



US 20220360251A1

(19) **United States**(12) **Patent Application Publication****Kay et al.**(10) **Pub. No.: US 2022/0360251 A1**(43) **Pub. Date: Nov. 10, 2022**

(54) **TRANSVERSELY-EXCITED FILM BULK ACOUSTIC RESONATOR WITH OXIDE STRIP ACOUSTIC CONFINEMENT STRUCTURES**

(71) Applicant: **Resonant Inc.**, Austin, TX (US)

(72) Inventors: **Andrew Kay**, Provo, UT (US); **Sean McHugh**, Santa Barbara, CA (US); **John Koulakis**, Los Angeles, CA (US); **Albert Cardona**, Santa Barbara, CA (US)

(21) Appl. No.: **17/719,311**

(22) Filed: **Apr. 12, 2022**

Related U.S. Application Data

- (63) Continuation-in-part of application No. 17/555,353, filed on Dec. 17, 2021, which is a continuation-in-part of application No. 17/542,290, filed on Dec. 3, 2021.
- (60) Provisional application No. 63/237,050, filed on Aug. 25, 2021, provisional application No. 63/182,465, filed on Apr. 30, 2021, provisional application No. 63/187,932, filed on May 12, 2021, provisional application No. 63/191,897, filed on May 21, 2021, provisional application No. 63/208,503, filed on Jun. 9, 2021.

Publication Classification

- (51) **Int. Cl.**
H03H 9/56 (2006.01)
H03H 9/02 (2006.01)
H03H 9/205 (2006.01)
H03H 3/02 (2006.01)
- (52) **U.S. Cl.**
CPC *H03H 9/568* (2013.01); *H03H 9/02228* (2013.01); *H03H 9/205* (2013.01); *H03H 9/02157* (2013.01); *H03H 3/02* (2013.01)

(57) ABSTRACT

Acoustic resonators, filters, and methods. A filter includes a piezoelectric plate supported by a substrate; and three or more diaphragms of the piezoelectric plate spanning a respective cavity in the substrate. A conductor pattern on the plate has interdigital transducers (IDTs) of three or more acoustic resonators. Each IDT has two sets of interleaved fingers extending from two busbars respectively. Overlapping portions of the fingers define an aperture of each acoustic resonator. Sometimes, each of the resonators has two dielectric strips that overlap the IDT fingers in first and second margins of the aperture and that extend into first and second gaps between the first and second margins and the busbars. Other times, the first and second dielectric strips are on the front surface of the plate, have a first portion under the IDT fingers and have a second portion extending into a gap between the margins and the busbars.

