US007009595B2

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

(10) **Patent No.: US 7,009,595 B2**
(45) **Date of Patent: Mar. 7, 2006**

(54) **EXTENDED REFRESHABLE TACTILE GRAPHIC ARRAY FOR SCANNED TACTILE DISPLAY**

(75) Inventors: **John W. Roberts**, Gaithersburg, MD (US); **Oliver T. Slattery**, Germantown, MD (US); **Bretton Swope**, Gaithersburg, MD (US); **David W. Kardos**, Sykesville, MD (US); **Volker Min**, Heiloo (NL); **Michael Sutton**, Welwyn Garden (GB); **Edwin C. Mulkens**, Uene (NL); **Gina Rodgers**, Chesapeake, VA (US); **Nicholas Guttenberg**, Gaithersburg, MD (US); **Tracy Comstock**, Cockeysville, MD (US)

(73) Assignee: **United States of America**, Washington, DC (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 366 days.

(21) Appl. No.: **10/335,688**

(22) Filed: **Jan. 2, 2003**

(65) **Prior Publication Data**

US 2003/0151597 A1 Aug. 14, 2003

Related U.S. Application Data

(60) Provisional application No. 60/346,152, filed on Jan. 3, 2002.

(51) **Int. Cl.**
G09G 5/00 (2006.01)

(52) **U.S. Cl.** **345/156**; 715/702

(58) **Field of Classification Search** 345/31, 345/108, 110, 156, 173; 434/112–114; 340/825.19, 340/407.1, 407.2; 341/21; 463/30; 382/114; 715/702, 701

See application file for complete search history.

(56) **References Cited**

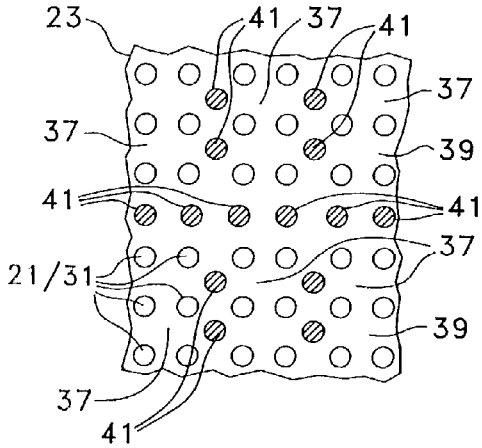
U.S. PATENT DOCUMENTS

2,521,338	A	9/1950	Bryce et al.	
2,549,632	A	4/1951	Nottingham	
3,624,772	A	11/1971	Grunwald	
3,736,672	A	6/1973	Skewis et al.	
4,500,293	A	2/1985	Eltgen	
4,551,102	A	11/1985	Meinzer	
4,650,352	A	3/1987	Eriksson	
4,836,784	A *	6/1989	Joachim	434/113
5,195,894	A	3/1993	Le Blanc et al.	
5,279,689	A *	1/1994	Shvartsman	156/220
5,453,012	A *	9/1995	Hudecek	434/114
5,636,038	A	6/1997	Lynt et al.	
5,718,588	A *	2/1998	Tretiakoff et al.	434/114
5,772,440	A *	6/1998	Ida	434/114
6,109,922	A	8/2000	Litschel et al.	
6,189,246	B1	2/2001	Gorthala	
6,354,839	B1	3/2002	Schmidt et al.	
6,417,821	B1 *	7/2002	Becker et al.	345/31
6,692,255	B1 *	2/2004	Roberts et al.	434/113
6,700,553	B1 *	3/2004	Becker et al.	345/31
6,776,619	B1 *	8/2004	Roberts et al.	434/113
6,819,228	B1	11/2004	Gipson et al.	
2002/0045151	A1	4/2002	Roberts et al.	

* cited by examiner

Primary Examiner—Kent Chang
(74) *Attorney, Agent, or Firm*—Harold A. Burdick

(57) **ABSTRACT**

Apparatus and methods for extended refreshable tactile graphic display are disclosed, the apparatus including an array of pins at a display surface, with pin setting actuators and display surface matrix preferably being separable units. The display matrix is provided by stacked functional layers, functions including temporary pin retention and pin locking.

20 Claims, 4 Drawing Sheets