each degree of freedom along which forces are desired to be transmitted. Actuators **910** can include active actuators, such as linear current control motors, stepper motors, pneumatic/hydraulic active actuators, a torquer (motor with limited angular range), a voice coil actuator as described in the embodiments above, and/or other types of actuators that transmit a force to an object. Passive actuators, can include magnetic particle brakes, friction brakes, or pneumatic/hydraulic passive actuators, and generate a damping resistance or friction in a degree, of motion. For example, an electrorheological fluid can be used in a passive damper, which is a fluid that has a viscosity that can be changed by an electric field. Likewise, a magnetorheological fluid can be used in a passive damper, which is a fluid that has a viscosity that can be changed by a magnetic field. These types of dampers can be used instead of or in addition to other types of actuators in the mouse interface device. In yet other embodiments, passive damper elements can be provided on the bearings of interface **830** to remove energy from the system and intentionally increase the dynamic stability of the mechanical system. In addition, in voice coil embodiments, multiple wire coils can be provided, where some of the coils can be used to provide back EMF and damping forces. In some embodiments, all or some of sensors **905** and actuators **910** can be included together as a sensor/actuator pair transducer.

[**0139**] The mechanism **835** may be the five-member linkage **835** described above, but can also be one of several types of mechanisms. Force feedback mouse **800** can alternatively be a puck, joystick, or other device or article coupled to linkage **835**, as described above.

[**0140**] Other input devices **1000** can optionally be included in system **100** and send input signals to microprocessor **970** and/or the computer **150**. Such input devices can include buttons, such as buttons on force feedback mouse **800**, used to supplement the input from the user to a simulation, GUI; game, etc, as will be discussed. Also, dials, switches, voice recognition hardware (with software implemented by computer **150**), or other input mechanisms can be used.

[**0141**] Safety or "deadman" switch **1005** may be included in haptic interface device **140** to provide a mechanism to allow a user to override and deactivate actuators **910**, or require a user to activate actuators **910**, for safety reasons, as discussed above:

[**0142**] In one version of the invention, a mouse **600**, which may be either a tactile mouse **250** or a force feedback mouse **800**, is used to control the display of a graphical hand **170**. Movement of the mouse **600** controls the positioning of the graphical hand **170** in the graphical environment **110**. For example, in one version, the two dimensional position of the mouse **600** directly controls the two-dimensional displayed position of the graphical hand **170**. In more complex version, the mouse **600** may be positionable in three dimensions and/or may to rotatable about one or more axes to control the three dimensional position and/or the orientation of the graphical hand **170**, as will be described.

[**0143**] In one version, one or more of the buttons **620** may be used to control the shape of the graphical hand **115**. Accordingly, when a button is depressed, the display of the shape of the graphical hand **170** may change. For example, a binary button, i.e. a button that is either "on" or "off" may be provided. When depressed, or when in the "on" condition, the graphical hand may be displayed in a grasping condition. In another version, a sensor, such as an analog sensor, is positioned to detect the amount of depression of the button **620** and the displayed graphical hand **170** shows the variable amount of grasping in response to the depression. For example, as shown in **FIG. 19A**, a sliding member **1050** may be connected to the interior of a button, such as button **620***a,* which is hingedly connected to the housing of the mouse **600**. Much of the interior of the mouse **600** is not shown for clarity. Alternatively, the button may be slidingly connected to the mouse **600** housing. The sliding member **1050** slides within a sensor **1060**. The sensor **1060** may comprise, for example, a potentiometer, an encoder, LVDT, or similar device. A signal from the sensor **1060** is transmitted to the computer **150** which uses the signal to control the display of the graphical hand, **170**. In one version, the graphical hand may comprise three displayed positions. The first position is an open hand and is displayed when the button **620***a* has not been depressed a predetermined amount When the button **620***a* reaches the predetermined amount, the graphical hand **170** is shown in a semi-closed position. When the button **620***a* is further depressed to a second predetermined position, a closed hand is shown. In more advanced versions; the display of the grasping action can be directly related to the amount of depression, of the button **620***a*.

[**0144**] An actuator **1070** may be provided, as shown schematically in **FIG. 19A**, to provide a haptic sensation to the button **630***a*. For example, a haptic sensation may be provided to simulate a resistive grasping farce, indicating to the user that an object is being grasped. Alternatively or additionally, tactile sensations such as vibrations may be output to the button to provide various indications to the user. **FIG. 19B** shows another version of a button sensor **1060** and a button actuator **1070** embodied in a motor/encoder pair. The button actuator **1070** comprises a motor having a rotatable shaft **1065** connected too a toothed wheel **1090**. The teeth on the toothed wheel engaging teeth **1080** on an extension member **1085** to allow the motor to drive the button **630***a,* optionally in either direction. An encoder or the like is positioned to detect rotation of the shaft and to correlate the detected rotation to a position of the button **630***a*. Another version of a button actuator **1070** is shown in **FIG. 19C**. In this version, the button actuator **1070** comprises a deformable leaf spring **110** that may be actuated by pulling on tendon **250** in the direction of arrow **1105**, as discussed above in connection with **FIGS. 4A-4C** and **5A-5B**. In addition, a motor or the like may be positioned within the mouse **600** or exterior to the mouse **600** and may comprise a position detector, such as an encoder, that may be used to detect a position of the button **630***a* since the linear position of the tendon **250** is related to the depressed position of the button **630***a*.

[**0145**] In another version, the depression of a button **620** may result in the bending of a finger on the graphical hand **170**. In one version, such as the version shown in **FIG. 12**, a button depression sensor is provided for all five fingers, each finger being able to independently control the bending of corresponding fingers on the graphical hand **170**. Accordingly, a user may depress button **620***a,* for example, and the graphical hand's index finger may be displayed as bending. Optionally, each button **630** may also be provided with an actuator to provide a haptic sensation to each of the fingers.