US 20240223169A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2024/0223169 A1**

YOUNKIN et al. (43) **Pub. Date: Jul. 4, 2024**

(54) **SYSTEMS AND METHODS FOR REAL-TIME FREQUENCY SHIFT DETECTION VIA A NESTED-MEMS ARCHITECTURE**

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(21) Appl. No.: **18/149,275**

(22) Filed: **Jan. 3, 2023**

Publication Classification

(51) **Int. Cl.**

H03K 5/00 (2006.01)

H03K 21/02 (2006.01)

(52) **U.S. Cl.**

CPC ***H03K 5/00006*** (2013.01); ***H03K 21/02*** (2013.01); *H03K 2005/00286* (2013.01)

(57) **ABSTRACT**

Systems and methods disclosed herein include a correction circuit. The correction circuit may include frequency division circuitry that is configured to receive and condition a reference signal. The correction circuit may include drive circuitry that is configured to receive the reference signal. The correction circuit may include a first resonator that is configured to receive the reference signal. The correction circuit may include sense circuitry that is configured to receive the reference signal from the first resonator. The correction circuit may include phase detector circuitry that is configured to generate at least one output signal based on receipt of a plurality of input signals from the drive circuitry and the sense circuitry. The correction circuit may include a proportional integral derivative controller that is configured to generate a temperature correction signal to correct frequency error in an oscillator based on receipt of the at least one output signal.