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

(10) **Patent No.:** **US 6,504,530 B1**
(45) **Date of Patent:** **Jan. 7, 2003**

(54) **TOUCH CONFIRMING TOUCHSCREEN UTILIZING PLURAL TOUCH SENSORS**

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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 0 days.

(21) Appl. No.: **09/390,207**

(22) Filed: **Sep. 7, 1999**

(51) **Int. Cl.^{7}** **G09G 5/00**

(52) **U.S. Cl.** **345/173**; 345/174; 345/175; 345/177

(58) **Field of Search** 345/173, 168, 345/174, 175, 176, 177, 178, 179

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Assistant Examiner—William C. Spencer

(57) **ABSTRACT**

A method and apparatus for discriminating against false touches in a touchscreen system is provided. The system is designed to confirm a touch registered by one touch sensor with another touch sensor, preferably of a different sensor type, prior to acting upon the touch (i.e., sending touch coordinates to the operating system). If the touch registered by the first touch sensor is not confirmed by the second touch sensor, the touch is invalidated. Thus the strengths of one type of sensor are used to overcome the deficiencies of another type of sensor. In one aspect, the secondary touch sensor comprises a force sensor to discriminate between true and false touches on other types of touch sensors, such as contaminants on optical and surface acoustic wave sensors, noise or weak signals on capacitive sensors, etc. The force sensor may be a simple one-element system that merely indicates that a touch has occurred or a multi-element system that can provide confirming or supplementary coordinate data. In another aspect, a capacitive sensor is used to confirm or veto touch data from optical, surface acoustic wave, and force sensors. As is the case with the secondary force sensor, a secondary capacitive sensor may be a simple discrete type or capable of providing touch coordinates in its own right. In a specific embodiment, one in which no touch overlay is used on a CRT monitor, the secondary touch sensor may employ the resistive coating on the surface of the CRT in combination with a current monitoring circuit that measures the amplitude of the electromagnetic noise signal coupled to the resistive coating. In this application when the screen is touched by a grounded object, the detected signal amplitude change exceeds a preset threshold thus indicating a valid touch.
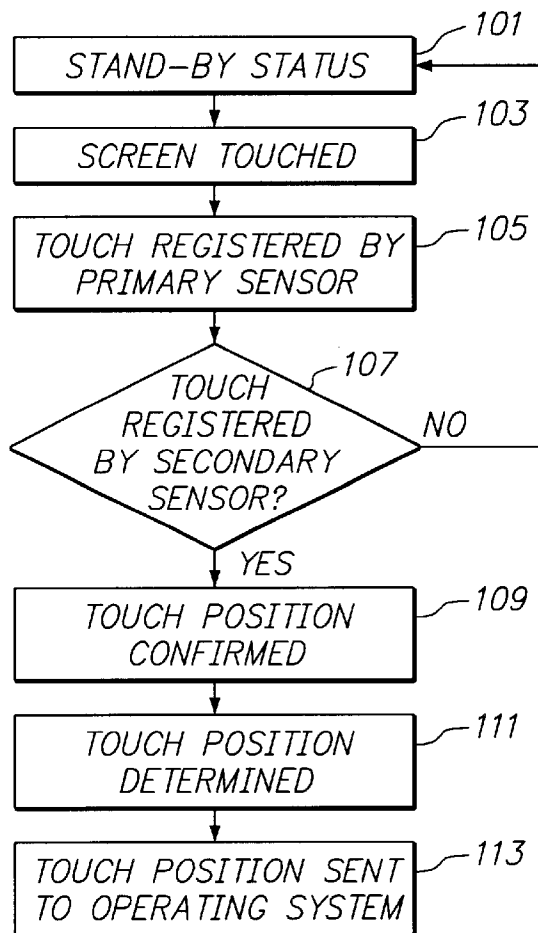
8 Claims, 9 Drawing Sheets
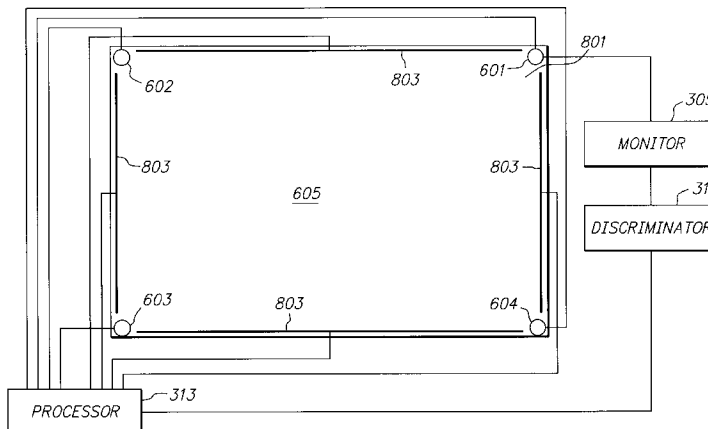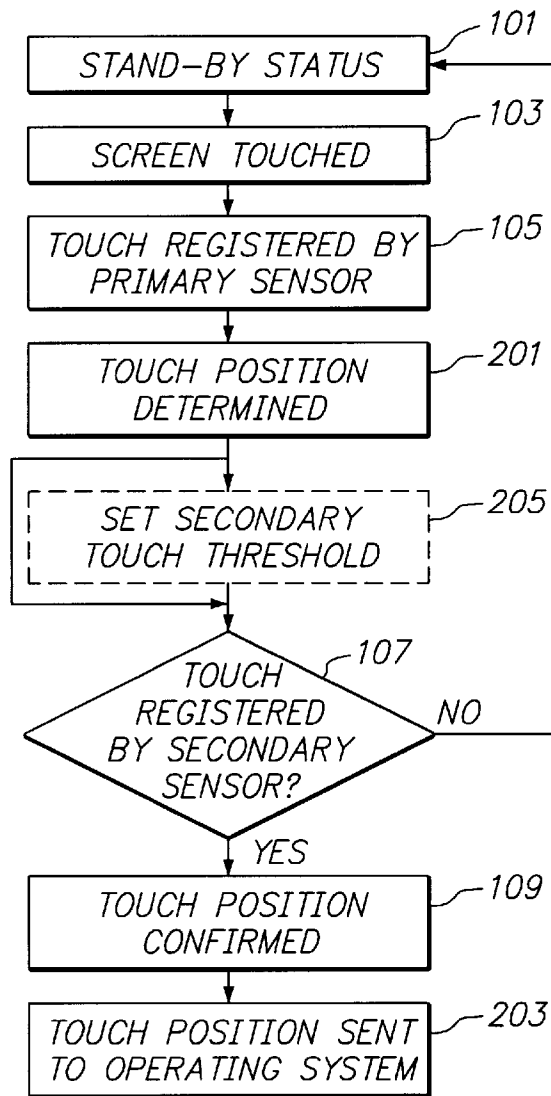
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FIG. 1

```
STAND-BY STATUS ─── 101
      │
      ▼
SCREEN TOUCHED ─── 103
      │
      ▼
TOUCH REGISTERED BY ─── 105
PRIMARY SENSOR
      │
      ▼
    TOUCH ─── 107
  REGISTERED        NO
BY SECONDARY ──────────►
  SENSOR?
      │
     YES
      │
      ▼
TOUCH POSITION ─── 109
CONFIRMED
      │
      ▼
TOUCH POSITION ─── 111
DETERMINED
      │
      ▼
TOUCH POSITION SENT ─── 113
TO OPERATING SYSTEM
```

FIG. 2

```
STAND-BY STATUS ─── 101
      │
      ▼
SCREEN TOUCHED ─── 103
      │
      ▼
TOUCH REGISTERED BY ─── 105
PRIMARY SENSOR
      │
      ▼
TOUCH POSITION ─── 201
DETERMINED
      │
      ▼
SET SECONDARY ─── 205
TOUCH THRESHOLD
      │
      ▼
    TOUCH ─── 107
  REGISTERED        NO
BY SECONDARY ──────────►
  SENSOR?
      │
     YES
      │
      ▼
TOUCH POSITION ─── 109
CONFIRMED
      │
      ▼
TOUCH POSITION SENT ─── 203
TO OPERATING SYSTEM
```
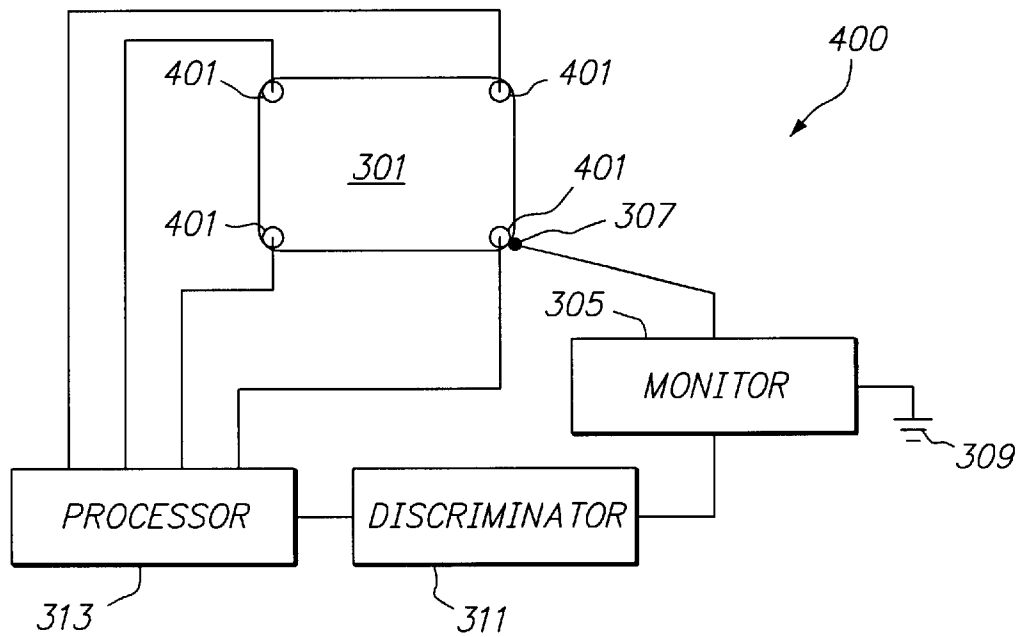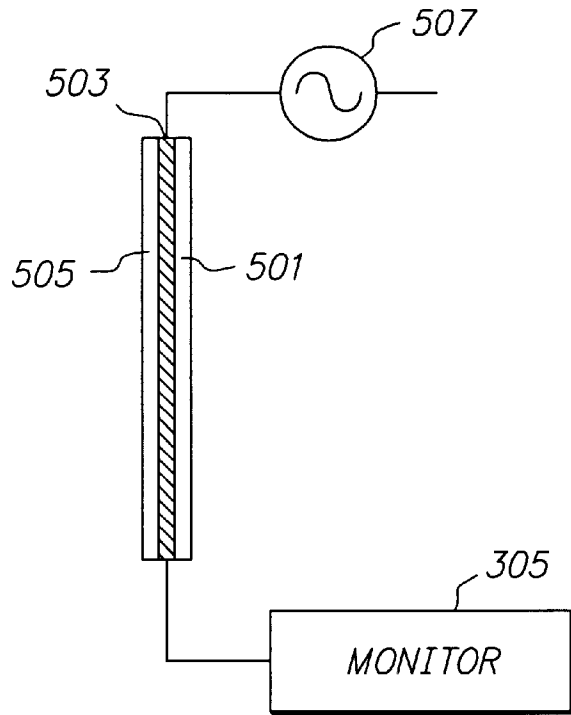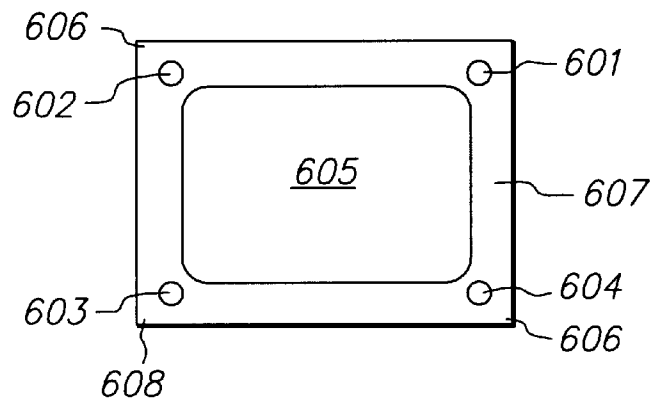
FIG. 3

FIG. 4

FIG. 5

FIG. 6

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