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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte JOSEPH JOHN SUMAKERIS, MICHAEL JAMES PAISLEY, and MICHAEL JOHN O'LOUGHLIN

Appeal 2011-013491
Application 11/512,800
Technology Center 1700

Before RICHARD TORCZON, MICHAEL P. COLAIANNI, and GRACE KARAFFA OBERMANN, *Administrative Patent Judges*.

OBERMANN, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants seek relief under 35 U.S.C. § 134 from the final rejection of claims 28, 29, 32-36, 38-56, 59-69, and 71-72 directed to a deposition system for depositing a film on a substrate. We have jurisdiction under 35 U.S.C. § 6(b).

We REVERSE.

STATEMENT OF THE CASE

Claim 28 is illustrative of the subject matter on appeal:

28. A deposition system for depositing a film on a substrate, the deposition system comprising:

a) a reaction chamber arranged and configured to receive the substrate and the process gas;

b) an interior surface contiguous with the reaction chamber;

c) a process gas supply system to supply a flow of the process gas to the reaction chamber;

d) a buffer gas supply system arranged and configured to supply a flow of a buffer gas between the interior surface and at least a portion of the process gas and flowing in contact with the process gas such that the flow of the buffer gas forms a gas barrier layer to inhibit contact between the interior surface and components of the process gas when the process gas is disposed in the reaction chamber; and

e) at least one susceptor member to heat the reaction chamber;

wherein the system is arranged and configured to provide the buffer gas to the reaction chamber at a temperature greater than a temperature of the process gas in the reaction chamber.

THE REJECTIONS

Appellants seek our review of the following final rejections, which we refer to by number in our analysis:

1. Claims 28, 29, 32-36, 38-42, 50-52, 59-62, 64, 68, 69, and 71 stand rejected under 35 U.S.C. §102(b) as anticipated by Rupp (US 6,299,683 B1 issued Oct. 9, 2001).

2. Claims 43-49, 65-67, and 72 stand rejected under 35 U.S.C. §103(a) as unpatentable over Rupp in view of Medcalf (US 2,759,855 issued Aug. 21, 1956).

3. Claims 53 and 56 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Rupp in view of Kim (US 6,306,216 B1 issued Oct. 23, 2001).

4. Claims 54 and 55 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Rupp, Izumi, Kim, and Steger (US 5,085,727 A issued Feb. 4, 1992).

5. Claim 63 stands rejected under 35 U.S.C. §103(a) as unpatentable over Rupp and Izumi.[1]

ISSUES

The following dispositive issues arise:

1. Does the Examiner err in finding that Rupp anticipates claim 28, including the limitation requiring an apparatus "arranged and configured to provide the buffer gas to the reaction chamber at a temperature greater than a temperature of the process gas in the reaction chamber"?

2. Does the Examiner err in finding that Rupp anticipates claim 32, including the limitation requiring an apparatus "wherein the buffer gas supply system and the process gas supply system are arranged and configured to flow the buffer gas and the process gas through the reaction chamber at substantially the same velocity"?

[1] Rejections 4 and 5 cite "Izumi et al. (US 5085,727 A)" but that reference is neither included in the Examiner's statement of evidence nor applied in the grounds of rejection. Ans. 24, 25.

3. Does the Examiner err in finding that Rupp anticipates claim 35, including the limitation requiring an apparatus "wherein the buffer gas supply system is arranged and configured to provide a substantially laminar flow of the buffer gas along the interior surface to at least a location downstream of the substrate"?

4. Does the Examiner err in finding that Rupp anticipates claim 59, including the limitation requiring an apparatus having "a susceptor assembly comprising at least one susceptor member defining" a reaction chamber, a process gas inlet, and a buffer gas inlet?

5. Does the Examiner err in finding that the subject matter of claim 65, including the limitation requiring a buffer gas that "includes an active material capable of chemically inhibiting the deposition of parasitic deposits on the interior surface and/or removing parasitic deposits from the interior surface" of a deposition system, would have been obvious over Rupp in view of Medcalf?

We answer these questions in the positive and REVERSE.

ANALYSIS

(with Findings of Fact and Conclusions of Law)

Appellants' arguments focus on the limitations of claims 28, 32, 35, 59, 61, and 65. Claim 61 depends from claim 59. Our analysis of claims 28, 32, 35, 59, and 65 is dispositive of all issues raised in this appeal.

Claim 28

The Examiner determines that Rupp anticipates claim 28, including the limitation requiring an apparatus "arranged and configured to provide the buffer gas to the reaction chamber at a temperature greater than a temperature of the process gas in the reaction chamber." Claim 28; Ans. 3.

Rupp describes an apparatus wherein a process gas stream **2** is delivered to a reaction chamber interior **33** via a nozzle **20**. Rupp Fig. 3; 4:59-66. "[A] cooling system **22** is preferably provided for the nozzle **20**, for example a liquid cooling system with an incoming line and an outgoing line parallel to the incoming line." *Id*. at 5:6-9. A buffer gas stream **3** surrounds the process "gas stream **2** on the sides." *Id*. at 3:61-63. A susceptor **6** and substrate holder **5** are induction heated by a high frequency coil **7** to provide on a substrate **4** a growth temperature that preferably ranges from about 800° C to 2500° C. *Id*. at Fig. 1; 2:30-32, 62-66; 3:25-34.

The Examiner finds that the process gas stream **2** and the buffer gas stream **3** are introduced into Rupp's reactor **10** at ambient temperature. Ans. 28 (citing Rupp Figs. 3, 4). The Examiner finds that "Rupp's cooling means **22** are shown as a dedicated cooling means for Rupp's process gas." *Id*. at 29 (citing Rupp Fig. 2; 5:15-34). The Examiner further finds that, "because of Rupp's nozzle's distance from Rupp's heat source **7**/**6**, Rupp's nozzle would still be cooler even if not actively cooled by Rupp's cooling means **22**." *Id*. at 27. Based on these findings, the Examiner determines that Rupp's buffer gas stream **3** is supplied "to the reaction chamber at a temperature greater than a temperature of the process gas" stream **2**, which is supplied via cooled nozzle **20**. Claim 28; *see* Ans. 32.

The evidence does not support the Examiner's finding that "Rupp's cooling means **22** are shown as a dedicated cooling means for Rupp's process gas." *Id*. at 29 (citing Rupp Fig. 2; 5:15-34). Rupp's cooling system **22** is "provided for the nozzle **20**" in an embodiment wherein "the nozzle **20** is arranged closer to the heated region of the reactor **10**." Rupp 5:5-7; *compare* Rupp Fig. 1 *to* Rupp Fig. 3. Rupp thus describes a cooling system **22** that is designed to cool nozzle **20** relative to the heat sources **6**, **5**, which become hot enough to provide growth temperatures ranging from about 800° C to 2500° C. *See* Rupp Figs. 1, 3; 2:30-33.

Appellants argue, and we agree, that one cannot tell from Rupp's disclosure whether nozzle **20** is cooled to a temperature that is lower than the ambient temperature of the incoming process gas stream **2**. App. Br. 8; *see* Ans. 28 (finding that the process gas stream **2** is introduced into Rupp's reactor at ambient temperature). We further agree with Appellants that, absent a showing that the cooling system **22** cools the nozzle **20** to a temperature that is less than that of the process gas stream **2**, the nozzle **20** is not shown to be a cooling element with respect to that gas stream. App. Br. 8. If Rupp's cooling system **22** in fact cools the nozzle **20** "only to a temperature that is still greater than" that of the process gas stream **2**, then the nozzle **20** is a heating element with respect to that gas stream. *Id*.

On this record, the Examiner fails to prima facie show that Rupp anticipates claim 28. We thus reverse the rejection of claim 28 as well as claims 29, 34, 36, 38-56, 71, and 73, which depend therefrom.

Claim 32

The Examiner determines that Rupp anticipates claim 32, including the limitation requiring an apparatus "wherein the buffer gas supply system and the process gas supply system are arranged and configured to flow the buffer gas and the process gas through the reaction chamber at substantially the same velocity." Claim 32; Ans. 6. The Examiner finds that this limitation is an "intended use" that Rupp's apparatus is "capable of performing." Ans. 7 (citations omitted); *see* Ans. 6 (providing no evidentiary support for the finding that Rupp's apparatus is configured to flow the buffer and process gases "at substantially the same velocity").

Rupp in fact teaches an apparatus wherein the flow velocity of the process gas stream **2** "is adjusted to be greater than the flow velocity of the" buffer gas stream **3**. Rupp 2:1-3; 5:66-6:3. The process gas flow velocity is "in general between about 3 times and about 30 times [the] value" of the buffer gas flow velocity, which "is preferably kept low, in order to limit the consumption of gases." *Id*. at 5:60-6:4; *see id*. at 2:5-9 ("Because of the higher flow velocity of the [process] gas stream, the loss of process gases from the [process] gas stream into the [buffer] gas stream due to interdiffusion of gas particles of the process gases and the carrier gas, is kept low."). In Rupp's apparatus, this flow velocity differential is "achieved by means of a corresponding selection of the nozzle **20**." *Id*. at 5:64-65; *see id*. at Fig. 3 and 3:28-30 ("flow velocity of the process gases is greater when it exits from the nozzle **20** than when it enters into the nozzle **20**").

The Examiner identifies no teaching in Rupp wherein nozzle **20** is selected to provide a buffer gas stream **3** and a process gas stream **2** that flow "through the reaction chamber at substantially the same velocity" as

required by claim 32. Nor does the Examiner identify any other structure in Rupp's apparatus that is configured to flow the buffer gas stream **3** and the process gas stream **2** through the reaction chamber at substantially the same velocity. *Id*. at 6, 7, 13.

On this record, the Examiner fails to prima facie show that Rupp anticipates claim 32. We thus reverse claim 32 as well as claims 68 and 69, which depend therefrom.

Claim 35

The Examiner determines that Rupp anticipates claim 35, including the limitation requiring an apparatus "wherein the buffer gas supply system is arranged and configured to provide a substantially laminar flow of the buffer gas along the interior surface to at least a location downstream of the substrate." Ans. 10 (citing Rupp claim 5 and Figs. 3, 5). The Examiner cites Rupp's claim 5 in support of this finding, *id*., but any relevance of that claim to the disputed laminar flow limitation is not evident. Rupp claim 5 (buffer gas stream 3 "comprises at least one inert gas").

The Examiner also cites Rupp's Figures 3 and 5, but does not explain how these drawings establish that the buffer gas stream **3** is provided in "a substantially laminar flow . . . along the interior surface to at least a location downstream of the substrate" as specified in claim 35. *Ibid*. Appellants point out that "laminar flow may depend on additional aspects of the configuration of the system, [] for example, the geometry of the reaction chamber, gas inlets, and/or substrate support." App. Br. 16. Appellants further argue that, "judging from the layout depicted in the drawings of Rupp, it appears that substantial turbulence would be induced at least by the

radially outboard portions of the gas stream **3** flowing directly into the end face of the susceptor **6**, which will presumably redirect the gas stream portions to flow laterally into the paths of the more interior gas stream portions, thereby inducing turbulence upstream of the substrate **4**." *Id*.

Having relied on the drawings to establish laminar flow, the Examiner responds that Rupp "does not disclose that the drawings are to scale and is silent as to dimensions," and finds that Appellants' "arguments based on measurement of the drawing features are of little value." Ans. 34. The only evidence of laminar flow – the drawings – is thus ambiguous, and the Examiner has not carried the burden of proof that Rupp anticipates claim 35. We thus reverse claim 35 as well as claim 33, which depends therefrom.

Claim 59

Claim 59 requires an apparatus having "a susceptor assembly comprising at least one susceptor member defining" a reaction chamber, a process gas inlet, and a buffer gas inlet. The Examiner finds that a "'susceptor member' is [nowhere] cited, verbatim, in Applicant's specification" and, on that basis, assumes that a "'susceptor member' is the same as the specification-supported 'susceptor assembly'" **100**. Ans. 36; *see* Spec. Figs. 2, 4. We reverse the Examiner's rejection of claim 59, as well as claims 60-64 which depend therefrom, because the rejection is based upon an erroneous claim construction.

The Specification explains that "the susceptor assembly **100**" is comprised of susceptor members, including, "a top member **110**, a pair of side members **130**, and a bottom member **140**." Spec. 7:16-18. The Specification further explains that the susceptor "members **110**, **130**, and

140 define an entrance opening **102** (at the end **100A**) and an exit opening **104** (at the end **100B**)." *Id*. at 7:19-21. The susceptor "members **110**, **130**, **140** also define a reaction chamber **106** extending from a process gas inlet **102B** to the opening **104**." *Id*. at 7:21-22. On this record, we reverse the rejection of claim 59, which is based on a misinterpretation of the term "susceptor member" to mean "susceptor assembly." Ans. 36.

Claim 65

The Examiner determines that the subject matter of claim 65, including the limitation requiring a buffer gas that "includes an active material capable of chemically inhibiting the deposition of parasitic deposits on the interior surface and/or removing parasitic deposits from the interior surface" of a deposition system, would have been obvious over Rupp in view of Medcalf. Ans. 17. The Examiner finds that Rupp includes "an active material capable of chemically inhibiting the deposition of parasitic deposits on the interior surface" but, in support of that finding, cites portions of Rupp that neither disclose nor suggest such a material. Ans. 22 (citing "inner diameter of **6**" and Rupp Figs. 3-4; 2:67; 5:15-34). The Examiner turns to Medcalf for a teaching of "the claimed inert gas sources for a similar reaction design." *Id*. (citations to Medcalf omitted).

Like Appellants, we are at a loss as to how the applied art discloses "an active material capable of chemically inhibiting" parasitic deposits as required by claim 65. App. Br. 21; *see* Spec. 15 (buffer gas "may consist of or include HCl or other active gas to chemically impede" formation of parasitic deposits). In response to Appellants' arguments on this point, the Examiner fails to identify in the applied art an active material that meets the

disputed limitation. *See* Ans. 39-40 (discussing Rupp and Medcalf without identifying an active material that chemically inhibits formation of parasitic deposits). On this record, the Examiner fails to prima facie show that claim 65 is unpatentable over Rupp in view of Medcalf. We thus reverse the rejection of claim 65 and claims 66-67 and 72, which depend therefrom.

CONCLUSION

For the above reasons, we reverse the rejections of claims 28, 29, 32-36, 38-56, 59-69, and 71-72.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136.

REVERSED

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