US009400570B2

(12) **United States Patent**
Chang

(10) **Patent No.: US 9,400,570 B2**
(45) **Date of Patent: Jul. 26, 2016**

(54) **STYLUS WITH INERTIAL SENSOR**

(71) Applicant: **Apple Inc.**, Cupertino, CA (US)

(72) Inventor: **Ray L. Chang**, Sunnyvale, CA (US)

(73) Assignee: **Apple Inc.**, Cupertino, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 33 days.

(21) Appl. No.: **14/542,483**

(22) Filed: **Nov. 14, 2014**

(65) **Prior Publication Data**

US 2016/0139690 A1 May 19, 2016

(51) **Int. Cl.**

G06F 3/03	(2006.01)
G06F 3/038	(2013.01)
G06F 3/0354	(2013.01)
G06F 3/046	(2006.01)
G06F 3/0338	(2013.01)

(52) **U.S. Cl.**

CPC ***G06F 3/0383*** (2013.01); ***G06F 3/0338*** (2013.01); ***G06F 3/03545*** (2013.01); ***G06F 3/046*** (2013.01)

(58) **Field of Classification Search**

None

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

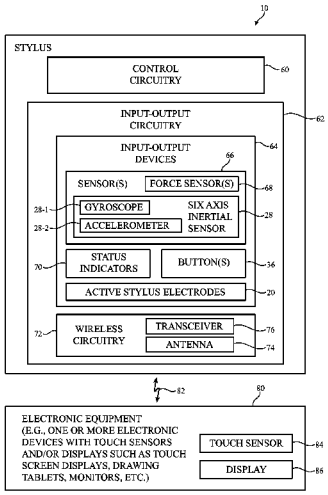
5,774,571	A	6/1998	Marshall
5,959,616	A	9/1999	Challener
6,307,956	B1	10/2001	Black
6,473,072	B1	10/2002	Comiskey
6,621,697	B2	9/2003	O'Hara et al.
7,184,033	B2	2/2007	Burrus, IV et al.
7,348,968	B2	3/2008	Dawson
7,467,948	B2	12/2008	Lindberg et al.
8,059,105	B2	11/2011	Rosenberg
8,482,545	B2	7/2013	King-Smith et al.
8,502,651	B2	8/2013	Birnbaum
8,723,820	B1	5/2014	Han
8,773,405	B1	7/2014	Ryshtun
8,878,823	B1	11/2014	Kremin et al.
8,922,527	B2	12/2014	Ryshtun et al.
8,956,230	B2	2/2015	Adhikari
8,988,445	B2	3/2015	Kuchenbecker
2001/0006383	A1	7/2001	Fleck
2002/0021291	A1	2/2002	Cook
2005/0083314	A1	4/2005	Shalit
2005/0116940	A1	6/2005	Dawson et al.
2005/0248549	A1	11/2005	Dietz et al.
2005/0253816	A1	11/2005	Himberg et al.
2007/0139399	A1	6/2007	Cook
2008/0030486	A1	2/2008	Cook
2008/0186255	A1	8/2008	Cohen
2009/0167702	A1	7/2009	Nurmi et al.
2009/0251338	A1	10/2009	Marggraff et al.

(Continued)

Primary Examiner — Joseph Haley

(74) *Attorney, Agent, or Firm* — Treyz Law Group, P.C.; G. Victor Treyz; Joseph F. Guihan

(57) **ABSTRACT**

A stylus may have an elongated body with opposing first and second ends. Electronic equipment may have a touch sensor that receives electromagnetic signals from one or more electrodes at the first end. The stylus may have a six-axis inertial sensor at the second end. Force sensors may be located at the first and second ends. User input from the force sensors, the inertial sensor, and other input-output devices may be used to supply the stylus with mode change commands. In response to the mode change commands the stylus may transition between operating modes such as a touch sensor mode and one or more inertial sensor modes. Inertial sensor data may be used to allow the stylus to operate as a joystick, a rotational controller, an air mouse, or other input devices in addition to serving as a touch sensor input device.

17 Claims, 9 Drawing Sheets