

(12) **United States Patent**
Barber et al.

(10) **Patent No.:** **US 6,342,134 B1**
(45) **Date of Patent:** **Jan. 29, 2002**

(54) **METHOD FOR PRODUCING
PIEZOELECTRIC FILMS WITH ROTATING
MAGNETRON SPUTTERING SYSTEM**

5,702,573 A * 12/1997 Biberger et al. 204/192.12
5,830,327 A 11/1998 Kolenkow 204/192.12
5,935,641 A * 8/1999 Beam, III et al. 427/100
6,001,227 A 12/1999 Pavate et al. 204/298.12

(75) Inventors: **Bradley Paul Barber**, Chatham, NJ
(US); **Ronald Eugene Miller**,
Riegelsville, PA (US)

OTHER PUBLICATIONS

Vossen et al., "Thin Film Processes", pp. 48, Dec. 1978.*

(73) Assignee: **Agere Systems Guardian Corp.**,
Orlando, FL (US)

* cited by examiner

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

Primary Examiner—Nam Nguyen
Assistant Examiner—Steven H. VerSteeg
(74) *Attorney, Agent, or Firm*—Lowenstein Sandler PC

(57) **ABSTRACT**

(21) Appl. No.: **09/503,225**

(22) Filed: **Feb. 11, 2000**

(51) **Int. Cl.**⁷ **C23C 14/34**

(52) **U.S. Cl.** **204/192.18; 204/192.13;**
204/192.22; 204/192.3; 427/8; 216/38;
29/25.35

(58) **Field of Search** 204/192.12, 192.13,
204/192.18, 192.22, 192.3; 427/8; 216/38;
29/25.35

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,642,163 A * 2/1987 Greschner et al. 156/643
5,378,341 A 1/1995 Drehman et al. 204/298.18
5,651,865 A * 7/1997 Sellers 204/192.13
5,683,558 A * 11/1997 Sieck et al. 204/192.12
5,693,197 A 12/1997 Lal et al. 204/192.2

A quality-assurance method is described that is useful in the fabrication of piezoelectric films of electronic devices, particularly resonators for use in RF filters. For example, the method comprises determining the surface roughness of an insulating layer on which the piezoelectric film is to be deposited and achieving a surface roughness for the insulating layer that is sufficiently low to achieve the high-quality piezoelectric film. According to one aspect of the invention, the low surface roughness for the insulating layer is achieved with use of a rotating magnet magnetron system for improving the uniformity of the deposited layer. According to other aspects of the invention, the high-quality piezoelectric film is assured by optimizing deposition parameters including determination of a "cross-over point" for reactive gas flow and/or monitoring and correcting for the surface roughness of the insulating layer pre-fabrication of the piezoelectric film.

7 Claims, 4 Drawing Sheets

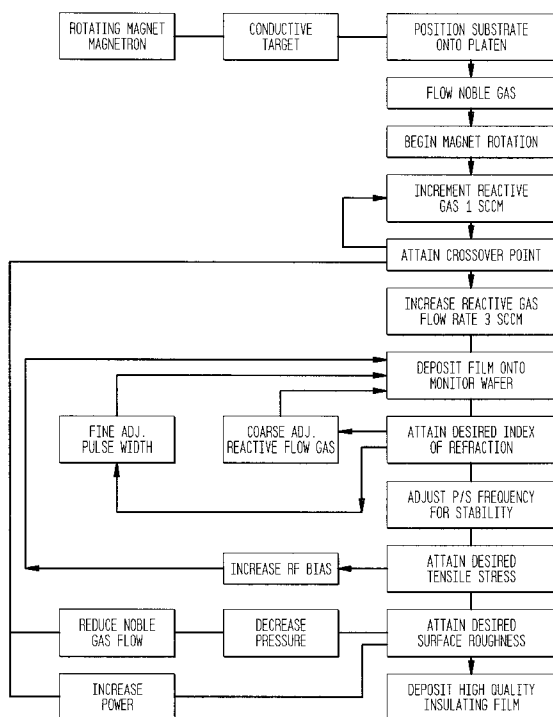
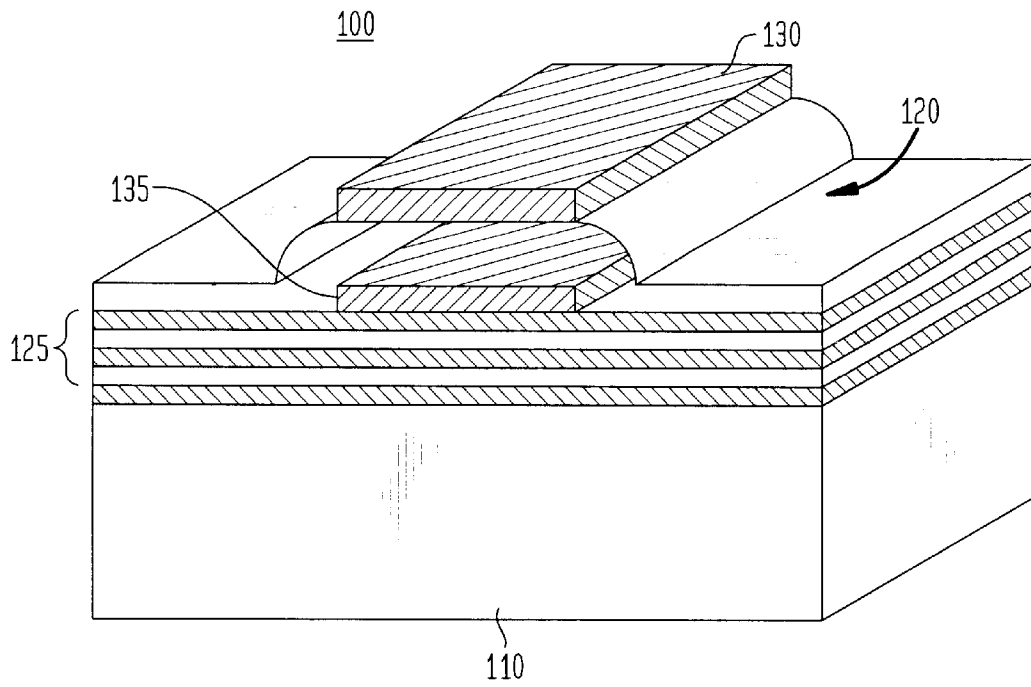


FIG. 1



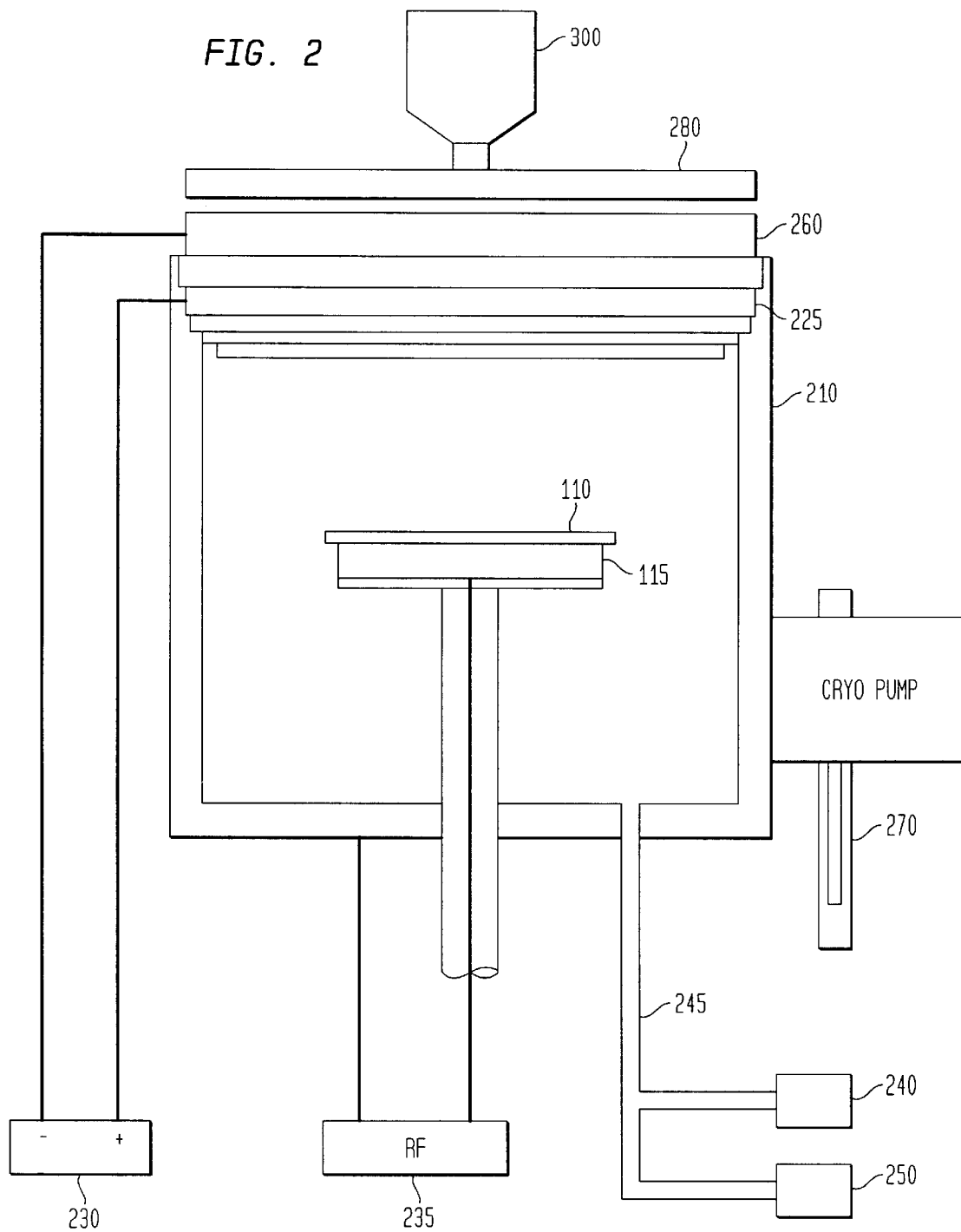


FIG. 3

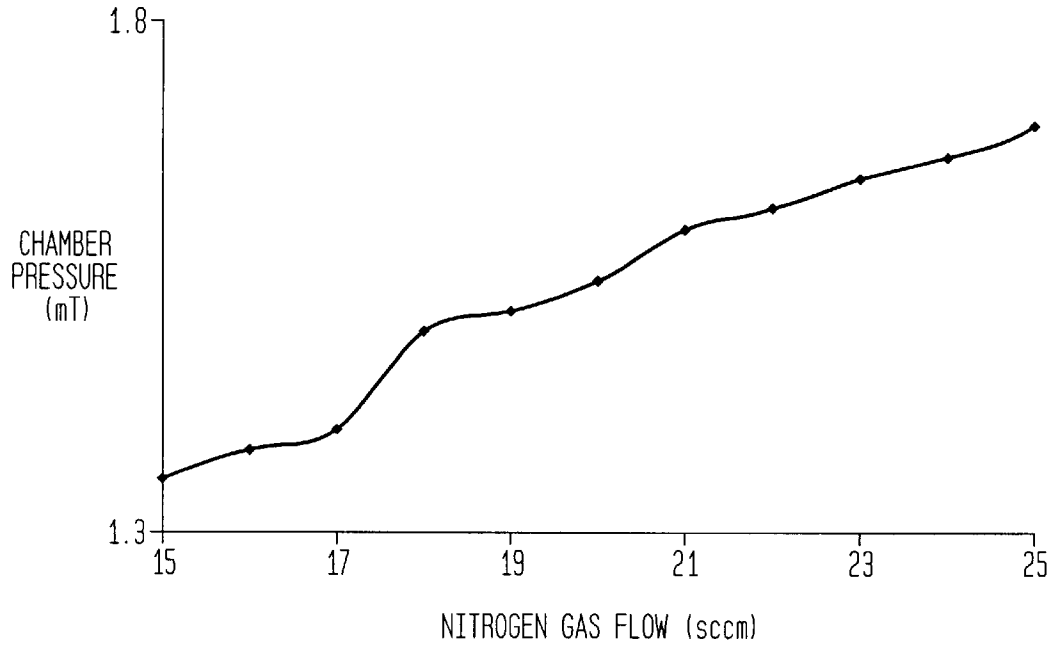


FIG. 4

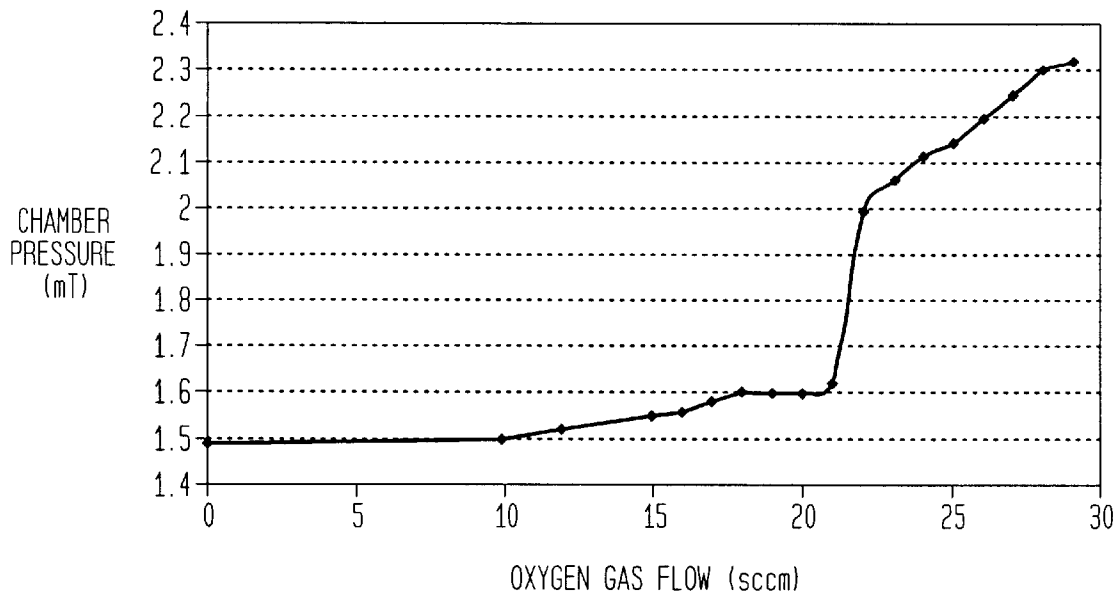
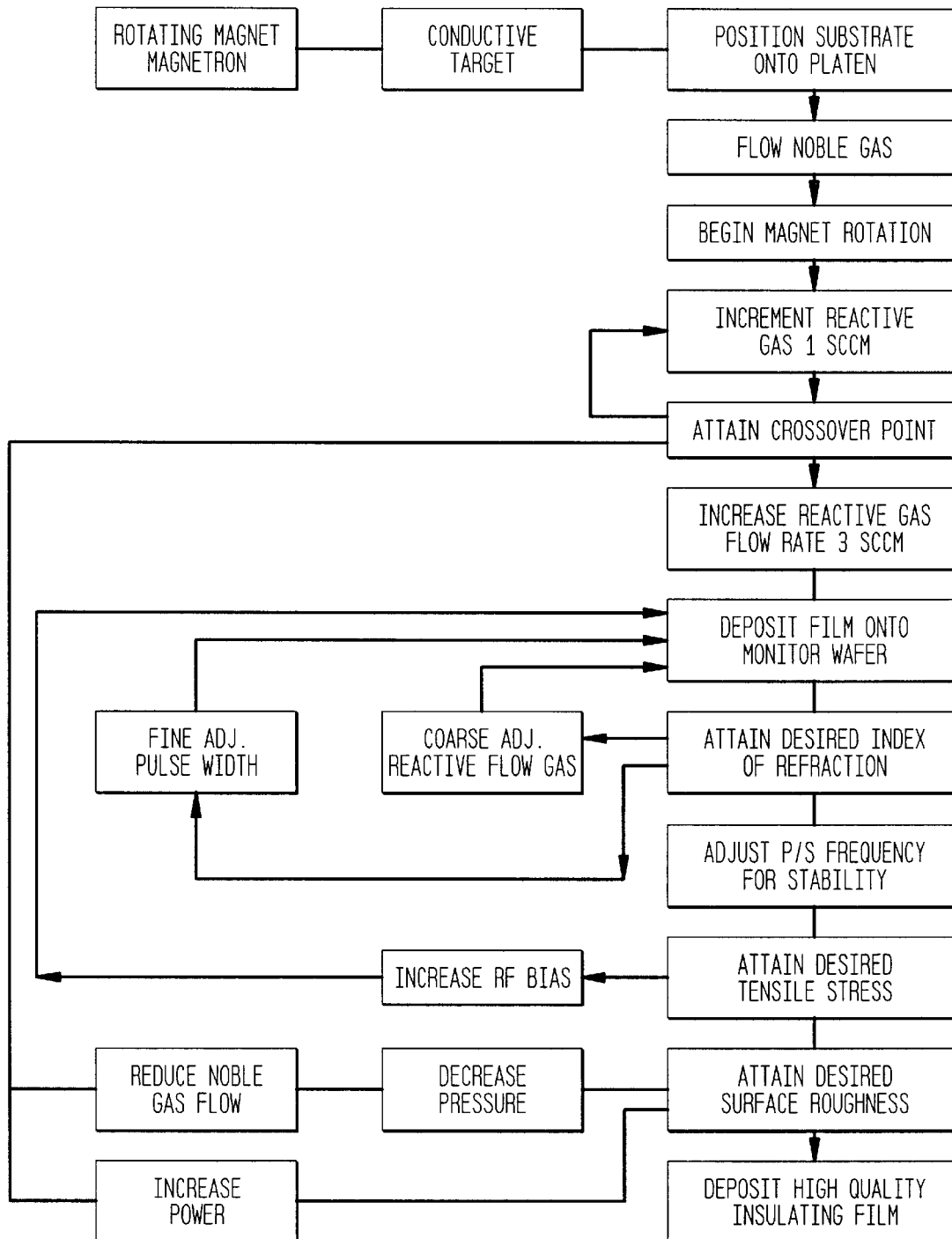


FIG. 5



Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.