Mouse Device," filed Dec. 7, 1999, which are both incorporated herein by reference. Other control devices or grips that can include a touchpad **16** of the present invention in its housing include a gamepad, mouse or trackball device for manipulating a cursor or other graphical objects in a computer-generated environment; or a pressure sphere or the like. For example, the touchpad **16** can be provided on the housing of a computer mouse to provide additional input to the host computer. Furthermore, selective disturbance filtering of forces, as described in copending patent application Ser. No. 08/839,249, and shaping of force signals to drive the touchpad with impulse waves as described in U.S. Pat. No. 5,959,613, can be used with the present invention, both disclosures incorporated herein by reference. Such impulses are also effective when driven with stored power in a battery on the computer **10** or from a bus such as USB connected to a host computer.

[**0064**] The touchpad **16** can also be provided with different control regions that provide separate input from the main cursor control region **70**. In some embodiments, the different regions can be physically marked with lines, borders, or textures on the surface of the pad **16** (and/or sounds from the computer **10**) so that the user can visually, audibly, and/or or tactilely tell which region he or she is contacting on the pad.

[**0065**] For example, scroll or rate control regions **62***a* and **62***b* can be used to provide input to perform a rate control task, such as scrolling documents, adjusting a value (such as audio volume, speaker balance, monitor display brightness, etc.), or panning/tilting the view in a game or virtual reality simulation. Region **62***a* can be used by placing a finger (or other object) within the region, where the upper portion of the region will increase the value, scroll up, etc., and the lower portion of the region will decrease the value, scroll down, etc. In embodiments that can read the amount of pressure placed on the pad **16**, the amount of pressure can directly control the rate of adjustment; e.g., a greater pressure will cause a document to scroll faster. The region **62***b* can similarly be used for horizontal (left/right) scrolling or rate control adjustment of a different value, view, etc.

[**0066**] Particular haptic effects can be associated with the control regions **62***a* and **62***b*. For example, when using the rate control region **62***a* or **62***b*, a vibration of a particular frequency can be output on the pad **16**. In those embodiments having multiple actuators, an actuator placed directly under the region **62***a* or **62***b* can be activated to provide a more localized tactile sensation for the "active" (currently used) region. As a portion of a region **62** is pressed for rate control, pulses can be output on the pad (or region of the pad) to indicate when a page has scroll by, a particular value has passed, etc. A vibration can also be continually output while the user contacts the region **62***a* or **62***b*.

[**0067**] Other regions **64** can also be positioned on the touchpad **16**. For example, each of regions **64** provides a small rectangular area, like a button, which the user can point to in order to initiate a function associated with the pointed-to region. The regions **64** can initiate such computer functions as running a program, opening or closing a window, going "forward" or "back" in a queue of web pages in a web browser, powering the computer **10** or initiating a "sleep" mode, checking mail, firing a gun in a game, cutting or pasting data from a buffer, selecting a font, etc. The regions **64** can duplicate functions and buttons provided in an application program or provide new, different functions.

[**0068**] Similarly to regions **62**, the regions **64** an each be associated with haptic sensations; for example, a region **64** can provide a pulse sensation when it has been selected by the user, providing instant feedback that the function has been selected. Furthermore, the same types of regions can be associated with similar-feeling haptic sensations. For example, each word processor related region **64** can, when pointed to, cause a pulse of a particular strength, while each game-related region can provide a pulse of different strength or a vibration. Furthermore, when the user moves the pointing object from one region **62** or **64** to another, a haptic sensation (such as a pulse) can be output on the pad **16** to signify that a region border has been crossed.

[**0069**] In addition, the regions are preferably programmable in size and shape as well as in the function with which they are associated. Thus, the functions for regions **64** can change based on an active application program in the graphical environment and/or based on user preferences input to and/or stored on the computer **10**. Preferably, the size and location of each of the regions can be adjusted by the user or by an application program, and any or all of the regions can be completely removed if desired. Furthermore, the user is preferably able to assign particular haptic sensations to particular areas or types of areas based on types of functions associated with those areas, as desired. Different haptic sensations can be designed in a tool such as Immersion Studio™ available from Immersion Corp. of San Jose, Calif.

[**0070**] It should be noted that the regions **62** and **64** need not be physical regions of the touchpad **16**. That is, the entire touchpad **16** surface need merely provide coordinates of user contact to the processor of the computer and software on the computer can designate where different regions are located. The computer can interpret the coordinates and, based on the location of the user contact, can interpret the touchpad input signal as a cursor control signal or a different type of signal, such as rate control, button function, etc. The local touchpad microprocessor, if present, may alternatively interpret the function associated with the user contact location and report appropriate signal or data to the host processor (such as position coordinates or a button signal), thus keeping the host processor ignorant of the lower level processing. In other embodiments, the touchpad **16** can be physically designed to output different signals to the computer based on different regions marked on the touchpad surface that are contacted by the user; e.g. each region can be sensed by a different sensor or sensor array.

[**0071**] **FIGS. 8***a* and **8***b* are top plan and side cross-sectional views, respectively, of another computer device embodiment **80** including a form of the haptic touchpad **16** of the present invention. Device **80** is in the form of a portable computer device such as "personal digital assistant" (PDA), a "pen-based" computer, "electronic book", or similar device (collectively known as a "personal digital assistant" or PDA herein). Those devices which allow a user to input information by touching a display screen or readout in some fashion are primarily relevant to this embodiment of the present invention. Such devices can include the Palm Pilot from 3Com Corp., the Newton from Apple Computer, pocket-sized computer devices from Casio, Hewlett-Packard, or other manufacturers, cellular phones or pagers having touch screens, etc.