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Ford et al.

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(54) **MICROMECHANICAL MEMBRANE TILT-MIRROR SWITCH**

(75) Inventors: **Joseph E. Ford; James A. Walker,**
both of Monmouth, NJ (US)

(73) Assignee: **Lucent Technologies,** Murray Hill, NJ (US)

(*) Notice: Under 35 U.S.C. 154(b), the term of this patent shall be extended for 0 days.

(21) Appl. No.: **09/271,577**

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(51) Int. Cl.⁷ **G02F 1/03**

(52) U.S. Cl. **359/247; 359/254; 359/290; 359/291**

(58) Field of Search **359/290, 291, 359/295, 298, 246, 251, 254, 247**

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,579,151 * 11/1996 Cho 359/291
5,917,647 * 6/1999 Yoon 359/298
5,978,128 * 11/1999 Yoon 359/298

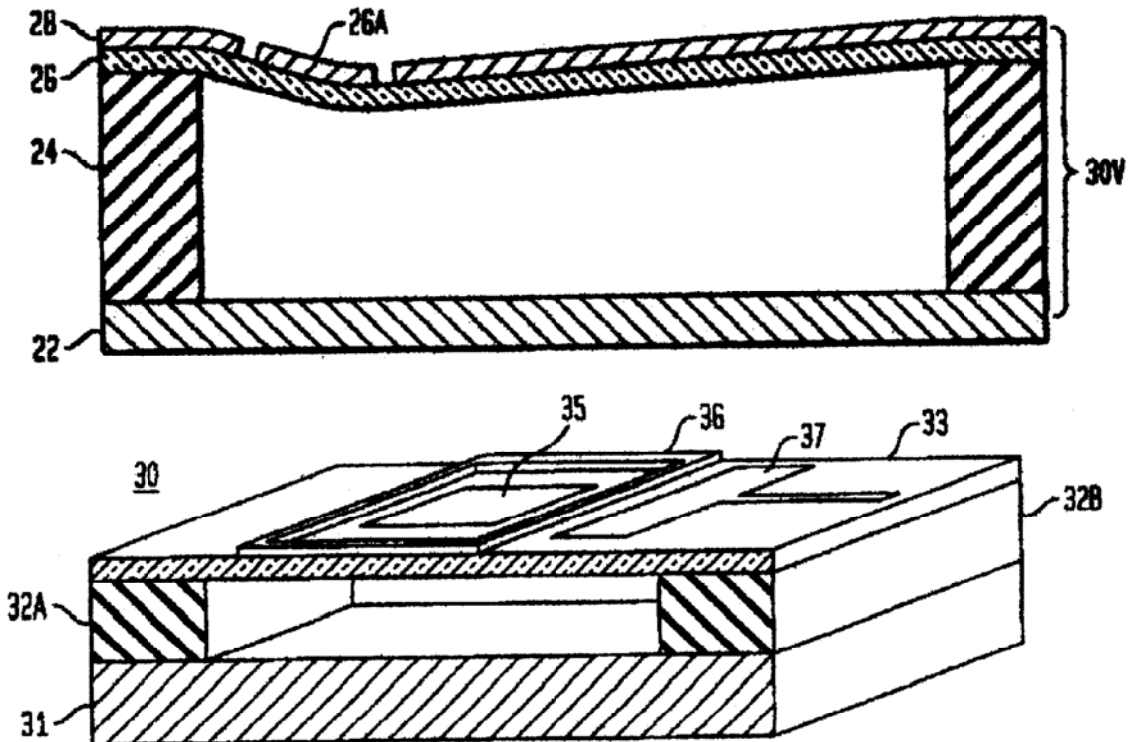
* cited by examiner

Primary Examiner—Huy Mai

(57) **ABSTRACT**

A micromechanical tilt mirror device that includes a membrane suspended by its ends over a substrate such that a mirror area of the membrane is asymmetrically positioned on the membrane whereby it is tilted when the membrane is deformed by electrostatic forces. This mirror tilt is used to steer an incident light beam in a prescribed direction. The mirror can be supported to provide tilt in either of two orthogonal directions with respect to a rest direction.

14 Claims, 4 Drawing Sheets



Capella 2029

FIG. 1A
(PRIOR ART)

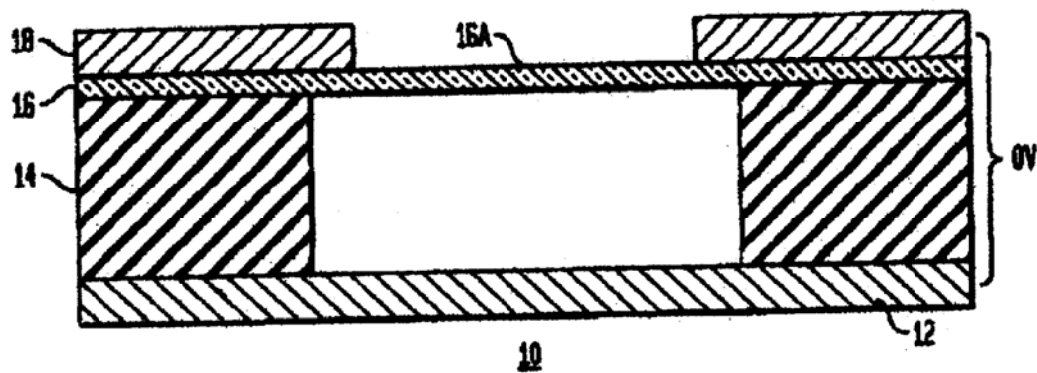


FIG. 1B
(PRIOR ART)

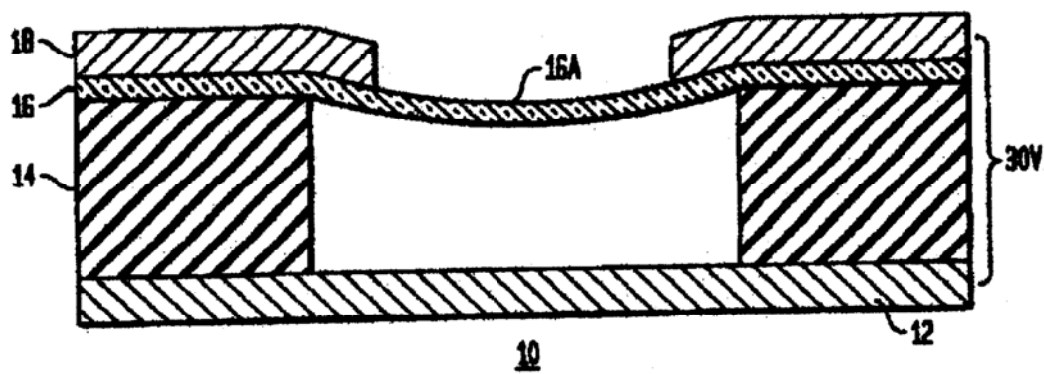


FIG. 2A

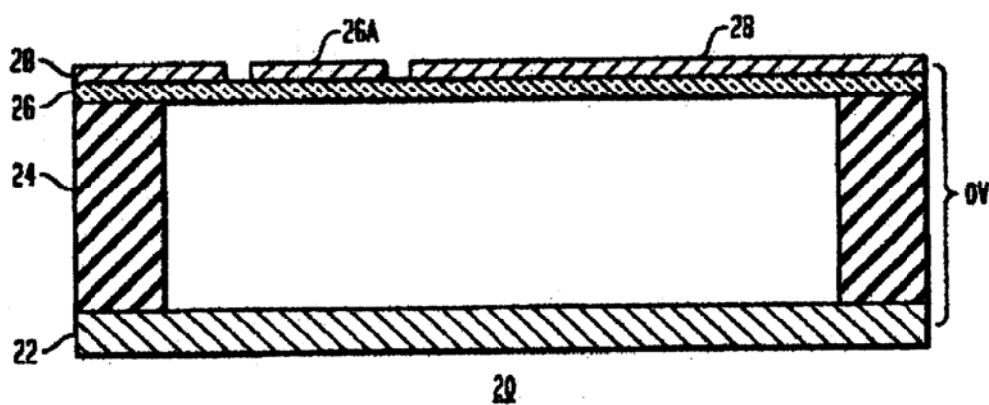


FIG. 2B

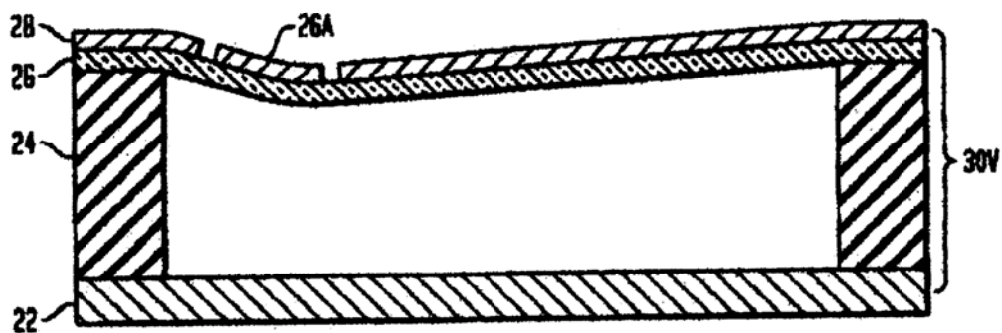


FIG. 3

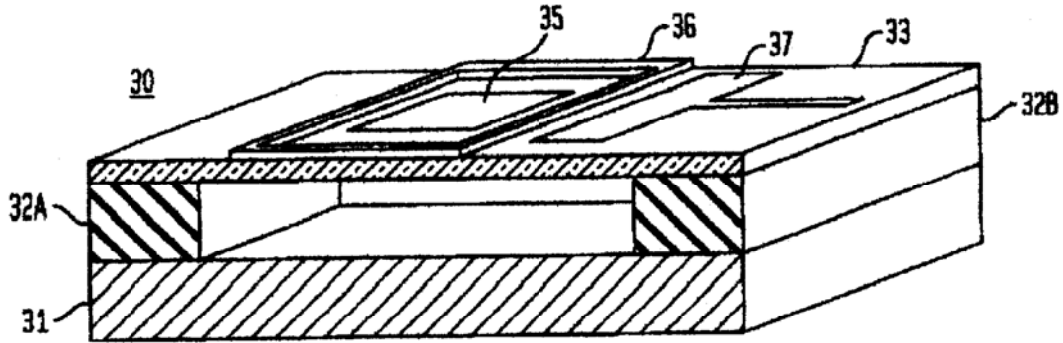


FIG. 4

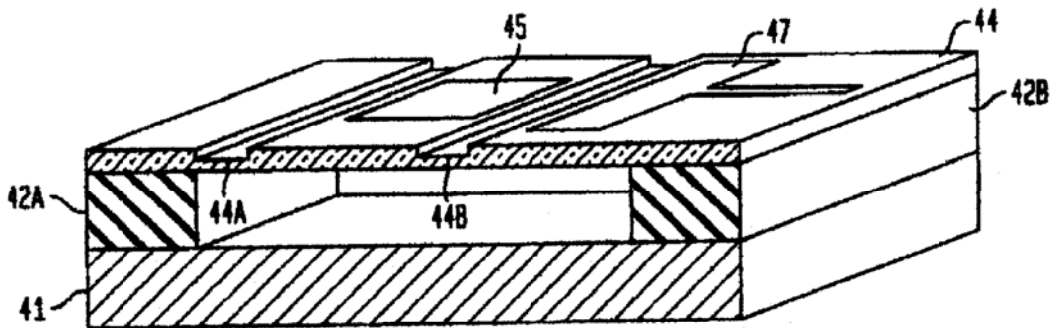


FIG. 5

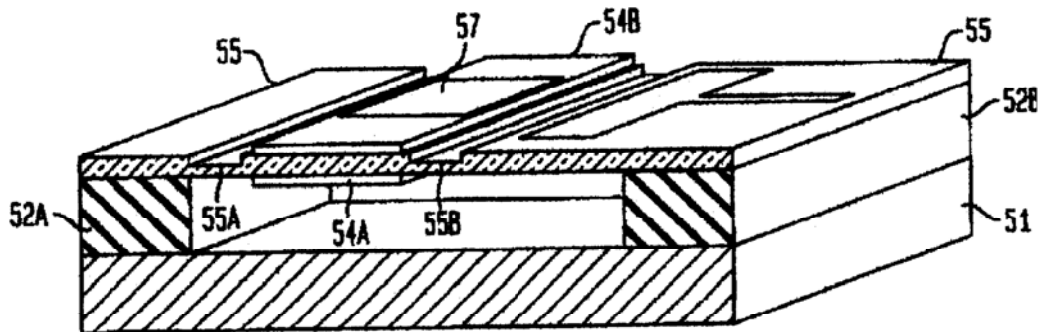
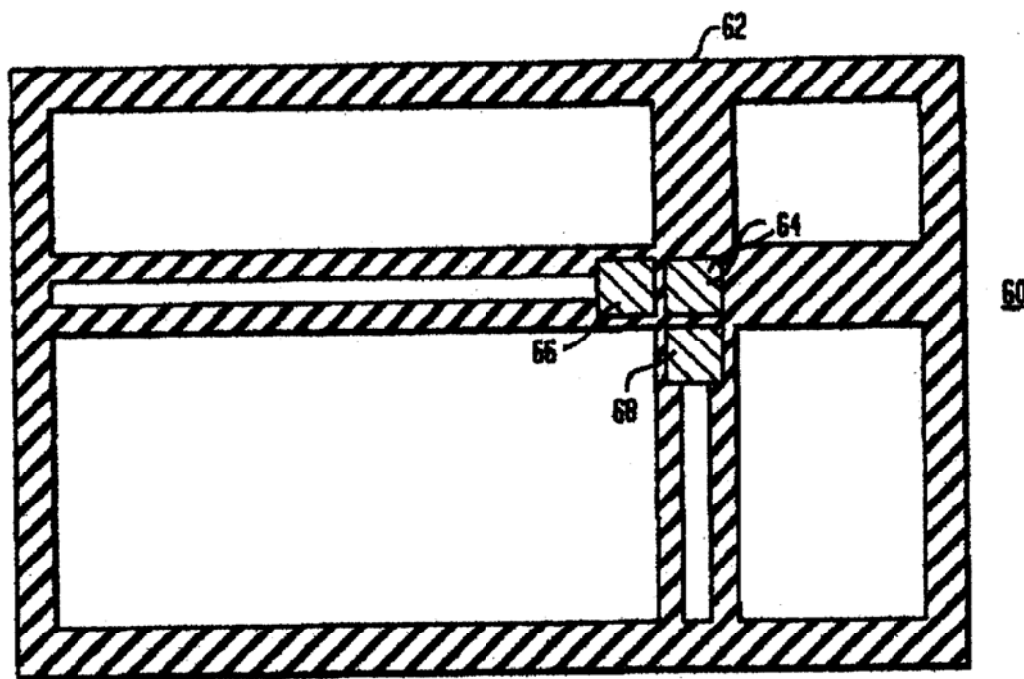


FIG. 6



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