

Exhibit 10



US007812828B2

(12) **United States Patent**
Westerman et al.

(10) **Patent No.:** **US 7,812,828 B2**
(45) **Date of Patent:** **Oct. 12, 2010**

(54) **ELLIPSE FITTING FOR MULTI-TOUCH SURFACES**

4,246,452 A	1/1981	Chandler
4,266,144 A	5/1981	Bristol
4,290,061 A	9/1981	Serrano
4,291,303 A	9/1981	Cutler et al.
4,550,221 A	10/1985	Mabusth
4,561,002 A	12/1985	Chiu
4,672,364 A	6/1987	Lucas
4,672,558 A	6/1987	Beckes et al.

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 707 days.

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(21) Appl. No.: **11/677,958**

FOREIGN PATENT DOCUMENTS

(22) Filed: **Feb. 22, 2007**

CA	1243096	10/1988
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(65) **Prior Publication Data**

US 2007/0139395 A1 Jun. 21, 2007

(Continued)

Related U.S. Application Data

OTHER PUBLICATIONS

(63) Continuation of application No. 11/015,434, filed on Dec. 17, 2004, now Pat. No. 7,339,580, which is a continuation of application No. 09/236,513, filed on Jan. 25, 1999, now Pat. No. 6,323,846.

Chang, C-C. et al. (Aug. 1, 1993). "A Hashing-Oriented Nearest Neighbor Searching Scheme," *Pattern Recognition Letters*, 14(8):625-630.

(Continued)

(60) Provisional application No. 60/072,509, filed on Jan. 26, 1998.

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(51) **Int. Cl.**
G06F 3/041 (2006.01)

(52) **U.S. Cl.** **345/173; 345/174; 345/175; 178/18.01; 178/18.03**

(57) **ABSTRACT**

(58) **Field of Classification Search** **345/173-178; 178/18.01, 18.03, 19.01, 20.01; 715/863**
See application file for complete search history.

Apparatus and methods are disclosed for simultaneously tracking multiple finger and palm contacts as hands approach, touch, and slide across a proximity-sensing, multi-touch surface. Identification and classification of intuitive hand configurations and motions enables unprecedented integration of typing, resting, pointing, scrolling, 3D manipulation, and handwriting into a versatile, ergonomic computer input device.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,333,160 A	7/1967	Gorski
3,541,541 A	11/1970	Engelhart
3,662,105 A	5/1972	Hurst et al.
3,798,370 A	3/1974	Hurst
4,237,421 A	12/1980	Waldron

35 Claims, 45 Drawing Sheets

