

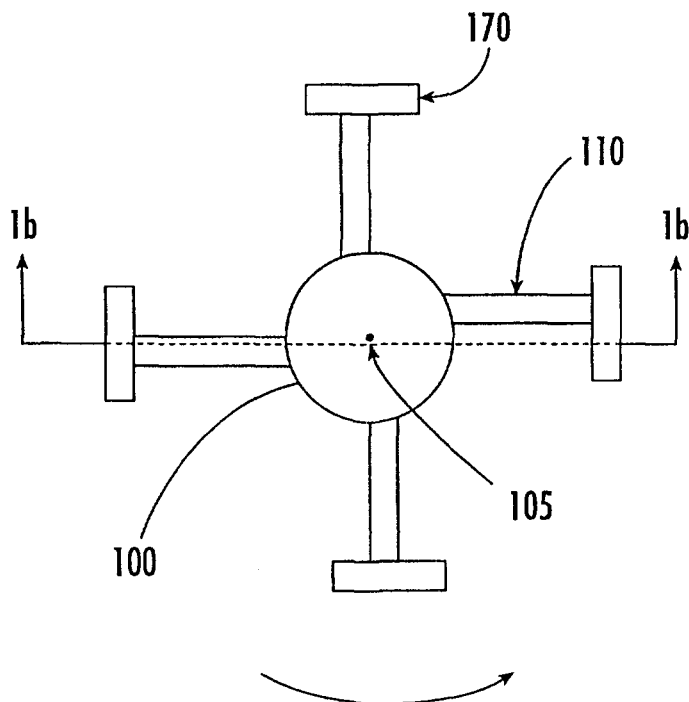


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| <b>(51) International Patent Classification <sup>7</sup> :</b><br><b>F03G 7/06</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>A1</b> | <b>(11) International Publication Number:</b> <b>WO 00/57055</b><br><b>(43) International Publication Date:</b> 28 September 2000 (28.09.00)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>(21) International Application Number:</b> PCT/US00/03867<br><b>(22) International Filing Date:</b> 16 February 2000 (16.02.00)<br><b>(30) Priority Data:</b><br>09/275,058      23 March 1999 (23.03.99)      US<br><b>(71) Applicant (for all designated States except US):</b> MCNC<br>[US/US]; 3021 Cornwallis Road, P.O. Box 12889, Research<br>Triangle Park, NC 27709 (US).<br><b>(72) Inventor; and</b><br><b>(75) Inventor/Applicant (for US only):</b> HILL, Edward, A. [US/US];<br>312 Forbush Mountain Drive, Chapel Hill, CA 27514 (US).<br><b>(74) Agents:</b> GOSNELL, Guy, R. et al.; Alston & Bird LLP, P.O.<br>Drawer 34009, Charlotte, NC 28234-4009 (US). |           | <b>(81) Designated States:</b> AE, AL, AM, AT, AT (Utility model), AU,<br>AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, CZ<br>(Utility model), DE, DE (Utility model), DK, DK (Utility<br>model), DM, EE, EE (Utility model), ES, FI, FI (Utility<br>model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS,<br>JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV,<br>MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO,<br>RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM,<br>TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO<br>patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW),<br>Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),<br>European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR,<br>GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF,<br>BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN,<br>TD, TG).<br><br><b>Published</b><br><i>With international search report.</i><br><i>Before the expiration of the time limit for amending the</i><br><i>claims and to be republished in the event of the receipt of</i><br><i>amendments.</i> |

**(54) Title:** MICROELECTROMECHANICAL ROTARY STRUCTURES**(57) Abstract**

MEMS (Microelectromechanical System) structures are provided that are designed to rotate in response to thermal actuation or the like. In one embodiment, the MEMS rotary structure includes a hub having one or more radial spoke members that impose a rotational force upon the hub in response to applied changes in temperature. The MEMS rotary structure can also include a ring at least partially encircling the hub and connected to the hub by means of one or more hub spoke members. Controllable clockwise, counterclockwise, or both clockwise and counterclockwise rotation of the hub or ring are provided. The MEMS rotary structures can also include thermal arched beam actuators that are operably connected to the spoke member. As the temperature changes, the thermal arched beam actuators move the spoke members in order to rotate the MEMS structure. Various applications are provided for these rotating MEMS structures, including but not limited to rotary actuators, rotary switches and relays, variable capacitors, variable resistors, shutters, and valves.



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