



- (51) **International Patent Classification:**
G06F 3/0354 (2013.01) *G06F 3/038* (2013.01)
- (21) **International Application Number:**
PCT/IB2013/055772
- (22) **International Filing Date:**
12 July 2013 (12.07.2013)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
601229 12 July 2012 (12.07.2012) NZ
610609 14 May 2013 (14.05.2013) NZ
- (72) **Inventors; and**
- (71) **Applicants :** ODGERS, Grant Neville [NZ/NZ]; 287 Okuti Valley Road, 7591 Little River (NZ). EARLY, William [NZ/NZ]; 17 Fairmile Drive, Kinmont Park, 9024 Mosgiel (NZ). THIRD, Simon [NZ/NZ]; 212 Antigua St, 8011 Christchurch (NZ). BEACH, David [NZ/NZ]; 2 Hampstead Lane, Prebbleton, 7604 Christchurch (NZ).
- (74) **Agents:** REDPATH, Ashlin Murray et al.; IPiphany - Intellectual Property, PO Box 2564, 8140 Christchurch (NZ).
- (81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM,

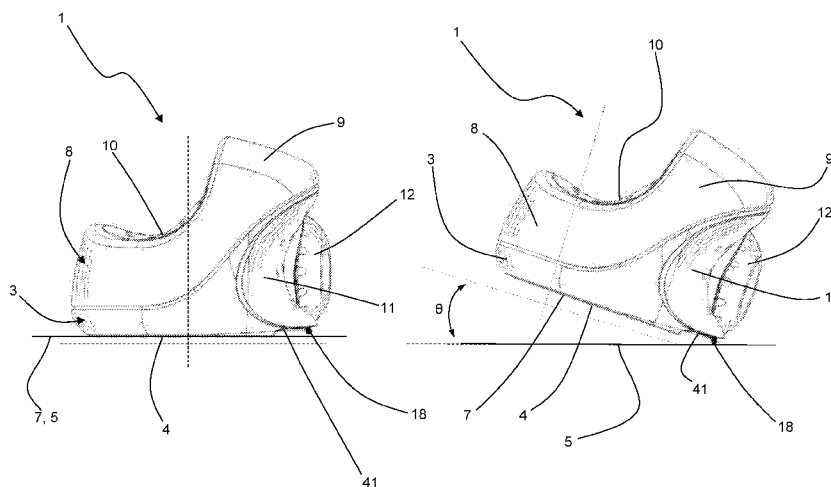
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

- (84) **Designated States** (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(54) **Title:** IMPROVEMENTS IN DEVICES FOR USE WITH COMPUTERS

Figure 2

(57) **Abstract:** The present invention includes a computer mouse (1) for use with a computer (2), including: - a base (3) with a lower surface (4) configured for sliding across a work surface (5), said lower surface (4) having at least one portion forming part of a base contact plane (7); - an upper body (8), extending from the base (3); - at least one contact sensor (15, 16); - a movement sensor system (17, 18), capable of detecting mouse (1) movement relative to said work surface (5); - a communication system, for communicating computer-readable movement and/or position data signals from the device (1) to a computer (2), said movement data signals indicating said detected mouse (1) movement and said position data signals indicating a position of the mouse (1) characterised in that the mouse (1) is configured to operate in a first and second modes.

Title: IMPROVEMENTS IN DEVICES FOR USE WITH COMPUTERS**Technical Field**

The present invention relates generally to improvements in devices for use with computers. In particular the present invention relates generally to an improved computer mouse, a configurable device for use with a computer and a method of configuring the devices.

Background Art

Computer mice and keyboards are the most widely used computer peripherals used to control a computer and manipulate data input and output and are deemed essential by many people to effectively use a computer. However, advances in touch-screen technology and miniaturisation of computer components have led to the widespread adoption of touch-controlled fully functional small portable computers such as smart phones and tablets.

Examples of common touch inputs or “*touch events*” and examples of their function in the computer operating system are shown in the following table.

Control	User finger action	Operating system interpretation
<i>Tap or select</i>	brief touch of finger on the touch-screen	The operating system typically interprets a <i>tap</i> as a selection of a GUI element, e.g. <i>tapping</i> on an application icon will launch the application. Two or more <i>taps</i> in quick succession offer additional functionality such as selecting entire words, sentences or zooming.
<i>long press</i>	placement of finger on the screen for longer than a threshold time indicating a <i>tap</i> .	The operating system typically interprets a <i>long press</i> as a request for access to a contextual menu associated with the GUI element selected in the <i>tap</i> .
<i>swipe</i>	movement of finger over the touch-screen while in contact.	The operating system typically translates a <i>swipe</i> into movement of GUI pages, screens or windows. Typical movements include panning (vertical and/or horizontal movement) scrolling (rapid vertical movement), flick (rapid horizontal movement) e.g. an upwards/downwards <i>swipe</i>

		may result in vertical scrolling of the GUI element while a sideways <i>flick</i> may result in BACK or FORWARD command in a web browser or flipping of pages in an e-book.
<i>drag</i>	a <i>long press</i> followed by a <i>swipe</i>	Movement of the finger following a <i>long press</i> may result in movement of the selected GUI element.
<i>Pinch</i> or <i>spread</i>	Two fingers are brought together (<i>pinch</i>) or apart (<i>spread</i>).	Typically a <i>pinch</i> is interpreted as a zoom-in command (fingers together) and a <i>spread</i> as a zoom-out command (fingers apart).
<i>rotate</i>	Two fingers are placed on screen and moved in opposite arcuate directions about a central point.	a <i>rotate</i> command typically results in rotation of the GUI element.

Many users find the finger manipulation of such a touch-screen more intuitive than using a mouse and keyboard for many tasks. However, touch-screen keyboards are not as efficient as a keyboard for entering large volumes of text and so many users may use a separate keyboard to enter data on a touch-screen controlled computer to assist in data entry. Moreover, if frequent manipulation of the touch-screen is required the user's fingers will frequently occlude on-screen items which may frustrate the user. Thus in such a 'productive' *mode* many users instead use the touch-screen primarily for viewing and connect a separate keyboard and mouse to the touch-screen computer with the keyboard used for data entry and the mouse used for on-screen manipulation of Graphical User Interface (GUI) objects.

The intuitive control gestures of touch-screen operating systems may also be useful in a conventional desktop or laptop working environment and recent Windows® operating systems (version 7 and 8) have been designed to work with touch-screen inputs. Thus, it can be seen that the use of touch-screens and touch-screen control methods are likely to increase as the prevalence of mobile 'smart' phones and tablet devices increases.

However, touch-screen operating systems are primarily designed for touch-input and thus many touch controls are not as easily performed by a mouse or keyboard combination, making it difficult for users to benefit from the intuitive touch-screen controls while using keyboard and mouse. The *swipe* gesture for example is typically emulated using a mouse by holding a button

down (e.g. left-click) while moving the mouse. This method is unintuitive for many people and strains a user's hand as they must grip the mouse to move it while placing pressure on a button.

It would therefore be advantageous to provide a mouse that offers a more intuitive *mode* of operation for use with a touch-screen optimised operating system or for providing touch-screen type inputs to a conventional computer operating system.

Computers typically require software 'drivers' to interface with a connected device. These drivers may be generic drivers suited to a wide range of devices (e.g. generic mouse drivers for MS Microsoft Windows) or unique drivers for that device that provide enhanced functionality and/or allow the device to be configured via the computer, e.g. a mouse driver software may allow configuration of mouse function parameters, such as choosing button functions or mouse pointer acceleration.

However, the use of unique drivers for devices can be a burden for users as they must install the software before they can configure and/or use their device.

To overcome some of this hindrance, some advanced devices have onboard memory and configuration controls enabling the user to change device parameters by pressing button combinations or the like.

However, most devices have no display screen and so it can be difficult for a user to determine how to configure the device and what changes they have made to the device. Often the user is required to refer to a user manual to determine which sequence or combination of buttons to press to change a particular configuration option.

It would thus be advantageous to provide a method of configuring a device via a computer without need for unique drivers.

It is an object of the present invention to address the foregoing problems or at least to provide the public with a useful choice.

It is acknowledged that the term 'comprise' may, under varying jurisdictions, be attributed with either an exclusive or an inclusive meaning. For the purpose of this specification, and unless otherwise noted, the term 'comprise' shall have an inclusive meaning - i.e. that it will be taken to mean an inclusion of not only the listed components it directly references, but also other non-specified components or elements. This rationale will also be used when the term 'comprised' or 'comprising' is used in relation to one or more steps in a method or process.

Further aspects and advantages of the present invention will become apparent from the ensuing description which is given by way of example only.

Disclosure of Invention

According to a preferred aspect, the present invention includes a computer mouse for use with a computer, said computer mouse including:

- a base with a lower surface configured for sliding across a work surface, said lower surface having at least one portion forming part of a base contact plane;
- an upper body, extending from the base;
- at least one contact sensor;
- a movement sensor system, capable of detecting mouse movement relative to said work surface;
- a communication system, for communicating computer-readable movement and/or position data signals from the device to a computer, said movement data signals indicating said detected mouse movement and said position data signals indicating a position of the mouse

characterised in that the mouse is configured to operate in a first and second *modes*.

A “computer mouse” is herein defined as a device used to provide input to a computer to indicate movement of the device and/or an on-screen Graphical User Interface (GUI) element, e.g. an icon, pointer or mouse cursor. Computer mice may be defined as a subset of a larger group of computer pointing devices including styluses, game controllers, trackballs, joysticks, remote controls, track-pads or the like.

A “computer” as referred to herein should be understood to include any computing device with a computer processor e.g. a desktop, laptop, netbook, tablet, phone, media player, network server, mainframe, navigation device, vehicle operating system or the like.

The computer mouse may have a computer interface unit or communication system provided in the form of a cord connection to the computer or a wireless chip to transmit signals via RF, Microwave, Bluetooth or other wireless protocols.

As used herein, a “work surface” is to be interpreted broadly and not in a restricted sense and includes but is not restricted to, a desk or table top, a surface of a computing device including the keyboard or screen, a person, or any other convenient surface. Similarly, the terms computer, host computer, or computing device and associated display, or the like are not limited to any specific implementation and include any desktop PC, portable computer, laptop, notebook, sub-notebook, PDA, palm device, mobile phone, wireless keyboard, touch screen,

tablet PC, or any other communication and/or display device and any combination or permutation of same.

The term “spine” with reference to the computer mouse includes any upright structure or features capable of being grasped between a user’s thumb and a finger to effect device movement, being narrower than the base portion and with at least one side of the spine projecting upwards from within the perimeter of the base portion, in contrast to a conventional mouse pointing device where the entire main body of the device extends upwards from the base perimeter.

“Fingertip engagement” as referred to herein with respect to thumb and fingertip engagement surfaces is used to denote a fingertip contact capable of moving and/or controlling the device and/or operating a contact sensor.

The term “contact sensor” as used herein refers to any sensor capable of detecting contact and/or pressure and includes by way of example depressible buttons as well as sensors capable of detecting changes in magnetism, conductivity, temperature, pressure, capacitance and/or resistance.

As used herein, the term “*touch event*” includes, but is not limited to, actual and virtual, simulated, emulated or translated touch actions on a touch screen or touch-enabled operating system capable of processing touch events and includes; a *tap*, *long press*, *swipe*, *drag*, *flick*, *scroll*, *pinch*, *spread* or *rotate* as well as mouse and/or keyboard commands used to provide equivalent inputs.

Reference herein will be made to a two-dimensional area provided with vertical and horizontal dimensions corresponding to a display screen in a typical upright orientation. This reference is to aid clarity and understanding only and should not be seen to be limiting as it will be appreciated the display screen may be orientated in a horizontal plane. Similarly, reference herein may be made to the computer mouse moving in a ‘Y’ direction and an orthogonal ‘X’ axis respectively correlating to the vertical and horizontal dimensions on the display screen. It should be appreciated that the X, Y, horizontal and vertical references may be used interchangeably depending on the orientation of the display screen.

The base contact plane is formed from X and Y components representing orthogonal dimensions in the plane. In preferred embodiments, the pointing device may be slightly elongate and so may have a longitudinal and lateral dimension respectively corresponding to the Y and X dimensions.

Preferably, said computer mouse is configured to operate in

- a first *mode* when orientated in a first orientation, and
- a second *mode* when orientated in a second orientation where said base contact plane is inclined with respect to said first orientation.

In use in the first orientation the base contact plane is typically placed on the work surface and orientated substantially parallel thereto and in the second orientation the base contact plane is preferably inclined to any orientation between one and fifty degrees from the work surface. Thus, the second *mode* is preferably only activated when the computer mouse is inclined such that the base contact plane is inclined between one and fifty degrees from the work surface.

The inclination is effected by a rotation of the base contact plane about a reorientation axis which may include components in both the X and Y dimensions with a majority of rotation occurring about a Y axis. It will be appreciated that the most comfortable rotation for a user holding the pointing device will be a left of the device a rolling of the wrist and a slight backwards tilt. This would result in mainly clockwise rotation for a right handed user and anticlockwise rotation for a left-handed user with backward tilt in both cases. The mouse may also be lifted to assist in the reorientation.

Hereinafter reference to the pointing device orientations will be made with respect to a longitudinal (Y), lateral (X) and vertical (Z) conventional coordinate system with a user's hand extending forward to the pointing device along the Y dimension and wrist rotation generally about the Y axis.

Preferably, said movement sensor system is configured to detect device movement and/or position relative to said work surface in both the first and second *modes*.

Preferably, the movement sensor system is capable of detecting device movement relative to a work surface. The movement sensor system may also generate device movement information in the form of movement data signals capable of being read by the computer.

The movement sensor system may also generate device position information in the form of position data signals capable of being read by the computer. The position information may be generated by detecting movement relative to an initial, reference, origin, start or restart point and calculating the displacement from that point.

The movement and position data signals may respectively indicate movement and position coordinates to a position on a computer display screen, touchpad or other input area of the computer.

The position data signals preferably indicate a relative position of the computer mouse as a

proportion of the display screen, e.g. the position data signal may include coordinate X56%, Y22% indicating a position at 56% of the display screen vertical dimension and 22% of the display screen horizontal position relative to reference screen edges. The computer mouse can thus be used with any screen resolution or size without further configuration or calibration as the movement and/or position is simply scaled to the screen size.

Most users find it easier to move a mouse side-to-side (X-axis) rather than moving a hand forwards and backwards (Y-axis) and thus users may find it difficult to perform mouse movements requiring large distance movements along the Y axis. Thus, in a preferred embodiment, the mouse is configured to scale mouse movement on the Y axis relative to the X axis movement. The scaling is typically two to three times so that a movement in the Y direction only needs to be half or a third of the distance of an equivalent movement in the X direction. This scaling is particularly useful for performing gestures in the second *mode*.

In a further embodiment the movement data signals include an indication of device movement speed relative to the work surface.

Preferably, said movement sensor system is an optical movement sensor system including:

- a light source configured to illuminate the work surface, and
- an image sensor or array, configured to receive reflected light from said work surface to capture an image of the work surface, wherein successive captured images are compared to determine device movement.

Preferably said image sensor or array is configured to capture an image of the work surface in both the first and second *modes*, wherein successive captured images are compared to determine device movement in both the first and second *modes*.

It will be appreciated that a conventional computer mouse may use an optical system comprising an image capture sensor or array that is positioned over an aperture open to a work surface illuminated by a light source such as an LED or Laser. A lens focuses the light from a focus zone of the surface to the image sensor and lens, which are orientated parallel to the work surface. The image capture sensor detects device movement by capturing successive images and comparing the images to determine relative movement. The movement information is transmitted to the computer and translated to mouse cursor movement on the display. However, a typical mouse optical system will not track movement when the mouse is lifted as the image sensor receives an image out of focus such that successive images cannot be compared accurately and movement therefore not detected. This deactivation when out of focus is an important function of a conventional mouse as the user needs to be able to lift and

reposition a mouse to move a mouse cursor large distances, repeat scrolling/panning movements, re-position their hand for comfort without moving the cursor or otherwise manipulate the mouse without moving the cursor. Conventional mice will also not work if they are inclined away from the work surface as the optic sensor again loses focus and therefore must be operated parallel to and directly above the work surface at the lens focus point.

Preferably, the optical system is configured with a depth of field sufficiently large such that substantially focused light from the work surface is received by the image sensor in both the first and second orientations and wherein said second orientation is at least five degrees inclined from said first orientation

It will be appreciated that the image sensor may have some tolerance in processing images and so may be able to process slightly unfocused images from the work surface. Thus, reference herein to substantially focused should be interpreted to mean focused within the tolerance limits of the image sensor used and need not be perfectly focused.

Preferably the optical movement sensor system is located and configured such that the image sensor captures images exceeding a threshold level of clarity, resolution, edge-contrast or other parameter such that the movement sensor system can detect, to an acceptable level, the differences between successive images indicating movement in both the first and second orientations.

Preferably, the optical system is positioned such that the focal zone of the optical system is at or adjacent to the *mode sensor*.

Preferably, said optical system includes at least one lens for focusing the light from the work surface to the image sensor.

According to a further aspect, the present invention further includes at least one *mode sensor* configured to initiate a said *mode*, wherein said light source is configured to illuminate the work surface at or adjacent said *mode sensor*.

According to a further aspect, the present invention includes at least one *mode sensor* configured to initiate a said *mode*.

Preferably, said mouse is configured to operate in:

- said first *mode* when orientated in a first orientation, and
- said second *mode* when orientated in a second orientation where said base contact plane is inclined with respect to said first orientation and a said *mode sensor* is configured to initiate

said first or second *mode* when the mouse is in said first or second orientation respectively.

The *mode sensor* is used to detect when the mouse is reoriented to the second orientation to thereby initiate the second mode.

According to a further aspect, said *mode sensor* is configured to initiate said second *mode* when the *mode sensor* contacts the work surface.

Preferably, the *mode sensor* is configured to initiate said second *mode* when the *mode sensor* is pressed against the work surface.

The *mode sensor* may thus be formed as a contact sensor, button or proximity sensor configured to initiate a particular mode depending respectively on whether or not the mode sensor is in contact, forced against or sufficiently near to the work surface.

Preferably, the *mode sensor* includes a projection extending towards said base contact plane.

Preferably, the *mode sensor* projection is located above the base contact plane.

Preferably, the *mode sensor* projection is releasably connected to the computer mouse. Alternatively, or in addition, the *mode sensor* projection may have an outer contact surface or portion for contacting the work surface, the outer contact surface or portion being releasably connected. The releasable connection allows the projection or outer contact surface/portion to be replaced if it wears or is broken. Wear may be a problem as the *mode sensor* is relatively small compared to the mouse and may become the single point of contact in the second *mode*.

Preferably, said mouse includes a scroll wheel, the scroll wheel including a *mode sensor*. It is possible to incorporate a contact or proximity sensor in the scroll wheel and thus use the scroll wheel as the *mode sensor* instead of an independent projection, button or the like. Alternatively, the scroll wheel may be formed as a button, actuated by movement along a linear axis or pivoting about a connection to the mouse body.

Preferably, at least one contact sensor is located on the upper body, said contact sensor activated by a contact or force applied in a direction toward said base contact plane. The contact sensor is preferably a button or touch input surface for providing corresponding mouse inputs. The contact sensor on the upper body is preferably generally located on the upper side and is thus located opposite the *mode sensor* extending from an underside of the base.

The second *mode* is thus only initiated when the mouse is inclined past a threshold angle which ideally is a minimal inclination allowing the user to easily activate the second *mode* without

excessive mouse manipulation. However, if the threshold angle is too small it may be too easy for the second mode to be inadvertently initiated, causing user confusion or frustration. Thus, a compromise must be made to minimise the threshold angle while minimising the risk of inadvertent switching between *modes*.

Preferably, said second orientation includes inclination of the base contact plane with respect to the work surface past a threshold angle, being at least degrees and less than twenty degrees.

Thus, the threshold angle for initiating the second *mode* is not too small (greater than five degrees) but not too large (less than twenty degrees). It will be appreciated however that the threshold angle may vary depending on the mouse shape and configuration.

According to a further aspect, said second orientation includes inclination of the base contact plane with respect to the work surface of between one and fifty degrees.

Accordingly to a further aspect of the present invention, said second orientation includes inclination of the base contact plane with respect to the work surface of between seven and thirty degrees.

Preferably, said upper body includes a spine portion projecting upwards from the base.

According to a further aspect of the present invention, the upper body may include finger engaging surfaces on either side of the spine such that a user may grip the computer mouse by pinching the spine between a finger and thumb.

Preferably said mouse is configured to provide position data signals calculated using movement data of the pointing device as detected by the movement sensing system relative to a start position.

According to a further aspect, the first *mode* includes a pointing *mode*, and in said pointing *mode* said computer mouse is configured to generate said movement or position data signals indicating on-screen pointer movement or position respectively.

Preferably, said mouse is configured in said second *mode* to provide touch events to said computer.

Preferably, said mouse is configured to translate said movement or position data signals into corresponding movement and/or position touch events.

Preferably, said computer mouse provides said movement or position data signals to said computer and said computer is configured to translate said data signals into corresponding

movement and/or position touch events.

According to a further aspect, the present invention includes a computer mouse configured to provide a touch event at a predetermined start position upon initiation of said second *mode* by said *mode sensor*, said computer mouse generating a position data signal corresponding to said start position.

Preferably, said computer mouse is configured to generate a corresponding touch event upon initiation of said second *mode* by said *mode sensor*.

Preferably, said mouse is configured to provide position data signals to the computer indicating a start position at a position representing an edge of a display screen connected to the computer, by two successive touch events.

Preferably, said mouse is configured such that any subsequent swipe gesture performed in said second *mode* after said successive touch events is provided as position and/or movement data signals indicating a touch event in a corresponding direction away from a given edge and wherein said given edge is inferred by said direction of said swipe gesture.

Preferably, the computer mouse is configured to provide a position data signal indicating a touch event at a restart position after a device movement interpreted as a swipe gesture, said swipe gesture being a movement of the pointing device from a start position in said second *mode*.

According to a further aspect, the start position is the position of an on-screen pointer when in said pointer *mode* before said second *mode* is initiated.

Preferably, the start position is a position corresponding to a centre, corner or edge position of a display screen connected to said computer.

Preferably, the computer mouse is configured to provide data signals to the computer when the mouse moves to a predetermined position, said data signals including a data signal corresponding to an end of a touch event, followed by a position data signal indicating a restart position for a subsequent touch event.

According to one aspect of the present invention, said predetermined position is within a threshold distance of an edge corresponding to an edge of a display screen connected to said computer.

Preferably, said mouse is configured to reposition an on-screen pointer or touch event to the start position after a *swipe*, *flick*, *scroll* or custom *touch event*.

In one embodiment said image sensor is inclined with respect to the base contact plane and orientated to receive light reflected from the work surface in both said first and second orientations. In a further embodiment, the optical componentry includes at least one lens positioned between the image sensor and the light reflected from the work surface, the lens focusing and/or redirecting light to said image sensor from said work surface. Preferably, at least two lenses are provided and are inclined with respect to each other and with respect to the image sensor and to the contact plane. The multiple lenses thus allow a focused image to be directed to the image sensor even if the image sensor is not parallel to the work surface as the lenses redirect light to the image sensor in both the first and second orientations.

Preferably, the image sensor is inclined in the direction of reorientation to said second orientation and more preferably approximately tangentially to an arc about a reorientation axis. Thus as the pointing device rotates, the distance from the image sensor to work surface may vary on slightly and thus the work surface remains substantially in focus even in the second orientation.

Preferably, the optical componentry include at least one prism with an input face for receiving light from the work surface, an output face for directing light to the image sensor and a reflecting surface for reflecting light from said input face to said output face.

Preferably the input face is inclined from said base contact plane and more preferably inclined in the direction of reorientation to said second orientation.

In a further embodiment the input face is aligned approximately tangentially to an arc about a reorientation axis. Thus as the pointing device rotates, the input face remains tangential to the arc and therefore the approximate distance from the input face to the work surface remains similar and thus the work surface remains substantially in focus even in the second orientation. The use of such a prism allows the image sensor to be located within the body of the pointing device and orientated in a convenient orientation with the prism acting to direct the light to the image sensor.

Preferably, said optical componentry includes a first prism and a second prism,

the first prism having:

- an input face for receiving light reflected off the work surface,
- an output face for transmitting light to the second prism,
- a reflecting surface for reflecting light from the input face to the output face,

the second prism having:

- an input face for receiving light from the first prism output face,
- an output face for transmitting light to the image sensor, and
- a reflecting surface orientated to reflect light toward the second prism output face.

Preferably, the first and second prisms are identical in shape and optical properties and are preferably constructed from a Polycarbonate material.

Preferably, the optical componentry includes a lens positioned between the first prism output face and the second prism input face.

In one embodiment at least one lens may be positioned on or adjacent the:

- first prism input face;
- first prism output face;
- second prism input face;
- second prism output face.

Preferably, an aperture is provided between the first prism output face and the second prism input face.

Preferably, the optical componentry also includes a light source orientated to irradiate light onto the work surface beneath the optical componentry and more preferably at the focal zone of the optical componentry.

The computer mouse is preferably rotated about the *mode sensor* when reoriented to activate the *mode sensor* which thereby acts as a pivot point. Thus to minimize potential distance variation of the receiving portion (where light reflected from the work surface is received, e.g. first prism input face) to the work surface, the receiving portion of the optical componentry is preferably located adjacent the *mode sensor*. Minimizing distance variation from the receiving portion to the work surface also minimizes the potential for the optical componentry to lose focus.

Preferably, the computer mouse includes a communication system capable of communicating contact sensor signals to a computer and associated display screen to provide input signals for software operating on said computer.

Preferably, the *mode sensor* protrudes downwards from the base toward the work surface.

Preferably, the *mode sensor* is located in a position such that re-orientation of the computer mouse to incline the base contact plane from the work surface activates said *mode sensor* by

contact and/or proximity with said work surface.

Preferably, the *mode sensor* is located in a position such that re-orientation of the computer mouse from said first to said second orientation causes said *mode sensor* to initiate the second *mode*.

Preferably, the *mode sensor* is located on the base and does not lie within the base contact plane of said lower surface. In one embodiment, the *mode sensor* is located on the base at a position elevated from the contact plane with respect to the work surface when the computer mouse base contact plane is resting on the work surface.

The *mode sensor* may be a button-type switch such as mechanical type plunger, rubber dome with carbon contact, foam element, lever contact or similar depressible button type contact sensor. However, as the pointing device rests on the *mode sensor* when inclined in the second *mode*, the travel and tactile 'click' feedback of typical depressible buttons may be undesirable. Moreover, friction may wear the surface of the *mode sensor* during use. Thus, the *mode sensor* is preferably a hard-wearing depressible foam element button with a thin foam element to minimize travel of button to activate. In another embodiment the *mode sensor* is a pressure sensor or lever arm actuator.

The *mode sensor* preferably has an outer contact surface for contacting the work surface. The outer contact surface is preferably constructed from Teflon, Nylon or other hard-wearing, low-friction material.

In one embodiment, the *mode sensor* has an outer contact surface with a lower portion lying in the base contact plane, the *mode sensor* depressible when the computer mouse is reoriented to activate the second *mode*.

Preferably, the *mode sensor* is releasably connected to the computer mouse and/or preferably has a releasably connected outer contact surface.

It will be appreciated that in an alternative embodiment the *modes* may be swapped i.e. the second *mode* is operational when in the first orientation and the first *mode* operational when in the second orientation.

It will be appreciated that the reorientation may include translation as well as rotation and may include multiple movements or a three-dimensional path. However, to aid clarity, reference will be made to rotation about a reorientation axis about which the computer mouse is rotated between the first and second orientations. Reference to such a reorientation axis should not be deemed limiting to a singular axis or movement direction.

In one embodiment the *mode sensor* may include an orientation sensor and the second *mode* may be activated by inclining the base contact plane past a threshold inclination as detected by the orientation sensor. The orientation sensor may for example include a gyroscope.

Preferably, the computer mouse includes a communication system capable of communicating the movement sensor signals to a computer. The communication system preferably includes a wireless communication system such as a Radio Frequency (RF) transceiver and more preferably includes an RF chip capable of supporting Bluetooth wireless standards.

The computer mouse is preferably configured to halt movement sensor signal generation when the image sensor detects an out of focus image. Thus, a user may lift to reposition the computer mouse without on-screen pointer movement or gesture GUI movements.

Preferably, when in said first and second *modes*, the computer mouse is configured to generate data signals for a computer indicating the computer mouse is operating in said first and second *modes* respectively.

Preferably, the first *mode* is a *pointing mode*, wherein the computer mouse generates movement data signals indicating movement of the computer mouse and results in on-screen pointer movement.

In one embodiment the second *mode* includes a “*gesture*” or “*touch*” *mode* and the computer mouse is configured to generate movement data signals interpretable by a computer as *touch events*.

As referred to herein the term “*swipe*” refers to a type of user command for a computer resulting in movement of GUI elements such as GUI pages, icons, text, screens or windows. Example *swipe* movements include *pan* (vertical and/or horizontal movement), *scroll* (vertical movement) and *flick* (rapid vertical or horizontal movements). Thus, a relatively slow pointing device movement in the positive Y direction may be interpreted as an upward *scroll*.

The *swipe* gestures may also include custom gestures such as shapes, alphanumeric characters, symbols or patterns, thereby providing additional controls and potential commands.

The *touch mode* is particularly useful in document and browser navigation or for use with touch-screen computers which are configured to receive gesture inputs from a user’s finger e.g. in *touch mode* the computer mouse may provide computer commands interpreted as *swipe* gestures without requiring a user to touch the screen.

In another embodiment, the second *mode* includes a *drawing mode* wherein the computer

mouse is configured to generate movement data signals interpretable by a computer as movement of a computer software drawing element such as a digital pen, brush or the like. The *drawing mode* is particularly useful when manipulating Art, Drawing, Computer Aided Drafting (CAD) or similar software programs as a user may easily switch between the *pointing* and *drawing modes* using only the computer mouse and not requiring additional keyboard commands or on-screen GUI element selection.

The aforementioned embodiments thus provide an enhanced computer mouse that can conveniently and quickly shift between operating *modes* to offer additional functionality over a conventional computer mouse.

It will be appreciated that the computer may be required to have suitable software to correctly interpret the computer mouse signals. However, the computer mouse is preferably configured to generate data signals of a generic or widely utilized standard and for example in the first *mode* the computer mouse generates data signals matching conventional mouse movement data signals and in said second *mode* generates data signals matching fingertip or stylus contact signals.

Preferably, an on-screen trace is displayed when in said *touch mode*, said trace matching the movement of the computer mouse.

The computer mouse preferably includes a computer memory chip for storing operating instructions and preferably includes a non-volatile memory chip to avoid the need for a continuous power supply to maintain memory state. The memory chip is preferably writable by connection to an internet user interface for programming the chip.

A common implementation of a *swipe* gesture involves movement of the finger over the touch-screen from one side to another, upwards or downwards resulting in a movement of the GUI objects, e.g. to flip through pages of an e-book, application or the pages on a home-screen. A finger is lifted and returned to the centre portion of the display to repeat the gesture for multiple pages. However, a conventional on-screen cursor does not emulate the finger-movement as the cursor must track back over the screen to reach the centre portion for multiple swipes. This action may be interpreted by the computer as a *swipe* in the reverse direction or requires software to ignore the reverse track.

Thus, in one preferred embodiment, the mouse is configured to provide a touch event input at a predetermined start position when the *mode sensor* is activated. Preferably, the start position is the position of the on-screen pointer when in said pointer *mode*, before entering said *touch mode*.

In alternative embodiments the start position may be a centre, corner or edge position or other predefined position.

Preferably, the mouse is configured to indicate a start position as an edge position by making two successive activations of the *mode sensor* within a predetermined time period. In a further embodiment, any subsequent *swipe* gesture is provided as movement of a finger from the start position such that a *swipe* in the left, right, up or down direction will be interpreted as a finger swipe inwards, respectively from the right, left, bottom or top screen edge. Thus, the mouse may be used to make screen-edge gestures by first double tapping the *mode sensor*.

According to another aspect of the present invention, there is provided a computer mouse as aforementioned and configured to reposition an on-screen pointer to a 'start' position after a *swipe* gesture when the computer mouse is in the *touch mode*.

Preferably, the pointer is repositioned when the pointer reaches a predetermined portion of the screen. Preferably, said predetermined position is a position within a threshold distance of the edge of the screen and more preferably is within 10% or 5% distance of the screen edge.

In one embodiment, the computer mouse may be configured to reposition an on-screen pointer to the 'start' position after a *swipe* gesture travels a predetermined length and more preferably a predetermined proportion of the screen. In a further embodiment said predetermined proportion is at least 30% and more preferably at least 50%.

In a further embodiment the proportion or threshold distance may be device-dependent, application-specific or set by a user.

In one embodiment the computer mouse is configured to reposition an on-screen pointer to the 'start' position after a *flick*, *scroll* or custom gesture.

The repositioning of the pointer is effected by the computer mouse detecting the *swipe* gesture, determining whether the pointer needs to be repositioned and sending a subsequent data signal indicating the 'start' position for the pointer to be displayed at.

Thus a user can operate the computer mouse in a more similar manner to using a finger or stylus than a conventional mouse as the on-screen pointer can be re-centred after a gesture without tracking back over the screen, registering as a reverse *swipe* or requiring the user to manoeuvre the computer mouse back to a start position.

In one embodiment the computer mouse is configured to deactivate and/or hide on-screen pointer movement when in the *touch mode*, the on-screen pointer respectively remaining in a

static position or no longer be displayed while the mouse remains in the *touch mode*. Thus, a user may operate the computer mouse in the *touch mode* without visible interference from the on-screen pointer / mouse cursor.

The lower surface preferably has a base contact plane formed from one or more portions or points of contact. The lower surface does not need to be a continuous planar surface and may instead include multiple projections, ridges or other protrusions having contact points forming a common base contact plane. The base contact plane may include surfaces, projections or combination of surfaces/projections capable of forming a contact plane for being placed in contact with a work surface to support the computer mouse in an 'upright' orientation.

The base and upper may be formed as one continuous component or formed from separate connectable components. The base is herein defined as the portions of the mouse forming the lower extents (with respect to a reference upright position) of the device.

Preferably, said upper body includes a spine portion projecting from the base.

In a further embodiment the upper body may include finger engaging surfaces on either side of the spine such that a user may grip the computer mouse by pinching the spine between a finger and thumb.

In a further embodiment the computer mouse includes:

- a spine portion, projecting substantially upward from said base portion and having a thumb-engaging surface on a first lateral side of the spine,

- at least one index fingertip and/or middle fingertip-engaging surface on a second lateral side of the spine opposing said first lateral side.

In a further embodiment the computer mouse includes a thumb-retaining portion, associated with said thumb-engaging surface and capable of retaining a user's thumb during use such that the device is capable of being moved by solely lateral movement of the thumb in a direction away from the spine,

Preferably, the upper body includes at least one contact sensor and more preferably includes at least two contact sensors.

Preferably, one contact sensor is aligned in front and below the other.

Preferably, both contact sensors are positioned on single fingertip-engaging surface on an upper portion of the spine. In a further embodiment the rear contact sensor protrudes from the

spine to a greater extent than the front contact sensor.

According to one aspect of the present invention, there is provided a computer mouse configured for use with a touch-screen operated computer, said computer mouse including:

- a base adapted for sliding over a work surface;
- an upper body extending upward from the base;
- at least one contact sensor on the upper body;
- a movement sensor system for detecting device movement;
- a communication system for transmitting data signals to the computer, said data signals indicating said detected device movement;

wherein the computer mouse is configured to position a finger input point in a 'start' position after a device movement interpreted as a *swipe* gesture, said *swipe* gesture being a movement of the pointing device from a start position with said contact sensor activated.

Preferably, the contact sensor is a *mode sensor* protruding downwards from the base portion.

The device movement is preferably interpreted by the computer as a continuous fingertip or stylus movement over the touch-screen.

According to a first aspect of the present invention there is provided a device capable of being connected to a computer via a wired and/or wireless connection, the device including:

- at least one user input control for receiving user input to control the device;
- at least one writeable memory storing device configuration data, the device configuration data being read by the device to determine operational characteristics of the device;

characterized in that the device is capable of entering a *configuration mode* wherein the device is configured to:

- send signals to the computer upon receiving user input to the at least one user input control, the signals corresponding to keyboard key-presses, sequences and/or combinations thereof; and
- write data to said memory device to modify the device configuration data.

According to a second aspect, there is provided a method of configuring the aforementioned device using a computer, the method including:

- manipulating a said user input control to cause the device to enter the *configuration*

mode;

- opening a web browser on said computer and navigating to a network address corresponding to a configuration webpage for the device;
- manipulating a said user input control to alter the device configuration data, the web browser displaying a visual indication of the change to the device configuration data caused by the user input control manipulation.

According to a third aspect, there is provided a computer server configured to serve a configuration webpage for the device, the server configured to change Graphical User Elements (GUI) on said webpage in response to receiving keyboard key-presses, sequences and/or combinations thereof from the computer thereby providing a visual indication of the change to the device configuration data caused by the user input control manipulation

Preferably, the at least one user input control includes a button or contact sensor. Other user input controls may include switches, capacitive sensors, touch-screens, joysticks, trackballs, optical sensors, photoelectric sensors or any control mechanism capable of being manipulated by a user to provide user input.

Preferably, the memory is a non-volatile memory such as Flash memory, F-RAM or MRAM.

Preferably, the device is a computer mouse, such as a computer mouse, and includes multiple user input controls, including at least two buttons and an optical movement sensor. Preferably, the computer mouse includes a scroll wheel.

Preferably, the keyboard codes sent to the computer by the device are indicative of combinations of key-presses and more preferably indicate at least three simultaneous key-presses. Sending combinations of key-presses minimises the chance of the user input being interpreted by the computer as commands for other software applications. Thus, only the webpage will be capable of interpreting the key-press combinations.

Alternatively, the keyboard codes sent to the computer by the device are indicative of sequences of key-presses and more preferably indicate a sequence of at least three key-presses.

The aforementioned device in the *configuration mode* sends keyboard codes to the computer and these codes are interpreted by the webpage as inputs, e.g. a user may press a device button which transmits a unique keyboard code indicating a combination or sequence of keys pressed (e.g. AABB).

The webpage receives the keyboard code input and interprets it to indicate the user has issued

a selection command to select a device parameter change. The device also changes that same parameter as a result of that button press.

The aforementioned device thus avoids the need for special driver software or user interface as the vast majority of computers are already configured to operate with a keyboard and are capable of receiving standardised keyboard signal codes.

To avoid prolixity, reference herein is made to the device being a computer mouse, such as a computer mouse though this should not be seen to be limiting as any device that has user input controls, (e.g. buttons) may utilise the aforementioned configuration. Such devices for example may include web cameras, televisions, fridges, microwave ovens, other appliances, vehicle control systems, speaker systems, calculators, printers.

Brief Description of Drawings

Further aspects of the present invention will become apparent from the following description which is given by way of example only and with reference to the accompanying drawings in which:

- Figure 1 shows a computer mouse according to one embodiment of the present invention and a host computer;
- Figure 2a shows a rear elevation of the computer mouse of Figure 1;
- Figure 2b shows a rear elevation of the computer mouse of Figure 1 inclined to operate in a second *mode*;
- Figure 3a shows a partial section view of the computer mouse of Figures 1-2;
- Figure 3b shows a partial section of the computer mouse of Figure 3a inclined to operate in the second *mode*;
- Figure 4 is a schematic diagram of the optical system of the computer mouse of Figures 1-3;
- Figure 5 is a schematic diagram of an alternative optical system of the computer mouse of Figures 1-3;
- Figure 6 shows the underside of a computer mouse according to one preferred embodiment of the present invention;
- Figure 7 is a transverse cross-section of the computer mouse of Figure 6;

- Figure 8 is an isometric view of the computer mouse of Figures 6 and 7;
- Figure 9 is a cross-section through an optical sensor system of the computer mouse of Figures 6-8;
- Figure 10 shows a front elevation of the computer mouse of Figures 6-9;
- Figure 11a shows an enlarged view of a portion of the computer mouse of Figures 6-10;
- Figure 11b shows the enlarged view of Figure 11a with the computer mouse tilted to operate in the second 'gesture' *mode*;
- Figure 12 shows a perspective view of a computer mouse according to a second embodiment of the present invention;
- Figure 13 shows a front elevation of the computer mouse of Figure 12;
- Figure 14 shows another perspective view of the computer mouse of Figures 12 and 13;
- Figure 15 shows a side elevation of a computer mouse according to a third embodiment of the present invention;
- Figure 16 shows a rear elevation of the computer mouse of Figure 15;

Brief Description of Drawings

Further aspects of the present invention will become apparent from the following description which is given by way of example only and with reference to the accompanying drawings in which:

- Figure 1 shows a computer mouse according to one embodiment of the present invention and a host computer;
- Figure 2a shows a rear elevation of the computer mouse of Figure 1;
- Figure 2b shows a rear elevation of the computer mouse of Figure 1 inclined to operate in a second *mode*;
- Figure 3a shows a partial section view of the computer mouse of Figures 1-2;
- Figure 3b shows a partial section of the computer mouse of Figure 3a inclined to operate in the second *mode*;

- Figure 4 is a schematic diagram of the optical system of the computer mouse of Figures 1-3;
- Figure 5 is a schematic diagram of an alternative optical system of the computer mouse of Figures 1-3;
- Figure 6 shows the underside of a computer mouse according to one preferred embodiment of the present invention;
- Figure 7 is a transverse cross-section of the computer mouse of Figure 6;
- Figure 8 is an isometric view of the computer mouse of Figures 6 and 7;
- Figure 9 is a cross-section through an optical sensor system of the computer mouse of Figures 6-8;
- Figure 10 shows a front elevation of the computer mouse of Figures 6-9;
- Figure 11a shows an enlarged view of a portion of the computer mouse of Figures 6-10;
- Figure 11b shows the enlarged view of Figure 11a with the computer mouse tilted to operate in the second 'gesture' *mode*;
- Figure 12 shows a perspective view of a computer mouse according to a second embodiment of the present invention;
- Figure 13 shows a front elevation of the computer mouse of Figure 12;
- Figure 14 shows another perspective view of the computer mouse of Figures 12 and 13;
- Figure 15 shows a side elevation of a computer mouse according to a third embodiment of the present invention;
- Figure 16 shows a rear elevation of the computer mouse of Figure 15;

Best Modes for Carrying out the Invention

Reference numerals for the figures.

1	Mouse	41	<i>Mode sensor elevation</i>
2	Computer	42	Inclined edge
3	Base	43	Document
4	Lower surface	44	Start position
5	Work surface	45	End edge position
6	Feet	46	Start edge position
7	Base contact plane	47	End screen position
8	Upper body	48	GUI settings bar

9	Spine	49	Brightness
10	Thumb-engaging surface	50	Cancel
11	Finger-engaging surface	51	Webpage
12	Scroll wheel	52	Configure instructions
13	Index fingertip engaging surface	53	Menu
14	Front 'left' button	54	Feedback textbox
15	Rear 'right' button	100	Mouse – second embodiment
16	Image sensor	101	Base
17	Optical system	102	Upper body
18	<i>Mode sensor</i>	103	Left mouse button
19	Stop	104	Right mouse button
20	Indicator LEDs	105	Scroll wheel
21	PCB	106	Lower surface
22a	First prism	107	Base contact plane
22b	Second prism	108	Base supporting feet
23a	First prism input face	109	<i>Mode sensor</i>
23b	Second prism input face	110	Optical system
24a	First prism output face	111	Inclined side edge
24b	Second prism output face	112	Inclined front edge
25a	First prism reflecting surface	113	Inclined rear edge
25b	Second prism reflecting surface	200	Mouse – third embodiment
26	Lens	201	Base
27	Lens aperture	202	Upper body
28	Reorientation axis	203	Left mouse button
29	Three-state slider switch	204	Right mouse button
30	Magnetic dock	205	Scroll wheel
31	Charging dock connections	206	Lower surface
32	USB receiver	207	Base contact plane
33	Indicator LED	208	Base supporting feet
34	Display screen	209	<i>Mode sensor</i>
35	Optics light source	210	Optical system
36	<i>Mode sensor</i> lever	211	Inclined side edge
37	Focus distance - base contact plane to sensor	212	Inclined front edge
38	Focus distance – maximum second orientation	213	Inclined rear edge
39	Focus distance – nominal second orientation		
40	Source light directing prism		

Figures 1-11 show a computer mouse (1) according to one preferred embodiment of the present invention. The mouse (1) is connectable to a computer, shown in Figure 1 as a tablet computer (2) with a touch-screen (34).

Preferred embodiments of the present invention are particularly suited to touch-screen computers such as tablets, smartphones or computers with operating systems configured to interpret touch events. However, it should be appreciated the present invention may have useful applications for use with desktops, laptops, notebook computers, televisions, games consoles, navigation systems, augmented reality systems or indeed any computer.

The mouse (1) has a body including a lower base (3) portion with a lower surface (4) configured for sliding across a work surface (5), e.g. a desk, table, book, laptop palm-rest or other surface. The lower surface (4) has a plurality of supporting projections (6) (hereinafter “feet”) with lowermost portions contacting the work surface (5) collectively forming a base contact plane (7). The feet (6) are provided to support the mouse (1) in a stable orientation while minimising friction as the mouse moves over the work surface (5). The feet (6) are thus shaped, sized and arranged accordingly.

The mouse (1) in these embodiments is elongate along a longitudinal axis (Y) with respect to

an orthogonal lateral axis (X) as shown in Figure 6.

An upper body (8) extends upwards from the base (3) and has a spine (9) with a thumb-engaging surface (10) on one lateral side of the spine (9) and a finger-engaging surface (11) on the opposite lateral side. The finger-engaging surface (11) is shaped and positioned to allow the user to place a middle, ring and/or little finger on it with the thumb on the opposite side of the spine (9), the mouse (1) thus being held in a pinch-grip akin to a pen-grip. Buttons (14, 15) and scroll wheel (12) may thus be manipulated by at least the index finger. The spine (9) thus has an index fingertip-engaging surface (13) on top of the spine (9).

A scroll-wheel (12) is provided on the forward portion of the mouse (1) and is elevated from the base contact plane (7) to prevent wheel rotation during planar mouse movement. The scroll-wheel (12) may be used either by the user rolling a finger over the scroll-wheel (12) or by tilting the mouse (1) forward and to the right (for a right-handed mouse) so that the scroll-wheel (12) makes contact with the work surface (5). The scroll wheel (12) rotates due to frictional contact with the work surface (5) as the user moves the scroll wheel (12) over the surface (5). The scroll-wheel (12) is also frustoconical so that when tilted the circumferential outer surface is roughly parallel with the work surface (5) thereby maximizing contact surface area and friction.

To aid clarity, we herein define the base (3) as being the portion of the mouse (1) below the finger-engaging surfaces (10 and 11) and button (14). The base (3) thus demarcated from the upper body (8) by a mutual boundary extending about the lateral periphery of the mouse (1) at the lower edges of the finger-engaging surfaces (10, 11). The finger-engaging surfaces (10 and 11) are thus defined as part of the upper body (8). The buttons (14, 15) are also positioned on the upper body while the scroll wheel (12) extends over both the base (3) and upper body (8) but is typically mounted with the rotation axis through the upper body (8). It will be appreciated that the mouse base (3) and upper body (8) may be formed as separate connectable components, formed as a unitary body or formed from multiple components. Reference herein is made to separate components for clarity, though this should not be seen as limiting.

The mouse (1) has an internal battery capable of being charged through a dedicated charger or the USB receiver (32) which couples with a magnetic dock (30) and two electrical contacts (31) on the base (3) of the mouse. The mouse (1) is also configured to automatically pair with a particular computer USB receiver (32) when it is docked with that USB receiver (32) thus enabling different mice to be used with different USB receivers than the receiver paired with a mouse at manufacture.

An indicator LED (33) is positioned on the top of the spine (9) and is used for various indications, e.g. battery state and ON – CONFIGURATION states or other indications.

The embodiment illustrated in figures 1-11 shows a mouse (1) optimised for use by a right-handed user though it will be appreciated a mouse may be created for left-handed use by creating a mirror image of the mouse (1).

Contact sensors are provided in the form of front (14) and rear (15) depressible buttons located on the upper portion of the spine (9) forming the index fingertip-engaging surface (13). The front button (14) is configured to perform 'left' click actions and is positioned forward and below the rear button (15) which is configured for 'right' click actions. The provision of the front (14) and rear (15) buttons on a single finger-engaging surface minimizes the space required and thus allows a smaller mouse to be created with the same functionality as a larger mouse with laterally arranged buttons. However, as a finger curls to click a rear button, the fingertip naturally raises and so if the buttons were at the same level the rear button would require an uncomfortable movement to operate. The rear button (15) is thus raised and rearward so that a user can comfortably operate both the front (14) and rear (15) buttons with different parts of the same finger, typically the index finger.

Reference herein is made to contact sensors and movement sensor systems being "activated" and "deactivated" to refer to the state of a contact sensor, button or the like being actuated or turned on (activated) and then released to return to its original state (deactivated). It should be understood that this reference is to describe two alternative states or functions of the component and "deactivation" should not be interpreted as a complete deactivation of the button.

The mouse (1) is a small, highly manoeuvrable mouse measuring less than approximately 6cm long by 4cm wide by 3.5cm high. The spine (9) is less than 2cm wide at its widest point and tapers to a narrow portion of less than approximately 1.5cm. Such a small mouse (1) enables the user to easily grip the spine (9) between thumb and middle finger (or ring finger) in a pen-grip style enabling the index finger to operate both buttons (14, 15).

The embodiments illustrated in figures 1-11 further include a movement sensor system provided in the form of an optical movement sensor system (17) capable of detecting relative movement between the mouse (1) and work surface (5).

The optical movement sensor system (17) includes a light source (35) configured to illuminate the work surface (5) and an image sensor or array (16) configured to receive reflected light from the work surface (5) to capture an image of the work surface (5). An image processing chip compares successive captured images to determine the direction and degree of device movement. The image sensor (16) may be of a known type such as an active pixel sensor imager CMOS type. Such image sensors (16) are known for use with computer mice and are

typically used in conjunction with an LED or laser light source (35) that illuminates the supporting surface sufficiently for optical detection of mouse movement. The LED, laser or other light source (35) is located in the base (3) and the light therefrom is directed to illuminate the area below the optical system (17).

The relative movement over a support surface as detected by the optical movement sensor system (17) may be used to generate movement data signals to be passed to the computer (2) to instruct the computer to display movement of an on-screen GUI element such as an on-screen mouse pointer. Typically prior art mice provide the computer with movement data signals provided as a vector, e.g. direction 4x, 5y at speed v. However, the mouse (1) is configured to use the movement data and a known 'start' location to determine a coordinate location within the corresponding display screen (34). The coordinates for example are given as X and Y coordinates corresponding to a position relative to the edges of the 2D area. These coordinates are given as a percentage rather than an absolute coordinate (e.g. pixel coordinate) so that the mouse can be used with any size screen or resolution. A centre position is thus given as X50%, Y50% while an upper-left corner position may be X10% Y90%. The use of position data rather than just movement data can be used to provide enhanced functionality when used with touch-input operating systems and will be discussed more fully below.

The movement data signals, position data signals, contact sensor signals and scroll-wheel data signals generated by the mouse may be transmitted to the host computer (2) by a communication system using any convenient electrical transmission means and in preferred embodiments includes a wireless Radio Frequency (RF) chip capable of supporting both Bluetooth™ and USB wireless standards. The use of both Bluetooth and USB wireless protocols allows the mouse (1) to be used with computers only having Bluetooth capability as well as those without Bluetooth capability but capable of accepting a USB receiver (32). The USB receiver (32) is preferably a micro-USB receiver for improved compatibility with mobile devices which increasingly use micro-USB as a standard interface, though of course any suitable connector may be used. The mouse (1) includes internal control circuitry including a Printed Circuit Board (PCB) and a non-volatile memory (not shown). The memory stores configuration data relating to first and second operational *modes* and any other component configurations, e.g. for the buttons, scroll-wheel, image sensor, communication protocols, indicator LEDs (20) and the like.

A *mode sensor* (18) is provided in the base (3) and has a projection extending from the base (3) toward the base contact plane (7). The *mode sensor* (18) in the embodiments shown in figures 1-11 is shaped as a small protruding nib or dome. However, it will be appreciated the shape may be varied in shape depending on the mouse size and configuration.

The mouse (1) of the present invention provides enhanced functionality over prior art mice by being capable of operating in two different *modes*.

The mouse (1) is configured to operate in a first "*pointer*" *mode* when in a first orientation (see Figures 2a, 3a, 7, 10, 11a) with the base contact plane (7) in contact with the work surface (5) and can be pivoted (and optionally lifted) to a second orientation (see Figures 2b, 3b, 11b) with the base contact plane (7) inclined relative to the work surface (5) such that the mode sensor (18) contacts the work surface (5) and initiates a second "*touch*" *mode*. The mode sensor (18) includes a switch, button, toggle or the like on it's distal end that can be actuated to trigger the mode *change* due to contact and/or increased pressure from the work surface (5).

In the embodiments shown in the drawings the *mode sensor* (18) is capable of initiating two *modes*, i.e. first *mode* and second *modes*. However, it will be appreciated the *mode sensor* could be configured to initiate more or different *modes* depending on the mouse configuration.

It will be appreciated that users may manipulate the mouse (1) differently according to their preferences. Typically the reorientation is effected by lifting and tilting the mouse (1) until the *mode sensor* (18) contacts with the work surface (5). This movement is caused by finger and/or wrist manipulation to rotate and tilt the mouse (1) slightly backwards. This movement results in a predominantly clockwise rotation of the mouse (1) for a right handed user and anticlockwise rotation for a left-handed user, with backward tilt and potential lift in both cases. Once in the second *mode* the mouse may be tilted about the *mode sensor* (18) in any direction with the *mode sensor* (18) acting as the only point of contact with the work surface (5), the *mode sensor* (18) thus acting as a pivot point.

The *mode sensor* (18) is positioned to prevent switching to the second *mode* until the mouse (1) is inclined past a threshold angle. Ideally, the threshold angle is a minimal inclination allowing the user to easily activate the second *mode* without excessive mouse manipulation. However, if the threshold angle is too small it may be too easy for the *mode sensor* (18) to be inadvertently contacted during mouse movement in the *pointer mode* thereby inadvertently switching to the second *mode*. Thus, a compromise must be made to minimise the threshold angle while minimising the risk of inadvertent switching between *modes*.

The threshold angle in preferred embodiments is an inclination of the base contact plane (7) from the work surface (5) of between five and ten degrees. In the embodiments shown in figures 1-5 the threshold angle is five degrees and in figures 6-12 is seven degrees.

Reference is made herein to the second orientation in the singular though it will be appreciated the second orientation can be any orientation within a particular range. Reference to the

“second orientation” should thus be understood to refer to any orientation within a “second orientation range”. The *touch mode* reorientation range is defined as the angular three-dimensional range between the second *mode* threshold angle and a maximum angle where either:

- a) the movement sensor system can no longer detect relative movement between the mouse (1) and work surface (5), or
- b) the mouse (1) cannot be rotated further, e.g. if work surface (5) contacts a portion of the mouse (1) or the user is physically incapable of rotating further.

The second *mode* reorientation range is typically between five degrees and fifty degrees inclination from the work surface (5) as shown in the embodiment of figures 1-5 or between approximately seven to thirty degrees in the embodiment shown in Figures 6-12.

With respect to Figures 3a and 3b the angle of inclination in the second orientation may be up to thirty-five degrees at which point a stop (19) contacts the work surface (5) preventing further rotation. In an alternative embodiment (see Figure 2) the stop (19) may be positioned to allow a fifty degree inclination before contacting with the work surface (5). It will be appreciated that while the stop (19) may provide useful tactile feedback indicating an inclination limit it is not necessary and the mouse (1) may alternatively be shaped to allow further free rotation.

Figure 7 shows an embodiment with a nominal or optimum inclination (ϕ) measured from vertical as seventy degrees, i.e. a base contact plane inclination of twenty degrees from the work surface. The maximum inclination (ϕ) before contacting stop (19) is sixty one degrees i.e. a base contact plane inclination of twenty-nine degrees from the work surface.

Figures 2 and 6-16 show the *mode sensor* (18) protruding from a portion (41) of the base (3) that is elevated from the base contact plane (7) in the first orientation (Fig 2a, 7, 10, 11a) and is activated by tilting and optionally lifting the mouse (1) into the second orientation (Fig 2b, 11b) to depress the *mode sensor* (18) and initiate the *touch mode*.

The *mode sensor* (18) protrudes downwardly from the base (3) to such an extent that when the mouse (1) is reoriented past the threshold angle the *mode sensor* (18) becomes the only point of contact with the work surface (5). The *mode sensor* (18) can thus be used as a small point of contact with the work surface (18) enabling very precise control by the user, akin to a stylus nib.

The *mode sensor* (18) is formed as a depressible switch with an outer contact surface of Teflon® or other hard-wearing low-friction material for contacting and moving across the work surface (5). The *mode sensor* (18) is connected to an end of a lever (36) with a distal end configured to activate a switch or close a circuit on the circuit board inside the mouse (1, 100,

200).

The *mode sensor* (18) has a very small travel for activation relative to conventional buttons so that it is activated easily and doesn't produce an audible or tactile 'click' of a conventional button. Such a 'click' is ergonomically undesirable when moving the mouse (1) over the work surface (5) with the *mode sensor* (18) being the only point of contact as the user may apply uneven levels of pressure resulting in successive 'clicks'. It is important that the *mode sensor* (18) is easily activated with minimal pressure so that it can slide easily over the work surface (5) without requiring the user push the mouse downwards which may result in significant strain on the user's hand.

The *mode sensor* (18) is also releasably connected to the lever (36) via a screw fitting to facilitate replacement of the *mode sensor* (18) if the distal end outer contact surface wears. It is also envisaged the contact end of the *mode sensor* (18) could alternatively be releasably attached via a snap-fit enabling replacement.

Optical movement sensor systems (17) for use in the mouse (1) are shown more clearly in Figures 4, 5 and 9. Each optical movement sensor system (17) must be configured so that the image sensor receives images capable of being used to detect relative movement between the mouse (1) and work surface (5) in both the first and second orientations. This enables the mouse (1) to provide movement and/or position data to the computer in both *modes*.

It is envisaged that two separate sensors may alternatively be used, each individually detecting movement in one of the two *modes* and the *mode sensor* (18) being used to switch the appropriate sensor on/off. Clearly, multiple separate sensors may be utilised for embodiments with multiple *modes*. However, using multiple sensors introduces attendant cost increases, complexity and potential for failure. Moreover, each sensor used to detect movement in one *mode* would need to be deactivated in the other *mode* to prevent battery drain or any interference with the other sensor.

An example of a suitable optical movement sensor system (17) is shown in Figure 4 and includes two identical polycarbonate prisms (22a, 22b), with a lens (26) and aperture stop (27) therebetween. The first prism (22a) has an input face (23a) for receiving light from the work surface (5), an output face (24a) and a reflecting surface (25a). The light from the reflecting face (25a) then passes to the output face (24a). The second prism (22b) also has an input face (23b), output face (24b) and total internal reflecting surface (25b). The lens (26) and associated aperture (27) are positioned between the first prism output face (24a) and the second prism input face (23b). The image sensor (16) is mounted on the PCB (21) and receives light from the output face (24b). The first prism input face (23a) is inclined from the base contact plane by

approximately 22 degrees and the reflecting surface (25a) is inclined at 55 degrees to the input face (23a) to ensure total internal reflection and direct the light to the lens (26). The double-prism optic system thus ensures that the light reflected from the work surface (5) is received by the image sensor (16) in focus in both the first and second orientations. It is important for the image sensor (16) to receive focused light reflected from the work surface (5) in both the first and second orientations so that the relative movement of the mouse (1) over the work surface (5) can be determined in both the first and second *modes*.

An alternative embodiment is shown in Figure 5 and is generally similar to the arrangement of Figure 4 but with the lens (27) formed on the first prism output face (24a) and second prism input face (23b).

The embodiments shown in the drawings are exemplary arrangements for the optical movement sensor system (17) and alternative optical systems for use in the mouse (1) are possible, including lens arrangements with at least one lens (26) inclined from the base contact plane (7) and/or the image sensor (16) itself may be inclined, e.g. being mounted on an inclined PCB. In one example, the optical system may have two prisms and lens components formed as a unitary body. The optical system (17) may thus take any form as long as it directs substantially focused light onto the image sensor (16) in both the first and second orientations.

A preferred optical movement sensor system (17) is shown in Figure 9 and instead of using the inclined surfaces of Figures 4 and 5 the optical system (17) is configured with components to provide a sufficiently large depth of field enabling the mouse (1) to detect relative movement between the mouse (1) and work surface (5) in both the first and second *modes*.

The optical system includes a light source (35) passing light to a prism (40) which redirects the light to a focal zone beneath a receiving lens (26), aperture (27) and optical sensor (16). The optical sensor (16) and light source (35) are mounted directly to the circuit board (21) which extends in a plane parallel with the base contact plane (7) with the light source (35) emitting light perpendicularly to the circuit board (21). The prism (40) is thus provided to reorientate the light to illuminate the region below the lens (26b).

In this embodiment the depth of field is 0.88mm +/- 20% with minimum focal distance from the lower lens surface (26b) to the work surface (5) of 1.46mm +/- 10% and maximum at 2.34mm +/- 10% with an optimal focal distance at 1.78mm between lower lens surface (26b) and work surface (5). It should be appreciated that these are exemplary dimensions and the optical system (17) may be modified to suit different sized and shaped mice as long as the optical sensor (16) receives images of sufficient optical resolution, i.e. of sufficient degree of focus in both the first and second orientations to detect relative changes and thus mouse movement.

The depth of field is determined by various system parameters, including lens aperture diameter, magnification, focal distance, distances between lens, aperture and sensor, sensor size/resolution and tolerances. The lens (26) shown in Figure 9 is asymmetrical with a 0.37mm thick lens with the upper surface (26a) having a larger radius of curvature than the lower side (26b), an aperture diameter of approximately 0.3mm, lens distance to sensor of 0.88mm. The focal zone or area has a diameter of 1mm.

It is preferable to arrange the optical movement sensor system such that the focal zone is at, immediately adjacent, or close to the *mode sensor* (18) to minimise the change in lens-to-surface distance between the first and second orientations, thereby minimising the depth of field required to ensure the mouse optics can receive a sufficiently focused image in both orientations.

It will be understood that the optical movement sensor system may be positioned further away from the *mode sensor* (18) and still function in both *modes* by using an optical movement sensor system with a larger depth of field or an image sensor with greater tolerance for low-resolution images. However, a larger the depth of field leads to the mouse still detecting movement when it is lifted away from the surface in the *pointer mode*, which as described previously is undesirable as the user may find it difficult to lift and reposition the mouse without providing pointer movement input to the screen. The need to deactivate pointer movement when the mouse (1) is lifted in the *pointer mode* restricts the maximum depth of field that can be used. Typically, a depth of field is provided to prevent pointer movement when the mouse base contact plane (8) is lifted a few mm and typically less than three millimetres. Thus, the optical movement sensor system (17) is positioned sufficiently close to the *mode sensor* (18) to detect mouse movement in both *modes* within this restricted depth of field.

It will be appreciated that alternative optical systems may be utilised with suitable optimisation of components to ensure the mouse (1) can detect movement in both orientations.

The first operation *mode* in preferred embodiments is a '*pointer mode*' where movement and/or position data signals indicating movement of the mouse (1) results in pointer movement on the display screen of the host computer (2), i.e. akin to a conventional mouse-computer operation.

The second *mode* or '*touch mode*' is activated when the base contact plane (7) is in a second orientation inclined and/or lifted with respect to the first orientation such that the *mode sensor* (18) is forced against the work surface and actuated accordingly. In the *touch mode*, movement detected by the optical system (17) generates data signals interpretable by the computer as *touch events*.

A *touch event* is a term used herein to describe an event interpreted by the computer as a touch on an equivalent touch-screen or a mouse/keyboard command used to provide equivalent commands. Windows 8 for example is capable of registering touch events and performing various functions in response. Another example may include Android OS devices that are configured to register a mouse left click as equivalent to a *touch event* and subsequent movement as a *swipe touch* event. As aforementioned, *touch events* generally fall within one of the following types: *tap*, *long press*, *swipe*, *drag*, *flick*, *scroll*, *pinch*, *spread* or *rotate*.

A “*swipe*” gesture is a type of user command representing movement of a finger across a touch-screen and typically results in movement of GUI elements such as GUI pages, icons, text, screens or windows. The *swipe* gesture is one of the primary control methods for tablets, mobile phones and other touch-screen computers. Typical *swipe* movements include *pan* (vertical and/or horizontal movement), *scroll* (vertical movement) and *flick* (rapid vertical or horizontal movements). The *swipe* gestures may also include custom gestures such as shapes, alphanumeric characters, symbols or patterns, thereby providing additional controls and potential commands.

An activation of the *mode sensor* (18) is not only used to activate the second mouse operating *mode* but is also used to signify a *touch event* to the computer (2) at a position indicated by the movement sensor (17). Thus, in the second *mode*, the mouse (1) may operate in an analogous manner to a finger operating on a touch screen, providing finger touch and movement equivalents.

In the second *mode*, the mouse movement over the work surface (5) detected by the image sensor (16) is received by the computer (2) as a *swipe* input thereby providing *swipe* touch-screen commands to the computer (2).

The second *mode* may also be application-specific, e.g. in a drawing application the second *mode* could be a *drawing mode* where the movement data signals are interpreted by the computer (2) as movement of a computer software drawing element such as a digital pen, brush or the like.

Similarly, in Computer Aided Drafting (CAD) software the second *mode* may be a *rotation mode* where the movement data signals are interpreted by the computer (2) as 3D rotation or other parameter.

The *touch mode* may also be useful to control computer operating systems that are not touch-optimized and can be used for example to provide BACK and FORWARD keyboard commands or the *mode sensor* (18) activation may be communicated to the computer as a conventional

mouse MIDDLE BUTTON CLICK thereby activating a panning *mode*. Alternatively, activation of the *mode sensor* (18) may be interpreted as a RIGHT CLICK so that the *touch mode* can be used in software applications that are preconfigured for mouse gestures, e.g. Google Chrome, Firefox.

Figures 12-14 show another mouse according to a preferred embodiment of the present invention. This mouse (100) is much larger (approximately 12cm by 6cm by 4cm) than the first embodiment and has a more conventional palm-grip type upper body (102).

The mouse (100) also has a scroll wheel (105) and two contact sensors provided in the form of left (103) and right (104) mouse buttons. Supporting feet (108) form a base contact plane (107) and are used to support the mouse as it slides over a work surface.

The mouse (100) has a *mode sensor* (109) positioned to protrude downward from the base (101). An optical movement detection system (110) is provided and configured to provide a focal zone at or very close to the *mode sensor* (109). The optical system (110) has a similar arrangement to the first mouse embodiment (1) as shown in Figure 9 and is capable of detecting mouse movement in both first (Figure 13) and second (Figure 14) orientations.

The base (101) has a right side portion (111) and forward portion (112) of the underside (106) inclined upward from the base contact plane (107). The underside chamfers (111, 112) provide clearance permitting the mouse (100) to be reoriented to the right and/or forward to activate the *mode sensor* (109) without interference from other parts of the base (101).

A mouse (200) according to a third embodiment is shown in Figures 15 and 16 and has the same components and general shape as the mouse of Figures 12-14, i.e. the mouse (200) has a scroll wheel (205) left (203) and right (204) mouse buttons, supporting feet (208) forming a base contact plane (207) and an inclined right side portion (111)

The mouse (200) differs to mouse (100) in that the *mode sensor* (209) is located toward the rear of the mouse (200) and the mouse has an inclined rearward chamfer (212) to allow the user to tilt the mouse backwards and to the right, rather than forwards and to the right as in the previous embodiment (100).

The mice (100, 200) provide a more conventional 'desktop' palm-grip shape but provide the same functionality as the smaller mouse (1) through use of two different operating *modes*, the second *mode* activated by reorientating the mouse to activate the *mode sensor* (109, 209).

A touch-based input operating system typically has no need for an on-screen pointer as the user has natural hand-eye coordination with their fingertips over the touch surface. However,

when using a mouse the user is typically looking at the display screen and not the mouse which makes coordination difficult without an on-screen pointer being displayed to represent the relative mouse position. Computers are thus typically configured to display on-screen pointer or other appropriate GUI element to provide the user with a visual indication of a position of the mouse (1).

The on-screen pointer is active and displayed in at least the first *mode* and the mouse (1) is configured to provide pointer coordinates to the computer (2) corresponding to mouse movement. However, in the second *mode* with the *mode sensor* activated the computer (2) will interpret the mouse (1, 100, 200) as providing touch events, thus, the on-screen pointer is not visible in the second *mode*. In this case, the invisible pointer will be referred to as a “*finger cursor*” representing emulation of a finger in contact with a display screen or touchpad.

The position for a *touch event* is determined by the mouse (1, 100, 200) as a relative location from a “start” position defined as a point where the second *mode* was initiated or alternatively from a predefined start point set when the computer starts or the mouse is connected e.g. typically the centre of the screen i.e. coordinate X50% Y50%. Subsequent movement is given relative to this start position.

Touch events are thus registered when the mouse is in the second *mode*, brief contact of the *mode sensor* with work surface is registered as a *tap touch event* as the mouse switches briefly to the second *mode* then returns to the first *mode*. The *mode sensor* can be held down against the work surface (5) to provide a *long-press touch event* or can be held down and moved to provide a *swipe touch event*. *Pinch* or *spread touch events* may be provided by rotating the scroll wheel (12) forwards or backwards when in the second *mode*.

The end of a *swipe* gesture may be registered as the mouse (1) registered that has reached the edge of the corresponding screen e.g. a coordinate within 10% of a screen boundary. After the end of such a *swipe* gesture the mouse (1, 100, 200) is configured to register a subsequent *touch event* at a restart position, i.e. the current touch event is stopped and another made at the restart position. This ‘resetting’ of the touch position after *swipe* gestures allows the user to avoid having to return the mouse (1, 100, 200) to its initial position to start another gesture, instead the user may make a continuous movement which is interpreted by the computer as multiple *swipe* gestures. This configuration is useful in providing intuitive finger-style navigation for multiple *flicks* or panning large distances, thus providing a form of infinite scrolling/panning.

Figure 17 shows a computer (2) with a display screen (34) displaying portions (43a, 43b) of a multi-page document (43). The dotted rectangle (43) represents an initially displayed page of the document.

The user may activate the *touch mode* by tipping the mouse (1, 100, 200) to activate the *mode sensor* (18, 109, 209) which is interpreted by the computer as a *touch event* at the start position (44). Subsequent movement of the mouse (1, 100, 200) to the left is interpreted as a *swipe* gesture to the left to an edge position (47) thereby causing movement of the GUI elements to the left, i.e. document page (43a) moves left to display the next document page (43b). The speed of movement is also detected and translated to the corresponding speed of movement of the GUI elements.

When the mouse (1) is moved further to the left and determines it is further left than the edge position (45), the mouse (1, 100, 200) sends a signal to the computer indicating the an end of that *touch event* and a new *touch event* at a restart position (44) i.e. indicating to the computer a touch at the restart/start position (44). Further movement of the mouse (1, 100, 200) leftwards repeats the procedure allowing the user to make a continuous movement to the left which is interpreted by the computer as multiple leftward *swipes*. This action displays successive pages of the document (43) in a continuous pan. The user is thus not required to cycle the mouse (1, 100, 200) from right to the left as would be the case using a conventional mouse with a touch screen.

The mouse (1, 100, 200) is also configured to indicate a start position as a screen edge by making two successive *touch events*, e.g. a *tap touch event* followed by a *swipe touch event* within a predefined time period. The direction of the *swipe* gesture will then be used to infer which screen edge the start position is located and is thus interpreted as a *swipe* gesture from that screen edge, e.g. a *tap* followed by a *swipe* in the left, right, up or down direction will be interpreted as a *swipe* inwards from the right, left, bottom or top screen edge respectively. The mouse (1, 100, 200) can thus be used to quickly create edge *swipe* gestures without requiring the user to first move the mouse (1) to the corresponding screen edge.

Figure 18 shows a *mode sensor* (18, 109, 209) *tap* followed by a left *swipe* gesture which is interpreted by the computer (2) as a *swipe* starting at the edge 'start' position (46) on the right hand side of the screen (34) to an end position (47) toward the centre. This causes a settings bar (48) to be displayed with "brightness" (49) and "cancel" (50) GUI elements.

Other 'start' positions may be utilised depending on the application or user configuration.

The mouse (1, 100, 200) may also be configured to emulate various touch gestures through different combinations of buttons and/or *touch events*. As an example, the common 'pinch-to-zoom' gesture may be provided by activating the rear contact sensor (15) when in the *touch mode* which causes the mouse (1) to register two finger inputs at a preset distance apart, a subsequent *swipe* gesture to the left will then indicate a *pinch* causing a zoom-in while a *swipe*

to the right will indicate a *spread* causing a zoom-out.

The mouse (1) includes a three-state slider switch (29) on the PCB (21) that a user can operate to switch the mouse (1) between, ON, OFF and CONFIGURE *modes*, respectively turning the mouse on, off or allowing the mouse firmware to be configured, such as modifications or updates.

Instead of using driver software installed on the computer to change mouse settings, the mouse (1, 100, 200) is capable of being modified when in the *configure mode* through a sequence or combination of button presses and/or scroll wheel movements that change device configuration data stored in an onboard flash memory in the mouse (1, 100, 200). The device configuration data controls how the mouse (1, 100, 200) operates and, through being stored in memory, the user's settings are carried with the mouse (1, 100, 200) and are computer-independent. Examples of mouse settings that may be changed include button function, mouse acceleration settings, LED settings, optical system settings, *touch event* settings or any other mouse setting.

Figure 19 shows an exemplary webpage (51) for use in the *configuration mode* of the mouse (1, 100, 200) or any configurable device. The webpage (51) includes instructions (52) on how to navigate using the mouse controls, a menu GUI (53) indicating the mouse settings (in this case fruit types are used) and a textbox (54) that displays confirmations and/or assistive text.

The device is configured to send signals to the computer indicating combinations of keyboard key-presses which are interpreted by the receiving computer (2) as navigation and/or selection commands on the webpage (51) in an internet browser software application displayed by the computer (2).

The webpage (51) thus enables the device settings to be configured without requiring specific driver software or applications on the computer (2). The device can thus be used and configured on any keyboard compatible computer (2) without requiring software driver installation or other computer configuration. The use of onboard memory ensures that the settings a user chooses when configuring the device are carried with the device and not dependent on the computer (2) being used.

The device (this may be a mouse (1, 100, 200) or any configurable device) when entering the *configuration mode* is configured to initially send a key sequence that is a unique four character ID. The first two characters are used by the server serving the webpage (51) to identify the device and the last two characters indicate the appropriate menu to display. Example key sequences and their associated devices are displayed in Table 1.

Table 1.

Key Sequence	Text	Parent Key	Helper Text
D101	Mobile Gesture Mouse	0000	
D1A1	FOOD	D101	
D1A2	ANIMALS	D101	
D1A3	CARS	D101	
D1B1	VEGES	D1A1	
D1B2	MEATS	D1A1	
D1B3	FRUITS	D1A1	
D1C1	BANANAS	D1B3	
D1C2	APPLES	D1B3	
D1C3	PEARS	D1B3	Pears are good for you
D1C4	ORANGES	D1B3	
D1C5	LEMONS	D1B3	

While in the *configuration mode* the device will only send Key Sequence codes to the computer in the format AAAAN, where AAAA is any four character key code, N is 0 or 1 (0 means 'navigate to', 1 means 'set to 'ON'), the comma is the end delimiter. All other device events (e.g. clicks, scrolls, keystrokes, mouse movement, and gestures) will be 'muted' such that no signals are sent to the computer.

The following example of this device configuration is made using a mouse (1, 100, 200).

The mouse (1, 100, 200) sends an initial code of D1B21 indicating a mouse device and displaying "MEATS" menu. The following menu is displayed.

D1B1- VEGES
D1B2- MEATS
D1B3 - FRUITS

When the user scrolls down or up, the device will respectively send the next (D1B3) or previous (D1B1) key sequence code in the current menu list. If there is no next or previous item in the list, no codes will be sent. The format used will be AAAA0, i.e. navigate to item AAAA.

When the user makes a left click the current menu item code will be sent in the format “AAAA1”, indicating that menu item is to be selected. In this example user scrolls down one unit and then left clicks, therefore sending codes D1B30 then D1B31 and selecting menu item FRUITS.

If the current menu item was a configuration ‘setting state’ it would not have any child menu items. In that case the webpage (51) would make the selected single menu item bold in the list.

The FRUITS item is not a settings value list and instead has child items as shown in the following table.

D1C1- BANANAS
D1C2- APPLES
D1C3- PEARS
D1C4- ORANGES
D1C5- LEMONS

On entering the FRUITS menu the device will send the menu item or setting code for that menu list as is stored on the device, i.e. indicating the stored setting on the device. In this example the stored setting was D1C31 which indicates PEARS setting. The user may then scroll up or down to select the menu item and then left click to select the item to change the setting.

In this example the user scrolls down one item (code D1C40) and left clicks (code D1C41), thereby changing the setting to ORANGES.

D1C1- BANANAS
D1C2- APPLES
D1C3- PEARS
D1C4- ORANGES
D1C5- LEMONS

The webpage will animate the left to right arrow GUI element on scrolling and then make D1C4 bold and centred in the list on the left click selection.

If the user makes a right button click the device will send a code indicating the parent menu in the format AAAA0, in this case, D1B30 (FRUITS) is sent which is the parent menu list of the fruit menu list currently shown.

The webpage will then animate the right to left arrow GUI element and make D1B3 bold and centred in the list.

D1B1- VEGES
D1B2- MEATS
D1B3 - FRUITS

The sequence of button presses and scroll wheel movements performed in the *configuration mode* can be used to trigger data writing, overwriting in the flash memory to change configuration data which controls how the mouse operates. In the example above, the user changed a setting from PEARS to ORANGES. This setting may for example have been swapping the front and rear mouse button functions.

In order for the aforementioned configuration system to function the device to be configured must be capable of being connected to a computer via a wired and/or wireless connection and include:

- at least one user input control for receiving user input to control the device;
- at least one writeable memory storing device configuration data, the device configuration data being read by the device to determine operational characteristics of the device;

wherein the device is capable of entering a *configuration mode* wherein the device is configured to:

- send signals to the computer upon receiving user input to the at least one user input control, the signals corresponding to keyboard key-presses, sequences and/or combinations thereof; and
- write data to said memory device to modify the device configuration data.

Aspects of the present invention have been described by way of example only and it should be appreciated that modifications and additions may be made thereto without departing from the scope thereof.

Claims:

1. A computer mouse for use with a computer, said computer mouse including:
 - a base with a lower surface configured for sliding across a work surface, said lower surface having at least one portion forming part of a base contact plane;
 - an upper body, extending from the base;
 - at least one contact sensor;
 - a movement sensor system, capable of detecting mouse movement relative to said work surface;
 - a communication system, for communicating computer-readable movement and/or position data signals from the device to a computer, said movement data signals indicating said detected mouse movement and said position data signals indicating a position of the mousecharacterised in that the mouse is configured to operate in a first and second *modes*.
2. A computer mouse as claimed in claim 1, configured to operate in
 - a first *mode* when orientated in a first orientation, and
 - a second *mode* when orientated in a second orientation wherein said base contact plane is inclined with respect to said first orientation.
3. A computer mouse as claimed in claim 2, wherein said movement sensor system is configured to detect device movement and/or position relative to said work surface in both the first and second *modes*.
4. A computer mouse as claimed in claim 3, wherein said movement sensor system is an optical movement sensor system including:
 - a light source configured to illuminate the work surface, and
 - an image sensor or array, configured to receive reflected light from said work surface to capture an image of the work surface, wherein successive captured images are compared to determine device movement.

5. A computer mouse as claimed in claim 4, wherein said image sensor or array is configured to capture an image of the work surface in both the first and second *modes*, wherein successive captured images are compared to determine device movement in both the first and second *modes*.
6. A computer mouse as claimed in claim 4 or claim 5, further including at least one *mode sensor* configured to initiate a said *mode*, wherein said light source is configured to illuminate the work surface at or adjacent said *mode sensor*.
7. A computer mouse as claimed in any one of claims 1-5, further including at least one *mode sensor* configured to initiate a said *mode*.
8. A computer mouse as claimed in claim 6 or claim 7, configured to operate in
 - a first *mode* when orientated in a first orientation, and
 - a second *mode* when orientated in a second orientation where said base contact plane is inclined with respect to said first orientation and a said *mode sensor* is configured to initiate said first or second *mode* when the mouse is in said first or second orientation respectively.
9. A computer mouse as claimed in any one of claims 6-8, wherein said *mode sensor* is configured to initiate said second *mode* when the *mode sensor* contacts the work surface.
10. A computer mouse as claimed in any one of claims 6-8, wherein the *mode sensor* is configured to initiate said second *mode* when the *mode sensor* is forced against the work surface.
11. A computer mouse as claimed in any one of claims 6-10, wherein the *mode sensor* includes a projection extending towards said base contact plane.
12. A computer mouse as claimed in claim 11, wherein the *mode sensor* projection is located above the base contact plane.
13. A computer mouse as claimed in any one of claims 11-12, wherein the *mode sensor* projection is releasably connected to the computer mouse.
14. A computer mouse as claimed in any one of claims 6-13, wherein the *mode sensor* projection has an outer contact surface for contacting the work surface, the outer contact surface being releasably connected.

15. A computer mouse as claimed in any one of claims 6-14, including a scroll wheel, the scroll wheel including said *mode sensor*.
16. A computer mouse as claimed in any one of claims 1-15, including at least one contact sensor located on the upper body, said contact sensor activated by a contact or force applied in a direction toward said base contact plane.
17. A computer mouse as claimed in claim 2, wherein said second orientation includes inclination of the base contact plane with respect to the work surface by at least 5 degrees.
18. A computer mouse as claimed in claim 2, wherein said second orientation includes inclination of the base contact plane with respect to the work surface of between 1 and 50 degrees.
19. A computer mouse as claimed in claim 18, wherein said second orientation includes inclination of the base contact plane with respect to the work surface of between 7 and 30 degrees.
20. The computer mouse as claimed in any one of claims 1-19, wherein said upper body includes a spine portion projecting upwards from the base.
21. The computer mouse as claimed in any one of claims 1-19, further including finger engaging surfaces on either side of the spine such that a user may grip the computer mouse by pinching the spine between a finger and thumb.
22. A computer mouse as claimed in any one of claims 1-21, configured to provide position data signals calculated using movement data of the pointing device as detected by the movement sensing system relative to a start position.
23. A computer mouse as claimed in any one of claims 1-22, configured in said second *mode* to provide *touch events* to said computer.
24. A computer mouse as claimed in claim 23, wherein said computer mouse is configured to translate said movement or position data signals into *touch events* corresponding to said movement and/or position.
25. A computer mouse as claimed in any one of claims 23-25, wherein said computer mouse provides said movement or position data signals to said computer and said computer is configured to translate said data signals into *touch events* corresponding to said movement and/or position.

26. A computer mouse as claimed in claim 24 or claim 25, configured to provide a *touch event* at a predetermined start position upon initiation of said second *mode* by said *mode sensor*, said computer mouse generating a position data signal corresponding to said start position.
27. A computer mouse as claimed in any one of claims 23-26, whereupon initiation of said second *mode* by a *mode sensor* said computer mouse is configured to generate a corresponding *touch event*.
28. A computer mouse as claimed in claim 27, whereupon after two successive *touch events*, the mouse is configured to provide position data signals to the computer indicating a start position for a *touch event* corresponding to an edge of a display screen connected to the computer.
29. A computer mouse as claimed in claim 28, configured such that any subsequent *swipe* gesture performed in said second *mode* after said successive *touch events* is provided as position and/or movement data signals indicating a *touch event* in a corresponding direction away from a given edge and wherein said given edge is inferred by said direction of said *swipe* gesture.
30. A computer mouse as claimed in any one of claims 23-29, wherein the computer mouse is configured to provide a position data signal indicating a *touch event* at a restart position after a device movement interpreted as a *swipe* gesture, said *swipe* gesture being a movement of the pointing device from a start position in said second *mode*.
31. The computer mouse as claimed in any one of claims 23-30, wherein the computer mouse is configured to provide data signals to the computer when the mouse moves to a predetermined position, said data signals including a data signal corresponding to an end of a *touch event*, followed by a position data signal indicating a restart position for a subsequent *touch event*.
32. The computer mouse as claimed in claim 31 wherein said predetermined position is within a threshold distance of an edge corresponding to an edge of a display screen connected to said computer.
33. The computer mouse as claimed in any one of claims 23-32, configured to reposition an on-screen pointer or *touch event* to a start position after a *swipe*, *flick*, *scroll* or custom gesture *touch event*.
34. The computer mouse as claimed in any one of claims 23-33, wherein the *touch events*

include a *tap*, *select*, *swipe*, *flick*, *scroll* or custom touch gesture.

35. A computer mouse as claimed in any one of claims 23-34, wherein a start position for a *touch event* is the position of an on-screen pointer when in said first *mode* before said second *mode* is initiated.
36. A computer mouse as claimed in any one of claims 23-34, wherein the start position is a position corresponding to a centre, corner or edge position of a display screen connected to said computer.
37. A computer mouse as claimed in any one of claims 23-36, wherein the first *mode* includes a *pointing mode*, and in said *pointing mode* said computer mouse is configured to generate said movement or position data signals indicating on-screen pointer movement or position respectively.
38. A device capable of being connected to a computer, the device including:
 - at least one user input control for receiving user input to control the device;
 - at least one writeable memory storing device configuration data, the device configuration data being read by the device to determine operational characteristics of the device;

the device capable of entering a configuration *mode* and configured to:

- send signals to the computer upon receiving user input to the at least one user input control, the signals corresponding to keyboard key-presses, sequences and/or combinations thereof; and
- write data to said memory device to modify the device configuration data as a result of user manipulation of a said user input control;

wherein the keyboard codes sent to the computer by the device are indicative of sequences and/or combinations of key-presses.

Figure 1

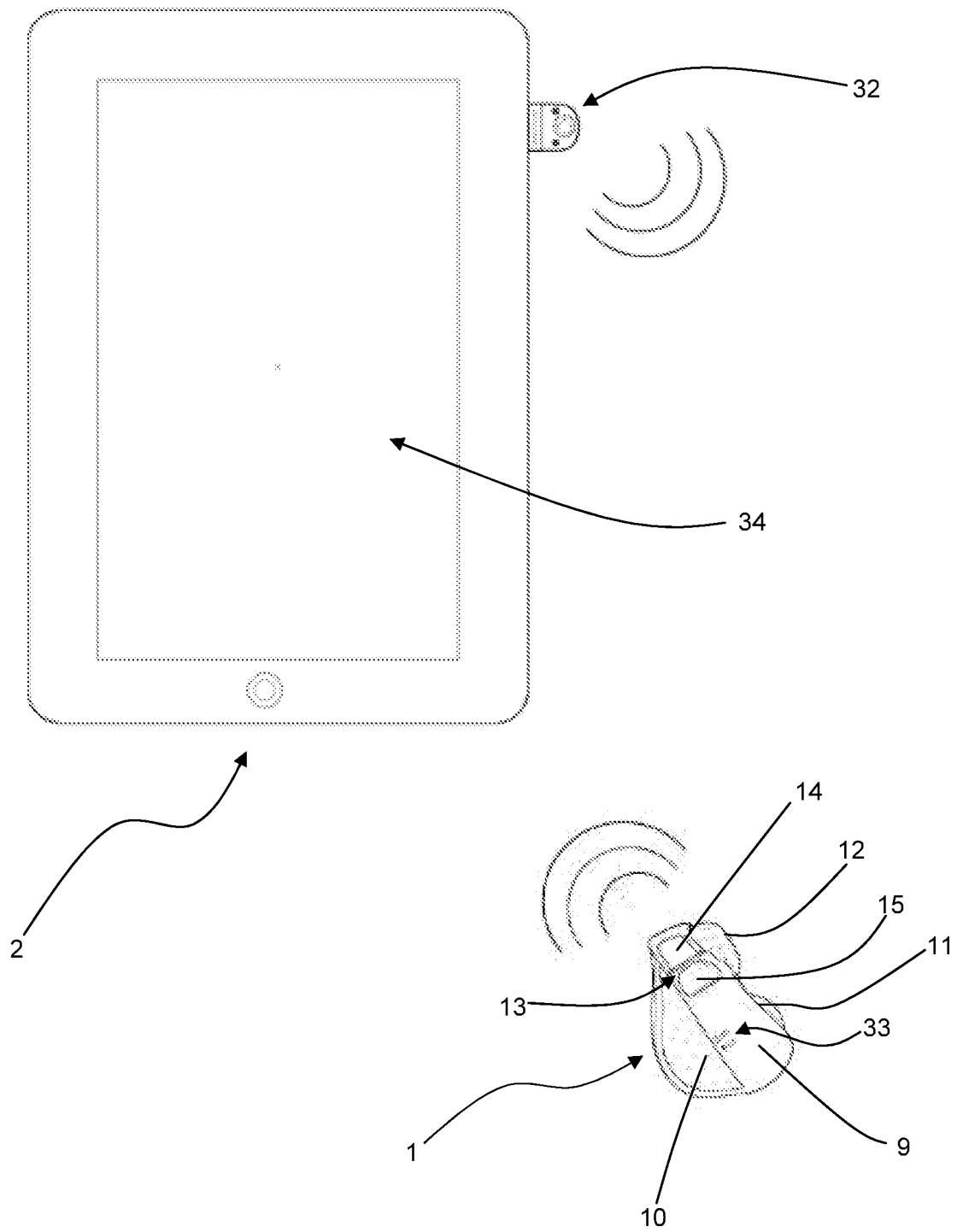


Figure 2

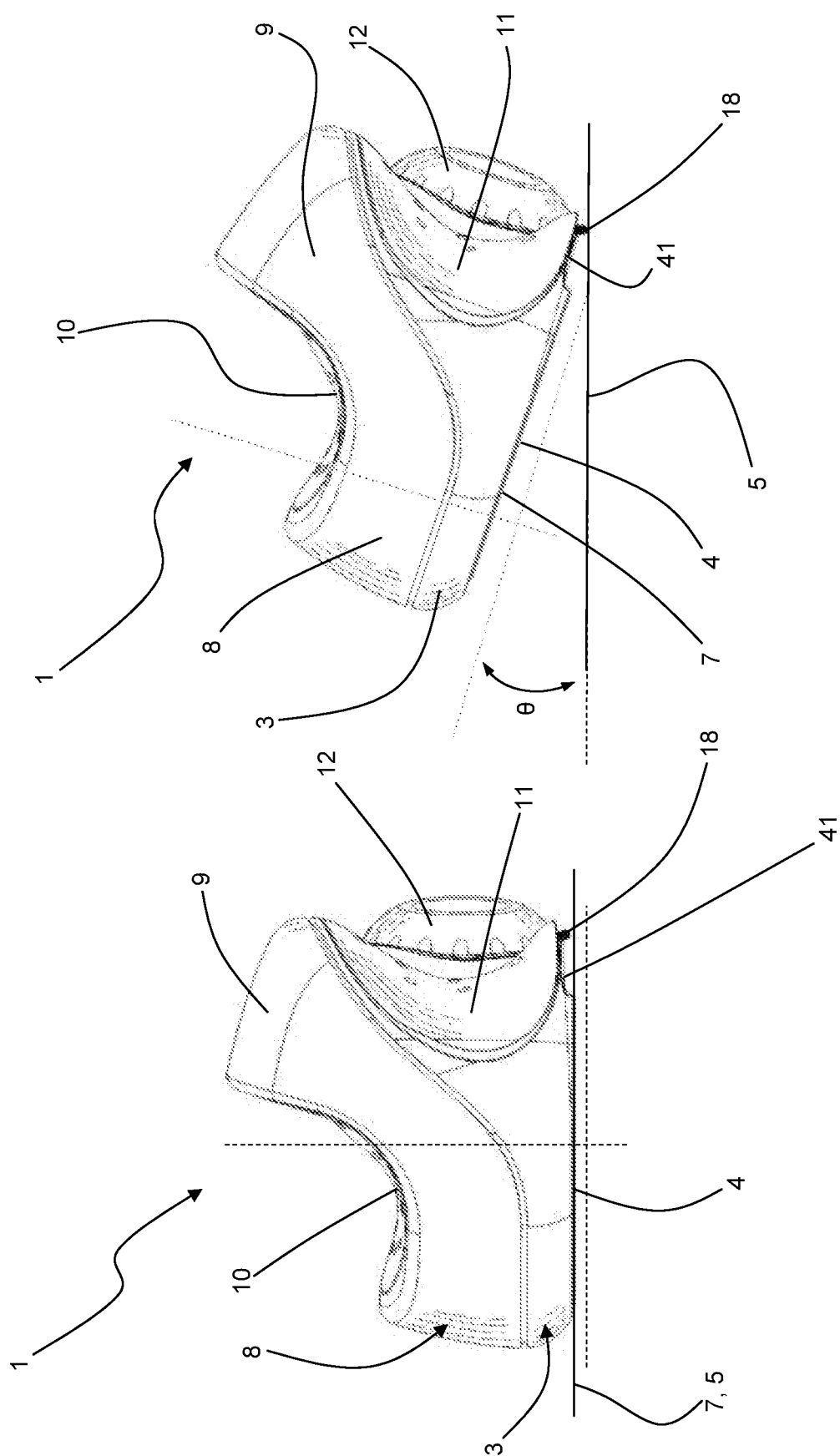


Figure 3a

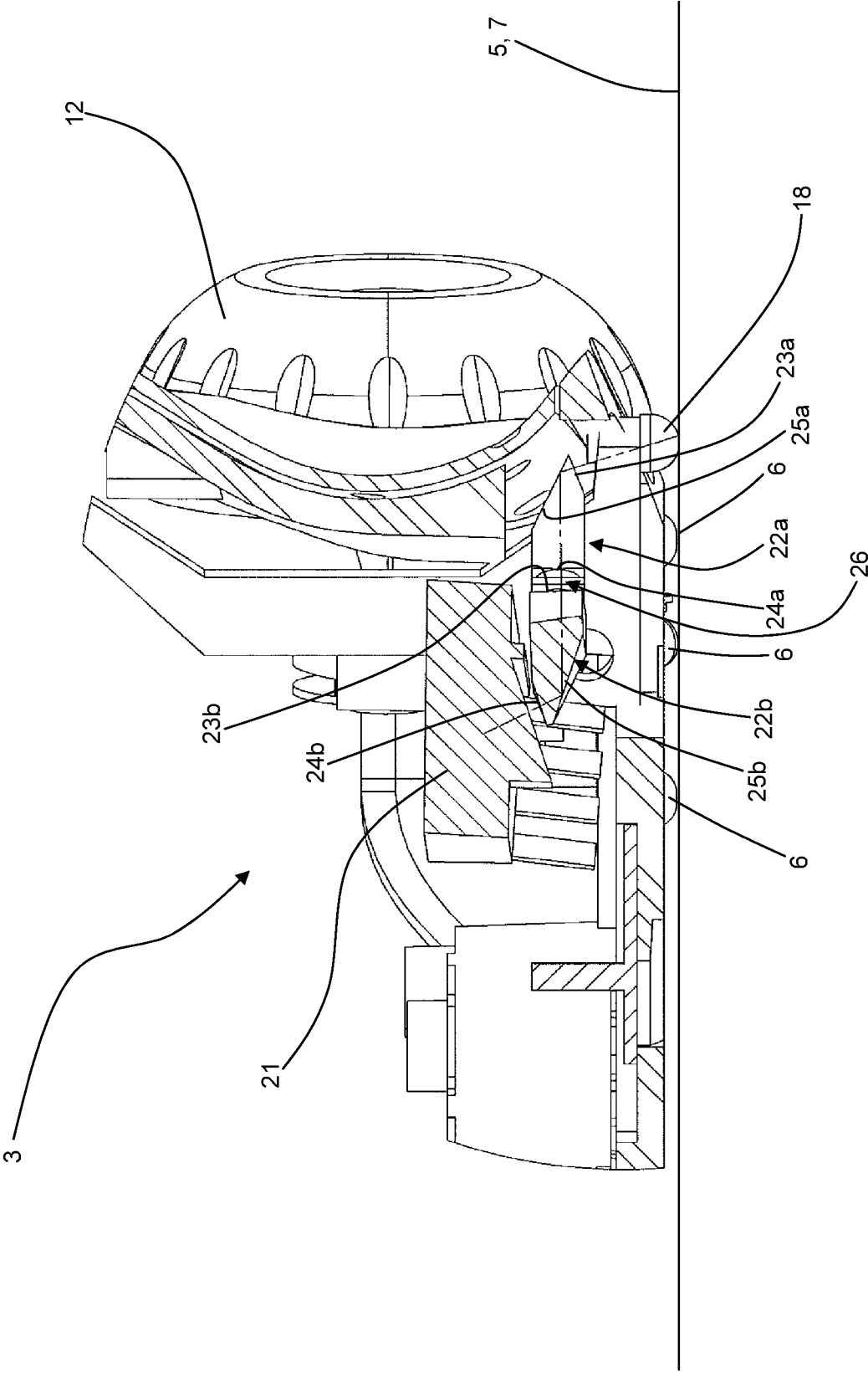


Figure 5

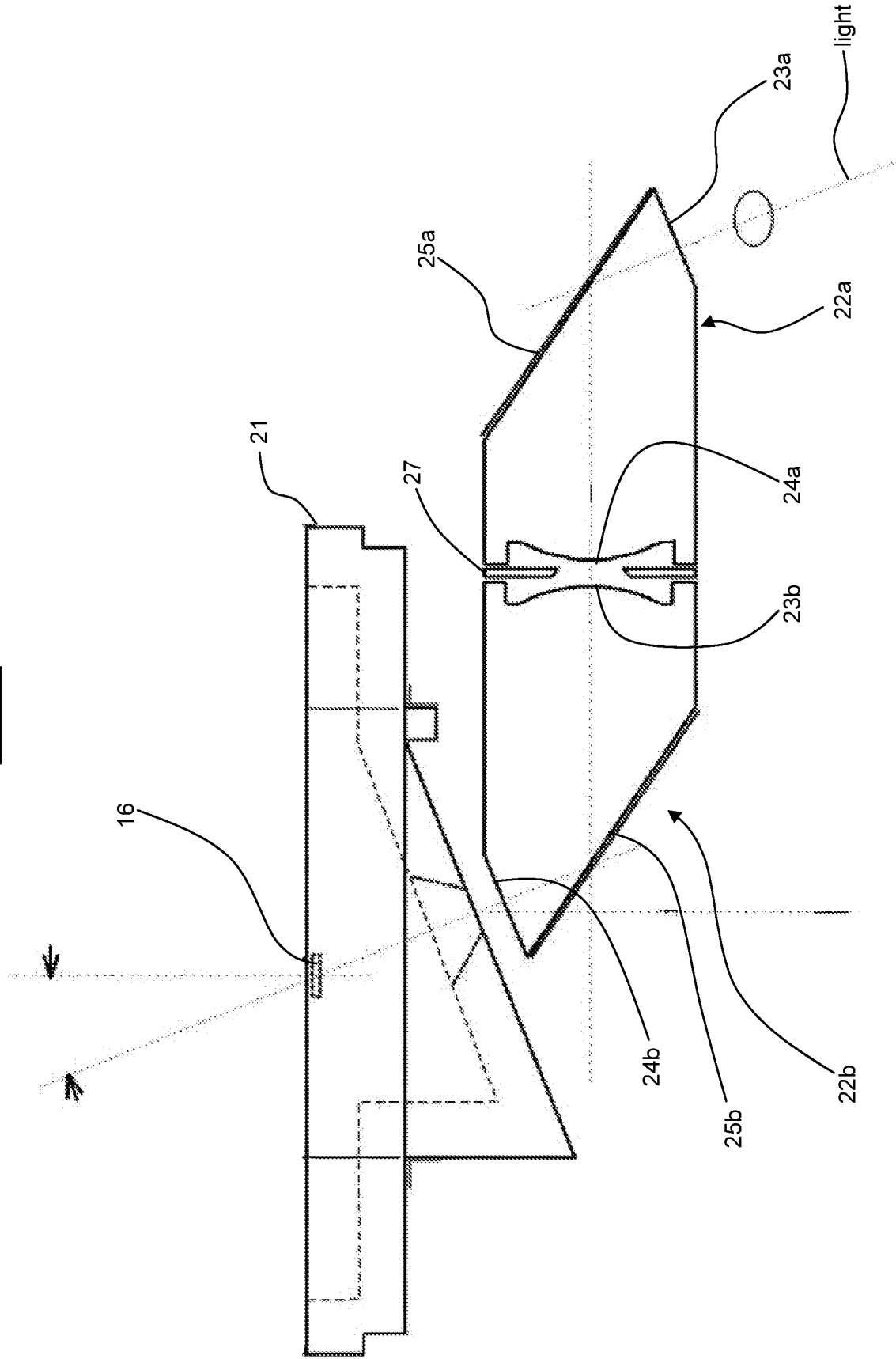


Figure 6

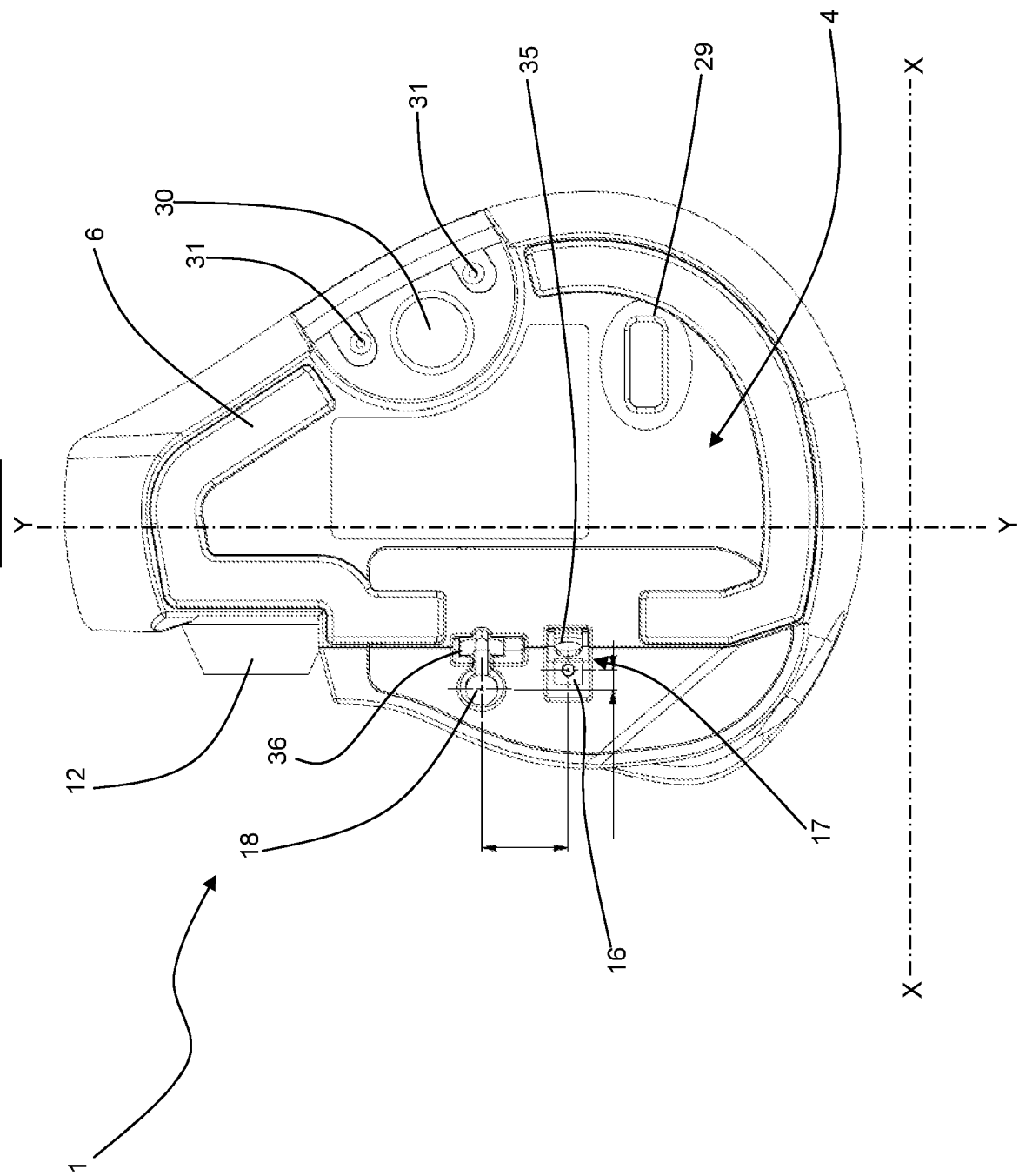


Figure 7

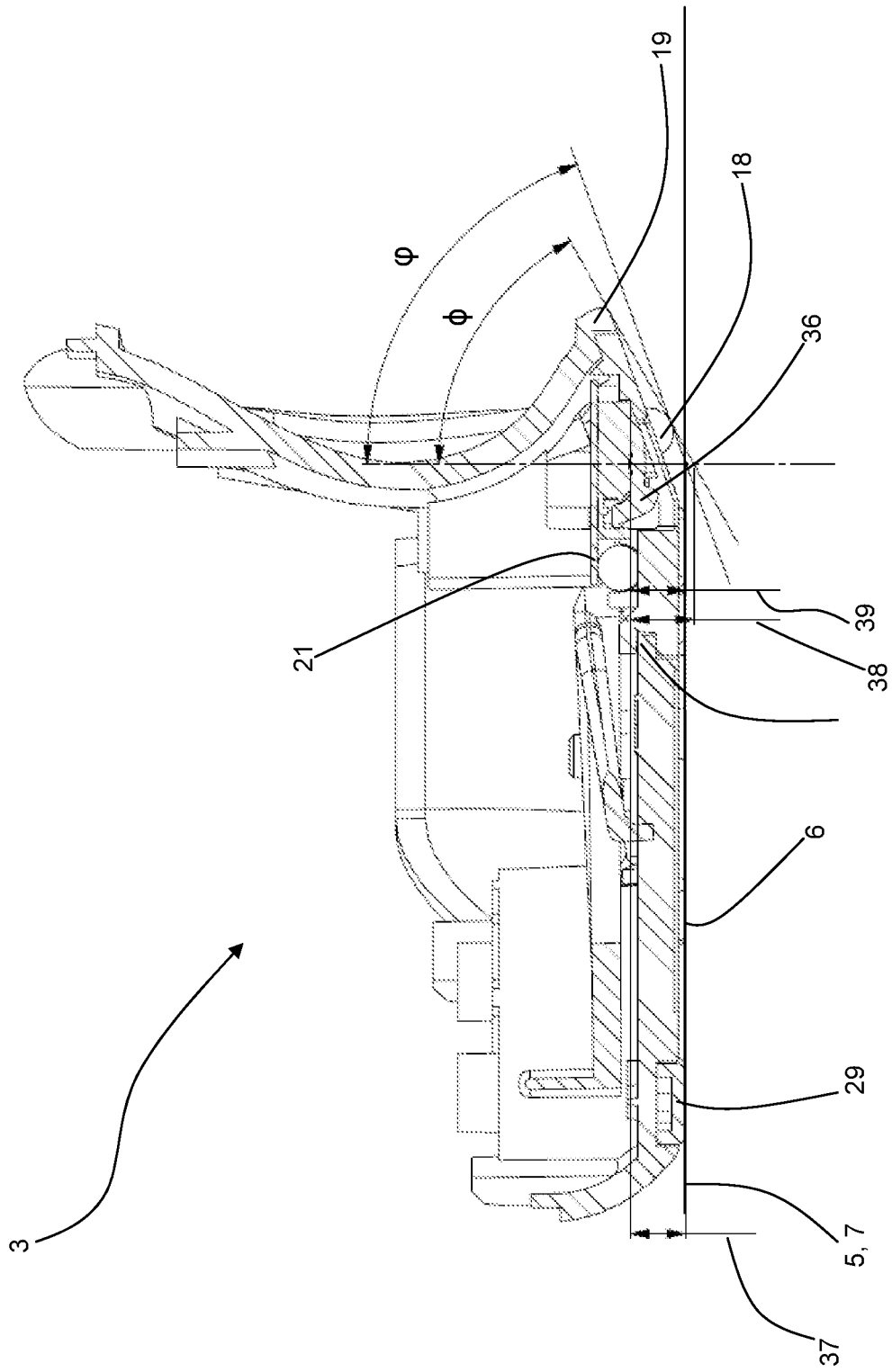


Figure 8

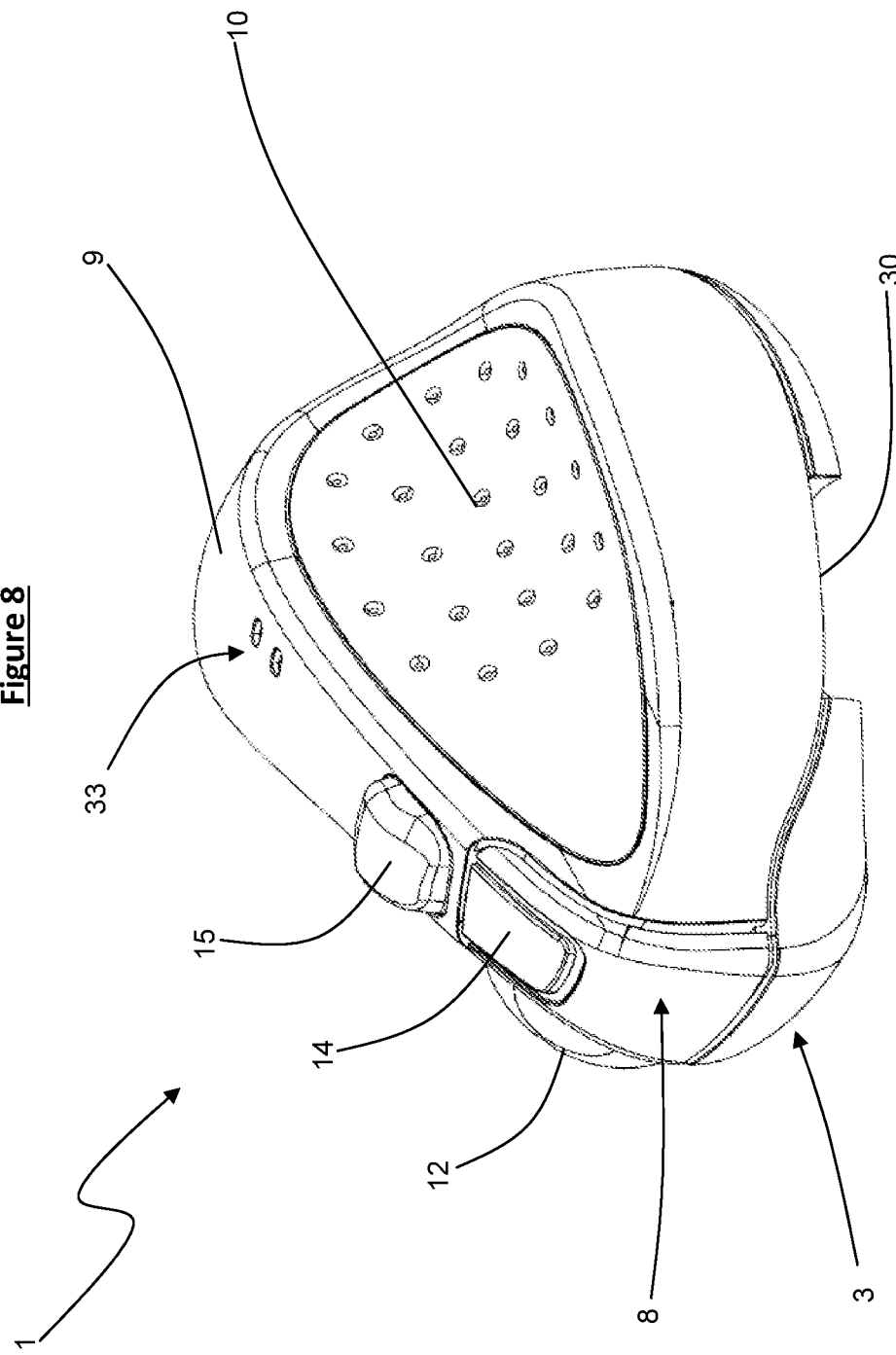
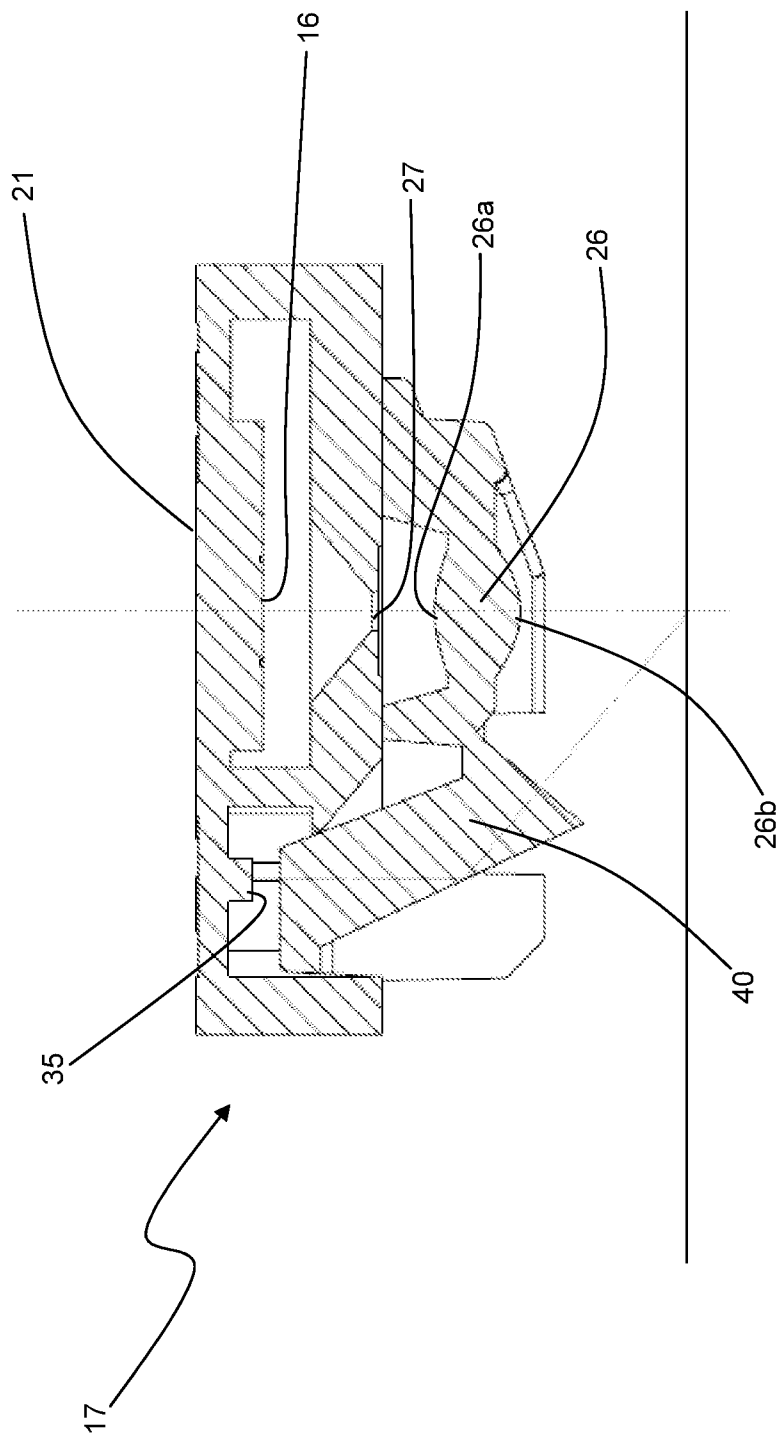


Figure 9



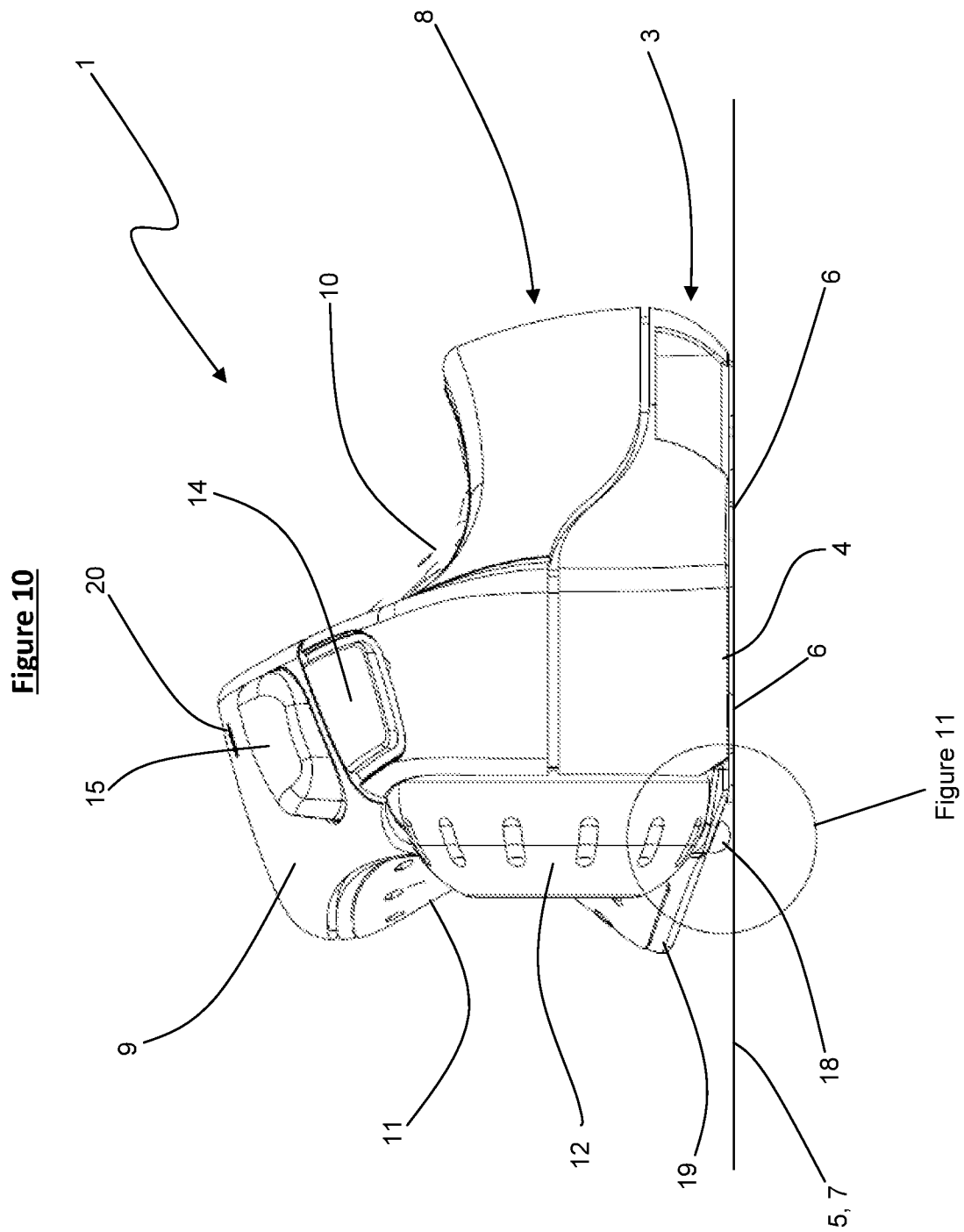


Figure 11

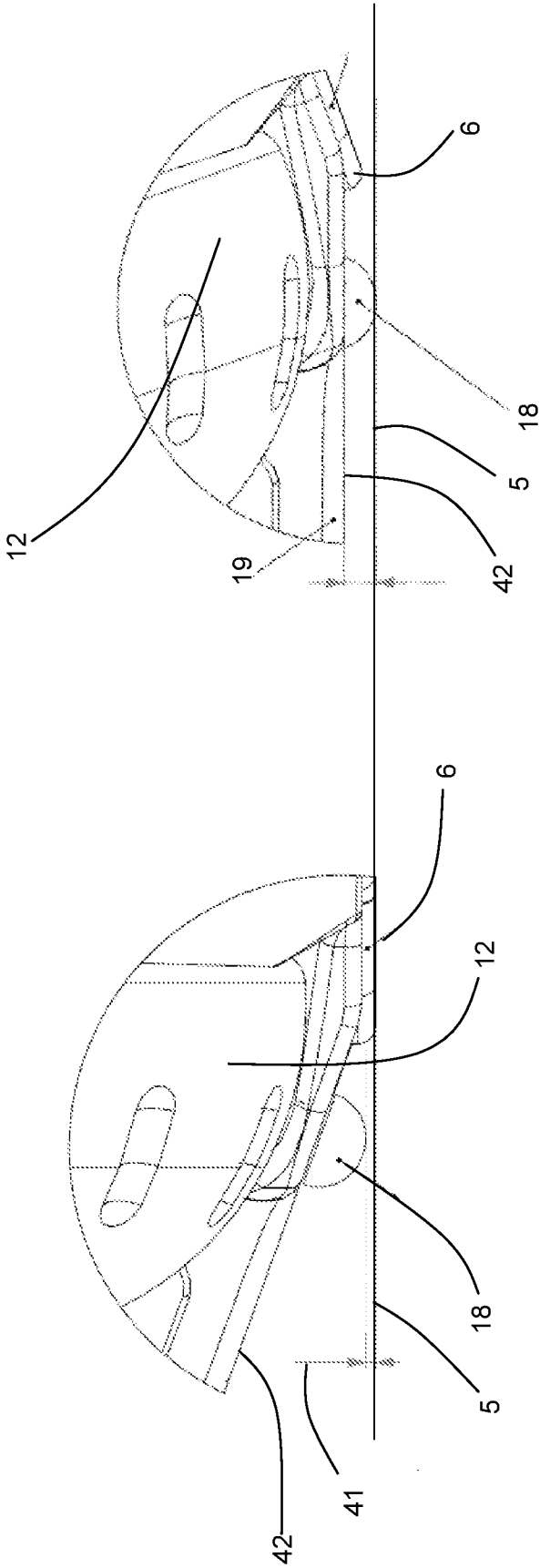


Figure 12

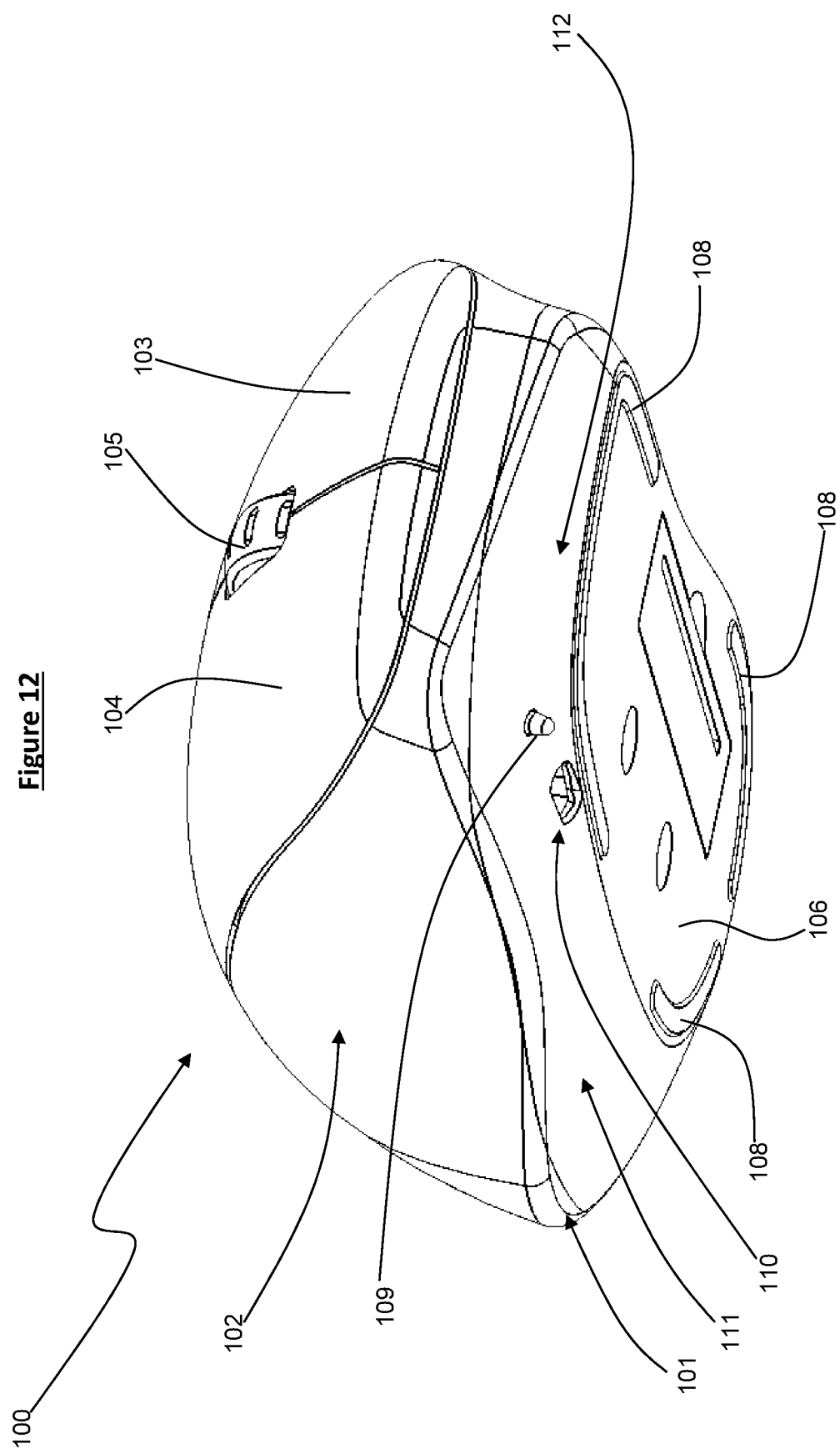


Figure 13

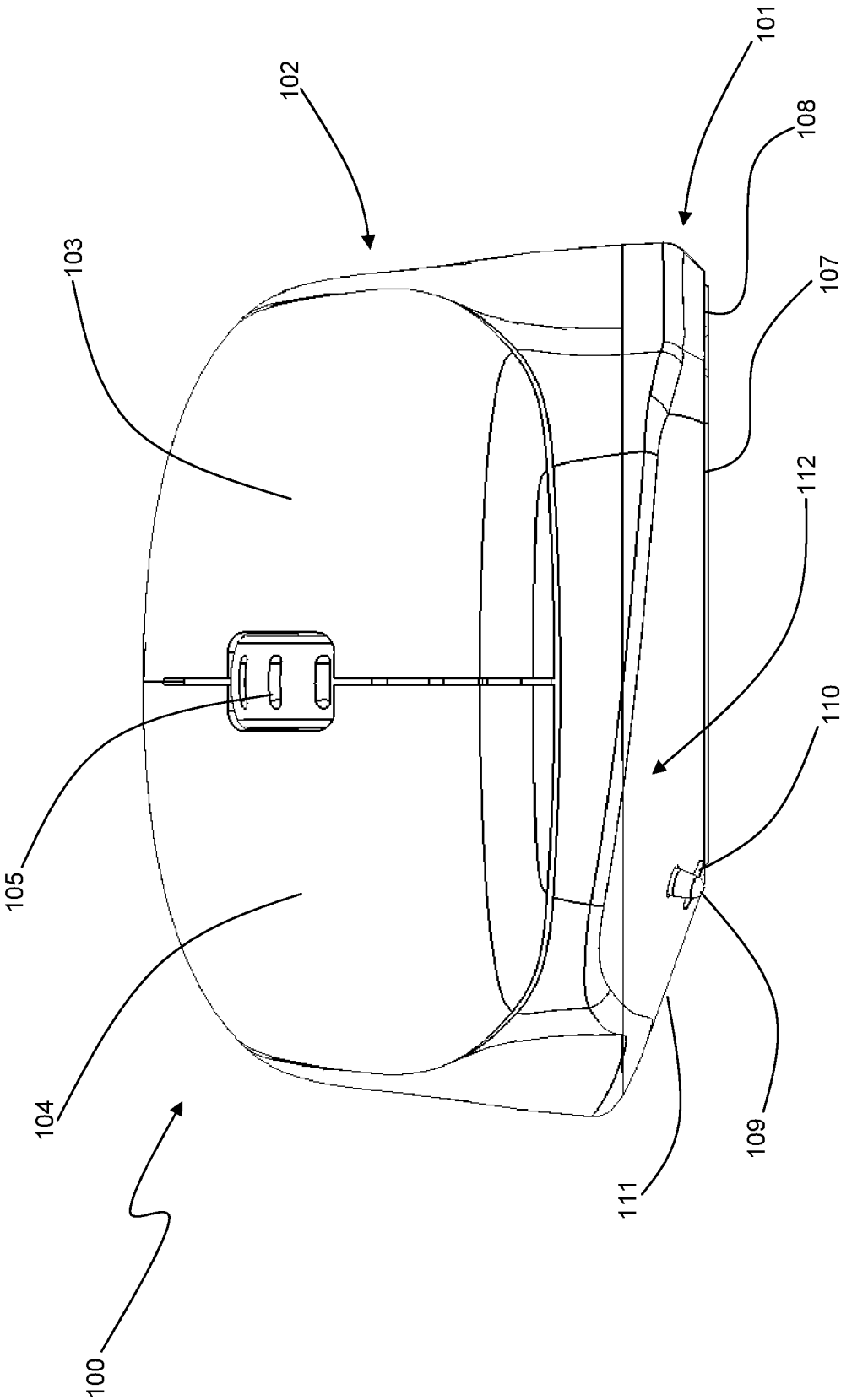


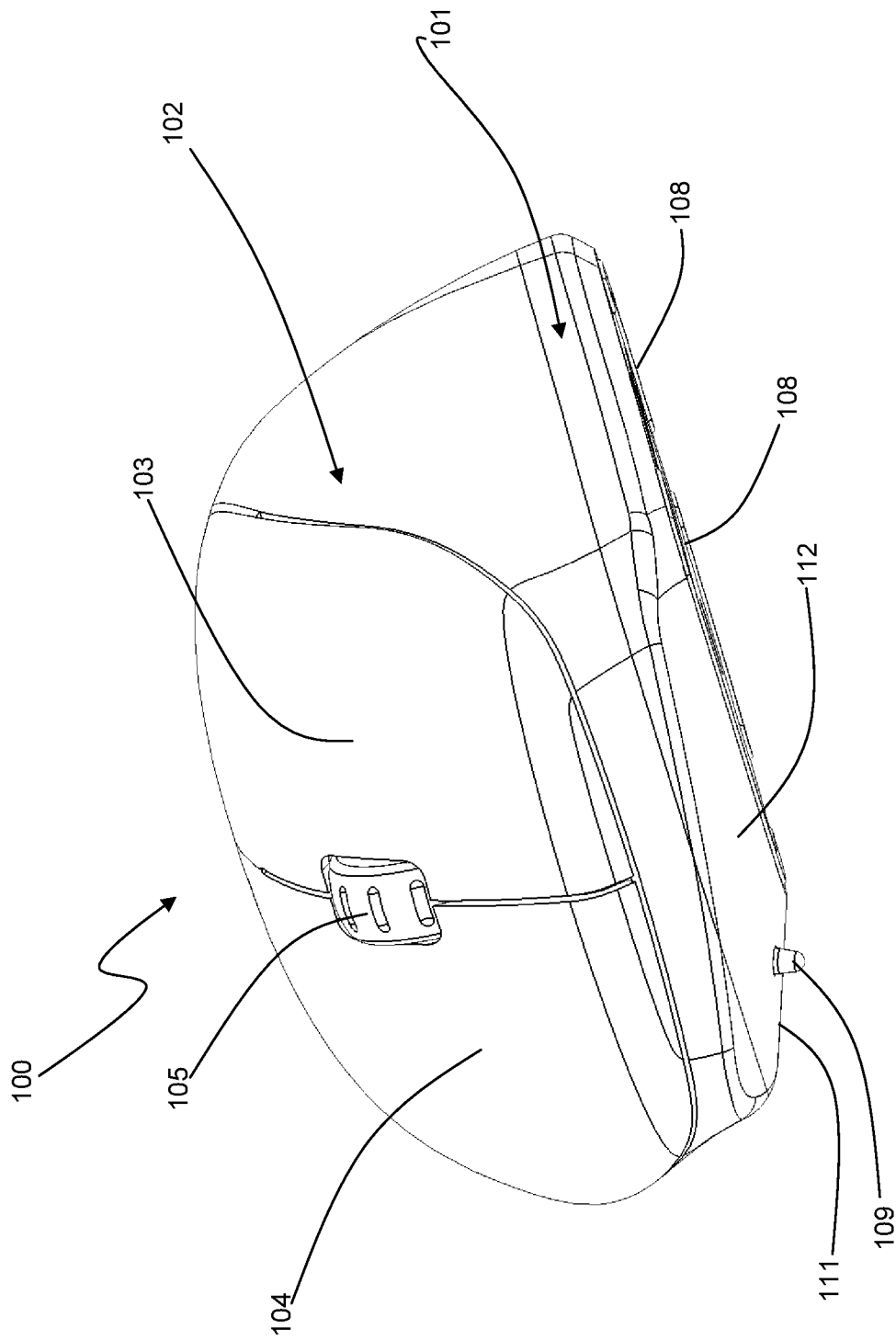
Figure 14

Figure 15

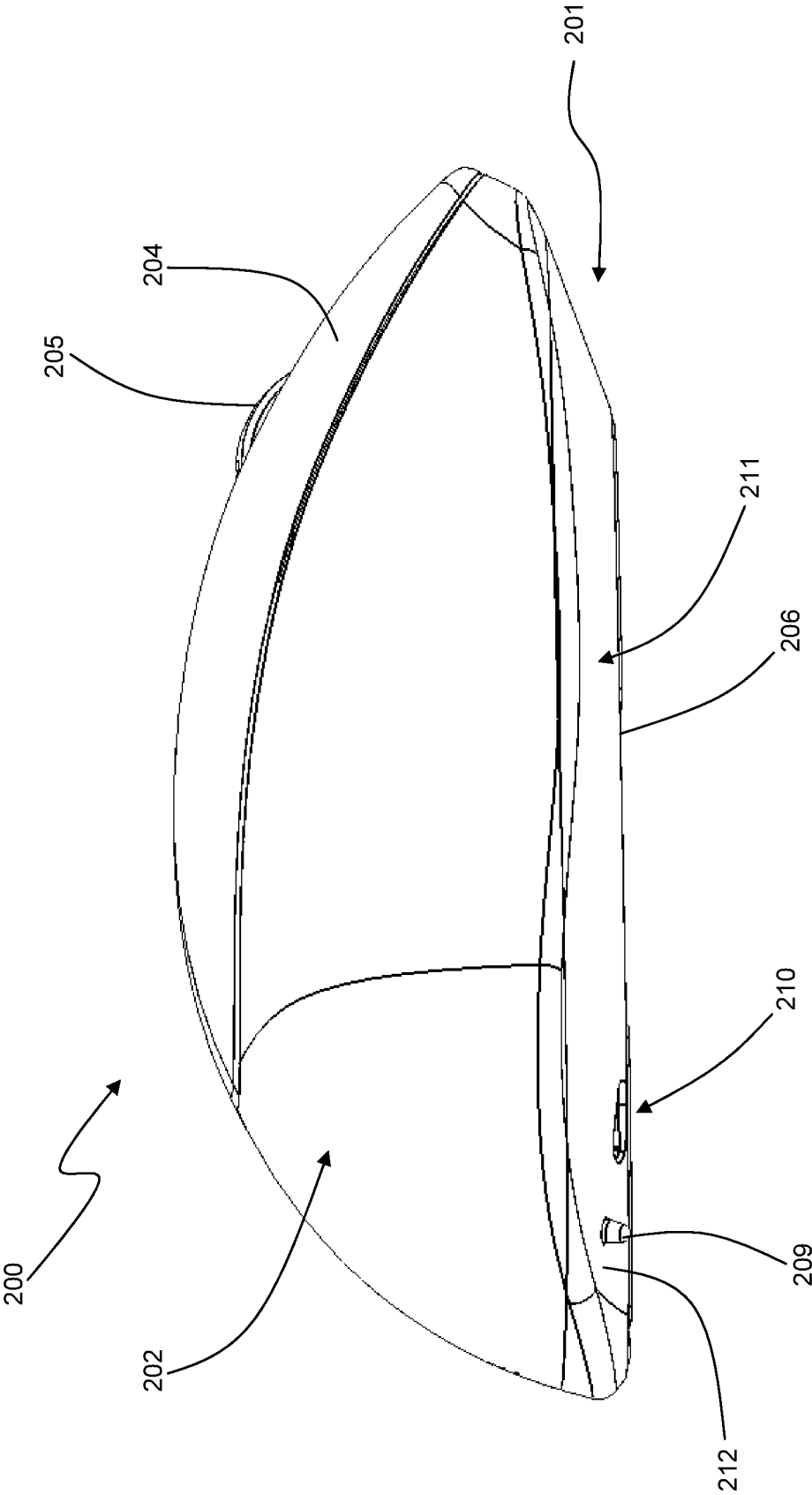


Figure 16

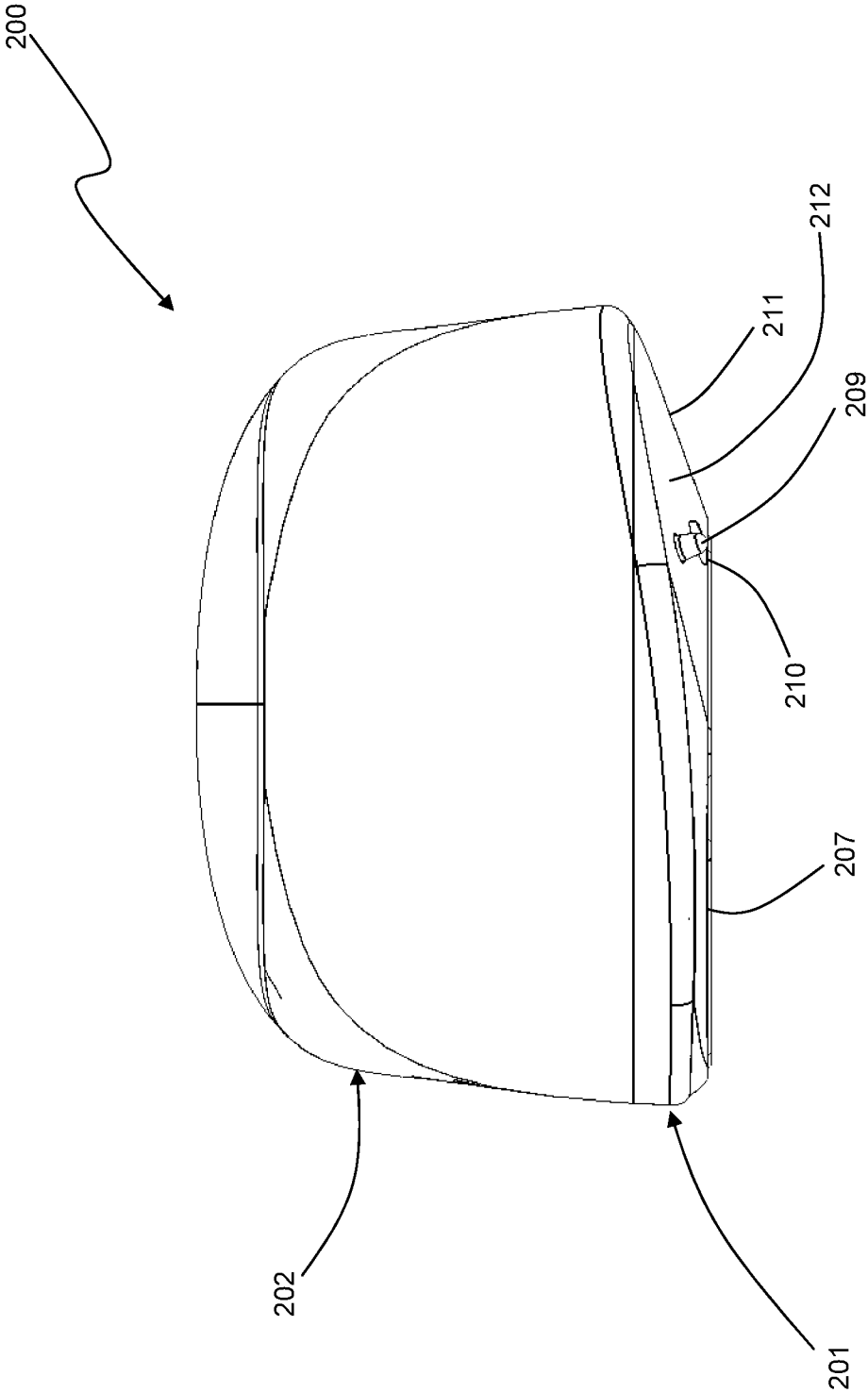


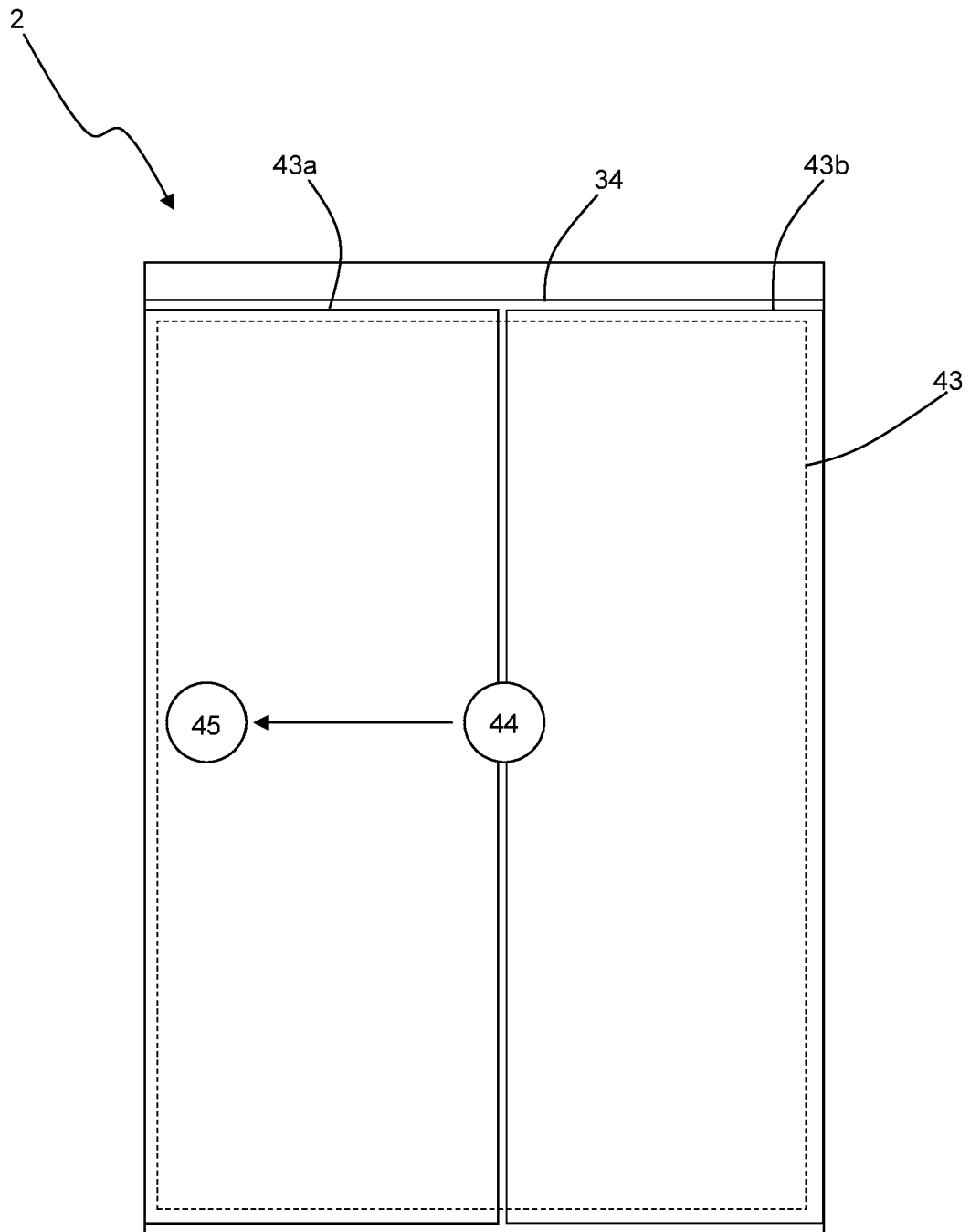
Figure 17

Figure 18

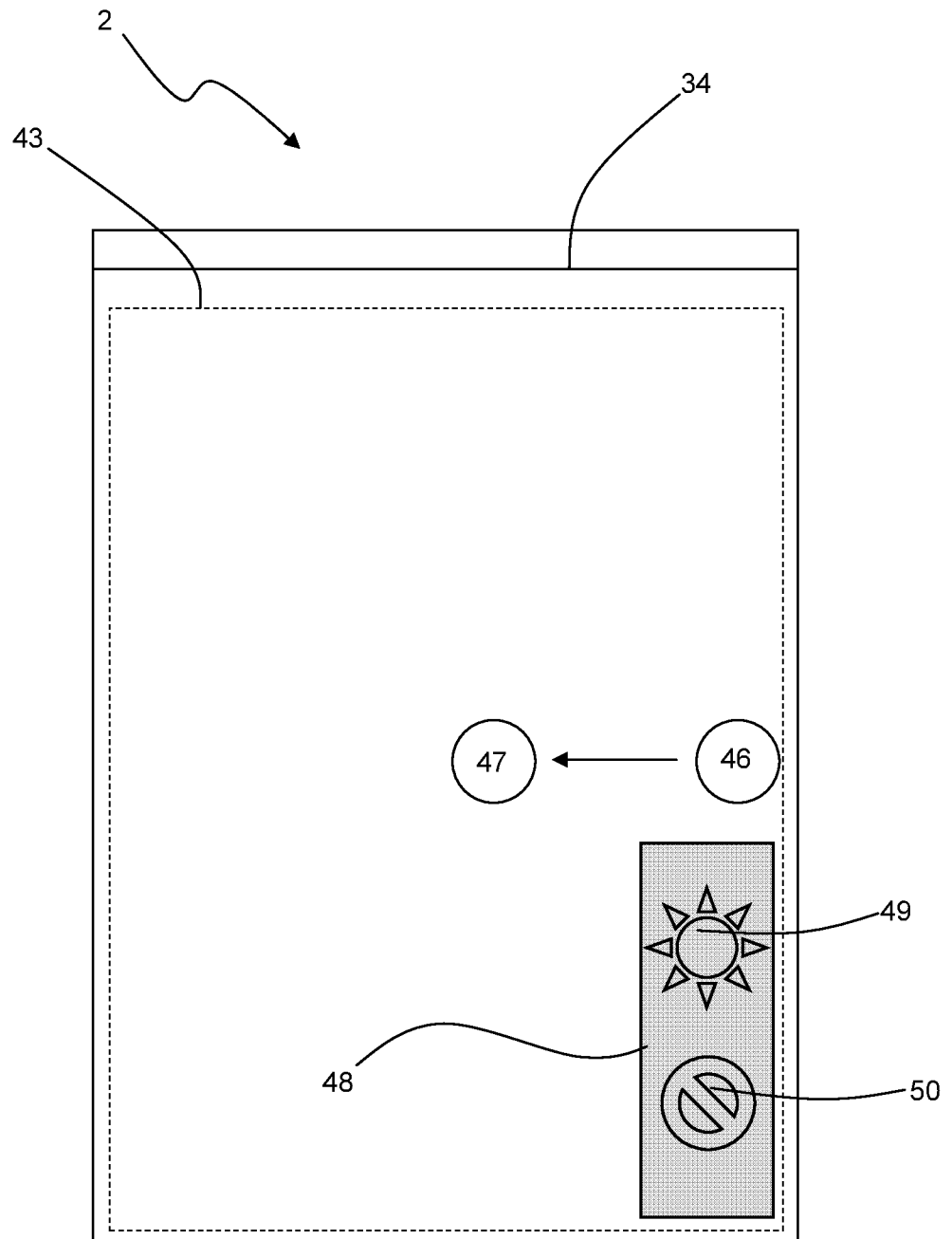
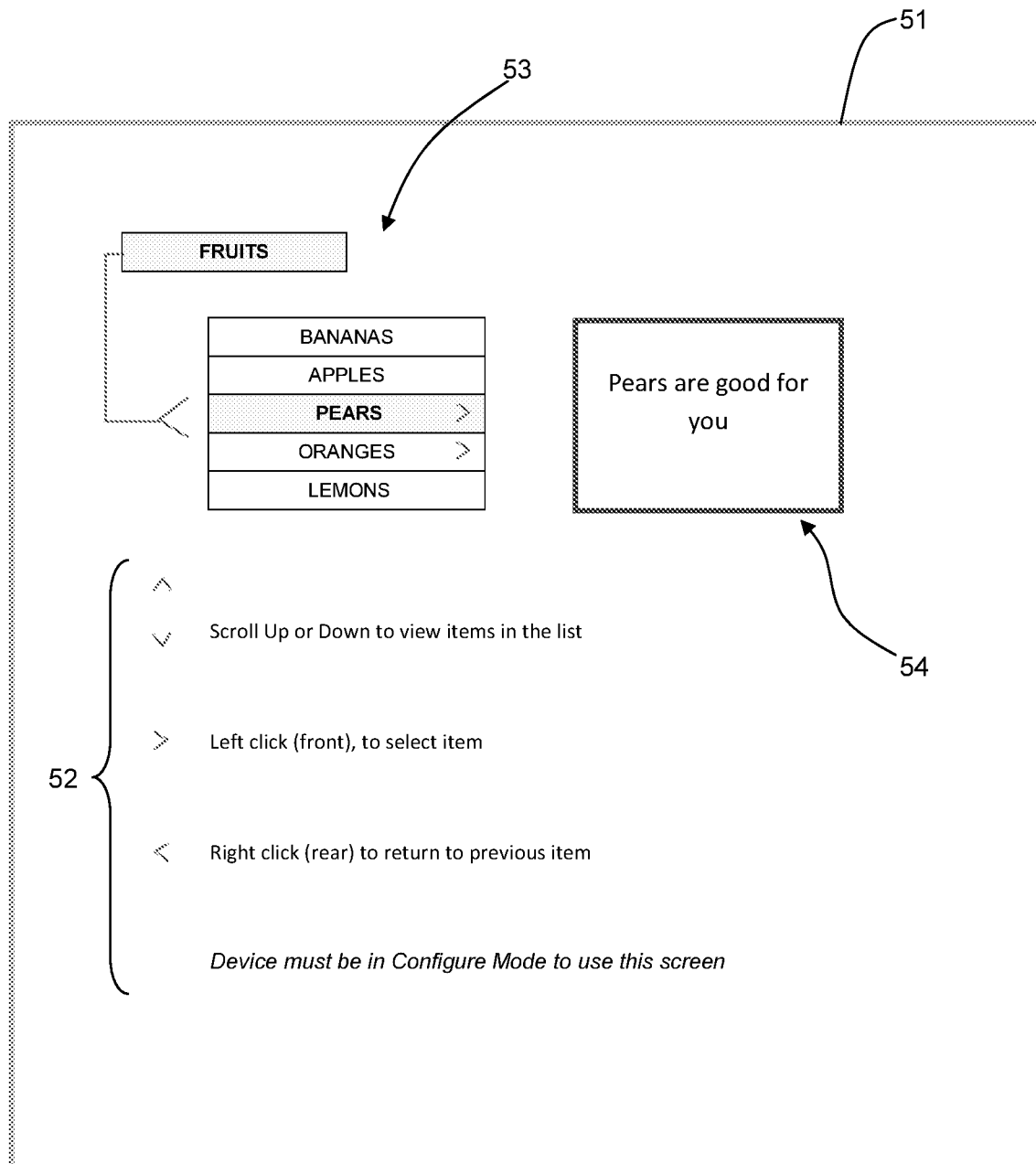


Figure 19

INTERNATIONAL SEARCH REPORT

 International application No.
PCT/IB2013/055772

A. CLASSIFICATION OF SUBJECT MATTER

G06F 3/0354 (2013.01) G06F 3/038 (2013.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, EPODOC: G06F3 IPC and mouse, mode, orientation, touch, spine and similar terms

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	



Further documents are listed in the continuation of Box C



See patent family annex

* "A"	Special categories of cited documents: document defining the general state of the art which is not considered to be of particular relevance	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E"	earlier application or patent but published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means	"&"	document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed		
Date of the actual completion of the international search 29 November 2013		Date of mailing of the international search report 29 November 2013	
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA Email address: pct@ipaustalia.gov.au Facsimile No.: +61 2 6283 7999		Authorised officer Henry Bolton AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No. 0262832507	

INTERNATIONAL SEARCH REPORT		International application No.
C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		PCT/IB2013/055772
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009/0295713 A1 (PIOT et al.) 03 December 2009 See e.g. figs. 2A and 4A and paras. 17, 66-69, 78-97	1-8, 16-37
X	CN 102200876 A (KYE SYSTEMS CORP) 28 September 2011 See e.g. fig. 2A and paras. 4-6, 38, 39, 42, 44-46	1, 7, 15, 16, 20-37
X	US 2012/0007806 A1 (LIU) 12 January 2012 See e.g. paras. 10-17, 24	1, 2, 7-14, 16, 17, 20-23, 27-37
X	US 2012/0050163 A1 (SHIH et al.) 01 March 2012 See e.g. abstract, figs. 1 and 4 and paras. 19, 21	1, 2, 7, 8, 16-23, 27-37

Form PCT/ISA/210 (fifth sheet) (July 2009)

Supplemental Box

Continuation of: Box III

This International Application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept.

This Authority has found that there are different inventions based on the following features that separate the claims into distinct groups:

- Claims 1 to 37 are directed to a computer mouse that is configured to operate in first and second modes.
- Claim 38 is directed to a device capable of being connected to a computer that sends signals corresponding to keyboard key presses, sequences and/or combinations thereof to the computer when the device is in a configuration mode. The configuration mode implies a second mode; however, a second mode is known as explained later. Claim 38 also contains the feature of the device, when in a configuration mode, writing to its memory to modify the configuration data.

PCT Rule 13.2, first sentence, states that unity of invention is only fulfilled when there is a technical relationship among the claimed inventions involving one or more of the same or corresponding special technical features. PCT Rule 13.2, second sentence, defines a special technical feature as a feature which makes a contribution over the prior art.

When there is no special technical feature common to all the claimed inventions there is no unity of invention.

In the above groups of claims, the only corresponding features common to all these two groups of claims and which could provide a technical relationship among them is:

- the feature in claims 1-37 of the mouse being configured to operate in 'first and second modes'; and
- the corresponding feature in claim 38 of the device being 'capable of entering a configuration mode' (wherein, as suggested above, it is considered implicit that the device must also be capable of functioning in a second mode in accordance with the determined 'operational characteristics of the device').

However these corresponding features of a device operating in two different modes do not make a contribution over the prior art because they are disclosed in, for example:

US 2009/0295713 A1 (PIOT et al.) 03 December 2009

It noted that the problems addressed by claims 1-37 (e.g. that inputting touch input-type commands using a standard mouse is unintuitive) are distinctly different from the problems addressed by claim 38 (e.g. that a specific software driver must be used on a computer to be able to configure a device).

In the light of this prior art, these corresponding features cannot be corresponding special technical features. Therefore there is no special technical feature common to all the claimed inventions and the requirements for unity of invention are consequently not satisfied *a posteriori*.

INTERNATIONAL SEARCH REPORT Information on patent family members		International application No. PCT/IB2013/055772	
This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.			
Patent Document/s Cited in Search Report		Patent Family Member/s	
Publication Number	Publication Date	Publication Number	Publication Date
US 2009/0295713 A1	03 Dec 2009	CN 101593024 B	17 Jul 2013
		US 2009295713 A1	03 Dec 2009
CN 102200876 A	28 Sep 2011	CN 102200876 B	09 Oct 2013
US 2012/0007806 A1	12 Jan 2012	US 2012007806 A1	12 Jan 2012
US 2012/0050163 A1	01 Mar 2012	None	
End of Annex			
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001. Form PCT/ISA/210 (Family Annex)(July 2009)			

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

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

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
the subject matter listed in Rule 39 on which, under Article 17(2)(a)(i), an international search is not required to be carried out, including
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

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

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

See Supplemental Box for Details

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-37

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.