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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/748,141	03/26/2010	Leonard J. Sharpless	1015292-000318	4576

119138 7590 09/23/2016

BUCHANAN INGERSOLL & ROONEY PC - LAM RESEARCH CORP
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ALEXANDRIA, VA 22314

EXAMINER

LEE, AIDEN Y

ART UNIT	PAPER NUMBER
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1718

NOTIFICATION DATE	DELIVERY MODE
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09/23/2016

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE
THE PATENT TRIAL AND APPEAL BOARD

Ex parte LEONARD J. SHARPLESS,¹
Harmeet Singh, and Michael S. Kang

Appeal 2015-001714
Application 12/748,141
Technology Center 1700

Before MARK NAGUMO, MICHAEL P. COLAIANNI and
JENNIFER R. GUPTA, *Administrative Patent Judges*.

NAGUMO, *Administrative Patent Judge*.

DECISION ON APPEAL

Leonard J. Sharpless, Harmeet Singh, and Michael S. Kang (“Lam”) timely appeal under 35 U.S.C. § 134(a) from the Final Rejection² of claims 1–3, 5–13, and 15–20, which are all of the pending claims.³ We have jurisdiction. 35 U.S.C. § 6. We reverse for reasons given by Lam.

¹ The real party in interest is identified as Lam Research Corporation (“Lam”) (Appeal Brief, filed 2 July 2014 (“Br.”), 2.).

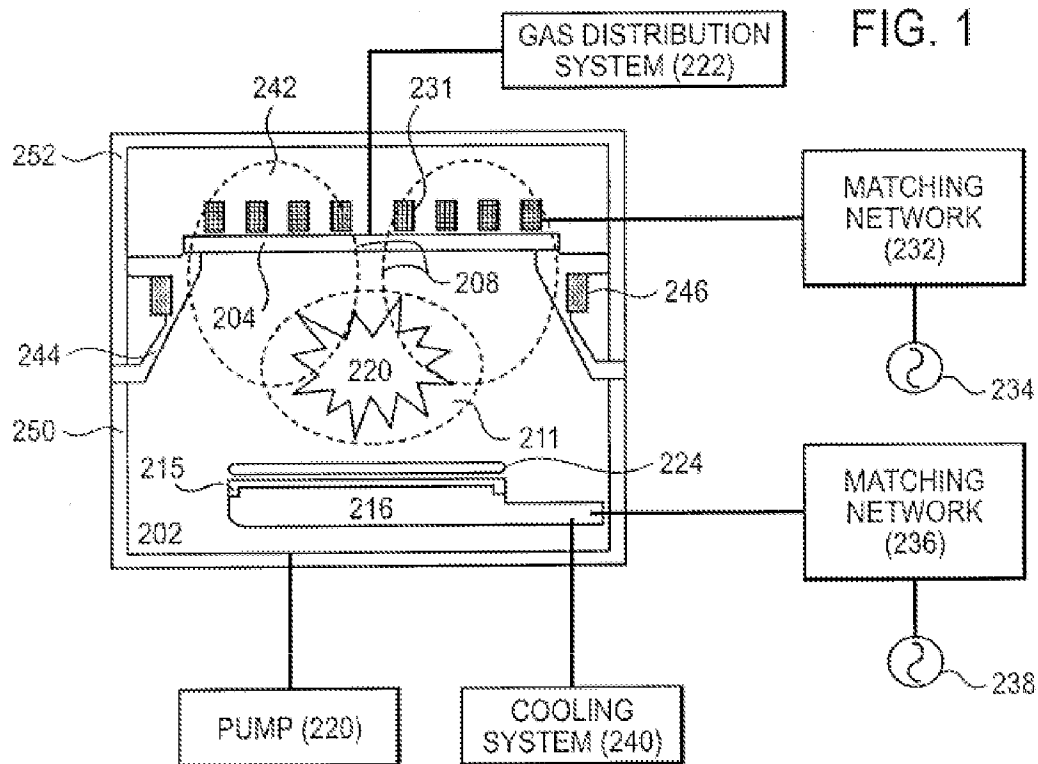
² Office action mailed 25 September 2013 (“Final Rejection”; cited as “FR”).

³ Notice of Panel Decision from Pre-Appeal Brief Review (29 May 2014).

OPINION

A. Introduction⁴

The subject matter on appeal relates to a replaceable upper chamber section **244**⁵ of a plasma reaction chamber **202**, illustrated in Fig. 1, below.



{Fig. 1 shows plasma reaction chamber **202** with replaceable upper section **244**}

The '141 Specification teaches that upper chamber section **244** is typically a machined aluminum cylinder having a conical inner surface

⁴ Application 12/748,141, *Replaceable upper chamber section of plasma processing apparatus*, filed 26 March 2010, claiming the benefit of a provisional application filed 27 March 2009. We refer to the substitute specification filed 5 May 2010 as the "'141 Specification," which we cite as "Spec."

⁵ Throughout this Opinion, for clarity, labels to elements are presented in bold font, regardless of their presentation in the original document.

coated with a plasma-resistant material such as a thermally sprayed yttria coating. (Spec. 3 [0010], 4 [0015].) It is said to be desirable to remove the upper chamber section for cleaning, but the yttria coating is easily damaged, and it is sometimes preferred to replace the chamber section rather than cleaning it. (*Id.* at 3 [0010].) Moreover, alignment is critical for proper gasket sealing (*Id.* at 3 [0011].) Furthermore, the substantial amount of material in the upper chamber section is said to result in a large thermal mass that can store thermal energy from the plasma process for extended periods and make control of multi-step multi-temperature processing more difficult. (*Id.* at 3 [0012]–4 [0013].) In particular, the Specification indicates that “heat-flow variations originating from the upper chamber section may cause the substrate temperature to vary outside narrow recipe parameters.” (*Id.* at 4 [0013].)

The inventors seek patent protection for a replaceable upper chamber section **300**, shown in Fig. 3, below right.

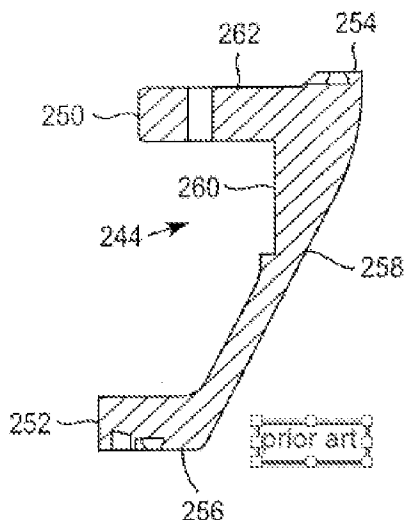


FIG. 2

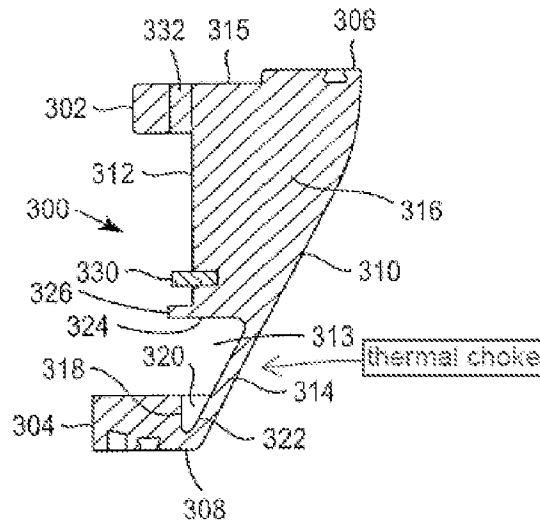


FIG. 3

{Annotated Fig. 2 (left) shows a prior art upper chamber section}

{Annotated Fig. 3 (right) shows an inventive upper chamber section **300**}

Upper chamber section **300** is said to have improved thermal characteristics due to thermal choke **314**—the thin-walled section of the cylinder that minimizes thermal transfer to the bottom chamber section **250**—compared to the substantially constant-width wall of the prior art upper chamber section illustrated *supra* in Fig. 2 (left).

Claim 1 is representative and reads:

A replaceable upper chamber section of a plasma reaction chamber in which semiconductor substrates can be processed, comprising:

- a monolithic metal cylinder having

- a conical inner surface which has a largest diameter at a lower end thereof,

- an upper flange extending horizontally outward away from the conical inner surface and

- a lower flange extending horizontally away from the conical inner surface;

- an upper annular vacuum sealing surface adapted to seal against a dielectric window of the plasma chamber;

- a lower annular vacuum sealing surface adapted to seal against a bottom section of the plasma chamber;

- a thermal choke at a lower portion of the cylinder effective to minimize transfer of heat across the lower vacuum sealing surface,*

- the thermal choke defined by a thin metal section having a thickness of less than 0.25 inch and extending at least 25 % of the length of the conical inner surface; and

- a thermal mass section at an upper portion of the cylinder, the thermal mass section defined by a portion of the cylinder between the conical inner surface, an outer surface extending vertically from the upper flange, a horizontal surface extending from an upper end of the thermal choke, and the upper flange.

(Br., Claims App. 1; some indentation, paragraphing, and emphasis added.)

The Examiner maintains the following grounds of rejection⁶:

- A. Claims 1, 3, 8, 10, 13, 15, and 20 stand rejected under 35 U.S.C. § 103(a) in view of the combined teachings of Sharpless,⁷ Knowlton,⁸ and Ikeda.⁹
- A1. Claims 9, 12, 16, and 19 stand rejected under 35 U.S.C. § 103(a) in view of the combined teachings of Sharpless, Knowlton, and Ikeda, and Chang.¹⁰
- A2. Claims 2 and 17 stand rejected under 35 U.S.C. § 103(a) in view of the combined teachings of Sharpless, Knowlton, and Ikeda, and Tyler.¹¹
- A3. Claims 5, 11, and 18 stand rejected under 35 U.S.C. § 103(a) in view of the combined teachings of Sharpless, Knowlton, and Ikeda, and Yoshida.¹²
- A4. Claim 6 stands rejected under 35 U.S.C. § 103(a) in view of the combined teachings of Sharpless, Knowlton, and Ikeda, and Cho.¹³
- A5. Claim 7 stands rejected under 35 U.S.C. § 103(a) in view of the combined teachings of Sharpless, Knowlton, and Ikeda, and Rice.¹⁴

⁶ Examiner's Answer mailed 30 September 2014 ("Ans.").

⁷ Leonard J. Sharpless and Keith Comendant, *Apparatus for an optimized plasma chamber top piece*, U.S. Patent Application Publication 2006/0000413 A1 (2006). (Issued as U.S. Patent No. 7,789,791 (24 August 2010), assigned to Lam Research Corp.).

⁸ Gregory D. Knowlton, et al., *Heat transfer delay*, U.S. Patent No. 6,298,784 B1 (2001).

⁹ Fumihide Ikeda and Yasuhiro Inokuchi, *Substrate processing apparatus*, U.S. Patent No. 6,132,553 (2000).

¹⁰ Chris Chang, U.S. Patent No. 7,220,497 B2 (2007).

¹¹ James Scott Tyler, U.S. Patent No. 6,972,071 B1 (2005).

¹² Kohei Yoshida et al., U.S. Patent No. 6,113,732 (2000).

¹³ Byung Chul Cho et al., U.S. Patent Application Publication 2004/0149212 A1 (2004).

B. Discussion

Findings of fact throughout this Opinion are supported by a preponderance of the evidence of record.

Lam urges that the Examiner has provided no reason to combine the teachings of Sharpless, which are directed to a plasma processing chamber comprising a replaceable upper chamber section, with the teachings of Knowlton, which are directed to a heat transfer delay provided by a heat transfer device in propellant, pyrotechnic, and explosive devices. Lam argues that the mere prior existence of thermal chokes—a fact that Lam acknowledges—does not suffice to demonstrate that it would have been obvious to incorporate such a thermal choke as a thin (less than 0.25 inch thick) walled section of the upper chamber section as required by the appealed claims. (*See* Br. 6, 2d para.; App. Br. 7, 3d para.)

The weight of the evidence of record, including the references and the rationale of the rejections, supports Lam’s arguments. The optimized chamber sections described by Sharpless reportedly weigh about 80% less than the prior art upper chamber sections (Sharpless 3 [0029]) and also have a thermal mass about 80% less than the [then] existing non-optimized top pieces (*id.* at [0042]). Although we note that Sharpless teaches that the relative small thermal mass allows temperature corrections by the cooling system to be “substantially synchronized” (*id.*), the Examiner has not directed our attention to any substantial concern expressed by Sharpless with the adverse consequences of heat transfer in the prior art upper chamber sections or in the lighter, ergonomically optimized chamber sections. The

¹⁴ Rice et al., U.S. Patent No. 6,095,083 (2000).

only place such concerns are expressed in the present record appear to be in the disclosure of the '141 Specification. Hindsight, however, is not an appropriate basis for the legal conclusion of obviousness.

The Examiner makes no findings regarding Ikeda, which is directed to thermal reaction furnaces for semiconductor substrate processing (Ikeda, col. 1, ll. 5–11), or regarding any of the other references, that cure the fundamental defect of the attempted combination of teachings of Sharpless and Knowlton.

We therefore reverse the rejections of record.

C. Order

It is ORDERED that the rejection of claims 1–3, 5–13, 15–20 is reversed.

REVERSED