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Chistyakov

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(54) **METHODS AND APPARATUS FOR GENERATING HIGH-DENSITY PLASMA**

(75) Inventor: **Roman Chistyakov**, Andover, MA (US)

(73) Assignee: **Zond, Inc.**, Mansfield, MA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 748 days.

This patent is subject to a terminal disclaimer.

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C23C 14/35 (2006.01)
C23C 16/00 (2006.01)

(52) **U.S. Cl.** .... **204/192.12**; 204/298.08; 204/298.06; 204/298.19; 315/111.21; 315/111.41; 118/723 R; 118/723 E

(58) **Field of Classification Search** .... 204/192.12, 204/298.08, 298.06, 298.19; 118/723 R, 118/723 E; 315/111.21, 111.41
See application file for complete search history.

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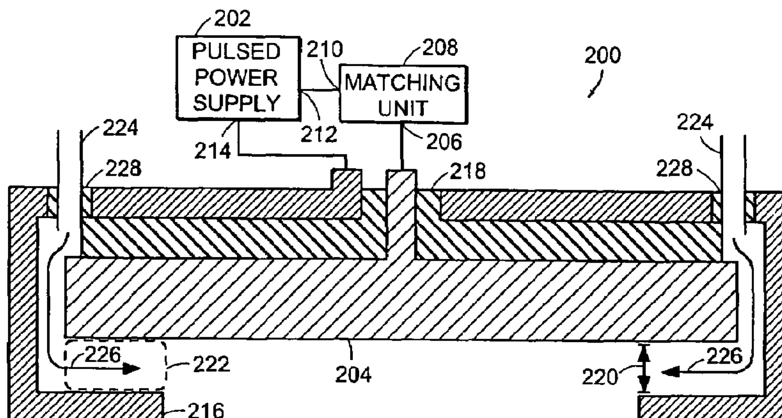
Primary Examiner—Rodney G McDonald
(74) *Attorney, Agent, or Firm*—Kurt Rauschenbach; Rauschenbach Patent Law Group, LLC

(57) **ABSTRACT**

Methods and apparatus for generating a strongly-ionized plasma are described. An apparatus for generating a strongly-ionized plasma according to the present invention includes an anode and a cathode that is positioned adjacent to the anode to form a gap there between. An ionization source generates a weakly-ionized plasma proximate to the cathode. A power supply produces an electric field in the gap between the anode and the cathode. The electric field generates excited atoms in the weakly-ionized plasma and generates secondary electrons from the cathode. The secondary electrons ionize the excited atoms, thereby creating the strongly-ionized plasma.

33 Claims, 13 Drawing Sheets



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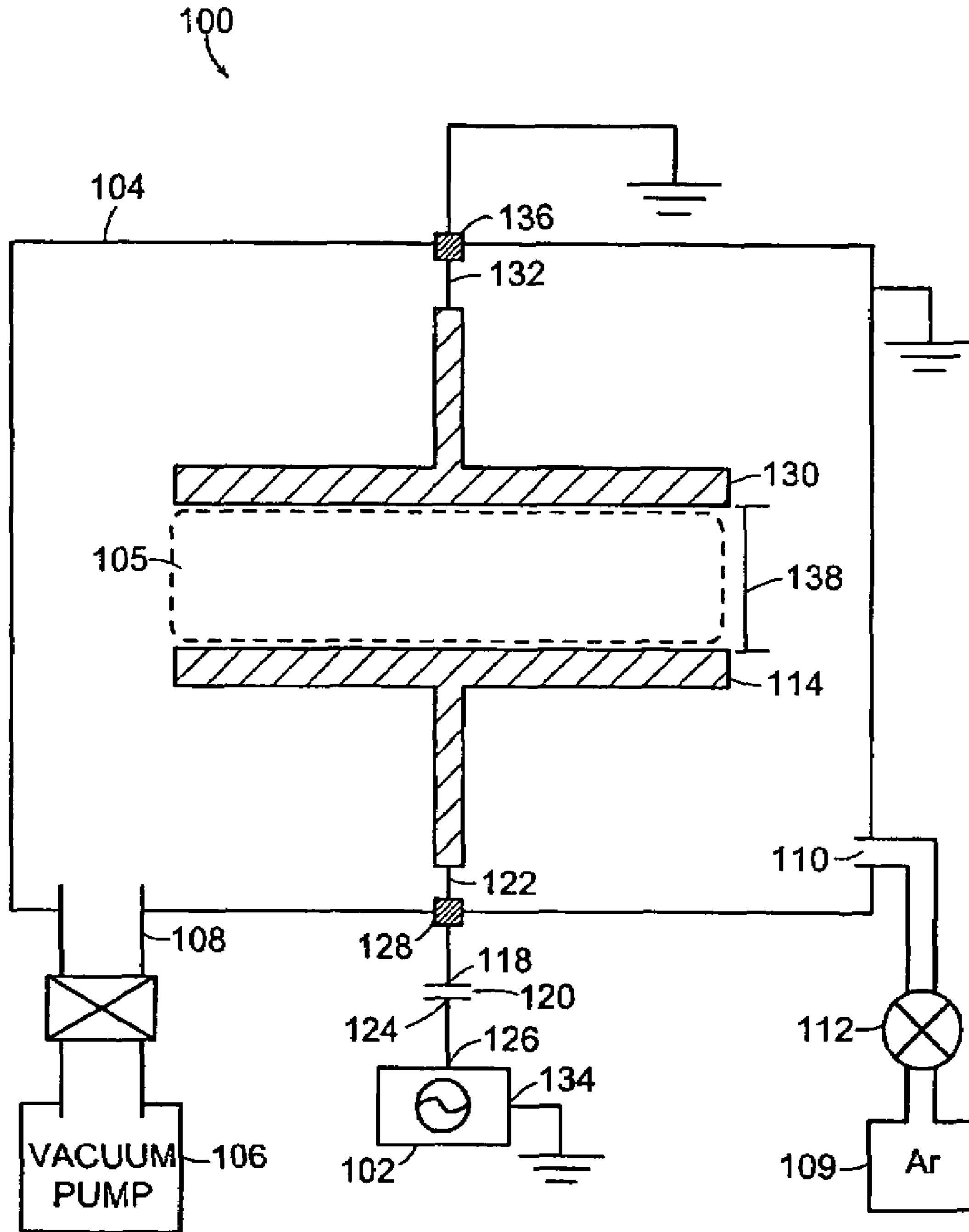

FIG. 1
PRIOR ART

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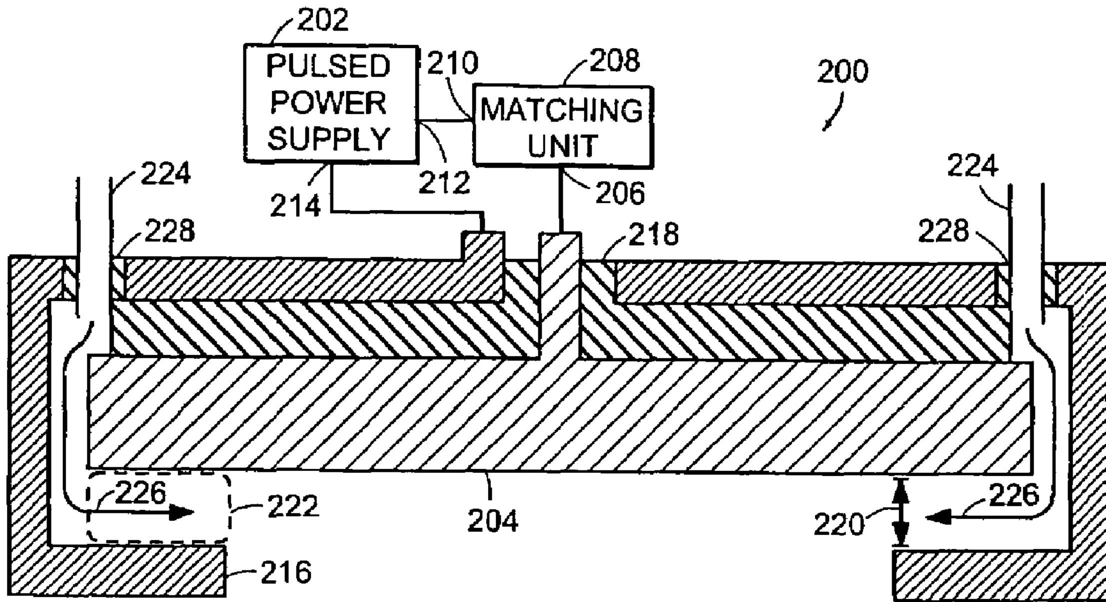

FIG. 2A

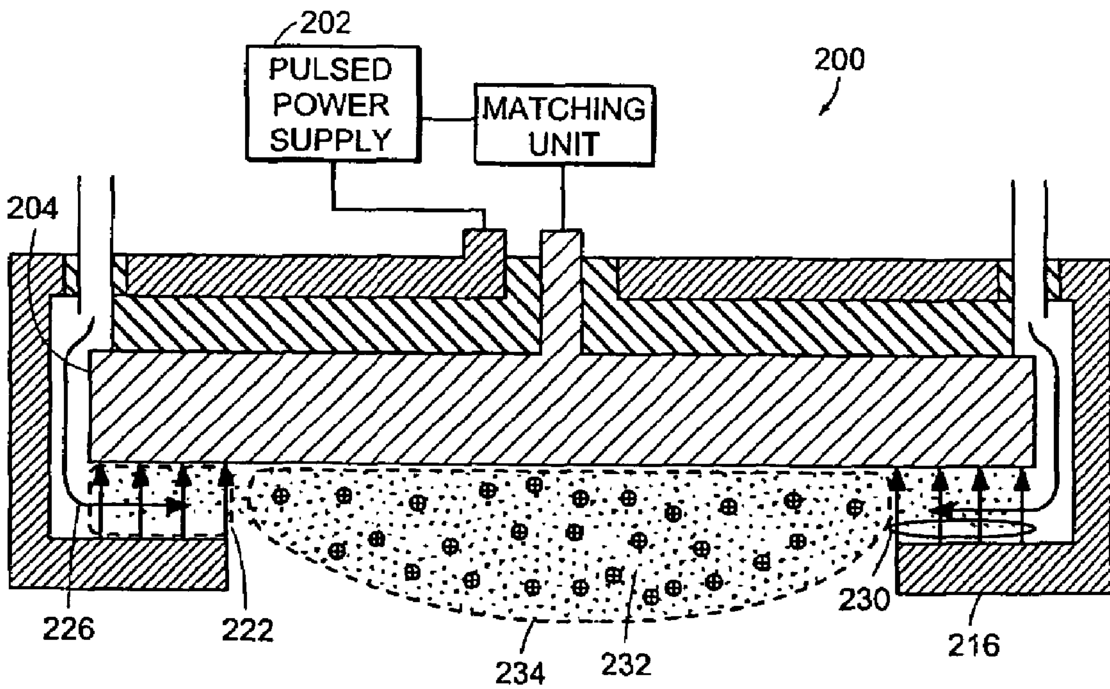

FIG. 2B

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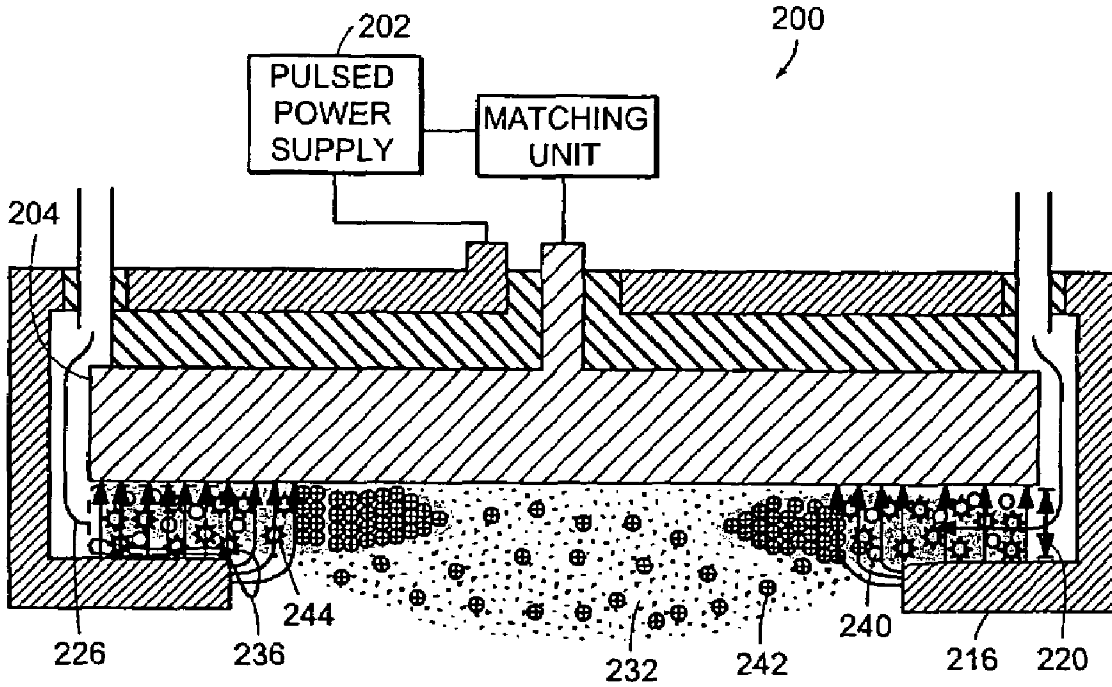

FIG. 2C

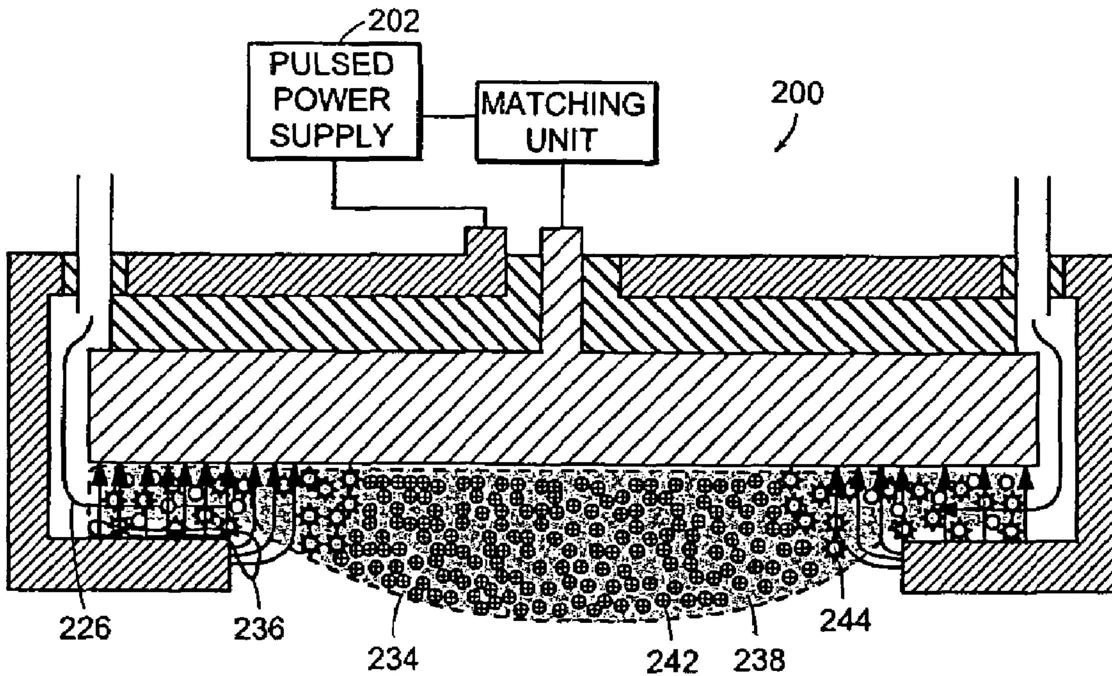

FIG. 2D

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