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(54) **OPTICAL ELEMENT HAVING TWO AXES OF ROTATION FOR USE IN TIGHTLY SPACED MIRROR ARRAYS**

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G02B 26/08　　(2006.01)
G02B 26/10　　(2006.01)

(52) **U.S. Cl.** **310/310**; 359/198; 359/224; 359/226; 359/385

(58) **Field of Classification Search** 310/309; 359/223–224, 872, 198, 225; 385/18
See application file for complete search history.

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(57)　　　**ABSTRACT**

A rotatable element includes a plate, a plate support, a cradle and a cradle support. The plate is coupled to the cradle via the plate support. The cradle is coupled to a surrounding frame by the cradle support. The plate and cradle are suspended over a cavity so that, in conjunction with the plate support and the cradle support, both the plate and cradle are capable of freely rotating about different axes of rotation when suitably actuated. Since the plate is capable of rotating independently of the cradle, yet also rotates when the cradle is rotated, the plate is rotatable about two axes of rotation. In some cases, the axis of rotation of the plate is perpendicular to the axis of rotation of the cradle. Since the cradle does not surround the plate, the plates of adjacent rotatable elements can be placed very close to one another (i.e., as close as about 1 micron) to provide, for example, an array of very-closely-spaced mirrors.
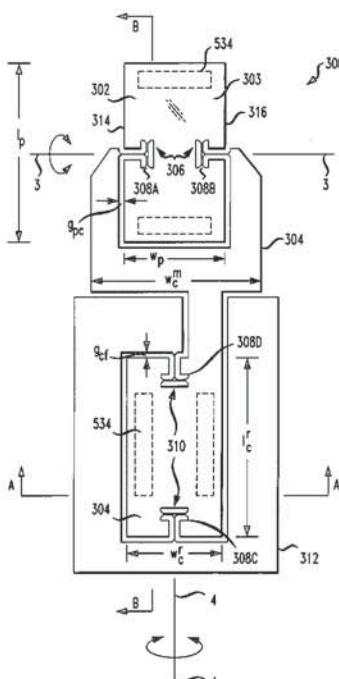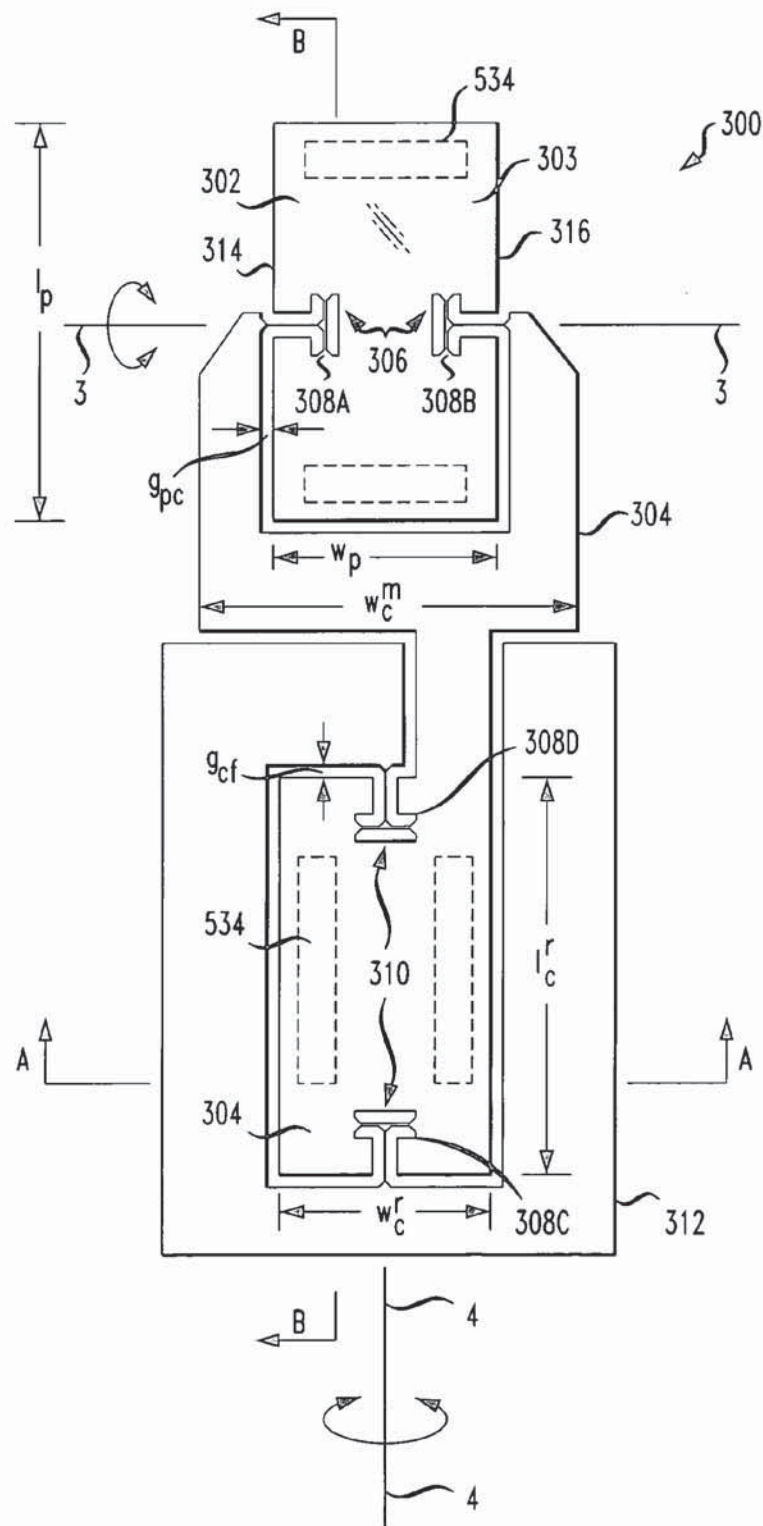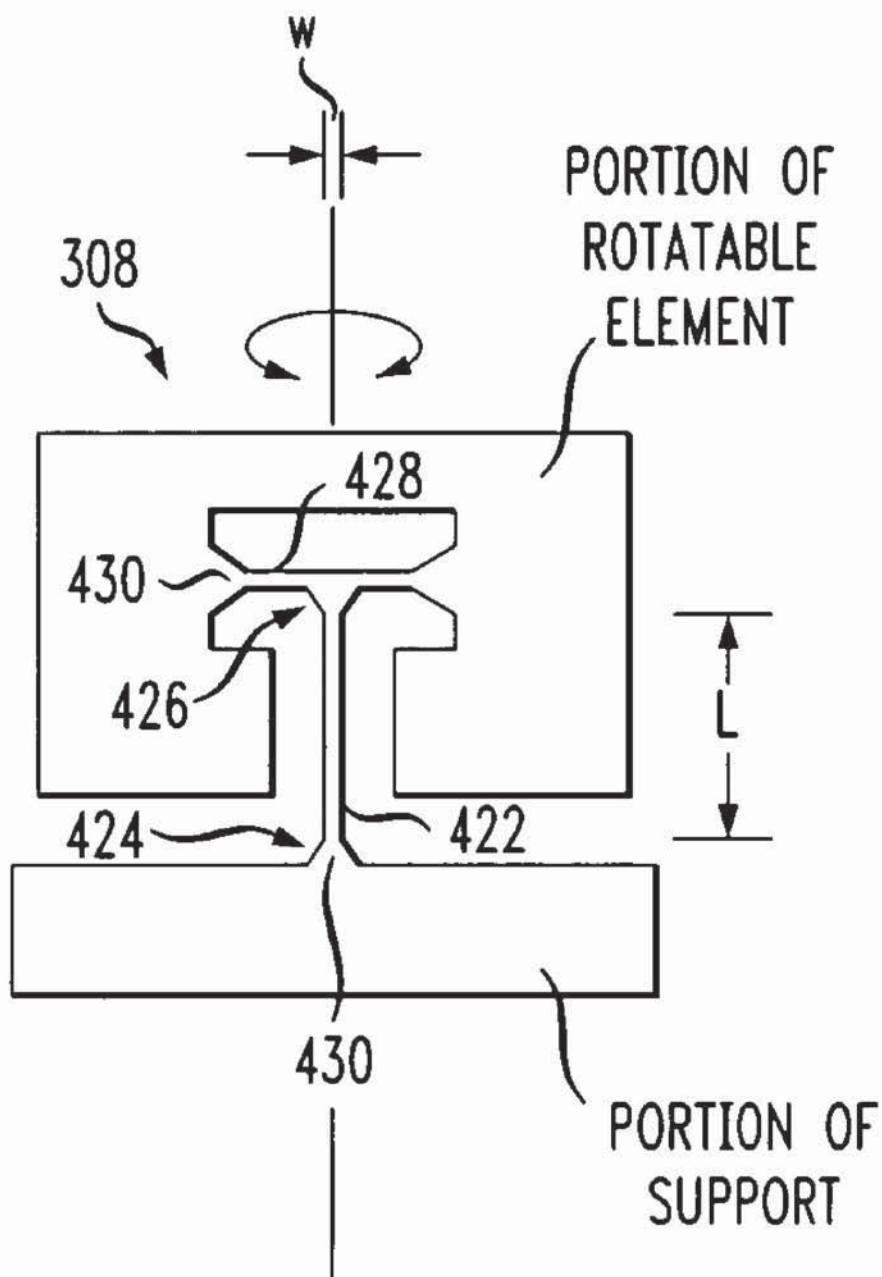
22 Claims, 6 Drawing Sheets

FIG. 1

FIG. 2

PORTION OF ROTATABLE ELEMENT

308

428

430

426

424

422

L

430

PORTION OF SUPPORT

W

FIG. 3

FIG. 4

FIG. 5

DOCKET ALARM
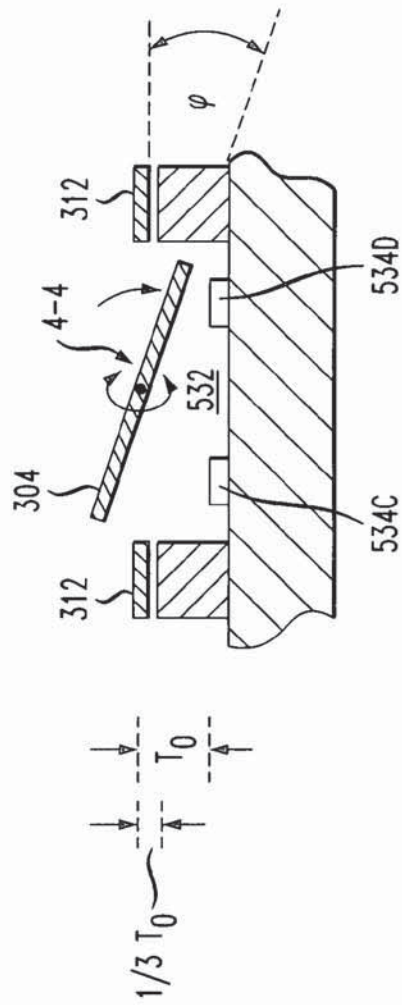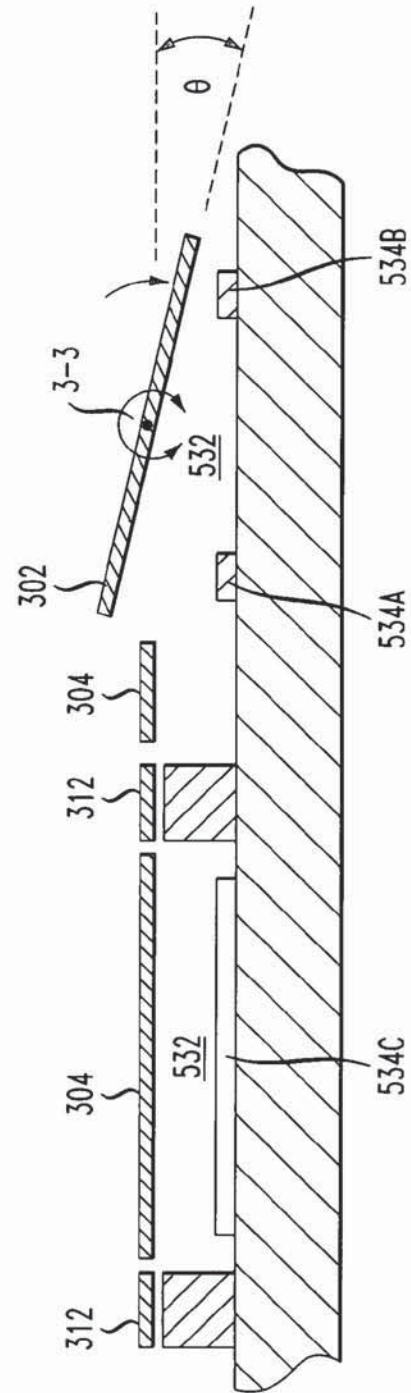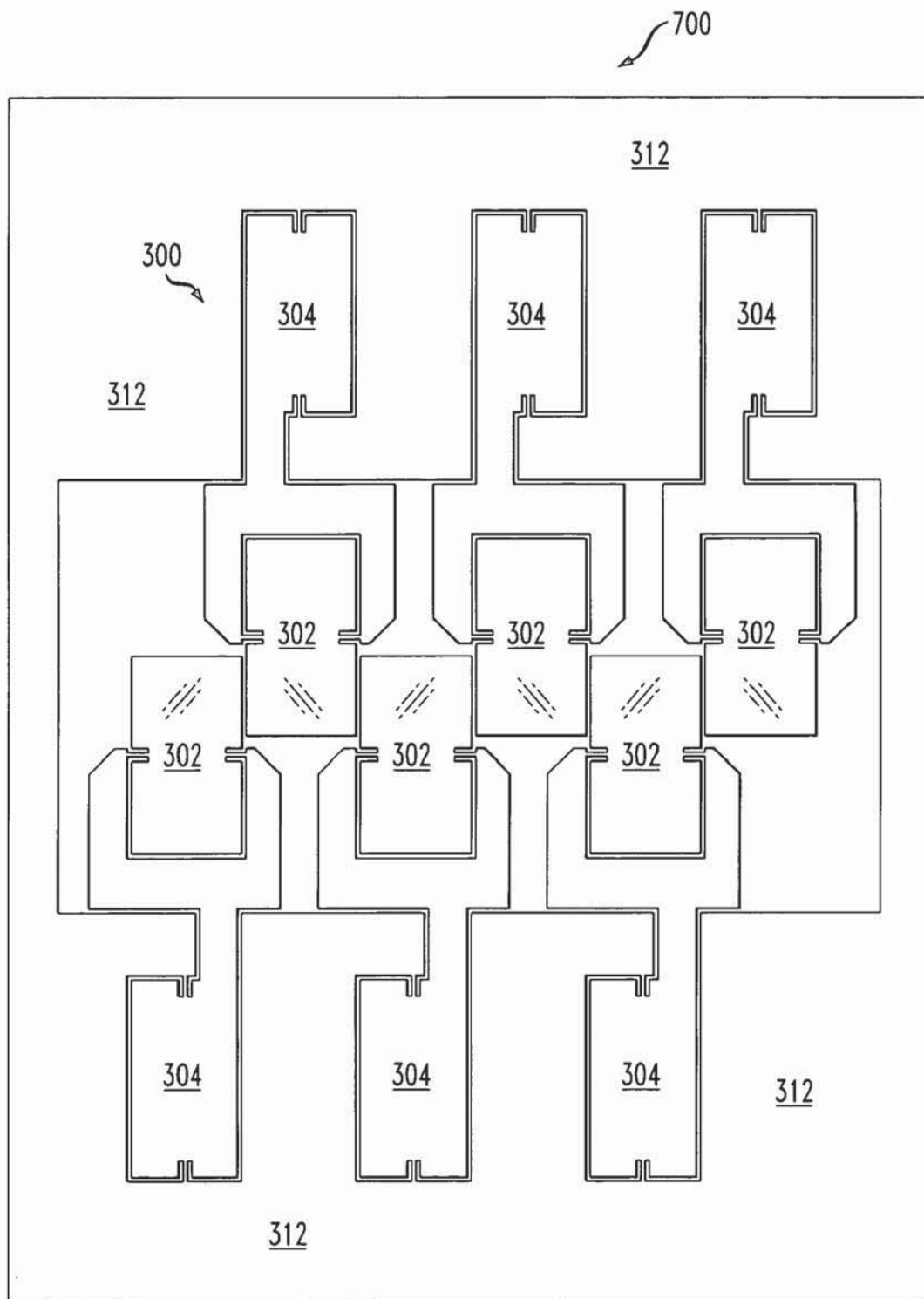
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