US006046705A

# United States Patent [19]

Anderson

[11] Patent Number: 6,046,705

[45] Date of Patent: Apr. 4, 2000

[54] STANDING WAVE PLASMA ANTENNA WITH PLASMA REFLECTOR

[75] Inventor: **Theodore R. Anderson**, West Greenwich, R.I.

[73] Assignee: **The United States of America as represented by the Secretary of the Navy**, Washington, D.C.

[21] Appl. No.: **09/317,084**

[22] Filed: **May 21, 1999**

[51] **Int. Cl.**[7] ..... **H01Q 19/10**; H01Q 1/26

[52] **U.S. Cl.** ..... **343/834**; 343/701

[58] **Field of Search** ..... 343/701, 785, 343/709, 834; 315/111.21, 111.41

[56] **References Cited**

U.S. PATENT DOCUMENTS

| | | | |
|---|---|---|---|
| 5,963,169 | 10/1999 | Anderson et al. | 343/701 |
| 5,990,837 | 11/1999 | Norris et al. | 343/701 |

*Primary Examiner*—Don Wong
*Assistant Examiner*—Tan Ho
*Attorney, Agent, or Firm*—Michael J. McGowan; Robert W. Gauthier; Prithvi C. Lall

[57] **ABSTRACT**

A standing wave plasma antenna is provided. An ionizer generates an ionizing beam in a bounded plasma column extending along a vertical axis. A modulating signal is applied to an electro-optical crystal that modulates the ionizing beam. The resulting changes in the ionizing beam produce gradients in the plasma that cause ions and electrons to oscillate in a vertical path that generates alternating current having the frequency of the modulator. At a remote end the antenna terminates in a reflector. The reflector includes a chamber having a plasma with a charged particle density that is greater than the charged particle density in the plasma. The generated currents are therefore reflected as in a standing wave antenna. These currents generate an amplitude-, phase- or frequency-modulated electromagnetic field that radiates from the plasma column.

**19 Claims, 3 Drawing Sheets**