



US005374787A

United States Patent [19][11] **Patent Number:** 5,374,787

Miller et al.

[45] **Date of Patent:** Dec. 20, 1994[54] **OBJECT POSITION DETECTOR**

5,194,862 5/1993 Edwards 341/33

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[73] Assignee: **Synaptics, Inc.**, San Jose, Calif.[21] Appl. No.: **115,743**[22] Filed: **Aug. 31, 1993**[57] **ABSTRACT**

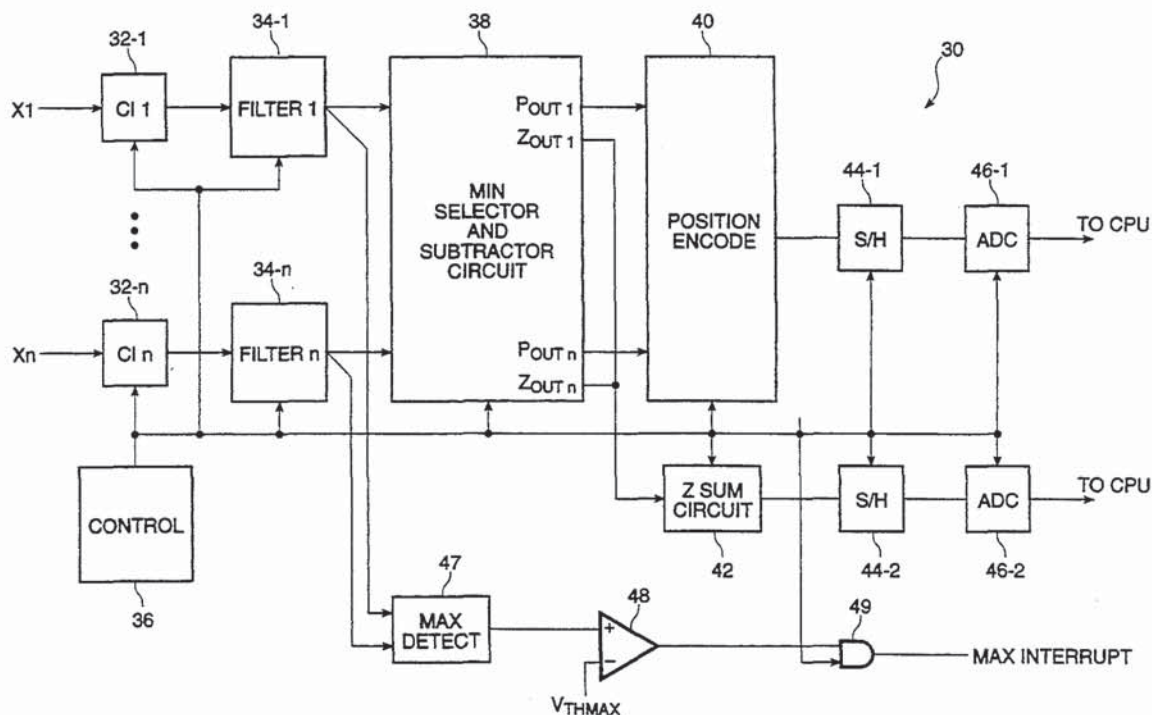
A proximity sensor system includes a sensor matrix array having a characteristic capacitance on horizontal and vertical conductors connected to sensor pads. The capacitance changes as a function of the proximity of an object or objects to the sensor matrix. The change in capacitance of each node in both the X and Y directions of the matrix due to the approach of an object is converted to a set of voltages in the X and Y directions. These voltages are processed by analog circuitry to develop electrical signals representative of the centroid of the profile of the object, i.e., its position in the X and Y dimensions. The profile of position may also be integrated to provide Z-axis (pressure) information.

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 895,934, Jun. 8, 1992.

[51] Int. Cl.⁵ **G08C 21/00; H03M 11/00**[52] U.S. Cl. **178/18; 341/33**[58] Field of Search **178/18, 19; 345/173-178; 341/33, 34**[56] **References Cited****U.S. PATENT DOCUMENTS**

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10 Claims, 12 Drawing Sheets

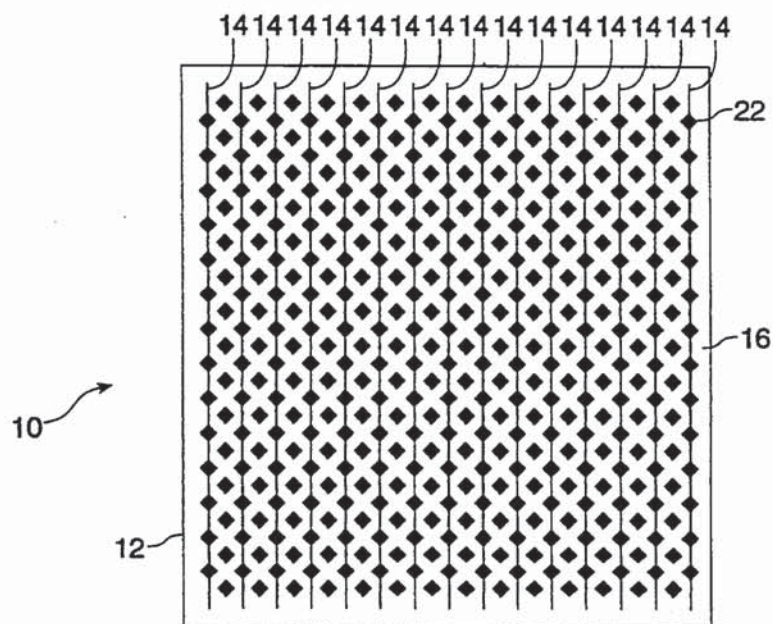


FIG. 1A

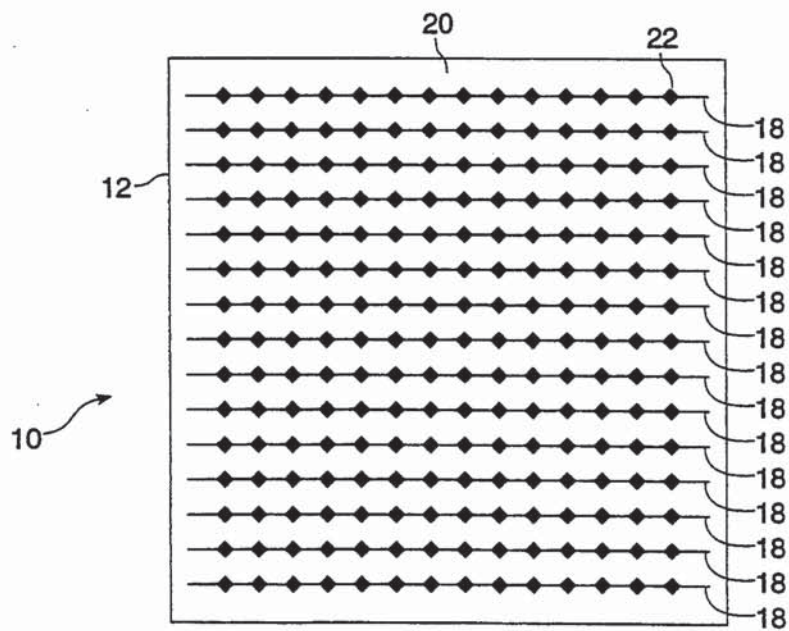


FIG. 1B

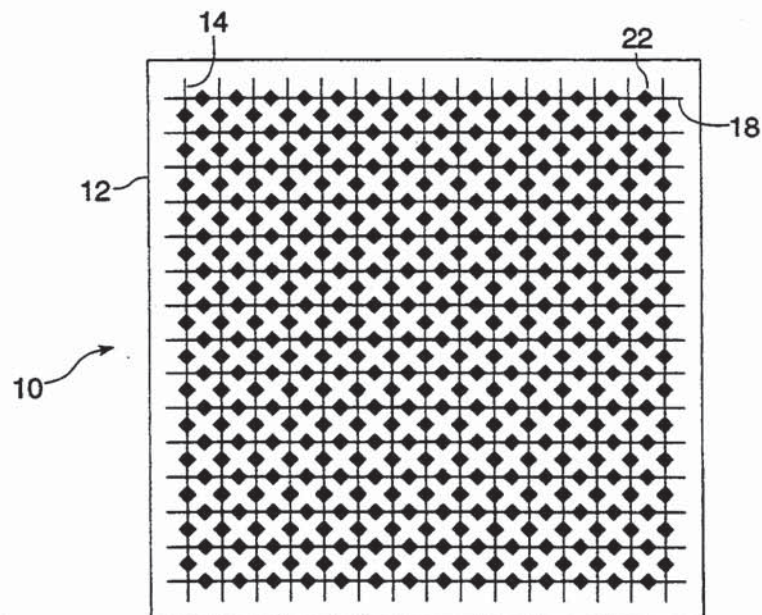


FIG. 1C

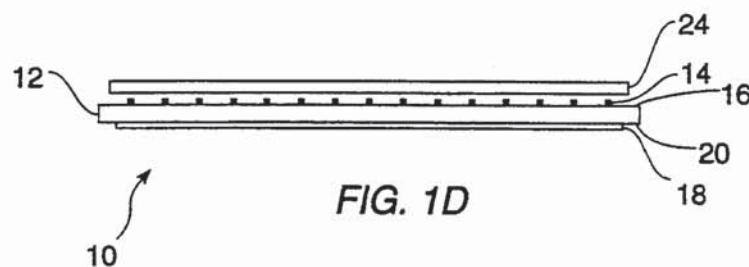


FIG. 1D

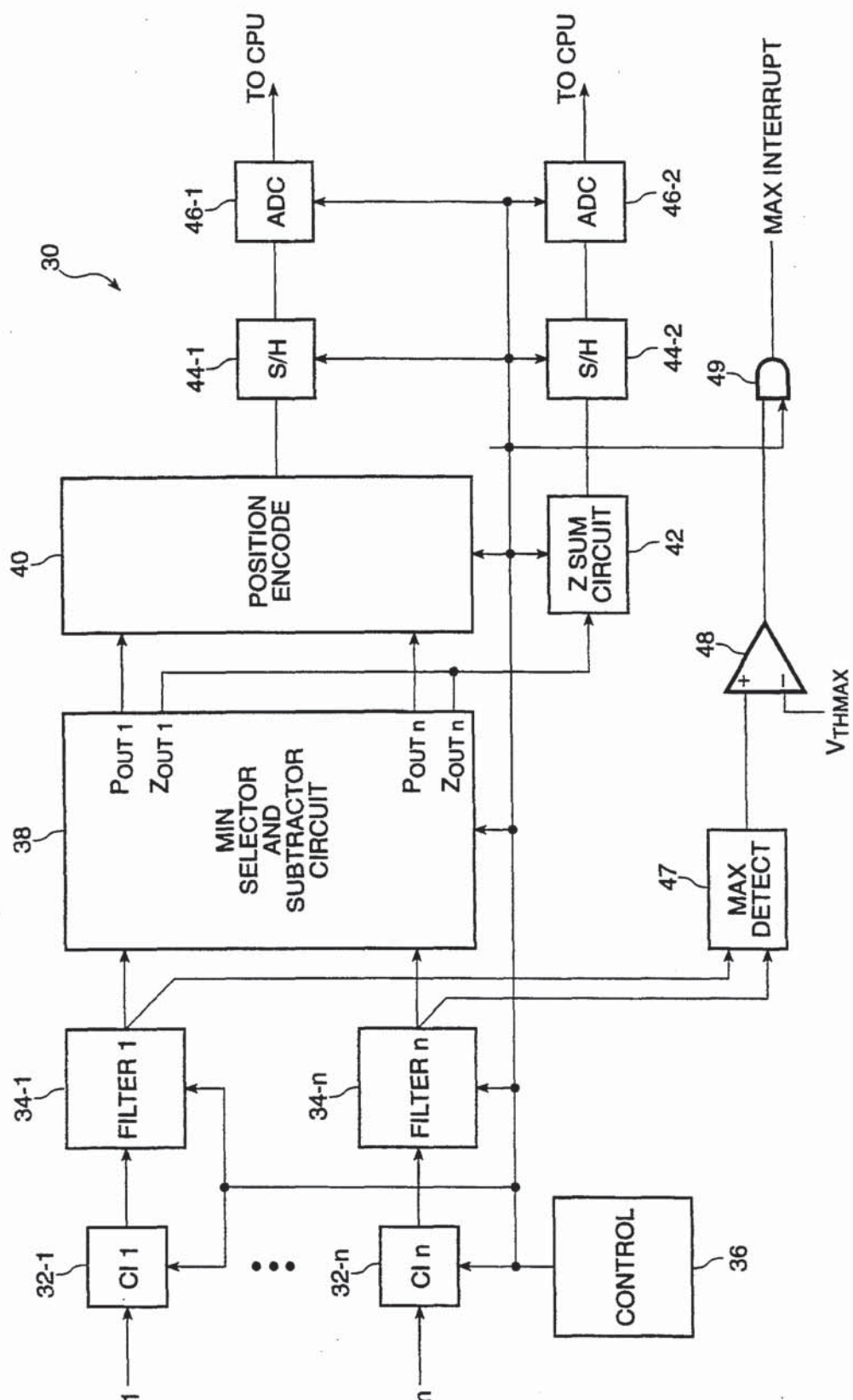


FIG. 2

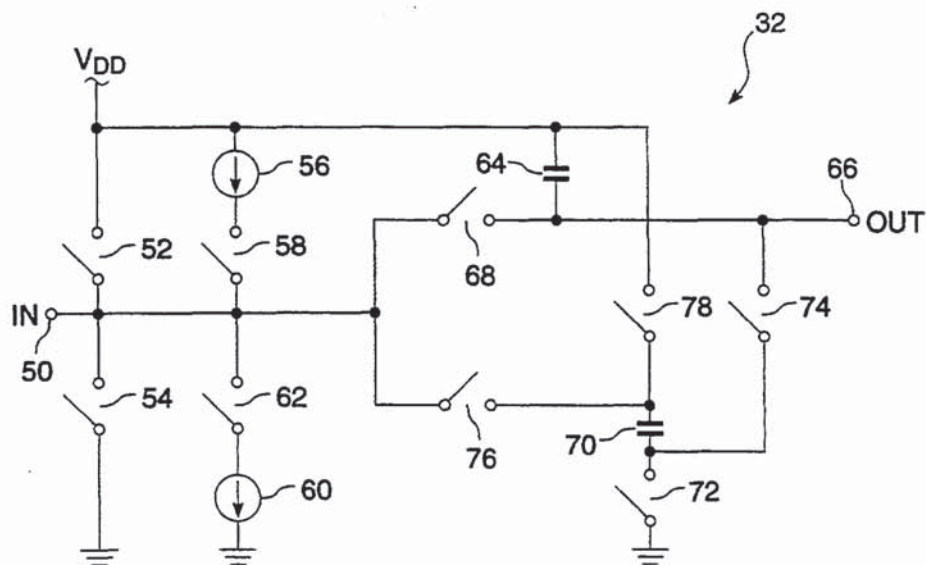


FIG. 3A

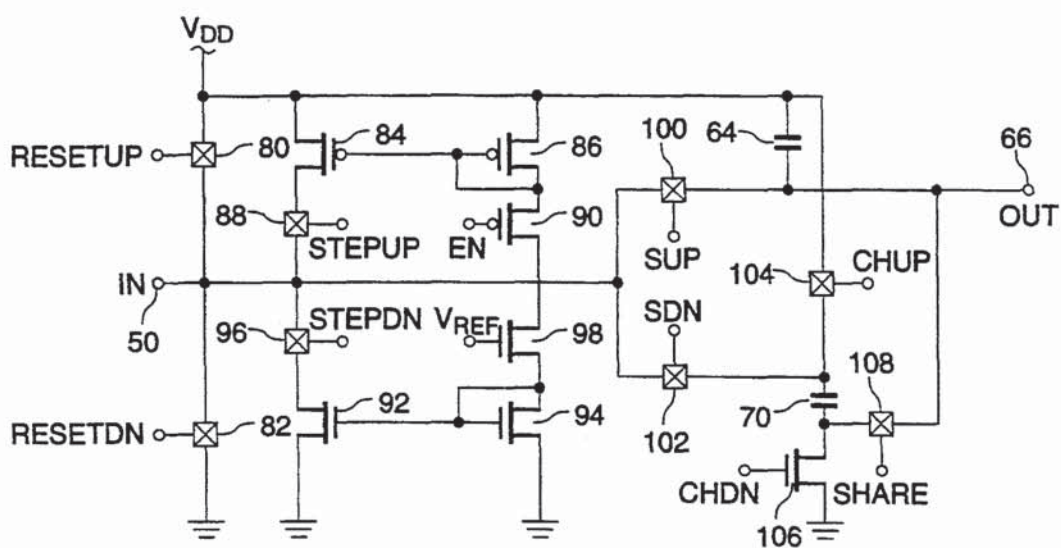


FIG. 3B



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