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**Zambetti et al.**

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(54) **USER INTERFACE OBJECT MANIPULATIONS IN A USER INTERFACE**

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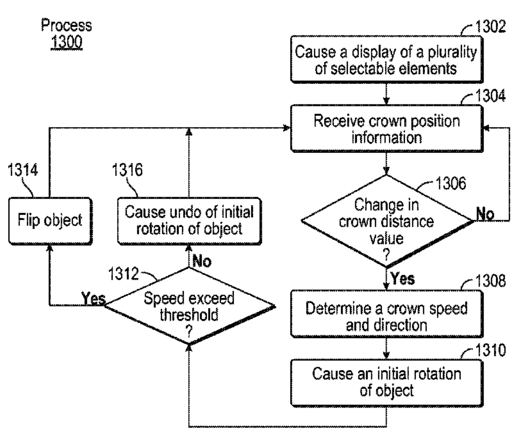

(57) **ABSTRACT**

Systems and processes for manipulating a graphical user interface are disclosed. One process can include receiving user input through a crown to rotate a virtual object. The process includes selecting a surface of the object from among the multiple surfaces of the object in response to determining that the crown rotation exceeded a speed threshold.

**61 Claims, 26 Drawing Sheets**

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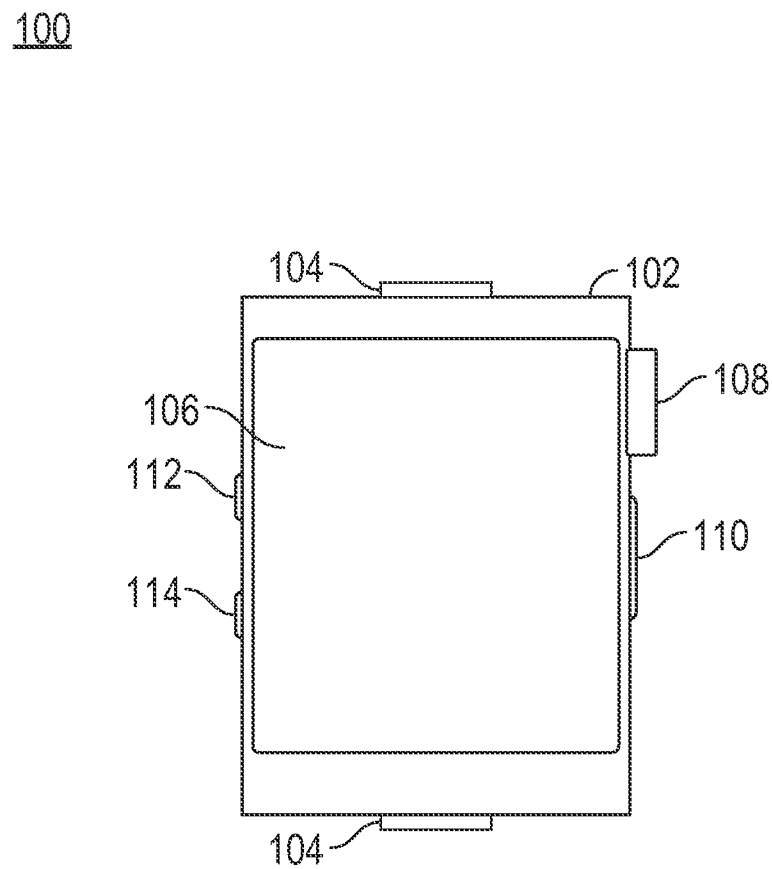
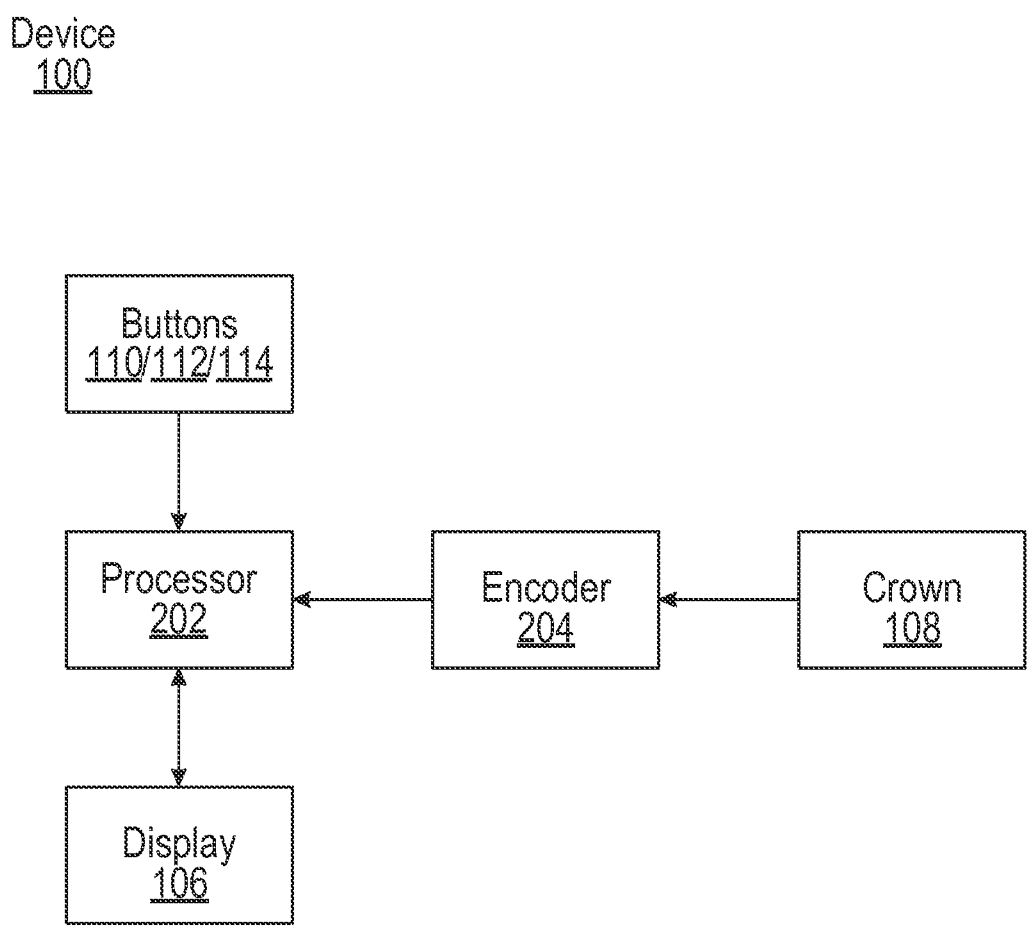



FIG. 1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Encoder
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Crown
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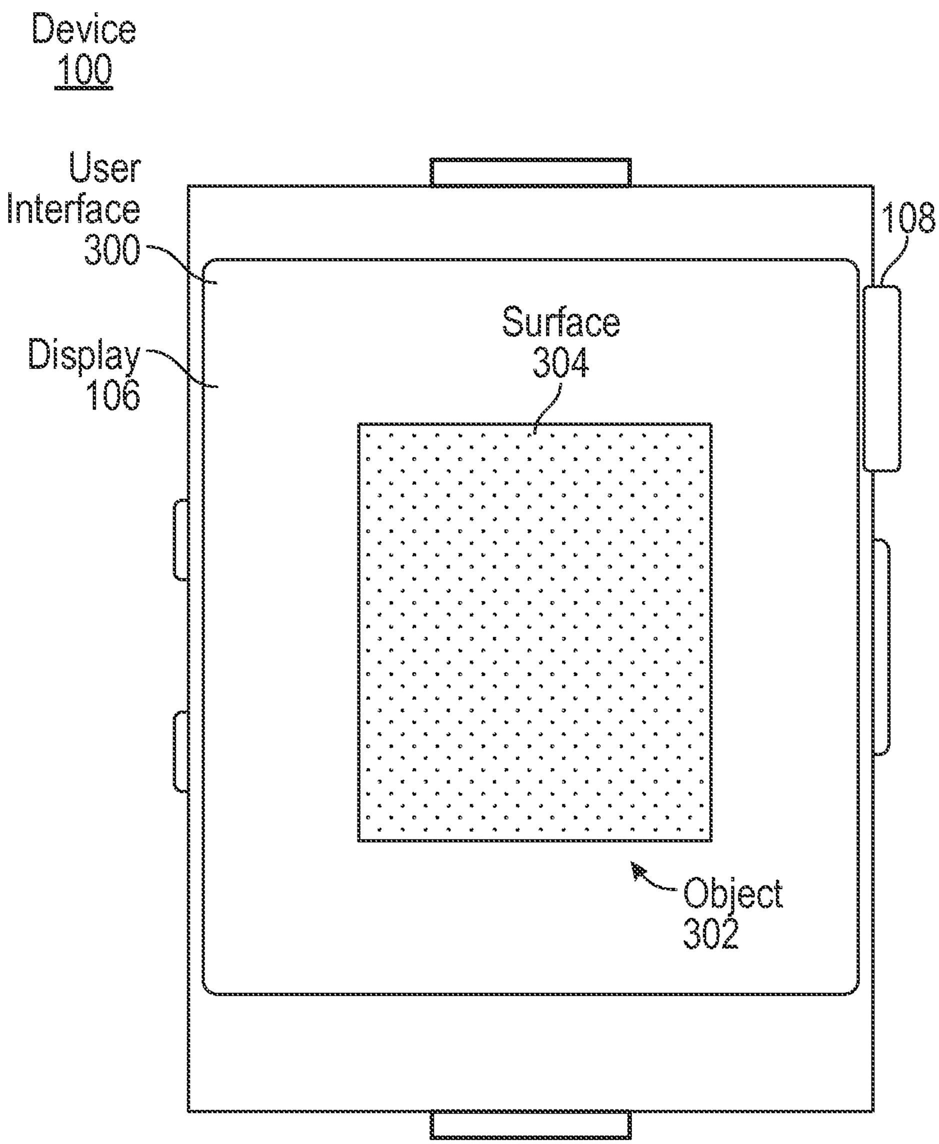
Display
106

FIG. 2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304
Object
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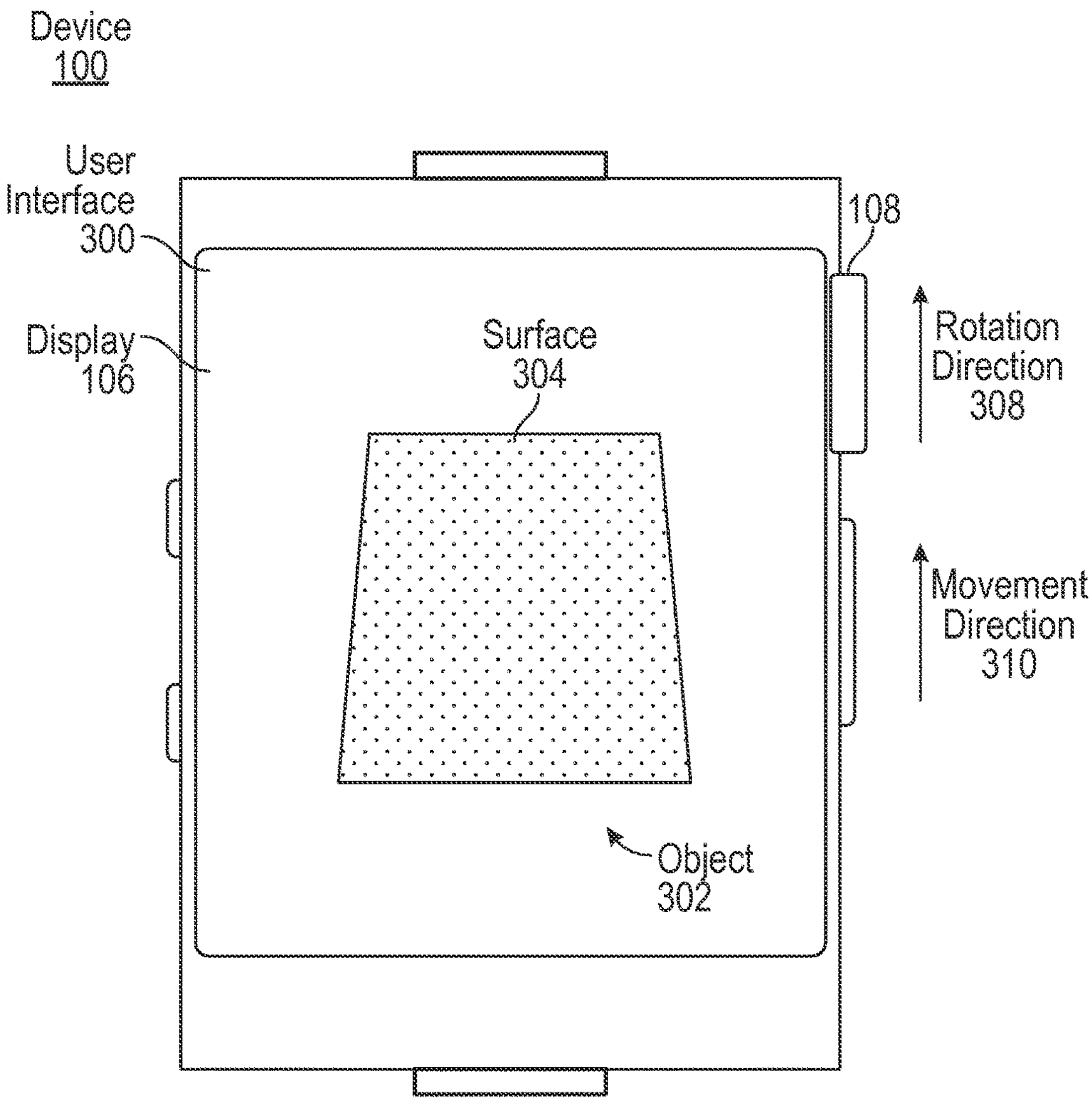
FIG. 3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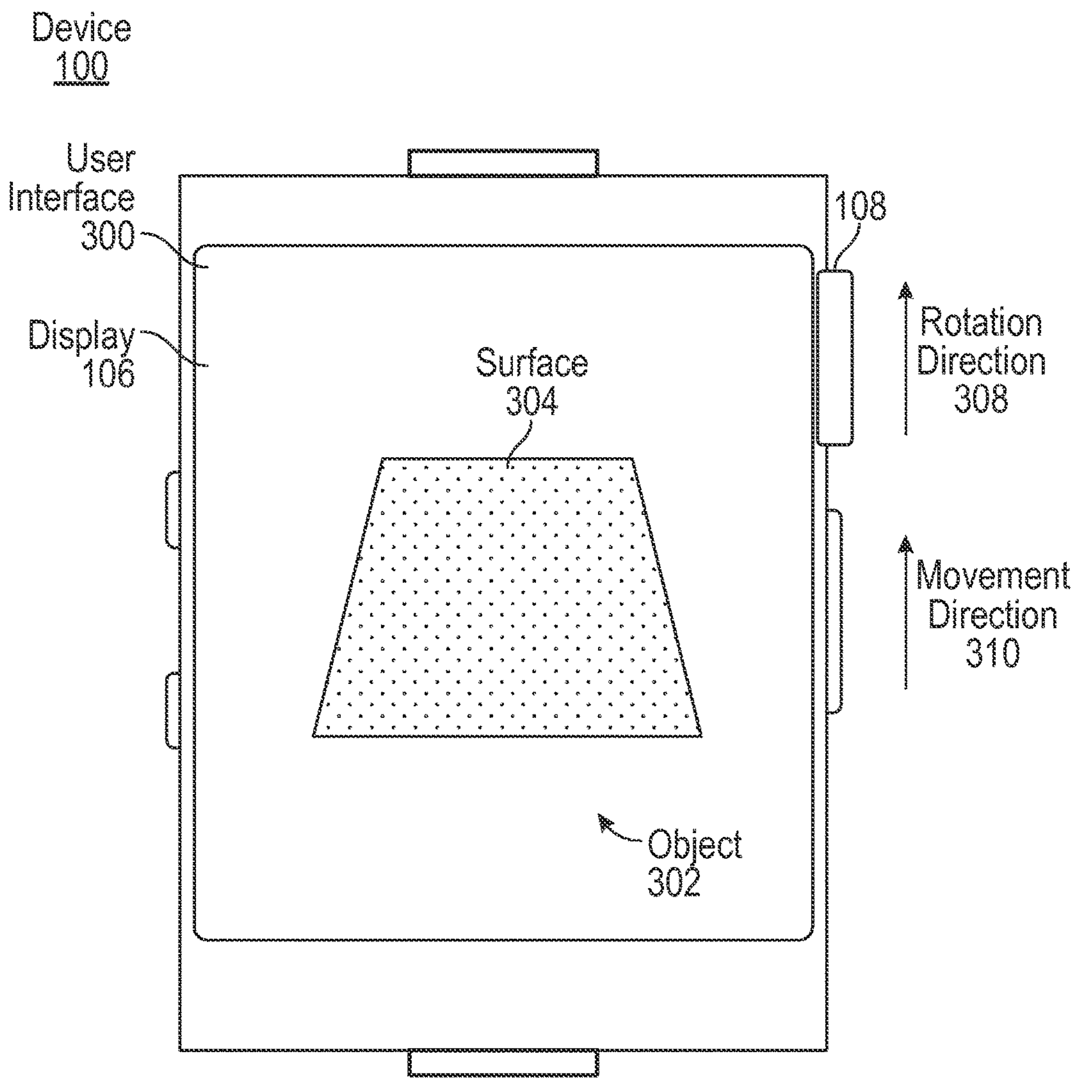
Direction
308
Movement
Direction
310
Object
302

FIG. 4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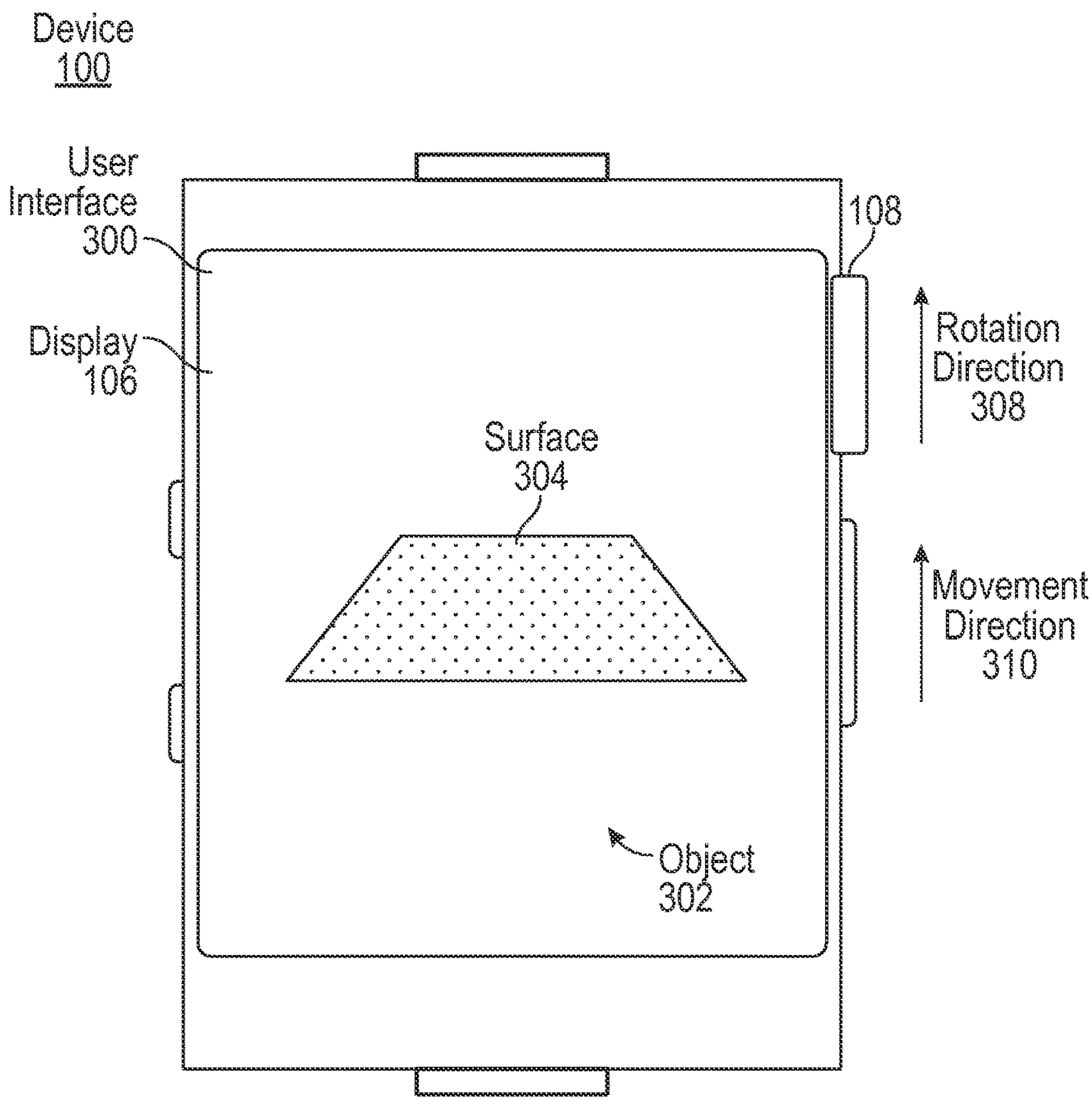
Surface
304
Movement
Direction
310
Object
302

FIG. 5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Rotation
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Surface
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Movement
Direction
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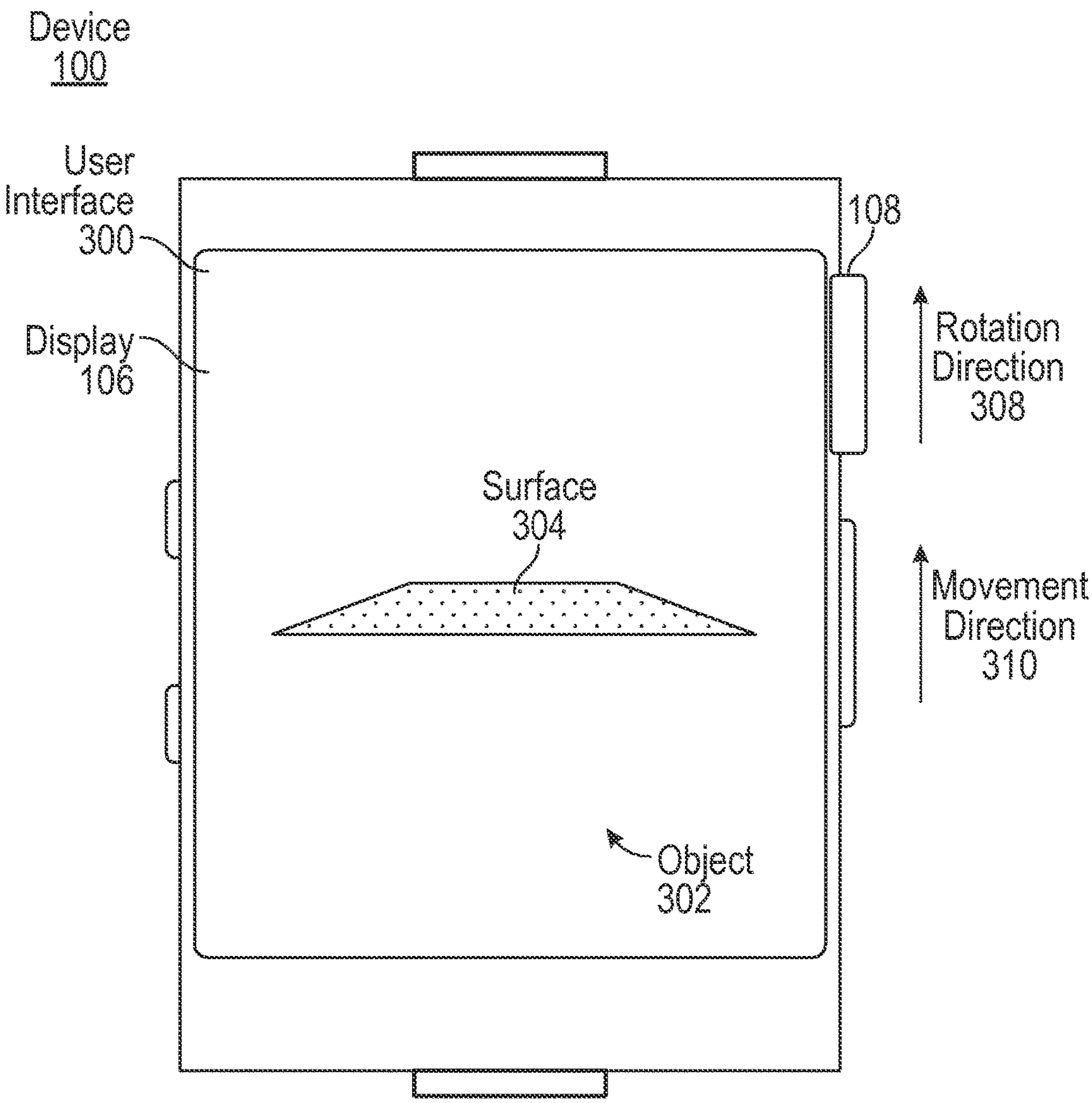
Object
302

FIG. 6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Rotation
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Surface
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Movement
Direction
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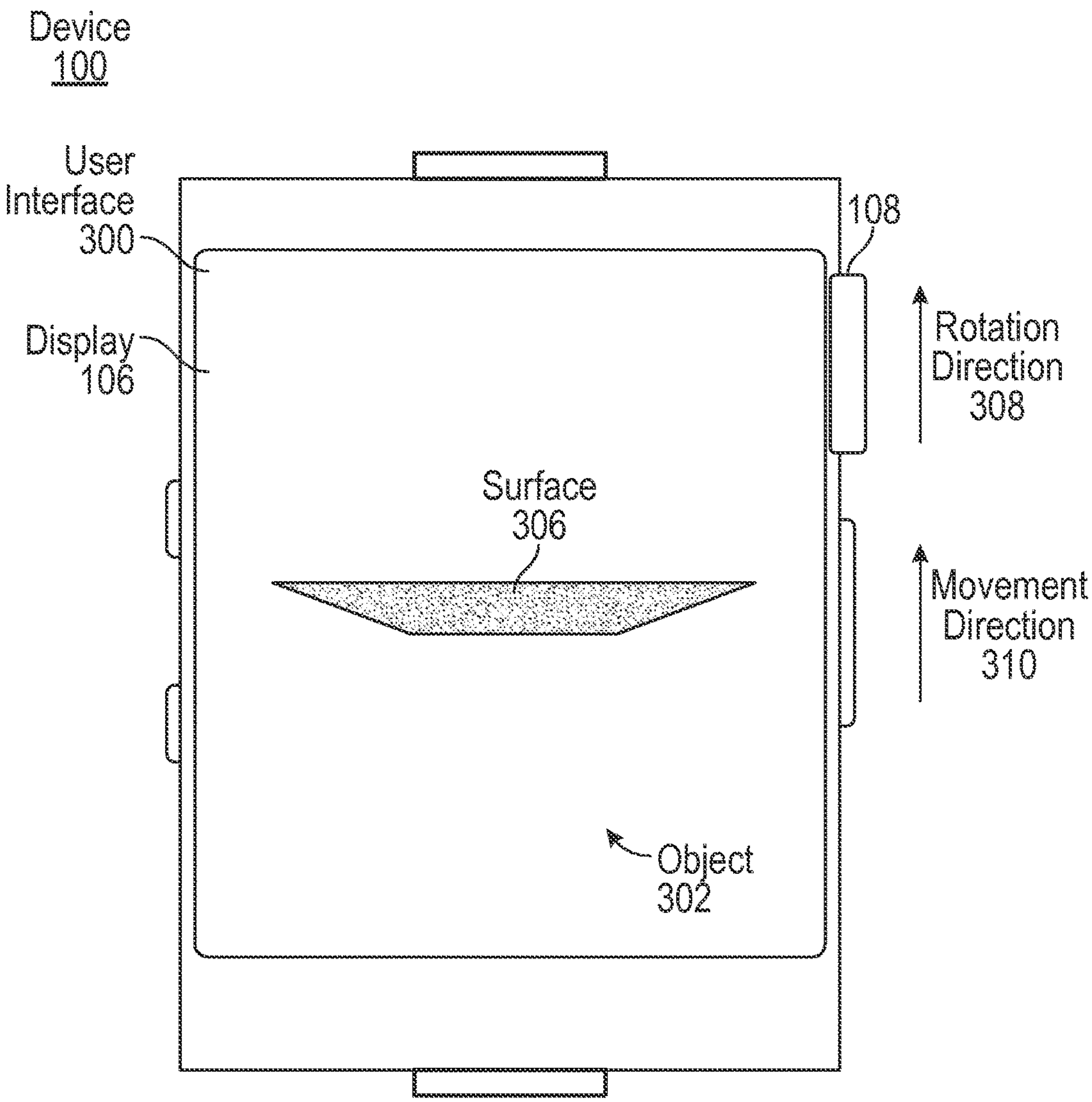
Object
302

FIG. 7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108
Rotation
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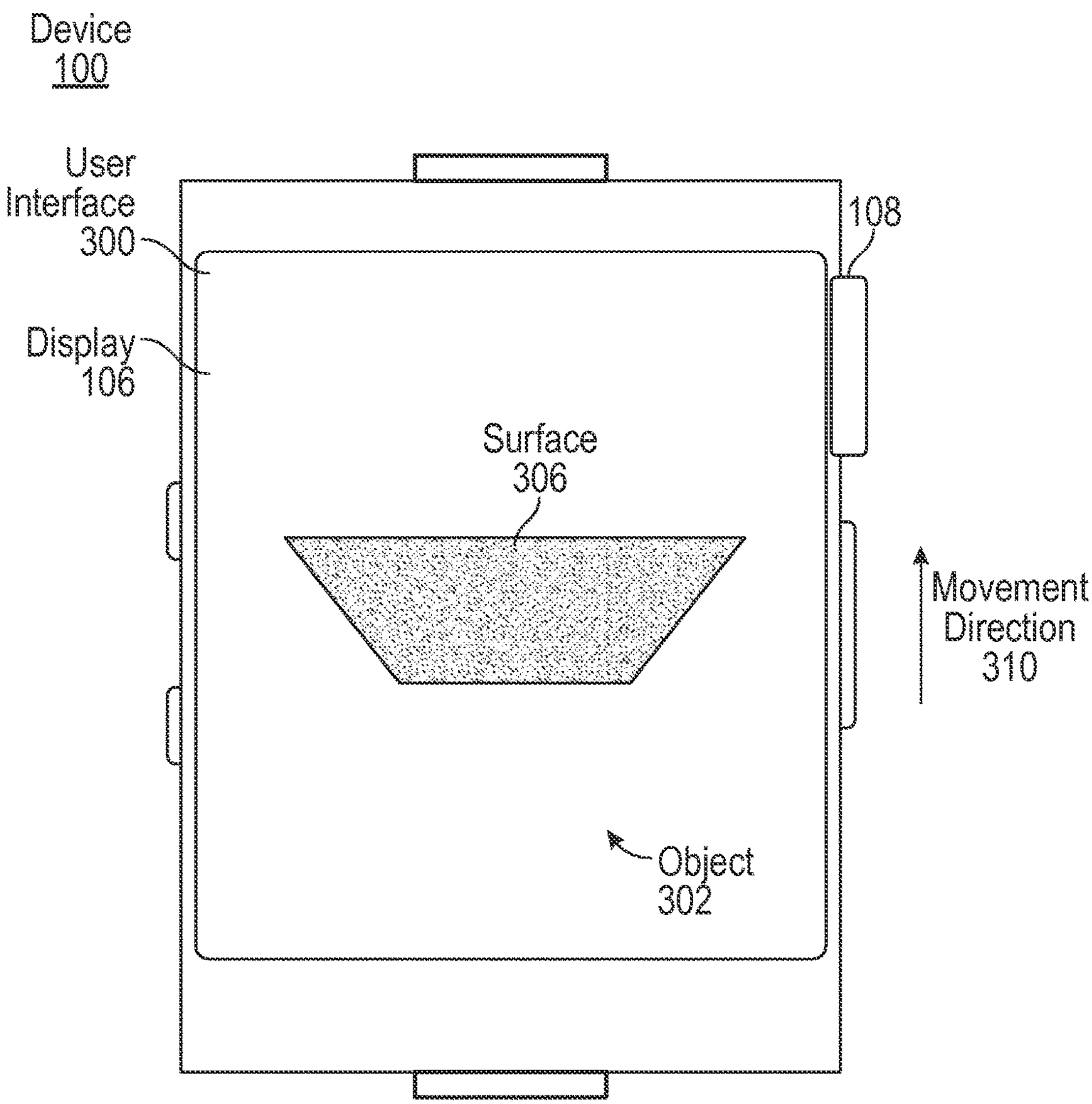
308
Surface
306
Movement
Direction
310
Object
302

FIG. 8


Device
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Display
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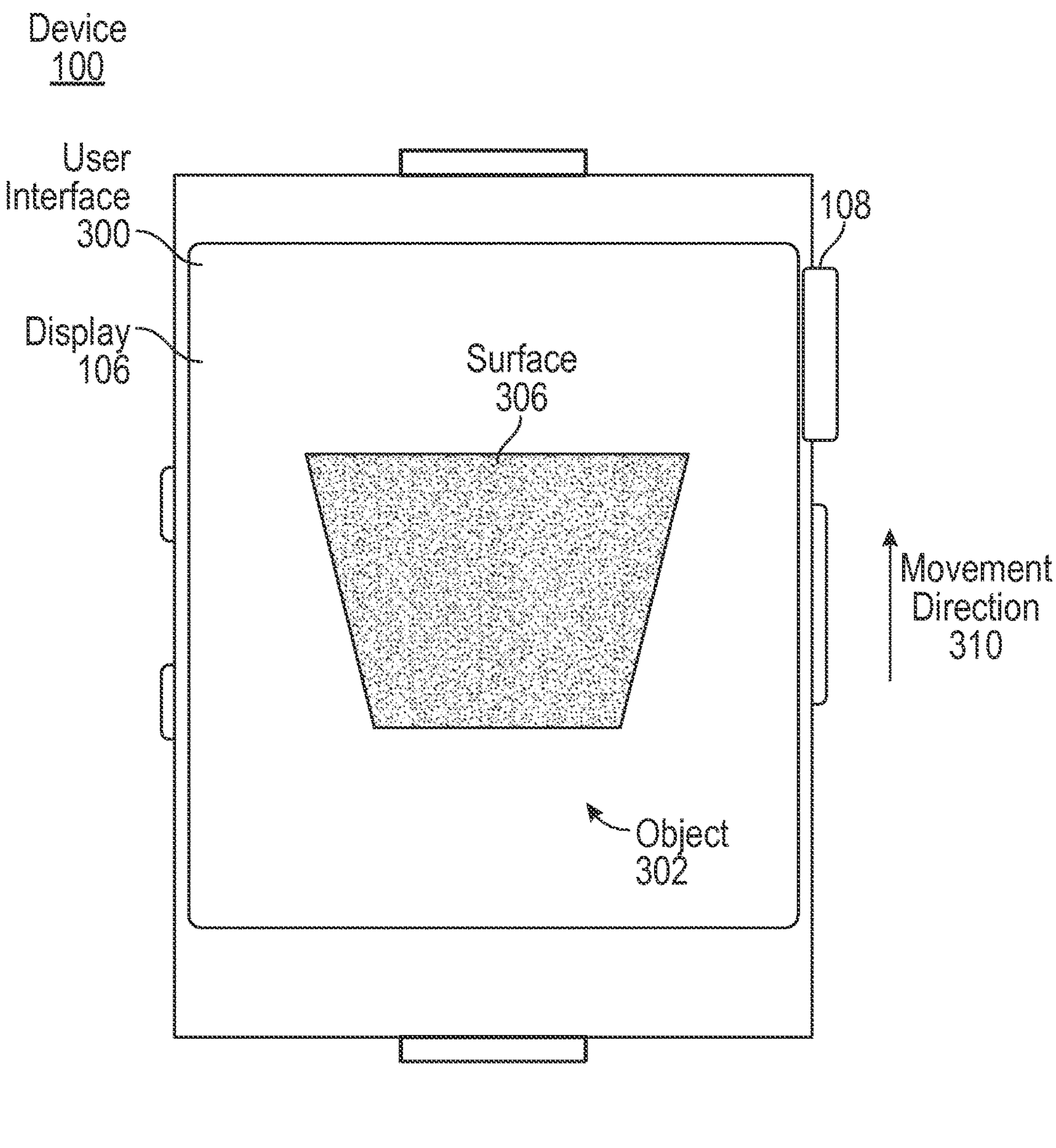
306
Movement
Direction
310
Object
302

FIG. 9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Display
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Movement
Direction
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Object
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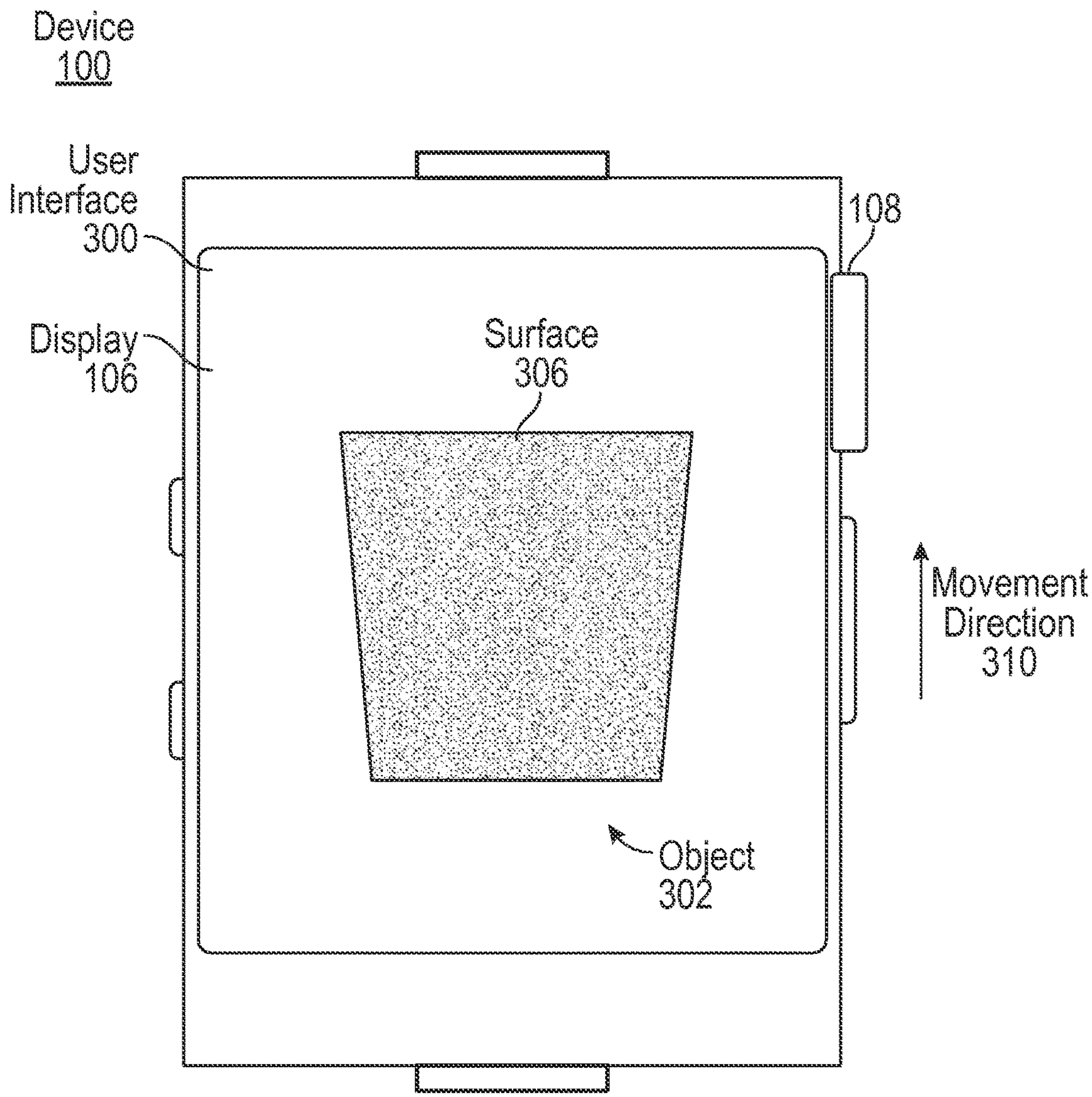
FIG. 10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Display
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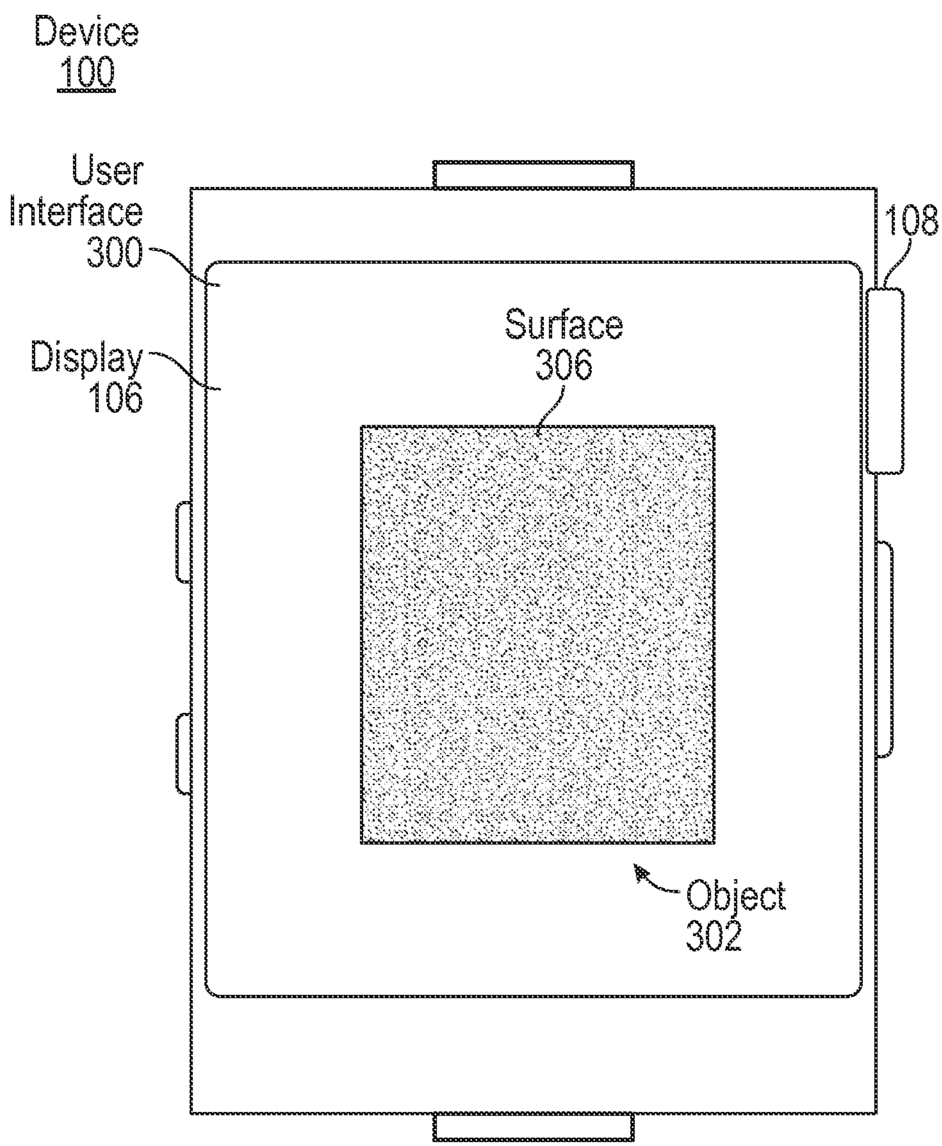
FIG. 11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User
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Display
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108
Surface
306
Object
302

FIG. 12

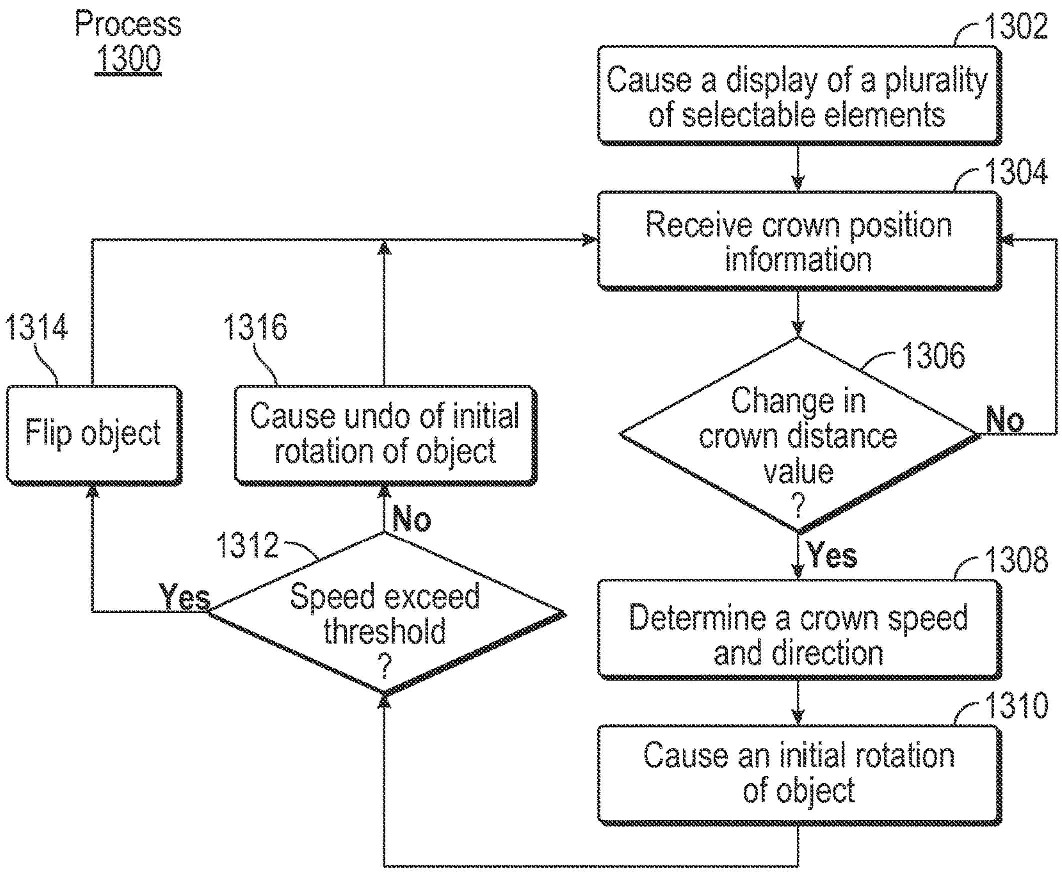
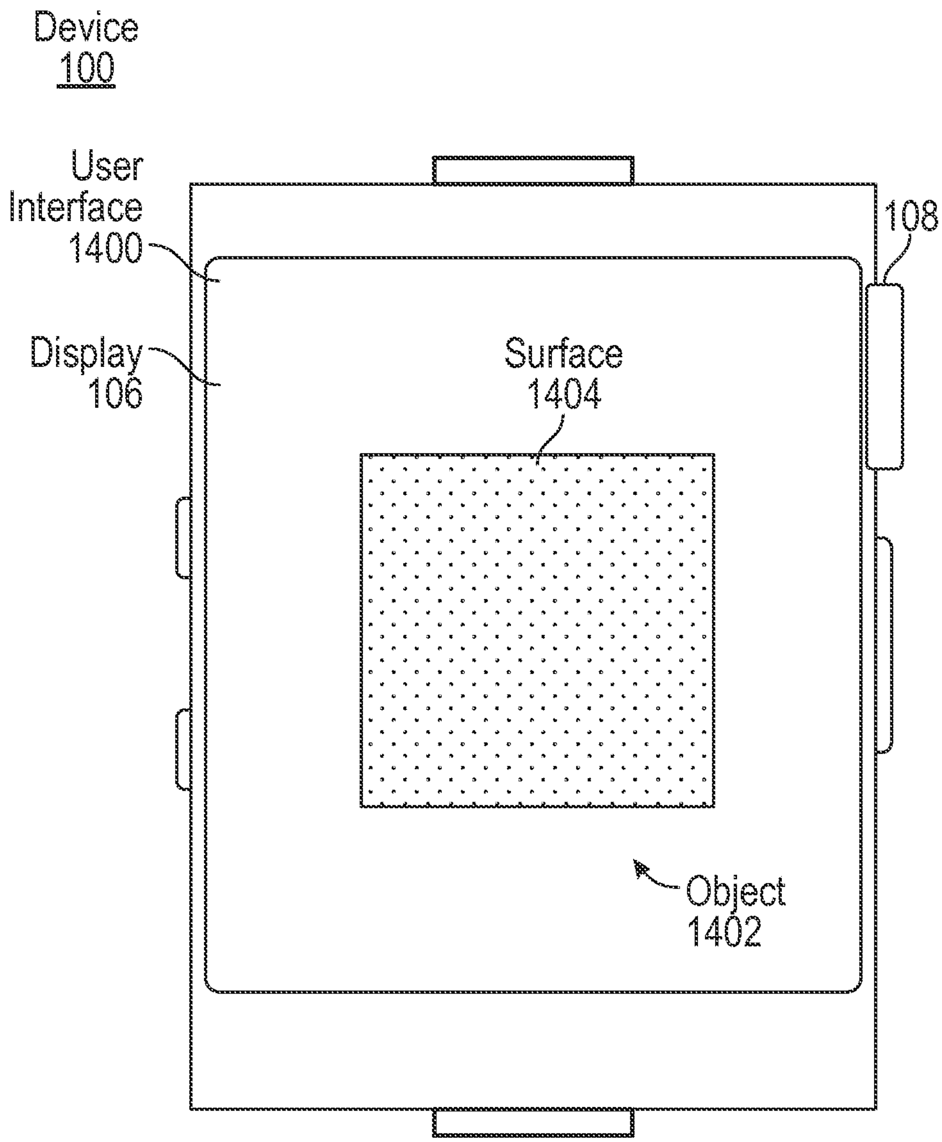

Process
1300
1302
Cause a display of a plurality of selectable elements
1304
Receive crown position information
1306
Change in crown distance value ?
No
Yes
1308
Determine a crown speed and direction
1310
Cause an initial rotation of object
1312
Speed exceed threshold ?
Yes
No
1314
Flip object
1316
Cause undo of initial rotation of object

FIG. 13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Display
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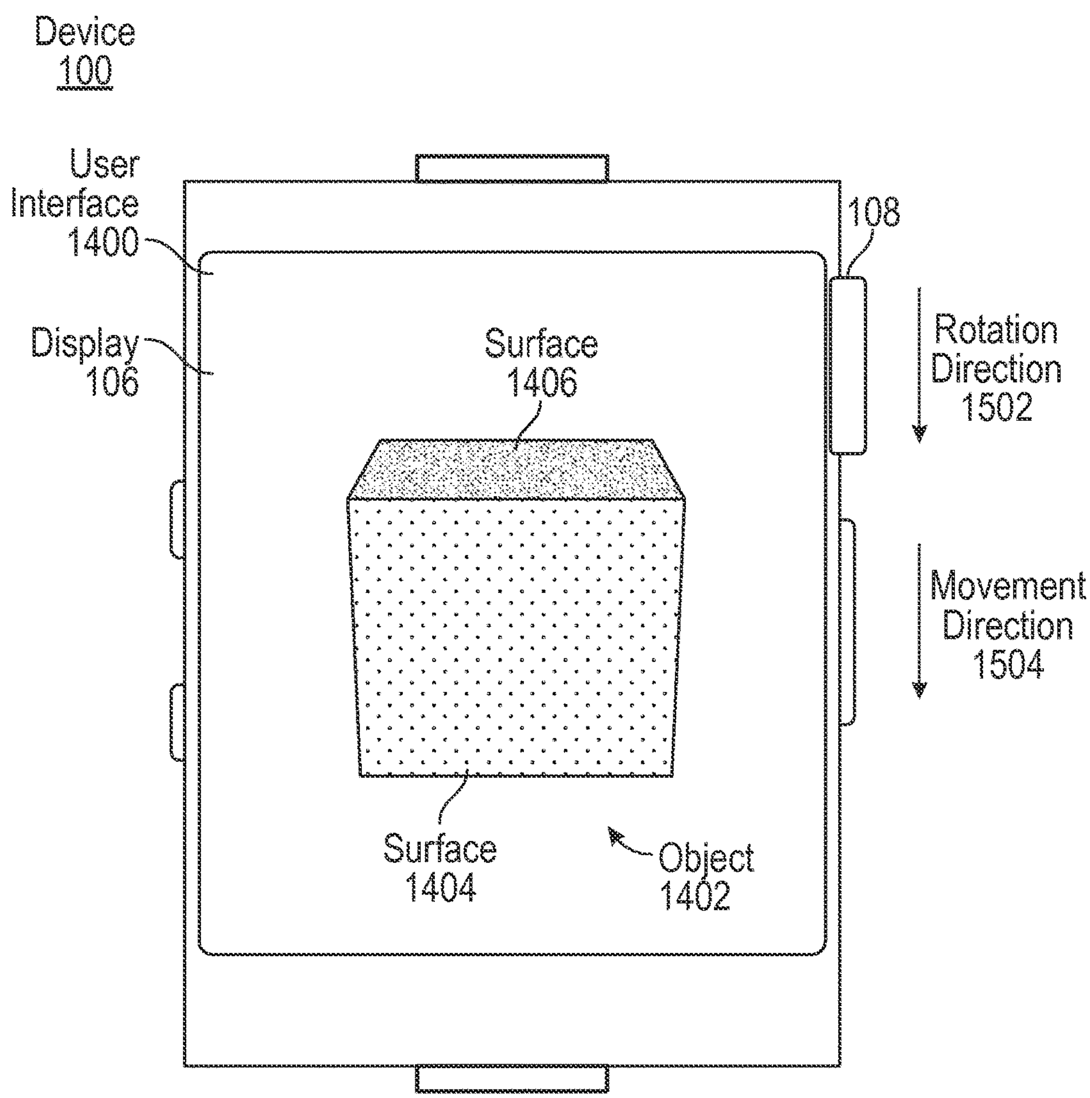
108
Surface
1404
Object
1402

FIG. 14


Device
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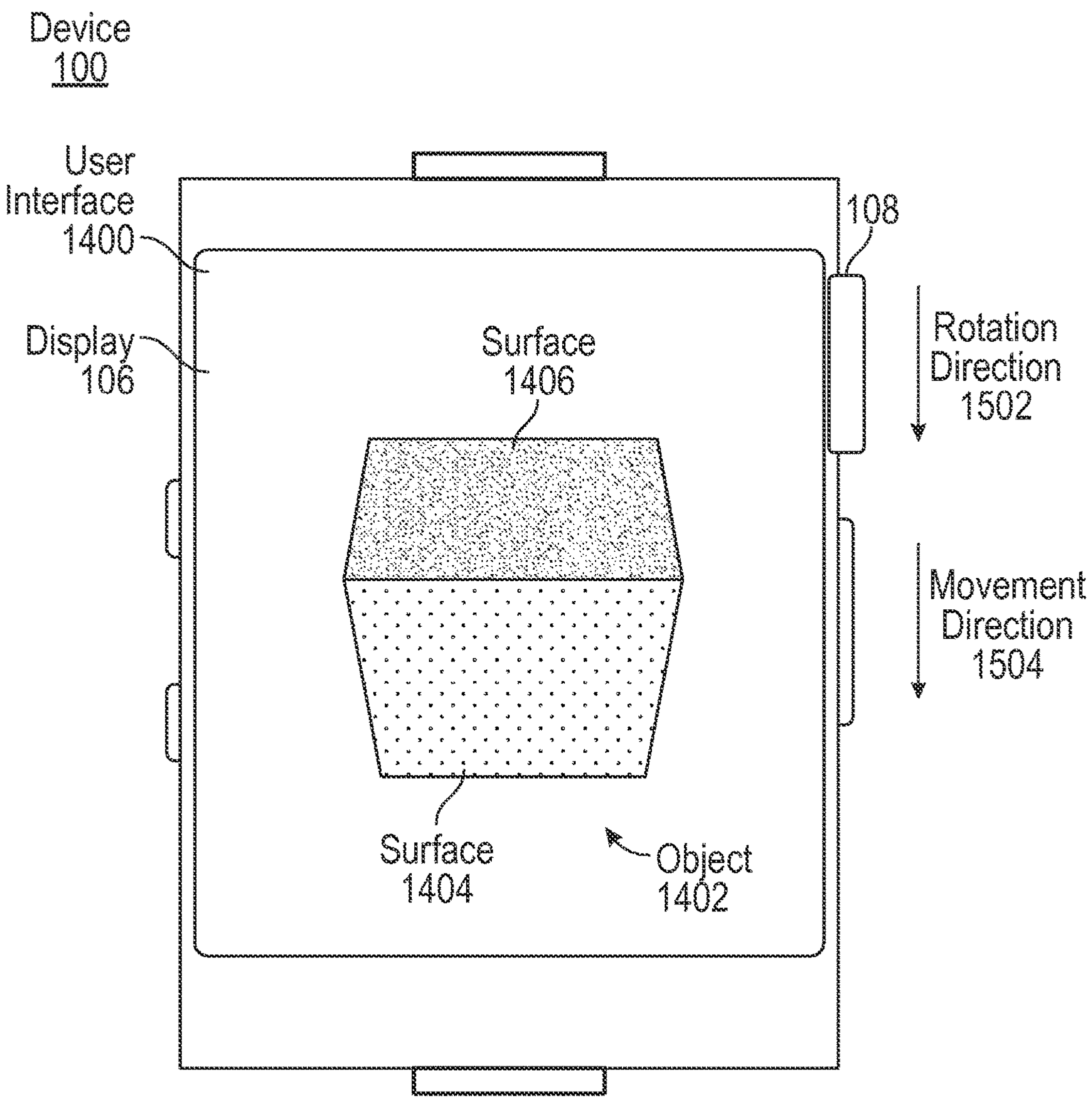
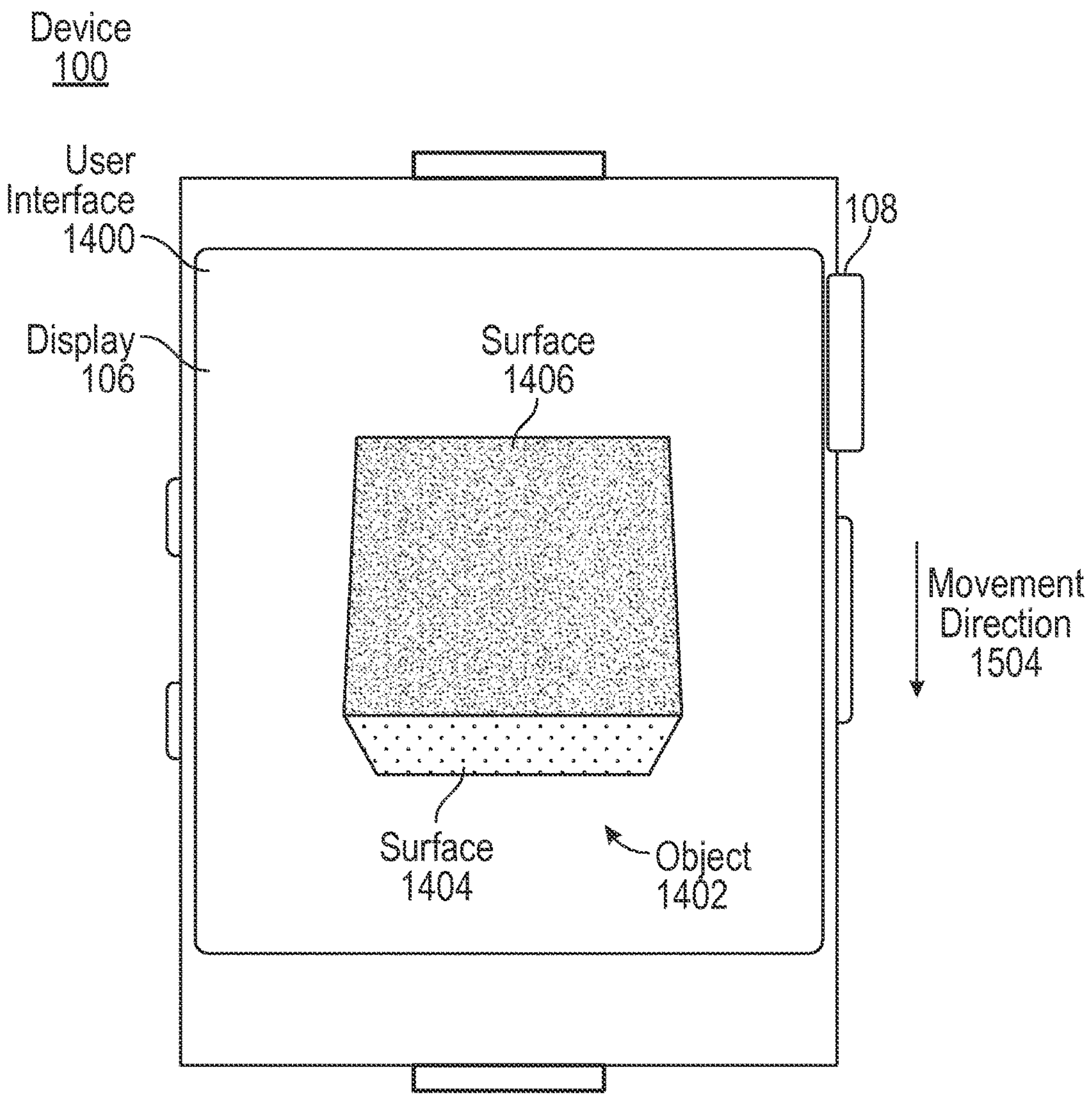
User
Interface
1400
Display
106
108
Surface
1406
Rotation
Direction
1502
Movement
Direction
1504
Surface
1404
Object
1402

FIG. 15



Device
100
User
Interface
1400
Display
106
108
Rotation
Direction
1502
Movement
Direction
1504
Surface
1406
Surface
1404
Object
1402


FIG. 16


Device
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Display
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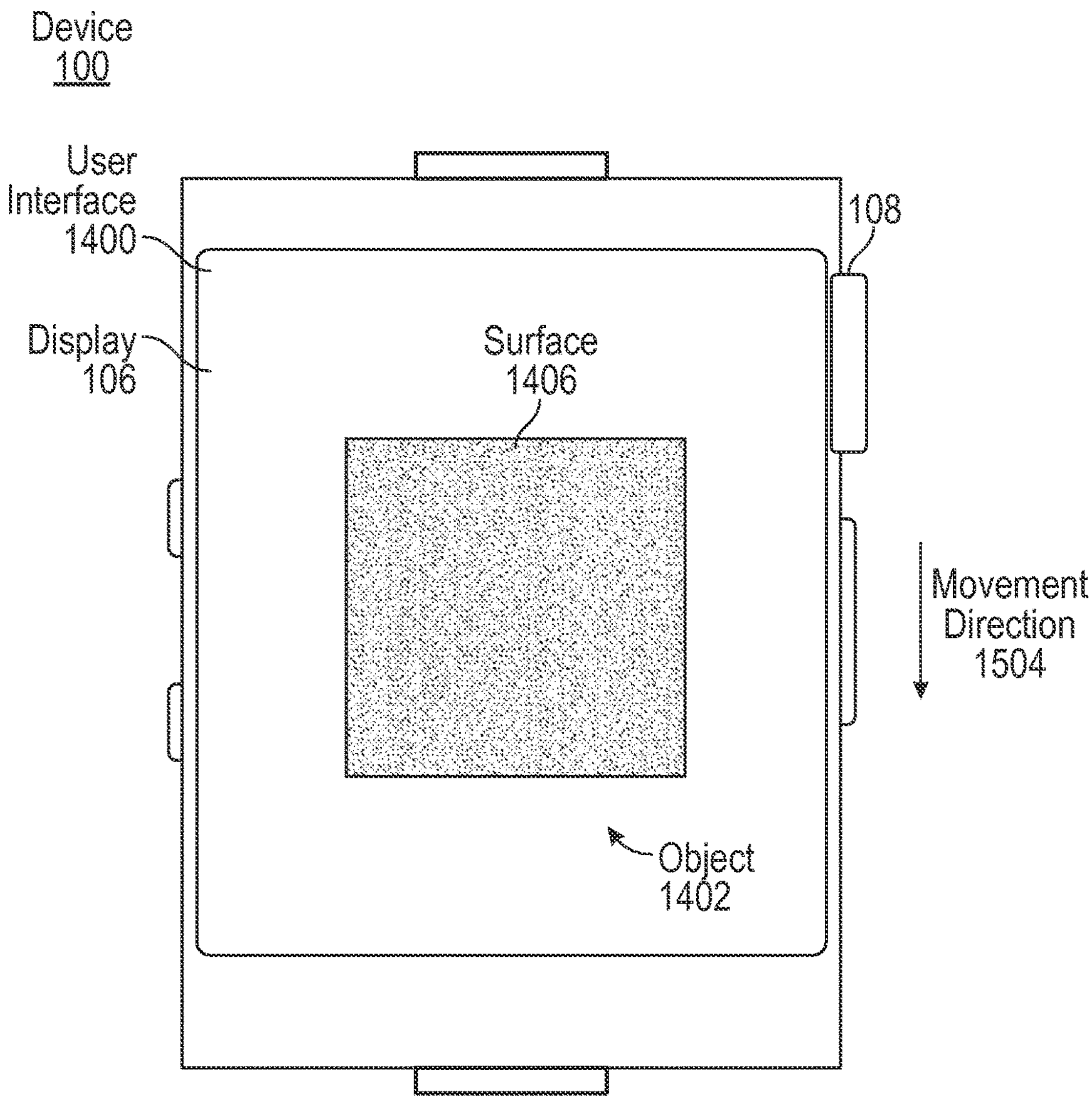
108
Surface
1406
Movement
Direction
1504
Surface
1404
Object
1402

FIG. 17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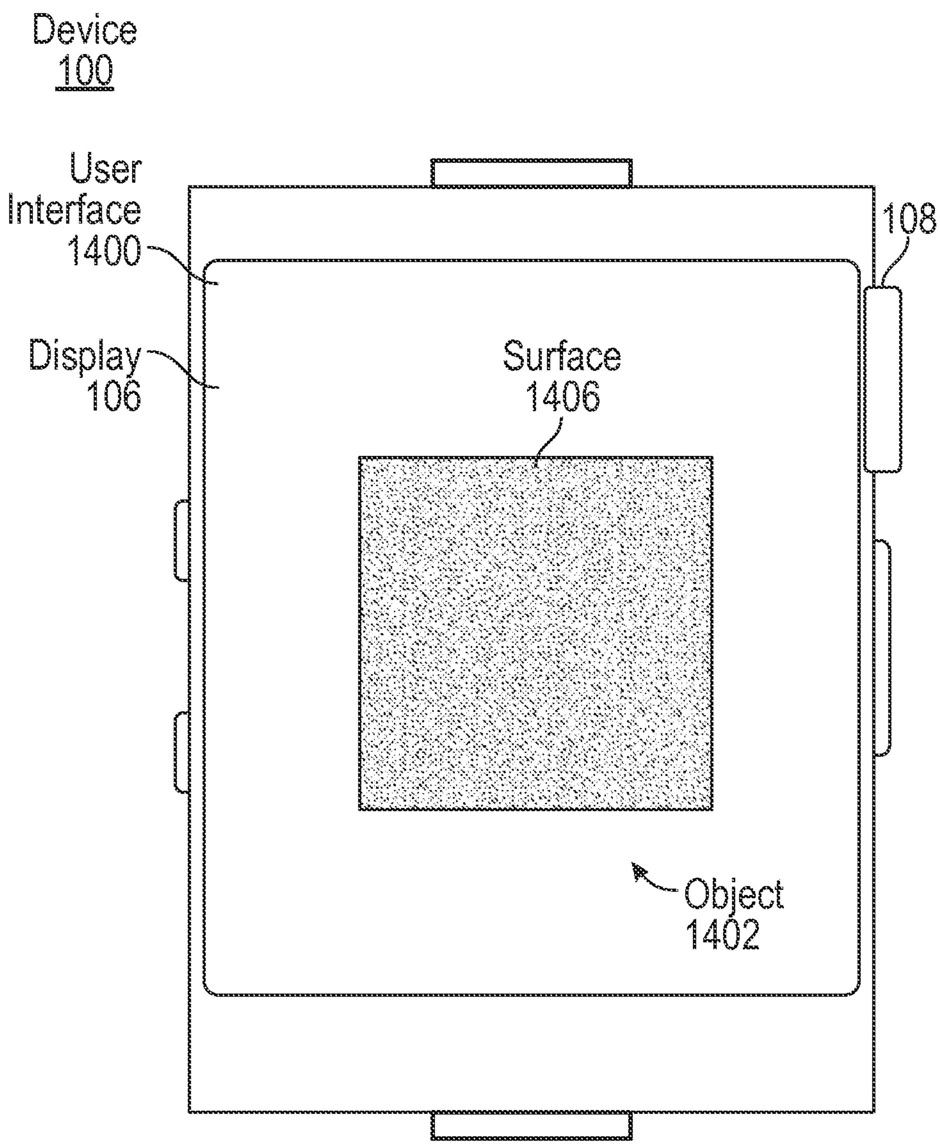
1406
Movement
Direction
1504
Object
1402

FIG. 18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1400
Display
106
108
Surface
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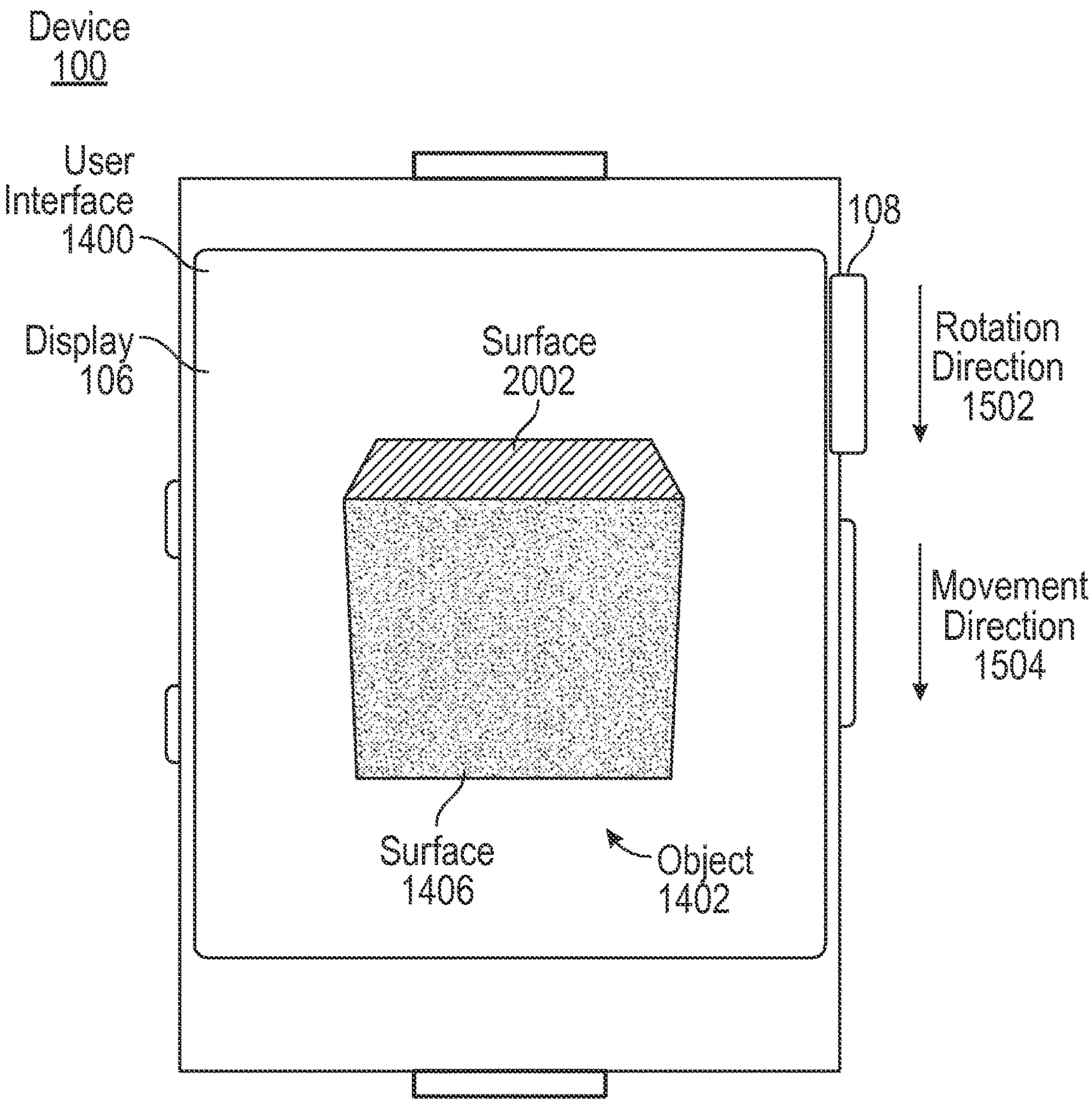
Object
1402

FIG. 19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Surface
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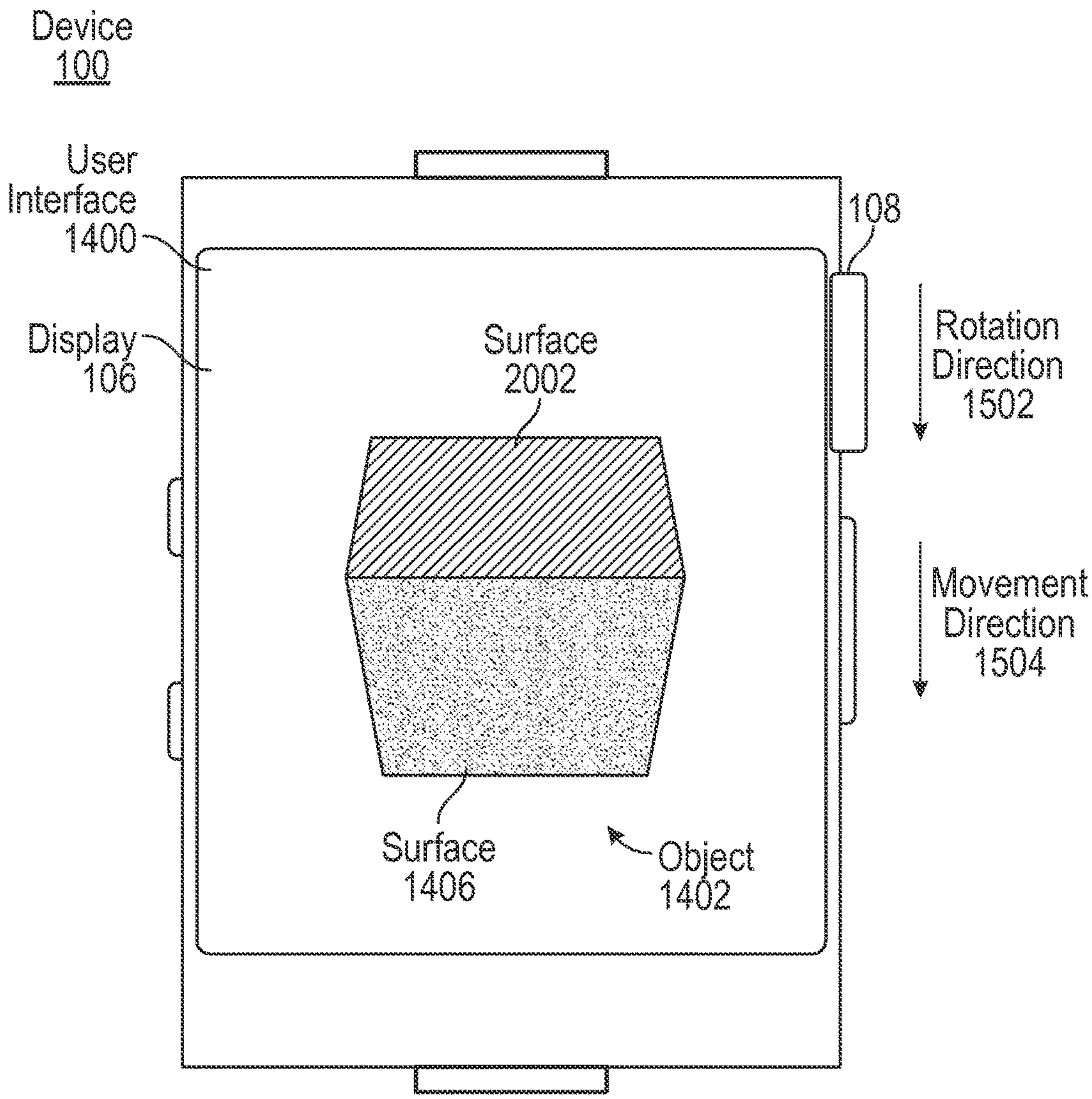
Object
1402

FIG. 20


Device
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Interface
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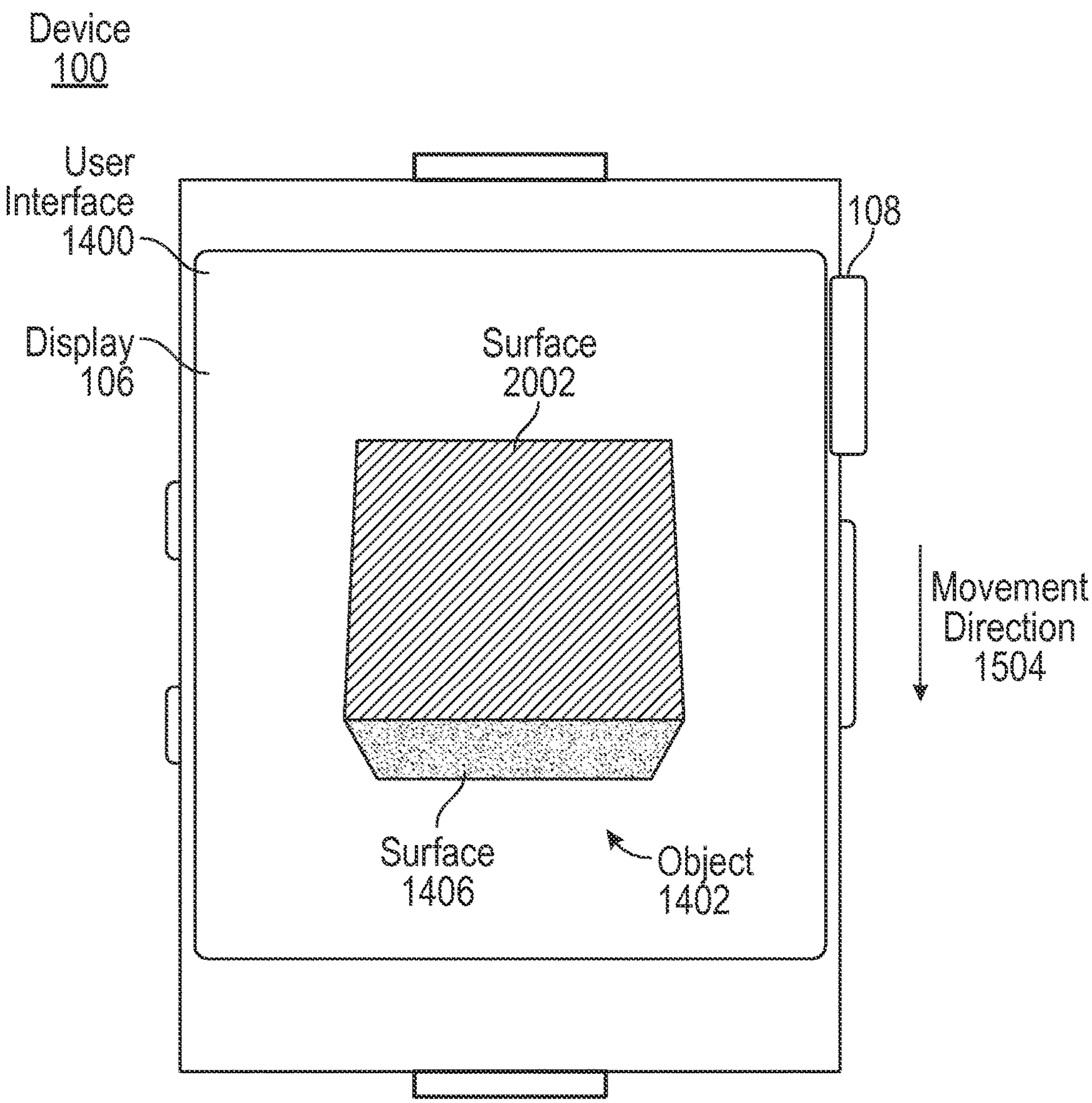
Rotation
Direction
1502
Movement
Direction
1504
Surface
2002
Surface
1406
Object
1402

FIG. 21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Display
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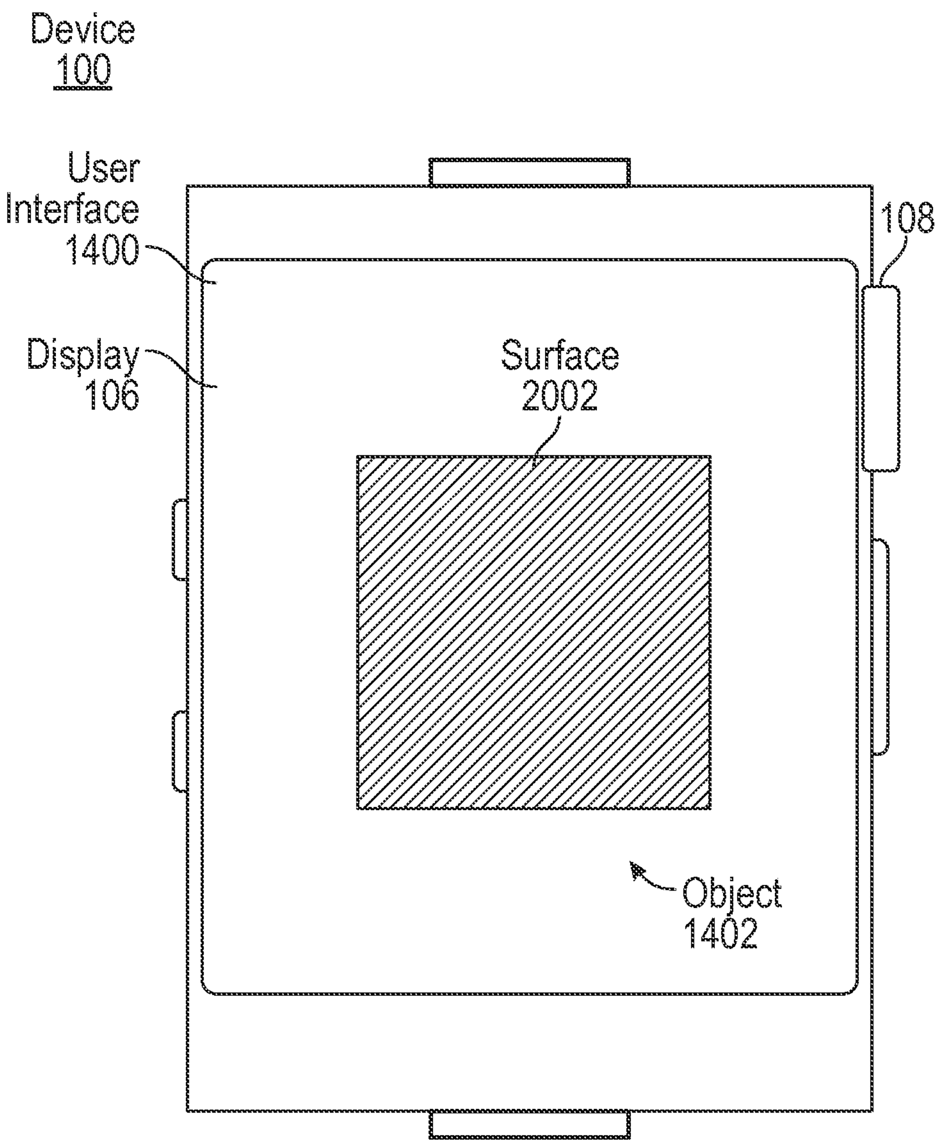
108
Surface
2002
Movement
Direction
1504
Surface
1406
Object
1402

FIG. 22



Device
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Interface
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Display
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Surface
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Object
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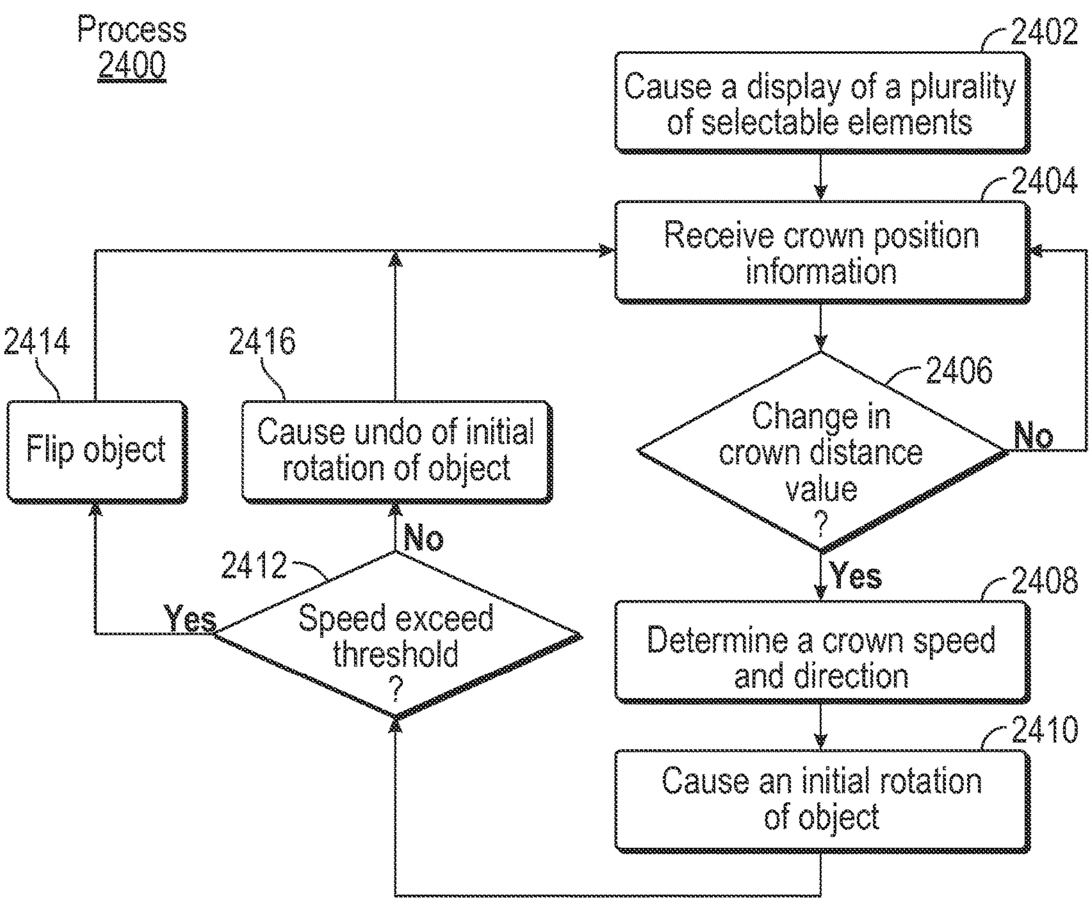
FIG. 23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Cause a display of a plurality of selectable elements
2404
Receive crown position information
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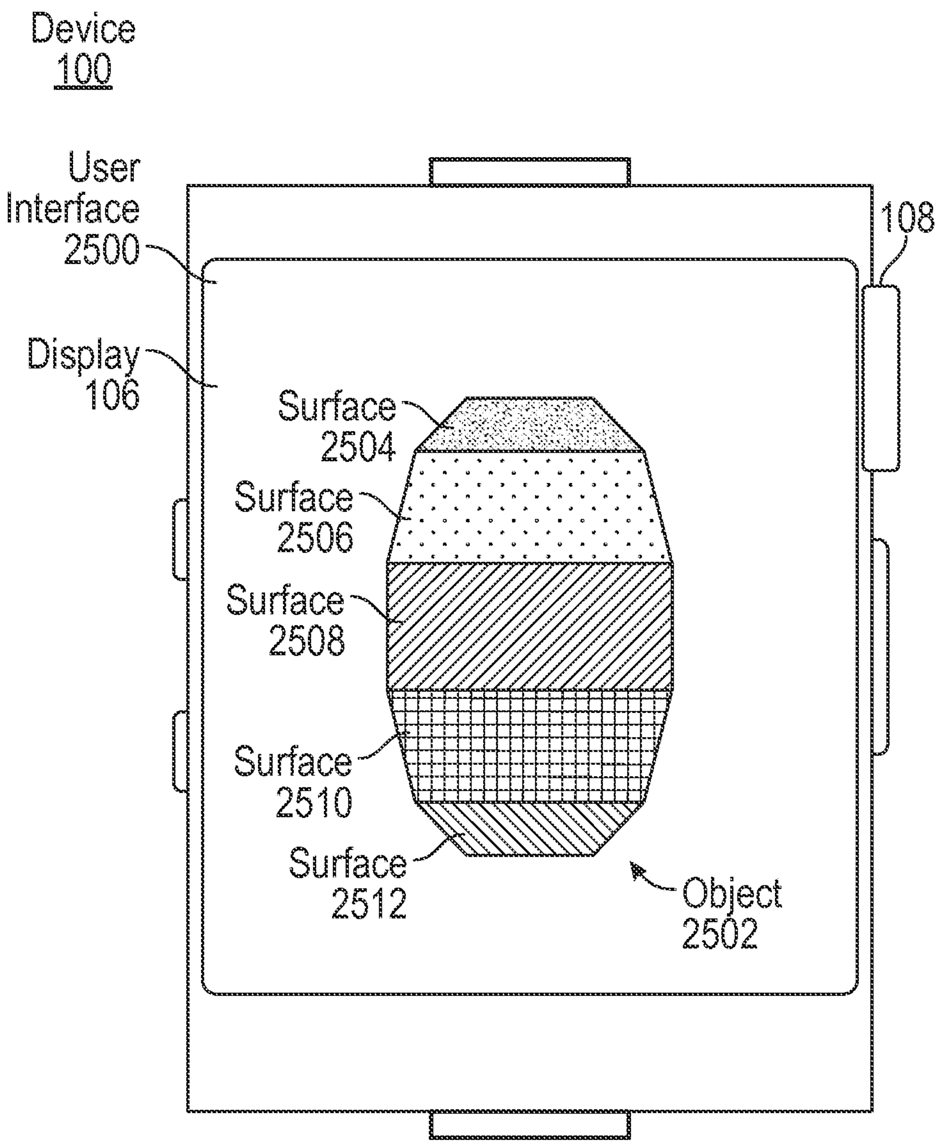
Change in crown distance value ?
No
Yes
2408
Determine a crown speed and direction
2410
Cause an initial rotation of object
2412
Speed exceed threshold ?
Yes
No
2414
Flip object
2416
Cause undo of initial rotation of object

FIG. 24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User Interface 2500
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108
Surface 2504
Surface 2506
Surface 2508
Surface 2510
Surface 2512
Object 2502

FIG. 25

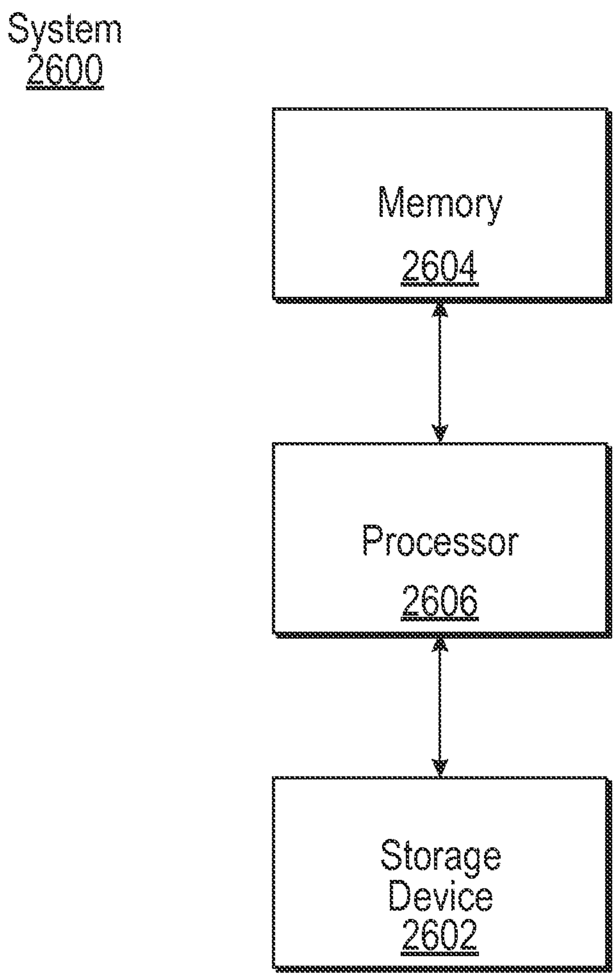
System
2600
Memory
2604
Processor
2606
Storage
Device
2602

FIG. 26

# USER INTERFACE OBJECT MANIPULATIONS IN A USER INTERFACE

## CROSS REFERENCE TO RELATED APPLICATIONS

This application is a national stage application of International Application No. PCT/US2014/053958, filed Sep. 3, 2014, entitled "USER INTERFACE OBJECT MANIPULATIONS IN A USER INTERFACE," which claims priority to: U.S. Provisional Patent Application Ser. No. 61/873,356, filed Sep. 3, 2013, entitled "CROWN INPUT FOR A WEARABLE ELECTRONIC DEVICE"; U.S. Provisional Patent Application Ser. No. 61/873,359, filed Sep. 3, 2013, entitled "USER INTERFACE OBJECT MANIPULATIONS IN A USER INTERFACE"; U.S. Provisional Patent Application Ser. No. 61/959,851, filed Sep. 3, 2013, entitled "USER INTERFACE FOR MANIPULATING USER INTERFACE OBJECTS"; and U.S. Provisional Patent Application Ser. No. 61/873,360, filed Sep. 3, 2013, entitled "USER INTERFACE FOR MANIPULATING USER INTERFACE OBJECTS WITH MAGNETIC PROPERTIES". International Application No. PCT/US2014/053958, filed Sep. 3, 2014, entitled "USER INTERFACE OBJECT MANIPULATIONS IN A USER INTERFACE," is also a continuation-in-part of U.S. Non-provisional patent application Ser. No. 14/476,657, filed Sep. 3, 2014, entitled "USER INTERFACE FOR MANIPULATING USER INTERFACE OBJECTS WITH MAGNETIC PROPERTIES". The content of these applications is hereby incorporated by reference in its entirety for all purposes.

This application is related to International Patent Application Serial Number PCT/US2014/053961, filed Sep. 3, 2014, entitled "USER INTERFACE FOR MANIPULATING USER INTERFACE OBJECTS WITH MAGNETIC PROPERTIES"; International Patent Application Serial Number PCT/US2014/053957, filed Sep. 3, 2014, entitled "USER INTERFACE FOR MANIPULATING USER INTERFACE OBJECTS"; and International Patent Application Serial Number PCT/US2014/053951, filed Sep. 3, 2014, entitled "CROWN INPUT FOR A WEARABLE ELECTRONIC DEVICE". The content of these applications is hereby incorporated by reference in its entirety for all purposes.

## FIELD

This disclosure relates generally to user interfaces and, more specifically, to user interfaces using a crown input mechanism.

## BACKGROUND

Advanced personal electronic devices can have small form factors. These personal electronic devices include, but are not limited to, tablets and smart phones. Use of such personal electronic devices involves manipulation of user interface objects on display screens which also have small form factors that complement the design of the personal electronic devices.

Exemplary manipulations that users can perform on personal electronic devices include navigating a hierarchy, selecting a user interface object, adjusting the position, size, and zoom of user interface objects, or otherwise manipulating user interfaces. Exemplary user interface objects include digital images, video, text, icons, maps, control elements such as buttons, and other graphics. A user can perform such



manipulations in image management software, video editing software, word pressing software, software execution platforms such as an operating system's desktop, website browsing software, and other environments.

Existing methods for manipulating user interface objects on reduced-size touch-sensitive displays can be inefficient. Further, existing methods generally provide less precision than is preferable.

## SUMMARY

Systems and processes for manipulating a graphical user interface are disclosed. One process can include receiving user input through a crown to rotate a virtual object. The process includes selecting a surface of the object from among the multiple surfaces of the object in response to determining that the crown rotation exceeded a speed threshold.

## BRIEF DESCRIPTION OF THE DRAWINGS

The present application can be best understood by reference to the following description taken in conjunction with the accompanying drawing figures, in which like parts may be referred to by like numerals.

FIG. **1** illustrates an exemplary wearable electronic device according to various examples.

FIG. **2** illustrates a block diagram of an exemplary wearable electronic device according to various examples.

FIGS. **3-12** illustrate an exemplary graphical user interface showing the selection of a surface of a two-sided object in response to a rotation of a crown.

FIG. **13** illustrates an exemplary process for selecting a surface of a two-sided object in response to a rotation of a crown.

FIGS. **14-23** illustrate an exemplary graphical user interface showing the selection of a surface of an object in response to a rotation of a crown.

FIG. **24** illustrates an exemplary process for selecting a surface of an object in response to a rotation of a crown.

FIG. **25** illustrates an exemplary multi-sided object in a graphical user interface.

FIG. **26** illustrates an exemplary computing system for manipulating a user interface in response to a rotation of a crown according to various examples.

## DETAILED DESCRIPTION

In the following description of the disclosure and examples, reference is made to the accompanying drawings in which it is shown by way of illustration specific examples that can be practiced. It is to be understood that other examples can be practiced and structural changes can be made without departing from the scope of the disclosure.

Many personal electronic devices have graphical user interfaces with options that can be activated in response to user inputs. Typically, a user can select and activate a particular option from among multiple options. For example, a user may select an option by placing a mouse cursor over the desired option using a pointing device. The user may activate the option by clicking a button of the pointing device while the option is selected. In another example, a user may select and activate an option displayed on a touch-sensitive display (also known as a touch screen) by touching the touch-sensitive display at the location of the displayed option. Given the inefficiency of existing methods for selecting options on reduced-size touch-sensitive displays, there is a need for methods that enable users to more efficiently and conveniently select a desired option in a graphical user interface environment.

The examples below describe improved techniques for selecting a surface of a user interface object in a graphical user interface using user inputs. More specifically, these techniques use a physical crown as an input device to enable a user to select a desired option by selecting a surface of the user interface object. As a result, the examples described below allow a user to more efficiently and conveniently select a desired option.

FIG. **1** illustrates exemplary personal electronic device **100**. In the illustrated example, device **100** is a watch that generally includes body **102** and strap **104** for affixing device **100** to the body of a user. That is, device **100** is wearable. Body **102** can designed to couple with straps **104**. Device **100** can have touch-sensitive display screen (hereafter touchscreen) **106** and crown **108**. Device **100** can also have buttons **110**, **112**, and **114**.

Conventionally, the term 'crown,' in the context of a watch, refers to the cap atop a stem for winding the watch. In the context of a personal electronic device, the crown can be a physical component of the electronic device, rather than a virtual crown on a touch sensitive display. Crown **108** can be mechanical meaning that it can be connected to a sensor for converting physical movement of the crown into electrical signals. Crown **108** can rotate in two directions of rotation (e.g., forward and backward). Crown **108** can also be pushed in towards the body of device **100** and/or be pulled away from device **100**. Crown **108** can be touch-sensitive, for example, using capacitive touch technologies that can detect whether a user is touching the crown. Moreover, crown **108** can further be rocked in one or more directions or translated along a track along an edge or at least partially around a perimeter of body **102**. In some examples, more than one crown **108** can be used. The visual appearance of crown **108** can, but need not, resemble crowns of conventional watches. Buttons **110**, **112**, and **114**, if included, can each be a physical or a touch-sensitive button. That is, the buttons may be, for example, physical buttons or capacitive buttons. Further, body **102**, which can include a bezel, may have predetermined regions on the bezel that act as buttons.

Display **106** can include a display device, such as a liquid crystal display (LCD), light-emitting diode (LED) display, organic light-emitting diode (OLED) display, or the like, positioned partially or fully behind or in front of a touch sensor panel implemented using any desired touch sensing technology, such as mutual-capacitance touch sensing, self-capacitance touch sensing, resistive touch sensing, projection scan touch sensing, or the like. Display **106** can allow a user to perform various functions by touching over hovering near the touch sensor panel using one or more fingers or other object.

In some examples, device **100** can further include one or more pressure sensors (not shown) for detecting a force or pressure applied to the display. The force or pressure applied to display **106** can be used as an input to device **100** to perform any desired operation, such as making a selection, entering or exiting a menu, causing the display of additional options/actions, or the like. In some examples, different operations can be performed based on the amount of force or pressure being applied to display **106**. The one or more pressure sensors can further be used to determine a position that the force is being applied to display **106**.

FIG. **2** illustrates a block diagram of some of the components of device **100**. As shown, crown **108** can be coupled to encoder **204**, which can be configured to monitor a physical state or change of state of crown **108** (e.g., the position of the crown), convert it to an electrical signal (e.g., convert it to an analog or digital signal representation of the position or change in position of crown **108**), and provide the signal to processor **202**. For instance, in some examples, encoder **204** can be configured to sense the absolute rotational position (e.g., an angle between 0-360°) of crown **108** and output an analog or digital representation of this position to processor **202**. Alternatively, in other examples, encoder **204** can be configured to sense a change in rotational position (e.g., a change in rotational angle) of crown **108** over some sampling period and to output an analog or digital representation of the sensed change to processor **202**. In these examples, the crown position information can further indicate a direction of rotation of the crown (e.g., a positive value can correspond to one direction and a negative value can correspond to the other). In yet other examples, encoder **204** can be configured to detect a rotation of crown **108** in any desired manner (e.g., velocity, acceleration, or the like) and can provide the crown rotational information to processor **202**. In alternative examples, instead of providing information to processor **202**, this information can be provided to other components of device **100**. While the examples described herein refer to the use of rotational position of crown **108** to control scrolling, scaling, or an objects position, it should be appreciated that any other physical state of crown **108** can be used.

In some examples, the physical state of the crown can control physical attributes of display **106**. For example, if crown **108** is in a particular position (e.g., rotated forward), display **106** can have limited z-axis traversal ability. In other words, the physical state of the crown can represent physical modal functionality of display **106**. In some examples, a temporal attribute of the physical state of crown **108** can be used as an input to device **100**. For example, a fast change in physical state can be interpreted differently than a slow change in physical state.

Processor **202** can be further coupled to receive input signals from buttons **110**, **112**, and **114**, along with touch signals from touch-sensitive display **106**. The buttons may be, for example, physical buttons or capacitive buttons. Further, body **102**, which can include a bezel, may have predetermined regions on the bezel that act as buttons. Processor **202** can be configured to interpret these input signals and output appropriate display signals to cause an image to be produced by touch-sensitive display **106**. While a single processor **202** is shown, it should be appreciated that any number of processors or other computational devices can be used to perform the general functions discussed above.

FIGS. **3-12** illustrate an exemplary user interface **300** displaying a two-sided user interface object **302**. Object **302** has a first surface **304** and a second surface **306**. Each surface of object **302** is a selectable surface associated with corresponding data. The data may be, for example, text, an image, an application icon, an instruction, a binary ON or OFF option, and the like. A user can select a surface from among the multiple selectable surfaces of object **302** by using a physical crown of a wearable electronic device to rotate object **302** to align the desired selection surface such that the surface is parallel to the display **106** of the device **100** and is displayed on the display **106**. The system is designed to transition between one surface to another, rather than stopping in between surfaces. Although examples are described with respect to object surfaces (or planes) being parallel to display **106**, the examples can also be modified to instead be described with respect to object surfaces (or planes) facing the viewer of display **106**. This modification may be particularly helpful when object surfaces or display **106** is not plane surface.

Crown **108** of device **100** is a user rotatable user interface input. The crown **108** can be turned in two distinct directions: clockwise and counterclockwise. FIGS. **3-12** include rotation direction arrows illustrating the direction of crown rotation and movement direction arrows illustrating the direction of rotation of a user interface object, where applicable. The rotation direction arrows and movement direction arrows are typically not part of the displayed user interface, but are provided to aid in the interpretation of the figures. In this example, a clockwise direction rotation of crown **108** is illustrated by a rotation direction arrow pointing in the up direction. Similarly, a counterclockwise direction rotation of crown **108** is illustrated by a rotation direction arrow pointing in the down direction. The characteristics of the rotation direction arrow are not indicative of the distance, speed, or acceleration with which crown **108** is rotated by a user. Instead, the rotation direction arrow is indicative of the direction of rotation of crown **108** by the user.

At FIG. **3**, first surface **304** of object **302** is aligned parallel to display **106** and is displayed, indicating selection of first surface **304**. The selected first surface **304** can be activated through, for example, an additional user input. At FIG. **4**, device **100** determines a change in the position of crown **108** in the clockwise direction, as indicated by rotation direction arrow **308**. Device **100** determines a rotational speed and a direction based on the determined change in the position of crown **108**. In response to determining the change in the position of crown **108**, the device rotates object **302**, as indicated by movement direction arrow **310** and illustrated in FIG. **4**. The rotation of object **302** is based on the determined rotational speed and direction. Rotational speed may be expressed in numerous ways. For example, rotational speed may be expressed as hertz, as rotations per unit of time, as rotations per frame, as revolutions per unit of time, as revolutions per frame, as a change in angle per unit of time, and the like. In one example, object **302** may be associated with a mass or may have a calculated rotational inertia.

At FIGS. **5-7**, device **100** continues to determine a change in the position of crown **108** in the clockwise direction, as indicated by rotation direction arrow **308**. Device **100** determines a rotational speed and a direction based on the determined change in the position of crown **108**. In response to determining the change in the position of crown **108**, the device continues to rotate object **302**, as indicated by movement direction arrow **310** and illustrated in FIG. **5-6**. The rotation of object **302** is based on the determined rotational speed and direction.

In one example, the degrees of rotation of object **302**, as measured from the object's position while parallel to display **106**, is based on the determined speed. For easier visualization, object **302** can be thought of as having some similar qualities as an analog tachometer. As the determined speed increases, the degree of rotation of object **302** increases. In this example, if the rotation of crown **108** is maintained at a constant speed, object **302** will stay at a static rotated position that is not parallel to display **106**. If the speed of the rotation of crown **108** is increased, the determined speed will increase and object **302** will rotate an additional amount.

In some examples, object **302** is configured to become perpendicular to display **106** in response to the determined speed being at a speed threshold. When the determined speed exceeds the speed threshold, object **302** exceeds a total rotation of 90 degrees, causing first surface **304** of object **302** to no longer be displayed and instead causing second surface **306** of object **302** to be displayed. This transition between the display of first surface **304** and second surface **306** is illustrated as the transition between FIGS. **7** and **8**. Thus, as the determined speed exceeds the speed threshold the object **302** flips from one side to another side.



At FIGS. **9-12**, device **100** determines that there is no further change in the position of crown **108**. As a result of this determination, the rotation of object **302** is changed such that a surface of object **302** is parallel to display **106**. This change may be animated, as illustrated in FIGS. **9-12**. Device **100** will rotate object **302** such that the surface of object **302** partially facing display **106** when device **100** determines that there is no change in the position of crown **108** is the surface that will be displayed as being parallel to display **106**. When a surface of object **302** is parallel to display **106** and no change in the position of crown **108** is detected, object **302** is in a steady state. An object is in a steady state when the object is not being translated, rotated, or scaled.

In some examples, when object **302** is in a steady state, the displayed surface of object **302** that is parallel to display **106** can be activated with an additional input. The displayed surface that is parallel to display **106** in a steady state is determined to be selected even prior to activation. For example, object **302** may be used as an ON/OFF switch or toggle. First surface **304** is associated with an ON instruction and second surface **306** is associated with an OFF instruction. A user can transition between the ON and OFF states by rotating crown **108** at above a speed threshold, causing object **302** to flip and display a desired surface. The desired surface is determined to be selected when the desired surface is displayed on display **106**, is parallel to display **106**, and no change in the position of crown **108** is detected.

While a surface is selected, the user can activate the selected surface by one or more of many techniques. For example, the user may press on touch-sensitive display **106**, press on touch-sensitive display with a force greater than a predetermined threshold, press button **112**, or simply allow the surface to remain selected for a predetermined amount of time. In another example, when the displayed surface is parallel to display **106**, the action can be interpreted as both a selection and an activation of the data associated with the displayed surface.

FIG. **13** illustrates an exemplary process for selecting a surface of a two-sided graphical user interface object in response to a rotation of a crown. Process **1300** is performed at a wearable electronic device (e.g., device **100** in FIG. **1**) having a physical crown. In some examples, the electronic device also includes a touch-sensitive display. The process provides an efficient technique for selecting a surface of a two-sided, two-dimensional object.

At block **1302**, the device causes a display of a two-sided object on a touch-sensitive display of a wearable electronic device. In some examples, the object is two-dimensional. In other examples, the object is three dimensional but only two surfaces are selectable. Each selectable surface of the object is associated with a corresponding data value. The data may be, for example, text, an image, an application icon, an instruction, a binary ON or OFF option, and the like.

At block **1304**, the device receives crown position information. The crown position information may be received as a series of pulse signals, real values, integer values, and the like.

At block **1306**, the device determines whether a change has occurred in a crown distance value. The crown distance value is based on an angular displacement of the physical crown of the wearable electronic device. A change in the crown distance value is indicative of a user providing input to the wearable electronic device by, for example, turning the physical crown. If the device determines that a change in the crown distance value has not occurred, the system returns to block **1304** and continues receiving crown position information. If the device determines that a change in the crown distance value has occurred, the system continues to block **1308**, though the system may continue to receive crown position information.

At block **1308**, the device determines a direction and a crown speed. The crown speed is based on the speed of rotation of the physical crown of the wearable electronic device. For example, the determined crown speed may be expressed as hertz, as rotations per unit of time, as rotations per frame, as revolutions per unit of time, as revolutions per frame, and the like. The determined direction is based on a direction of rotation of the physical crown of the wearable electronic device. For example, an up direction can be determined based on a clockwise rotation of the physical crown. Similarly, a down direction can be determined based on a counterclockwise rotation of the physical crown. In other examples, a down direction can be determined based on a clockwise rotation of the physical crown and an up direction can be determined based on a counterclockwise rotation of the physical crown.

At block **1310**, in response to determining the change in the crown distance value, the device causes an initial rotation of the two-sided object on the display. The amount of the rotation is based on the determined crown speed. The direction of rotation is based on the determined direction. The rotation may be animated.

At block **1312**, the device determines whether the determined crown speed exceeds a speed threshold. If the device determines that the determined crown speed exceeds the speed threshold, the device continues to block **1314**. For example, the speed threshold may be thought of as an escape velocity (or escape speed). An escape velocity is the speed at which the kinetic energy plus the gravitational potential energy of an object is zero. If the device determines that the determined crown speed does not exceed the speed threshold, the device transitions to block **1316**.

In some examples, the minimum angular velocity of crown rotation that is necessary to reach escape velocity corresponds directly to the instantaneous angular velocity of crown **108** (FIG. **1**), meaning that the user interface of device **100**, in essence, responds when crown **108** reaches a sufficient angular velocity. In some embodiments, the minimum angular velocity of crown rotation necessary for reaching the escape velocity is a calculated velocity that is based on, but not directly equal to, the instantaneous ("current") angular velocity of crown **108**. In these examples, device **100** can maintain a calculated crown (angular) velocity V in discrete moments in time T according to equation 1:

$$V_T = V_{(T-1)} + \Delta V_{CROWN} - \Delta V_{DRAG}. \quad \text{(EQ. 1)}$$

In equation 1, $V_T$ represents a calculated crown velocity (speed and direction) at time T, $V_{(T-1)}$ represents the previous velocity (speed and direction) at time T−1, $\Delta V_{CROWN}$ represents the change in velocity caused by the force being applied through the rotation of the crown at time T, and $\Delta V_{DRAG}$ represents the change in velocity due to a drag force. The force being applied, which is reflected through $\Delta V_{CROWN}$, can depend on the current velocity of angular rotation of the crown. Thus, $\Delta V_{CROWN}$ can also depend on the current angular velocity of the crown. In this way, device **100** can provide user interface interactions based not only on instantaneous crown velocity but also based on user input in the form of crown movement over multiple time intervals, even if those intervals are finely divided. Note, typically, in the absence of user input in the form of $\Delta V_{CROWN}$, $V_T$ will approach (and become) zero based on $\Delta V_{DRAG}$ in accordance with EQ. 1, but $V_T$ would not change signs without user input in the form of crown rotation ($\Delta V_{CROWN}$).

Typically, the greater the velocity of angular rotation of the crown, the greater the value of $\Delta V_{CROWN}$ will be. However, the actual mapping between the velocity of angular rotation of the crown and $\Delta V_{CROWN}$ can be varied depending on the desired user interface effect. For example, various linear or non-linear mappings between the velocity of angular rotation of the crown and $\Delta V_{CROWN}$ can be used.

Also, $\Delta V_{DRAG}$ can take on various values. For example, $\Delta V_{DRAG}$ can depend on the velocity of crown rotation such that at greater velocities, a greater opposing change in velocity ($\Delta V_{DRAG}$) can be produced. In another example, $\Delta V_{DRAG}$ can have a constant value. It should be appreciated that the above-described requirements of $\Delta V_{CROWN}$ and $\Delta V_{DRAG}$ can be changed to produce desirable user interface effects.

As can be seen from EQ. 1, the maintained velocity ($V_T$) can continue to increase as long as $\Delta V_{CROWN}$ is greater than $\Delta V_{DRAG}$. Additionally, $V_T$ can have non-zero values even when no $\Delta V_{CROWN}$ input is being received, meaning that user interface objects can continue to change without the user rotating the crown. When this occurs, objects can stop changing based on the maintained velocity at the time the user stops rotating the crown and the $\Delta V_{DRAG}$ component.

In some examples, when the crown is rotated in a direction corresponding to a rotation direction that is opposite the current user interface changes, the $V_{(T-1)}$ component can be reset to a value of zero, allowing the user to quickly change the direction of the object without having to provide a force sufficient to offset the $V_T$.

At block **1314**, the device causes the object to flip past a transition position between a first surface that was last selected and a second surface. For example, the object has flipped past the transition position when the object will not return to having the first surface displayed parallel to the display without receiving additional user input. In the example of a two-sided object, the transition position may be when the surface is perpendicular to the display.

Once the object reaches a steady state, the displayed surface that is parallel to the display can be activated by a designated user input. The displayed surface that is parallel to the display in a steady state is determined to be selected even prior to activation. An object is in a steady state when the object is not being translated, rotated, or scaled. This may result in the first surface of the object no longer being displayed, in the case of a cube-shaped object.

At block **1316**, because the escape velocity has not been reached, the device causes the object to at least partially return to the object's initial position at the time of block **1302**. For example, part of the initial rotation of the object caused at block **2410** can be negated. To achieve this, the device animates a rotation of the object that is in an opposite direction of the initial rotation at block **1310**.

FIGS. **14-23** illustrate an exemplary graphical user interface showing the selection of a surface of a cube object in response to a rotation of a crown. Object **1402** is a cube with six surfaces. In this example, four of the six surfaces are selectable. These four selectable surfaces include surface

1404 of object 1402, which is facing a viewer of display 106, the top surface of object 1402, the bottom surface of object 1402, and the back surface of object 1402. In this example, the left and right surfaces of object 1402 are not selectable. However, the left and right surfaces of object 1402 may be selectable in other examples. Although examples are described with respect to object surfaces (or planes) being parallel to display 106, the examples can also be modified to instead be described with respect to object surfaces (or planes) facing the viewer of display 106. This modification may be particularly helpful when object surfaces or display 106 is not plane surface.

Each selectable surface of object 1402 is associated with corresponding data. The data may be, for example, text, an image, an application icon, an instruction, a quad-state setting (such as Off/Low/Medium/High), and the like. A user can select a surface from among the multiple selectable surfaces of the object 1402 by using a physical crown of a wearable electronic device to rotate object 1402 to align the desired selection surface such that it is parallel to the display 106 and displayed on display 106.

Crown 108 of device 100 is a user rotatable user interface input. The crown 108 can be turned in two distinct directions: clockwise and counterclockwise. FIGS. 14-23 include rotation direction arrows illustrating the direction of crown rotation and movement direction arrows illustrating the direction of rotation of a user interface object, where applicable. The rotation direction arrows and movement direction arrows are typically not part of the displayed user interface, but are provided to aid in the interpretation of the figures. In this example, a clockwise direction rotation of crown 108 is illustrated by a rotation direction arrow pointing in the up direction. Similarly, a counterclockwise direction rotation of crown 108 is illustrated by a rotation direction arrow pointing in the down direction. The characteristics of the rotation direction arrow are not indicative of the distance, speed, or acceleration with which crown 108 is rotated by a user. Instead, the rotation direction arrow is indicative of the direction of rotation of crown 108 by the user.

At FIG. 14, first surface 1404 of object 1402 is aligned parallel to display 106 and is displayed, indicating selection of first surface 1404. At FIG. 15, device 100 determines a change in the position of crown 108 in the counterclockwise direction, as indicated by rotation direction arrow 1502. Device 100 determines a rotational speed and a direction based on the determined change in the position of crown 108. In response to determining the change in the position of crown 108, the device rotates object 1402, as indicated by movement direction arrow 1504 and illustrated in FIG. 15. The rotation of object 1402 is based on the determined rotational speed and direction. Rotational speed may be expressed in numerous ways. For example, rotational speed may be expressed as hertz, as rotations per unit of time, as rotations per frame, as revolutions per unit of time, as revolutions per frame, and the like. In one example, object 1402 may be associated with a mass or may have a calculated rotational inertia.

At FIG. 16, device 100 continues to determine a change in the position of crown 108 in the counterclockwise direction, as indicated by rotation direction arrow 1502. Device 100 determines a rotational speed and a direction based on the determined change in the position of crown 108. In response to determining the change in the position of crown 108, the device continues to rotate object 1402, as indicated by movement direction arrow 1504 and illustrated in FIG. 16. The rotation of object 1402 is based on the determined rotational speed and direction.

In one example, the degrees of rotation of object 1402 is based on the determined speed. As the determined speed increases, the degree of rotation of object 1402 increases. In this example, if the rotation of crown 108 is maintained at a constant speed, object 1402 will stay at a static rotated position where no surface of object 1402 is parallel to display 106. If the speed of the rotation of crown 108 is increased, the determined speed will increase and object 1402 will rotate an additional amount.

In some examples, object 1402 is configured to rotate to have a surface parallel to display 106 in response to the determined speed being above a speed threshold. When the determined speed exceeds the speed threshold, object 1402 exceeds a rotation of 45 degrees, causing first surface 1404 of object 1402 to rotate away from the display to no longer be displayed and instead causing second surface 1406 of object 1402 to rotate toward the display to be displayed. This transition between the display of first surface 1404 and second surface 1406 is illustrated as the transition between FIGS. 16 and 17. Thus, as the determined speed exceeds the speed threshold, the object 1402 flips from one surface to another surface.

At FIGS. 17-18, device 100 determines that there is no change in the position of crown 108. As a result of this determination, object 1402 is rotated such that a displayed surface of object 1402 is parallel to display 106. This rotation may be animated, as illustrated in FIGS. 17-18. Device 100 will rotate object 1402 such that the displayed surface of object 1402 that has the smallest angle with respect to the display is made parallel to the display 106. In other words, the object's surface that best faces the display 106 or is closest to parallel to display 106 is made parallel to the display 106. When a surface of object 1402 is parallel to display 106 and no change in the position of crown 108 is detected, object 1402 is in a steady state. An object is in a steady state when the object is not being translated, rotated, or scaled.

In some examples, when object 1402 is in a steady state, the surface of object 1402 that is parallel to display 106 and displayed on display 106 is determined to be selected. For example, object 1402 may be used as four-phase selection switch. First surface 1404 is associated with a LOW setting instruction and second surface 1406 is associated with a MEDIUM instruction setting. The remaining two selectable surfaces are associated with HIGH and OFF instruction settings. A user can transition between the four settings by rotating crown 108 at above a speed threshold, causing object 1402 to flip and display a desired surface. The desired surface is determined to be selected when the displayed surface is parallel to display 106 and no change in the position of crown 108 is detected.

While a surface is selected, the user can activate the selected surface by one or more of many techniques. For example, the user may press on touch-sensitive display 106, press button 112, or simply allow the surface to remain selected for a predetermined amount of time. In another example, when the displayed surface is parallel to display 106, the action can be interpreted as both a selection and an activation of the data associated with the displayed surface.

FIGS. 20-23 illustrate a second flip of object 1402 to select third surface 2002 of object 1402. In FIGS. 21-22, device 100 determines a change in the position of crown 108 in the counterclockwise direction, as indicated by rotation direction arrow 1502. Device 100 determines a rotational speed and a direction based on the determined change in the position of crown 108. In response to determining the change in the position of crown 108, the device rotates object **1402**, as indicated by movement direction arrow **1504** and illustrated in FIG. **21**-**22**. The rotation of object **1402** is based on the determined rotational speed and direction.

In response to the rotational speed exceeding a threshold, object **1402** flips to cause third surface **2002** to be parallel to display **106** and to be displayed on display **106**, as illustrated in FIG. **23**. An object is in a steady state when the object is not being translated, rotated, or scaled. When object **1402** is in a steady state, the surface of object **1402** that is parallel to display **106** and displayed on display **106** is determined to be selected. In this example, third surface **2002** is selected.

FIG. **24** illustrates an exemplary process for selecting a surface of a multi-sided graphical user interface object in response to a rotation of a crown. Process **2400** is performed at a wearable electronic device (e.g., device **100** in FIG. **1**) having a physical crown. In some examples, the electronic device also includes a touch-sensitive display. The process provides an efficient technique for selecting a surface of a multi-sided, three-dimensional object.

At block **2402**, the device causes a display of a multi-sided object on a touch-sensitive display of a wearable electronic device. Each selectable surface of the object is associated with a corresponding data value. The data may be, for example, text, an image, an application icon, an instruction, and the like.

At block **2404**, the device receives crown position information. The crown position information may be received as a series of pulse signals, real values, integer values, and the like.

At block **2406**, the device determines whether a change has occurred in a crown distance value. The crown distance value is based on an angular displacement of the physical crown of the wearable electronic device. A change in the crown distance value is indicative of a user providing input to the wearable electronic device by, for example, turning the physical crown. If the device determines that a change in the crown distance value has not occurred, the system returns to block **2404** and continues receiving crown position information. If the device determines that a change in the crown distance value has occurred, the system continues to block **2408**, though the system may continue to receive crown position information.

At block **2408**, the device determines a direction and a crown speed. The crown speed is based on the speed of rotation of the physical crown of the wearable electronic device. For example, the determined crown speed may be expressed as hertz, as rotations per unit of time, as rotations per frame, as revolutions per unit of time, as revolutions per frame, and the like. The determined direction is based on a direction of rotation of the physical crown of the wearable electronic device. For example, an up direction can be determined based on a clockwise rotation of the physical crown. Similarly, a down direction can be determined based on a counterclockwise rotation of the physical crown. In other examples, a down direction can be determined based on a clockwise rotation of the physical crown and an up direction can be determined based on a counterclockwise rotation of the physical crown.

At block **2410**, in response to determining the change in the crown distance value, the device causes an initial rotation of the multi-sided object on the display. The amount of the rotation is based on the determined crown speed. The direction of rotation is based on the determined direction. The rotation may be animated.

At block **2412**, the device determines whether the determined crown speed exceeds a speed threshold. If the device determines that the determined crown speed exceeds the speed threshold, the device continues to block **2414**. For example, the speed threshold may be thought of as an escape velocity (or escape speed). An escape velocity is the speed at which the kinetic energy plus the gravitational potential energy of an object is zero. If the device determines that the determined speed does not exceed the speed threshold, the device continues to block **2416**.

In some examples, the minimum angular velocity of crown rotation that is necessary to reach escape velocity corresponds directly to the instantaneous angular velocity of crown **108** (FIG. **1**), meaning that the user interface of device **100**, in essence, responds when crown **108** reaches a sufficient angular velocity. In some embodiments, the minimum angular velocity of crown rotation necessary for reaching the escape velocity is a calculated velocity that is based on, but not directly equal to, the instantaneous ("current") angular velocity of crown **108**. In these examples, device **100** can maintain a calculated crown (angular) velocity V in discrete moments in time T according to equation 1:

$$V_T = V_{(T-1)} + \Delta V_{CROWN} - \Delta V_{DRAG}. \qquad \text{(EQ. 1)}$$

In equation 1, $V_T$ represents a calculated crown velocity (speed and direction) at time T, $V_{(T-1)}$ represents the previous velocity (speed and direction) at time T−1, $\Delta V_{CROWN}$ represents the change in velocity caused by the force being applied through the rotation of the crown at time T, and $\Delta V_{DRAG}$ represents the change in velocity due to a drag force. The force being applied, which is reflected through $\Delta V_{CROWN}$, can depend on the current velocity of angular rotation of the crown. Thus, $\Delta V_{CROWN}$ can also depend on the current angular velocity of the crown. In this way, device **100** can provide user interface interactions based not only on instantaneous crown velocity but also based on user input in the form of crown movement over multiple time intervals, even if those intervals are finely divided. Note, typically, in the absence of user input in the form of $\Delta V_{CROWN}$, $V_T$ will approach (and become) zero based on $\Delta V_{DRAG}$ in accordance with EQ. 1, but $V_T$ would not change signs without user input in the form of crown rotation ($\Delta V_{CROWN}$).

Typically, the greater the velocity of angular rotation of the crown, the greater the value of $\Delta V_{CROWN}$ will be. However, the actual mapping between the velocity of angular rotation of the crown and $\Delta V_{CROWN}$ can be varied depending on the desired user interface effect. For example, various linear or non-linear mappings between the velocity of angular rotation of the crown and $\Delta V_{CROWN}$ can be used.

Also, $\Delta V_{DRAG}$ can take on various values. For example, $\Delta V_{DRAG}$ can depend on the velocity of crown rotation such that at greater velocities, a greater opposing change in velocity ($\Delta V_{DRAG}$) can be produced. In another example, $\Delta V_{DRAG}$ can have a constant value. It should be appreciated that the above-described requirements of $\Delta V_{CROWN}$ and $\Delta V_{DRAG}$ can be changed to produce desirable user interface effects.

As can be seen from EQ. 1, the maintained velocity ($V_T$) can continue to increase as long as $\Delta V_{CROWN}$ is greater than $\Delta V_{DRAG}$. Additionally, $V_T$ can have non-zero values even when no $\Delta V_{CROWN}$ input is being received, meaning that user interface objects can continue to change without the user rotating the crown. When this occurs, objects can stop changing based on the maintained velocity at the time the user stops rotating the crown and the $\Delta V_{DRAG}$ component.

In some examples, when the crown is rotated in a direction corresponding to a rotation direction that is opposite the current user interface changes, the $V_{(T-1)}$ component can be reset to a value of zero, allowing the user to quickly change the direction of the object without having to provide a force sufficient to offset the $V_T$.

At block **2414**, the device causes the object to flip past a transition position between a first surface that was last selected and a new surface. For example, the object has flipped past the transition position when the object will not return to having the first surface displayed parallel to the display without receiving additional user input.

Once the object reaches a steady state, the displayed surface that is parallel to the display can be activated through a designated user input. The displayed surface parallel to the display in the steady state is determined to be selected even before activation. An object is in a steady state when the object is not being translated, rotated, or scaled. This may result in the first surface of the object no longer being displayed, in the case of a cube-shaped object.

At block **2416**, because the escape velocity has not been reached, the device causes the object to at least partially return to the object's initial position at the time of block **2408**. For example, part of the initial rotation of the object caused at block **2410** can be negated. To achieve this, the device animates a rotation of the object that is in an opposite direction of the initial rotation at block **2410**.

FIG. **25** illustrates a graphical user interface **2500** showing the selection of a surface **2506** of a multi-sided object in response to a rotation of a crown. Object **2502** is a 12-sided rotatable dial, shaped similar to a wheel. Object **2502** is rotatable along a fixed axis. In this example, all 12 surfaces of object **2502** are selectable. These 12 selectable surfaces include surface **2504**, surface **2506**, surface **2508**, surface **2510**, and surface **2512**. In FIG. **25**, surface **2508** is selected because surface **2508** is parallel to display **106** and is displayed on display **106**. The selectable surfaces of object **2505** can be selected according to the processes and techniques described in other examples.

In some examples, device **100** can provide haptic feedback based on the content displayed on the display **106**. When a user interface object is displayed on display **106**, the device can modify the appearance of the object based on a change in a crown distance value received at the device **100** based on a rotation of crown **108**. When a criterion is satisfied, a tactile output is output at the device **100**.

In one example, the object is a rotatable multi-sided object, such as is described above. The criterion is satisfied when a surface of the multi-sided object is selected. In another example, the criterion is satisfied each time a displayed surface of the multi-sided object passes through a plane parallel to the display.

One or more of the functions relating to a user interface can be performed by a system similar or identical to system **2600** shown in FIG. **26**. System **2600** can include instructions stored in a non-transitory computer readable storage medium, such as memory **2604** or storage device **2602**, and executed by processor **2606**. The instructions can also be stored and/or transported within any non-transitory computer readable storage medium for use by or in connection with an instruction execution system, apparatus, or device, such as a computer-based system, processor-containing system, or other system that can fetch the instructions from the instruction execution system, apparatus, or device and execute the instructions. In the context of this document, a "non-transitory computer readable storage medium" can be any medium that can contain or store the program for use by or in connection with the instruction execution system, apparatus, or device. The non-transitory computer readable storage medium can include, but is not limited to, an electronic, magnetic, optical, electromagnetic, infrared, or semiconductor system, apparatus or device, a portable computer diskette (magnetic), a random access memory (RAM), a read-only memory (ROM), an erasable programmable read-only memory (EPROM) (magnetic), a portable optical disc such a CD, CD-R, CD-RW, DVD, DVD-R, or DVD-RW, or flash memory such as compact flash cards, secured digital cards, USB memory devices, memory sticks, and the like.

The instructions can also be propagated within any transport medium for use by or in connection with an instruction execution system, apparatus, or device, such as a computer-based system, processor-containing system, or other system that can fetch the instructions from the instruction execution system, apparatus, or device and execute the instructions. In the context of this document, a "transport medium" can be any medium that can communicate, propagate or transport the program for use by or in connection with the instruction execution system, apparatus, or device. The transport medium can include, but is not limited to, an electronic, magnetic, optical, electromagnetic or infrared wired or wireless propagation medium.

In some examples, system **2600** can be included within device **100**. In these examples, processor **2606** can be the same or a different process than processor **202**. Processor **2606** can be configured to receive the output from encoder **204**, buttons **110**, **112**, and **114**, and from touch-sensitive display **106**. Processor **2606** can process these inputs as described above with respect to the processes described and illustrated. It is to be understood that the system is not limited to the components and configuration of FIG. **26**, but can include other or additional components in multiple configurations according to various examples.

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

What is claimed is:

**1**. A computer-implemented method comprising:

displaying a first surface of a plurality of selectable surfaces of a virtual object on a touch-sensitive display of a wearable electronic device, the first surface associated with a first data;

detecting rotation of a physical crown of the wearable electronic device;

determining a speed, wherein the speed is based on an angular velocity of the physical crown during the detected rotation of the wearable electronic device;

in response to detecting rotation of the physical crown, displaying, on the display, an animation of rotating the virtual object about an axis parallel to the display in a first direction; and

after rotating the virtual object about the axis parallel to the display in the first direction:

in response to the speed being determined to exceed a speed threshold, displaying, on the display, an animation of continuing to rotate the virtual object rotating about an axis parallel to the display in the first direction to display a second surface of the plurality of selectable surfaces of the virtual object on the display, the second surface displayed parallel to the display while in a steady state; and

in response to a determination that the speed is below the speed threshold, displaying, on the display, an animation of rotating the virtual object about the axis parallel to the display in a second direction that is opposite to the first direction to display the first surface of the plurality of selectable surfaces of the virtual object on the display, the first surface displayed parallel to the display while in the steady state.

**2**. The computer-implemented method of claim **1**, further comprising: determining a selection of the second surface in response to the display of the second surface parallel to the display in the steady state.

**3**. The computer-implemented method of claim **2**, further comprising: in response to determining the selection of the second surface, generating a haptic output at the wearable electronic device.

**4**. The computer-implemented method of claim **2**, wherein determining a selection of the second surface in response to the display of the second surface parallel to the display the steady state further comprise instructions for detecting one or more of: a tap gesture on the second surface, a first touch with a force greater than a predetermined threshold, on the touch-sensitive display, a second touch on the physical crown, a press on the physical crown, and a third touch on a touch-sensitive surface of the wearable electronic device.

**5**. The computer-implemented method of claim **1**, wherein the virtual object is a cube.

**6**. The computer-implemented method of claim **1**, wherein the virtual object is a multi-sided rotatable dial.

**7**. The computer-implemented method of claim **1**, further comprising: associating the second surface with a second data, wherein the first data and the second data are different.

**8**. The computer-implemented method of claim **1**, wherein the speed is determined based on the rate of rotation of the virtual object.

**9**. The computer-implemented method of claim **1**, further comprising: determining a selection of the first surface in response to the display of the first surface-parallel to the display.

**10**. The computer-implemented method of claim **9**, further comprising: in response to a determining a selection of the first surface, generating a haptic output at the wearable electronic device.

**11**. A computer-implemented method comprising:

displaying, on a touch-sensitive display of a wearable electronic device, a first surface of a plurality of selectable surfaces of a virtual object, the first surface associated with a first data;

detecting rotation of a physical crown of the wearable electronic device;

determining an angular velocity of the physical crown during the detected rotation;

in response to detecting rotation of the physical crown, displaying, on the display, an animation of rotating the virtual object about an axis parallel to the display in a first direction;

and after rotating the virtual object about the axis parallel to the display in the first direction:

in response to a determination that the angular velocity exceeds an angular velocity threshold, displaying, on the display, an animation of continuing to rotate the virtual object about the axis parallel to the display in the first direction to display a second surface of the plurality of selectable surfaces of the virtual object on the display, the second surface displayed parallel to the display while in a steady state; and

in response to a determination that the angular velocity is below the angular velocity threshold, displaying, on the display, an animation of rotating the virtual object about the axis parallel to the display in a second direction that is opposite to the first direction to display the first surface of the plurality of selectable surfaces of the virtual object on the display, the first surface displayed parallel to the display while in the steady state.

**12**. The computer-implemented method of claim **11**, further comprising: determining a selection of the second surface in response to the display of the second surface parallel to the display in the steady state.

**13**. The computer-implemented method of claim **12**, further comprising: in response to determining the selection of the second surface, generating a haptic output at the wearable electronic device.

**14**. The computer-implemented method of claim **12**, wherein determining a selection of the second surface in response to the display of the second surface parallel to the display the steady state further comprise instructions for detecting one or more of: a tap gesture on the second surface, a first touch with a force greater than a predetermined threshold, on the touch-sensitive display, a second touch on the physical crown, a press on the physical crown, and a third touch on a touch-sensitive surface of the wearable electronic device.

**15**. The computer-implemented method of claim **11**, wherein the virtual object is a cube.

**16**. The computer-implemented method of claim **11**, wherein the virtual object is a multi-sided rotatable dial.

**17**. The computer-implemented method of claim **11**, further comprising: associating the second surface with a second data, wherein the first data and the second data are different.

**18**. The computer-implemented method of claim **11**, wherein the angular velocity is determined based on the rate of rotation of the virtual object.

**19**. The computer-implemented method of claim **11**, further comprising: determining a selection of the first surface in response to the display of the first surface-parallel to the display.

**20**. The computer-implemented method of claim **19**, further comprising: in response to a determining a selection of the first surface, generating a haptic output at the wearable electronic device.

**21**. A non-transitory computer-readable storage medium comprising instructions for:

displaying a first surface of a plurality of selectable surfaces of a virtual object on a touch-sensitive display of a wearable electronic device, the first surface associated with a first data;

detecting rotation of a physical crown of the wearable electronic device;

determining a speed, wherein the speed is based on an angular velocity of the physical crown during the detected rotation;

in response to detecting rotation of the physical crown, displaying, on the display, an animation of rotating the virtual object about an axis parallel to the display in a first direction;

and after rotating the virtual object about the axis parallel to the display in the first direction:

in response to the speed being determined to exceed a speed threshold, displaying, on the display, an animation of continuing to rotate the virtual object rotating about an axis parallel to the display in the first direction to display a second surface of the plurality of selectable surfaces of the virtual object on the display, the second surface displayed parallel to the display while in a steady state; and

in response to a determination that the speed is below the speed threshold, displaying, on the display, an animation of rotating the virtual object about the axis parallel to the display in a second direction that is opposite to the first direction to display the first surface of the plurality of selectable surfaces of the virtual object on the display, the first surface displayed parallel to the display while in the steady state.

**22**. The non-transitory computer-readable storage medium of claim **21**, further comprising instructions for: determining a selection of the second surface in response to the display of the second surface parallel to the display in the steady state.

**23**. The non-transitory computer-readable storage medium of claim **22**, further comprising instructions for: in response to determining the selection of the second surface, generating a haptic output at the wearable electronic device.

**24**. The non-transitory computer-readable storage medium of claim **22**, wherein determining a selection of the second surface in response to the display of the second surface parallel to the display the steady state further comprises instructions for detecting one or more of: a tap gesture on the second surface, a first touch with a force greater than a predetermined threshold, on the touch-sensitive display, a second touch on the physical crown, a press on the physical crown, and a third touch on a touch-sensitive surface of the wearable electronic device.

**25**. The non-transitory computer-readable storage medium of claim **21**, further comprising instructions for: determining a selection of the first surface in response to the display of the first surface parallel to the display.

**26**. The non-transitory computer-readable storage medium of claim **25**, further comprising instructions for: in response to a determining a selection of the first surface, generating a haptic output at the wearable electronic device.

**27**. The non-transitory computer-readable storage medium of claim **21**, wherein the virtual object is a cube.

**28**. The non-transitory computer-readable storage medium of claim **21**, wherein the virtual object is a multi-sided rotatable dial.

**29**. The non-transitory computer-readable storage medium of claim **21**, further comprising instructions for: associating the second surface with a second data, wherein the first data and the second data are different.

**30**. The non-transitory computer-readable storage medium of claim **21**, wherein the speed is determined based on the rate of rotation of the virtual object.

**31**. A non-transitory computer-readable storage medium comprising instructions for:

displaying, on a touch-sensitive display of a wearable electronic device, a first surface of a plurality of selectable surfaces of a virtual object, the first surface associated with a first data;

detecting rotation of a physical crown of the wearable electronic device;

determining an angular velocity of the physical crown during the detected rotation;

in response to detecting rotation of the physical crown, displaying, on the display, an animation of rotating the virtual object about an axis parallel to the display in a first direction; and

after rotating the virtual object about the axis parallel to the display in the first direction:

in response to a determination that the angular velocity exceeds an angular velocity threshold, displaying, on the display, an animation of continuing to rotate the virtual object about the axis parallel to the display in the first direction to display a second surface of the plurality of selectable surfaces of the virtual object on the display, the second surface displayed parallel to the display while in a steady state; and

in response to a determination that the angular velocity is below the angular velocity threshold, displaying, on the display, an animation of rotating the virtual object about the axis parallel to the display in a second direction that is opposite to the first direction to display the first surface of the plurality of selectable surfaces of the virtual object on the display, the first surface displayed parallel to the display while in the steady state.

**32**. The non-transitory computer-readable storage medium of claim **31**, wherein the physical crown is a mechanical crown.

**33**. The non-transitory computer-readable storage medium of claim **31**, further comprising instructions for: determining a selection of the second surface in response to the display of the second surface parallel to the display in the steady state.

**34**. The non-transitory computer-readable storage medium of claim **33**, further comprising instructions for: in response to determining the selection of the second surface, generating a haptic output at the wearable electronic device.

**35**. The non-transitory computer-readable storage medium of claim **33**, wherein determining a selection of the second surface in response to the display of the second surface parallel to the display the steady state further comprise instructions for detecting one or more of: a tap gesture on the second surface, a first touch with a force greater than a predetermined threshold, on the touch-sensitive display, a second touch on the physical crown, a press on the physical crown, and a third touch on a touch-sensitive surface of the wearable electronic device.

**36**. The non-transitory computer-readable storage medium of claim **31**, wherein the virtual object is a cube.

**37**. The non-transitory computer-readable storage medium of claim **31**, wherein the virtual object is a multi-sided rotatable dial.

**38**. The non-transitory computer-readable storage medium of claim **31**, further comprising instructions for: associating the second surface with a second data, wherein the first data and the second data are different.

**39**. The non-transitory computer-readable storage medium of claim **31**, wherein the angular velocity is determined based on the rate of rotation of the virtual object.

**40**. The non-transitory computer-readable storage medium of claim **31**, further comprising instructions for: determining a selection of the first surface in response to the display of the first surface-parallel to the display.

**41**. The non-transitory computer-readable storage medium of claim **40**, further comprising instructions for: in response to a determining a selection of the first surface, generating a haptic output at the wearable electronic device.

**42**. An electronic device comprising:

one or more processors;

a physical crown operatively coupled to the one or more processors; and

a touch-sensitive display operatively coupled to the one or more processors, the one or more processors configured for:

displaying a first surface of a plurality of selectable surfaces of a virtual object on a touch-sensitive display of a wearable electronic device, the first surface associated with a first data;

detecting rotation of a physical crown of the wearable electronic device;

determining a speed, wherein the speed is based on an angular velocity of the physical crown during the detected rotation;

in response to detecting rotation of the physical crown, displaying, on the display, an animation of rotating the virtual object about an axis parallel to the display in a first direction; and

after rotating the virtual object about the axis parallel to the display in the first direction:

in response to the speed being determined to exceed a speed threshold, displaying, on the display, an animation of continuing to rotate the virtual object rotating about an axis parallel to the display in the first direction to display a second surface of the plurality of selectable surfaces of the virtual object on the display, the second surface displayed parallel to the display while in a steady state; and

in response to a determination that the speed is below the speed threshold, displaying, on the display, an animation of rotating the virtual object about the axis parallel to the display in a second direction that is opposite to the first direction to display the first surface of the plurality of selectable surfaces of the virtual object on the display, the first surface displayed parallel to the display while in the steady state.

**43**. The electronic device of **42**, further comprising: determining a selection of the second surface in response to the display of the second surface parallel to the display in the steady state.

**44**. The electronic device of claim **43**, further comprising: in response to determining the selection of the second surface, generating a haptic output at the wearable electronic device.

**45**. The electronic device of claim **43**, wherein determining a selection of the second surface in response to the display of the second surface parallel to the display the steady state further comprise instructions for detecting one or more of: a tap gesture on the second surface, a first touch with a force greater than a predetermined threshold, on the touch-sensitive display, a second touch on the physical crown, a press on the physical crown, and a third touch on a touch-sensitive surface of the wearable electronic device.

**46**. The electronic device of claim **42**, wherein the virtual object is a cube.

**47**. The electronic device of claim **42**, wherein the virtual object is a multi-sided rotatable dial.

**48**. The electronic device of claim **42**, further comprising: associating the second surface with a second data, wherein the first data and the second data are different.

**49**. The electronic device of claim **42**, wherein the speed is determined based on the rate of rotation of the virtual object.

**50**. The electronic device of claim **42**, further comprising: determining a selection of the first surface in response to the display of the first surface-parallel to the display.

**51**. The electronic device of claim **50**, further comprising: in response to a determining a selection of the first surface, generating a haptic output at the wearable electronic device.

**52**. An electronic device comprising:

one or more processors;

a physical crown operatively coupled to the one or more processors; and

a touch-sensitive display operatively coupled to the one or more processors, the one or more processors configured for:

displaying, on a touch-sensitive display of a wearable electronic device, a first surface of a plurality of selectable surfaces of a virtual object, the first surface associated with a first data;

detecting rotation of a physical crown of the wearable electronic device;

determining an angular velocity of the physical crown during the detected rotation;

in response to detecting rotation of the physical crown, displaying, on the display, an animation of rotating the virtual object about an axis parallel to the display in a first direction; and

after rotating the virtual object about the axis parallel to the display in the first direction:

in response to a determination that the angular velocity exceeds an angular velocity threshold, displaying, on the display, an animation of continuing to rotate the virtual object about the axis parallel to the display in the first direction to display a second surface of the plurality of selectable surfaces of the virtual object on the display, the second surface displayed parallel to the display while in a steady state; and

in response to a determination that the angular velocity is below the angular velocity threshold, displaying, on the display, an animation of rotating the virtual object about the axis parallel to the display in a second direction that is opposite to the first direction to display the first surface of the plurality of selectable surfaces of the virtual object on the display, the first surface displayed parallel to the display while in the steady state.

**53**. The electronic device of **52**, further comprising: determining a selection of the second surface in response to the display of the second surface parallel to the display in the steady state.

**54**. The electronic device of claim **53**, further comprising: in response to determining the selection of the second surface, generating a haptic output at the wearable electronic device.

**55**. The electronic device of claim **53**, wherein determining a selection of the second surface in response to the display of the second surface parallel to the display the steady state further comprise instructions for detecting one or more of: a tap gesture on the second surface, a first touch with a force greater than a predetermined threshold, on the touch-sensitive display, a second touch on the physical crown, a press on the physical crown, and a third touch on a touch-sensitive surface of the wearable electronic device.

**56**. The electronic device of claim **52**, wherein the virtual object is a cube.

**57**. The electronic device of claim **52**, wherein the virtual object is a multi-sided rotatable dial.

**58**. The electronic device of claim **52**, further comprising: associating the second surface with a second data, wherein the first data and the second data are different.

**59**. The electronic device of claim **52**, wherein the angular velocity is determined based on the rate of rotation of the virtual object.

**60**. The electronic device of claim **52**, further comprising: determining a selection of the first surface in response to the display of the first surface-parallel to the display.

**61**. The electronic device of claim **60**, further comprising: in response to a determining a selection of the first surface, generating a haptic output at the wearable electronic device.

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