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# United States Patent [19]

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Moslehi

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[54] **MULTIPURPOSE LOW-THERMAL-MASS CHUCK FOR SEMICONDUCTOR PROCESSING EQUIPMENT**

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[57] **ABSTRACT**

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A multipurpose low-thermal-mass radio-frequency chuck for semiconductor device processing equipment (18) and applicable to plasma processing over a wide range of substrate temperatures. The stacked multilayer chuck structure comprises process vacuum base plate (16), heating module (48), cooling module (44) and radio-frequency power plate (50). Vacuum base plate (16) provides mechanical support and necessary feed-throughs (RF power connection, coolant inlet/outlet, heater wires and thermocouple) for main chuck (20). Water-cooled vacuum base plate (16) is thermally insulated from main chuck module (20). Heating element (48) comprises top layer (80) of electrical insulation and passivation, power heating resistor (82), bottom layer of electrical insulation (84) and heater substrate (86) made of boron nitride or quartz or SiC-coated graphite. Coolant module (44) comprises a plurality of coolant tunnels and is made of a high thermal conductivity material (nickel-plated copper, aluminum or a suitable refractory metal). Radio-frequency plate (50) comprises a refractory metal or aluminum material.

[21] Appl. No.: **565,765**

[22] Filed: **Aug. 10, 1990**

[51] Int. Cl.<sup>5</sup> ..... **B23K 9/00**

[52] U.S. Cl. .... **219/121.43; 219/121.49; 219/121.4; 219/158; 156/345**

[58] Field of Search ..... **219/121.43, 121.4, 159-161, 219/121.49; 156/345, 643, 646; 427/34; 313/111.21, 111.31, 111.51**

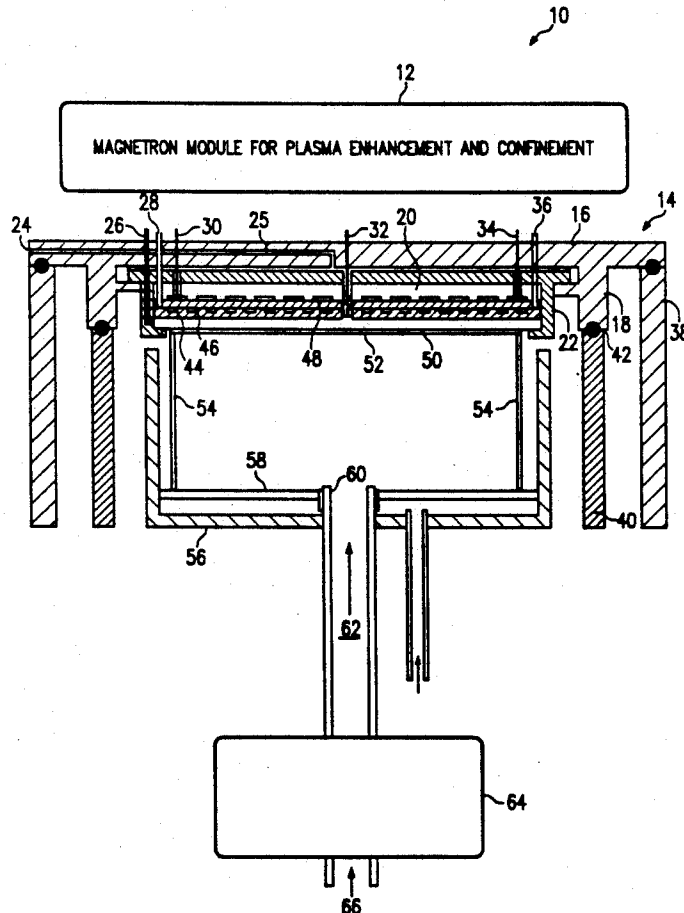
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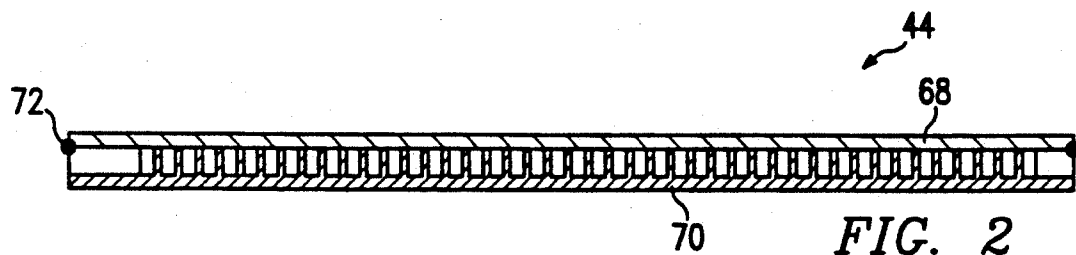
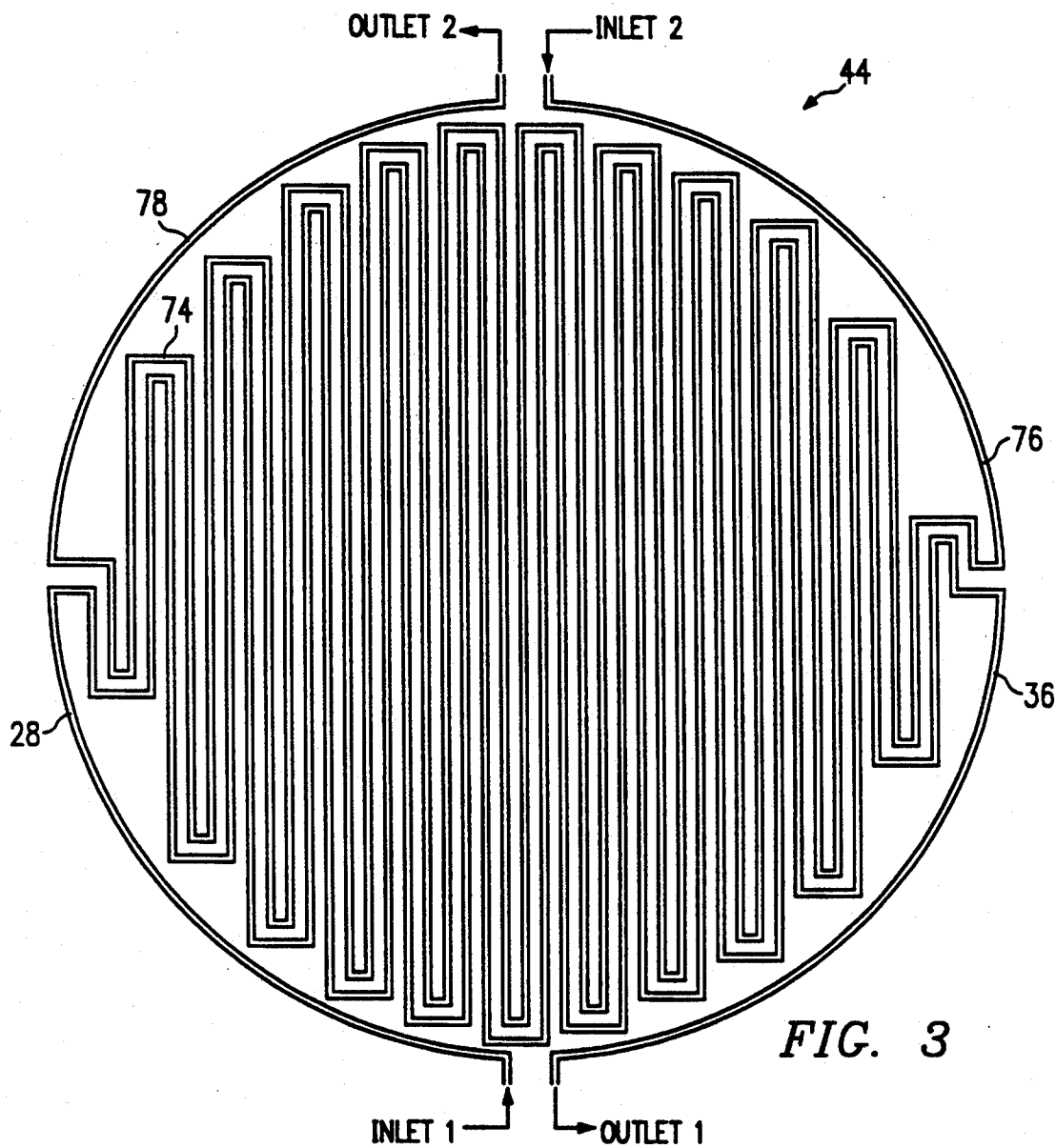
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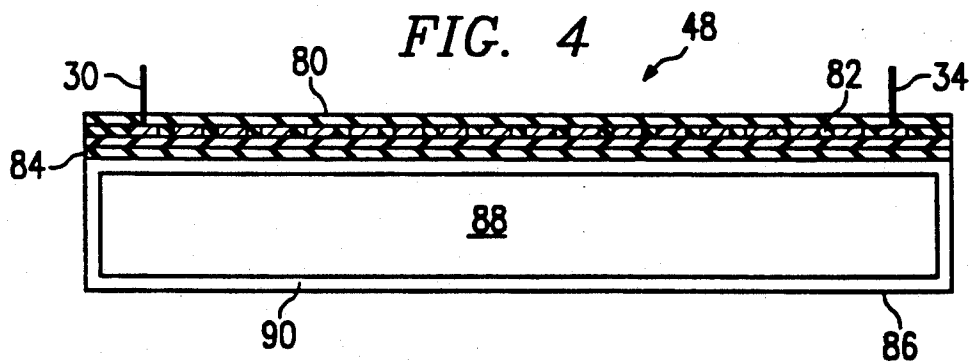
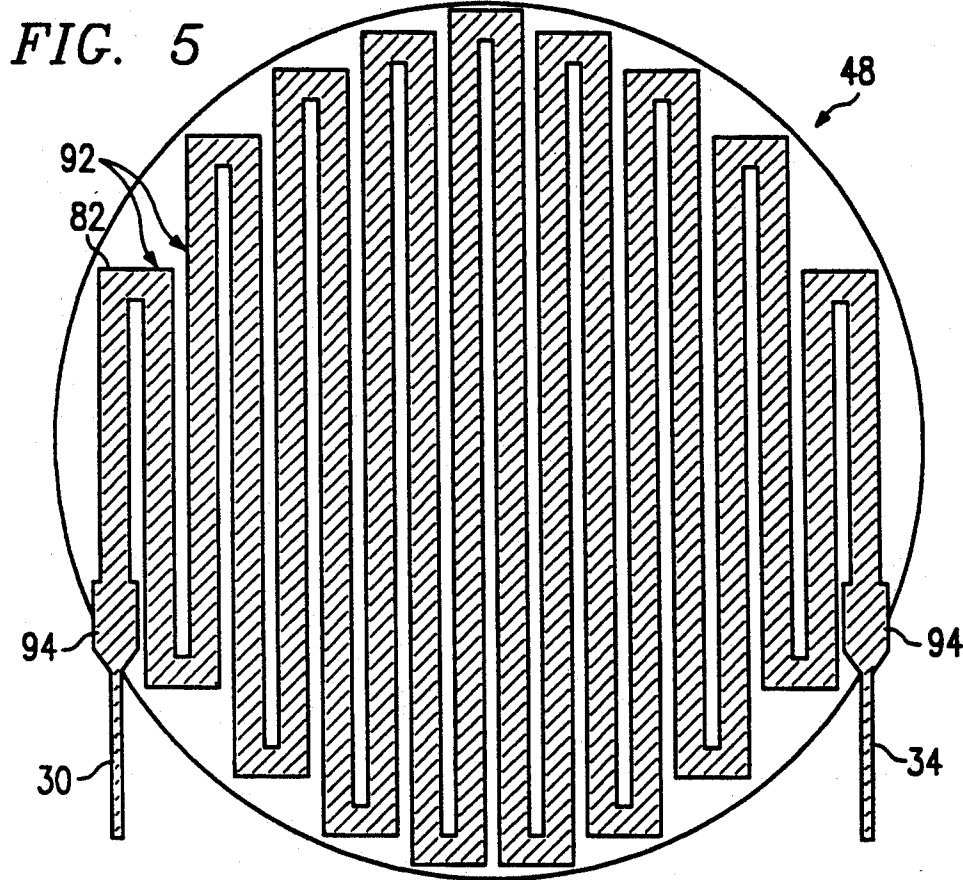
*Primary Examiner*—Mark H. Paschall

**25 Claims, 11 Drawing Sheets**









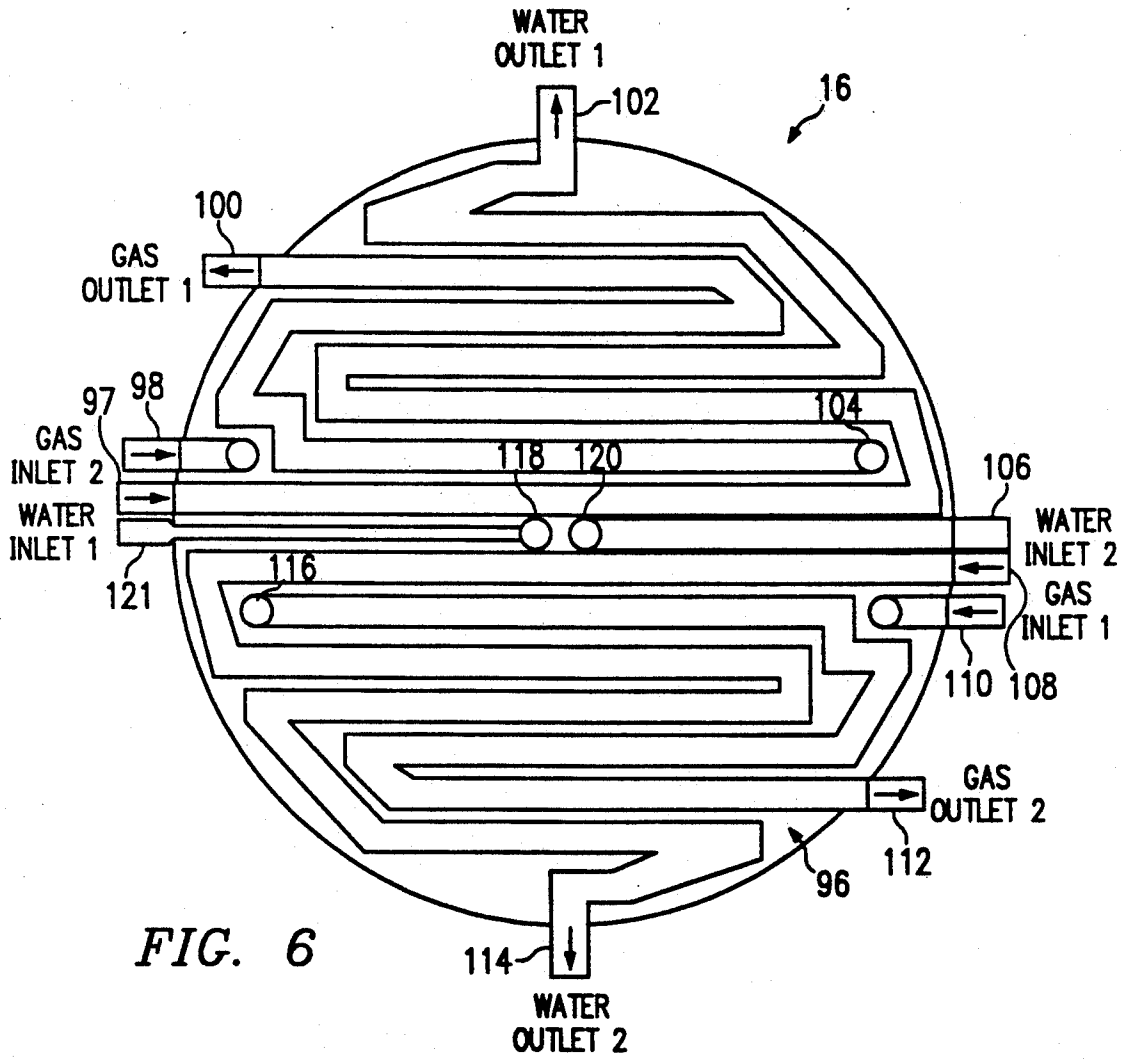


FIG. 6

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