Title: ELECTRO-ACTIVE DEVICE USING RADIAL ELECTRIC FIELD PIEZO-DIAPHRAGM FOR CONTROL OF FLUID MOVEMENT

Abstract: A fluid-control electro-active device (100) includes a piezo-diaphragm (10) made from a ferroelectric material sandwiched by first and second electrode patterns configured to introduce an electric field into the ferroelectric material when voltage (102) is applied thereto. The electric field originates at a region of the ferroelectric material between the first and second electrode patterns, and extends radially outward from this region of the ferroelectric material and substantially parallel to the plane of the ferroelectric material. The piezo-diaphragm (10) deflects symmetrically about this region in a direction substantially perpendicular to the electric field. An annular region (30) coupled to and extending radially outward from the piezo-diaphragm (10) perimetricaly borders the piezo-diaphragm (10). A housing (40) is connected to the annular region (30) and defines at least one fluid flow path (50) therethrough with the piezo-diaphragm (10) disposed therein.
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.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) : H01L 41/047, 41/055; H02N 2/04
US CL : 310/324, 365
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. : 310/324, 365, 328, 330, 366; 417/413.2, 325

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO, JPO, IBM-TBD, Derwent, US-FGPUBS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tbody>
<tr>
<td>A</td>
<td>US 6,265,811 B1 (Takeuchi et al.) 24 July 2001, figs. 3, 4, 11A.</td>
<td>1, 16, 29</td>
</tr>
<tr>
<td>A</td>
<td>US 5,862,275 A (Takeuchi et al.) 19 January 1999, Figs. 4, 5, 6, 12.</td>
<td>1, 16, 29</td>
</tr>
<tr>
<td>A</td>
<td>US 5,852,337 A (Takeuchi et al.) 22 December 1998, Fig. 1B.</td>
<td>1, 16, 29</td>
</tr>
<tr>
<td>A</td>
<td>US 6,323,580 B1 (Bernstein) 27 November 2001, Figs. 5, 6, 8, 11.</td>
<td>1, 16, 29</td>
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DATE OF ACTUAL COMPLETION OF THE INTERNATIONAL SEARCH
16 JUNE 2003

Authorized officer
THOMAS M. DOUGHERTY

Date of mailing of the international search report
OCT 2003

Name and mailing address of the ISA/US Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231
Facsimile No. (703) 305-3230
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</tr>
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<tbody>
<tr>
<td>A</td>
<td>US 4,379,246 A (Guntersdorfer et al.) 05 April 1983, Fig. 1.</td>
<td>1, 16, 29</td>
</tr>
<tr>
<td>A</td>
<td>US 3,857,049 A (Zoltn) 24 December 1974, Fig. 6.</td>
<td>1-3, 6, 16, 18, 19, 21-23, 29, 31, 33, 36</td>
</tr>
<tr>
<td>A</td>
<td>US 2,963,597 A (Gerber) 06 December 1960, Figs. 1, 3, 5.</td>
<td>1, 6, 11, 16, 21, 34</td>
</tr>
<tr>
<td>A</td>
<td>WO87/07218 A1 (Heinzl) 19 May 1987, Figs. 2, 3, 5.</td>
<td>1, 2, 16, 29</td>
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