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Chistyakov

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(54) **METHODS AND APPARATUS FOR GENERATING STRONGLY-IONIZED PLASMAS WITH IONIZATIONAL INSTABILITIES**

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This patent is subject to a terminal disclaimer.

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(52) **U.S. Cl.** **315/111.21**; 315/111.41; 315/111.71

(58) **Field of Classification Search** ..... 315/111.21–111.91; 216/67, 71; 118/723 VE, 118/723 R; 156/345.33; 204/192.12, 192.1, 204/298.08

See application file for complete search history.

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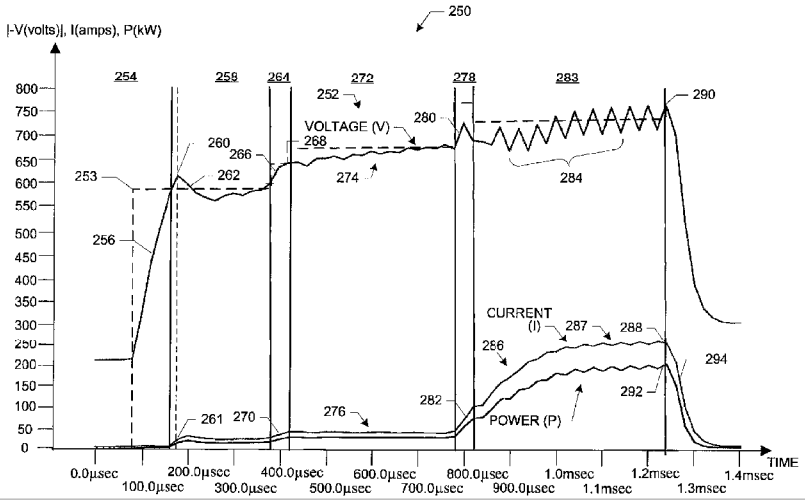
(57) **ABSTRACT**

Methods and apparatus for generating strongly-ionized plasmas are disclosed. A strongly-ionized plasma generator according to one embodiment includes a chamber for confining a feed gas. An anode and a cathode assembly are positioned inside the chamber. A pulsed power supply is electrically connected between the anode and the cathode assembly. The pulsed power supply generates a multi-stage voltage pulse that includes a low-power stage with a first peak voltage having a magnitude and a rise time that is sufficient to generate a weakly-ionized plasma from the feed gas. The multi-stage voltage pulse also includes a transient stage with a second peak voltage having a magnitude and a rise time that is sufficient to shift an electron energy distribution in the weakly-ionized plasma to higher energies that increase an ionization rate which results in a rapid increase in electron density and a formation of a strongly-ionized plasma.

20 Claims, 16 Drawing Sheets



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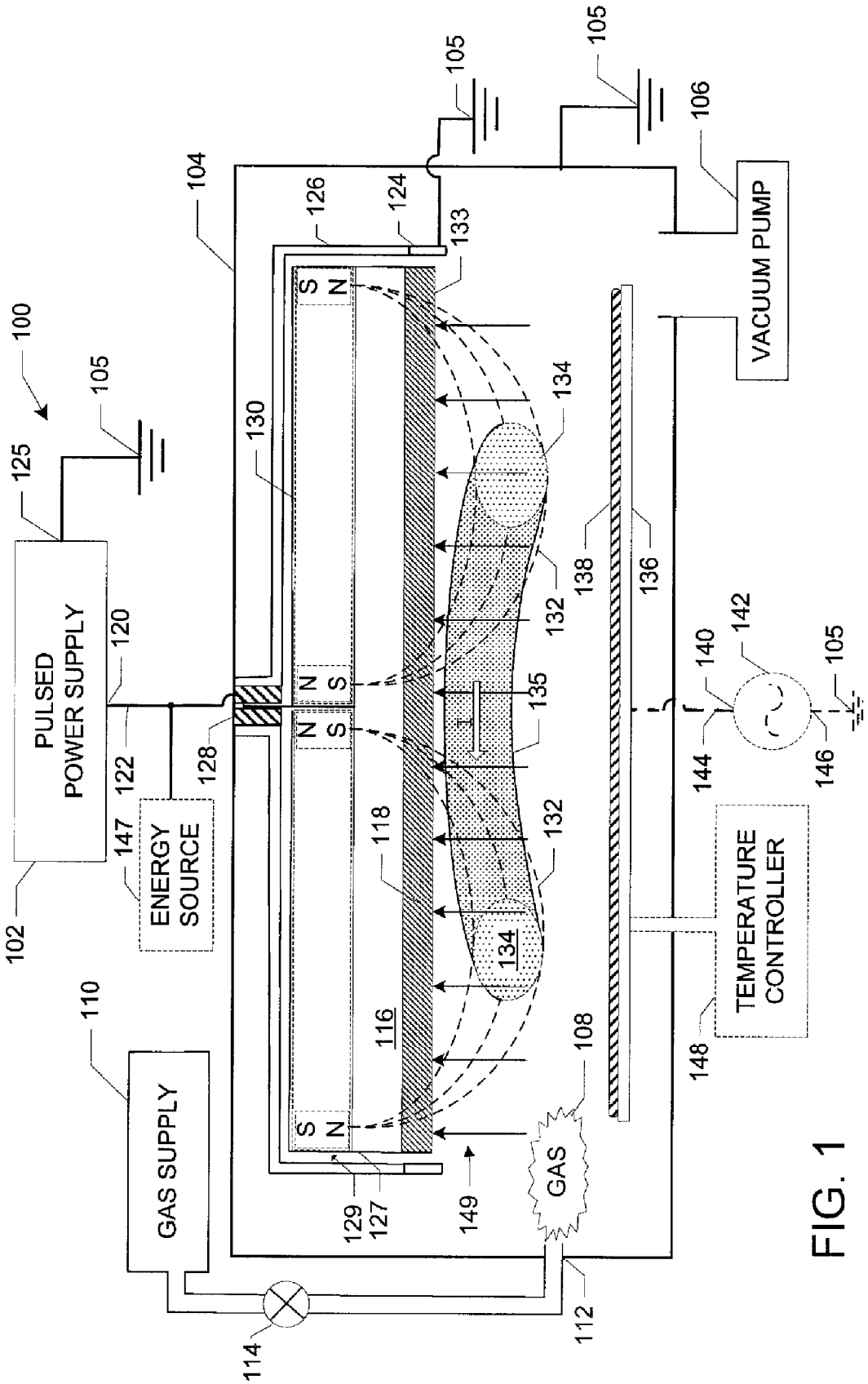

FIG. 1

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