in FIG. **5**C. FIGS. **5**B and **5**D illustrate an example where, in accordance with a determination that the output criteria have not been met, tactile output generators **167** generate tactile outputs **8714** that correspond to boundary **8703** of the user interface object **8702**, as in FIG. **5**B, without generating tactile outputs that correspond to subdivision **8702-2** of user interface object **8702**, as in FIG. **5**D.

[0216] In some embodiments, as illustrated in FIGS. **5**C-**5**D, the output criteria include a criterion that the focus selector has a velocity that is below a respective velocity threshold (e.g., "VT_F") when the focus selector moves over the respective user interface object. For example, as illustrated in FIG. **5**C, in response to detecting movement of cursor **8706** over user interface object **8702**, in accordance with a determination that an output criterion (e.g., that cursor **8706**, or alternatively contact **8710**, has a velocity that is below a respective velocity threshold VT_F) has been met (e.g., because cursor **8706**, or alternatively contact **8710**, has a velocity that is below VT_F in FIG. **5**C), tactile output generators **167** generate tactile outputs **8714** that correspond to boundary **8703** (e.g., as shown in FIG. **5**B) of the user interface object **8702** and subdivision **8702-2** (e.g., as shown in FIG. **5**C). In contrast, as illustrated in FIG. **5**D, in

response to detecting movement of cursor **8706** over user interface object **8702**, in accordance with a determination that an output criterion (e.g., that cursor **8706**, or alternatively contact **8710**, has a velocity that is below a respective velocity threshold VT_F) has not been met (e.g., because cursor **8706**, or alternatively contact **8710**, has a velocity below VT_F in FIG. **5**D), tactile output generators **167** generate tactile outputs **8714** that correspond to boundary **8703** (e.g., as shown in FIG. **5**B) of the user interface object without generating tactile outputs that correspond to subdivision **8702-2** (e.g., as shown in FIG. **5**D).

[0217] In some embodiments, as illustrated in FIGS. **5**E-**5**F, the output criteria include a criterion that the contact has an intensity above a respective intensity threshold (e.g., "IT_D") when the focus selector moves over the respective user interface object. For example, as illustrated in FIG. **5**E, in response to detecting movement of cursor **8706** over user interface object **8702**, in accordance with a determination that an output criterion (e.g., that contact **8710** has an intensity above a respective intensity threshold "IT_D") has not been met (e.g., because contact **8710** has an intensity below IT_D in FIG. **5**E), tactile output generators **167** generate tactile outputs **8714** that correspond to boundary **8703** of the user interface object (e.g., as shown in FIG. **5**B) without generating tactile outputs that correspond to subdivision **8702-2**. In contrast, as illustrated in FIG. **5**F, in response to detecting movement of cursor **8706** over user interface object **8702**, in accordance with a determination that an output criterion (e.g., that contact **8710** has an intensity above a respective intensity threshold "IT_D") has been met (e.g., because contact **8710** has an intensity above IT_D in FIG. **5**F), tactile output generators **167** generate tactile outputs **8714** that correspond to boundary **8703** of the user interface object **8702** (e.g., as shown in FIG. **5**B) and subdivision **8702-2** (e.g., as shown in FIG. **5**F).

[0218] In some embodiments, as illustrated in FIGS. **5**G-**5**H, the output criteria include a criterion that the contact has an intensity below a respective intensity threshold (e.g., "IT_D") when the focus selector moves over the respective user interface object. For example, as illustrated in FIG. **5**G, in response to detecting movement of cursor **8706** over user interface object **8702**, in accordance with a determination that an output criterion (e.g., that contact **8710** has an intensity below a respective intensity threshold IT_D) has been met (e.g., because contact **8710** has an intensity below IT_D in FIG. **5**G), tactile output generators **167** generate tactile outputs **8714** that correspond to boundary **8703** (e.g., as shown in FIG. **5**B) of the user interface object **8702** and subdivision **8702-2** (e.g., as shown in FIG. **5**G). In contrast, as illustrated in FIG. **5**H, in response to detecting movement of cursor **8706** over user interface object **8702**, in accordance with a determination that an output criterion (e.g., that contact **8710** has an intensity below a respective intensity threshold IT_D) has not been met (e.g., because contact **8710** has an intensity above IT_D in FIG. **5**H), tactile output generators **167** generate tactile outputs **8714** that correspond to boundary **8703** (e.g., as shown in FIG. **5**B) of the user interface object without generating tactile outputs that correspond to subdivision **8702-2** (e.g., as shown in FIG. **5**H).

[0219] FIGS. **5**I-**5**K illustrates an example, where first user interface object **8702** and second user interface object **8704** include a hierarchy of subdivisions, including a level corresponding to a first class of subdivisions and a level corresponding to a second class of subdivisions. For example, first user interface object **8702**, e.g., the first paragraph displayed on display **450**, includes a first class of subdivisions (e.g., individual words), including first user interface object subdivision **8702-1** (i.e., the word "Four") and second user interface object subdivision **8702-2** (i.e., the word "score"), and a second class of subdivisions (e.g., individual letters), including first user interface super-subdivision **8702-1***a* (i.e., the letter "F") and second user interface super-subdivision **8702-1***b* (i.e., the letter "o").

[0220] FIGS. **5**I-**5**K illustrate tactile outputs generated in response to detecting a continuation of gesture **8712** includes movement of contact **8710** on touch-sensitive surface **451** that corresponds to movement of cursor **8706** over first user interface object **8702** and second user interface object **8704** displayed on display **450** (e.g., movement of the cursor into a respective area of the display that is occupied by a first paragraph of text followed by movement into a respective area of the display that is occupied by a second paragraph of text). In response to detecting movement of contact **8710** on touch-sensitive surface **451** that corresponds to movement of cursor **8706** over user interface object **8702**, tactile output generators **167** generate tactile outputs **8714** that correspond to boundary **8703** of user interface object **8702**, as shown in FIG. **5**B.

[0221] In some embodiments, illustrated in FIGS. **5**I-**5**K, in accordance with a determination that first output criteria have been met, tactile output generators **167** generate: tactile outputs **8722-1***a* and **8724-1***a* that correspond to respective boundaries of first user interface object **8702** and second user interface object **8704**; and tactile outputs (e.g., tactile outputs **8722-2***a* and **8724-2**a) that correspond to respective boundaries of first class subdivisions (e.g., individual words) **8702-2** to **8702-30** and **8704-2** to **8704-73**, without generating tactile outputs corresponding to subdivisions in the second class of subdivisions (e.g., individual letters), and in accordance with a determination that second output criteria have been met, (optionally, in addition to a determination that the first output criteria have been met) tactile output generators **167** generate tactile outputs: **8722-1***a* and **8724-1***a* that correspond to respective boundaries of first user interface object **8702** and second user interface object **8704**; tactile outputs **8722-2***a* and **8724-2***a* that correspond to respective boundaries of first class subdivisions (e.g., individual words) **8702-2** to **8702-30** and **8704-2** to **8704-73**; and tactile outputs (e.g., tactile outputs **8722-1***b* and **8724-1***b*) that correspond to respective boundaries of second class subdivisions (e.g., individual letters) including subdivisions **8702-1***b* to **8702-2***d* and **8704-1***b* to **8704-1***c*. In some embodiments, for a user interface object that is an application window with a block of text, the first and second subdivision levels include two or more of: paragraphs, sentences, words, and letters.

[0222] In some embodiments where tactile outputs are generated for different types of boundaries (e.g., boundaries of user interface objects, boundaries of the first class of subdivisions and boundaries of the second class of subdivisions), the tactile outputs generated for a first type of boundary are different from the tactile outputs generated for a second type of boundary. For example, in FIGS. **5**I-**5**K, the tactile outputs **8722-1***a* and **8724-1***a* that correspond to respective boundaries of first user interface object **8702** and second user interface object **8704** have a first magnitude and/or movement profile; the tactile outputs **8722-2***a* and **8724-2***a* that correspond to respective boundaries of first

class subdivisions (e.g., individual words) **8702-2** and **8704-2** have a second magnitude and/or movement profile that is different from the first magnitude/movement profile. Similarly, tactile outputs **8722-1***b* and **8724-1***b* that correspond to respective boundaries of second class subdivisions (e.g., individual letters) **8702-1***b* and **8704-1***b* have a third magnitude and/or movement profile that is different from the first magnitude/movement profile and the second magnitude/movement profile. While the different types of boundaries are shown in FIGS. **5**I-**5**K as being associated with tactile outputs with different magnitudes and/or movement profiles, in some embodiments, some or all of the different types of boundaries are associated with tactile outputs with the same or substantially similar magnitudes and/or movement profiles.

[0223] FIG. **5**I illustrates an example where the output criteria include criteria based on contact intensity. In some of these embodiments, if the focus selector moves over a row of text while the user is pressing down very hard with the contact (e.g., with an intensity above a second intensity threshold "IT_D"), the device generates tactile outputs corresponding to the beginnings or ends of paragraphs or sentences, individual words, and individual letters. In contrast, when the focus selector moves over a row of text while the user is pressing down slightly less hard with the contact (e.g., with an intensity below a second intensity threshold "IT_D" but above a first intensity threshold "IT_L"), the device generates tactile outputs corresponding to the beginnings or ends of paragraphs or sentences and individual words but not individual letters. In contrast, when the focus selector moves over a row of text while the user is pressing down lightly with the contact (e.g., with an intensity below a first intensity threshold "IT_L"), the device only generates tactile outputs corresponding to beginnings or endings of paragraphs or sentences.

[0224] FIG. **5**J illustrates an example where the output criteria include criteria based on contact intensity. In some of these embodiments, if the focus selector moves over a row of text while the user is pressing down very hard with the contact (e.g., with an intensity above a second intensity threshold "IT_D"), the device only generates tactile outputs corresponding to beginnings or endings of paragraphs or sentences. In contrast, when the focus selector moves over a row of text while the user is pressing down slightly less hard with the contact (e.g., with an intensity below a second intensity threshold "IT_D" but above a first intensity threshold "IT_L"), the device generates tactile outputs corresponding to the beginnings or ends of paragraphs or sentences and individual words but not individual letters. In contrast, when the focus selector moves over a row of text while the user is pressing down lightly with the contact (e.g., with an intensity below a first intensity threshold "IT_L"), the device generates tactile outputs corresponding to the beginnings or ends of paragraphs or sentences, individual words, and individual letters.

[0225] FIG. **5**K illustrates an example where the output criteria include criteria based on contact velocity, or optionally focus selector velocity. In some of these embodiments, when the contact, or optionally the focus selector, is moving very fast (e.g., at a velocity above a fast velocity threshold "VT_F"), the device only generates tactile outputs corresponding to beginnings or endings of paragraphs or sentences. In contrast, when the contact, or optionally the focus selector, is moving slightly slower (e.g. at a velocity below a fast velocity threshold "VT_F" but above a slow velocity threshold "VT_S") the device generates tactile outputs corresponding to the beginnings or ends of paragraphs or sentences and individual words. In contrast, when the contact, or optionally the focus selector, is moving very slowly (e.g., at a velocity below a slow velocity threshold "VT_S"), the device generates tactile outputs corresponding to the beginnings or ends of paragraphs or sentences, individual words, and individual letters.

[0226] FIG. **5**L illustrates an example where movement **8728** of contact **8726** on touch sensitive surface **451** corresponds to movement of cursor **8720** over subdivision **8716-2** (e.g., a hyperlink) of user interface object **8716** (e.g., an active web browser window), and in response to detecting movement of cursor **8720** over user interface object subdivision **8716-2** displayed in active user interface object **8716**, where a determination that output criterion including that the respective user interface object is displayed in an active window in the user interface has been met (e.g., because user interface object **8716** is active), tactile output generators **167** generate tactile outputs **8714** that correspond to user interface object subdivision **8716-2**. In contrast, as illustrated in FIG. **5**M, continuation of gesture **8728** on touch sensitive surface **451** corresponds to movement of cursor **8720** over subdivision **8718-2** (e.g., a hyperlink) of user interface object **8718** (e.g., an inactive web browser window), and in response to detecting movement of cursor **8720** over user interface object subdivision **8718-2** displayed in inactive user interface object **8718**, where a determination that output criterion including that the respective user interface object is displayed in an active window in the user interface has not been met (e.g., because user interface object **8718** is inactive), tactile outputs that correspond to user interface object subdivision **8718-2** are not generated.

[0227] In some embodiments, as illustrated in FIGS. **5**L-**5**M, the plurality of user interface objects include application windows (e.g., web browsers, document windows, file menus, and other application windows) and the subdivisions of the respective user interface object include selectable affordances within the application windows. (e.g., hyperlinks, folders, controls, and document icons).

[0228] In some embodiments, as illustrated in FIGS. **5**A-**5**K, the plurality of user interface objects include blocks of text (e.g., paragraphs, sentences, or words) and the subdivisions of the respective user interface object include smaller portions of the text (e.g., sentences, words, or letters). In some embodiments, the plurality of user interface objects include paragraphs and the subdivisions of the respective user interface object include individual sentences. In some embodiments, the plurality of user interface objects include paragraphs and the subdivisions of the respective user interface object include individual words. In some embodiments, the plurality of user interface objects include paragraphs and the subdivisions of the respective user interface object include individual letters. In some embodiments, the plurality of user interface objects include sentences and the subdivisions of the respective user interface object include individual words. In some embodiments, the plurality of user interface objects include sentences and the subdivisions of the respective user interface object include individual letters. In some embodiments, the plurality of user interface objects include words and the subdivisions of the respective user interface object include individual letters.

[0229] In some embodiments, as illustrated in FIGS. **5**I-**5**K, a respective user interface object of the plurality of user interface objects includes a hierarchy of subdivisions, including a level corresponding to a first class of subdivisions and a level corresponding to a second class of subdivisions (e.g., for a user interface object that is an application window with a block of text, the first and second subdivision levels include two or more of: paragraphs, sentences, words, and letters). In some embodiments, the plurality of user interface objects include paragraphs, a first class of subdivisions includes individual sentences, a second class of subdivisions includes individual words, and a third class of subdivisions includes individual letters. In some embodiments, the plurality of user interface objects include paragraphs, a first class of subdivisions includes individual sentences, a second class of subdivisions includes individual words. In some embodiments, the plurality of user interface objects include paragraphs, a first class of subdivisions includes individual sentences, a second class of subdivisions includes individual letters. In some embodiments, the plurality of user interface objects include paragraphs, a first class of subdivisions includes individual words, a second class of subdivisions includes individual letters. In some embodiments, the plurality of user interface objects include sentences, a first class of subdivisions includes individual words, a second class of subdivisions includes individual letters.

[0230] FIGS. **6**A-**6**C are flow diagrams illustrating a method **8800** of providing feedback when a focus selector moves over a subdivision of a user interface object in accordance with some embodiments. The method **8800** is performed at an electronic device (e.g., device **300**, FIG. **3**, or portable multifunction device **100**, FIG. **1**A) with a display and a touch-sensitive surface. In some embodiments, the display is a touch screen display and the touch-sensitive surface is on the display. In some embodiments, the display is separate from the touch-sensitive surface. Some operations in method **8800** are, optionally, combined and/or the order of some operations is, optionally, changed.

[0231] As described below, the method **8800** provides an intuitive way to provide feedback when a focus selector moves over a user interface object. The method reduces the cognitive burden on a user when detecting feedback when a focus selector moves over a user interface object, thereby creating a more efficient human-machine interface. For battery-operated electronic devices, enabling a user to detect feedback when a focus selector moves over a user interface object faster and more efficiently conserves power and increases the time between battery charges.

[0232] In some embodiments, the device displays (**8802**) a plurality of user interface objects (e.g., first user interface object **8702** and second user interface object **8704** in FIGS. **5**A-**5**K or first user interface object **8716** and second user interface object **87!6** in FIGS. **5**L-**5**M) on a display (e.g., display **450** in FIGS. **5**A-**5**K), where each of the plurality of user interface objects includes a plurality of subdivisions (e.g., first user interface object subdivisions **8702-1** and **8702-2**, and second user interface object subdivisions **8704-1** and **8704-2**, in FIGS. **5**A-**5**K or first user interface object subdivisions **8716-1** and **8716-2**, and second user interface object subdivisions **8718-1** and **8718-2**, in FIGS. **5**L-**5**M).

[0233] In some embodiments, the plurality of user interface objects include (**8804**) application windows and the subdivisions of the respective user interface object include selectable affordances within the application windows (e.g., hyperlinks, folders, controls, document icons), as shown in FIGS. **5**L-**5**M. In other embodiments, the plurality of user interface objects are (**8806**) paragraphs and the subdivisions are words. In other embodiments, the plurality of user interface objects are (**8808**) sentences and the subdivisions are words. In yet other embodiments, the plurality of user interface objects are (**8810**) words and the subdivisions are letters (e.g., the device generates tactile-outputs for each letter if a focus selector is moving slowly over a sentence, but only at the beginning of each word if the focus selector is moving quickly).

[0234] In some embodiments, while the device displays the user interface objects, the device detects (**8812**) movement of a contact (e.g., contact **8710** in FIGS. **5**A-**5**H or contact **8726** in FIGS. **5**L-**5**M) on the touch-sensitive surface (e.g., touch-sensitive surface **451**) that corresponds to movement of a focus selector (e.g., cursor **8706** in FIGS. **5**A-**5**K or cursor **8720** in FIGS. **5**L-**5**M) over a respective user interface object (e.g., first user interface object **8702** in FIGS. **5**A-**5**K or first user interface object **8716** in FIGS. **5**L-**5**M) in the plurality of user interface objects.

[0235] In some embodiments, in response (**8814**) to detecting the movement of the contact: in accordance with a determination that output criteria have been met, the device generates (**8816**) tactile outputs (e.g., tactile outputs **8714** in FIGS. **5**B-**5**C) that correspond to a respective boundary (e.g., a tactile output corresponding to boundary **8703** in FIG. **5**B) of the respective user interface object and subdivisions (e.g., tactile outputs corresponding to subdivisions **8702-1** and **8702-2** in FIG. **5**C) of the respective user interface object (e.g., user interface object **8702** in FIGS. **5**B-**5**C). In some embodiments, the output criteria are subdivision-tactile-output criteria (e.g., criteria that are used to determine whether or not to provide tactile output corresponding to subdivisions in a respective user interface object).

[0236] In some embodiments, the output criteria include (**8818**) a criterion that the focus selector has a velocity that is below a respective velocity threshold when the focus selector moves over the respective user interface object. In some embodiments, if the focus selector moves quickly over a row of text, tactile outputs are generated at the beginning of paragraphs but not for individual sentences, words, and/or letters, whereas if the focus selector moves slowly over the row of text, tactile outputs are generated for the beginnings of paragraphs, as well as for individual sentences, words and/or individual letters. In some embodiments, if the focus selector moves quickly over a row of text, tactile outputs are generated at the beginning of sentences but not for individual words and/or letters, whereas if the focus selector moves slowly over the row of text, tactile outputs are generated for the beginnings of sentences, as well as for individual words and/or letters. In some embodiments, if the focus selector moves quickly over a row of text, tactile outputs are generated at the beginning of words but not for individual letters, whereas if the focus selector moves slowly over the row of text, tactile outputs are generated for the beginnings of words and also for individual letters.

[0237] In some embodiments, the output criteria include (**8820**) a criterion that the contact has an intensity above a respective intensity threshold when the focus selector moves over the respective user interface object. In some embodi-

ments, if the focus selector moves over a row of text while the user is pressing down lightly with the contact, tactile outputs are generated at the beginning of paragraphs but not for individual sentences, words, and/or letters, whereas if the focus selector moves over the row of text while the user is pressing down hard with the contact, tactile outputs are generated for the beginnings of paragraphs, as well as for individual sentences, words and/or individual letters. In some embodiments, if the focus selector moves over a row of text while the user is pressing down lightly with the contact, tactile outputs are generated at the beginning of sentences but not for individual words and/or letters, whereas if the focus selector moves over the row of text while the user is pressing down hard with the contact, tactile outputs are generated for the beginnings of sentences, as well as for individual words and/or letters. In some embodiments, if the focus selector moves over a row of text while the user is pressing down lightly with the contact, tactile outputs are generated at the beginning of words but not for individual letters, whereas if the focus selector moves over the row of text while the user is pressing down hard with the contact, tactile outputs are generated for the beginnings of words and also for individual letters.

[0238] In some embodiments, the output criteria include (**8822**) a criterion that the contact has an intensity below a respective intensity threshold when the focus selector moves over the respective user interface object. In some embodiments, if the focus selector moves over a row of text while the user is pressing down hard with the contact, tactile outputs are generated at the beginning of paragraphs but not for individual sentences, words, and/or letters, whereas if the focus selector moves over the row of text while the user is pressing down lightly with the contact, tactile outputs are generated for the beginnings of paragraphs, as well as for individual sentences, words and/or individual letters. In some embodiments, if the focus selector moves over a row of text while the user is pressing down hard with the contact, tactile outputs are generated at the beginning of sentences but not for individual words and/or letters, whereas if the focus selector moves over the row of text while the user is pressing down lightly with the contact, tactile outputs are generated for the beginnings of sentences, as well as for individual words and/or letters. In some embodiments, if the focus selector moves over a row of text while the user is pressing down hard with the contact, tactile outputs are generated at the beginning of words but not for individual letters, whereas if the focus selector moves over the row of text while the user is pressing down lightly with the contact, tactile outputs are generated for the beginnings of words and also for individual letters.

[0239] In some embodiments, the output criteria include (**8824**) a criterion that the respective user interface object is displayed in an active window in the user interface. In some embodiments the output criteria include a criterion that the respective user interface object is displayed in an active window in the user interface. For example, if the focus selector moves over a row of text of a background window, tactile outputs are generated at the beginning of words but not for individual letters or no tactile outputs are generated, whereas if the focus selector moves over a row of text of the active window, tactile outputs are generated for the beginnings of words and, in some embodiments, also for individual letters. In some embodiments, as illustrated in FIGS. **5**L-**5**M, tactile outputs are generated in response to detecting movement of the focus selector when the focus selector moves over elements in the active window but not when the focus selector moves over elements in an inactive window. For example, if there are a plurality of web browser pages that have hyperlinks open, and the focus selector moves over a plurality of hyperlinks, tactile outputs are generated for the hyperlinks in the active browser window, but tactile outputs are not generated for hyperlinks in the background browser window(s).

[0240] In response (**8814**) to detecting the movement of the contact: in accordance with a determination that the output criteria have not been met, the device generates (**8826**) tactile outputs (e.g., tactile outputs **8714** in FIG. **5**B) that correspond to the respective boundary (e.g., boundary **8703** in FIG. **5**B) of the respective user interface object without generating tactile outputs that correspond to the subdivisions (e.g., subdivisions **8702-1** and **8702-2** in FIG. **5**D) of the respective user interface object (e.g., user interface object **8702** in FIGS. **5**B and **5**D). For example in FIGS. **5**B and **5**D, when the contact has a velocity above VT_F, the device generates a tactile output when cursor **8706** moves over a boundary of paragraph **8702** but does not generate a tactile output when cursor **8706** moves over a boundary of word **8702-2**. Similarly, in FIGS. **5**B and **5**E, when the contact has an intensity below IT_D, the device generates a tactile output when cursor **8706** moves over a boundary of paragraph **8702** but does not generate a tactile output when cursor **8706** moves over a boundary of word **8702-2**.

[0241] In some embodiments, a respective user interface object of the plurality of user interface objects includes (**8836**) a hierarchy of subdivisions, including a level corresponding to a first class of subdivisions (e.g., first user interface object first class subdivisions **8702-1** and **8702-2** corresponding to words in paragraph **8702** and second user interface object first class subdivisions **8704-1** and **8704-2** corresponding to words in paragraph **8704** in FIGS. **5**I-**5**K) and a level corresponding to a second class of subdivisions (e.g., first user interface object second class subdivisions **8702-1***a*, **8702-1***b*, **8702-1***c* and **8702-1***d*, corresponding to letters in words in paragraph **8702** and second user interface object second class subdivisions **8704-1***a*, **8704-1***b* and **8704-1***c* corresponding to letters in words in paragraph **8704** in FIGS. **5**I-**5**K). For example, for a user interface object that is an application window with a block of text, the first and second subdivision levels include two or more of: paragraphs, sentences, words, and letters.

[0242] In some embodiments, in response (**8814**) to detecting the movement of the contact: in accordance with a determination that first output criteria have been met, the device generates (**8838**) tactile outputs (e.g., tactile outputs **8722-1***a*, **8722-2***a*, **8724-1***a* and **8724-2***a* in FIG. **5**K) corresponding to subdivisions in the first class of subdivisions (e.g., first class user interface object subdivisions **8702-1**, **8702-2**, **8704-1** and **8704-2** that correspond to words in paragraphs in FIGS. **5**I-**5**K) without generating tactile outputs corresponding to subdivisions in the second class of subdivisions (e.g., second class user interface object subdivisions **8702-1***b*, **8702-2***b*, and **8704-1***b* that correspond to letters in words in FIGS. **5**I-**5**K).

[0243] In some embodiments, in response (**8814**) to detecting the movement of the contact: in accordance with a determination that second output criteria have been met (optionally, in addition to a determination that the first output criteria have been met), the device generates (**8840**)

tactile outputs (e.g., tactile outputs **8722-1***a*, **8722-2***a*, **8724-1***a* and **8724-2***a* in FIGS. **5**I-**5**K) corresponding to subdivisions in the first class of subdivisions (e.g., first class user interface object subdivisions **8702-1**, **8702-2**, **8704-1** and **8704-2** that correspond to words in paragraphs in FIGS. **5**I-**5**K) and the device generates tactile outputs (e.g., tactile outputs **8722-1***b*, **8722-2***b*, **8724-1***b* and **8724-2***b* in FIGS. **5**I-**5**K) corresponding to subdivisions in the second class of subdivisions (e.g., second class user interface object subdivisions **8702-1***b*, **8702-2***b*, and **8704-1***b* that correspond to letters in words in FIGS. **5**I-**5**K). For example, when the contact is moving very fast, the device only generates tactile outputs corresponding to ends of sentences, when the contact is moving slightly slower the device generates tactile outputs corresponding to the ends of words and sentences, and when the contact is moving very slowly, the device generates tactile outputs corresponding to the ends of words, sentences, and individual letters.

[0244] It should be understood that the particular order in which the operations in FIGS. **6**A-**6**C have been described is merely exemplary and is not intended to indicate that the described order is the only order in which the operations could be performed. One of ordinary skill in the art would recognize various ways to reorder the operations described herein. Additionally, it should be noted that details of other processes described herein with respect to other methods described herein (e.g., those listed in the fifth paragraph of the Description of Embodiments) are also applicable in an analogous manner to method **8800** described above with respect to FIGS. **6**A-**6**C. For example, the contacts, gestures, user interface objects, tactile outputs, intensity thresholds, velocity thresholds and focus selectors described above with reference to method **8800** optionally have one or more of the characteristics of the contacts, gestures, user interface objects, tactile outputs, intensity thresholds, velocity thresholds and focus selectors described herein with reference to other methods described herein (e.g., those listed in the fifth paragraph of the Description of Embodiments). For brevity, these details are not repeated here.

[0245] In accordance with some embodiments, FIG. **7** shows a functional block diagram of an electronic device **8900** configured in accordance with the principles of the various described embodiments. The functional blocks of the device are, optionally, implemented by hardware, software, or a combination of hardware and software to carry out the principles of the various described embodiments. It is understood by persons of skill in the art that the functional blocks described in FIG. **7** are, optionally, combined or separated into sub-blocks to implement the principles of the various described embodiments. Therefore, the description herein optionally supports any possible combination or separation or further definition of the functional blocks described herein.

[0246] As shown in FIG. **7**, an electronic device **8900** includes a display unit **8902** configured to display one or more user interface objects, a touch-sensitive surface unit **8904** configured to receive user contacts, optionally one or more sensor units **8906** configured to detect intensity of contacts with the touch-sensitive surface unit **8904**; and a processing unit **8908** coupled to the display unit **8902**, the touch-sensitive surface unit **8904** and the one or more sensor units **8906**. In some embodiments, the processing unit **8908** includes a display enabling unit **8909**, a detecting unit **8910**, and a generating unit **8912**.

[0247] In some embodiments, the processing unit **8908** is configured to enable display (e.g., with the display enabling unit **8909**) of a plurality of user interface objects on the display unit **8902**, where each of the plurality of user interface objects includes a plurality of subdivisions. In some embodiments, the processing unit **8908** is further configured to detect movement of a contact on the touch-sensitive surface that corresponds to movement of a focus selector over a respective user interface object in the plurality of user interface objects (e.g., with the detecting unit **8910**); and in response to detecting the movement of the contact: in accordance with a determination that output criteria have been met, the processing unit **8908** is configured to generate tactile outputs (e.g., with the generating unit **8912**) that correspond to a respective boundary of the respective user interface object and subdivisions of the respective user interface object; and in accordance with a determination that the output criteria have not been met, the processing unit **8908** is configured to generate tactile outputs (e.g., with the generating unit **8912**) that correspond to the respective boundary of the respective user interface object without generating tactile outputs that correspond to the subdivisions of the respective user interface object.

[0248] In some embodiments, the output criteria include a criterion that the focus selector has a velocity that is below a respective velocity threshold when the focus selector moves over the respective user interface object.

[0249] In some embodiments, the output criteria include a criterion that the contact has an intensity above a respective intensity threshold when the focus selector moves over the respective user interface object.

[0250] In some embodiments, the output criteria include a criterion that the contact has an intensity below a respective intensity threshold when the focus selector moves over the respective user interface object.

[0251] In some embodiments, the output criteria include a criterion that the respective user interface object is displayed in an active window in the user interface.

[0252] In some embodiments, the plurality of user interface objects include application windows and the subdivisions of the respective user interface object include selectable affordances within the application windows.

[0253] In some embodiments, the plurality of user interface objects are paragraphs, and the subdivisions are words.

[0254] In some embodiments, the plurality of user interface objects are sentences, and the subdivisions are words.

[0255] In some embodiments, the plurality of user interface objects are words, and the subdivisions are letters.

[0256] In some embodiments, a respective user interface object of the plurality of user interface objects includes a hierarchy of subdivisions, including a level corresponding to a first class of subdivisions and a level corresponding to a second class of subdivisions. In some of these embodiments, in response to detecting the movement of the contact: in accordance with a determination that first output criteria have been met, the processing unit **8908** is configured to generate tactile outputs (e.g., with the generating unit **8912**) corresponding to subdivisions in the first class of subdivisions without generating tactile outputs corresponding to subdivisions in the second class of subdivisions; and in accordance with a determination that second output criteria have been met, the processing unit **8908** is configured to generate tactile outputs (e.g., with the generating unit **8912**) corresponding to subdivisions in the first class of subdivi-

sions and generate tactile outputs (e.g., with the generating unit **8912**) corresponding to subdivisions in the second class of subdivisions.

[0257] The operations in the information processing methods described above are, optionally implemented by running one or more functional modules in information processing apparatus such as general purpose processors (e.g., as described above with respect to FIGS. **1**A and **3**) or application specific chips.

[0258] The operations described above with reference to FIGS. **6**A-**6**C are, optionally, implemented by components depicted in FIGS. **1**A-**1**B or FIG. **7**. For example, detection operation **8812** and determination operations **8816**, **8826**, **8838** and **8840** are, optionally, implemented by event sorter **170**, event recognizer **180**, and event handler **190**. Event monitor **171** in event sorter **170** detects a contact on touch-sensitive display **112**, and event dispatcher module **174** delivers the event information to application **136-1**. A respective event recognizer **180** of application **136-1** compares the event information to respective event definitions **186**, and determines whether a first contact at a first location on the touch-sensitive surface corresponds to a predefined event or sub-event, such as selection of an object on a user interface or generation of a tactile output (e.g., corresponding to a boundary of a user interface object or subdivision thereof). When a respective predefined event or sub-event is detected, event recognizer **180** activates an event handler **190** associated with the detection of the event or sub-event. Event handler **190** optionally utilizes or calls data updater **176** or object updater **177** to update the application internal state **192**. In some embodiments, event handler **190** accesses a respective GUI updater **178** to update what is displayed by the application. Similarly, it would be clear to a person having ordinary skill in the art how other processes can be implemented based on the components depicted in FIGS. **1**A-**1**B.

Providing Tactile Feedback When Interacting With a User Interface Object

[0259] Many electronic devices have graphical user interfaces that display user interface objects that can be activated in response to a user input (e.g., by clicking or scrolling over the object). For example, a graphical user interface optionally displays an application window containing a button, hyperlink, document launch icon, application launch icon, menu or other selectable affordance associated with a particular action (e.g., launching an application, loading content associated with a hyperlink or manipulating an object within an application). Typically, a user accesses the activatable content by first selecting the appropriate user interface object (e.g., via moving a focus selector over the object) and secondly activating the user interface object (e.g., via "clicking" on the object). Given the complexity of a user interface environment containing multiple user interface objects associated with activatable content, there is a need to provide feedback that enables the user to more efficiently and conveniently navigate through the user interface environment.

[0260] The embodiments described below provide improved methods and user interfaces for providing feedback to a user navigating a complex user interface environment. More specifically, these methods and user interfaces provide different tactile feedback to the user when a focus selector moves over a respective user interface object than when the user subsequently activates the respective user interface object. The tactile feedback distinguishes between these two actions by providing physical cues that feel different to the user. In this fashion, the methods and user interfaces provided below allow the user to more efficiently and conveniently discern between these two actions by providing tactile feedback, instead of or in addition to audible and/or visual feedback. Some methods for distinguishing between the selection and activation of a user interface object rely on an audible or visual cue. However, there are many situations (e.g., at work, in a theatre and in various social situations) where the volume of an electronic device will be lowered or muted, rendering audible cues ineffective. Advantageously, the methods and user interfaces described below augment or replace audible feedback by providing tactile feedback indicating that a user interface object has been selected and/or activated.

[0261] FIGS. **8**A-**8**E illustrate exemplary user interfaces for providing feedback when interacting with a user interface object 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**. FIGS. **8**A-**8**D include intensity diagrams that show the current intensity of the contact on the touch-sensitive surface relative to a plurality of intensity thresholds including an activation intensity threshold (e.g., light press intensity threshold "IT_L"). In some embodiments, operations similar to those described below with reference to IT_L are performed with reference to a different intensity threshold (e.g., "IT_D"). These intensity diagrams are typically not part of the displayed user interface, but are provided to aid in the interpretation of the figures. FIGS. **8**B-**8**D include waveform diagrams that show the amplitude (e.g., a high amplitude "AH" or low amplitude "AL") and shape (e.g., square or sawtooth) of the waveform corresponding to tactile output generated on the touch-sensitive surface in response to a tactile output triggering event (e.g., selection or activation of a user interface object). These waveform diagrams are typically not part of the displayed user interface, but are provided to aid in the interpretation of the figures.

[0262] FIG. **8**A illustrates exemplary user interface **9008** displaying one or more user interface objects **9004**. For example, user interface **9008** displays web browser **9002** (e.g., a user interface application window) that includes navigation button **9004-1** (e.g., a user interface object with an activatable hyperlink) and cursor **9006** (e.g., a focus selector). In FIG. **8**A, user interface **9008** is displayed on display **450** of an electronic device that also includes touch-sensitive surface **451** and one or more sensors for detecting intensity of contacts with touch-sensitive surface. In some embodiments, touch-sensitive surface **451** is a touch screen display that is optionally display **450** or a separate display.

[0263] In some embodiments, the device is an electronic device with a separate display (e.g., display **450**) and a separate touch-sensitive surface (e.g., touch-sensitive surface **451**). In some embodiments, the device is portable multifunction device **100**, the display is touch-sensitive display system **112**, and the touch-sensitive surface includes tactile output generators **167** on the display (FIG. **1**A). For convenience of explanation, the embodiments described with reference to FIGS. **8**A-**8**H and FIG. **9** will be discussed with reference to display **450** and a separate touch-sensitive surface **451**, however analogous operations are, optionally, performed on a device with a touch-sensitive display system

112 in response to detecting movement of the contacts described in FIGS. 8A-8H on the touch-sensitive display system 112 while displaying the user interfaces shown in FIGS. 8A-8H on the touch-sensitive display system 112; in such embodiments, the focus selector is, optionally: a respective contact, a representative point corresponding to a contact (e.g., a centroid of a respective contact or a point associated with a respective contact), or a centroid of two or more contacts detected on the touch-sensitive display system 112, in place of cursor 9006.

[0264] FIGS. 8A-8E illustrate various embodiments where cursor 9006, controlled by contact 9010 on touch-sensitive surface 451 and movement 9012 thereof, moves over (e.g., selects) and then clicks (e.g., activates) user navigation button 9006. In response, tactile output generators 167 provide different feedback (e.g., tactile outputs 9014, 9018 and 9022) to the user, identifying the actions as either selection or activation events. For example, depending on the type of action (e.g., selection or activation), the tactile outputs have a unique waveform (e.g., square waveforms 9016 and 9024 or sawtooth waveform 9020) or amplitude (e.g., a high amplitude "AH" or low amplitude "AL") indicating to the user which action was performed through their sense of touch.

[0265] FIGS. 8A-8E illustrate that contact 9010, corresponding to cursor 9002 displayed on display 450, and a gesture including movement 9012 of contact 9010 (e.g., movement 9012-*a* of contact 9010 from location 9010-*a* in FIG. 8A to location 9010-*b* in FIG. 8B) or change in intensity of contact 9010 (e.g., change in intensity of contact 9010 from an intensity below IT_L in FIGS. 8A-8B to an intensity above IT_L in FIG. 8C-8D; and/or liftoff of contact 9010 in FIG. 8C or FIG. 8D, as illustrated in FIG. 8E) are detected on touch-sensitive surface 451. Contact 9010 is detected at a position on touch-sensitive surface 451 corresponding to an area on display 450 occupied by focus selector 9006 (e.g., contact 9010 corresponds to a focus selector on the display, such as cursor 9006 which is at or near a location of user interface object 9002). In some embodiments, movement of contact 9010 on touch-sensitive surface 451 corresponds to movement of focus selector (e.g., a cursor 9006) on display 450 (e.g., as illustrated in FIGS. 8A-8B).

[0266] FIGS. 8A-8B illustrate an example of a beginning of a gesture where cursor 9006 moves over navigation button 9004-1, in accordance with movement 9012 of contact 9010, corresponding to cursor 9006 on display 450, on touch-sensitive surface 451, without activating navigation button 9004-1. In FIG. 8B, the device (e.g., via tactile output generators 167) generates first tactile outputs 9014 having a signature corresponding to a scroll over event (e.g., waveform 9016 and/or high amplitude "AH"), because the focus selector scrolled over the user interface object without activating the user interface object.

[0267] FIGS. 8B-8D illustrate various examples where the device detects a continuation of a gesture including movement 9012 of contact 9010, or a second gesture initiated after the completion of movement 9012, that includes an increase of intensity of contact 9010 above an activation intensity threshold (e.g., light press intensity threshold "IT_L"). In FIGS. 8C-8D, the device (e.g., via tactile output generators 167) generates second tactile outputs 9018 or 9022 having a signature corresponding to an activation event (e.g., waveform 9020 and/or low amplitude "AL"). For example, after moving a cursor over an activatable user interface object (e.g., a hyperlink or navigation button associated therewith), causing the device to generate a first tactile feedback (e.g., tactile output 9014, as shown in FIG. 8B), the user pushes down with greater force on the touch-sensitive surface to activate the user interface object, and in response the device generates a second tactile feedback (e.g., tactile output 9018 in FIG. 8C or tactile output 9022 in FIG. 8D) that feels different from the first tactile feedback (e.g., tactile output 9014 in FIG. 8B).

[0268] FIGS. 8B and 8C illustrate an example where the second tactile output (e.g., tactile output 9018) has a different movement profile (e.g., waveform 9020), but substantially the same maximum amplitude (e.g., "AH"), as the first tactile output (e.g., tactile output 9014). For example, the tactile feedback corresponding to activation of the user interface object feels different from, but is equally (or approximately) as strong as, the tactile feedback corresponding to selection of the user interface object. In contrast, FIGS. 8B and 8D illustrate an example where the second tactile output (e.g., tactile output 9022) has substantially the same movement profile (e.g., waveform 9024), but a different maximum amplitude (e.g. "AL"), as the first tactile output (e.g., tactile output 9014). For example, the tactile feedback corresponding to activation of the user interface object feels similar to, but is noticeably stronger or weaker than, the tactile feedback corresponding to selection of the user interface object.

[0269] FIGS. 8C-8E illustrate various examples where, in response to an increase of intensity of contact 9010 above an activation intensity threshold (e.g., light press intensity threshold "IT_L"), where contact 9010 corresponds to an area on display 450 occupied by focus selector 9006 located over user interface object 9004-1, the user interface object is activated. For example, as illustrated in FIG. 8E, after the user pushes down harder on touch-sensitive surface 451 (e.g., via contact 9010), with cursor 9006 positioned over navigation button 9004-1, and lifts off the contact from the touch-sensitive surface (or, alternatively, reduces the intensity of contact 9010 to an intensity between IT_0 and IT_L without lifting contact 9010 off of the touch-sensitive surface 451), content associated with a hyperlink embedded within the navigation button is loaded onto web browser 9004-1 (e.g., a new webpage is loaded on web browser 9002).

[0270] As described above, tactile outputs are, optionally, generated for a selection of a user interface object and an activation of a user interface object. FIGS. 8F-8H illustrate example waveforms of movement profiles for generating these tactile outputs. FIG. 8F illustrates a sawtooth waveform. FIG. 8G illustrates a square waveform and FIG. 8H illustrates a square waveform that has a lower amplitude than the square waveform of FIG. 8G. The high-amplitude square movement profile in FIG. 8G is, optionally, associated with moving over (e.g., scrolling over) a user interface object; the tactile output generated for moving over (e.g., scrolling over) a user interface object is, optionally, generated in accordance with a high-amplitude square movement profile. The low-amplitude square movement profile in FIG. 8H is, optionally, associated with activation of a user interface object; the tactile output generated for activation of a user interface object are, optionally, generated in accordance with a low-amplitude square movement profile. The sawtooth movement profile in FIG. 8F is, optionally, associated

with activation of a user interface object; the tactile output generated for activation of a user interface object is, optionally, generated in accordance with the sawtooth movement profile.

[0271] FIG. **9** is a flow diagram illustrating a method **9100** of providing feedback when interacting with a user interface object in accordance with some embodiments. The method **9100** is performed at an electronic device (e.g., device **300**, FIG. **3**, or portable multifunction device **100**, FIG. **1**A) with a display and a touch-sensitive surface. In some embodiments, the display is a touch screen display and the touch-sensitive surface is on the display. In some embodiments, the display is separate from the touch-sensitive surface. Some operations in method **9100** are, optionally, combined and/or the order of some operations is, optionally, changed.

[0272] As described below, the method **9100** provides an intuitive way to provide feedback when interacting with a user interface object. The method reduces the cognitive burden on a user when detecting feedback when interacting with a user interface object, thereby creating a more efficient human-machine interface. For battery-operated electronic devices, enabling a user to detect feedback when interacting with a user interface object faster and more efficiently conserves power and increases the time between battery charges.

[0273] In some embodiments, the device displays (**9102**) one or more interface objects (e.g., user interface objects **9004** including one or more of the affordances, controls, buttons or hyperlinks displayed in application window **9002**) on a display (e.g., display **450** in FIGS. **8**A-**8**E.

[0274] In some embodiments, while the device displays the user interface objects, the device detects (**9104**) a contact (e.g., contact **9010**) on a touch-sensitive surface (e.g., touch sensitive surface **451**), where the contact corresponds to a focus selector (e.g., cursor **9006**) on a display (e.g., display **450**). In some embodiments, the contact is a finger contact. In some embodiments, the contact is the focus selector (e.g., when the device has a touch screen, the focus selector is, optionally, contact **9010**). In some embodiments, the contact corresponds to a cursor or selection box that is displayed on the display.

[0275] In some embodiments, while the device displays the user interface objects, the device detects (**9106**) a gesture based on input from the contact (e.g., movement **9012** of contact **9010** in FIGS. **8**A-**8**B, increase of intensity of contact **9010** in FIGS. **8**B-**8**D, and/or liftoff of contact **9010** in FIGS. **8**C-**8**E). In some embodiments, the gesture includes a change in intensity of the contact. In some embodiments, the gesture includes movement of the contact. In some embodiments, the gesture includes both movement of the contact and a change in intensity of the contact.

[0276] In some embodiments, in response (**9108**) to detecting the gesture: in accordance with a determination that the gesture corresponds to movement of the focus selector over a respective user interface object (e.g., navigation button **9004-1**) without activating the respective user interface object (e.g., moving a mouse cursor over a button without activating the button), the device generates (**9110**) a first tactile output (e.g., tactile output **9014** in FIG. **8**B) on the touch-sensitive surface that corresponds to movement of the focus selector over the respective user interface object (e.g., navigation button **9004-1**). In some embodiments, the respective user interface object is a button, a hyperlink, a document icon, an application launch icon or another selectable affordance.

[0277] In response (**9108**) to detecting the gesture: in accordance with a determination that the gesture corresponds to an increase of intensity of the contact above an activation intensity threshold (e.g., light press intensity threshold "IT_L") while the focus selector is over the respective user interface object, the device generates (**9112**) a second tactile output (e.g., tactile output **9018** in FIG. **8**C or **9022** in FIG. **8**D) on the touch-sensitive surface that corresponds to activation of the respective user interface object, where the second tactile output is different from the first tactile output. For example, where a "detent" (e.g., tactile output **9014** in FIG. **8**B) that is generated on the touch-sensitive surface when a user moves a cursor/contact over a user interface object feels different from a "click" (e.g., tactile output **9018** in FIG. **8**C or tactile output **9022** in FIG. **8**D) that is generated on the touch-sensitive surface when a user activates the user interface object. In some embodiments, the first tactile output is more prominent (e.g., has a larger amplitude) than the second tactile output. In some embodiments, the second tactile output is more prominent (e.g., has a larger amplitude) than the first tactile output.

[0278] In some embodiments, in response (**9108**) to detecting the gesture: in accordance with a determination that the gesture corresponds to an increase of intensity of the contact above an activation intensity threshold (e.g., light press intensity threshold "IT_L") while the focus selector is over the respective user interface object, the device activates (**9114**) the respective user interface object (e.g., loads content associated with a hyperlink embedded with navigation button **9004-1**, as illustrated in FIG. **8**E). In some embodiments, activating the user interface object includes launching an application corresponding to an application icon or loading content associated with a hyperlink. In some embodiments, the respective user interface object is activated in response to detecting an increase in intensity of the contact above the activation intensity threshold (e.g., the down stroke of the press input). In some embodiments, the respective user interface object is activated in response to detecting an increase in intensity of the contact above the activation intensity threshold (e.g., "IT_L") followed by a subsequent decrease in intensity of the contact below the activation intensity threshold (e.g., "IT_L") or a slightly lower hysteresis intensity threshold (e.g., the up stroke of the press input). In some embodiments, the respective user interface object is activated in response to detecting an increase in intensity of the contact above the activation intensity threshold (e.g., "IT_L") followed by a liftoff of the contact from the touch-sensitive surface.

[0279] In some embodiments, the first tactile output is generated (**9116**) by movement of the touch-sensitive surface that includes a first dominant movement component, the second tactile output is generated by movement of the touch-sensitive surface that includes a second dominant movement component, and the first dominant movement component and the second dominant movement component have substantially a same amplitude (e.g., high amplitude "AH" in FIGS. **8**B-**8**C) and substantially different movement profiles (e.g., square waveform **9016** in FIGS. **8**B and **8**G and sawtooth waveform **9020** in FIGS. **8**C and **8**F). In some embodiments, movement of the touch-sensitive surface corresponds to an initial impulse, ignoring any unin-

tended resonance. In some embodiments, the movement profiles differ in their waveform shape (e.g., square, sine, squine, triangle or sawtooth waveform shape), waveform pulse width and/or waveform pulse period (e.g., frequency). For example, as illustrated in FIGS. **8**B-**8**C, a "detent" that is generated on the touch-sensitive surface when a user moves a cursor/contact over a user interface object has a square waveform movement profile (e.g., waveform **9016** in FIGS. **8**B and **8**G), whereas a "click" that is generated on the touch-sensitive surface when a user activates the user interface object has a sawtooth waveform movement profile (e.g., waveform **9020** in FIGS. **8**C and **8**F), or vice versa.

[0280] In some embodiments, the first tactile output is generated (**9118**) by movement of the touch-sensitive surface that includes a first dominant movement component, the second tactile output is generated by movement of the touch-sensitive surface that includes a second dominant movement component, and the first dominant movement component and the second dominant movement component have a substantially same movement profile (e.g., square waveform **9016** in FIGS. **8**B and **8**G and square waveform and **9024** in FIGS. **8**D and **8**H) and substantially different amplitudes (e.g., high amplitude "AH" in FIG. **8**B and low amplitude "AL" in FIG. **8**D). In some embodiments, movement of the touch-sensitive surface corresponds to an initial impulse, ignoring any unintended resonance. For example, as illustrated in FIGS. **8**B and **8**D, a "detent" that is generated on the touch-sensitive surface when a user moves a cursor/contact over a user interface object has greater amplitude than a "click" that is generated on the touch-sensitive surface when a user activates the user interface object (e.g., high amplitude "AH" of tactile output **9014** in FIG. **8**B is greater than low amplitude "AL" of tactile output **9022** in FIG. **8**D), or vice versa.

[0281] It should be understood that the particular order in which the operations in FIG. **9** have been described is merely exemplary and is not intended to indicate that the described order is the only order in which the operations could be performed. One of ordinary skill in the art would recognize various ways to reorder the operations described herein. Additionally, it should be noted that details of other processes described herein with respect to other methods described herein (e.g., those listed in the fifth paragraph of the Description of Embodiments) are also applicable in an analogous manner to method **9100** described above with respect to FIG. **9**. For example, the contacts, gestures, user interface objects, tactile sensations, intensity thresholds and focus selectors described above with reference to method **9100** optionally have one or more of the characteristics of the contacts, gestures, user interface objects, tactile sensations, intensity thresholds and focus selectors described herein with reference to other methods described herein (e.g., those listed in the fifth paragraph of the Description of Embodiments). For brevity, these details are not repeated here.

[0282] In accordance with some embodiments, FIG. **10** shows a functional block diagram of an electronic device **9200** configured in accordance with the principles of the various described embodiments. The functional blocks of the device are, optionally, implemented by hardware, software, or a combination of hardware and software to carry out the principles of the various described embodiments. It is understood by persons of skill in the art that the functional blocks described in FIG. **10** are, optionally, combined or separated into sub-blocks to implement the principles of the various described embodiments. Therefore, the description herein optionally supports any possible combination or separation or further definition of the functional blocks described herein.

[0283] As shown in FIG. **10**, an electronic device **9200** includes a display unit **9202** configured to display one or more user interface objects, a touch-sensitive surface unit **9204** configured to receive user contacts, one or more sensor units **9206** configured to detect intensity of contacts with the touch-sensitive surface unit **9204**; and a processing unit **9208** coupled to the display unit **9202**, the touch-sensitive surface unit **9204** and the one or more sensor units **9206**. In some embodiments, the processing unit **9208** includes a display enabling unit **9210**, a detecting unit **9212**, a generating unit **9214** and an activating unit **9216**.

[0284] In some embodiments, the processing unit **9208** is configured to enable display (e.g., with the display enabling unit **9210**) of one or more user interface objects on display unit **9202**. In some embodiments, the processing unit **9208** is configured to detect a contact on the touch-sensitive surface unit **9204** (e.g., with detecting unit **9212**), where the contact corresponds to a focus selector on display unit **9202**. In some embodiments, the processing unit **9208** is further configured to detect a gesture based on input from the contact (e.g., with detecting unit **9212**); and in response to detecting the gesture: in accordance with a determination that the gesture corresponds to movement of the focus selector over a respective user interface object of the one or more user interface objects without activating the respective user interface object, the processing unit **9208** is configured to generate a first tactile output on the touch-sensitive surface unit **9204** that corresponds to movement of the focus selector over the respective user interface object (e.g., with the generating unit **9214**); and in accordance with a determination that the gesture corresponds to an increase of intensity of the contact above an activation intensity threshold while the focus selector is over the respective user interface object, the processing unit **9208** is configured to generate a second tactile output on the touch-sensitive surface unit **9204** that corresponds to activation of the respective user interface object, where the second tactile output is different from the first tactile output (e.g., with the generating unit **9214**).

[0285] In some embodiments, the processing unit **9208** is further configured to, in accordance with a determination that the gesture corresponds to an increase of intensity of the contact above an activation intensity threshold (e.g., IT_L) while the focus selector is over the respective user interface object, activate the respective user interface object (e.g., with the activating unit **9216**).

[0286] In some embodiments, the first tactile output is generated by movement of the touch-sensitive surface unit **9204** that includes a first dominant movement component, the second tactile output is generated by movement of the touch-sensitive surface unit **9204** that includes a second dominant movement component, and the first dominant movement component and the second dominant movement component have a same amplitude and different movement profiles.

[0287] In some embodiments, the first tactile output is generated by movement of the touch-sensitive surface unit **9204** that includes a first dominant movement component, the second tactile output is generated by movement of the

touch-sensitive surface unit **9204** that includes a second dominant movement component, and the first dominant movement component and the second dominant movement component have a same movement profile and different amplitudes.

[0288] The operations in the information processing methods described above are, optionally implemented by running one or more functional modules in information processing apparatus such as general purpose processors (e.g., as described above with respect to FIGS. **1**A and **3**) or application specific chips.

[0289] The operations described above with reference to FIG. **9** are, optionally, implemented by components depicted in FIGS. **1**A-**1**B or FIG. **10**. For example, detection operations **9104** and **9106**, determination operations **9110**, **9112** and **9114** and generation operations **9110** and **9112** are, optionally, implemented by event sorter **170**, event recognizer **180**, and event handler **190**, respectively. Event monitor **171** in event sorter **170** detects a contact on touch-sensitive display **112**, and event dispatcher module **174** delivers the event information to application **136-1**. A respective event recognizer **180** of application **136-1** compares the event information to respective event definitions **186**, and determines whether a first contact at a first location on the touch-sensitive surface corresponds to a predefined event or sub-event, such as selection or activation of an object on a user interface. When a respective predefined event or sub-event is detected, event recognizer **180** activates an event handler **190** associated with the detection of the event or sub-event. Event handler **190** optionally utilizes or calls data updater **176** or object updater **177** to update the application internal state **192**. In some embodiments, event handler **190** accesses a respective GUI updater **178** to update what is displayed by the application. In some embodiments, event handler **190** accesses a respective tactile output generator **167** to generate a tactile output. Similarly, it would be clear to a person having ordinary skill in the art how other processes can be implemented based on the components depicted in FIGS. **1**A-**1**B.

Providing Tactile Feedback that Distinguishes Between User Interface Objects

[0290] Many electronic devices have graphical user interfaces that display application windows having separate regions for displaying content-independent affordances (e.g., affordances which are always displayed in the application window irrespective of the content displayed), e.g., "control regions," and content-dependent affordances (e.g., affordances which are displayed in the application window only when a specific content is displayed), e.g., "content regions." For example, a web browser window optionally includes a control region displaying affordances that perform an operation on content displayed in a content region (e.g., moving forward and backwards in the browser history, inputting a URL address or bookmarking a web page) without being dependent upon the content itself. Likewise, a web browser window optionally includes a content region displaying affordances that are integrated into the displayed content (e.g., a hyperlink, text box or drop-down menu) that are associated with the particular content being displayed (e.g., a web page). Given the complexity of a user interface environment where certain affordances displayed in an application window are content-independent and other affordances are content-dependent, there is a need to provide feedback that enables the user to more efficiently and conveniently navigate through the user interface environment.

[0291] The embodiments described below provide improved methods and user interfaces for generating feedback to a user navigating a complex user interface environment. More specifically, these methods and user interfaces provide different tactile feedback to the user when a focus selector moves over an affordance displayed in a control region and an affordance displayed in a content region of an application window. The tactile feedback distinguishes between these two actions by providing physical cues that feel different to the user. In this fashion, the methods and user interfaces provided below allow the user to more efficiently and conveniently discern the type of affordance selected by providing tactile feedback, instead of or in addition to audible and/or visual feedback. Some methods for distinguishing between the selection and activation of a user interface object rely on an audible or visual cue. However, there are many situations (e.g., at work, in a theatre and in various social situations) where the volume of an electronic device will be lowered or muted, rendering audible cues ineffective. Advantageously, the methods and user interfaces described below augment or replace audible feedback by providing tactile feedback indicating the type or location of an affordance displayed in an application window.

[0292] FIGS. **11**A-**11**D illustrate exemplary user interfaces for providing feedback when a focus selector moves over a user interface object in accordance with some embodiments. The user interfaces in these figures are used to illustrate the processes described below, including the processes in FIGS. **12**A-**12**B. FIGS. **11**A-**11**D include intensity diagrams that show the current intensity of the contact on the touch-sensitive surface relative to a plurality of intensity thresholds including a contact detection intensity threshold (e.g., "IT_0") and a light press intensity threshold (e.g., "IT_L"). In some embodiments, operations similar to those described below with reference to IT_L are performed with reference to a different intensity threshold (e.g., "IT_D"). In some embodiments, the operations described below are not dependent on an intensity of the contact. FIGS. **11**B-**11**D include waveform diagrams that show the amplitude (e.g., a high amplitude "AH" or low amplitude "AL") and shape (e.g., square or triangle) of the waveform corresponding to tactile output generated on the touch-sensitive surface in response to a qualifying event (e.g., selection or activation of a user interface object). These waveform diagrams are typically not part of the displayed user interface, but are provided to aid in the interpretation of the figures.

[0293] FIG. **11**A illustrates exemplary user interface **9316** displaying application window **9302** that includes control region **9304** (e.g., located above bar **9308**) and content region **9306** (e.g., located below bar **9308**) distinct from the control region. In FIG. **11**A, user interface **9316** is displayed on display **450** of an electronic device that also includes touch-sensitive surface **451** and one or more sensors for detecting intensity of contacts with touch-sensitive surface. In some embodiments, touch-sensitive surface **451** is a touch screen display that is optionally display **450** or a separate display. User interface **9316** displays control region **9304** that includes a plurality of affordances **9312** for performing operations on content in the content region (e.g., icon **9312**-*a* for saving browser based content, icon **9312**-*b* for navigat-

ing backwards in the browser's history and navigation bar **9312**-*c* for inputting a web address). In some embodiments, control region **9304** includes one or more content-dependent affordances. User interface **9316** displays content region **9306** displaying content that includes one or more content-dependent affordances **9314** (e.g., a navigation button **9314-1** associated with a hyperlink) integrated into the content. User interface **9316** also displays cursor **9310**, controllable by the user through contacts on touch-sensitive surface **451**. For example, detection of movement of a contact (e.g., a gesture) on touch-sensitive surface **451** corresponds to movement of cursor **9310** on user interface **9316**.

[0294] In some embodiments, the plurality of affordances in control region **9304** (e.g., affordances **9312** in FIGS. **11**A-**11**D) includes multiple content-independent controls that are displayed in the control region of the application without regard to the content that is displayed in content region **9306**.

[0295] In some embodiments, the device is an electronic device with a separate display (e.g., display **450**) and a separate touch-sensitive surface (e.g., touch-sensitive surface **451**). In some embodiments, the device is portable multifunction device **100**, the display is touch-sensitive display system **112**, and the touch-sensitive surface includes tactile output generators **167** on the display (FIG. **1**A). For convenience of explanation, the embodiments described with reference to FIGS. **11**A-**11**G and FIGS. **12**A-**12**B will be discussed with reference to display **450** and a separate touch-sensitive surface **451**, however analogous operations are, optionally, performed on a device with a touch-sensitive display system **112** in response to detecting movement of the contacts described in FIGS. **11**A-**11**G on the touch-sensitive display system **112** while displaying the user interfaces shown in FIGS. **11**A-**11**G on the touch-sensitive display system **112**; in such embodiments, the focus selector is, optionally: a respective contact, a representative point corresponding to a contact (e.g., a centroid of a respective contact or a point associated with a respective contact), or a centroid of two or more contacts detected on the touch-sensitive display system **112**, in place of cursor **9310**.

[0296] FIGS. **11**A-**11**D illustrate various embodiments where cursor **9310**, controlled by contact **9318** on touch-sensitive surface **451** and movement **9320** thereof, moves over an affordance in either control region **9304** (e.g., affordances **9312**) or content region **9306** (e.g., navigation button **9314-1**). In response, tactile output generators **167** provide different feedback (e.g., tactile outputs **9322**, **9326** and **9330**) to the user, identifying the affordances as located in either the control region or the content region. For example, depending on the location of the affordance (e.g., in control region **9304** or content region **9306**), the tactile outputs have a different waveform (e.g., square waveforms **9324** and **9332** or sawtooth waveform **9328**) and/or amplitude (e.g., a high amplitude "AH" or low amplitude "AL") indicating to the user where the affordance is located, so that the user can tell based on the tactile output whether an affordance under or near the focus selector is a control affordance or a content affordance.

[0297] FIGS. **11**A-**11**D illustrate that contact **9318**, corresponding to cursor **9310** displayed on display **450**, and a gesture including movement **9320** of contact **9318** (e.g., movement **9320**-*a* of contact **9318** from location **9318**-*a* in FIG. **11**A to location **9318**-*b* in FIG. **11**B or movement **9320**-*b* of contact **9318** from location **9318**-*b* in FIG. **11**B to location **9318**-*c* in FIG. **11**C or FIG. **11**D) are detected on touch-sensitive surface **451**. Contact **9318** is detected at a position on touch-sensitive surface **451** corresponding to an area on display **450** occupied by focus selector **9310** (e.g., contact **9318** corresponds to a focus selector on the display, such as cursor **9310** which is at or near a location of web browser window **9302**). In some embodiments, movement of contact **9318** on touch-sensitive surface **451** corresponds to movement of focus selector (e.g., a cursor **9310**) on display **450** (e.g., as illustrated in FIGS. **11**A-**11**D).

[0298] FIGS. **11**A-**11**B illustrate an example of a beginning of a gesture where cursor **9310** moves over affordance **9312**-*a* located in control region **9304** of web browser window **9302**, in accordance with movement **9320**-*a* of contact **9318** on touch-sensitive surface **451**. In FIG. **11**B, the device (e.g., via tactile output generators **167**) generates first tactile output **9322** having a signature corresponding to an affordance (e.g., icon **9312**-*a*) located in control region **9304** (e.g., waveform **9324** and/or high amplitude "AH"). FIG. **11**B illustrates an example where, in accordance with a determination that the focus selector (e.g., cursor **9310**) moves over an affordance displayed in a control region of an application window (e.g., icon **9312**-*a* in control region **9304** of web browser **9302**), the electronic device generates a tactile output (e.g., tactile output **9322**) that corresponds to affordances located in the control region (e.g., that feels different from a tactile output generated in response to movement of the cursor over an affordance in a content region of an application window).

[0299] FIGS. **11**C-**11**D illustrate various examples where the device detects movement **9320**-*b* of contact **9318** on touch-sensitive surface **451** that corresponds to movement of cursor **9310** past the boundary of control region **9306** (e.g., below line **9308**) and over navigation button **9314-1** located in content region **9306** of web browser window **9302**. In FIGS. **11**C-**11**D, the device (e.g., via tactile output generators **167**) generates second tactile outputs **9326** or **9330** having a signature corresponding to an affordance (e.g., navigation button **9314-1**) located in content region **9306** (e.g., sawtooth waveform **9328** and/or a square waveform **9332** with low amplitude "AL"). FIGS. **11**C-**11**D illustrate examples where, in accordance with a determination that the focus selector (e.g., cursor **9310**) moves over an affordance displayed in a control region of an application window (e.g., navigation button **9314-1** in control region **9304** of web browser window **9302**), the electronic device generates a tactile output (e.g., tactile output **9326** or **9330**) that corresponds to affordances located in the control region (e.g., that feels different from a tactile output generated in response to movement of the cursor over an affordance located in a control region of an application window).

[0300] FIGS. **11**B and **11**C illustrate an example where the second tactile output (e.g., tactile output **9326** in FIG. **11**C) has substantially the same maximum amplitude (e.g., high amplitude "AH"), but a substantially different movement profile (e.g., sawtooth waveform **9328**), as the first tactile output (e.g., tactile output **9322** in FIG. **11**B having square waveform **9324**). For example, the tactile feedback corresponding to the movement of cursor **9310** over navigation button **9314-1** located in content region **9306** is equally (or approximately) as strong as, but feels different from, the tactile feedback corresponding to the movement of cursor **9310** over icon **9312**-*a* located in control region **9304**. In

contrast, FIGS. **11**B and **11**D illustrate an example where the second tactile output (e.g., tactile output **9330** in FIG. **11**D) has substantially the same movement profile (e.g., square waveform **9324**), but a different maximum amplitude (e.g. low amplitude "AL"), as the first tactile output (e.g., tactile output **9322** in FIG. **11**B having a high amplitude "AH"). For example, the tactile feedback corresponding to the movement of cursor **9310** over navigation button **9314-1** located in content region **9306** feels similar to, but is noticeably stronger or weaker than, the tactile feedback corresponding to the movement of cursor **9310** over icon **9312**-*a* located in control region **9306**.

[0301] As described above, tactile outputs are, optionally, generated for affordances located in a control region and a content region of a respective application window (e.g., web browser window **9302**). FIGS. **11**E-**11**G illustrate example waveforms of movement profiles for generating these tactile outputs. FIG. **11**E illustrates a sawtooth waveform. FIG. **11**F illustrates a square waveform and FIG. **11**G illustrates a square waveform that has a lower amplitude than the square waveform of FIG. **11**F. The high-amplitude square movement profile in FIG. **11**F is, optionally, associated with movement of a focus selector over an affordance located in a control region of an application window; the tactile output generated for moving over (e.g., scrolling over) an affordance in a control region of an application window is, optionally, generated in accordance with a high-amplitude square movement profile. The low-amplitude square movement profile in FIG. **11**G is, optionally, associated with movement of a focus selector over an affordance located in a content region of an application window; the tactile output generated for moving over (e.g., scrolling over) an affordance in a content region of an application window is, optionally, generated in accordance with a low-amplitude square movement profile. The sawtooth movement profile in FIG. **11**E is, optionally, associated with movement of a focus selector over an affordance located in a content region of an application window; the tactile output generated for selection of an affordance in a content region of an application window is, optionally, generated in accordance with the sawtooth movement profile.

[0302] FIGS. **12**A-**12**B are flow diagrams illustrating a method **9400** of providing feedback when a focus selector moves over a user interface object in accordance with some embodiments. The method **9400** is performed at an electronic device (e.g., device **300**, FIG. **3**, or portable multifunction device **100**, FIG. **1**A) with a display and a touch-sensitive surface. In some embodiments, the display is a touch screen display and the touch-sensitive surface is on the display. In some embodiments, the display is separate from the touch-sensitive surface. Some operations in method **9400** are, optionally, combined and/or the order of some operations is, optionally, changed.

[0303] As described below, the method **9400** provides an intuitive way to provide feedback when a focus selector moves over a user interface object. The method reduces the cognitive burden on a user when detecting feedback when a focus selector moves over a user interface object, thereby creating a more efficient human-machine interface. For battery-operated electronic devices, enabling a user to detect feedback when a focus selector moves over a user interface object faster and more efficiently conserves power and increases the time between battery charges.

[0304] In some embodiments, the device displays (**9402**) an application window (e.g., web browser window **9302** in FIGS. **11**A-**11**D) that includes a control region (e.g., control region **9304** in FIGS. **11**A-**11**D) and a content region (e.g., content region **9306** in FIGS. **11**A-**11**D) distinct from the control region on a display (e.g., display **450** in FIGS. **11**A-**11**D). In some embodiments, the control region includes (**9404**) a plurality of affordances for performing operations on content in the content region (e.g., icon **9312**-*a* for saving browser based content, icon **9312**-*b* for navigating backwards in the browser's history and navigation bar **9312**-c for inputting a web address). In some embodiments, the plurality of affordances includes a toolbar of a web browser with buttons and drop down menus that are content-independent. In some embodiments, the plurality of affordances in the control region includes (**9406**) multiple content-independent controls that are displayed in the control region of the application without regard to the content that is displayed in the content region. For example, application-specific controls that are not content-dependent, such as back/forward/reload/home buttons in a web browser and bold/italic/underline buttons in a word processing application.

[0305] In some embodiments, the content region displays (**9408**) content that includes one or more affordances (e.g., the hyperlinks shown in the webpage in content region **9306** including navigation button **9314-1** in FIGS. **11**A-**11**D) integrated into the content. For example, in some embodiments, the content is a webpage with a plurality of hyperlinks, text boxes, drop down menus and/or other selectable affordances that are content-dependent.

[0306] In some embodiments, while the device displays an application window that includes a control region and a content region distinct from the control region, the device detects (**9410**) a contact (e.g., contact **9318** in FIGS. **11**A-**11**D) on a touch-sensitive surface (e.g., touch-sensitive surface **451** in FIGS. **11**A-**11**D). In some embodiments, the contact is a finger contact.

[0307] In some embodiments, while the device displays an application window that includes a control region and a content region distinct from the control region, the device detects (**9412**) a gesture that includes movement of the contact across the touch-sensitive surface (e.g., movement **9320** of contact **9318** in FIGS. **11**A-**11**D) that corresponds to movement of a focus selector (e.g., cursor **9310** in FIGS. **11**A-**11**D) on the display across the application window. In some embodiments, the contact is the focus selector (e.g., when the device has a touch screen, the focus selector is, optionally, contact **9318**). In some embodiments, the contact corresponds to a cursor or selection box that is displayed on the display.

[0308] In some embodiments, in response (**9414**) to detecting the gesture: in accordance with a determination that the gesture corresponds to movement of the focus selector over a first affordance in the control region (e.g., icon **9312**-*a* in control region **9304** in FIG. **11**B), the device generates (**9416**) a first tactile output (e.g., tactile output **9322** in FIG. **11**B) on the touch-sensitive surface (e.g., touch-sensitive surface **451**) that corresponds to movement of the focus selector over an affordance in the control region.

[0309] In response (**9414**) to detecting the gesture: in accordance with a determination that the gesture corresponds to movement of the focus selector over a second affordance in the content region (e.g., navigation button

9314-1 in content region **9306** in FIGS. **11**C-**11**D), the device generates (**9418**) a second tactile output (e.g., tactile output **9326** in FIG. **11**C or tactile output **9330** in FIG. **11**D) on the touch-sensitive surface (e.g., touch-sensitive surface **451**) that corresponds to movement of the focus selector over an affordance in the content region, wherein the second tactile output is different from the first tactile output. For example, in some embodiments, a "detent" that is generated on the touch-sensitive surface when a user moves a cursor/contact over a button in a toolbar of an application feels different from a "detent" that is generated on the touch-sensitive surface when a user moves a cursor/contact over a hyperlink in content displayed in the application. In some embodiments, the first tactile output is more prominent (e.g., has a larger amplitude) than the second tactile output. In some embodiments, the second tactile output is more prominent (e.g., has a larger amplitude) than the first tactile output.

[0310] In some embodiments, the first tactile output is generated (**9420**) by movement of the touch-sensitive surface that includes a first dominant movement component, the second tactile output is generated by movement of the touch-sensitive surface that includes a second dominant movement component and the first dominant movement component and the second dominant movement component have a substantially same amplitude (e.g., high amplitude "AH" in FIGS. **11**B-**11**C) and substantially different movement profiles (e.g., square waveform **9324** in FIGS. **11**B and **11**F and sawtooth waveform **9328** in FIGS. **11**C and **11**E). In some embodiments, movement of the touch-sensitive surface corresponds to an initial impulse, ignoring any unintended resonance. In some embodiments, the movement profiles differ in their waveform shape (e.g., square, sine, squine, triangle or sawtooth waveform shape), waveform pulse width and/or waveform pulse period (e.g., frequency). For example, as illustrated in FIGS. **11**B-**11**C, a "detent" that is generated with the touch-sensitive surface when a user moves a cursor/contact over a button in a toolbar of an application has a square waveform movement profile (e.g., waveform **9324** in FIGS. **11**B and **11**F), whereas a "detent" that is generated with the touch-sensitive surface when a user moves a cursor/contact over a hyperlink in content displayed in the application has a sawtooth waveform movement profile (e.g., waveform **9328** in FIGS. **11**C and **11**E), or vice versa.

[0311] In some embodiments, the first tactile output is generated (**9422**) by movement of the touch-sensitive surface that includes a first dominant movement component, the second tactile output is generated by movement of the touch-sensitive surface that includes a second dominant movement component and the first dominant movement component and the second dominant movement component have substantially a same movement profile (e.g., square waveforms **9324** in FIGS. **11**B and **11**F and square waveform in FIGS. **11**D and **11**G) and substantially different amplitudes (e.g., high amplitude "AH" in FIG. **11**B and low amplitude "AL" in FIG. **11**D). In some embodiments, movement of the touch-sensitive surface corresponds to an initial impulse, ignoring any unintended resonance. For example, as illustrated in FIGS. **11**B and **11**D, a "detent" that is generated with the touch-sensitive surface when a user moves a cursor/contact over a button in a toolbar of an application has less amplitude than a "detent" that is generated with the touch-sensitive surface when a user moves a cursor/contact over a hyperlink in content displayed in the application (e.g., high amplitude "AH" of tactile output **9322** in FIG. **11**B is greater than low amplitude "AL" of tactile output **9330** in FIG. **11**D), or vice versa.

[0312] It should be understood that the particular order in which the operations in FIGS. **12**A-**12**B have been described is merely exemplary and is not intended to indicate that the described order is the only order in which the operations could be performed. One of ordinary skill in the art would recognize various ways to reorder the operations described herein. Additionally, it should be noted that details of other processes described herein with respect to other methods described herein (e.g., those listed in the fifth paragraph of the Description of Embodiments) are also applicable in an analogous manner to method **9400** described above with respect to FIGS. **12**A-**12**B. For example, the contacts, gestures, user interface objects, tactile sensations and focus selectors described above with reference to method **9400** optionally have one or more of the characteristics of the contacts, gestures, user interface objects, tactile sensations and focus selectors described herein with reference to other methods described herein (e.g., those listed in the fifth paragraph of the Description of Embodiments). For brevity, these details are not repeated here.

[0313] In accordance with some embodiments, FIG. **13** shows a functional block diagram of an electronic device **9500** configured in accordance with the principles of the various described embodiments. The functional blocks of the device are, optionally, implemented by hardware, software, or a combination of hardware and software to carry out the principles of the various described embodiments. It is understood by persons of skill in the art that the functional blocks described in FIG. **13** are, optionally, combined or separated into sub-blocks to implement the principles of the various described embodiments. Therefore, the description herein optionally supports any possible combination or separation or further definition of the functional blocks described herein.

[0314] As shown in FIG. **13**, an electronic device **9500** includes a display unit **9502** configured to display an application window that includes a control region and a content region distinct from the control region, a touch-sensitive surface unit **9504** configured to receive user contacts, optionally one or more sensor units **9506** configured to detect intensity of contacts with the touch-sensitive surface unit **9504**; and a processing unit **9508** coupled to the display unit **9502**, the touch-sensitive surface unit **9504** and optionally the one or more sensor units **9506**. In some embodiments, the processing unit **9508** includes a display enabling unit **9510**, a detecting unit **9512** and a generating unit **9514**.

[0315] In some embodiments, the processing unit **9508** is configured to enable display (e.g., with the display enabling unit **9510**) of an application window that includes a control region and a content region distinct from the control region on the display, where the control region includes a plurality of affordances for performing operations on content in the content region and the content region displays content that includes one or more affordances integrated into the content. In some embodiments, the processing unit **9508** is further configured to detect a contact on the touch-sensitive surface unit **9504** (e.g., with the detecting unit **9512**). In some embodiments, the processing unit **9508** is further configured to detect a gesture that includes movement of the contact across the touch-sensitive surface unit **9504** (e.g., with the detecting unit **9512**) that corresponds to movement of a

focus selector on the display unit **9502** across the application window; and in response to detecting the gesture: in accordance with a determination that the gesture corresponds to movement of the focus selector over a first affordance in the control region, the processing unit **9508** is configured to generate a first tactile output on the touch-sensitive surface unit **9504** (e.g., with the generating unit **9514**) that corresponds to movement of the focus selector over an affordance in the control region; and in accordance with a determination that the gesture corresponds to movement of the focus selector over a second affordance in the content region, the processing unit **9508** is configured to generate a second tactile output on the touch-sensitive surface unit **9504** (e.g., with the generating unit **9514**) that corresponds to movement of the focus selector over an affordance in the content region, where the second tactile output is different from the first tactile output.

[0316] In some embodiments, the plurality of affordances in the control region includes multiple content-independent controls that are displayed in the control region of the application without regard to the content that is displayed in the content region.

[0317] In some embodiments, the first tactile output is generated by movement of the touch-sensitive surface unit **9504** that includes a first dominant movement component, the second tactile output is generated by movement of the touch-sensitive surface unit **9504** that includes a second dominant movement component and the first dominant movement component and the second dominant movement component have a same amplitude and different movement profiles.

[0318] In some embodiments, the first tactile output is generated by movement of the touch-sensitive surface unit **9504** that includes a first dominant movement component, the second tactile output is generated by movement of the touch-sensitive surface unit **9504** that includes a second dominant movement component and the first dominant movement component and the second dominant movement component have a same movement profile and different amplitudes.

[0319] The operations in the information processing methods described above are, optionally implemented by running one or more functional modules in information processing apparatus such as general purpose processors (e.g., as described above with respect to FIGS. **1**A and **3**) or application specific chips.

[0320] The operations described above with reference to FIGS. **12**A-**12**B are, optionally, implemented by components depicted in FIGS. **1**A-**1**B or FIG. **13**. For example, detection operations **9410** and **9412**, determination operations **9416** and **9418** are, optionally, implemented by event sorter **170**, event recognizer **180** and event handler **190**, respectively. Event monitor **171** in event sorter **170** detects a contact on touch-sensitive display **112**, and event dispatcher module **174** delivers the event information to application **136-1**. A respective event recognizer **180** of application **136-1** compares the event information to respective event definitions **186**, and determines whether a first contact at a first location on the touch-sensitive surface corresponds to a predefined event or sub-event, such as selection of an object on a user interface. When a respective predefined event or sub-event is detected, event recognizer **180** activates an event handler **190** associated with the detection of the event or sub-event. Event handler **190** optionally utilizes or calls data updater **176** or object updater **177** to update the application internal state **192**. In some embodiments, event handler **190** accesses a respective GUI updater **178** to update what is displayed by the application. In some embodiments, event handler **190** accesses a respective tactile output generator **167** to generate a tactile output on touch-sensitive surface **451**. Similarly, it would be clear to a person having ordinary skill in the art how other processes can be implemented based on the components depicted in FIGS. **1**A-**1**B.

Adjusting a Tactile Output Level in Accordance With an Adjustment of a Volume Level

[0321] Many electronic devices also change output levels of sensory properties of the device in response to the enablement of a setting or mode of the device. However, there are sometimes a large number of sensory properties to adjust and adjusting output levels of these sensory properties separately can be confusing and difficult for users. The embodiments below provide a more convenient and intuitive user interface by adjusting a tactile output level of a device in tandem with an adjustment of a volume level of the device. Subsequently, the device provides the adjusted tactile output level in response to detection of a plurality of inputs on a touch-sensitive surface. In some embodiments, the tactile output level changes in parallel with the volume level. In some embodiments, the tactile output level changes inversely to the volume level.

[0322] FIGS. **14**A-**14**I illustrate exemplary user interfaces for adjusting a tactile output level in accordance with an adjustment of a volume level in accordance with some embodiments. The user interfaces in these figures are used to illustrate the processes described below, including the processes in FIGS. **15**A-**15**C.

[0323] In some embodiments, the device is an electronic device with a separate display (e.g., display **450**) and a separate touch-sensitive surface (e.g., touch-sensitive surface **451**). In some embodiments, the device is portable multifunction device **100**, the display is touch-sensitive display system **112**, and the touch-sensitive surface includes tactile output generators **167** on the display (FIG. **1**A). For convenience of explanation, the embodiments described with reference to FIGS. **14**A-**14**I and FIGS. **15**A-**15**C will be discussed with reference to display **450** and a separate touch-sensitive surface **451**, however analogous operations are, optionally, performed on a device with a touch-sensitive display system **112**.

[0324] FIG. **14**A illustrates the device detecting a first plurality of inputs on the touch-sensitive surface **451**, including contacts **9602** and **9604**. FIG. **14**A further illustrates volume level **9606** at a first level (e.g., L1).

[0325] FIG. **14**B illustrates the device providing tactile feedback **9607** in accordance with a tactile output level **9608** in response to detecting the first plurality of inputs (e.g., contacts **9602** and **9604**). FIG. **14**B further illustrates volume level **9606** at the first level (e.g., L1).

[0326] FIG. **14**C illustrates the volume level increasing by a respective amount (e.g., the difference between volume level **9606** and volume level **9610**) from a first non-zero volume level to a second non-zero volume level in response to a request to adjust the volume of the device by the respective amount (e.g., from L1 to a level above L1, both of which are non-zero volume levels in this example). FIG. **14**C further illustrates adjusting the tactile output level (e.g., tactile output level **9608** in FIG. **14**B) of the device by

adjusting the amplitude of the respective tactile output that corresponds to the respective input on the touch-sensitive surface **451** in response to the request to adjust volume level **9606**. FIG. **14**C, for example, shows adjusted tactile output level **9612** with an amplitude above A1 in contrast to the amplitude of tactile output level **9608** in FIG. **14**B at A1, both of which are non-zero tactile output levels in this example.

[0327] In some embodiments, the request to adjust the volume of the device is received when a user depresses a physical button (e.g., a button for increasing or decreasing volume, or a rocker switch for adjusting the volume up or down depending on the direction in which it is depresses). In some embodiments, a request to adjust the volume of the device is received when the user makes a corresponding gesture on the touch sensitive surface **451**, for example, when the user slides a displayed volume indicator (displayed on the display **450**) in a direction corresponding to increased or decreased volume. In some embodiments, both modes of adjusting volume are available to the user.

[0328] FIG. **14**C further illustrates adjusting the tactile output level (e.g., tactile output level **9608** in FIG. **14**B) of the device by adjusting the movement profile of the respective tactile output that corresponds to the respective input on the touch-sensitive surface **451** in response to the request to adjust volume level **9606**. FIG. **14**C, for example, shows adjusted tactile output level **9614** with a different waveform shape (e.g., triangular shape) in contrast to the waveform shape of tactile output level **9608** in FIG. **14**B (e.g., rectangular shape).

[0329] FIG. **14**C further illustrates adjusting the tactile output level (e.g., tactile output level **9608** in FIG. **14**B) of the device by adjusting the amplitude and the movement profile of the respective tactile output that corresponds to the respective input on the touch-sensitive surface **451** in response to the request to adjust volume level **9606**. FIG. **14**C, for example, shows adjusted tactile output level **9616** with both a greater amplitude (e.g., above A1) and a different waveform shape (e.g., triangular shape) than tactile output level **9608** in FIG. **14**B (e.g., with an amplitude at A1 and a rectangular shape).

[0330] FIG. **14**D illustrates adjusting the tactile output level of the device by increasing the tactile output level in accordance with a determination that adjusting the volume level by the respective amount includes increasing the volume level. In this example, the volume level (e.g., volume level **9606** in FIG. **14**B) increases to a level above L1 (e.g., volume level **9618**). FIG. **14**D further illustrates increasing the tactile output level **9608** to adjusted tactile output level **9620** in tandem with volume level **9618**.

[0331] FIG. **14**E illustrates adjusting the tactile output level of the device by decreasing the tactile output level in accordance with a determination that adjusting the volume level by the respective amount includes decreasing the volume level. In this example, the volume level (e.g., volume level **9606** in FIG. **14**B) decreases to a level below L1 level (e.g., volume level **9622**). FIG. **14**E further illustrates decreasing the tactile output level **9608** to adjusted tactile output level **9624** (e.g., a non-zero level below Al) in tandem with volume level **9622**.

[0332] FIG. **14**F illustrates adjusting the tactile output level of the device by decreasing the tactile output level in accordance with an increase in the volume level by a respective amount. In this example, the volume level (e.g., volume level **9606** in FIG. **14**B) increases to a level above L1 (e.g., volume level **9626**). FIG. **14**F further illustrates decreasing the tactile output level **9608** to adjusted tactile output level **9628**—the inverse of the change in volume level to volume level **9626**.

[0333] FIG. **14**G illustrates adjusting the tactile output level of the device by increasing the tactile output level in accordance with a decrease in the volume level by a respective amount. In this example, the volume level (e.g., volume level **9606** in FIG. **14**B) decreases to a level below L1 (e.g., volume level **9630**). FIG. **14**G further illustrates increasing the tactile output level **9608** to adjusted tactile output level **9632** above A1—the inverse of the change in volume level to volume level **9630**.

[0334] FIG. **14**H illustrates the device detecting a second plurality of inputs (e.g., contacts **9634** and **9636**) on the touch-sensitive surface **451**. The device detects contacts **9634** and **9636**, for example, subsequent to adjusting the tactile output level of the device (e.g., from the tactile output level **9608** in FIG. **14**B to the tactile output level **9612** in FIG. **14**C).

[0335] FIG. **141** illustrates the device providing tactile feedback **9638** in accordance with adjusted tactile output level **9612** and in response to detecting the second plurality of inputs (e.g., contacts **9634** and **9636**) on the touch-sensitive surface **451**.

[0336] FIGS. **15**A-**15**C are flow diagrams illustrating a method **9700** of adjusting a tactile output level in accordance with an adjustment of a volume level in accordance with some embodiments. The method **9700** is performed at an electronic device (e.g., device **300**, FIG. **3**, or portable multifunction device **100**, FIG. **1**A) with a display and a touch-sensitive surface. In some embodiments, the display is a touch screen display and the touch-sensitive surface is on the display. In some embodiments, the display is separate from the touch-sensitive surface. Some operations in method **9700** are, optionally, combined and/or the order of some operations is, optionally, changed.

[0337] As described below, the method **9700** provides an intuitive way to adjust a tactile output level in accordance with an adjustment of a volume level. The method reduces the cognitive burden on a user when adjusting a tactile output level in accordance with an adjustment of a volume level, thereby creating a more efficient human-machine interface. For battery-operated electronic devices, enabling a user to adjust a tactile output level in accordance with an adjustment of a volume level faster and more efficiently conserves power and increases the time between battery charges.

[0338] The device detects (**9702**) a first plurality of inputs on the touch-sensitive surface. FIG. **14**A, for example, shows a first plurality of inputs (e.g., contacts **9602** and **9604**) on the touch-sensitive surface **451**.

[0339] In response to detecting the first plurality of inputs, the device provides (**9704**) tactile feedback in accordance with a tactile output level of the device (e.g., the tactile output level corresponds to an average magnitude of tactile outputs, a magnitude of a reference tactile output generated by the device, or a magnitude of a maximum tactile output generated by the device). FIG. **14**B, for example, shows the device providing tactile feedback **9607** in accordance with tactile output level **9608** and in response to detecting the first plurality of inputs (e.g., contacts **9602** and **9604**).

[0340] The device receives (**9706**) a request to adjust a volume level (e.g., audio output level) of the device by a respective amount. FIG. **14**C, for example, shows the request to adjust the volume level of the device by a respective amount (e.g., the difference between volume level **9606** and volume level **9610**, both of which are non-zero volume levels in this example).

[0341] In response to the request (**9708**) to adjust the volume level, the device adjusts (**9710**) the volume level by the respective amount from a first non-zero volume level to a second non-zero volume level. FIG. **14**C, for example, shows increasing volume level **9606** (e.g., at level L1, a non-zero volume level) to volume level **9610** (e.g., at a level above L1, a non-zero volume level) in response to the request to adjust the volume level of the device.

[0342] In response to the request (**9708**) to adjust the volume level, the device also adjusts (**9712**) the tactile output level of the device in accordance with the respective amount. FIG. **14**C, for example, shows adjusting the tactile output level **9608** to adjusted tactile output level **9612** in response to the request to adjust the volume level of the device (e.g., from volume level **9605** to volume level **9608**).

[0343] In some embodiments, adjusting the tactile output level of the device comprises adjusting (**9713**) the tactile output level of the device, in accordance with the respective amount, from a first non-zero tactile output level to a second non-zero tactile output level. FIG. **14**C, for example, shows adjusted tactile output level **9612** with an amplitude above Al in contrast to the amplitude of tactile output level **9608** in FIG. **14**B at Al, both of which are non-zero tactile output levels in this example.

[0344] In some embodiments, a respective tactile output that corresponds to a respective input on the touch-sensitive surface is generated (**9714**) by movement of the touch-sensitive surface that includes a dominant movement component that has a movement profile (e.g., a waveform shape such as square, sine, squine, sawtooth or triangle; and/or width/period) and an amplitude (e.g., movement corresponding to the initial impulse, ignoring any unintended resonance). In some embodiments, in response to the request (**9708**) to adjust the volume level, adjusting the tactile output level of the device includes adjusting (**9716**) the amplitude of the respective tactile output that corresponds to the respective input on the touch-sensitive surface (e.g., increasing or decreasing the amplitude of the initial impulse of the respective tactile output). FIG. **14**C, for example, shows adjusting the amplitude of tactile output level **9608** in FIG. **14**B (e.g., with an amplitude at A1) to produce adjusted output level **9612** (e.g., with an amplitude above A1), both of which are non-zero tactile output levels in this example.

[0345] In some embodiments, a respective tactile output that corresponds to a respective input on the touch-sensitive surface is generated (**9714**) by movement of the touch-sensitive surface that includes a dominant movement component that has a movement profile (e.g., a waveform shape such as square, sine, squine, sawtooth or triangle; and/or width/period) and an amplitude (e.g., movement corresponding to the initial impulse, ignoring any unintended resonance). In some embodiments, in response to the request (**9708**) to adjust the volume level, adjusting the tactile output level of the device includes adjusting (**9718**) the movement profile of the respective tactile output that corresponds to the respective input on the touch-sensitive surface (e.g., increasing or decreasing the width or shape of the initial impulse of the respective tactile output). FIG. **14**C, for example, shows adjusting the movement profile of tactile output level **9608** in FIG. **14**B (e.g., with a rectangular waveform shape) to produce adjusted output level **9614** (e.g., with a triangular waveform shape).

[0346] In some embodiments, in response to the request (**9708**) to adjust the volume level, adjusting the tactile output level of the device includes adjusting (**9718**) the movement profile of the respective tactile output that corresponds to the respective input on the touch-sensitive surface and further includes adjusting (**9720**) the amplitude of the respective tactile output that corresponds to the respective input on the touch-sensitive surface. FIG. **14**C, for example, shows adjusting both the movement profile and the amplitude of tactile output level **9608** in FIG. **14**B (e.g., with a rectangular waveform shape and an amplitude at A1) to produce adjusted output level **9616** (e.g., with a triangular waveform shape and an amplitude above A1).

[0347] In some embodiments, in response to the request (**9708**) to adjust the volume level, in accordance with a determination that adjusting the volume level by the respective amount includes increasing the volume level, adjusting the tactile output level of the device includes increasing (**9722**) the tactile output level (e.g., the tactile output changes in tandem with the audio output). For example, when the audio output level is increased by 50% the tactile output level is increased by 50%. FIG. **14**D, for example, shows volume level **9618** (e.g., a 50% increase from volume level **9606** in FIG. **14**B) and adjusted tactile output level **9620** (e.g., a 50% increase from tactile output level **9608** in FIG. **14**B).

[0348] In some embodiments, in response to the request (**9708**) to adjust the volume level, in accordance with a determination that adjusting the volume level by the respective amount includes decreasing the volume level, adjusting the tactile output level of the device includes decreasing (**9724**) the tactile output level (e.g., the tactile output changes in tandem with the audio output). For example, when the audio output level is decreased by 50% the tactile output level is decreased by 50%. FIG. **14**E, for example, shows volume level **9622** (e.g., a 50% decrease from volume level **9606** in FIG. **14**B) and adjusted tactile output level **9624** (e.g., a 50% decrease from tactile output level **9608** in FIG. **14**B).

[0349] In some embodiments, in response to the request (**9708**) to adjust the volume level, in accordance with a determination that adjusting the volume level by the respective amount includes increasing the volume level, adjusting the tactile output level of the device includes decreasing (**9726**) the tactile output level (e.g., the increased audio output is a replacement for the decreased tactile output). For example, when the audio output level is increased by 50% the tactile output level is decreased by 50%. FIG. **14**F, for example, shows volume level **9626** (e.g., a 50% increase from volume level **9606** in FIG. **14**B) and adjusted tactile output level **9628** (e.g., a 50% decrease from tactile output level **9608** in FIG. **14**B).

[0350] In some embodiments, in response to the request (**9708**) to adjust the volume level, in accordance with a determination that adjusting the volume level by the respective amount includes decreasing the volume level, adjusting the tactile output level of the device includes increasing (**9728**) the tactile output level (e.g., the increased tactile output is a replacement for the decreased audio output). For

example, when the audio output level is decreased by 50% the tactile output level is increased by 50%. FIG. **14**G, for example, shows volume level **9630** (e.g., a 50% decrease from volume level **9606** in FIG. **14**B) and adjusted tactile output level **9632** (e.g., a 50% increase from tactile output level **9608** in FIG. **14**B).

[0351] In some embodiments, after adjusting the tactile output level of the device, the device detects (**9730**) a second plurality of inputs on the touch-sensitive surface. FIG. **14**H, for example, shows the device detecting a second plurality of inputs (e.g., contacts **9634** and **9636**) on the touch-sensitive surface **451**. The device detects contacts **9634** and **9636** on the touch-sensitive surface **451**, for example, subsequent to adjusting the tactile output level of the device (e.g., from tactile output level **9608** in FIG. **14**B to adjusted tactile output level **9612** in FIG. **14**C).

[0352] In some embodiments, in response to detecting the second plurality of inputs on the touch-sensitive surface, the device provides (**9732**) tactile feedback in accordance with the adjusted tactile output level. FIG. **141**, for example, shows the device providing tactile feedback **9638** in accordance with adjusted tactile output level **9612**. The device provides tactile feedback **9638**, for example, subsequent to detecting the second plurality of inputs (e.g., contacts **9634** and **9636**) on the touch-sensitive surface **451**.

[0353] It should be understood that the particular order in which the operations in FIGS. **15**A-**15**C have been described is merely exemplary and is not intended to indicate that the described order is the only order in which the operations could be performed. One of ordinary skill in the art would recognize various ways to reorder the operations described herein. Additionally, it should be noted that details of other processes described herein with respect to other methods described herein (e.g., those listed in the fifth paragraph of the Description of Embodiments) are also applicable in an analogous manner to method **9700** described above with respect to FIGS. **15**A-**15**C. For example, the contacts (inputs), gestures and tactile sensations described above with reference to method **9700** optionally have one or more of the characteristics of the contacts (inputs), gestures, and tactile sensations described herein with reference to other methods described herein (e.g., those listed in the fifth paragraph of the Description of Embodiments). For brevity, these details are not repeated here.

[0354] In accordance with some embodiments, FIG. **16** shows a functional block diagram of an electronic device **9800** configured in accordance with the principles of the various described embodiments. The functional blocks of the device are, optionally, implemented by hardware, software, or a combination of hardware and software to carry out the principles of the various described embodiments. It is understood by persons of skill in the art that the functional blocks described in FIG. **16** are, optionally, combined or separated into sub-blocks to implement the principles of the various described embodiments. Therefore, the description herein optionally supports any possible combination or separation or further definition of the functional blocks described herein **989898**.

[0355] As shown in FIG. **16**, an electronic device **9800** includes a display unit **9802** configured to display information; a touch-sensitive surface unit **9804** configured to receive inputs (e.g., contacts); a tactile feedback unit **9806** configured to provide tactile feedback (e.g., generated by movement of the touch-sensitive surface unit **9804**); an audio unit **9808** configured to produce an audio signal and an audio control signal in accordance with at least a volume level (optionally includes an audio speaker); and a processing unit **9810** coupled to the display unit **9802**, the touch-sensitive surface unit **9804**, the tactile feedback unit **9806**, and the audio unit **9808**. In some embodiments, processing unit **9810** includes a detecting unit **9812**, a providing unit **9814**, a receiving unit **9816**, an adjusting unit **9818**, and a determining unit **9820**. Optionally, electronic device **9800** further includes one or more sensor units **9824** configured to detect intensity of contacts with the touch-sensitive surface unit **9804**.

[0356] The processing unit **9810** is configured to: detect (e.g., with the detecting unit **9812**) a first plurality of inputs on the touch-sensitive surface unit **9804**; in response to detecting the first plurality of inputs, provide (e.g., with the providing unit **9814**) tactile feedback via tactile feedback unit **9806** in accordance with a tactile output level of the device; and receive (e.g., with the receiving unit **9816**) a request to adjust a volume level of the device by a respective amount. The processing unit **9810** is further configured to, in response to the request to adjust the volume level: adjust (e.g., with adjusting the unit **9818**) the volume level by the respective amount; and adjust (e.g., with the adjusting unit **9818**) the tactile output level of the device in accordance with the respective amount.

[0357] In some embodiments, a respective tactile output that corresponds to a respective input on the touch-sensitive surface unit **9804** is generated by movement of the touch-sensitive surface unit **9804** that includes a dominant movement component that has a movement profile and an amplitude; adjusting the tactile output level of the device includes adjusting (e.g., with the adjusting unit **9818**) the amplitude of the respective tactile output that corresponds to the respective input on the touch-sensitive surface unit **9804**.

[0358] In some embodiments, a respective tactile output that corresponds to a respective input on the touch-sensitive surface unit **9804** is generated by movement of the touch-sensitive surface unit **9804** that includes a dominant movement component that has a movement profile and an amplitude; adjusting the tactile output level of the device includes adjusting (e.g., with the adjusting unit **9818**) the movement profile of the respective tactile output that corresponds to the respective input on the touch-sensitive surface unit **9804**.

[0359] In some embodiments, the processing unit **9810** is configured to adjust the tactile output level of the device by adjusting (e.g., with the adjusting unit **9818**) the movement profile and the amplitude of the respective tactile output that corresponds to the respective input on the touch-sensitive surface unit **9804**.

[0360] In some embodiments, after adjusting (e.g., with the adjusting unit **9818**) the tactile output level of the device, the processing unit **9810** is configured to detect (e.g., with the detecting unit **9812**) a second plurality of inputs on the touch-sensitive surface unit **9804**; and in response to detecting the second plurality of inputs on the touch-sensitive surface unit **9804**, provide (e.g., with the providing unit **9814**) tactile feedback via tactile feedback unit **9806** in accordance with the adjusted tactile output level.

[0361] In some embodiments, the processing unit **9810** is configured to adjust (e.g., with the adjusting unit **9818**) the output level of the device by: in accordance with a determination (e.g., with the determining unit **9820**) that adjusting the volume level by the respective amount includes

increasing the volume level, adjusting (e.g., with the adjusting unit **9818**) the tactile output level of the device includes increasing the tactile output level; and in accordance with a determination (e.g., with the determining unit **9820**) that adjusting the volume level by the respective amount includes decreasing the volume level, adjusting (e.g., with the adjusting unit **9818**) the tactile output level of the device includes decreasing the tactile output level.

[0362] In some embodiments, the processing unit **9810** is configured to adjust (e.g., with the adjusting unit **9818**) the output level of the device by: in accordance with a determination (e.g., with the determining unit **9820**) that adjusting the volume level by the respective amount includes increasing the volume level, adjusting (e.g., with the adjusting unit **9818**) the tactile output level of the device includes decreasing the tactile output level; and in accordance with a determination (e.g., with the determining unit **9820**) that adjusting the volume level by the respective amount includes decreasing the volume level, adjusting (e.g., with the adjusting unit **9818**) the tactile output level of the device includes increasing the tactile output level.

[0363] The operations in the information processing methods described above are, optionally implemented by running one or more functional modules in information processing apparatus such as general purpose processors (e.g., as described above with respect to FIGS. **1**A and **3**) or application specific chips.

[0364] The operations described above with reference to FIGS. **15**A-**15**C are, optionally, implemented by components depicted in FIGS. **1**A-**1**B or FIG. **16**. For example, detecting operations **9702** and **9728**, providing operations **9704** and **9730**, receiving operation **9706**, adjusting operations **9710**-**9712**, and determining operations **9720**-**9726** are, optionally, implemented by event sorter **170**, event recognizer **180**, and event handler **190**. Event monitor **171** in event sorter **170** detects a contact on touch-sensitive display **112**, and event dispatcher module **174** delivers the event information to application **136**-**1**. A respective event recognizer **180** of application **136**-**1** compares the event information to respective event definitions **186**, and determines whether a first contact at a first location on the touch-sensitive surface corresponds to a predefined event or sub-event, such as selection of an object on a user interface. When a respective predefined event or sub-event is detected, event recognizer **180** activates an event handler **190** associated with the detection of the event or sub-event. Event handler **190** optionally utilizes or calls data updater **176** or object updater **177** to update the application internal state **192**. In some embodiments, event handler **190** accesses a respective GUI updater **178** to update what is displayed by the application. Similarly, it would be clear to a person having ordinary skill in the art how other processes can be implemented based on the components depicted in FIGS. **1**A-**1**B.

Forgoing Generation of Tactile Output for a Multi-Contact Gesture

[0365] Many electronic devices provide a form of confirmation to a user in response to an event being triggered by a user action. For example, when a user clicks on an affordance (e.g., an icon button) corresponding to respective content (e.g., an electronic document, an image, or a video), an audio output is provided via a speaker to the user to confirm that the user is clicking on the affordance. Similarly, for example, after a user clicks on a hyperlink corresponding to a webpage, a web browser displays some form of visual confirmation (e.g., a semicircular arrow spinning in a clockwise manner or a spinning globe) indicating that the webpage associated with the hyperlink is being loaded. However, this confirmation or feedback can be distracting or confusing to a user when it occurs in response to inputs that do not correspond to the feedback. The embodiments described below provide a more convenient and intuitive interface by generating a tactile output in response to detecting a gesture that includes a first number of contacts (e.g., one contact)and forging generating the tactile output if the gesture includes a second number of contacts (e.g., two or more contacts). Furthermore, in some embodiments, the device assigns less than all of a plurality of contacts to the gesture; thereby, excluding one or more of the plurality of contacts from the gesture in accordance with predefined gesture criteria (e.g., shape, surface area, intensity, or chronological order).

[0366] FIGS. **17**A-**17**F illustrate exemplary user interfaces for generating a tactile output for a gesture having a first number of contacts (e.g., a single contact gesture) and forgoing generation of a tactile output for a gesture having a second number of contacts (e.g., a multi-contact gesture) in accordance with some embodiments. The user interfaces in these figures are used to illustrate the processes described below, including the processes in FIG. **18**. FIGS. **17**A-**17**F include intensity diagrams that show the current intensity of the contact on the touch-sensitive surface relative to a plurality of intensity thresholds including a respective threshold (e.g., "IT_L"). In some embodiments, operations similar to those described below with reference to "IT_L" are performed with reference to a different intensity threshold (e.g., "IT_D").

[0367] In some embodiments, the device is an electronic device with a separate display (e.g., display **450**) and a separate touch-sensitive surface (e.g., touch-sensitive surface **451**). In some embodiments, the device is portable multifunction device **100**, the display is touch-sensitive display system **112**, and the touch-sensitive surface includes tactile output generators **167** on the display (FIG. **1**A). For convenience of explanation, the embodiments described with reference to FIGS. **17**A-**17**F and FIG. **18** will be discussed with reference to display **450** and a separate touch-sensitive surface **451**; however, analogous operations are, optionally, performed on a device with a touch-sensitive display system **112** in response to detecting the contacts described in FIGS. **17**A-**17**F on the touch-sensitive display system **112** while displaying the user interfaces shown in FIGS. **17**A-**17**F on the touch-sensitive display system **112**; in such embodiments, the focus selector is, optionally: a respective contact, a representative point corresponding to a contact (e.g., a centroid of a respective contact or a point associated with a respective contact), or a centroid of two or more contacts detected on the touch-sensitive display system **112**, in place of cursor **9904**.

[0368] FIG. **17**A illustrates a user interface **9900** displayed on a display **450** of an electronic device. In this example, the user interface **9900** is associated with an application (e.g., a web browser), and the user interface **9900** includes image **9902** and control icons **9903** (e.g., next image button **9903**-**1** and previous image button **9903**-**2**, associated with a sequence of images of the week). FIG. **17**A further illustrates a contact **9906** detected on touch-sensitive surface **451**

and a displayed representation of a focus selector (e.g., cursor **9904**) corresponding to contact **9906**. In this example, cursor **9904** is located over next image button **9903-1**. FIG. **17**A illustrates the intensity of contact **9906** between IT_0 and IT_L.

[0369] FIGS. **17**A-**17**B illustrates an example of detecting, on the touch-sensitive surface **451**, a gesture that includes an increase of intensity of a contact **9906** above a respective intensity threshold (e.g., "IT_L"). In this example, the intensity of contact **9906** increases (e.g., from below IT_L in FIG. **17**A to above IT_L in FIG. **17**B) above the respective intensity threshold (e.g., "IT_L").

[0370] FIG. **17**B illustrates an example of generating a tactile output (e.g., tactile output **9910**) on the touch sensitive **451**. In this example, the device generates tactile output **9910** on the touch sensitive **451** in response to detecting the gesture (e.g., the increase of intensity of contact **9906** above IT_L) and in accordance a determination that the gesture includes a first number of contacts. In some embodiments, the first number of contacts is one contact. FIGS. **17**A-**17**B illustrate detecting the gesture including one contact (e.g., contact **9906**). FIG. **17**B further illustrates displaying image **9908** on display **450** in response to the press input (e.g., the increase in intensity of contact **9906** above IT_L) while cursor **9904** is over next image button **9903-1**, which relates to the next image in the sequence of images of the week.

[0371] FIG. **17**C illustrates detecting two contacts (e.g., contacts **9912** and **9914**) on the touch-sensitive surface **451**. In this example, contact **9912** corresponds to cursor **9904** (e.g., contact **9912** was detected prior to contact **9914**). FIG. **17**C further illustrates the intensities of contacts **9912** and **9914** between IT_0 and IT_L.

[0372] FIGS. **17**C-**17**D illustrate an example of detecting, on the touch-sensitive surface **451**, a gesture that includes an increase of intensity of contact **9912** above a respective intensity threshold (e.g., "IT_L"). In this example, the intensity of contact **9912** increases (e.g., from below IT_L in FIG. **17**C to above IT_L in FIG. **17**D) above the respective intensity threshold (e.g., "IT_L").

[0373] FIGS. **17**C-**17**D further illustrate a multi-touch pinch (zooming out) gesture. In this example, the multi-touch pinch gesture includes contact **9912** moving from location **9912**-*a* in FIG. **17**C to location **9912**-*b* in FIG. **17**D and contact **9914** moving from location **9914**-a in FIG. **17**C to location **9914**-b in FIG. **17**D (e.g., contacts **9912** and **9914** are moving towards each other while remaining contact with the touch-sensitive surface **451**). FIGS. **17**C-**17**D illustrate zooming out from, or reducing the size of, image **9902** and control icons **9903** (e.g., image **9902** and control icons **9903** are displayed at a smaller size in FIG. **17**D, in contrast to FIG. **17**C) in response to the multi-touch pinch gesture.

[0374] FIG. **17**D illustrates an example of forgoing generating a tactile output on the touch sensitive **451**. In this example, the device forgoes generating the tactile output (e.g., tactile output **9910** in FIG. **17**B is not generated) on the touch sensitive **451** in response to detecting the gesture (e.g., the movement of contacts **9912** and **9914** toward each other that includes the increase of intensity of contact **9912** above IT_L) and in accordance with a determination that the gesture includes a second number of contacts (e.g., contacts **9912** and **9914**). In some embodiments, the second number of contacts is two or more contacts. FIGS. **17**C-**17**D illustrate detecting the gesture including two contacts (e.g., contacts **9912** and **9914**).

[0375] FIG. **17**E illustrates detecting a plurality of contacts (e.g., contacts **9918** and **9920**) on the touch-sensitive surface **451**. In this example, contact **9918** corresponds to cursor **9904** (e.g., contact **9918** was detected prior to contact **9920**), and the intensities of contacts **9918** and **9920** are between IT_0 and IT_L.

[0376] FIG. **17**E further illustrates assigning one or more of the plurality of contacts, comprising less than all of the plurality of contacts, to the gesture in accordance with predefined gesture criteria. In this example, contact **9918** is assigned to the gesture in accordance with predefined gesture criteria, but contact **9920** (e.g., representing a portion of a user's palm on touch-sensitive surface **451**) is not assigned to the gesture (e.g., contact **9920** is not in accordance with predefined gesture criteria including shape and surface area, these predefined gesture criteria sometimes include accidental input rejection criteria such as palm rejection criteria that enable the device to ignore accidental contacts on the touch-sensitive surface such as a contact formed by the palm of a user's hand).

[0377] FIGS. **17**E-**17**F illustrate an example of detecting, on the touch-sensitive surface **451**, a gesture that includes an increase of intensity of a contact (e.g., contact **9918**) above a respective intensity threshold (e.g., "IT_L"). In this example, the intensity of contact **9918** increases (e.g., from a level below IT_L in FIG. **17**E to a level above IT_L in FIG. **17**F) above the respective intensity threshold (e.g., "IT_L").

[0378] FIG. **17**F illustrates an example of generating a tactile output (e.g., tactile output **9910**) on the touch sensitive **451**. In this example, the device generates tactile output **9910** on the touch sensitive **451** in response to detecting the gesture (e.g., the increase of intensity of contact **9918** above IT_L) and in accordance with a determination that the gesture includes a first number of contacts (e.g., one contact, in this example contact **9918**, excluding contact **9920**). FIG. **17**F further illustrates displaying image **9908** on display **450** in response to the press input (e.g., the increase in intensity of contact **9918** above IT_L) while cursor **9904** is over next image button **9903-1**, which relates to the next image in the sequence of images of the week). In some embodiments, the next image button **9903-1** is activated in response to an increase in intensity of contact **9918** above IT_L (e.g., the down-stroke of a press input). In some embodiments, the next image button **9903-1** is activated in response to a subsequent decrease in intensity of contact **9918** below IT_L (e.g., the up-stroke of a press input).

[0379] FIG. **18** is a flow diagram illustrating a method **10000** of generating a tactile output for a gesture having a first number of contacts (e.g., a single contact gesture) and forgoing generation of a tactile output for a gesture having a second number of contacts (e.g., a multi-contact gesture) in accordance with some embodiments. The method **10000** is performed at an electronic device (e.g., device **300**, FIG. **3**, or portable multifunction device **100**, FIG. **1**A) with a display and a touch-sensitive surface. In some embodiments, the display is a touch screen display and the touch-sensitive surface is on the display. In some embodiments, the display is separate from the touch-sensitive surface. Some operations in method **10000** are, optionally, combined and/or the order of some operations is, optionally, changed.

[0380] As described below, the method **10000** provides an intuitive way to generate a tactile output for a gesture having a first number of contacts and forgo generation of a tactile output for a gesture having a second number of contacts. The

method reduces the cognitive burden on a user when generating a tactile output for a gesture having a first number of contacts and forgoing generation of a tactile output for a gesture having a second number of contacts, thereby creating a more efficient human-machine interface. For battery-operated electronic devices, enabling a user to generate a tactile output for a gesture having a first number of contacts and forgo generation of a tactile output for a gesture having a second number of contacts conserves power and increases the time between battery charges.

[0381] The device detects (**10002**), on a touch-sensitive surface, a gesture that includes an increase of intensity of a contact above a respective intensity threshold. FIGS. **17**A-**17**B, for example, show a gesture that includes an increase of intensity of contact **9906** (e.g., from below IT_L in FIG. **17**A to above IT_L in FIG. **17**B) above a respective intensity threshold (e.g., "IT_L") on the touch-sensitive surface **451**.

[0382] In some embodiments, the gesture includes (**10004**) a press input detected on the touch-sensitive surface while a focus selector is over a control icon (e.g., a button) displayed on the display. FIGS. **17**A-**17**B, for example, show a press a press input detected on the touch-sensitive surface **451** (e.g., the increase in the intensity of contact **9906** from below IT_L in FIG. **17**A to above IT_L in FIG. **17**B) while a focus selector (e.g., cursor **9904**) is over a control icon (e.g., next image button **9903-1**) displayed on the display **450**.

[0383] In some embodiments, the respective intensity threshold is (**10006**) an activation threshold and the tactile output provides a confirmation to the user that the activation threshold has been met. For example, a tactile output confirming to the user that an operation has been performed, or a tactile output confirming to the user that an operation will be performed upon detecting an end of the gesture, such as liftoff of the contact. FIG. **17**B, for example, shows tactile output **9910** on touch-sensitive surface **451** providing confirmation to the user that the activation threshold has been met (e.g., the respective intensity threshold—IT_L).

[0384] In response to detecting the gesture (**10008**) and in accordance with a determination that the gesture includes a first number of contacts, the device generates (**10010**) a tactile output on the touch-sensitive surface. FIG. **17**B, for example, shows tactile output **9910** generated on touch-sensitive surface **451** in response to detecting the gesture (e.g., an increase in the intensity of contact **9906** above IT_L) and in accordance with a determination that the gesture includes a first number of contacts (e.g., contact **9906**).

[0385] In some embodiments, the first number of contacts is (**10012**) one contact (e.g., the tactile output is generated when the gesture is a single-contact press input). FIGS. **17**A-**17**B, for example, show the gesture including one contact (e.g., contact **9906**).

[0386] In some embodiments, the tactile output is (**10014**) a tactile output that corresponds to the increase of intensity of the contact above the respective intensity threshold. For example, the tactile output that is generated when the gesture includes a first number of contacts (and is not generated when the gesture includes a second number of contacts) is a tactile output that corresponds to the increase of intensity of a contact above a respective threshold (e.g., "IT_L"). In some embodiments, the tactile output is a simulation of a "mouse click" tactile output that is generated by the device when a contact exceeds a "down click" intensity threshold (e.g., "IT_L") and the gesture is performed with a single contact (e.g., the user performs a press input with a single contact). FIG. **17**B, for example, shows tactile output **9910** corresponding to the increase of intensity of contact **9906** above the respective intensity threshold (e.g., "IT_L").

[0387] In some embodiments, the tactile output is (**10016**) a predefined tactile output (e.g., to simulate a "mouse click" sensation corresponding to depressing a physical actuator on a mouse or trackpad) that is generated when the user performs one of a set of predefined single-contact user interface object interaction operations in the user interface. For example, the tactile output corresponds to a "mouse click" sensation, where the "mouse click" sensation is provided in response to selection of user interface objects when the user is using the touch-sensitive surface as a single-contact trackpad (e.g., rather than a multi-contact gesture input area).

[0388] In response to detecting the gesture and in accordance with a determination that the gesture includes a second number of contacts, the device forgoes (**10018**) generating the tactile output on the touch-sensitive surface. FIG. **17**D, for example, shows the device forgoing generation of the tactile output on the touch-sensitive surface **451** (e.g., tactile output **9910** in FIG. **17**B is not generated) in response to detecting the gesture (e.g., an increase in the intensity of contact **9912** from below IT_L in FIG. **17**C to above IT_L in FIG. **17**D) and in accordance with a determination that the gesture includes a second number of contacts (e.g., contacts **9912** and **9914**). In some embodiments, the tactile output is not generated when the gesture is performed with multiple contacts (e.g., the user performs a multi-contact gesture such as a pinch or depinch gesture). FIGS. **17**C-**17**D, for example, show a multi-touch pinch gesture on touch-sensitive surface **451**.

[0389] In some embodiments, the second number of contacts is (**10020**) two or more contacts (e.g., the tactile output is not generated when the gesture is a multi-contact pinch/depinch gesture). FIGS. **17**C-**17**D, for example, show the pinch gesture including two or more contacts (e.g., contacts **9912** and **9914**).

[0390] In some embodiments, the device detects (**10022**) a plurality of contacts on the touch-sensitive surface and assigns one or more of the plurality of contacts, comprising less than all of the plurality of contacts, to the first gesture in accordance with predefined gesture criteria. In some embodiments, one or more simultaneously detected contacts are excluded from the gesture (e.g., the device ignores palm contact or accidental contacts on the touch-sensitive surface). In some embodiments, predefined gesture criteria include: a shape of the one or more of the plurality of contacts, a surface area of the one or more of the plurality of contacts, an intensity of the one or more of the plurality of contacts, a predefined or chronological order of the plurality of contacts, or any combination thereof.

[0391] FIGS. **17**E-**17**F, for example, show the detection of a plurality of contacts (e.g., contacts **9918** and **9920**) on the touch-sensitive surface **451**. FIGS. **17**E-**17**F, for example, also show the assignment of one of the plurality of contacts (e.g., contact **9918**), comprising less than all of the plurality of contacts, to the gesture in accordance with predefined gesture criteria. For example, the shape and surface area of contact **9918** (e.g., circular and approximately the surface area of a user's fingertip) are in accordance with the predefined gesture criteria, but the shape and surface area of contact **9920** (e.g., oblong and having a surface area greater

than a predefined maximum surface area for a touch contact) are not in accordance with predefined gesture criteria.

[0392] It should be understood that the particular order in which the operations in FIG. **18** have been described is merely exemplary and is not intended to indicate that the described order is the only order in which the operations could be performed. One of ordinary skill in the art would recognize various ways to reorder the operations described herein. Additionally, it should be noted that details of other processes described herein with respect to other methods described herein (e.g., those listed in the fifth paragraph of the Description of Embodiments) are also applicable in an analogous manner to method **10000** described above with respect to FIG. **18**. For example, the contacts, gestures, user interface objects, intensity thresholds, and focus selectors described above with reference to method **10000** optionally have one or more of the characteristics of the contacts, gestures, user interface objects, intensity thresholds, and focus selectors described herein with reference to other methods described herein (e.g., those listed in the fifth paragraph of the Description of Embodiments). For brevity, these details are not repeated here.

[0393] In accordance with some embodiments, FIG. **19** shows a functional block diagram of an electronic device **10100** configured in accordance with the principles of the various described embodiments. The functional blocks of the device are, optionally, implemented by hardware, software, or a combination of hardware and software to carry out the principles of the various described embodiments. It is understood by persons of skill in the art that the functional blocks described in FIG. **19** are, optionally, combined or separated into sub-blocks to implement the principles of the various described embodiments. Therefore, the description herein optionally supports any possible combination or separation or further definition of the functional blocks described herein.

[0394] As shown in FIG. **19**, an electronic device **10100** includes: a display unit **10102** configured to display a graphical user interface; a touch-sensitive surface unit **10104** configured to receive contacts; one or more sensor units **10106** configured to detect intensity of contacts with the touch-sensitive surface unit **10104**; a tactile output unit **10108** configured to generate a tactile output (e.g., generated by movement of the touch-sensitive surface unit **10104**); and a processing unit **10110** coupled to the display unit **10102**, the touch-sensitive surface unit **10104**, the one or more sensor units **10106**, and the tactile output unit **10108**. In some embodiments, the processing unit **10110** includes a detecting unit **10112**, a determining unit **10114**, a generating unit **10116**, and an assigning unit **10118**.

[0395] The processing unit **10110** is configured to: detect (e.g., with the detecting unit **10112**), on the touch-sensitive surface unit **10104**, a gesture that includes an increase of intensity of a contact above a respective intensity threshold. The processing unit **10110** is further configured to, in response to detecting the gesture: in accordance with a determination (e.g., with the determining unit **10114**) that the gesture includes a first number of contacts, generate (e.g., with the generating unit **10116**) a tactile output via the tactile output unit **10108** on the touch-sensitive surface unit **10104**; and in accordance with a determination (e.g., with the determining unit **10114**) that the gesture includes a second number of contacts different from the first number, forgo generating the tactile output on the touch-sensitive surface unit **10104**.

[0396] In some embodiments, the tactile output is a tactile output that corresponds to the increase of intensity of the contact above the respective intensity threshold.

[0397] In some embodiments, the tactile output is a predefined tactile output that is generated via the tactile output unit **10108** when the user performs one of a set of predefined single-contact user interface object interaction operations in the user interface.

[0398] In some embodiments, the first number of contacts is one contact, and the second number of contacts is two or more contacts.

[0399] In some embodiments, the respective intensity threshold is an activation threshold and the tactile output provides a confirmation to the user that the activation threshold has been met.

[0400] In some embodiments, the gesture includes a press input detected (e.g., with the detecting unit **10112**) on the touch-sensitive surface unit **10104** while a focus selector is over a control icon displayed on the display unit **10102**.

[0401] In some embodiments, the processing unit **10110** is further configured to: detect (e.g., with the detecting unit **10112**) a plurality of contacts on the touch-sensitive surface unit **10104**; and assign (e.g., with the assigning unit **10118**) one or more of the plurality of contacts, comprising less than all of the plurality of contacts, to the gesture in accordance with predefined gesture criteria.

[0402] The operations in the information processing methods described above are, optionally implemented by running one or more functional modules in information processing apparatus such as general purpose processors (e.g., as described above with respect to FIGS. **1**A and **3**) or application specific chips.

[0403] The operations described above with reference to FIG. **18** are, optionally, implemented by components depicted in FIGS. **1**A-**1**B or FIG. **19**. For example, detecting operations **10002** and **10022**, determining operations **10010** and **10018**, and generating operation **10010** are, optionally, implemented by event sorter **170**, event recognizer **180**, and event handler **190**. Event monitor **171** in event sorter **170** detects a contact on touch-sensitive display **112**, and event dispatcher module **174** delivers the event information to application **136-1**. A respective event recognizer **180** of application **136-1** compares the event information to respective event definitions **186**, and determines whether a first contact at a first location on the touch-sensitive surface corresponds to a predefined event or sub-event, such as selection of an object on a user interface. When a respective predefined event or sub-event is detected, event recognizer **180** activates an event handler **190** associated with the detection of the event or sub-event. Event handler **190** optionally utilizes or calls data updater **176** or object updater **177** to update the application internal state **192**. In some embodiments, event handler **190** accesses a respective GUI updater **178** to update what is displayed by the application. Similarly, it would be clear to a person having ordinary skill in the art how other processes can be implemented based on the components depicted in FIGS. **1**A-**1**B.

[0404] It should be understood that the particular order in which the operations have been described above is merely exemplary and is not intended to indicate that the described order is the only order in which the operations could be

performed. One of ordinary skill in the art would recognize various ways to reorder the operations described herein. Additionally, it should be noted that the various processes separately described herein (e.g., those listed in the fifth paragraph of the Description of Embodiments) can be combined with each other in different arrangements. For example, the contacts, user interface objects, tactile sensations, intensity thresholds, and/or focus selectors described above with reference to any one of the various processes separately described herein (e.g., those listed in the fifth paragraph of the Description of Embodiments) optionally have one or more of the characteristics of the contacts, gestures, user interface objects, tactile sensations, intensity thresholds, and focus selectors described herein with reference to one or more of the other methods described herein (e.g., those listed in the fifth paragraph of the Description of Embodiments). For brevity, all of the various possible combinations are not specifically enumerated here, but it should be understood that the claims described above may be combined in any way that is not precluded by mutually exclusive claim features.

[0405] 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 various described embodiments 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 various described embodiments and their practical applications, to thereby enable others skilled in the art to best utilize the various described embodiments with various modifications as are suited to the particular use contemplated.

What is claimed is:

1. A method, comprising:

at an electronic device with a touch-sensitive surface and a display:

displaying, on the display, a plurality of user interface objects, wherein each of the plurality of user interface objects includes a plurality of subdivisions;

detecting movement of a contact on the touch-sensitive surface over a respective user interface object in the plurality of user interface objects; and

in response to detecting the movement of the contact:

in accordance with a determination that output criteria have been met, wherein the output criteria include a criterion that the contact has a velocity that is below a respective velocity threshold when the contact moves over the respective user interface object, generating tactile outputs that correspond to a respective boundary of the respective user interface object and subdivisions of the respective user interface object; and

in accordance with a determination that the output criteria have not been met, generating tactile outputs that correspond to the respective boundary of the respective user interface object without generating tactile outputs that correspond to the subdivisions of the respective user interface object.

2. The method of claim **1**, wherein the output criteria include a criterion that the contact has an intensity above a respective intensity threshold when the contact moves over the respective user interface object.

3. The method of claim **1**, wherein the output criteria include a criterion that the contact has an intensity below a respective intensity threshold when the contact moves over the respective user interface object.

4. The method of claim **1**, wherein the output criteria include a criterion that the respective user interface object is displayed in an active window in the user interface.

5. The method of claim **1**, wherein:

the plurality of user interface objects include application windows; and

the subdivisions of the respective user interface object include selectable affordances within the application windows.

6. The method of claim **1**, wherein:

the plurality of user interface objects are paragraphs; and

the subdivisions are words.

7. The method of claim **1**, wherein:

the plurality of user interface objects are sentences; and

the subdivisions are words.

8. The method of claim **1**, wherein:

the plurality of user interface objects are words; and

the subdivisions are letters.

9. The method of claim **1**, wherein:

a respective user interface object of the plurality of user interface objects includes a hierarchy of subdivisions, including a level corresponding to a first class of subdivisions and a level corresponding to a second class of subdivisions; and

the method includes, in response to detecting the movement of the contact:

in accordance with a determination that first output criteria have been met, generating tactile outputs corresponding to subdivisions in the first class of subdivisions without generating tactile outputs corresponding to subdivisions in the second class of subdivisions; and

in accordance with a determination that second output criteria have been met, generating tactile outputs corresponding to subdivisions in the first class of subdivisions and generating tactile outputs corresponding to subdivisions in the second class of subdivisions.

10. An electronic device, comprising:

a display;

a touch-sensitive surface;

one or more processors;

memory; and

one or more programs, wherein the one or more programs are stored in the memory and configured to be executed by the one or more processors, the one or more programs including instructions for:

displaying, on the display, a plurality of user interface objects, wherein each of the plurality of user interface objects includes a plurality of subdivisions;

detecting movement of a contact on the touch-sensitive surface over a respective user interface object in the plurality of user interface objects; and

in response to detecting the movement of the contact:

in accordance with a determination that output criteria have been met, wherein the output criteria include a criterion that the contact has a velocity that is below a respective velocity threshold when the contact moves over the respective user interface object, generating tactile outputs that corre-

spond to a respective boundary of the respective user interface object and subdivisions of the respective user interface object; and

in accordance with a determination that the output criteria have not been met, generating tactile outputs that correspond to the respective boundary of the respective user interface object without generating tactile outputs that correspond to the subdivisions of the respective user interface object.

11. The electronic device of claim **10**, wherein the output criteria include a criterion that the contact has an intensity above a respective intensity threshold when the contact moves over the respective user interface object.

12. The electronic device of claim **10**, wherein the output criteria include a criterion that the contact has an intensity below a respective intensity threshold when the contact moves over the respective user interface object.

13. The electronic device of claim **10**, wherein the output criteria include a criterion that the respective user interface object is displayed in an active window in the user interface.

14. The electronic device of claim **10**, wherein:

the plurality of user interface objects include application windows; and

the subdivisions of the respective user interface object include selectable affordances within the application windows.

15. A computer readable storage medium storing one or more programs, the one or more programs comprising instructions which, when executed by an electronic device with one or more processors, a display and a touch-sensitive surface, cause the electronic device to perform operations comprising:

displaying, on the display, a plurality of user interface objects, wherein each of the plurality of user interface objects includes a plurality of subdivisions;

detecting movement of a contact on the touch-sensitive surface over a respective user interface object in the plurality of user interface objects; and

in response to detecting the movement of the contact:

in accordance with a determination that output criteria have been met, wherein the output criteria include a criterion that the contact has a velocity that is below a respective velocity threshold when the contact moves over the respective user interface object, generating tactile outputs that correspond to a respective boundary of the respective user interface object and subdivisions of the respective user interface object; and

in accordance with a determination that the output criteria have not been met, generating tactile outputs that correspond to the respective boundary of the respective user interface object without generating tactile outputs that correspond to the subdivisions of the respective user interface object.

16. The computer readable storage medium of claim **15**, wherein the output criteria include a criterion that the contact has an intensity above a respective intensity threshold when the contact moves over the respective user interface object.

17. The computer readable storage medium of claim **15**, wherein the output criteria include a criterion that the contact has an intensity below a respective intensity threshold when the contact moves over the respective user interface object.

18. The computer readable storage medium of claim **15**, wherein the output criteria include a criterion that the respective user interface object is displayed in an active window in the user interface.

19. The computer readable storage medium of claim **15**, wherein:

the plurality of user interface objects include application windows; and

the subdivisions of the respective user interface object include selectable affordances within the application windows.

20. The computer readable storage medium of claim **15**, including instructions which cause the device to:

detect a plurality of contacts on the touch-sensitive surface; and

assign one or more of the plurality of contacts, comprising less than all of the plurality of contacts, to the gesture in accordance with predefined gesture criteria.

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