

[54] **METHODS AND APPARATUS FOR PRE-STABILIZED PLASMA GENERATION FOR MICROWAVE CLEAN APPLICATIONS**

5,273,609 12/1993 Moslehi ..... 315/111.21 X  
 5,282,899 2/1994 Balmashnov et al. .... 118/723 R  
 5,403,434 4/1995 Moslehi ..... 134/1.2  
 5,468,686 11/1995 Kawamoto ..... 438/905 X  
 5,578,163 11/1996 Yachi ..... 438/714 X

[75] Inventors: **Gary Fong**, Cupertino; **Fong Chang**, Los Gatos; **Long Nguyen**, Fremont, all of Calif.

**FOREIGN PATENT DOCUMENTS**

4-199816 7/1992 Japan ..... 315/111.21

[73] Assignee: **Applied Materials, Inc.**, Santa Clara, Calif.

*Primary Examiner*—Robert Pascal  
*Assistant Examiner*—Justin P. Bettendorf  
*Attorney, Agent, or Firm*—Townsend & Townsend & Crew

[21] Appl. No.: **08/746,658**

[57] **ABSTRACT**

[22] Filed: **Nov. 13, 1996**

The present invention provides systems, methods and apparatus for high temperature (at least about 500–800° C.) processing of semiconductor wafers. The systems, methods and apparatus of the present invention allow multiple process steps to be performed in situ in the same chamber to reduce total processing time and to ensure high quality processing for high aspect ratio devices. Performing multiple process steps in the same chamber also increases the control of the process parameters and reduces device damage. In particular, the present invention can provide high temperature deposition, heating and efficient cleaning for forming dielectric films having thickness uniformity, good gap fill capability, high density, low moisture, and other desired characteristics.

[51] **Int. Cl.<sup>6</sup>** ..... **B08B 6/00**

[52] **U.S. Cl.** ..... **315/111.21**; 134/1.1; 438/714; 438/905

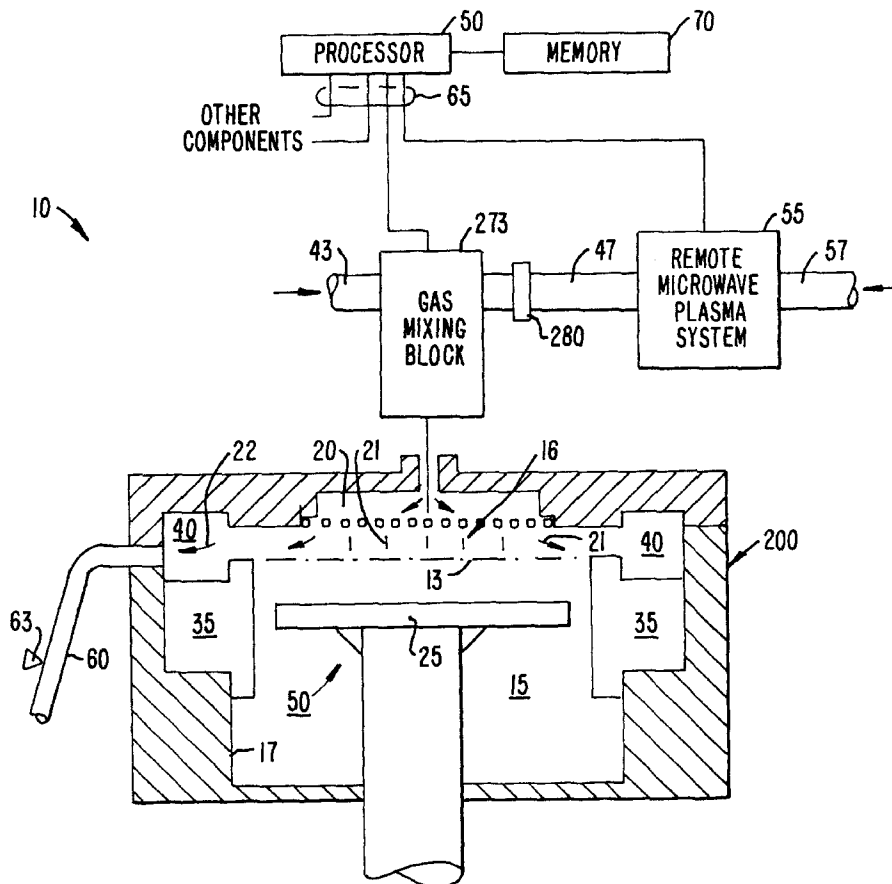
[58] **Field of Search** ..... 315/111.21; 438/714, 438/727, 905; 134/1.1, 1.2

[56] **References Cited**

**U.S. PATENT DOCUMENTS**

4,576,692 3/1986 Fukura et al. .... 204/165  
 4,579,623 4/1986 Suzuki et al. .... 438/714 X  
 4,872,947 10/1989 Wang et al. .... 156/643  
 4,951,601 8/1990 Maydan et al. .... 118/719  
 5,082,517 1/1992 Moslehi ..... 156/345  
 5,266,364 11/1993 Tamura et al. .... 427/571

**20 Claims, 42 Drawing Sheets**



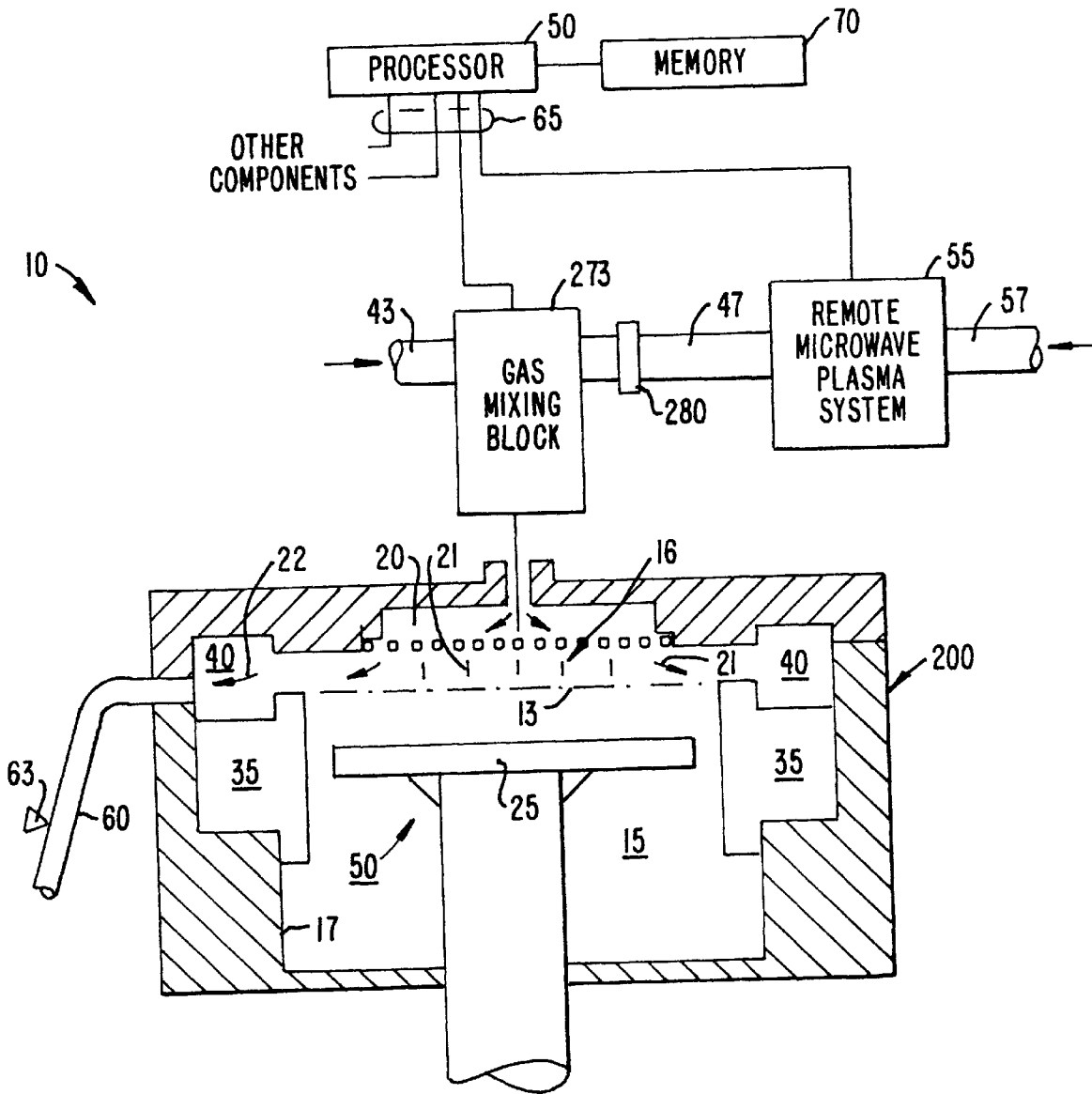
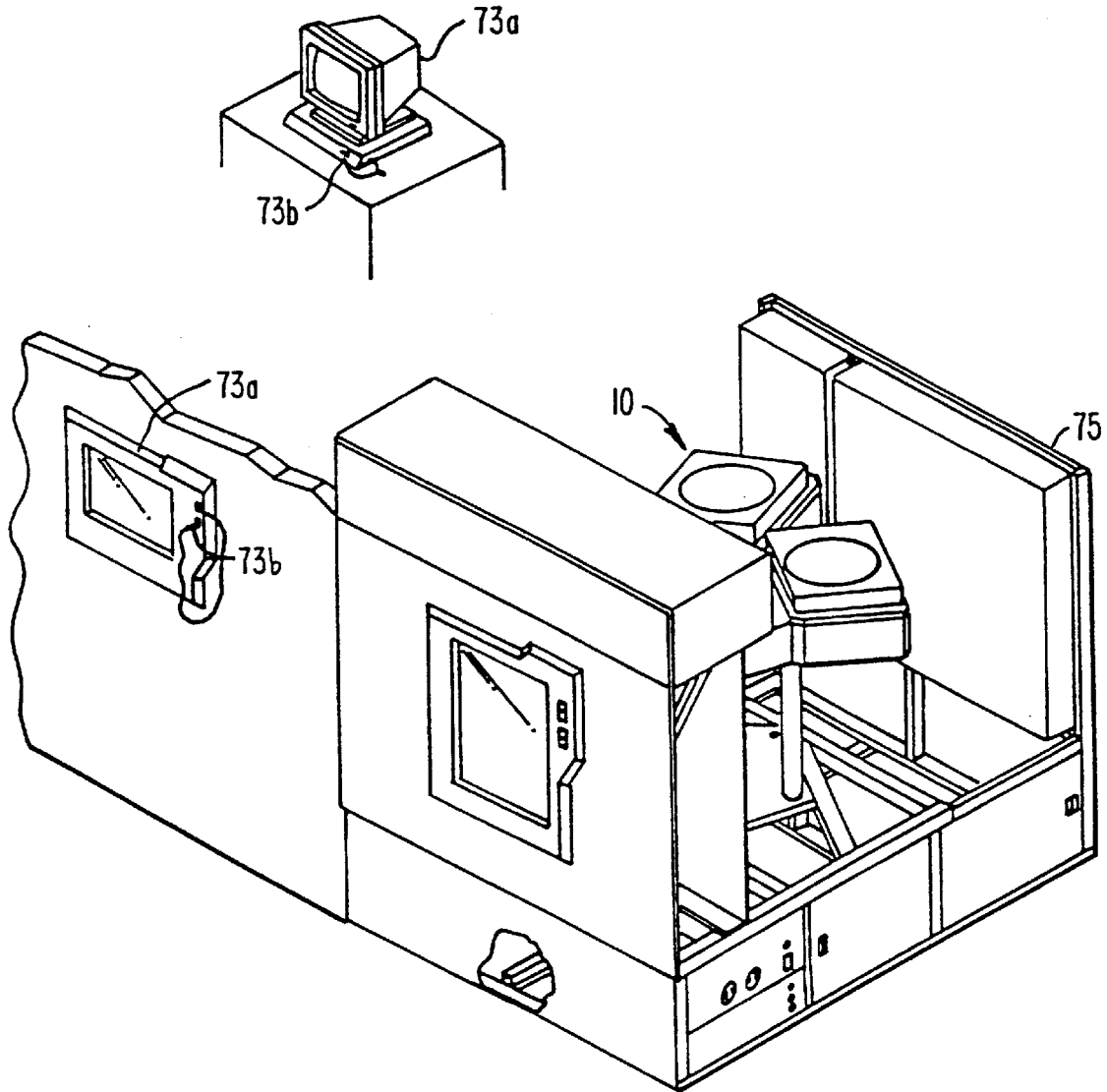


FIG. 1A.



**FIG. 1B.**

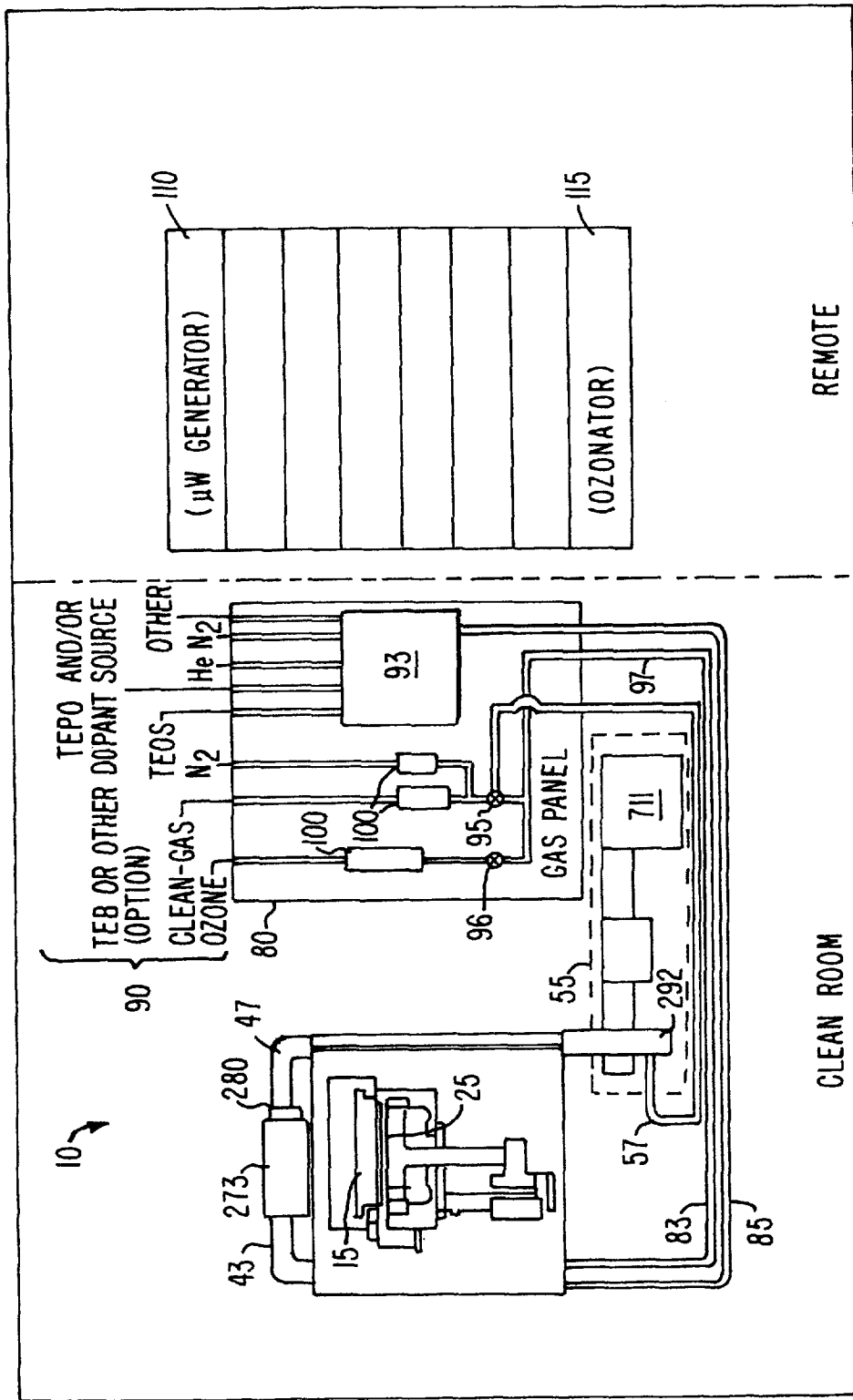


FIG. 1C.

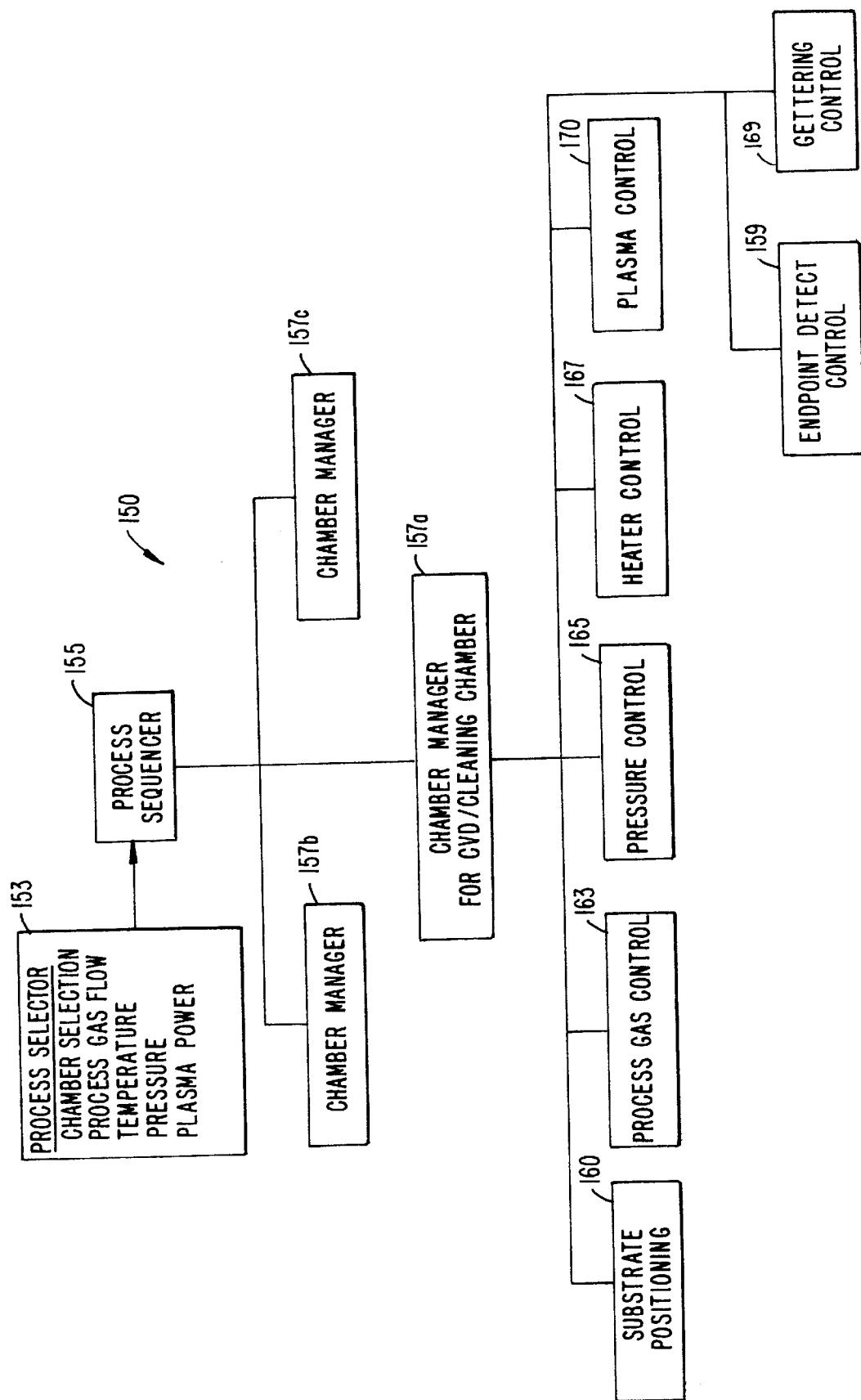


FIG. 1D.

# 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.