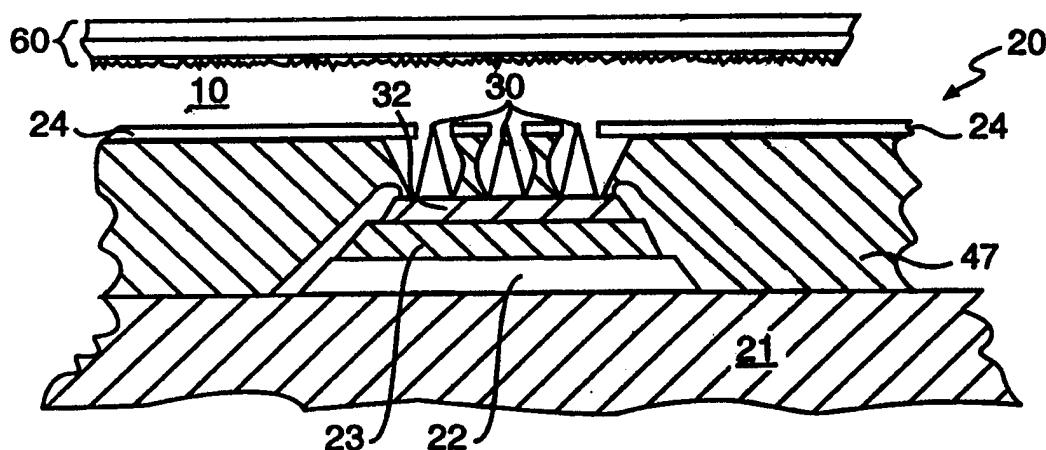




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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|---|-----------|---|
| <p>(51) International Patent Classification <sup>6</sup> :<br/>H01J 1/30</p>  | <p>A3</p> | <p>(11) International Publication Number: <b>WO 98/31044</b><br/>(43) International Publication Date: 16 July 1998 (16.07.98)</p>   |
| <p>(21) International Application Number: PCT/US98/00149<br/>(22) International Filing Date: 13 January 1998 (13.01.98)<br/>(30) Priority Data:<br/>08/781,289 13 January 1997 (13.01.97) US<br/>(71) Applicant: FED CORPORATION [US/US]; Hudson Valley Research Park, 1580 Route 52, Hopewell Junction, NY 12533 (US).<br/>(72) Inventors: JONES, Gary, W.; 8 Taconic View Court, Lagrangeville, NY 12540 (US). JONES, Susan, K., S.; 8 Taconic View Court, Lagrangeville, NY 12540 (US). MARINO, Jeffrey; 269 Crestwood Court, Fishkill, NY 12524 (US). HO, Joseph, K.; 6 Laurel Park Road, Wappingers Falls, NY 12590 (US). BOYSEL, Robert, Mark; Apartment No. 23, 294 West Road, Pleasant Valley, NY 12569 (US). ZIMMERMAN, Steven, M.; 37 Meddaugh Road, Pleasant Valley, NY 12569 (US). LIU, Yachin; 22 Colette Drive, Poughkeepsie, NY 12601 (US). COSTA, Michael, J.; 39 Hagen Drive, Poughkeepsie, NY 12601 (US). SILVERNAIL, Jeffrey, A.; 27 Fairview Avenue, Kingston, NY 12401 (US).</p> |           | <p>(74) Agents: COYNE, Patrick, J. et al.; Collier, Shannon, Rill &amp; Scott, Suite 400, 3050 K Street, N.W., Washington, DC 20007 (US).<br/>(81) Designated States: CA, JP, KR, SG, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).<br/><b>Published</b><br/><i>With international search report.</i><br/>(88) Date of publication of the international search report:<br/>29 October 1998 (29.10.98)</p> |

(54) Title: A FIELD EMITTER DEVICE WITH A CURRENT LIMITER STRUCTURE



## (57) Abstract

A field emitter device includes a column conductor (22), an insulator (23), and a resistor structure (32) for advantageously limiting current in a field emitter array. A wide column conductor (22) is deposited on an insulating substrate (21). An insulator (47) is laid over the column conductor (22). A high resistance layer (32) is placed on the insulator (23) and is physically isolated from the column conductor (22). The high resistance material may be chromium oxide or 10-50 wt.% Cr+SiO. A group of microtip electron emitters (30) is placed over the high resistance layer (32) to connect in an electrical series circuit the column conductor (22), the high resistance layer (32), and the group of electron emitters (30). One or more layers of insulator (23) and a gate electrode (24), all with cavities for the electron emitters, are laid over the high resistance material (32). One layer of insulator is selected from a group of materials including SiC, SiO, and Si<sub>3</sub>N<sub>4</sub>. An anode plate (60) is attached with intermediate space (70) between the anode plate (60) and the microtip electron emitters (30) being evacuated.

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INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US98/00149

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(6) :H 01 J 1/30  
US CL :313/361, 351; 445/24  
According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
U.S. : 313/361, 351; 445/24

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
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**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                           | Relevant to claim No.            |
|-----------|--|----------------------------------|
| A         | US, 5,550,426 A (SMITH et al.) 27 August 1996 (27.08.96), COL 1, LINE 51 TO COL 2, LINE 27. Fig 1 AND Fig 2. | 1, 5, 10, 11, 12, 13, 17, 19, 20 |
| Y, P      | US 5,598,056 A (JIN ET AL.) 28 January 1997 (28.01.97), COL 5, LINES 41-51. FIG 5                            | 2-4, 6-9, 14-16, 18              |
| Y         | US 4,940,916 A (BOREL ET AL.) 10 July 1990 (10.07.90), COL 6, LINES 15-33, FIG 4.                            | 2-4, 6-9, 14-16, 18              |
| A         | US 3,998,678 A (FUKASE ET AL.) 21 December 1976 (21.12.76), COL 8, LINE 4 TO COL 10, LINE 38.                | 21, 22, 23                       |

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