

[54] ANGULAR RATE SENSOR

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[58] Field of Search 73/505, 518, 519

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[57] ABSTRACT

Angular rate sensors are disclosed. Each sensor includes a forked vibrating element having two tines extending from a base end to a free end. Each of the tines are magnetized to have two regions of opposing magnetic polarity, with the polarity of corresponding regions between the different tines being opposite. In a first embodiment, the tines are driven in complementary resonant vibration by a pair of drive coils positioned about the tines near the free ends thereof. In a second embodiment, the drive coils are located about the tines at the junction of the regions of magnetization mid-element. In the first embodiment, sense motions are detected by a pair of sense coils positioned about mid-element near the junction of the first and second regions of magnetization. In the second embodiment, sense motions are detected by capacitive sensing, which consists of two parallel plate capacitors formed of the tines and additional plates, which are connected for differential sensing. Each of the tines is configured to have a first natural frequency of resonance in the drive plane and a second natural frequency of resonance for sense motions, with the second frequency being greater than the first, in order to extend the usable bandwidth of operation of the sensor.

23 Claims, 17 Drawing Figures

