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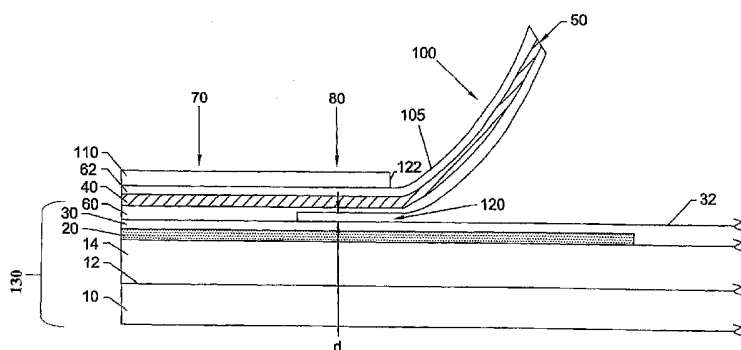
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: FLEXIBLE ELECTROSTATIC ACTUATOR



(57) Abstract: An electrostatic actuator having a base (10) including a first electrode (20), and having a flexible membrane (50) including at least two material layers of different materials in contact with each other. At least one of the material layers includes a second electrode (40) electrically isolated from the first electrode. The flexible membrane includes a fixed end where the flexible membrane connects to the base and a free end opposite the fixed end. In the flexible membrane, the second electrode has at least first

and second portions separated by a third portion in a combination defining a step provided in a vicinity of the fixed end. The first step is closest to the fixed end and separated by a shorter distance from the first electrode than the second portion. A stiffening member (310) can be disposed on the flexible membrane toward the free end of the flexible membrane. The electrostatic actuator can include an elongated orifice (420,320) extending through the base and extending along a direction away from the fixed end. The first electrode of the base can extend past an end of the second electrode of the flexible membrane in a direction defined toward the fixed end. The flexible membrane can include a peripheral or side cut out configured to communicate to an interior of the flexible membrane.

WO 2005/104717 A3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US05/14104

A. CLASSIFICATION OF SUBJECT MATTER IPC(7) : G02F 1/03, 1/01; G02B 26/00; H01H 57/00; H05F 3/00; H01G 5/01; H01L 29/84 US CL : 359/254, 288, 291, 292, 295; 200/181; 361/233, 278; 257/415 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) U.S. : 359/254, 230, 288, 290-292, 295; 200/181, 512; 361/233, 278, 281, 207; 257/415, 414 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched NONE Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) Please See Continuation Sheet		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6,236,491 A (GOODWIN-JOHANSSON) 22 May 2001 (22.05.2001), column 2, line 48 to column 11, line 15.	1-91
A	US 6,373,682 A (GOODWIN-JOHANSSON) 16 April 2002 (16.04.2002), column 4, line 47 to column 11, line 37.	1-91
A	US 6,057,520 A (GOODWIN-JOHANSSON) 02 May 2000 (02.05.2000), column 5, line 5 to column 12, line 56.	1-91
A	US 6,229,683 A (GOODWIN-JOHANSSON) 08 May 2001 (08.05.2001), column 4, line 46 to column 11, line 7.	1-91
A	US 6,396,620 A (GOODWIN-JOHANSSON) 28 May 2002 (28.05.2002), column 5, line 31 to column 11, line 22.	1-91
A	US 6,731,492 A (GOODWIN-JOHANSSON) 04 May 2004 (04.05.2004), column 5, line 50 to column 13, line 56.	1-91
A	US 5,781,331 A (CARR et al) 14 July 1998 (14.07.1998), column 3, line 58 to column 6, line 10.	1, 17, 34, 46, 61, 80
A	US 5,835,256 A (HUIBERS) 10 November 1998 (10.11.1998), column 4, line 66 to column 8, line 43.	1-16
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
* Special categories of cited documents:		
"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family	
Date of the actual completion of the international search 11 August 2005 (11.08.2005)		Date of mailing of the international search report <div style="text-align: center; font-size: 1.5em; font-weight: bold;">15 DEC 2005</div>
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703) 305-3230		Authorized officer LOHA BEN Telephone No. (571) 272-2323

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US05/14104

Continuation of B. FIELDS SEARCHED Item 3:

WEST: (1) - (electrostatic\$4 WITH (actuat\$3 or force\$1 or modul\$3)) SAME (flexibl\$1 NEAR10 (membrane\$1 or sheet\$1 or composite\$1 or member\$1)) SAME electrode\$1 SAME (isolat\$3 or insulat\$3 or dielectric\$4) and (electrostatic\$4 WITH (actuat\$3 or force\$1 or modul\$3)) SAME (flexibl\$1 NEAR10 (membrane\$1 or sheet\$1 or composite\$1 or member\$1)) SAME electrode\$1 SAME material\$1 and (electrostatic\$4 WITH (actuat\$3 or force\$1 or modul\$3)) SAME (flexibl\$1 NEAR10 (membrane\$1 or sheet\$1 or composite\$1 or member\$1)) SAME electrode\$1 SAME layer\$1 and (electrostatic\$4 WITH (actuat\$3 or force\$1 or modul\$3)) SAME (flexibl\$1 NEAR10 (membrane\$1 or sheet\$1 or composite\$1 or member\$1)) SAME electrode\$1 SAME (polymer\$1 or polyimide\$1)

(2) -- (electrostatic\$4 WITH (actuat\$3 or force\$1 or modul\$3)) SAME (flexibl\$1 NEAR10 (membrane\$1 or sheet\$1 or composite\$1 or member\$1)) SAME electrode\$1 SAME free SAME fixed SAME end\$1