

[54] **VIBRATORY LINEAR ACCELERATION AND ANGULAR RATE SENSING SYSTEM**

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[21] **Appl. No.:** 172,380

[22] **Filed:** Mar. 24, 1988

[51] **Int. Cl.<sup>5</sup>** ..... G01P 9/04

[52] **U.S. Cl.** ..... 73/505; 73/510; 73/517 AV

[58] **Field of Search** ..... 73/505, 510, 517 R, 73/517 AV

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[57] **ABSTRACT**

An inertial sensing system includes a geometric structure having several independent mechanically resonant modes of vibration such that when the structure is subjected to outside inertial motions that are to be sensed, a driven mode of vibration will couple energy in a specific manner into a pickup mode. The driven mode serves as a reference motion. The system measures angular rotation rate by sensing the vibrations in the pickup mode caused by the action of the Coriolis effect on the balanced driven mode which couples energy into the pickup mode. The system includes a portion of the geometric structure that is subject to strain caused by linear acceleration in one direction. The strain introduces an imbalance in the driven mode which causes energy to be coupled to the pickup mode of vibration in a nominally linear manner. A sensing circuit is provided to sense the amount of energy coupled into the pickup system as a measure of applied angular rotation and applied acceleration. The coupling of energy into the pickup caused by linear acceleration is orthogonal to the coupling of energy caused by angular rotation rate, and the effects of the two sources of coupled energy can be separated by the system circuitry such that independent determination of the two types of input motion is realized. The sensing system is preferably made of a material such as crystalline quartz that is mechanically stable and is also piezoelectric so that the driving and sensing can be accomplished by piezoelectric techniques.

**10 Claims, 15 Drawing Sheets**

