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United States Patent [19]

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Gillespie et al.

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[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.**⁶ **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 .

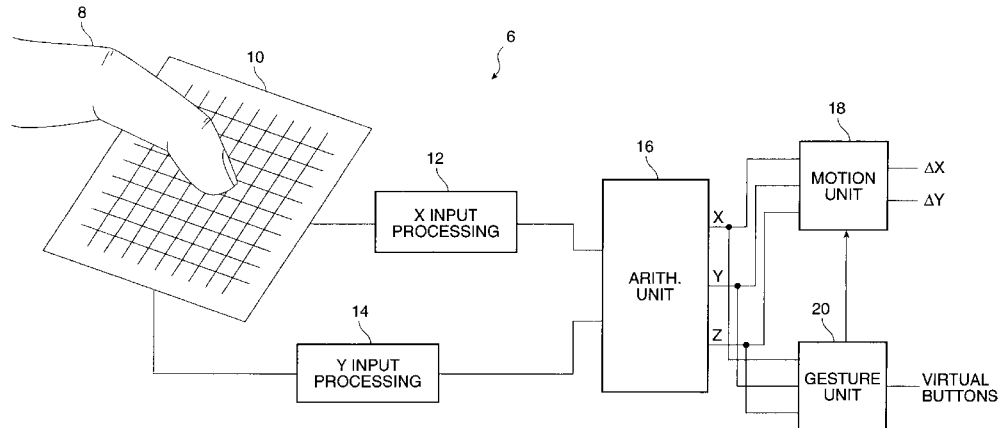
Methods for recognizing gestures made by a conductive object on a touch-sensor pad and for cursor motion are disclosed. Tapping, drags, pushes, extended drags and variable drags gestures are recognized by analyzing the position, pressure, and movement of the conductive object on the sensor pad during 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 340/347 DD
 3,675,239 7/1972 Ackerman et al. 340/365
 3,683,371 8/1972 Holz 340/365
 3,696,409 10/1972 Braaten 340/365
 3,732,389 5/1973 Kaelin et al. 200/167 A
 3,737,670 6/1973 Larson 307/116
 3,757,322 9/1973 Barkan et al. 340/365 C
 3,760,392 9/1973 Stich 340/200
 3,773,989 11/1973 Hacon 200/52 R
 3,875,331 4/1975 Halsenbalg 178/19
 3,921,166 11/1975 Volpe 340/365 C
 3,931,610 1/1976 Marin et al. 340/172.5
 3,932,862 1/1976 Graven 340/324 M
 3,974,332 8/1976 Abe et al. 178/18
 3,992,579 11/1976 Dym et al. 178/18
 3,999,012 12/1976 Dym 178/18
 4,056,699 11/1977 Jordan 200/5 A
 4,058,765 11/1977 Richardson et al. 324/61 R
 4,071,691 1/1978 Pepper, Jr. 178/19
 4,087,625 5/1978 Dym et al. 178/19
 4,103,252 7/1978 Bobick 331/48
 4,129,747 12/1978 Pepper, Jr. 178/19
 4,148,014 4/1979 Burson 340/709
 4,177,354 12/1979 Mathews 178/18
 4,177,421 12/1979 Thornburg 324/61 R
 4,198,539 4/1980 Pepper, Jr. 178/18
 4,221,975 9/1980 Lednicki et al. 307/116
 4,224,615 9/1980 Penz 340/712
 4,246,452 1/1981 Chandler 200/5 A
 4,257,117 3/1981 Besson 368/69
 4,264,903 4/1981 Bigelow 340/365 C
 4,281,323 7/1981 Burnett et al. 340/712
 4,290,052 9/1981 Eichelberger et al. 340/365 C
 4,290,061 9/1981 Serrano 340/712
 4,291,303 9/1981 Cutler et al. 340/711
 4,293,734 10/1981 Pepper, Jr. 178/18
 4,302,011 11/1981 Pepper, Jr. 273/85
 4,310,839 1/1982 Schwerdt 340/712
 4,313,113 1/1982 Thornburg 345/159
 4,334,219 6/1982 Paülus et al. 340/712
 4,371,746 2/1983 Pepper, Jr. 178/18
 4,398,181 8/1983 Yamamoto 340/365 S
 4,423,286 12/1983 Bergeron 178/19
 4,430,917 2/1984 Pepper, Jr. 84/1.01
 4,442,317 4/1984 Jandrell 178/18

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

FOREIGN PATENT DOCUMENTS

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

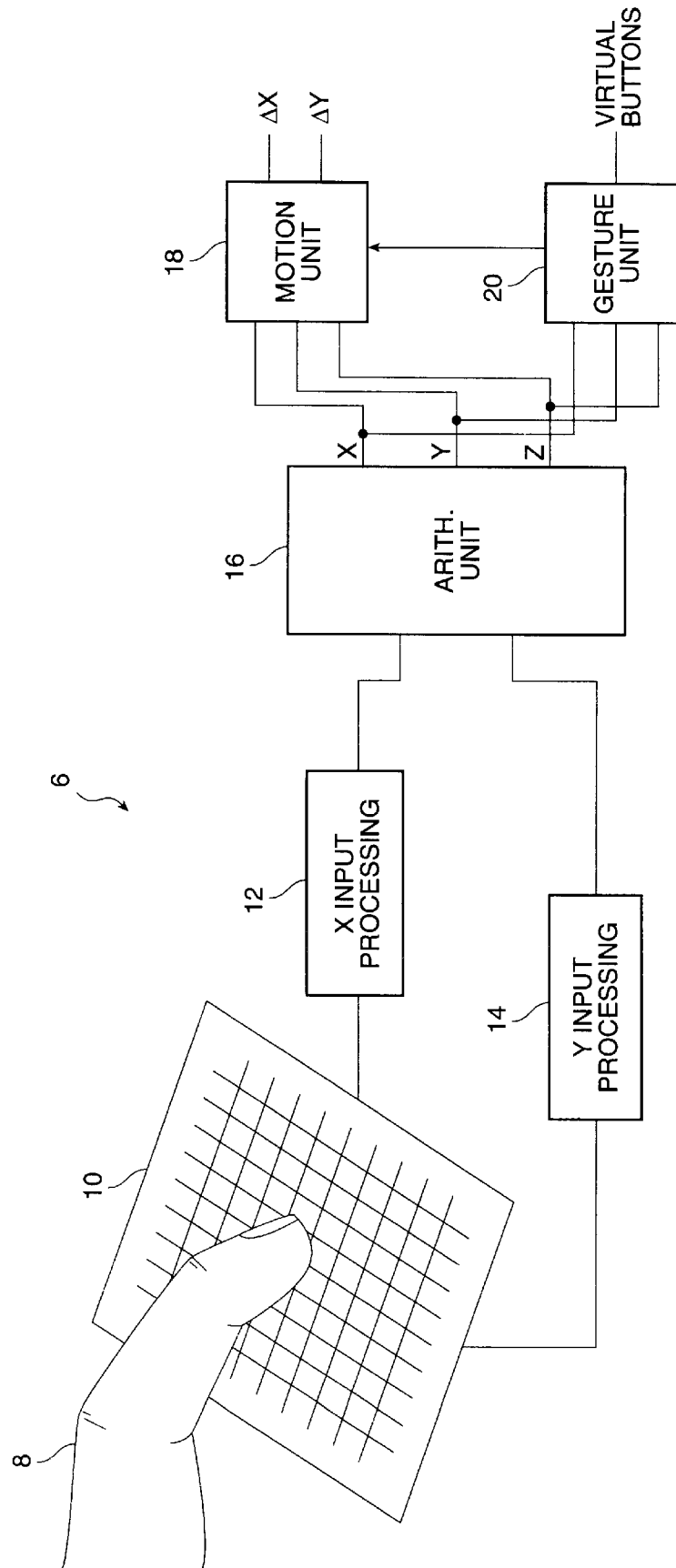


FIG. 1

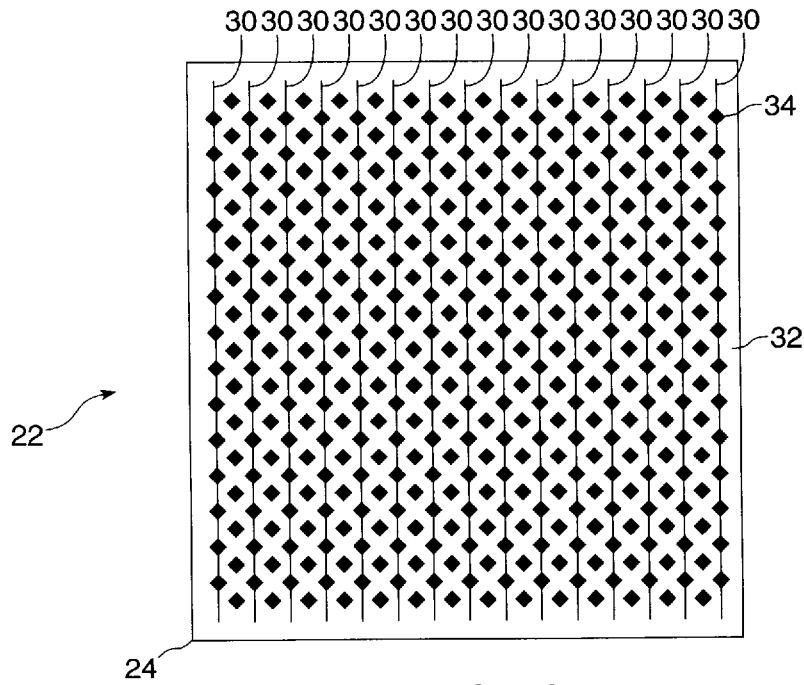


FIG. 2A

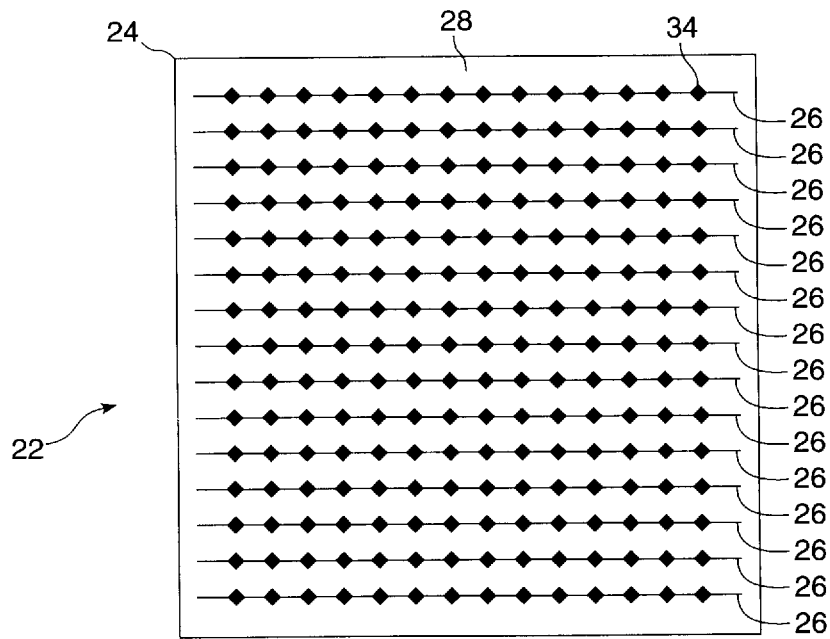


FIG. 2B

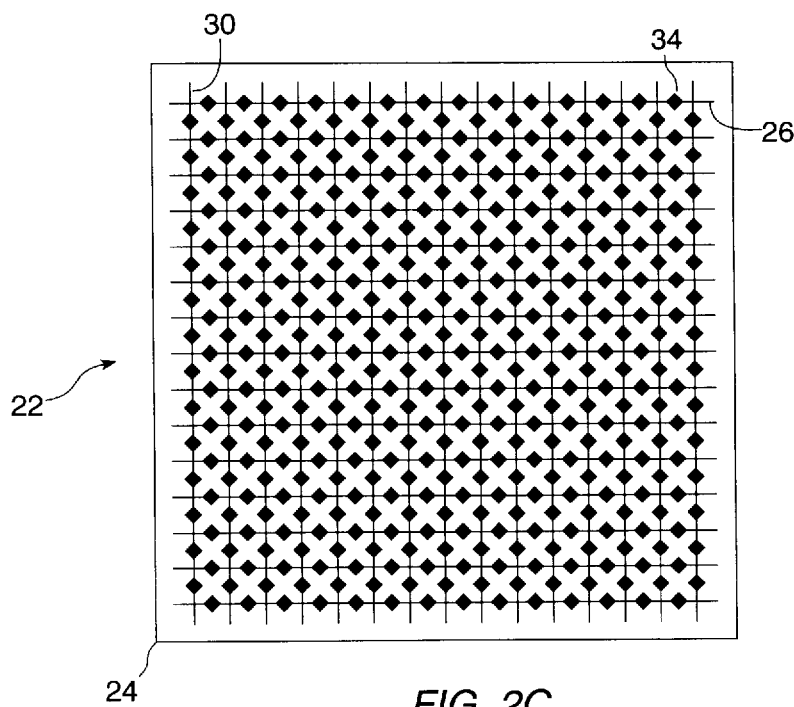


FIG. 2C

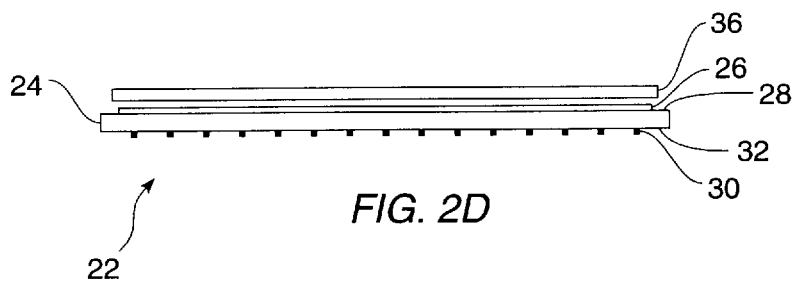


FIG. 2D

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