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Table with 5 columns: APPLICATION NO., FILING DATE, FIRST NAMED INVENTOR, ATTORNEY DOCKET NO., CONFIRMATION NO. Includes application details for Andrew Stratton Bravo and examiner information for ZERVIGON, RUDY.

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE
THE PATENT TRIAL AND APPEAL BOARD

Ex parte ANDREW STRATTON BRAVO,¹
Joydeep Guha, and Jatinder Kumar

Appeal 2018-006871
Application 15/151,650
Technology Center 1700

Before BRADLEY R. GARRIS, BEVERLY A. FRANKLIN, and
MARK NAGUMO, *Administrative Patent Judges*.

NAGUMO, *Administrative Patent Judge*.

DECISION ON APPEAL

Lam Research Corporation (“Bravo”) timely appeals under 35 U.S.C. § 134(a) from the Final Rejection² of all pending claims 1 and 5–10. We have jurisdiction. 35 U.S.C. § 6. We reverse.

¹ The applicant under 37 C.F.R. § 1.46 (Application Data Sheet, filed 11 May 2016), and hence the appellant under 35 U.S.C. § 134, is the real party in interest, identified as Lam Research Corporation. (Appeal Brief, filed 6 March 2018 (“Br.”), 3.)

² Office Action mailed 16 October 2017 (“Final Rejection”; cited as “FR”).

OPINION

A. Introduction³

The subject matter on appeal relates to controlling the delivery of gaseous process materials in semiconductor wafer processing devices. Typically, a gas-distribution device, such as a “showerhead,” is arranged over a substrate, such as a semiconductor wafer. Various gases may be introduced, and a plasma lit by RF-induction. (Spec. 1 [0003]–[0004].) Uniformity of the substrate is said to be dependent upon flow uniformity, especially at the edges. (*Id.* at 4, ¶ [0018].) The process of directing gases at the outer region of the substrate is referred to as “side tuning.” (*Id.*) Moreover, the ability to change faceplates with particular hole distributions for particular processes is said to be desirable but time-consuming. (*Id.* at [0019].)

The inventors seek patent protection for showerheads, an embodiment of which is illustrated in Figures 4 and 5, reproduced on the next page. This showerhead addresses some of the issues raised *supra* by having two rings of holes surrounding the center of faceplate **400**⁴, that side-tune gases, which may be the same or different, by directing them at different angles towards the edges of the substrate. More particularly, inner ring **420** and outer ring **424** are fed gases via plenums—here, grooves **448**, **440**, respectively—which, through plural holes **428**, **432**, respectively, direct gases at different

³ Application 15/151,650, *Adjustable side gas plenum for edge rate control in a downstream reactor*, filed 11 May 2016. We refer to the “650 Specification,” which we cite as “Spec.”.

⁴ Throughout this Opinion, for clarity, labels to elements are presented in bold font, regardless of their presentation in the original document.

angles towards the edges of substrate **412**. Furthermore, rings **420** and **424** are detachable from one another and from faceplate **400** (*id.* at 12–13 [0042]–[0043], allowing for ready side tuning by changing the relative orientations of the inner and outer rings, as shown in Figures 6A–6G (not reproduced here).

{Figures 4 and 5 are shown below }

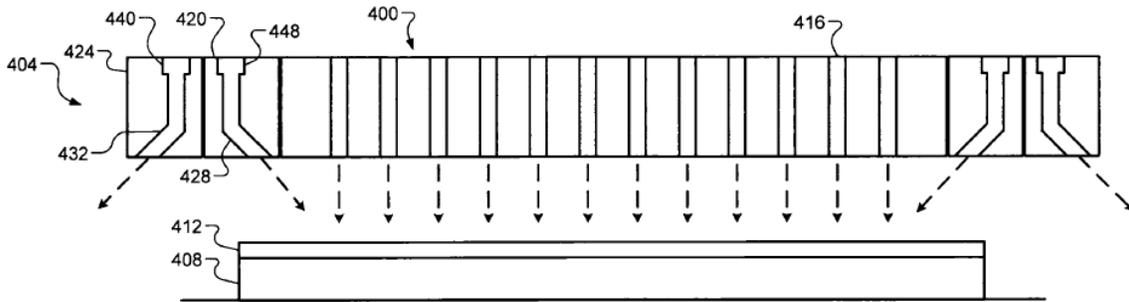


FIG. 4

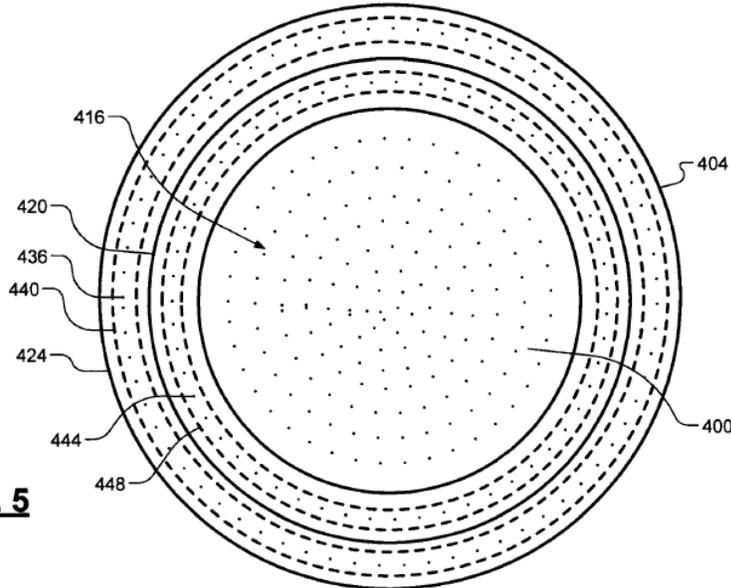


FIG. 5

{Figure 4 shows a cross-section through a showerhead of the invention }
{Figure 5 shows a top-down view of a showerhead of the invention }

Claim 1 is representative and reads:

A side tuning ring [404] for a gas distribution device of a substrate processing system, the side tuning ring comprising:

a first ring [420]

adjacent to a faceplate [400] of the gas distribution device, wherein the first ring surrounds the faceplate and defines a first plenum [448], and the first ring communicates with a first gas source and includes a first plurality of holes [444] arranged to direct gas from the first gas source into a process chamber at a first angle; and

a second ring [424]

adjacent to the first ring [420], wherein the second ring surrounds the first ring and defines a second plenum [440], and the second ring communicates with at least one of the first gas source and a second gas source and includes a second plurality of holes [436] arranged to direct gas from the at least one of the first gas source and the second gas source into the process chamber at a second angle,

wherein the first ring [420] and the second ring [424] are detachable from the faceplate [400] of the gas distribution device,

wherein the first ring [420] is detachable from the second ring [424], and

wherein the first angle and the second angle are different.

(Claims App., Br. 18; some formatting, emphasis, and bracketed labels to elements shown in Figures 4 and 5 added.)

The Examiner maintains the following grounds of rejection^{5, 6}:

- A. Claims 1, 5, and 6 stand rejected under 35 U.S.C. § 103 in view of the combined teachings of Goodlin,⁷ Takagi,⁸ and Deacon.^{9, 10}
- A1. Claims 7–9 stand rejected under 35 U.S.C. § 103 in view of the combined teachings of Goodlin, Takagi, and Deacon.

B. Discussion

The Board’s findings of fact throughout this Opinion are supported by a preponderance of the evidence of record.

The Examiner finds that Goodlin teaches, in Figure 6, reproduced on the next page, a gas distributing device having first ring **6022**¹¹ (FR 3, ¶ 4) and second ring **6012** (*id.* at 4), which together form outer ring showerhead **6004** (Goodlin 2 [0023]) surrounding circular inner showerhead **6006** (which in turn is comprised of gas distribution manifolds **6018** and **6020** (Goodlin 2 [0022])). The Examiner finds that

⁵ Examiner’s Answer mailed 30 April 2018 (“Ans.”).

⁶ Because this application was filed after 16 March 2013, the effective date of the America Invents Act, we refer to the AIA version of the statute.

⁷ Brian E. Goodlin and Qidu Jiang, *Showerhead for CVD depositions*, U.S. Patent Application Publication 2011/0256729 A1 (2011).

⁸ Toshio Takagi, *Film forming apparatus, film forming method and storage medium*, U.S. Patent Application Publication 2010/0119727 A1 (2010).

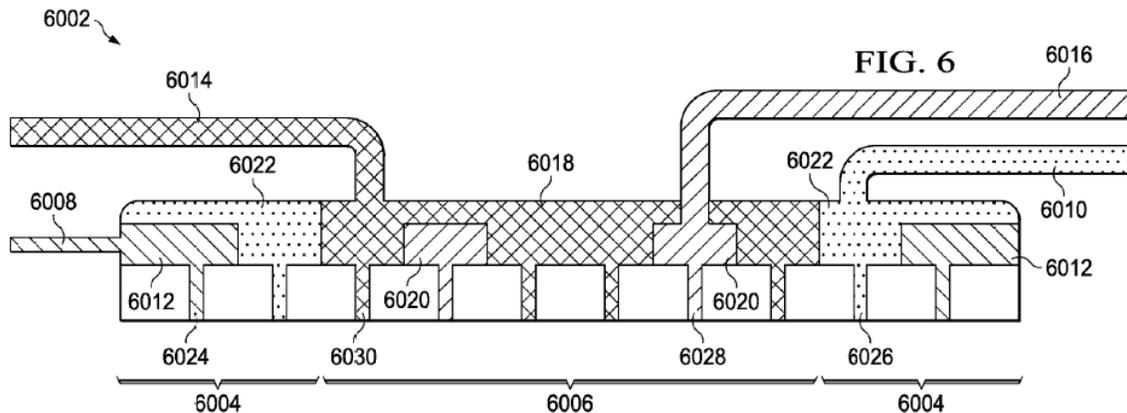
⁹ Thomas E. Deacon et al., *Gas distribution for CVD systems*, U.S. Patent No. 5,792,269 (1998).

¹⁰ The Examiner drops a rejection based solely on Goodlin and Takagi. (Ans. 5, last para., through 6, first full para.)

¹¹ Goodlin identifies element **6022** as a gas distribution manifold. (Goodlin 2 [0023].)

Goodlin does not teach that the outer rings are detachable from one another or from the circular inner showerhead **6006**. (Ans. 5, last para., through 6, first full para.) The Examiner finds that “Takagi teaches a similar detachable (see distinct cross-hatching; Figure[s] 1, 2), side tuning ring gas distribution device (**54c**, Figure[s] 1–3 . . .)” (FR 5), and concludes that “it would have been obvious . . . to make Goodlin’s components separable” (*id.*).

{ Goodlin Figure 6 is shown below }

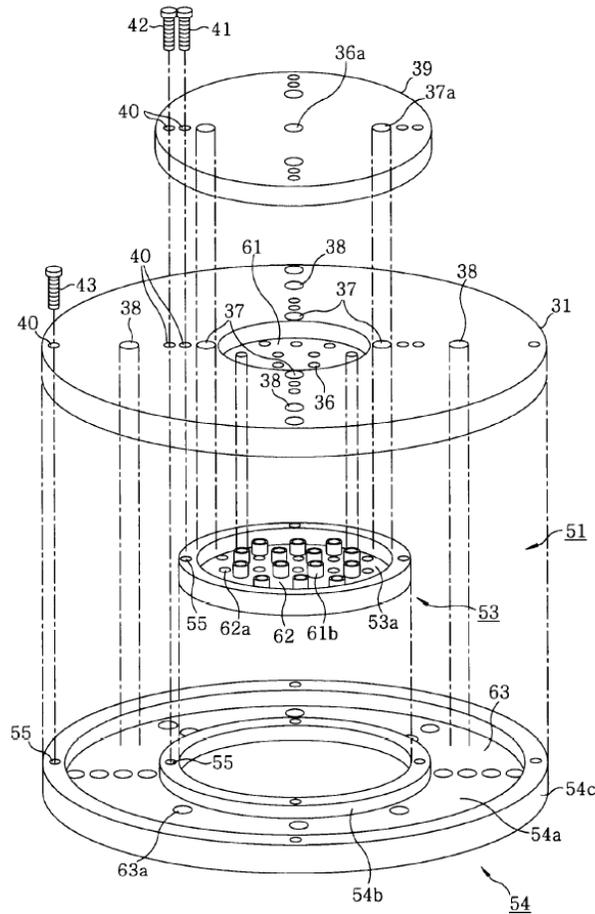


{ Goodlin Figure 6 show a cross section of dual split showerhead **6002** having central section **6006** (fed by manifolds **6018** and **6020**), and edge ring portion **6004** (fed by manifolds **6012** and **6022**) }

Regarding the direction of the inlet holes, the Examiner finds that neither Goodlin nor Takagi teaches or suggests different directions for the holes of the two outer rings. (FR 5–6.) The Examiner finds that Deacon teaches, in Figures 5 and 6 (not reproduced here), angled holes through a faceplate. (*Id.* at 7.) The Examiner concludes that it would have been obvious, as a matter of routine optimization of a known result-effective variable, to provide the gas-delivery holes in the rings with different angles

in order to provide improved sidewall coverage [of features such as trenches and wells on the surface of the substrate]. (*Id.*)

Bravo argues that Takagi teaches only, as shown in Figure 4, below,



{Takagi Figure 4 shows an exploded view of gas showerhead **51**, with peripheral region **54** detachable from central region **53**}

that the ring surrounding a faceplate may be made separable from the faceplate. Bravo urges that Takagi would have not suggested that one surrounding ring be detachable from another surrounding ring. (Br. 11.) Moreover, in Bravo's view, Deacon only teaches optimizing angles through a faceplate, and does not teach or suggest optimizing angles of holes through rings surrounding the faceplate. (*Id.* at 12.)

The Examiner responds that Bravo is addressing the teachings of the references individually, and not in combination. (Ans. 7, ll. 4–10, with respect to the teachings of Goodlin and Takagi; *id.* at para. bridging 9–10, regarding the teachings of Goodlin and Deacon.) These responses merely beg the questions underlying Bravo’s arguments, namely: what teachings in the prior art would have suggested to the routineer that the outer gas distribution ring fed by manifold **6012**, described by Goodlin, be made detachable from the inner gas distribution ring fed by manifold **6012**; and what teachings would have suggested that the angles of the gas distribution holes in the rings be made different from one another?

The legal conclusion of obviousness must be based on findings of fact that a person having ordinary skill in the art would not only have been capable of making the necessary modifications—a point we understand not to be in dispute—but also that there were teachings or suggestions in the prior art, not necessarily the same as led the Appellant to the claimed invention, that would have prompted that person to make the claimed invention. The present rejection does no more than show that certain aspects of the prior art indicate that it would have been within the ordinary skill of the art to make the claimed invention. This is a necessary, but not sufficient basis, for the conclusion of obviousness. What is missing from the findings regarding the cited prior art are any specific teachings of problems to be solved, and ways of solving them, that would have prompted the particular invention now claimed.¹² On the present record, the only reasons for doing

¹² In this regard, we are disturbed that the majority of specific teachings have been pointed out by Bravo, in rebuttal of the general arguments made by the Examiner. For example, the discussion of Takagi Figure 4 is due to Bravo

so are presented in the '650 Specification. But hindsight is not an acceptable basis for the legal conclusion of obviousness.

C. Conclusion

In summary:

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
1, 5, 6	103	Goodlin, Takagi, Deacon		1, 5, 6
7-9	103	Goodlin, Takagi, Deacon		7-9
Overall Outcome	1, 5-10	1, 5-10		1, 5-10

REVERSED

alone. The most specific teaching cited by the Examiner is of Deacon, Figure 19 (showing concentric rings of holes alternating between outward-directed holes and inward directed holes), mentioned for the first time in the Response to Argument section of the Examiner's Answer. (Ans. 10.) This is too late to establish a prima facie case of obviousness, as there is no compelling reason that Figure 19 could not have been cited and discussed earlier. It is also too little, as it does not address the question of making the holes in one ring point at one angle, while the holes in the other ring point at another angle. Nor does this teaching address why the routineer would have been motivated to make the outer rings described by Goodlin detachable from one another, as well as from the central faceplate.