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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte QI LIANG and WILLIAM BRIAN ATKINS

Appeal 2019-006530
Application 15/315,635
Technology Center 1700

Before CHRISTOPHER L. OGDEN, MERRELL C. CASHION, JR., and
SHELDON M. MCGEE, *Administrative Patent Judges*.

CASHION, *Administrative Patent Judge*.

DECISION ON APPEAL
STATEMENT OF THE CASE

Pursuant to 35 U.S.C. § 134(a), Appellant¹ appeals the Examiner's rejection of claims 1, 2, and 4–20, which constitute all the claims pending in this application. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

The invention generally relates to a polycrystalline diamond and methods for forming a polycrystalline diamond. Claims 1 and 16 are illustrative of the subject matter claimed and are reproduced below from the Claims Appendix to the Appeal Brief:

¹ We use the word “Appellant” to refer to “applicant” as defined in 37 C.F.R. § 1.42. Appellant identifies the real party in interest as Halliburton Energy Services, Inc. Appeal Br. 3.

1. A method of forming a polycrystalline diamond element, the method comprising:

placing at least two leached polycrystalline diamond segments comprising pores formed by removal of a diamond sintering aid adjacent one another with a reactant gas comprising methane, acetone, methanol, another hydrocarbon gas, or any combinations thereof in an assembly; and

applying to the assembly a voltage and amperage sufficient to heat the reactant gas to a temperature of 1500 °C or less at which the reactant gas forms a plasma, which plasma forms diamond bonds and carbide structures in at least a portion of the polycrystalline diamond pores, wherein diamond bonds bridge the adjacent polycrystalline diamond segments and covalently bond the adjacent polycrystalline diamond segments to one another to form a polycrystalline diamond element.

16. A polycrystalline diamond compact (PDC) element comprising polycrystalline diamond segments adjacent one another and covalently bonded to one another by diamond bonds in pores formed by removal of a diamond sintering aid, wherein the diamond bonds bridge the adjacent polycrystalline diamond segments.

Independent claim 18 recites an article comprising the polycrystalline diamond of claim 16.

Appellant requests review of the following rejections from the Examiner's Non-Final Office Action dated September 4, 2018:

I. Claims 16 and 18–20 rejected under 35 U.S.C. § 102(a)(1) as anticipated by Setlur (US 2012/0097457 A1, published April 26, 2012).²

² The Examiner also relies on DiGiovanni (US 2013/0086847 A1, published April 11, 2013) as an evidentiary reference in this rejection. Non-Final Act. 3.

II. Claims 1, 2, 4–11, 13, 15, and 17 rejected under 35 U.S.C. § 103 as unpatentable over Setlur and Egan (US 2010/0206941 A1, published August 19, 2010).³

III. Claims 12 and 14 rejected under 35 U.S.C. § 103 as unpatentable over Setlur, Egan, and DiGiovanni.

Appellant argues independent claims 16 and 18 together (Rejection I) and presents separate arguments for independent claim 1 (Rejection II). Appellant does not present arguments for the respectively rejected dependent claims 2, 4–11, 13, 15, 17, and 19–20 or separately rejected claims 12 and 14 (Rejection III). *See generally* Appeal Br. Accordingly, we select the independent claims 1 and 16 as representative of the claimed subject matter and decide the appeal as to all grounds of rejection based on the arguments presented for these claims.

OPINION

After review of the respective positions Appellant provides in the Appeal Brief⁴ and the Examiner provides in the Non-Final Action and the Answer, we AFFIRM the Examiner's rejections of claims 1, 2, and 4–20 under 35 U.S.C. §§ 102(a)(1) and 103 for essentially the reasons the Examiner presents in the Non-Final Office Action and the Answer. We add the following for emphasis.

³ The Examiner further relies on Fang (Z. Zack Fang et al. *Synthesis, sintering, and mechanical properties of nanocrystalline cemented tungsten carbide - A review*. Int'l J. Refractory Metals & Hard Materials 27 (2009) 288–299) as an evidentiary reference in both rejections under 35 U.S.C. 103. Non-Final Act. 7, 17.

⁴ Appellant did not file a Reply Brief.

Claim 16 (Rejection I under 35 U.S.C. § 102(a)(1))

Claim 16 recites a polycrystalline diamond compact (PDC) element comprising polycrystalline diamond segments adjacent one another and covalently bonded to one another by diamond bonds in pores formed by removal of a diamond sintering aid, wherein the diamond bonds bridge the adjacent polycrystalline diamond segments.

The Examiner finds that Setlur describes a PDC element comprising leached polycrystalline diamond segments bonded to one another by diamond bonds. Non-Final Act. 3; Setlur ¶¶ 15, 16, 18, 37, 38, 59, 60. The Examiner finds that Setlur, like Appellant, bonds the polycrystalline diamond segments by subjecting them to a spark plasma sintering process. Non-Final Act. 4; Ans. 19–20; Setlur ¶ 18. Setlur discloses operating the spark plasma sintering process at temperatures of from about 1000 to about 2500° C, which encompasses the operation temperatures that Appellant discloses for the same process. Setlur ¶ 18; Spec. 7. The Examiner relies on DiGiovanni solely to establish that it is known to use a spark plasma sintering process to bond diamond grains or crystals directly together by intergranular diamond-to-diamond bonds and that these bonds can be “any direct atomic bond (e.g., *covalent*, ionic, etc.) between atoms in adjacent grains of material.” Non-Final Act. 3–4 (emphasis added); DiGiovanni ¶¶ 20–22, 24.

In view of the above, the Examiner finds that Setlur anticipates the subject matter of claim 16. Non-Final Act. 4.

After consideration of the arguments the Appellant presents to address the anticipation rejection of claim 16 (Appeal Br. 7–11), we are not persuaded of reversible error in the Examiner’s determination of anticipation

for the reasons the Examiner presents (Ans. 19–23).

In order to anticipate, a reference must identify something falling within the claimed subject matter with sufficient specificity to constitute a description thereof within the purview of § 102. *In re Schaumann*, 572 F.2d 312, 317 (CCPA 1978). It is also well settled that when a claimed product reasonably appears to be substantially the same as a product disclosed by the prior art, the burden is on the applicant to prove that the prior art product does not necessarily or inherently possess characteristics attributed to the claimed product, and that it is of no moment whether the rejection is based on § 102 or § 103 since the burden on the applicant is the same. *In re Spada*, 911 F.2d 705, 708 (Fed Cir. 1990); *In re Best*, 562 F.2d 1252, 1255 (CCPA 1977).

The premise of the Examiner’s rejection is that the polycrystalline diamond compact (PDC) element of claim 16 “reasonably appears to be substantially the same as a product disclosed by [Setlur]” because Setlur forms such an element using the same spark plasma sintering process the Appellant uses.

Appellant acknowledges that Setlur discloses a polycrystalline diamond compact element made by a spark plasma sintering process. Appeal Br. 7, 9; Setlur ¶¶ 59–60. However, Appellant argues that Setlur uses diamond powder placed between the two leached polycrystalline diamond segments to bond them and this diamond powder prevents forming the bridging diamond bonds in the pores of the two segments as claimed. Appeal Br. 7. According to Appellant, the diamond powder forms new polycrystalline diamond material between the two polycrystalline diamond segments. *Id.*

These arguments do not point to reversible error in the Examiner's rejection.

We first note that Setlur's invention addresses the same problem as the claimed invention: the presence of residual catalyzing materials that imposes a limit upon the maximum useful operating temperature of the PCD cutting element while in service. Setlur ¶ 5; Spec. 1. Both Setlur and Appellant teach the segments to be bonded to remove or substantially remove the residual material. Setlur ¶ 37; Spec. 1.

As the Examiner notes, Setlur teaches the use of the spark plasma sintering process on stacks of pre-sintered discs (or stack) of previously pressed diamond powder materials and does not disclose that a diamond filler material is placed between the stacks of pre-sintered. Ans. 20; Setlur ¶¶ 59–60. Setlur does disclose that, in this embodiment, “sparkling allows the ‘stack’ 100 to form diamond-to-diamond bonds of PCD, similar to those formed in the traditional HTHP process.” Setlur ¶ 60. As the Examiner notes (Ans. 19–20), Appellant's arguments do not address adequately the portions of Setlur that the Examiner relies upon. Appellant does not explain adequately, or provide evidence to support, why Setlur's spark plasma sintering process would not result in polycrystalline diamond segments adjacent one another and covalently bonded to one another by diamond bonds in pores formed by removal of a diamond sintering aid, wherein the diamond bonds bridge the adjacent polycrystalline diamond segments.

Given that the Examiner established that using a spark plasma sintering process results in covalent bonds to bond diamond grains or crystals directly together (Non-Final Act. 3–4; DiGiovanni ¶¶ 20–22, 24), the Examiner has provided a reasonable basis to assert that the claimed

polycrystalline diamond compact element and Setlur's product are substantially the same. Appellant has not provided any persuasive reasoning or credible evidence to show otherwise.

Appellant argues that Di Giovanni only discusses the use of the spark plasma sintering process in conjunction with a high temperature and high pressure (HTHP) sintering process while Setlur does not use spark plasma sintering in the context of a HTHP process. Appeal Br. 10.

Appellant's argument lacks persuasive merit. The Examiner relied upon DiGiovanni for its teaching that spark plasma sintering results in covalent diamond bonds when forming a polycrystalline diamond element. Non-Final Act. 3–4; DiGiovanni ¶¶ 20–22, 24. The argument does not address the reason for which the Examiner relies upon DiGiovanni. The argument also fails to explain why DiGiovanni does not teach that spark plasma sintering would not result in covalent diamond bonds as disclosed by the reference.

Accordingly, we AFFIRM the Examiner's prior art rejection of claims 16 and 18–20 under 35 U.S.C. § 102(a)(1) for the reasons the Examiner presents and we give above.

Claim 1 (Rejections under 35 U.S.C. § 103)

We refer to the Examiner's Non-Final Action for the statement of rejection of claim 1. Non-Final Act. 7–12.

The Examiner relies on the additional references to Egan and Fang (as an evidentiary reference) to address additional features recited in claim 1. *Id.* at 10–12.

Appellant relies on arguments similar to those presented to address the rejection of claim 16. Appeal Br. 11–12. Appellant does not present

arguments contesting the Examiner's reliance on Egan and Fang to address the additional limitations recited in claim 1.

Accordingly, we AFFIRM the Examiner's prior art rejections of claims 1, 2, 4-11, 12-15, and 17 under 35 U.S.C. § 103 for the reasons the Examiner presents and we give above.

CONCLUSION

In summary:

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
16, 18-20	102(a)(1)	Setlur	16, 18-20	
1, 2, 4-11, 13, 15, 17	103	Setlur, Egan	1, 2, 4-11, 13, 15, 17	
12, 14	103	Setlur, Egan, DiGiovanni	12, 14	
Overall Outcome			1, 2, 4-20	

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