



(12) **United States Patent**
Rosenberg

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(54) **POINTING DEVICE WITH FORCED FEEDBACK BUTTON**

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(*) **Notice:** This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

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Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(57) **ABSTRACT**

Related U.S. Application Data

(63) Continuation-in-part of application No. 09/156,802, filed on Sep. 17, 1998, and a continuation-in-part of application No. 09/103,281, filed on Jun. 23, 1998.

A low-cost force feedback interface device for providing low cost force feedback for enhancing interactions and manipulations in a graphical environment provided by a computer. One embodiment provides a mouse movable in a planar workspace and providing output sensor signals representative of that movement. Mouse button movement is detected to send command signals to the host computer, and an actuator coupled to the button applies an output force in the degree of freedom of the button. In a different embodiment, a force feedback pointing device includes a cylindrical member that may be rotated about an axis and translated along that axis to provide sensor signals to control a position of a graphical object such as a cursor. A command sensor detects motion of the cylindrical member perpendicular to the translation, such as when the cylindrical member is pressed down by the user. An actuator applies an output force in the perpendicular degree of freedom of the cylindrical member. The output force is correlated with interaction of the controlled cursor with other graphical objects in the graphical environment. The force sensation can be a jolt, vibration, constant force, texture force, or other type of force.

(51) **Int. Cl.⁷** **G09G 5/08**

(52) **U.S. Cl.** **345/161**

(58) **Field of Search** 345/161, 163, 345/156, 157, 160, 158

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36 Claims, 5 Drawing Sheets

