



(51) International Patent Classification:  
*H01J 37/32* (2006.01)

(21) International Application Number:  
PCT/US2021/051179

(22) International Filing Date:  
21 September 2021 (21.09.2021)

(25) Filing Language: English

(26) Publication Language: English

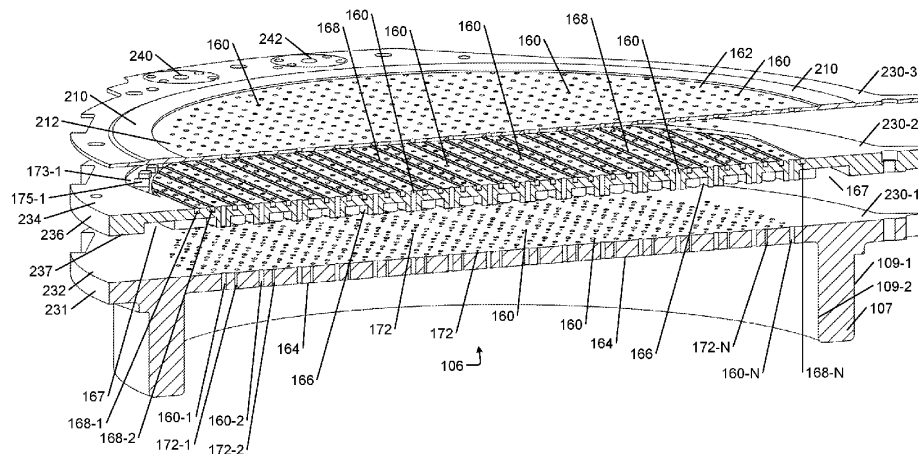
(30) Priority Data:  
63/084,541 28 September 2020 (28.09.2020) US

(71) Applicant: **LAM RESEARCH CORPORATION**  
[US/US]; 4650 Cushing Parkway, Fremont, California  
94538 (US).

(72) Inventors: **VARADARAJAN, Bhadri**; 16675 SW Hart Road, Beaverton, Oregon 97007 (US). **DURBIN, Aaron**; 8025 SW Laurelwood Court, Portland, Oregon 97225 (US). **QIU, Huatan**; 3297 NW Kinsley Ter, Portland, Oregon 97229 (US). **GONG, Bo**; 17353 SW Inkster Dr, Sherwood, Oregon 97140 (US). **BATZER, Rachel E.**; 11865 SW Tualatin Rd., Apt. 44, Tualatin, Oregon 97062 (US). **BHIMARASETTI, Gopinath**; 14778 NW Delia Street, Portland, Oregon 97229 (US). **MILLER, Aaron Blake**; 3365 Coeur D Alene Dr, West Linn, Oregon 97068 (US). **BREILING, Patrick G.**; 14383 SW 134th Drive, Tigard, Oregon 97224 (US). **HOHN, Geoffrey**; 1324 SW Dolph St, Portland, Oregon 97219 (US).

(74) Agent: **HO, Michael T.** et al.; Weaver Austin Villeneuve & Sampson LLP, P.O. BOX 70250, Oakland, California 94612-0250 (US).

(54) Title: REMOTE PLASMA ARCHITECTURE FOR TRUE RADICAL PROCESSING



**FIG. 3**

(57) **Abstract:** A showerhead comprises first, second, and third components. The first component includes a disc-shaped portion and a cylindrical portion extending perpendicularly from the disc-shaped portion. The disc-shaped portion includes first and second sets of holes having first and second diameters, respectively, that extend from a center of the disc-shaped portion to an inner diameter of the cylindrical portion. The second component is disc-shaped and is attached to the disc-shaped portion of the first component, defines a plenum that is in fluid communication with the second set of holes, and includes a pair of arc-shaped grooves along a periphery and on opposite ends of the top surface and a plurality of grooves extending between the pair of arc-shaped grooves. The third component is disc-shaped, is attached to the second component, and includes a gas inlet connected to the plenum, and fluid inlet and outlet connected to the arc-shaped grooves.

[Continued on next page]

**(81) Designated States** (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, IT, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

**(84) Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

**Declarations under Rule 4.17:**

— *of inventorship (Rule 4.17(iv))*

**Published:**

— *with international search report (Art. 21(3))*