2012 Pat. App. LEXIS 2784

Board of Patent Appeals and Interferences

May 31, 2012, Decided

Appeal 2011-006601from Technology Center 1700Satish Chandra, Examiner

USPTO Bd of Patent Appeals & Interferences; Patent Trial & Appeal Bd Decs.

Reporter

2012 Pat. App. LEXIS 2784 *

Ex parte ORBOTECH LT SOLAR, LLC (In rem Application 11/826,336)

Notice:

ROUTINE OPINION. Pursuant to the Patent Trial and Appeal Board Standard Operating Procedure 2, the opinion below has been designated a routine opinion.

Core Terms

plate, teach, porous, hole, shower, diffusion, has, elongate, plasma, slot, apparatus, width, fink, ratio, shower head, contaminant, showerhead, clean, skill, wafer, upstream, said, thickness, baffle, vapor, deposition, configure, particle, section, flange

Counsel

Joseph Bach, NIXON PEABODY LLP, of Washington, D.C.

Panel: [*1] Before Fred E. Mckelvey, Richard E. Schafer and Richard Torczon, Administrative Patent Judges.

Opinion By: TORCZON

Opinion

TORCZON, *Administrative Patent Judge*.

DECISION ON APPEAL

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The appellant (Orbotech) seeks relief from the final rejection of its claims 1-6, 11 and 13-17 under *35 U.S.C. 134*. We AFFIRM.

OPINION

BACKGROUND

The invention relates to a chemical vapor deposition (CVD) apparatus using a "showerhead" . [1] Claim 1, [2] one of two independent claims on appeal, defines the invention as follows:

> 1. A showerhead for a CVD apparatus, comprising:
>
> a shower plate being made of a metal and comprising a flat plate and a flange section extending from an outer edge of the flat plate; and
>
> a porous plate contacting a rear face of said shower plate and situated within the flange section, the porous plate having pores of diameter 0.5-100 [mu] m,
>
> wherein a plurality of elongated gas diffusion holes having length larger than width are formed in a plate section of said shower plate, which faces a workpiece, and penetrate the plate section in the thickness direction, the elongated gas diffusion holes having depth equal **[*2]** to or greater than the width, and
>
> said porous plate covers all of the gas diffusion holes.

The showerhead has both a shower plate and a porous plate. The shower plate is metal and has a flange and elongated gas diffusion holes. The porous plate is behind (away from the workpiece) the shower plate, covers the holes in the shower plate and has micrometer-scale pores.

THE REJECTIONS

The examiner finally rejected [3] most of the claims as having been obvious over the combined teachings of the Suzuki [4] and Srivastava [5] published applications, patents to Su [6] and Janakiraman, [7] and the Japanese published

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[1] Specification (Spec.) 1:1-5.

[2] All claim language is reproduced from the unchallenged claims appendix. Brief (Br.) 24-28; Examiner's Answer (Ans.) 3.

[3] E.g., Fin. Rej. 2, citing *35 U.S.C. 103*.

[4] K. Suzuki et al., *Method and apparatus for reducing particle contamination in a deposition system*, US 2007/0215048 A1 (Suzuki).

[5] A.K. Srivastava, *Gas distribution plate assembly for plasma reactors*, US 2005/0150601 A1 (Srivastava).

[6] Y.-J. Su, *Gas distribution plate for semiconductor wafer processing apparatus with means for inhibiting arcing*, 5,589,002 (granted 31 December 1996) (Su).

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applications [8] of Oshima [9] and Nishimoto. [10] The examiner also rejected these claims as having been obvious over the combined teachings of the same references excluding Suzuki and Oshima. [11] Specifically, the examiner maintains the following combination **[*3]** of rejections:

Claims 1, 2, 11 and 13-17 over Suzuki, Srivastava, Oshima, Su, Janakiraman and Nishimoto.

Claims 3 and 4 over the base combination plus a published application of Fink. [12]

Claim 5 over the base combination plus a published application of Larson. [13]

Claim 6 over the base combination plus patents to Dhindsa [14] and Arai. [15]

Claims 1, 2, 11, 13, 15 and 16 are alternatively rejected over Nishimoto, Srivastava, Su and Janakiraman.

Claims 3 and 4 over this second base combination plus Fink.

Claim 5 over the second base combination plus Larson or a patent to Lee. [16]

Claim 6 over the second base combination plus Dhindsa and Arai.

[*4] [*5]

Suzuki

The examiner relies on the Suzuki patent to teach a CVD apparatus with a shower plate. Suzuki Figure 1 (below, right) is a schematic view of Suzuki's CVD system. The system has a process chamber **10** with a vapor distribution plate **34** facing a substrate **25**. The system has a vapor delivery system **40** with a set of particle diffusers **47***a*,

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[8] The record available to the board includes an English-language abstract for each Japanese published application, but no translation of the published application itself. No one has pointed us to an objection to the form or reliability of these materials so we proceed to judgment on the materials before us.

[9] K. Oshima, *Shower plate and method of manufacturing the same, and shower head using the same*, Kokai 2003-282462 (pub'd 3 October 2003) (Oshima). In the record, this reference has been cited as "Kazuyoshi".

[10] S. Nishimoto, *Plasma processing system*, Kokai 2003-338492 (pub'd 28 November 2003) (Nishimoto).

[11] Fin. Rej. 13.

[12] S.T. Fink, *Method and apparatus for delivering process gas to a process chamber*, US 2005/0011447 A1 (Fink).

[13] D.J. Larson et al., *Quartz guard ring*, US 2008/0099448 A1 (Larson).

[14] R. Dhindsa et al., *Gas distribution apparatus for semiconductor processing*, US 6,245,192 B1 (granted 12 June 2001) (Dhindsa).

[15] I. Arai et al., *Plasma processing method and plasma processing apparatus*, 6,110,287 (granted 29 August 2000) (Arai).

[16] C. Lee et al., *Methods and apparatus for passivating a substrate in a plasma reactor*, 5,968,275 (granted 19 October 1999)

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47*b*, **47***c* and a vapor distribution plate **34**. The examiner finds the vapor distribution plate **34** is a shower plate. The examiner notes an in-situ cleaning unit **70** linked to the vapor delivery system **40**. The cleaning unit **70**: [17]

> [p]er a frequency determined by the operator, ...can perform routine cleanings of the deposition system **1** in order to remove accumulated residue on internal surfaces of deposition system **1**. The in-situ cleaning system **70** can, for example, comprise a radical generator configured to introduce chemical radical capable of chemically **[*6]** reacting and removing such residue. Additionally, for example, the in-situ cleaning system **70** can, for example, include an ozone generator configured to introduce a partial pressure of ozone. For instance, the radical generator can include an upstream plasma source configured to generate oxygen or fluorine radical from oxygen (O[2]), nitrogen trifluoride (NF[3]), O[3], XeF[2], ClF[3], or C[3]F[8] (or, more generally, C[x]F[y]), respectively. The radical generator can include an Astron(R) reactive gas generator, [which is] commercially available…

The examiner finds that Suzuki Figure 2 (right, detail, schematic of another embodiment) teaches an unlabeled flange on the diffuser plate **147***a* contacting the showerhead **134**.

[*7]

According to the examiner, Suzuki does not disclose that the plate is flat and metal or that the flange extends beyond the flat plate. [18] Orbotech argues that Suzuki also lacks elongated gas diffusion holes. [19]

Srivastava

Srivastava Figure 3 (right) shows a cross-sectional view of a gas distribution plate assembly **54** including a flange **78**. The plate may be made of aluminum. [20]

The examiner finds that substituting a plate like Srivastava's into an apparatus like Suzuki would be consistent with the ordinary level of skill in the art inasmuch as it would involve using a known device for its intended purpose.

The examiner finds that the combination **[*8]** of Suzuki and Srivastava does not teach the claimed pore configuration.

Oshima Kazuyoshi

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[17] Fin. Rej. 2, citing Suzuki P0058.

[18] Fin. Rej. 3.

[19] Br. 10.

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The examiner relies on Oshima for a plasma generating apparatus with a shower head. Oshima Figure 2 (right) shows a shower head plate **4**. The shower plate **4** supplies treatment gas onto the surface of a wafer. The shower plate **4** contains at least 99.5 wt.% of alumina and is formed of a ceramic porous material having a porosity of 30-65%. [21] The examiner finds that Oshima further discloses that Oshima's preferred mean particle diameter is about 36.5 [mu] m and the pore diameter is in the range of 20-23 [mu] m. [22] The examiner finds that substituting the Oshima's porous plate into an apparatus such Suzuki/Srivastava apparatus because it would have simply been an example of using a known component for its known purpose. The examiner finds, however, that the combination still lacks the claimed elongated holes. [23] Orbotech argues that modifying Suzuki with the teachings of Srivastava and Oshima results in a complete replacement of Suzuki's showerhead. [24]

[*9]

Su

The examiner relies on Su for the elongated holes. [25] Su teaches a circular gas distribution plate **10** with elongated slots **14**. Sue notes that reaction byproducts with the wafer or reaction chamber walls can block circular holes. [26]

Su Figure 3 (right) shows an enlarged detail of the plate showing the width **X** and length **Y** of a non-circular opening. The shower plate may be aluminum. [27] The examiner notes the following disclosure in Su:

> a circular gas distribution plate **10** is provided with a series of elongated slots **14**, i.e., noncircular openings, arranged in a star-like pattern with the major axis of each slot passing through the center point or axis of plate **10**. As best seen **[*10]** in FIG. **3**, each slot has a major axis **Y** and a minor axis **X**. The minimum length **Y** of each slot **14** should be greater than the maximum width **X** of slot **14**, and should be at least about 635 [mu] m (25 mils), preferably at least about 762 [mu] m (30 mils). The maximum length **Y** of slot **14** is governed only by the size (diameter) of plate **10**. That is, the maximum length **Y** of slot **14** must be less than the radius of plate **10**. The minimum width **X** of slot 14 should be at least about 127 [mu] m (5 mils) and preferably will be at least

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[21] Oshima abstract (trans.).

[22] Fin. Rej. 4, citing Oshima P0033.

[23] Fin. Rej. 4-5.

[24] Br. 11.

[25] Fin. Rej. 5.

[26] Su 1:49-56.

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