US006577496B1

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

(10) **Patent No.: US 6,577,496 B1**
(45) **Date of Patent: Jun. 10, 2003**

(54) **NON-RIGID MOUNTING OF A FOLDABLE DISPLAY**

(75) Inventors: **Rich Gioscia**, Santa Clara, CA (US); **Lawrence Lam**, San Jose, CA (US); **Udagawa Masamichi**, Tokyo (JP)

(73) Assignee: **Palm, Inc.**, Santa Clara, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 47 days.

(21) Appl. No.: **09/766,176**

(22) Filed: **Jan. 18, 2001**

(51) **Int. Cl.**[7] **G02F 1/1333**

(52) **U.S. Cl.** **361/681**; 361/683; 345/156; 379/433; 455/344

(58) **Field of Search** 361/681, 683, 361/682, 686, 687; 345/156, 158, 159, 121, 168, 169, 173, 901, 905, 32, 85, 58; 348/734, 818; 359/742, 474, 472, 477, 230; 340/825.79, 825.71; 364/186, 189, 708.1, 709.1, 709.11–709.16; 455/344, 556, 566, 557, 550, 553, 572, 574, 575, 347, 351, 158.4, 90, 128; 379/433, 434, 438, 447, 428, 440

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,662,807	A	*	5/1972	Miller	160/135
3,748,971	A	*	7/1973	Grundell	93/1 E
5,049,862	A	*	9/1991	Dao et al.	340/706
5,189,632	A	*	2/1993	Paajanen et al.	364/705.05
5,467,102	A	*	11/1995	Kuno et al.	345/1
5,534,888	A	*	7/1996	Lebby et al.	345/121
5,646,649	A	*	7/1997	Iwata et al.	345/173
5,734,513	A	*	3/1998	Wang et al.	359/742
5,768,812	A	*	6/1998	Cross	40/120
5,896,575	A	*	4/1999	Higginbotham et al.	455/344
6,047,196	A	*	4/2000	Makela et al.	455/556
6,057,814	A	*	5/2000	Kalt	345/58
6,107,988	A	*	8/2000	Phillipps	345/156
6,259,932	B1	*	7/2001	Constein	455/556
6,297,945	B1	*	10/2001	Yamamoto	361/681
6,317,108	B1	*	11/2001	Kalt	345/85
6,331,840	B1	*	12/2001	Nielson et al.	345/1.1
6,356,443	B2	*	3/2002	Jenks et al.	361/686
6,377,324	B1	*	4/2002	Katsura	349/58

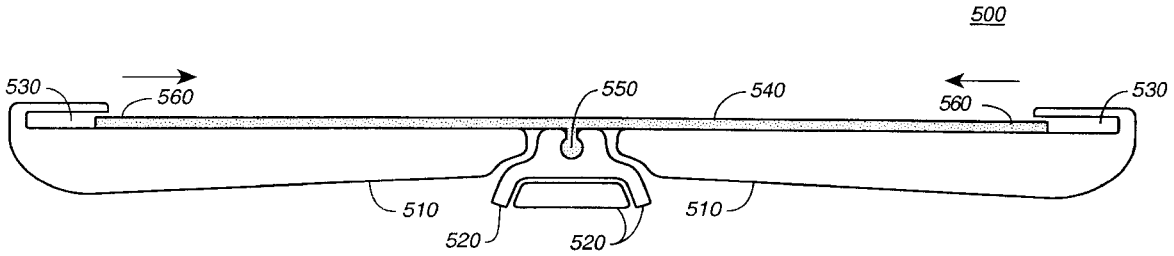
FOREIGN PATENT DOCUMENTS

JP	407181462	A	* 7/1995	G02F/1/1333
JP	410207389	A	* 8/1998	G06F/9/00
JP	410319879	A	* 12/1998	G09F/9/40
JP	411073262	A	* 3/1999	G06F/3/023
JP	02001051251	A	* 2/2001	G02F/1/133

* cited by examiner

Primary Examiner—Darren Schuberg
Assistant Examiner—Michael Datskovsky
(74) *Attorney, Agent, or Firm*—Wagner, Murabito & Hao LLP

(57) **ABSTRACT**

A foldable display device coupled to a non-rigid support mechanism movable between an unfolded and a folded position. In one embodiment, the e-ink display device is dual sided and both sides can display information as well as accept touch screen commands. One side of the display device is used in the unfolded position and the opposite side is used in the folded position. In the unfolded position, the display device has a Personal Digital Assistant (PDA) form factor, and the entire area of one side of the display device is viewable. The display device is supported within the non-rigid support mechanism such that it lies in a flat plane in the unfolded position, and there is no loss of viewable area due to folding of the display device. The two sides of the non-rigid support mechanism are coupled for movement between a folded and an unfolded position and the display device is folded in a bend radius that precludes any disruption to the display area. Moving the support mechanism from the unfolded position to the folded position folds the display device about an axis that divides the display device into two equal rectangles. In the folded position, the display device has a candy bar form factor useful in cell phone applications, and the viewable area is about one half that of the PDA form factor used in the unfolded position. The non-rigid support mechanism holds the viewable area of the display device in a flat plane in the folded position.

24 Claims, 6 Drawing Sheets