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# United States Patent [19]

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Gillespie et al.

[45] Date of Patent: **Mar. 9, 1999**

[54] **OBJECT POSITION DETECTOR WITH EDGE MOTION FEATURE AND GESTURE RECOGNITION**

0 609 021	8/1994	European Pat. Off. ....	G06K 11/16
2 662 528	5/1990	France .....	G06K 11/16
60-205625	10/1985	Japan .....	G06F 3/03
62-126429	6/1987	Japan .....	G06F 3/033
63-073415	4/1988	Japan .....	G06F 3/033
2 040614	2/1990	Japan .....	G02G 1/133
4 015725	1/1992	Japan .....	G06F 3/033

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(List continued on next page.)

[73] Assignee: **Synaptics, Incorporated**, San Jose, Calif.

### OTHER PUBLICATIONS

[21] Appl. No.: **623,483**

“Pressure-Sensitive Icons”, IBM Technical Disclosure Bulletin, Jun. 1990, vol. 33, No. 1B, pp. 277-278.

[22] Filed: **Mar. 28, 1996**

“Scroll Control Box”, IBM Technical Disclosure Bulletin, Apr. 1993, vol. 36, No. 4, pp. 399-403.

### Related U.S. Application Data

Wilton, Microsoft Windows 3 Developer’s Workshop, 1991, pp. 229-230.

[63] Continuation-in-part of Ser. No. 320,158, Oct. 7, 1994, Pat. No. 5,543,591, which is a continuation-in-part of Ser. No. 300,387, Sep. 2, 1994, abandoned, which is a continuation-in-part of Ser. No. 115,743, Aug. 31, 1993, Pat. No. 5,374,787, which is a continuation-in-part of Ser. No. 895,934, Jun. 8, 1992, abandoned.

Tiburtius, “Transparente Folientastaturen”, Feinwerktechnik & Messtechnik 97, No. 7, Munchen, DE, Jul. 1989, pp. 299-300.

[51] **Int. Cl.**<sup>6</sup> ..... **G08C 21/00**; G09G 5/08; G09G 5/00

“Double-Click Generation Method for Pen Operations”, IBM Technical Disclosure Bulletin, Nov. 1992, vol. 35, No. 6, p. 3.

[52] **U.S. Cl.** ..... **178/18.01**; 178/19.01; 345/157; 345/159; 345/173

“Three-Axis Touch-Sensitive Pad”, IBM Technical Disclosure Bulletin, Jan. 1987, vol. 29, No. 8, pp. 3451-3453.

[58] **Field of Search** ..... 178/18.01, 19.01, 178/20.01; 345/157, 159, 160, 173, 174; 382/119, 186, 187, 316

Chun, et al., “A High-Performance Silicon Tactile Imager Based on a Capacitive Cell”, IEEE Transactions on Electron Devices, Jul. 1985, vol. ED-32, No. 7, pp. 1196-1201.

*Primary Examiner*—Vijay Shankar  
*Attorney, Agent, or Firm*—D’Alessandro & Ritchie

### [56] References Cited

### [57] ABSTRACT

#### U.S. PATENT DOCUMENTS

Re. 23,030	8/1948	Holt .
2,219,497	10/1940	Stevens et al. .
3,128,458	4/1964	Romero .

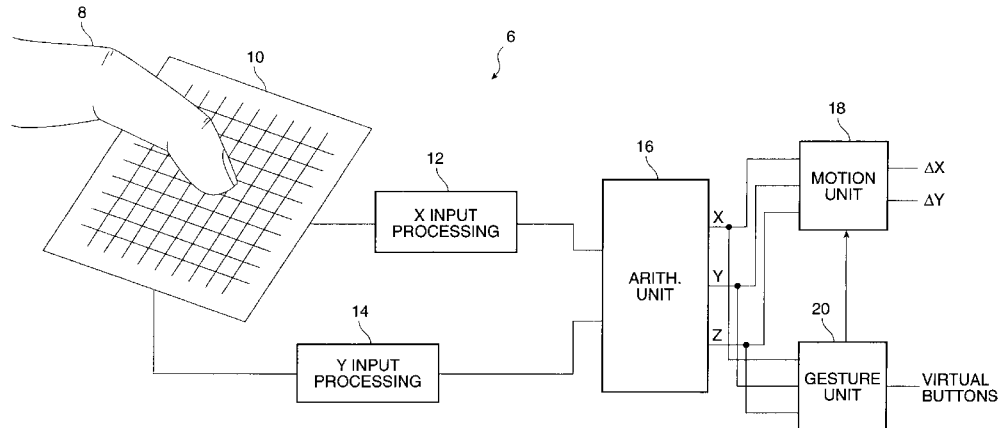
Methods for recognizing gestures made by a conductive object on a touch-sensor pad and for cursor motion are disclosed. Tapping, drags, pushes, extended drags and variable drags gestures are recognized by analyzing the position, pressure, and movement of the conductive object on the sensor pad during the time of a suspected gesture, and signals are sent to a host indicating the occurrence of these gestures. Signals indicating the position of a conductive object and distinguishing between the peripheral portion and an inner portion of the touch-sensor pad are also sent to the host.

(List continued on next page.)

#### FOREIGN PATENT DOCUMENTS

0 187 372	12/1985	European Pat. Off. ....	G01B 7/00
0 394 614	10/1990	European Pat. Off. ....	G06F 3/033
0 490 001	6/1992	European Pat. Off. ....	G06F 3/033
0 574 213	12/1993	European Pat. Off. ....	G06K 11/16
0 589 498	3/1994	European Pat. Off. ....	G06K 11/16

**64 Claims, 28 Drawing Sheets**



U.S. PATENT DOCUMENTS

3,207,905	9/1965	Bray .	
3,244,369	4/1966	Nassimbene .	
3,401,470	9/1968	Gaven .	
3,437,795	4/1969	Kuljian .	
3,482,241	12/1969	Johnson .	
3,492,440	1/1970	Cerbone et al. .	
3,493,791	2/1970	Adelson et al. .	
3,497,617	2/1970	Ellis et al. .	
3,497,966	3/1970	Gaven .	
3,516,176	6/1970	Cleary et al. .	
3,522,664	8/1970	Lambright et al. .	
3,530,310	9/1970	Adelson et al. .	
3,543,056	11/1970	Klein .	
3,549,909	12/1970	Adelson et al. ....	307/252
3,593,115	7/1971	Dym et al. ....	323/93
3,598,903	8/1971	Johnson et al. ....	178/18
3,662,378	5/1972	MacArthur ..... DD	340/347
3,675,239	7/1972	Ackerman et al. ....	340/365
3,683,371	8/1972	Holz ..... C	340/365
3,696,409	10/1972	Braaten ..... C	340/365
3,732,389	5/1973	Kaelin et al. .... A	200/167
3,737,670	6/1973	Larson ..... C	307/116
3,757,322	9/1973	Barkan et al. .... C	340/365
3,760,392	9/1973	Stich ..... C	340/200
3,773,989	11/1973	Hacon ..... R	200/52
3,875,331	4/1975	Halsenbalg ..... C	178/19
3,921,166	11/1975	Volpe ..... C	340/365
3,931,610	1/1976	Marin et al. .... M	340/172.5
3,932,862	1/1976	Graven ..... M	340/324
3,974,332	8/1976	Abe et al. .... C	178/18
3,992,579	11/1976	Dym et al. .... C	178/18
3,999,012	12/1976	Dym ..... C	178/18
4,056,699	11/1977	Jordan ..... A	200/5
4,058,765	11/1977	Richardson et al. .... R	324/61
4,071,691	1/1978	Pepper, Jr. .... C	178/19
4,087,625	5/1978	Dym et al. .... C	178/19
4,103,252	7/1978	Bobick ..... C	331/48
4,129,747	12/1978	Pepper, Jr. .... C	178/19
4,148,014	4/1979	Burson ..... C	340/709
4,177,354	12/1979	Mathews ..... C	178/18
4,177,421	12/1979	Thornburg ..... R	324/61
4,198,539	4/1980	Pepper, Jr. .... C	178/18
4,221,975	9/1980	Lednicki et al. .... C	307/116
4,224,615	9/1980	Penz ..... C	340/712
4,246,452	1/1981	Chandler ..... A	200/5
4,257,117	3/1981	Besson ..... C	368/69
4,264,903	4/1981	Bigelow ..... C	340/365
4,281,323	7/1981	Burnett et al. .... C	340/712
4,290,052	9/1981	Eichelberger et al. .... C	340/365
4,290,061	9/1981	Serrano ..... C	340/712
4,291,303	9/1981	Cutler et al. .... C	340/711
4,293,734	10/1981	Pepper, Jr. .... C	178/18
4,302,011	11/1981	Pepper, Jr. .... C	273/85
4,310,839	1/1982	Schwerdt ..... C	340/712
4,313,113	1/1982	Thornburg ..... C	345/159
4,334,219	6/1982	Paülus et al. .... C	340/712
4,371,746	2/1983	Pepper, Jr. .... C	178/18
4,398,181	8/1983	Yamamoto ..... S	340/365
4,423,286	12/1983	Bergeron ..... C	178/19
4,430,917	2/1984	Pepper, Jr. .... C	84/1.01
4,442,317	4/1984	Jandrell ..... C	178/18

4,455,452	6/1984	Schuyler ..... C	178/18
4,475,235	10/1984	Graham ..... C	382/3
4,476,463	10/1984	Ng et al. .... C	340/712
4,511,760	4/1985	Garwin et al. .... C	178/18
4,516,112	5/1985	Chen ..... C	340/365
4,526,043	7/1985	Boie et al. .... C	73/862.04
4,550,221	10/1985	Mabusth ..... C	178/18
4,550,310	10/1985	Yamaguchi et al. .... C	340/365
4,554,409	11/1985	Mitsui et al. .... C	178/19
4,570,149	2/1986	Thornburg et al. .... C	338/114
4,582,955	4/1986	Blesser ..... C	178/19
4,595,913	6/1986	Aubuchon ..... C	340/365
4,616,107	10/1986	Abe et al. .... C	178/18
4,639,720	1/1987	Rympalski et al. .... C	340/712
4,672,154	6/1987	Rodgers et al. .... C	178/19
4,680,430	7/1987	Yoshikawa et al. .... C	178/19
4,686,332	8/1987	Greanias et al. .... C	178/19
4,698,461	10/1987	Meadows et al. .... C	178/19
4,733,222	3/1988	Evans ..... C	340/365
4,734,685	3/1988	Watanabe ..... C	340/710
4,736,191	4/1988	Matzke et al. .... C	340/365
4,758,690	7/1988	Kimura ..... C	178/19
4,766,423	8/1988	Ono et al. .... C	340/709
4,788,385	11/1988	Kimura ..... C	178/19
4,794,208	12/1988	Watson ..... C	178/19
4,820,886	4/1989	Watson ..... C	178/19
4,853,498	8/1989	Meadows et al. .... C	178/19
4,914,624	4/1990	Dunthorn ..... C	364/900
4,918,262	4/1990	Flowers et al. .... C	178/18
4,922,061	5/1990	Meadows et al. .... C	178/19
4,935,728	6/1990	Key ..... C	340/709
4,988,982	1/1991	Rayner et al. .... C	345/173
5,016,008	5/1991	Gruaz et al. .... C	341/33
5,117,071	5/1992	Greanias et al. .... C	178/19
5,120,907	6/1992	Shinbori et al. .... C	478/18
5,149,919	9/1992	Greanias et al. .... C	178/19
5,153,572	10/1992	Caldwell et al. .... C	340/712
5,194,862	3/1993	Edwards ..... C	341/20
5,231,450	7/1993	Daniels ..... C	355/27
5,239,140	8/1993	Kuroda et al. .... C	178/18
5,270,711	12/1993	Knapp ..... C	341/34
5,327,161	7/1994	Logan et al. .... C	345/157
5,365,254	11/1994	Kawamoto ..... C	345/157
5,369,227	11/1994	Stone ..... C	178/18
5,373,118	12/1994	Watson ..... C	178/19
5,374,787	12/1994	Miller et al. .... C	178/18
5,386,219	1/1995	Greanias et al. .... C	345/174
5,408,593	4/1995	Kotaki et al. .... C	395/122
5,488,204	1/1996	Mead et al. .... C	345/179

FOREIGN PATENT DOCUMENTS

06 139022	5/1994	Japan ..... C	G06F 3/033
07 072 976	3/1995	Japan ..... C	G06F 3/033
2 139 762	11/1984	United Kingdom ..... C	G06F 3/033
2 266 038	10/1993	United Kingdom ..... C	G06F 3/033
2 288 665	4/1995	United Kingdom ..... C	G06K 11/12
91/03039	3/1991	WIPO ..... C	G09G 3/02
91/05327	4/1991	WIPO ..... C	G09G 3/02
96/07966	3/1996	WIPO ..... C	G06F 3/033
96/11435	4/1996	WIPO ..... C	G06F 3/033
96/18179	6/1996	WIPO ..... C	G08C 21/00

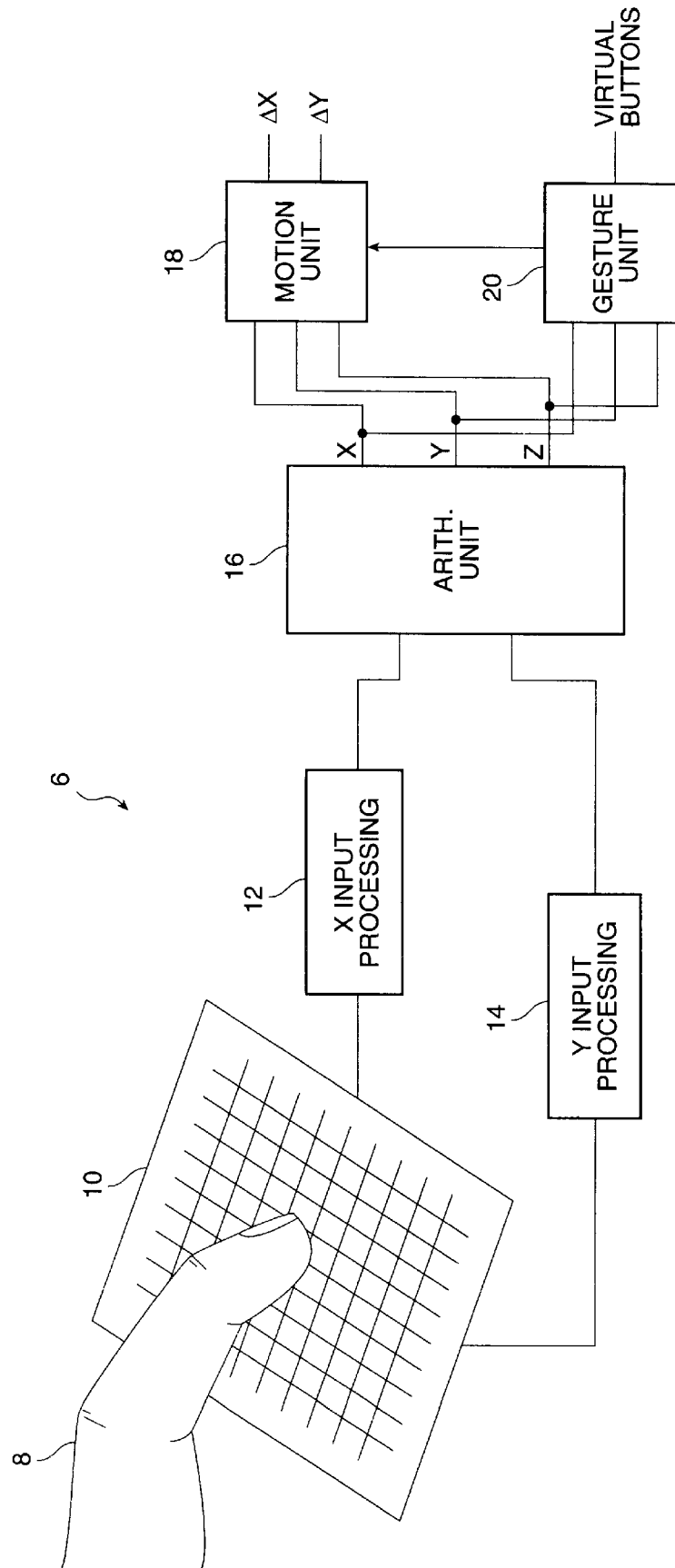


FIG. 1

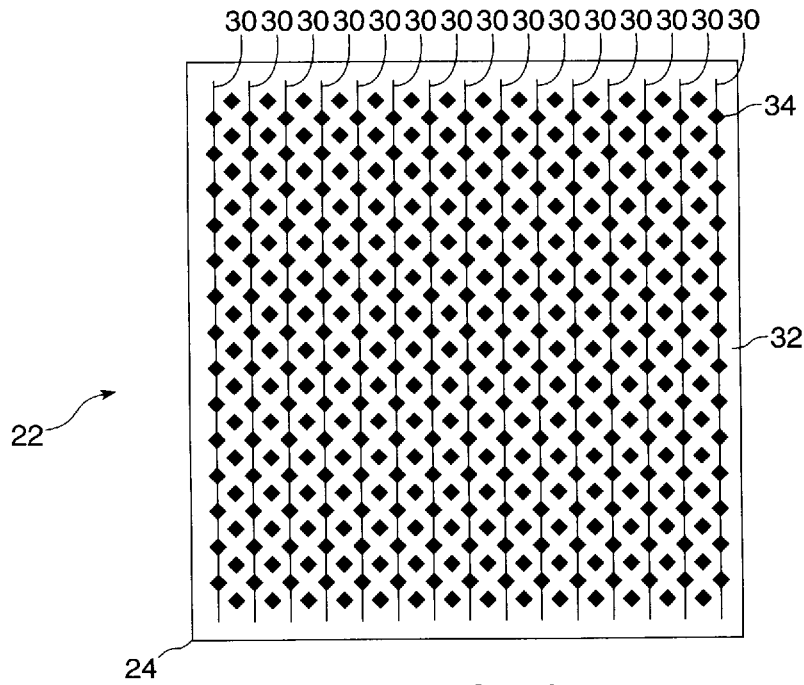


FIG. 2A

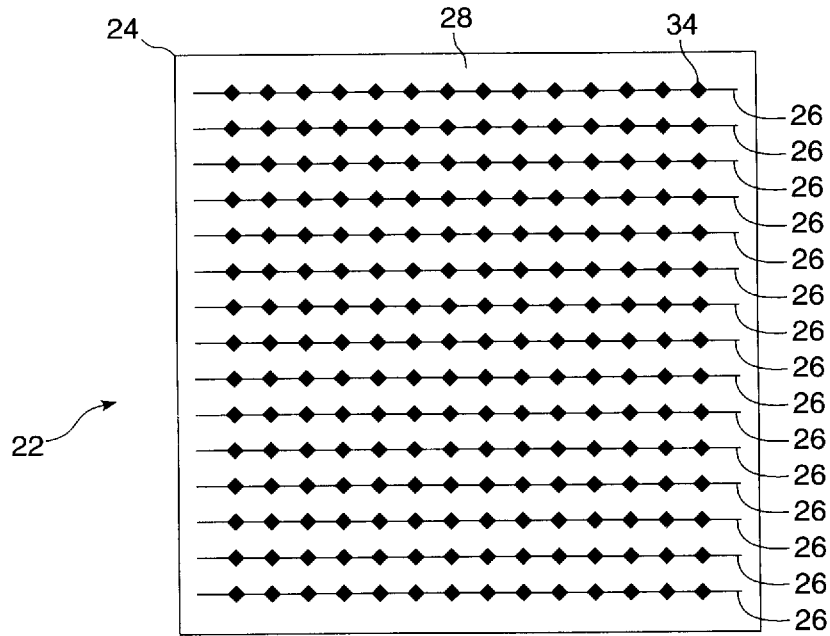


FIG. 2B

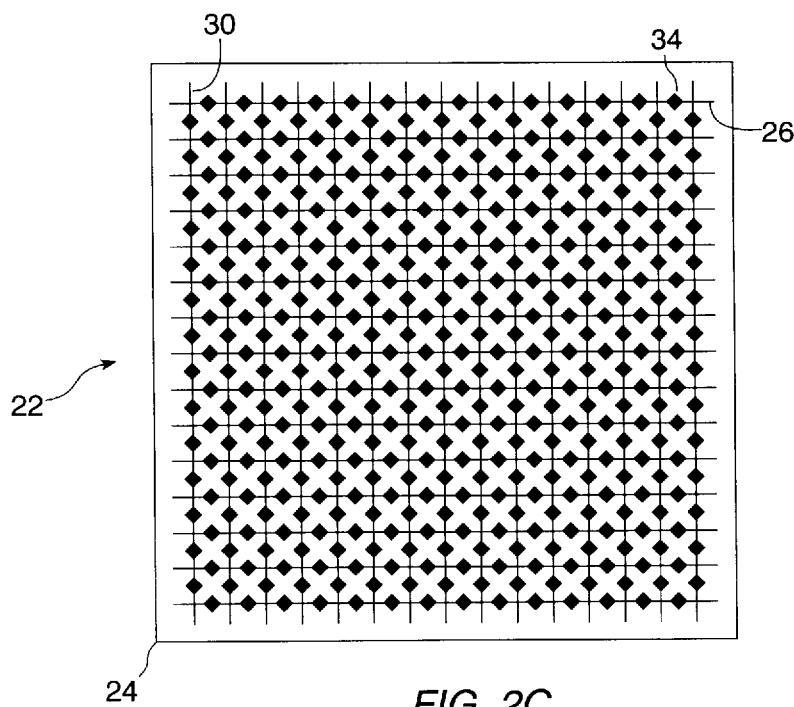


FIG. 2C

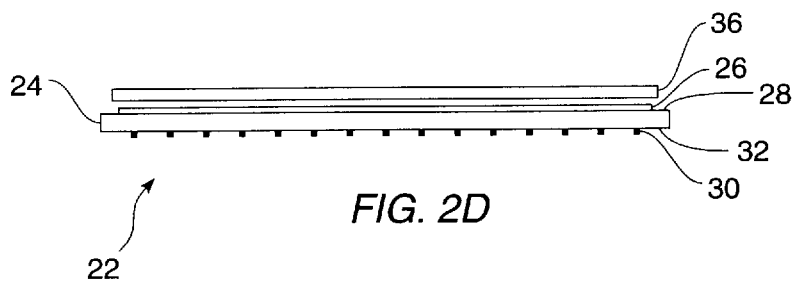


FIG. 2D

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