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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte DAVID SABENS, CHAO LIU, WEN-QING XU, and
CHARLES D. TANNER

Appeal 2019-003228
Application 14/966,085
Technology Center 1700

BEFORE JEFFREY B. ROBERTSON, JAMES C. HOUSEL, and
MONTÉ T. SQUIRE, *Administrative Patent Judges*.

SQUIRE, *Administrative Patent Judge*.

DECISION ON APPEAL¹

Appellant² appeals under 35 U.S.C. § 134(a) from the Examiner’s decision rejecting claims 16–20.³ We have jurisdiction under 35 U.S.C. § 6(b).

¹ In this Decision, we refer to the Specification filed Dec. 11, 2015 (“Spec.”); Non-Final Office Action dated Feb. 22, 2018 (“Non-Final Act.”); Appeal Brief filed Aug. 22, 2018 (“Appeal Br.”); Examiner’s Answer dated Jan. 14, 2019 (“Ans.”); and Reply Brief filed Mar. 14, 2019 (“Reply Brief”).

² We use the word “Appellant” to refer to “applicant” as defined in 37 C.F.R. § 1.42(a). Appellant identifies II-VI Incorporated as the real party in interest. Appeal Br. 2.

³ Claims 1–15 are withdrawn. Non-Final Act. 1.

We AFFIRM.

CLAIMED SUBJECT MATTER

Appellant's disclosure relates to a method for microwave plasma chemical vapor deposition growth of diamond films. Spec. ¶¶ 3, 42; Abstract. Claim 16, the sole independent claim, illustrates the claimed subject matter on appeal and is reproduced below from the Claims Appendix to the Appeal Brief:

16. A method of growing a diamond film comprising:
 - (a) providing a microwave plasma reactor comprising:
 - a resonance chamber made of an electrically conductive material;
 - a microwave generator coupled to feed microwaves into the resonance chamber;
 - a plasma chamber comprising part of the resonance chamber interior space and separated from a remainder of the resonance chamber by a gas-impermeable dielectric window;
 - a gas control system for supplying a process gas and a cooling gas into the plasma chamber, removing gaseous byproducts from the plasma chamber, and for maintaining the plasma chamber at a lower gas pressure than the remainder of the resonant chamber;
 - an electrically conductive and cooled substrate holder disposed at the bottom of the plasma chamber; and
 - an electrically conductive substrate for growing diamond film on a top surface of the substrate that faces away from the substrate holder, wherein the substrate is disposed in the plasma chamber parallel to the substrate holder, the substrate is spaced from the substrate holder by a gap having a height d , ***the substrate is electrically insulated from the substrate holder by electrically insulating spacers*** placed without adhesive between the substrate and the substrate holder, the gas control system is

adapted to supply the process gas into the plasma chamber between the dielectric window and the substrate, and the gas control system is adapted to supply the cooling gas into the gap;

(b) providing the cooling gas into the gap between the substrate and the substrate holder;

(c) providing the process gas into the plasma chamber;

(d) supplying to the resonant chamber microwaves of sufficient energy to cause the process gas to form in the plasma chamber a plasma that heats a top surface of the substrate to an average temperature between 750°C and 1200°C; and

(e) in the presence of the plasma in the plasma chamber, actively controlling a temperature distribution across the top surface of the substrate and/or across a growth surface of the diamond film growing on the top surface of the substrate in response to the plasma such that the temperature distribution has less than a predetermined temperature difference between a highest temperature of the temperature distribution and a lowest temperature of the temperature distribution.

Appeal Br. 10–11 (key disputed claim language italicized and bolded).

REFERENCES

The Examiner relies on the following prior art references as evidence in rejecting the claims on appeal:

Name	Reference	Date
Kosky et al. (“Kosky”)	US 5,397,396	Mar. 14, 1995
Slutz	US 5,491,002	Feb. 13, 1996
Williams et al. (“Williams”)	US 2010/0015438 A1	Jan. 21, 2010
Won et al. (“Won”)	US 2012/0171391 A1	July 5, 2012
Mollart	WO 2013/087706 A1	June 20, 2013

F. Silva et al., *Microwave Engineering of Plasma-Assisted CVD Reactors for Diamond Deposition*, 21 J. Phys.: Condens. Matter 1–16 (2009) (“Silva”).

REJECTIONS

On appeal, the Examiner maintains (Ans. 3) the following rejections:

1. Claims 16 and 18–20 are rejected under 35 U.S.C. § 103 as being unpatentable over Mollart in view of Silva, Won, and Slutz (“Rejection 1”). Ans. 3.
2. Claim 17 is rejected under 35 U.S.C. § 103 as being unpatentable over Mollart in view of Silva, Won, and Slutz as applied to claim 16 above, and further in view of Kosky and Williams (“Rejection 2”). *Id.* at 12.

OPINION

Having considered the respective positions advanced by the Examiner and Appellant in light of this appeal record, we affirm the Examiner’s rejections based on the fact-finding and reasoning set forth in the Answer and Non-Final Office Action, which we adopt as our own. We add the following primarily for emphasis.

Rejection 1

The Examiner rejects claims 16 and 18–20 under § 103 as obvious over the combination of Mollart, Silva, Won, and Slutz (Ans. 3–12), which we refer to as Rejection 1.

In response to the Examiner’s rejection, Appellant presents argument for the patentability of independent claim 16 only and does not present separate argument for the patentability of dependent claims 18–20. Appeal Br. 4. We select claim 16 as representative and claims 18–20 stand or fall with claim 16. 37 C.F.R. § 41.37(c)(1)(iv).

The Examiner determines the combination of Mollart, Silva, Won, and Slutz suggests a method of growing a diamond film in a plasma reactor satisfying all of the limitations of claim 16 and concludes the combination would have rendered the claim obvious. Ans. 3–10.

Regarding the recitation “the substrate is electrically insulated from the substrate holder by electrically insulating spacers” of claim 16, the Examiner relies principally on Won for teaching or suggesting that element of the claim. *Id.* at 8–9. In particular, the Examiner finds Won teaches a microwave chemical vapor deposition (CVD) chamber where the substrate is spaced from the substrate holder or susceptor using spacers and that the spacers may be fabricated from any metal, ceramic, or high temperature material. *Id.* at 8 (citing Won, Abstract, ¶¶ 24, 25, Fig. 1).

Based on the Examiner’s findings regarding the teachings of the prior art, the Examiner concludes

it would have been obvious to a person having ordinary skill in the art before the effective filing date of the claimed invention to have modified the teachings of Mollart in view of Silva to have formed the spacers from a ceramic material because Won indicates that ceramics are acceptable materials for forming spacers in a microwave CVD system such that it will yield the desired and predictable result of successfully separating the substrate from the substrate holder during deposition.

Id. at 8–9. The Examiner finds and explains that, because it is known in the art that ceramics are not electrically conductive, as evidenced at paragraph 15 of Appellant’s Specification, the spacers formed of ceramics in the method of Mollart in view of Silva and Won would be electrically insulating and the substrate would be electrically insulated from the substrate holder in the manner claimed. *Id.* at 9 (citing Spec. ¶ 15).

Appellant argues the Examiner’s rejection of claim 16 should be reversed because the cited art does not teach or suggest the “electrically insulating spacers” recitation of the claim. Appeal Br. 4–8; Reply Br. 1–8. In particular, Appellant contends that, in contrast to the claimed invention, “Mollart implicitly teaches its spacer wires or spacer pads are electrically conductive — not electrically insulating.” Appeal Br. 6.

Appellant further contends that, as evidenced by the Inglis⁴ reference, which teaches the use of electrically conductive spacers to ensure good electrical contact between the spacer elements and the substrate holder, and to avoid the problems of arcing under the substrate during CVD growth, one of ordinary skill in the art would not have used electrically insulating ceramic spacers in place of Mollart’s spacer wires or spacer pads. *Id.* at 6–7; *see also* Reply Br. 3 (same).

In other words, Appellant argues one of ordinary skill would not have modified Mollart’s method and system to include Won’s electrically insulating ceramic spacers because “one skilled in the art would expect the arcing problems noted in Inglis to occur during diamond film growth — which arcing is undesirable.” Appeal Br. 7.

Appellant also argues one of ordinary skill in the art would not have combined the teachings of Mollart and Won to arrive at the claimed invention because the references involve “two completely different materials” and “very different process conditions.” *Id.* at 7. Appellant contends that Mollart is about growing a diamond film, while Won is about

⁴ Inglis, WO 2013/087702 A2, published June 20, 2013. A copy of the Inglis reference is attached as Exhibit A of the Evidence Appendix to the Appeal Brief.

depositing a silicon-containing dielectric layer. *Id.* at 7. Appellant further contends that, in contrast to the growth pressure used in Won’s CVD process, which is about 50 mTorr to about 250 mTorr, the growth pressure used in Mollart’s CVD process is at least 80 Torr, which differs by orders of magnitude. *Id.* at 7; *see also* Reply Br. 4–5 (citing the Sabens Declaration⁵).

We do not find Appellant’s arguments persuasive of reversible error in the Examiner’s rejection. Rather, based on the fact-finding and reasoning provided by the Examiner at pages 3–10 and 16–22 of the Answer and pages 3–11 of the Non-Final Action, we find a preponderance of the evidence and sound technical reasoning support the Examiner’s obviousness analysis and determination that the cited art suggests “electrically insulating spacers,” as recited in claim 16.

As the Examiner finds (Ans. 3–5), Mollart teaches a CVD method of growing a diamond film in a microwave plasma reactor on the top surface of a substrate in a chamber whereby the substrate is spaced from the substrate holder 34 by spacers 36. Mollart 5, 14, 15, 17, 19, Figs. 3, 5.

As the Examiner further finds (Ans. 8), Won teaches a thin film deposition process using microwave plasma having a CVD chamber where the substrate 102 is spaced from the substrate holder/susceptor 110 using spacers 190, and that the spacers 190 may be fabricated from ceramic, which is an electrically insulating material. Won, Abstract, ¶ 24 (disclosing the “spacers **190** may be fabricated from any metal, ceramics, high temp material”), ¶ 25, Fig. 1; *see also* Spec. ¶ 15 (disclosing that “ceramic is

⁵ Rule 132 Declaration of David Sabens dated Nov. 20, 2017 (“Sabens Declaration”).

chosen as the material for the insulating spacers because ceramic is an electrical insulator”).

The Examiner also provides a reasonable basis, which is supported by a preponderance of the evidence in the record, to evince why one of ordinary skill would have combined the teachings of the cited art to arrive at the claimed invention. Ans. 8–9 (explaining it would have been obvious to one of ordinary skill to have modified Mollart’s method and microwave plasma system to include ceramic spacers as taught by Won because Won explicitly teaches that ceramics are acceptable materials for fabricating spacers in a microwave plasma CVD system). Indeed, it is well-settled that the mere substitution of one known material for another known in the art is likely to be obvious when it does no more than yield predictable results. *KSR Int’l Co. v. Teleflex, Inc.*, 550 U.S. 398, 416 (2007) (“The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.”).

Absent more, the fact that Mollart is silent as to the material used to form its spacers does not implicitly teach that electrically conductive spacers must be used or teach away from the use of electrically insulating spacers, as Appellant’s argument seems to suggest. *Allergan, Inc. v. Apotex Inc.*, 754 F.3d 952, 964 (Fed. Cir. 2014) (explaining that “silence does not imply teaching away”).

Based on the Examiner’s fact-finding and reasoning provided at pages 17–19 of the Answer, Appellant’s arguments regarding the Inglis reference is equally unpersuasive. In particular, as the Examiner finds (Ans. 18) and contrary to what Appellant’s argument implies, the Inglis reference does not teach or suggest that the use of electrically conductive spacers is required.

Rather, as the Examiner finds and correctly points out (Ans. 17), the portion of Inglis relied upon by Appellant actually teaches that the “spacer elements *may* be electrically conductive and/or *may* be fixed in place with an electrically conductive adhesive” (Inglis 29) (emphasis added), which we find would have reasonably suggested to one of ordinary skill in the art that the use of electrically conductive spacers is optional and not necessarily required. That is, electrically conductive spacers may or may not be used in microwave plasma CVD systems. *See In re Burckel*, 592 F.2d 1175, 1179 (CCPA 1979) (“[A] reference must be considered not only for what it expressly teaches, but also for what it fairly suggests.”); *see also In re Preda*, 401 F.2d 825, 826 (CCPA 1968) (“[I]n considering the disclosure of a reference, it is proper to take into account not only specific teachings of the reference but also the inferences which one skilled in the art would reasonably be expected to draw therefrom.”).

Moreover, the fact that the Inglis reference, which was not cited or relied upon by the Examiner in the rejection, discusses or suggests that electrically conductive spacers may be used or may be preferable for its CVD process, without more, does not negate or take away from the reference’s broader disclosure or from Won’s explicit disclosure regarding ceramic spacers being known in the art and suitable for use in a microwave plasma CVD process. *In re Susi*, 440 F.2d 442, 445-46 (CCPA 1971) (disclosure of particularly preferred embodiments does not teach away from broader disclosure or non-preferred embodiments); *see also In re Keller*, 642 F.2d 413, 425 (CCPA 1981) (explaining in making an obviousness determination, the combined teachings of the prior art must be considered as a whole).

We do not find Appellant's argument that one of ordinary skill would not have combined Mollart and Won because they involve "two completely different materials" and "very different process conditions" (Appeal Br. 7) persuasive based on the Examiner's findings and reasoning provided at pages 19–22 of the Answer. As the Examiner explains (Ans. 19), Appellant's argument is misplaced because it mischaracterizes and is not based on the Examiner's rejection. Contrary to what Appellant's argument suggests, the Examiner's rejection does not propose modifying Mollart's process to deposit the silicon-based materials described in Won on Mollart's substrate at the process conditions described in Won. Rather, as previously discussed above, the Examiner's rejection is based on the Examiner's conclusion that it would have been obvious to one of ordinary skill to have modified Mollart's method and microwave plasma system to include ceramic spacers because Won explicitly teaches that ceramic spacers were known and suitable in the art for use in microwave plasma CVD. Won ¶¶ 23, 24.

The fact that Won may describe, in certain embodiments, depositing materials on a substrate at process conditions, which may differ from and are not specifically discussed in Mollart, without more, does not negate or teach away from Won's disclosure regarding the known use and suitability of ceramic spacers for microwave plasma CVD. Moreover, as the Examiner finds (Ans. 19), Won teaches that its process and plasma chamber (process chamber **100**), nonetheless, can be used and "may be configured to deposit a variety of materials on the substrates **102**." Won ¶ 23.

Because Appellant's argument regarding the Sabens Declaration is presented for the first time on appeal in the Reply Brief (Reply Br. 4–7) and

is not accompanied by a showing of good cause, we need not consider it. 37 C.F.R. §§ 41.37(c)(1)(iv), 41.41(b)(2).

Even if we were to consider Appellant’s reply argument regarding the Sabens Declaration, it is not persuasive. In particular, Appellant’s contentions at pages 4–7 of the Reply Brief regarding the Sabens Declaration are entitled to little weight because they are largely conclusory and unsupported by persuasive evidence in the record. *In re De Blauwe*, 736 F.2d 699, 705 (Fed. Cir. 1984). The portions of the Sabens Declaration upon which Appellant relies (*see* Sabens Decl. 2–5) lack adequate factual support and neither Appellant nor Dr. Sabens identify or direct us to persuasive evidence to support the opinion testimony. *See, e.g., Ashland Oil, Inc. v. Delta Resins & Refractories, Inc.*, 776 F.2d 281, 294 (Fed. Cir. 1985) (“Lack of factual support for expert opinion going to factual determinations ... may render the testimony of little probative value in a validity determination.”); *In re Am. Acad. of Sci. Tech. Ctr.*, 367 F.3d 1359, 1368 (Fed. Cir. 2004) (“[T]he Board is entitled to weigh the declarations and conclude that the lack of factual corroboration warrants discounting the opinions expressed in the declarations.”) (citations omitted).

Accordingly, we affirm the Examiner’s rejection of claims 16 and 18–20 under 35 U.S.C. § 103 as obvious over the combination of Mollart, Silva, Won, and Slutz.

Rejection 2

In response to the Examiner’s rejection of claim 17 as obvious over the combination of Mollart, Silva, Won, Slutz, Kosky, and Williams (Ans. 12–16), which we refer to as Rejection 2, Appellant does not present any new or additional substantive arguments.

Thus, based on the fact-finding and reasoning provided by the Examiner at pages 12–16 of the Answer, and for principally the same reasons discussed above for affirming the Examiner’s rejection of claim 16, we affirm the Examiner’s rejection of claim 17 under 35 U.S.C. § 103 as obvious over the combination of Mollart, Silva, Won, Slutz, Kosky, and Williams.

CONCLUSION

In summary:

Claim(s) Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
16, 18–20	103	Mollart, Silva, Won, Slutz	16, 18–20	
17	103	Mollart, Silva, Won, Slutz, Kosky, Williams	17	
Overall Outcome			16–20	

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED