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United States Patent [19]

[11] **Patent Number:** 5,565,658

Gerpheide et al.

[45] **Date of Patent:** Oct. 15, 1996

[54] **CAPACITANCE-BASED PROXIMITY WITH INTERFERENCE REJECTION APPARATUS AND METHODS**

4,371,746	2/1983	Pepper, Jr.	178/18
4,476,463	10/1984	Ng et al.	178/187
4,845,682	7/1989	Boozer et al.	342/16 X
5,053,757	10/1991	Meadows	178/18 X
5,305,017	4/1994	Gerpheide	345/174

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[21] Appl. No.: 351,008

[22] Filed: Dec. 7, 1994

[57] ABSTRACT

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 193,275, Feb. 8, 1994, Pat. No. 5,478,170, which is a continuation of Ser. No. 914,043, Jul. 13, 1992, Pat. No. 5,305,017.

Apparatus and method for a capacitance-based proximity sensor with interference rejection. A pair of electrode arrays establish a capacitance on a touch detection pad, the capacitance varying with movement of a conductive object near the pad. The capacitance variations are measured synchronously with a reference frequency signal to thus provide a measure of the position of the object. Electrical interference is rejected by producing a reference frequency signal which is not coherent with the interference.

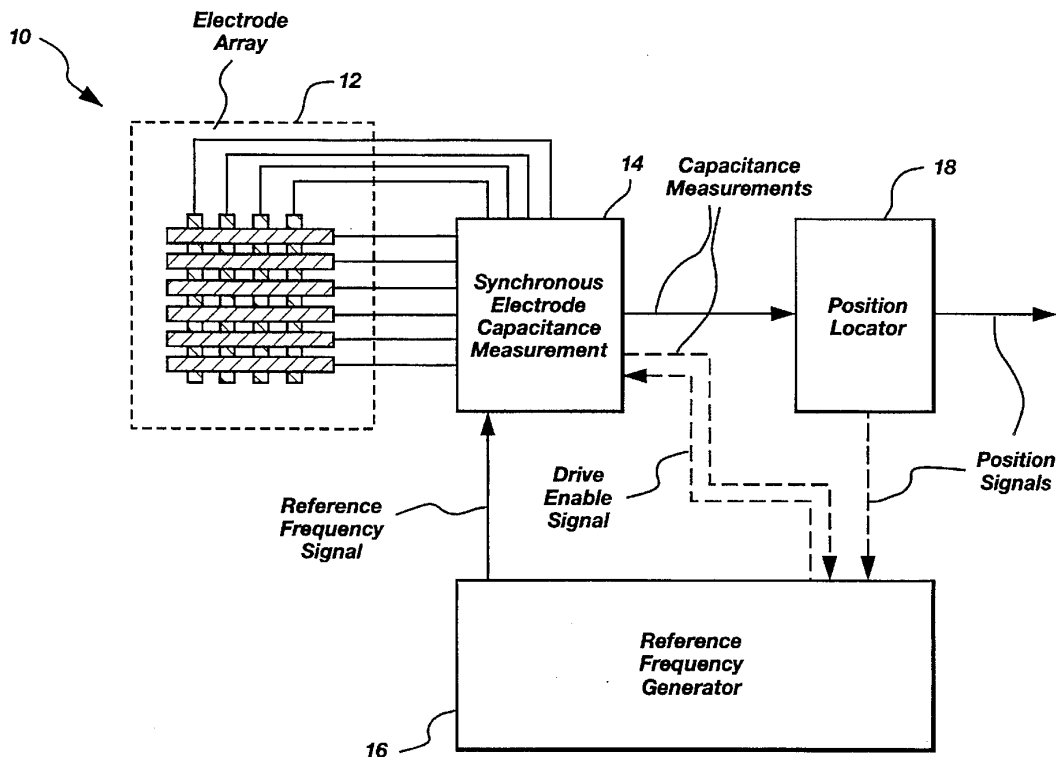
[51] **Int. Cl.⁶** **G08C 21/00**
[52] **U.S. Cl.** **178/19; 345/174**
[58] **Field of Search** 178/18, 19, 20;
345/168, 173, 174; 328/5; 342/16

[56] References Cited

U.S. PATENT DOCUMENTS

4,237,421 12/1980 Waldron 325/5

14 Claims, 8 Drawing Sheets



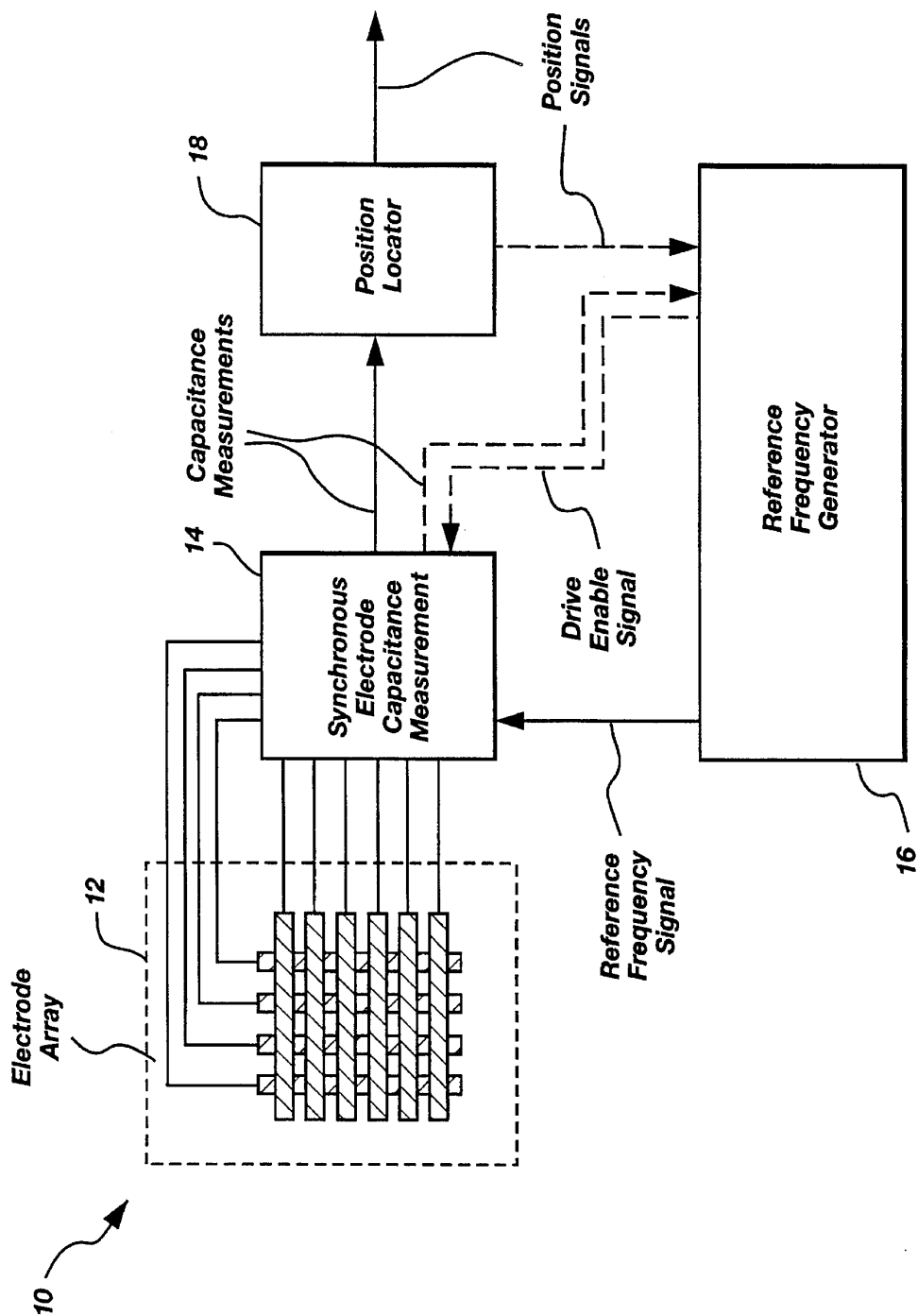


Fig. 1

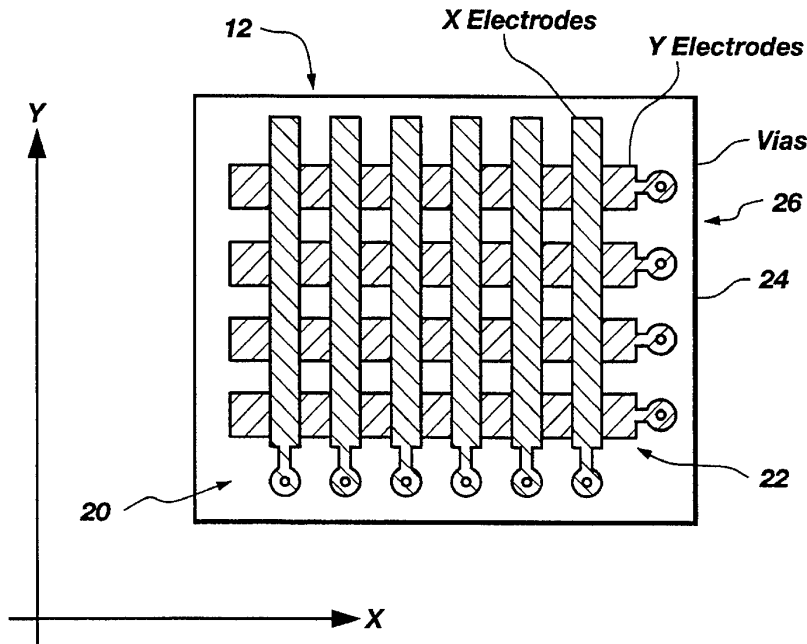


Fig. 2a

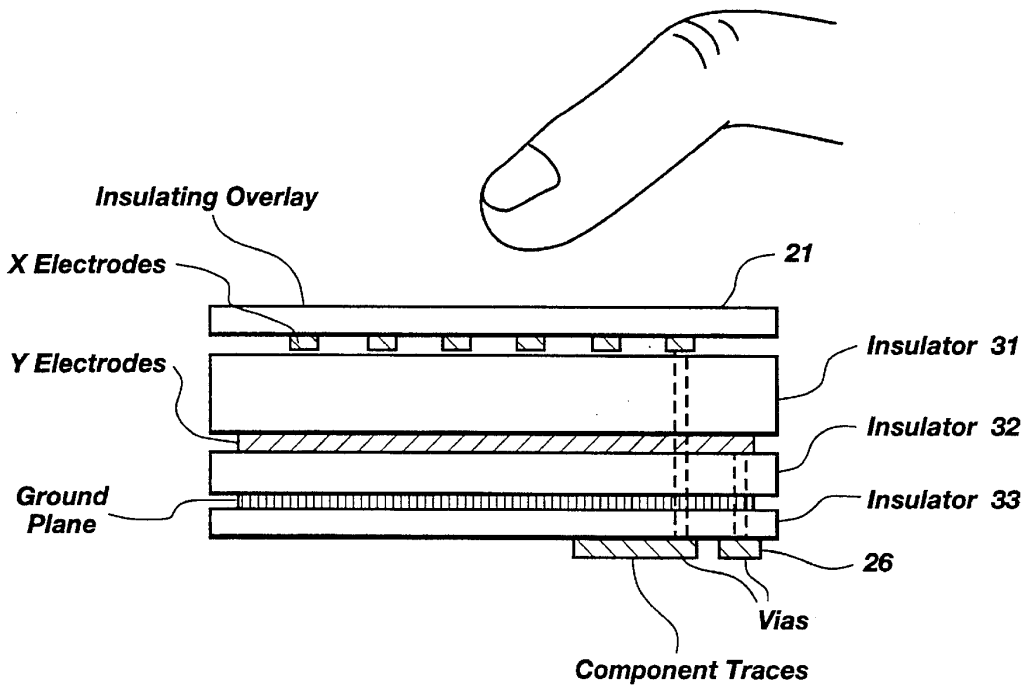


Fig. 2b

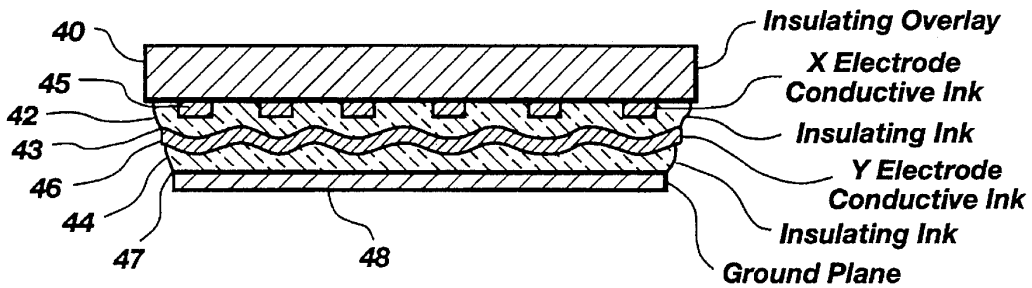


Fig. 3a

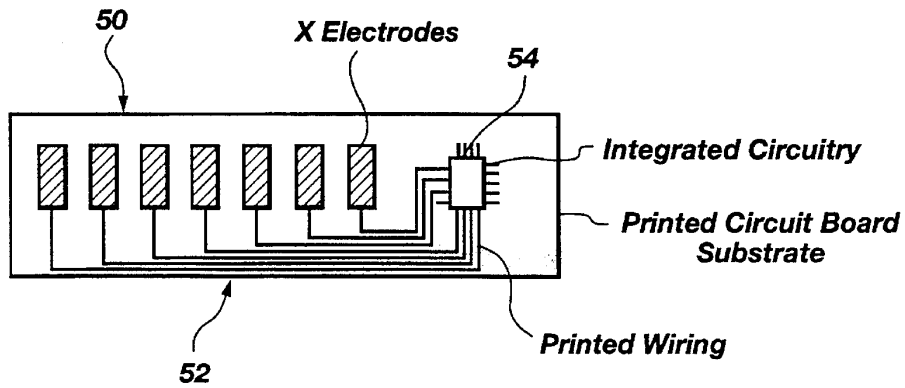


Fig. 3b

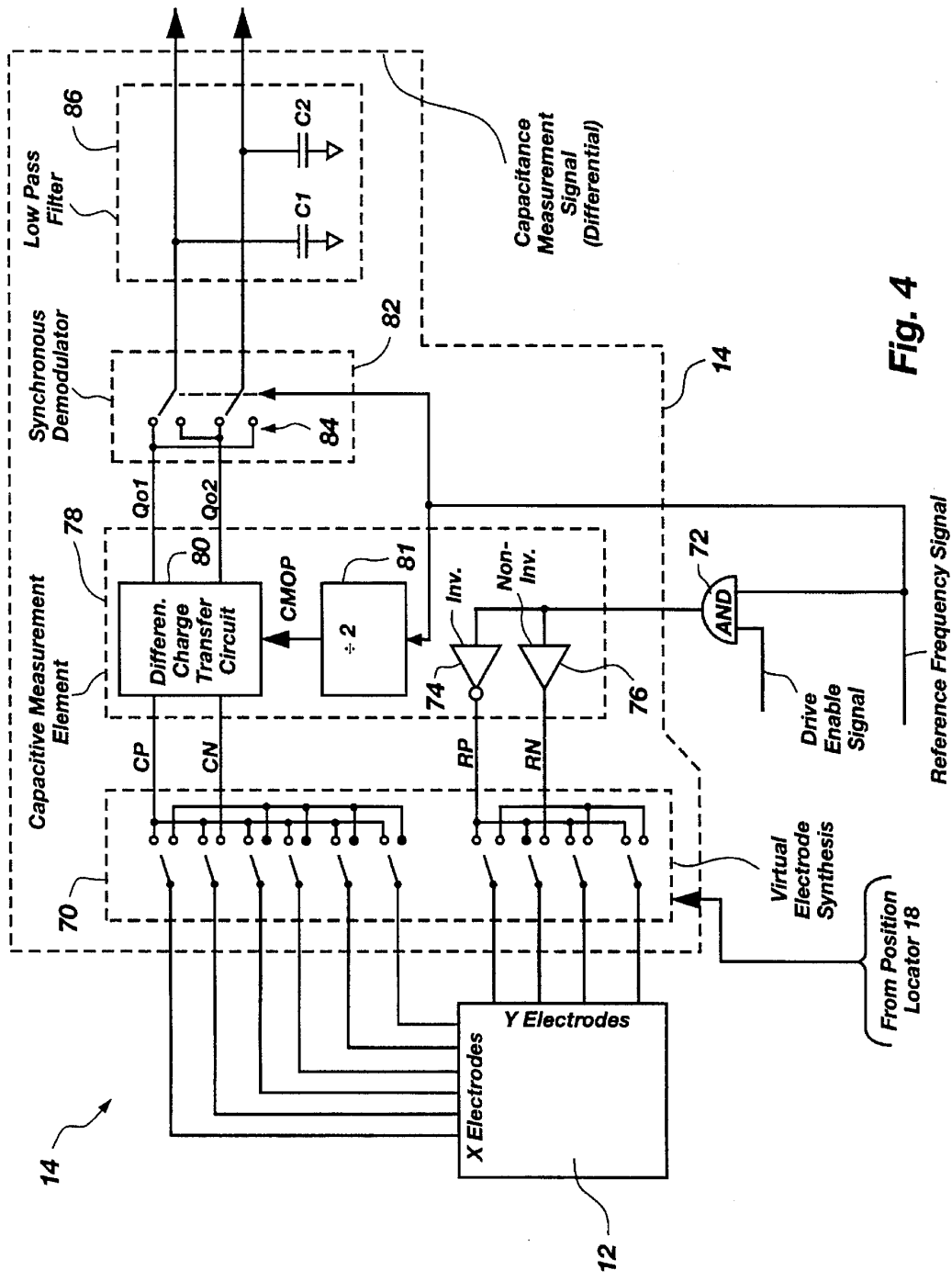


Fig. 4

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