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United States Patent [19][11] **Patent Number:** **5,598,050****Bowen et al.**[45] **Date of Patent:** **Jan. 28, 1997**[54] **ACOUSTIC ACTUATOR AND
FLEXTENSIONAL COVER PLATE
THEREFOR**[75] Inventors: **Leslie J. Bowen**, Concord; **Richard L. Gentilman**, Acton, both of Mass.[73] Assignee: **Materials Systems Inc.**, Littleton, Mass.[21] Appl. No.: **392,548**[22] Filed: **Feb. 17, 1995**[51] **Int. Cl.⁶** **H01L 41/08**[52] **U.S. Cl.** **310/322; 310/331; 310/367**[58] **Field of Search** 310/322, 324,
310/328, 330-332, 358, 366, 367; 381/190[56] **References Cited****U.S. PATENT DOCUMENTS**

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[57]

ABSTRACT

A flextensional cover plate for redirecting the vibrational displacement of terminal ends of at least one pair of piezoelectric or electrostrictive ceramic bender elements vibrating toward and away from each other. The flextensional cover plate includes at least one flexible pleat configured to be bondable to terminal ends of the bender elements such that the bender element vibrational displacement is converted to vibrational displacement of said cover plate in a direction normal to said element vibrational displacement. The preferred flextensional cover plate is configured such that the amplitude of the cover plate vibrational displacement is greater than that of the bender element vibrational displacement. Also disclosed are an acoustic actuator panel including the flextensional cover plate, a method for redirecting vibrational displacement of terminal ends of at least one pair of piezoelectric or electrostrictive ceramic bender elements toward and away from each other, and methods for fabricating the flextensional cover plate and acoustic actuator panel.

11 Claims, 3 Drawing Sheets