US008773146B1

(12) **United States Patent**   (10) **Patent No.:**   **US 8,773,146 B1**

Hills et al.   (45) **Date of Patent:**   **Jul. 8, 2014**

(54) **WATERPROOF SCANNING OF A CAPACITIVE SENSE ARRAY**

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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 392 days.

(21) Appl. No.: **13/075,762**

(22) Filed: **Mar. 30, 2011**

Related U.S. Application Data

(60) Provisional application No. 61/325,124, filed on Apr. 16, 2010.

(51) **Int. Cl.**
G01R 27/26	(2006.01)
G06F 3/041	(2006.01)
G06F 3/045	(2006.01)
G01N 27/22	(2006.01)
G06F 3/0488	(2013.01)

(52) **U.S. Cl.**
CPC *G01N 27/22* (2013.01); *G06F 3/0488* (2013.01)
USPC **324/658**; 324/662; 324/663; 345/173; 345/174

(58) **Field of Classification Search**
USPC 324/662, 663, 658; 345/173, 174
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

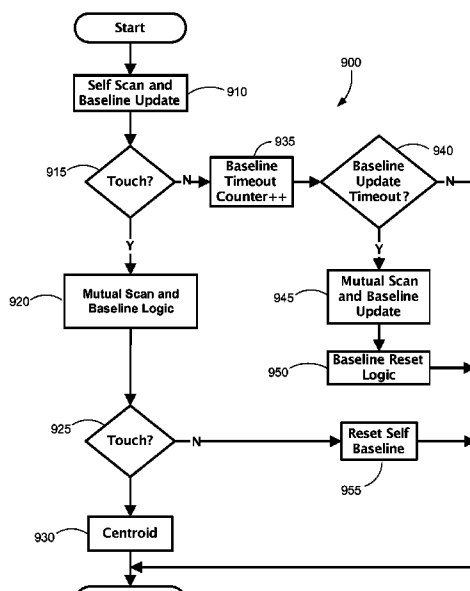|				
6,283,504	B1 *	9/2001	Stanley et al.	280/735
6,504,530	B1	1/2003	Wilson et al.	
8,054,296	B2 *	11/2011	Land et al.	345/173
2005/0001633	A1 *	1/2005	Okushima et al.	324/658
2008/0136792	A1	6/2008	Peng et al.	
2008/0158146	A1	7/2008	Westerman	
2008/0158174	A1	7/2008	Land et al.	
2008/0158182	A1	7/2008	Westerman	
2009/0009485	A1 *	1/2009	Bytheway	345/174
2009/0073140	A1	3/2009	Fujita et al.	
2009/0174676	A1	7/2009	Westerman	
2009/0322351	A1	12/2009	McLeod	
2010/0007631	A1 *	1/2010	Chang	345/174
2010/0060608	A1	3/2010	Yousefpor	
2010/0328262	A1 *	12/2010	Huang et al.	345/174
2012/0050214	A1 *	3/2012	Kremin et al.	345/174

* cited by examiner

Primary Examiner — Amy He

(57)   **ABSTRACT**

A water-resistant capacitance sensing apparatus comprising a plurality of capacitive sense elements and a capacitance sensing circuit configured to measure both the mutual capacitance and self-capacitance on the plurality of capacitive sense elements.

A method for water-resistant capacitance sensing, the method comprising performing a self-capacitance scan and a mutual capacitance scan, and detecting, by a processing device, a presence of an object with the plurality of sense elements. The method further determines whether the detected presence of the object is legitimate.
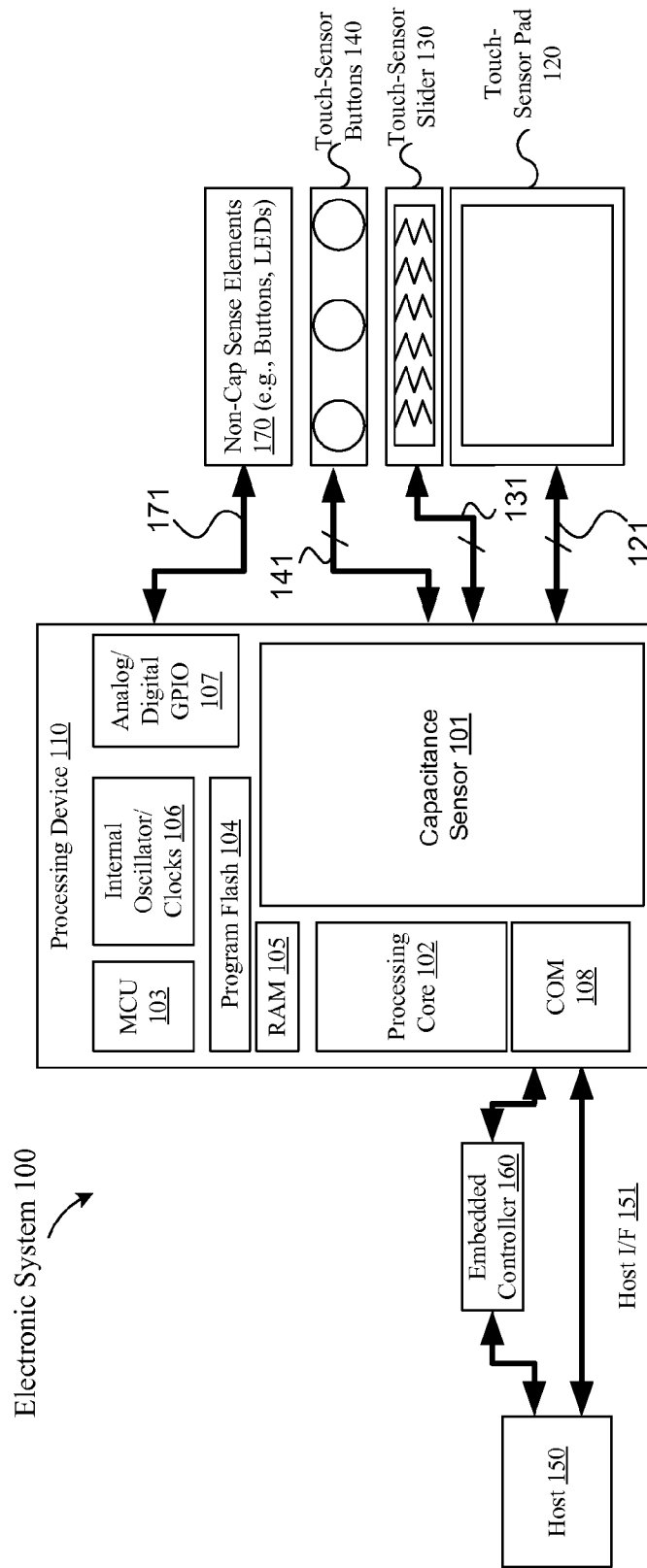
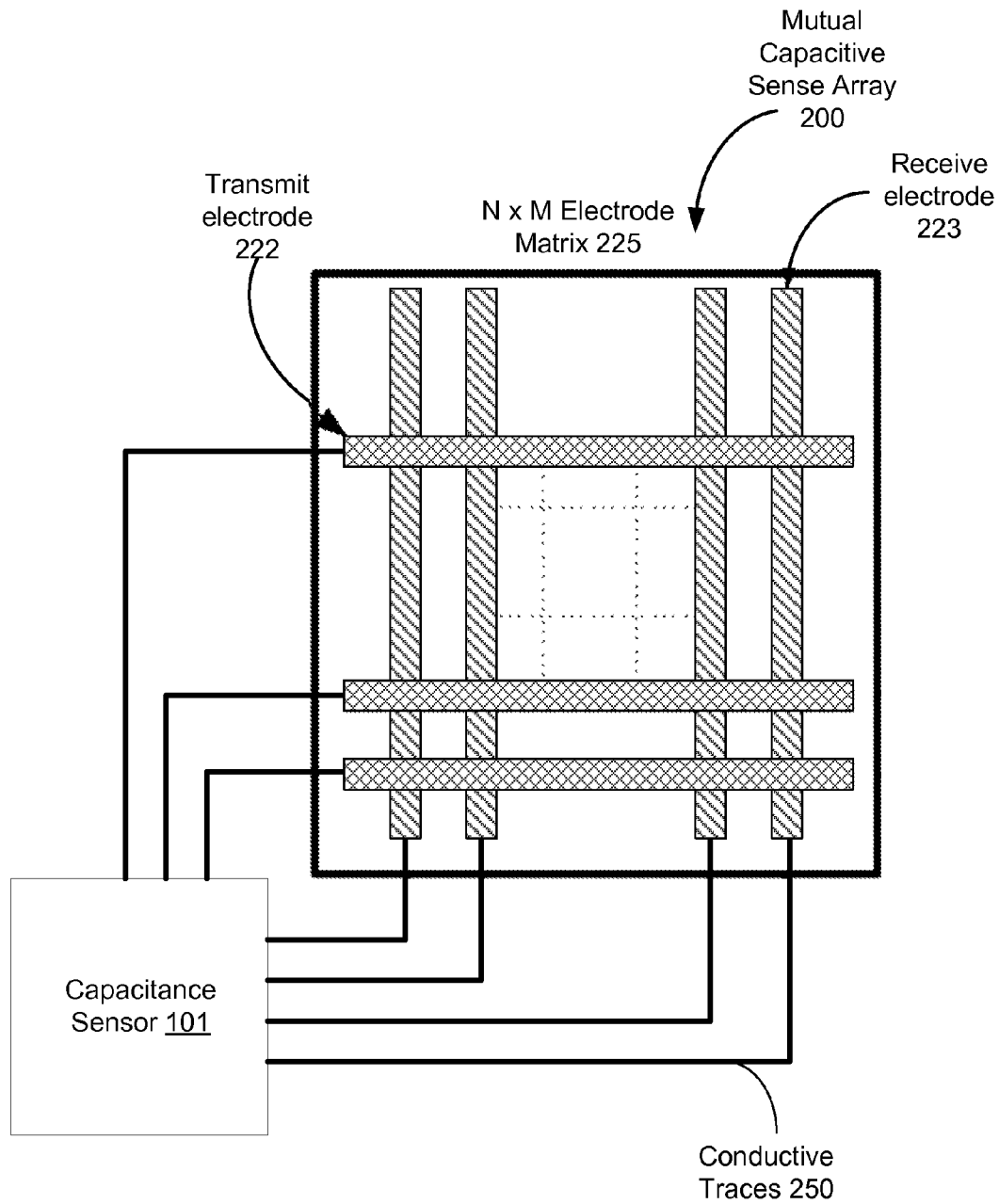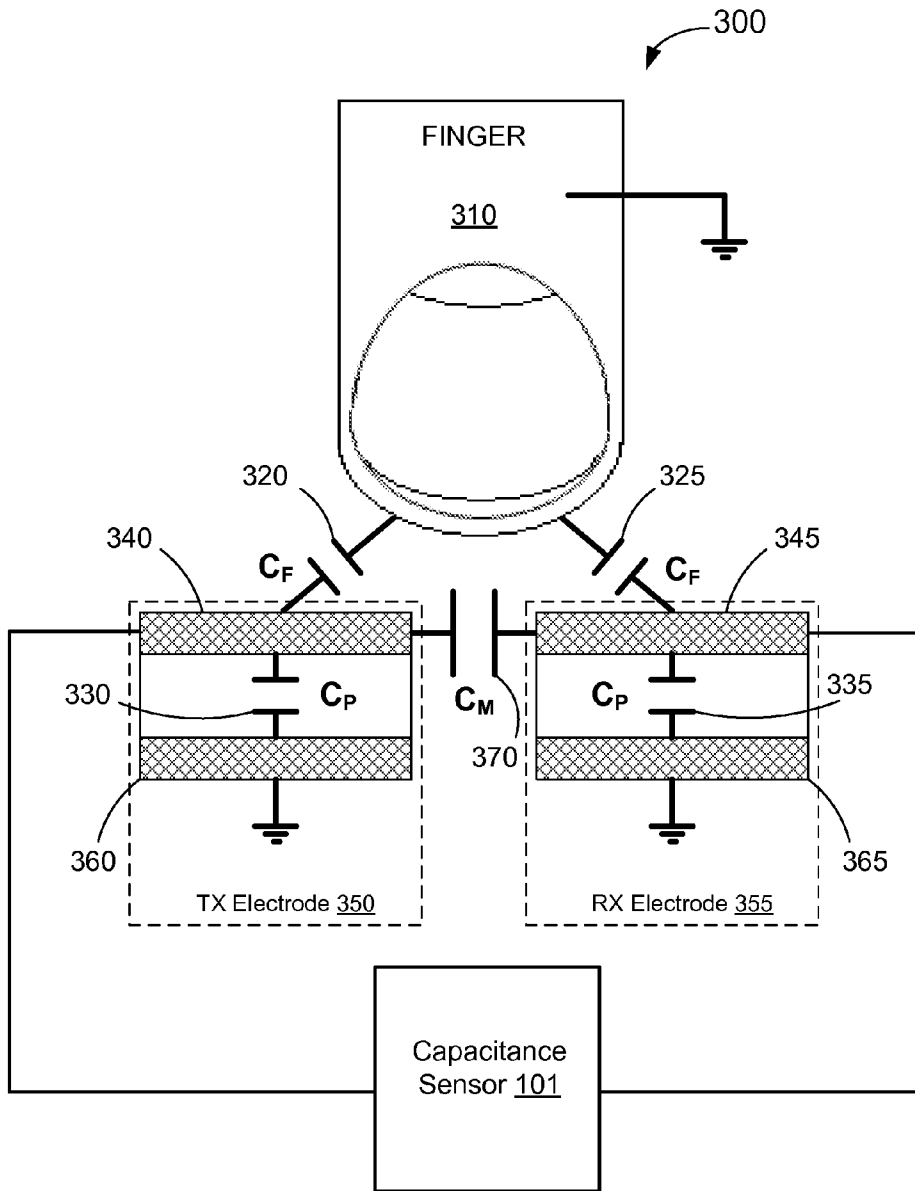**18 Claims, 9 Drawing Sheets**

FIG. 1

Mutual
Capacitive
Sense Array
200

Transmit
electrode
222

N x M Electrode
Matrix 225

Receive
electrode
223

Capacitance
Sensor 101

Conductive
Traces 250

FIG. 2

FIG. 3

Sense Element 403(1)

Sense Element 401(1)

Sense Element 403(K)

Row 1 404(1)

Sense Array 400

Conductive Object 310

Row N 404(N)

Column 1 405(1)

Column M 405(M)

Conductive Traces 502

Capacitance Sensor 101

Y

Sense Element 401(L)

Conductive Traces 402
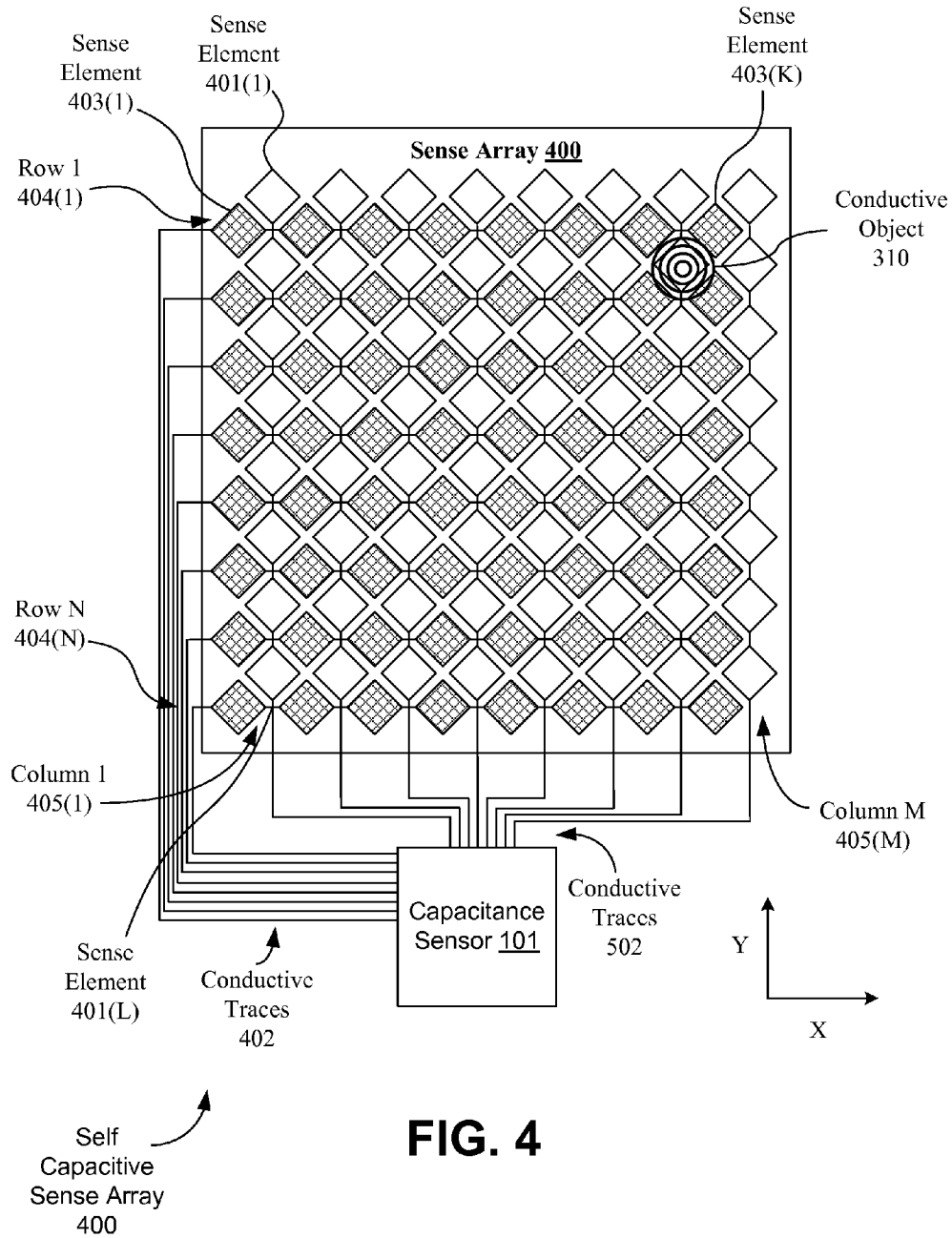
X

Self Capacitive Sense Array 400

FIG. 4

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