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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte ZHIQIANG BI and RICHARD C. RUBY

Appeal 2016-007474
Application 13/661,669
Technology Center 2800

Before TERRY J. OWENS, PETER F. KRATZ, and CHRISTOPHER C. KENNEDY, *Administrative Patent Judges*.

OWENS, *Administrative Patent Judge.*

DECISION ON APPEAL

STATEMENT OF THE CASE

The Appellants appeal under 35 U.S.C. § 134(a) from the Examiner's rejection of claims 1–13 and 19–25. We have jurisdiction under 35 U.S.C. § 6(b).

The Invention

The Appellants claim a temperature compensated bulk acoustic wave (BAW) resonator device and a wafer having a plurality of those devices. Claim 1 is illustrative:

> 1. A temperature compensated bulk acoustic wave (BAW) resonator device having low trim sensitivity for providing an accurate resonant frequency, the device comprising:
>
> a first electrode disposed on a substrate;
>
> a piezoelectric layer disposed on the first electrode;

a second electrode disposed on the piezoelectric layer; and

an acoustic mirror pair disposed on the second electrode, the acoustic mirror pair comprising a low acoustic impedance layer and a high acoustic impedance layer, at least one of the low acoustic impedance layer and the high acoustic impedance layer having a thickness frequency trimmed to fine tune the resonant frequency,

wherein at least one of the first electrode and the second electrode comprises:

an electrode layer; and

a temperature compensating layer configured to compensate for a temperature coefficient of at least the piezoelectric layer.

The References

Ruby (Ruby '798)	US 2004/0172798 A1	Sept. 9, 2004
Jang	US 2007/0063793 A1	Mar. 22, 2007
Sinha	US 2010/0187948 A1	July 29, 2010
Ruby (Ruby '925)	US 2011/0266925 A1	Nov. 3, 2011

The Rejections

The claims stand rejected under 35 U.S.C. § 103 as follows: claims 1–8, 11–13 and 19–24 over Ruby '925 in view of Sinha, claim 9 over Ruby '925 in view of Sinha and Jang, and claims 10 and 25 over Ruby '925 in view of Sinha and Ruby '798.[1]

OPINION

We affirm the rejections.

The Appellants argue the claims as a group (App. Br. 7–14). The Appellants address claims 9–11, 19 and 25 separately but do not provide a substantive argument for the separate patentability of those claims

[1] A rejection of claims 1 and 19 under 35 U.S.C. § 112, second paragraph, is withdrawn in the Examiner's Answer (Ans. 2).

(App. Br. 11–14). We therefore limit our discussion to one claim, i.e., claim 1. Claims 2–13 and 19–25 stand or fall with that claim. *See* 37 C.F.R. § 41.37(c)(1)(iv) (2012).

Ruby '925 discloses a BAW resonator (100) comprising a first electrode (120) on a substrate (110), a piezoelectric layer (130) on the first electrode (120), and a second electrode (140) on the piezoelectric layer (130), where the first electrode (120) comprises an electrode layer (122) and a temperature compensating layer (124) for compensating a temperature coefficient of the piezoelectric layer (130) (¶¶ 21, 23; Fig. 1).

Sinha discloses a BAW resonator comprising, on an upper electrode (18), an energy-confining Bragg reflector (48) having a plurality of pairs of low acoustic impedance layers (22) and high acoustic impedance layers (24) (¶ 41; Fig.3). "Each of these Bragg material layers (**22**, **24**) has a thickness equal to an odd integer multiple of the quarter acoustic wavelength of the operational mode in the material" (¶ 41).[2]

The Appellants assert that "assuming *arguendo* that the Bragg reflector 48 in FIG. 3 of SINHA et al. teaches an acoustic mirror pair disposed on a second electrode, there is no teaching or suggestion by SINHA et al. that the Bragg reflector 48 includes a low acoustic impedance layer and a high acoustic impedance layer, <u>at least one of which having a thickness frequency trimmed to fine tune the resonant frequency of the device</u>" (App. Br. 10), and "[m]erely identifying the thickness of each of the Bragg material layers (22,24) does not teach or suggest at least one of the

[2] The Appellants' Specification states that "[e]ach of the [Bragg Reflector's] layers is approximately one quarter-wavelength thick at the acoustic wavelength" (Spec. ¶ 22).

low and high acoustic impedance layers having a 'frequency trimmed' thickness or providing fine tuning of the BAW resonator's resonant frequency" (App. Br. 11).

The Appellants' Specification does not indicate the meaning of claim 1's term "thickness frequency". The Appellants' disclosure that "conventional FBARs [thin film bulk acoustic resonators] are very sensitive to frequency trimming (or wafer trimming), which is a process used to remove extremely small amounts of material from a top-most layer of the wafer in order to decrease thickness, thereby fine tuning the resonant frequencies of the FBARs while still part of the wafer" (Spec. ¶ 3) indicates that the claim term "thickness frequency" should be "thickness" and that frequency trimming has the effect of removing an extremely small amount of material from a layer such that the layer is thinned to an extremely small degree. For that reason and because claim 1 does not require any particular degree of fine tuning or characteristic obtained by the fine tuning, it appears that Sinha's acoustic impedance layer (22 or 24), regardless of whether it has been frequency trimmed, can have the same or substantially the same thickness as a frequency trimmed acoustic impedance layer. "[W]hen the PTO shows sound basis for believing that the products of the applicant and the prior art are the same, the applicant has the burden of showing that they are not." *In re Spada*, 911 F.2d 705, 708 (Fed. Cir. 1990). The Appellants have not carried that burden.

The Appellants assert that "appropriately selecting thicknesses of low and high acoustic impedance layers of the Bragg reflector is a function of design, whereas accurately producing these selected thicknesses in a finished product (i.e., a temperature compensated BAW resonator device), as a

practical matter, to accurately provide the desired resonant frequency is not addressed by SINHA et al." (Reply Br. 6), and "[t]here is no disclosure of such frequency trimmed acoustic impedance layers or low trim sensitivity characteristics in structure 52 in FIG. 3 of SHINHA [sic] et al. to obtain the resonant frequency" (*id.*).

The Appellants' Specification states that "[t]he [acoustic mirror pair's] low and high acoustic impedance layers enable the wafer to have low sensitivity to frequency trimming, such that the BAW resonator devices provide substantially uniform resonant frequencies" (Spec. ¶ 6). Because the low trim sensitivity is due to the acoustic mirror pair, it would be a characteristic of Ruby '925's BAW including Sinha's acoustic mirror pair (Bragg reflector 48; ¶ 41).

For the above reasons we are not persuaded of reversible error in the rejections.

DECISION/ORDER

The rejections under 35 U.S.C. § 103 of claims 1–8, 11–13 and 19–24 over Ruby '925 in view of Sinha, claim 9 over Ruby '925 in view of Sinha and Jang, and claims 10 and 25 over Ruby '925 in view of Sinha and Ruby '798 are affirmed.

It is ordered that the Examiner's decision is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a).

AFFIRMED