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Nguyen et al.

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(54) **MICROMECHANICAL FREQUENCY DIVIDER**

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H03L 7/18; H03B 5/30; H03B 19/14
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(57) **ABSTRACT**

A micro-electromechanical system (MEMS) frequency divider apparatus having one or more MEMS resonators on a substrate is presented. A first oscillator frequency, as an approximate multiple of the parametric oscillation frequency, is capacitively coupled from a very closely-spaced electrode (e.g., 40 nm) to a resonant structure of the first oscillator, thus inducing mechanical oscillation. This mechanical oscillation can be coupled through additional MEMS resonators on the substrate. The mechanical resonance is then converted, in at least one of the MEMS resonators, by capacitive coupling back to an electrical signal which is a division of the first oscillation frequency. Output may be generated as a single ended output, or in response to a differential signal between two output electrodes.

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24 Claims, 10 Drawing Sheets

