



US005654679A

United States Patent [19]

Mavretic et al.

[11] **Patent Number:** **5,654,679**[45] **Date of Patent:** **Aug. 5, 1997**[54] **APPARATUS FOR MATCHING A VARIABLE LOAD IMPEDANCE WITH AN RF POWER GENERATOR IMPEDANCE**[75] Inventors: **Anton Mavretic**, Marlton; **Andrew Ciszek**, Maple Shade; **Joseph Stach**, Medford, all of N.J.[73] Assignee: **RF Power Products, Inc.**, Voorhees, N.J.[21] Appl. No.: **662,886**[22] Filed: **Jun. 13, 1996**[51] **Int. Cl.⁶** **H03H 7/40**[52] **U.S. Cl.** **333/17.3; 333/32**[58] **Field of Search** **333/17.3, 99 PL, 333/32; 343/861; 315/111.21**[56] **References Cited****U.S. PATENT DOCUMENTS**

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Primary Examiner—Paul Gensler*Attorney, Agent, or Firm*—Blakely, Sokoloff, Taylor & Zafman LLP[57] **ABSTRACT**

An apparatus for matching the variable impedance of a load with the fixed impedance of a radio frequency (RF) power generator to provide maximum power transfer. The impedance matching network further allows an RF power generator to vary the frequency of the voltage applied to a load, e.g., a plasma chamber as may be utilized in semiconductor or flat panel plasma display manufacturing processes. The impedance matching network further utilizes fixed solid state components to adjust the impedance of the attached load to provide maximum power transfer between the generator and the load. A parallel switched capacitor network is controlled by an electrical switching means such as PIN diodes to turn fixed capacitors on or off. A means for varying the frequency of the applied voltage is used to match the impedance of the load with the impedance of the RF power generator within milliseconds.

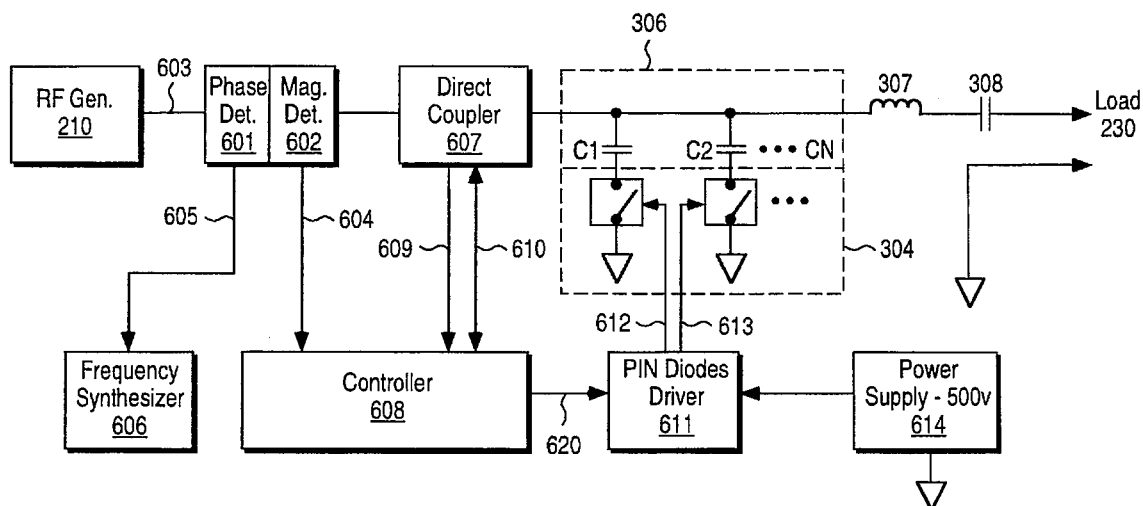
17 Claims, 6 Drawing Sheets

FIG. 1 (Prior Art)

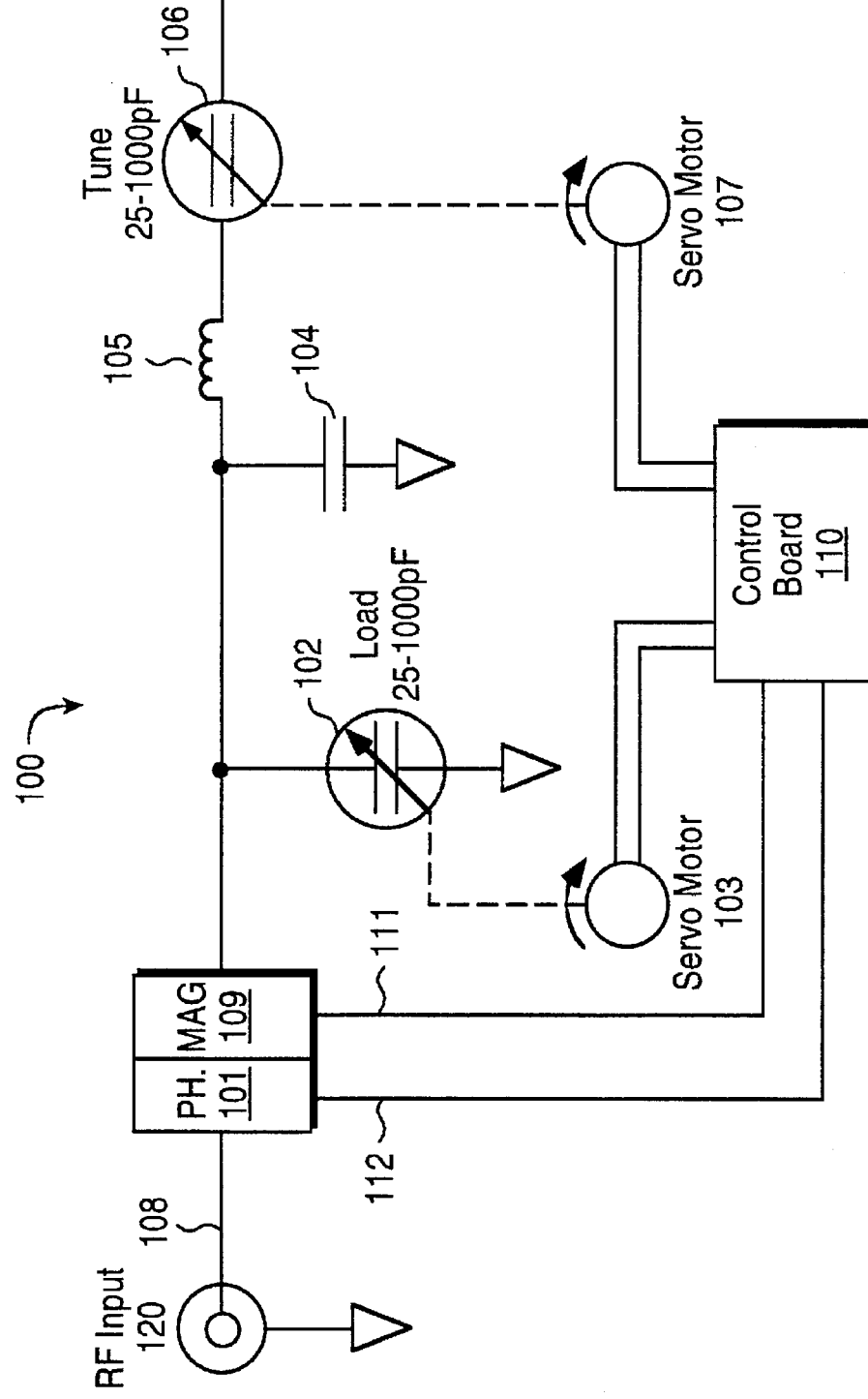


FIG. 2

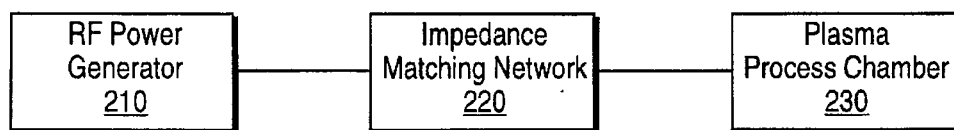


FIG. 3

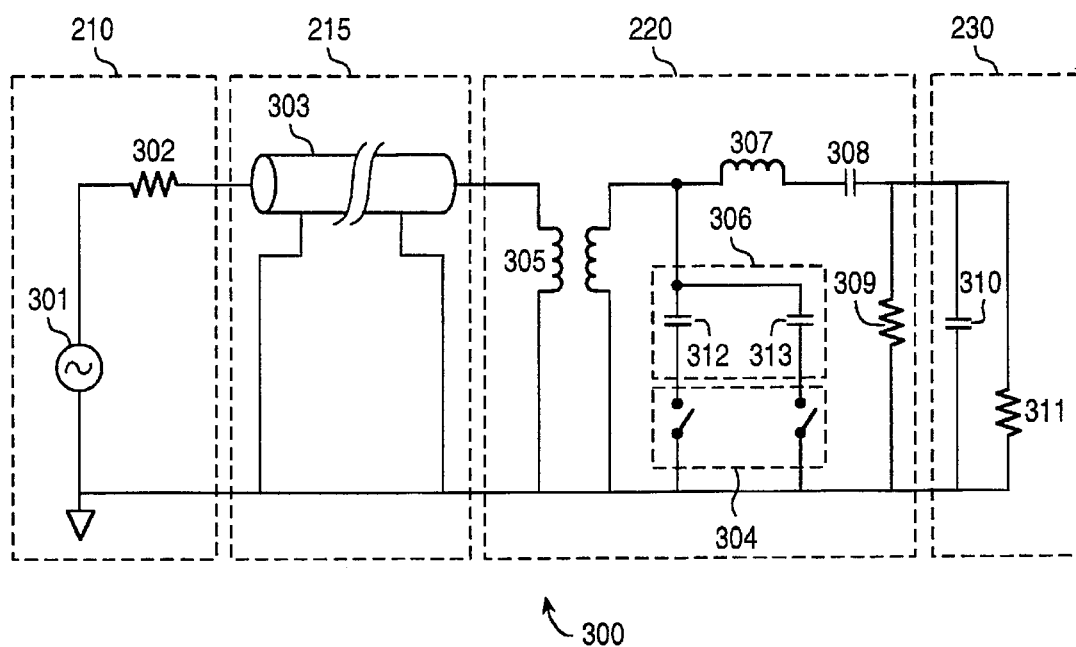


FIG. 4

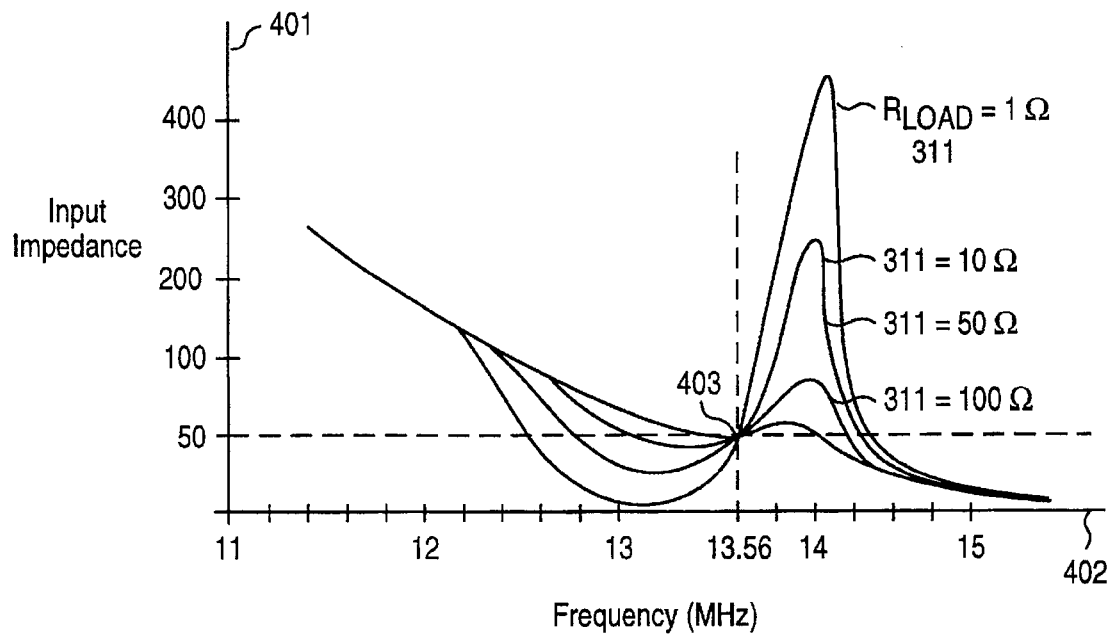
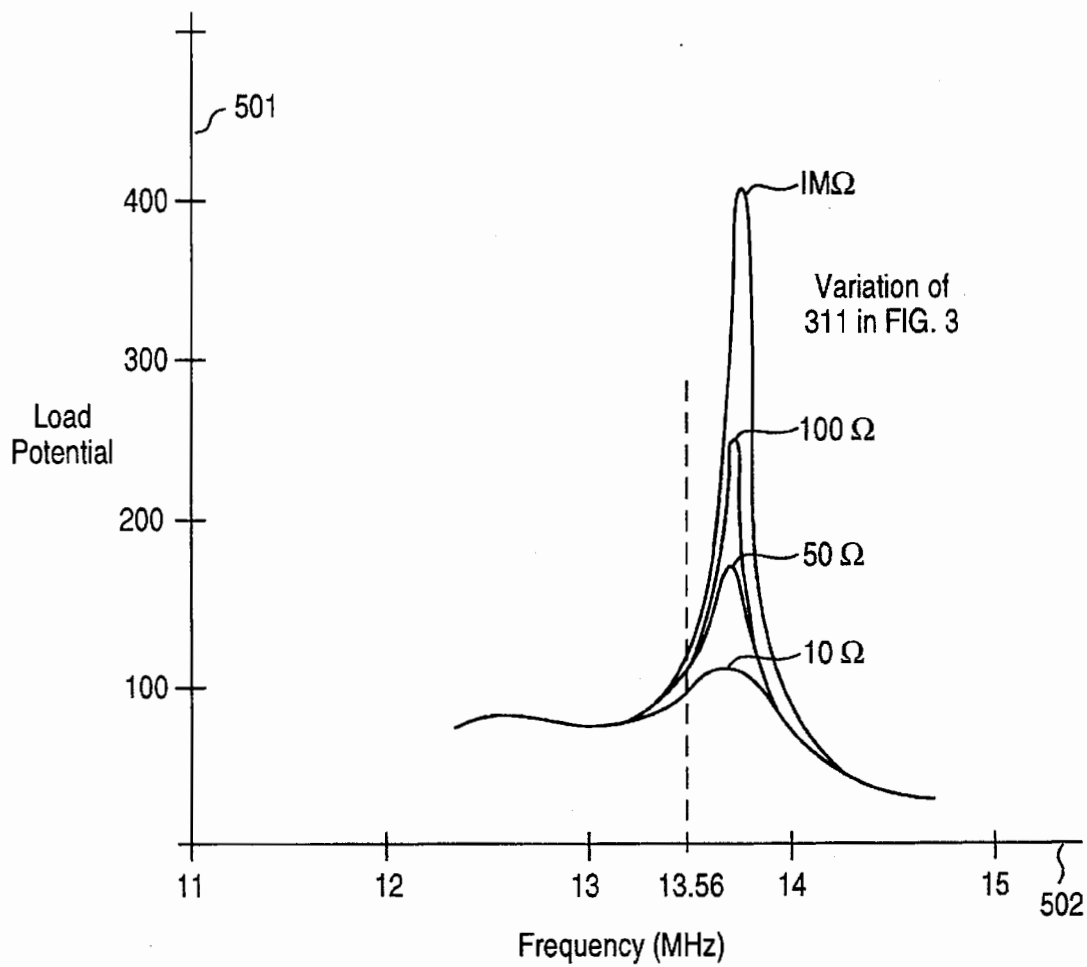


FIG. 5





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