US007147759B2

(12) **United States Patent**
Chistyakov

(10) **Patent No.: US 7,147,759 B2**
(45) **Date of Patent: *Dec. 12, 2006**

(54) **HIGH-POWER PULSED MAGNETRON SPUTTERING**

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(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 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **10/065,277**

(22) Filed: **Sep. 30, 2002**

(65) **Prior Publication Data**

US 2004/0060813 A1 Apr. 1, 2004

(51) **Int. Cl.**
C23C 14/35 (2006.01)

(52) **U.S. Cl.** **204/192.12**; 204/192.13; 204/298.03; 204/298.06; 204/298.08; 204/298.14; 204/298.19

(58) **Field of Classification Search** 204/192.12, 204/192.13, 298.03, 298.06, 298.08, 298.14, 204/298.19, 298.26
See application file for complete search history.

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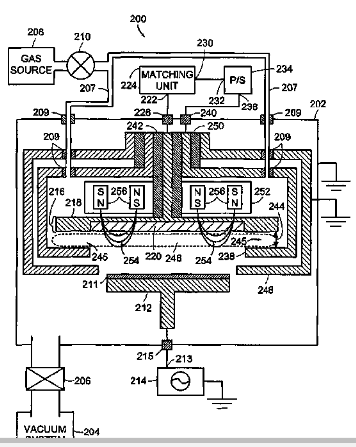
(57) **ABSTRACT**

Magnetically enhanced sputtering methods and apparatus are described. A magnetically enhanced sputtering source according to the present invention includes an anode and a cathode assembly having a target that is positioned adjacent to the anode. An ionization source generates a weakly-ionized plasma proximate to the anode and the cathode assembly. A magnet is positioned to generate a magnetic field proximate to the weakly-ionized plasma. The magnetic field substantially traps electrons in the weakly-ionized plasma proximate to the sputtering target. A power supply produces an electric field in a gap between the anode and the cathode assembly. The electric field generates excited atoms in the weakly ionized plasma and generates secondary electrons from the sputtering target. The secondary electrons ionize the excited atoms, thereby creating a strongly-ionized plasma having ions that impact a surface of the sputtering target to generate sputtering flux.

50 Claims, 18 Drawing Sheets



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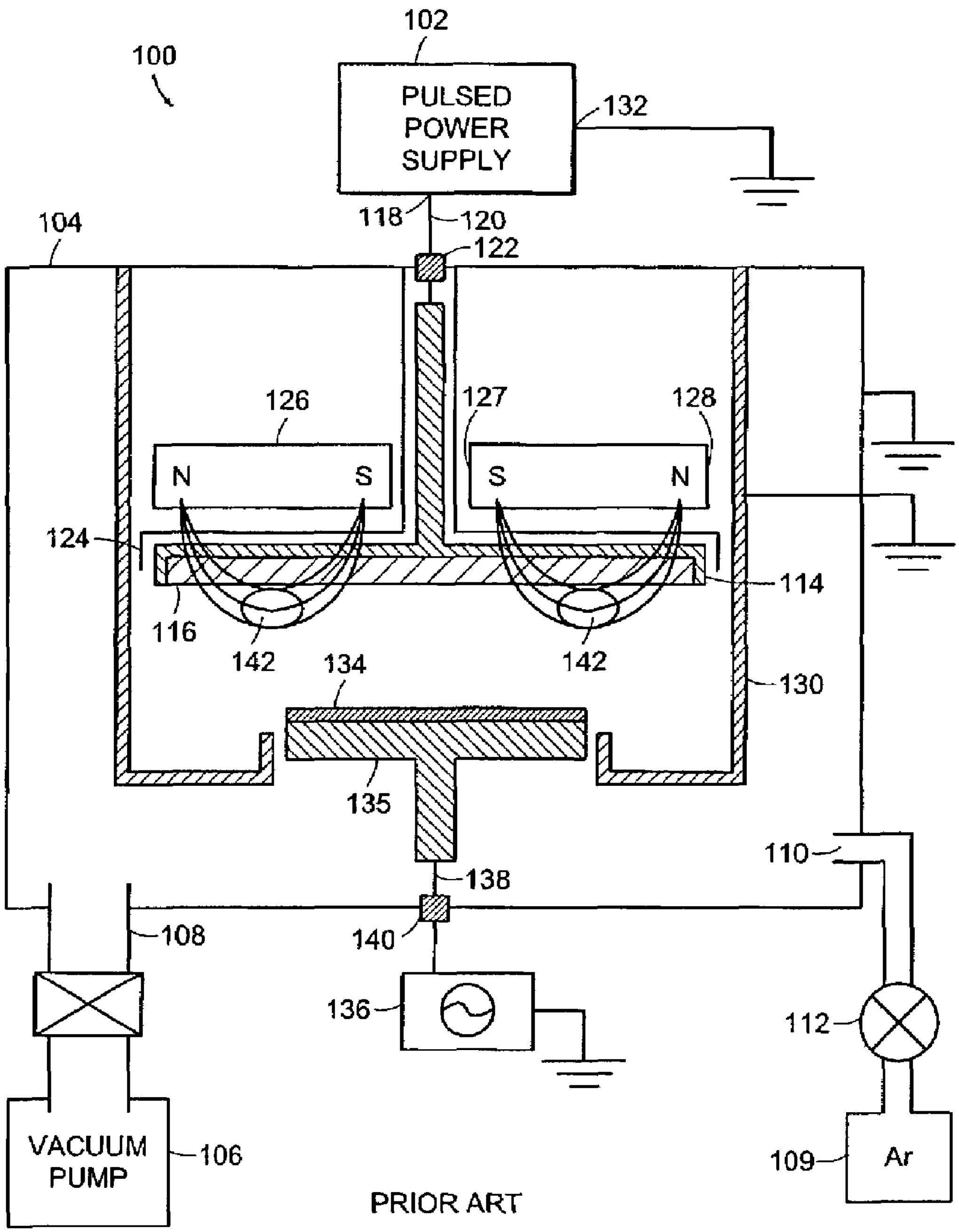
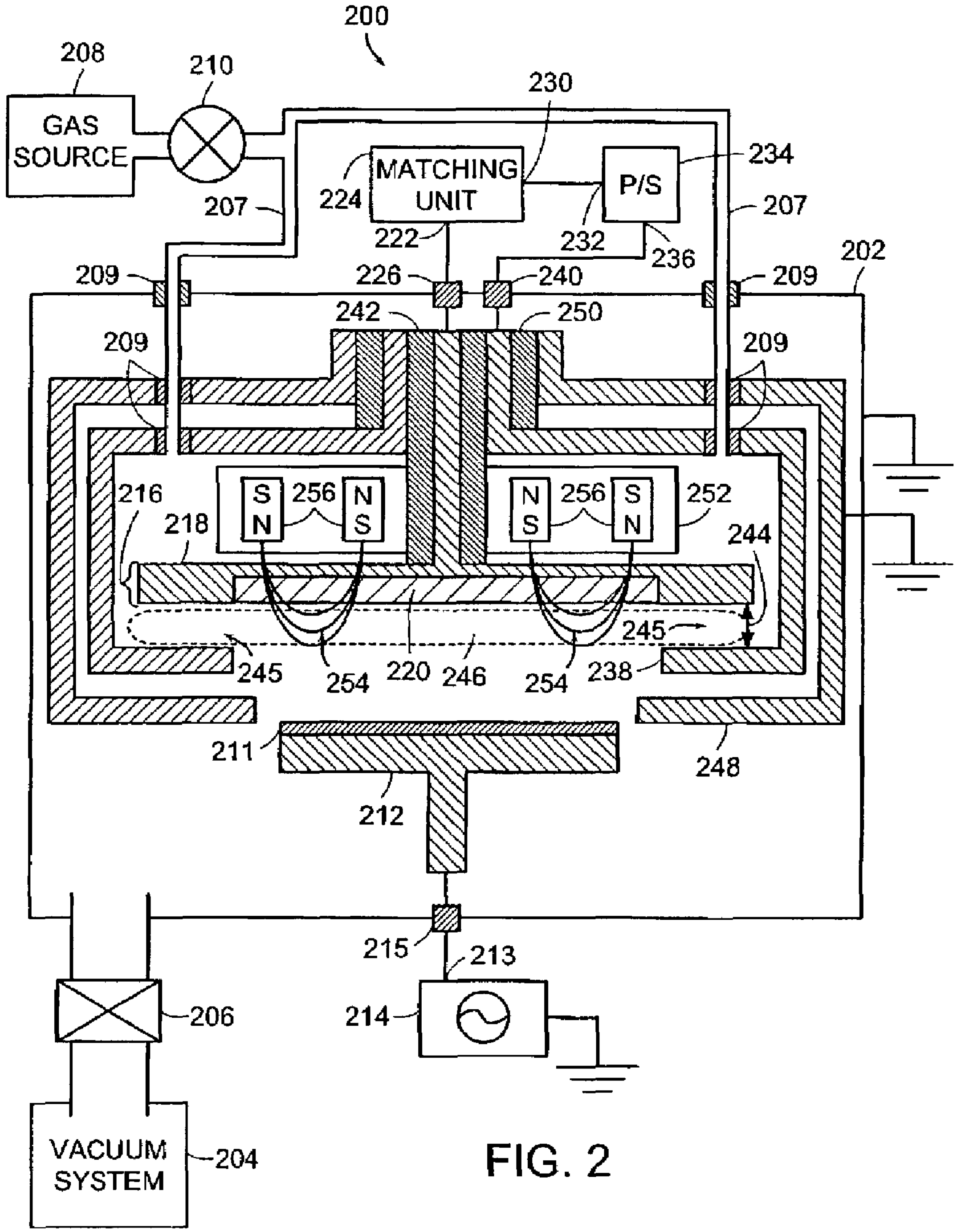


PRIOR ART
FIG. 1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VACUUM SYSTEM
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FIG. 2

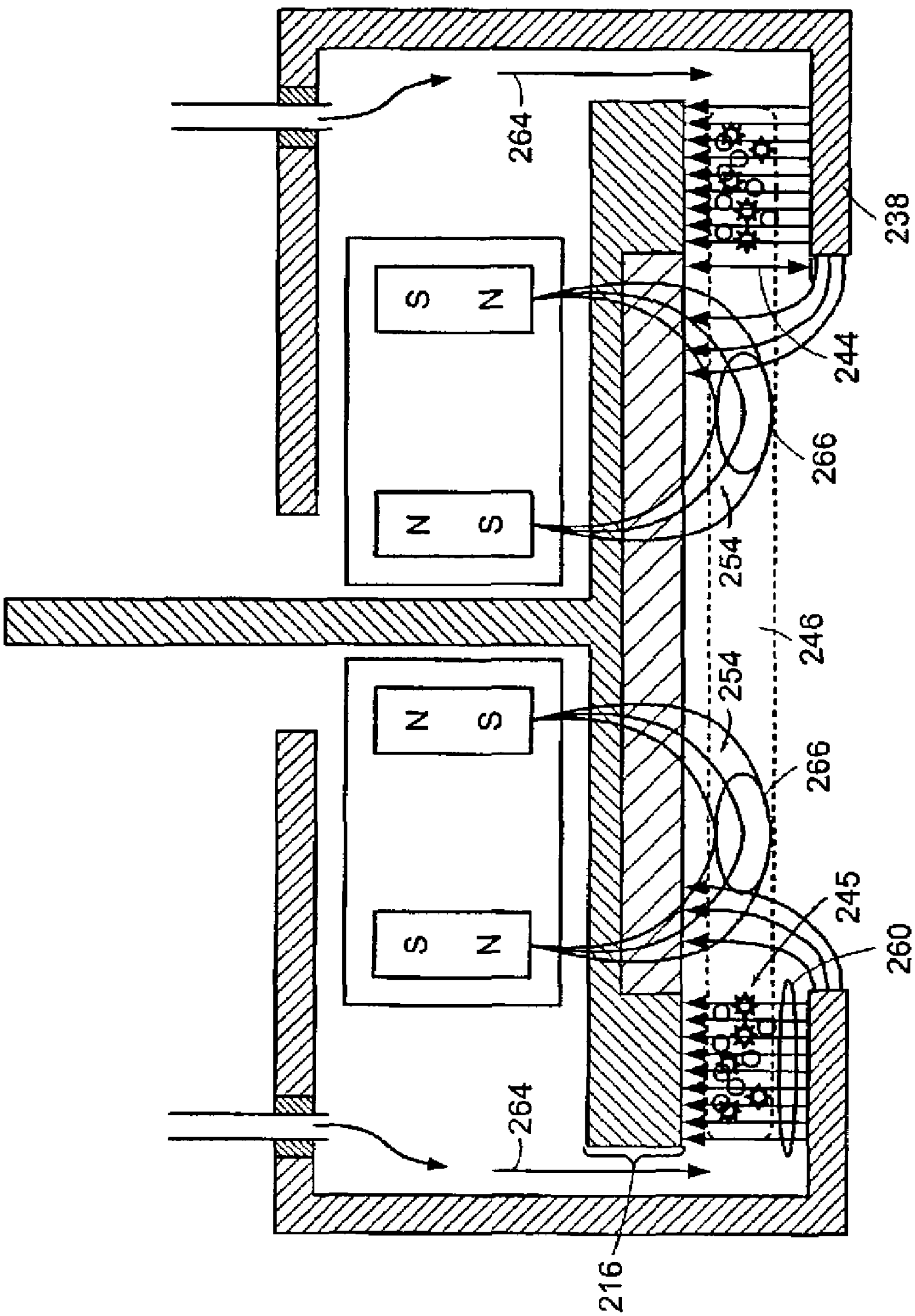

FIG. 3

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