Title (en)

OPTO-MECHANICAL VALVE AND VALVE ARRAY FOR FIBER-OPTIC COMMUNICATION

Title (de)

OPTOMECHANISCHES VENTIL UND VENTILBATTERIE FÜR FASEROPTISCHE ÜBERTRAGUNG

Title (fr)

VALVE OPTOMECANIQUE ET RESEAU DE VALVES POUR COMMUNICATION PAR FIBRE OPTIQUE

Publication

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Application

EP 00907240 A 20000210

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Abstract (en)

[origin: WO0052835A2] A microelectromechanical system (MEMS) optical switch is introduced which includes a mirror constructed on a substrate. The mirror is movable parallel to the surface of the substrate and either allows an input ray incident at an oblique angle, preferably 45 DEG , to the mirror surface to pass undisturbed through a transparent part of a substrate or reflects the ray to an alternate output. Three embodiments of the switch are shown. The first includes a variation on a comb-drive designed to produce larger forces than usual by using an envelope-like electrode into which the mirror is drawn. Larger forces can be obtained by designing the electrode edges to have a long perimeter line, such as in a fractal form. A second implementation supports a mirror on flexible beams which are attracted or repelled by electrostatically charging curved electrodes thereby actuating the mirror. In a third implementation, a magnetic field around the switch induces lateral forces when electric current flows in conductive supporting beams to cause switching. Two-dimensional arrays of such switches are shown to be able to switch any of a set of input rays to any of a set of outputs. Three-dimensional arrays allow switching to be done with shorter ray paths and fewer mirrors than with other switches. Such a 3D implementation is presented. A wavelength separating and combining device is also introduced that splits a multi-wavelength beam into a bundle of parallel, single-wavelength rays. By reversing the operation of this device, the single-wavelength parallel beams can be recombined. Such a device, in combination with one of the presented switches, is useful in wavelength division multiplexing applications. Conventional methods are suggested for fabrication but, to enhance the quality of the mirrors and precision of their positioning and motion and speed of operation, it is proposed that they be fabricated on the surface of substrate wafers. An innovative method is presented in order to fabricate 2D and 3D arrays of these switches involving positioning of switch elements on wafers and stacking wafers vertically in a defined pattern.
[origin: WO0052835A2] A microelectromechanical system (MEMS) optical switch is introduced which includes a mirror (1) constructed on a substrate (2). The mirror (1) is movable parallel to the surface of the substrate (2) and either allows an input ray incident at an oblique angle, preferably 45 DEG , to the mirror surface to pass undisturbed through a transparent part (49) of a substrate (2) or reflects the ray to an alternate output. Three embodiments of the switch are shown. The first includes a variation on a comb-drive designed to produce larger forces than usual by using an envelope-like electrode into which the mirror (1) is drawn. Larger forces can be obtained by designing the electrode edges to have a long perimeter line, such as in a fractal form. A second implementation supports a mirror (1) on flexible beams which are attracted or repelled by electrostatically charging curved electrodes thereby actuating the mirror. In a third implementation, a magnetic field around the switch induces lateral forces when electric current flows in conductive supporting beams to cause switching.

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