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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte JIINJEN ALBERT SUE, HAROLD SRESHTA, and RAJAGOPALA PILLAI[1]

Appeal 2018-008326
Application 14/410,475
Technology Center 3600

Before JENNIFER D. BAHR, BRANDON J. WARNER, and SEAN P. O'HANLON, *Administrative Patent Judges*.

BAHR, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Appellant appeals under 35 U.S.C. § 134(a) from the Examiner's decision rejecting claims 1–14. We have jurisdiction under 35 U.S.C. § 6(b).

We REVERSE.

[1] National Oilwell Varco, L.P. (Appellant) is the applicant as provided in 37 C.F.R. § 1.46 and is identified as the real party in interest. Application Data Sheet submitted Dec. 22, 2014; Appeal Br. 3.

THE CLAIMED SUBJECT MATTER

Claim 1, reproduced below, is illustrative of the claimed subject matter.

> 1. A downhole tool, comprising:
> a body made of a metal or metal alloy;
> a coating disposed on the body;
> wherein the coating includes at least 75 vol% tungsten carbide having an average grain size less than 1.0 µm; and
> wherein the coating includes only 40 to 64 vol% tungsten carbide with a grain size less than 0.5 µm.

REJECTIONS

I. Claims 1–12 and 14 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Keshavan et al. (US 5,535,838, issued July 16, 1996, hereinafter "Keshavan") and Shmyreva et al. (US 2012/0171469 A1, published July 5, 2012, hereinafter "Shmyreva").

II. Claim 13 stands rejected under 35 U.S.C. § 103(a) as unpatentable over Keshavan, Shmyreva, and Shinde et al. (US 2010/0068405 A1, published Mar. 18, 2010, hereinafter "Shinde").

DISCUSSION

Rejection I

The Examiner finds that Keshavan discloses a tungsten carbide-cobalt-chromium coating including at least 75 vol% tungsten carbide, but fails to disclose "the coating having at least 75 vol% tungsten carbide with a grain size less than 1 micrometer and 40-64 volume% having a grain size less than 0.5 micrometers." Final Act. 3–4 (selecting weight percentages within the ranges disclosed in column 8, lines 56–60 of Keshavan and converting to volume percentages, resulting in 76.6 vol% tungsten carbide).

The Examiner finds that Shmyreva teaches a tungsten carbide-cobalt-chromium coating comprising three different types of tungsten carbide grains provided in varying percentages, namely, 1–80% of the coating being of a nanocrystalline grain phase (having grain size below 100 nanometers), 1–90% of the coating being of a microcrystalline phase (having grain size below 1000 nanometers), and the remainder of the coating being of an amorphous phase. *Id.* at 4. Within these three ranges of tungsten carbide phases taught by Shmyreva, the Examiner selects 70% for the nanocrystalline phase having a grain size below 0.1 μm, 20% for the microcrystalline phase having an average grain size of 0.6 μm (from within the range of 0.1–1.0 micrometers taught in paragraph 21 of Shmyreva), and the remaining 10% of the tungsten carbide being an amorphous phase. *Id.*

By selecting a percentage of the coating of 76.6 vol% of tungsten carbide from the range disclosed in Keshavan, the Examiner calculates a result of "59 vol % [*sic*: 53.6 vol%] tungsten carbide with an average particle size less than .5 micrometers (70 % nanocrystalline of 76.6 vol% is 53.6 % by volume tungsten carbide grains less than .5 micrometers[)]" and "29 % microcrystalline of 76.6 vol% tungsten carbide[, which] is 22.2 % by volume tungsten carbide grains less [*sic*] averaging .6 micrometers."[2] *Id.* The Examiner then concludes that it would have been obvious to apply "the

[2] The Examiner's use of 29 vol% for the microcrystalline phase is inconsistent with the Examiner's earlier selection of 20% for the microcrystalline phase having an average grain size of .6 micrometers. *See* Final Act. 4.

grain size distribution of [Shmyreva] in the invention of [Keshavan] in order to provide improved coatings for enhanced corrosion and wear resistance in severe environments as taught by [Shmyreva]." *Id.* (citing Shmyreva ¶ 7). Using the selected percentages, the Examiner determines that the resulting coating would comprise 75.8 percent by volume tungsten carbide with a grain size under 1.0 µm, which is within the "at least 75 vol%" claimed, with only 53.6 percent by volume of the tungsten carbide particles having a grain size of less than 0.5 µm, which is within the "only 40 to 64 vol%" claimed. *Id.*

Appellant argues that "Shmyreva is silent regarding the amount, if any, of the particles of the microcrystalline phase (grain sizes between 0.1 µm and 1.0 µm) that have grain sizes above or below 0.5 µm." Appeal Br. 13 (italics omitted). Therefore, Appellant submits that "Shmyreva does not expressly teach or disclose a coating comprising only 40 to 64 vol% tungsten carbide with a grain size less than 0.5 µm as included in claim 1," nor is the claimed "closed vol% range of tungsten carbide in the coating having grain sizes less than 0.5 µm . . . inherent or implied in the teachings of Shmyreva." *Id.* (italics and underlining omitted).

Shmyreva teaches providing, in the coating,

> from about 1 to about 95 volume percent of an amorphous phase, from about 1 to about 80 volume percent of a nanocrystalline phase, and from about 1 to about 90 volume percent of a microcrystalline phase, and wherein said amorphous phase, nanocrystalline phase and microcrystalline phase comprise about 100 volume percent of said thermally sprayed coating.

Shmyreva ¶ 18. Shmyreva defines the nanocrystalline phase as comprising discrete particles having a structure comprising a grain size of less than about 100 nanometers (0.1 μm) and the microcrystalline phase as comprising discrete particles having a structure comprising a grain size from about 100 nanometers to less than about 1000 nanometers (about 0.1 μm to less than about 1.0 μm). *Id.* ¶ 21. More specifically, Shmyreva teaches that the coatings typically comprise from about 5 to about 75 (more preferably from about 25 to about 50) volume percent of the nanocrystalline phase and from about 5 to about 80 (more preferably from about 25 to about 50) volume percent of the microcrystalline phase. *Id.* ¶¶ 24–25.

Although it may have been obvious to select any percentage from within the range of percentages taught by Shmyreva for each of the nanocrystalline phase and the microcrystalline phase, Shmyreva is silent as to what percentage, if any, of the particles in the microcrystalline phase (which have grain sizes ranging from about 0.1 μm to less than about 1.0 μm) would have grain sizes less than 0.5 μm. The Examiner appears to choose arbitrarily an average grain size of 0.6 μm for the microcrystalline phase and then appears to treat the microcrystalline phase particles as having grain sizes less than 1.0 μm, but not less than 0.5 μm. This is problematic for two reasons. First, having an "average" grain size of 0.6 μm does not speak to the question of what percentage, if any, of the particles of the microcrystalline phase would have grain sizes less than 0.5 μm. Second, Shmyreva gives no indication that one would, or even could, select any particular average grain size for the particles in the microcrystalline phase, much less a specific grain size for all of the particles of the microcrystalline phase (in case the Examiner actually intends to select a grain size of .6 μm for all of the particles in the microcrystalline phase).[3] *See Atofina v. Great Lakes Chemical Corp.*, 441 F.3d 991, 999 (Fed. Cir. 2006) (pointing out that "the disclosure of a genus in the prior art is not necessarily a disclosure of every species that is a member of that genus"). "[T]he disclosure of a range is no more a disclosure of the end points of the range than it is of each of the intermediate points." *Id*. at 1000.

The Examiner offers two interpretations of Shmyreva's teaching of the microcrystalline phase comprising discrete particles having a structure comprising a grain size of about 0.1 μm to less than about 1.0 μm. The first interpretation is that "the grain size of this phase can be selected to be one of any of the values in this range." Ans. 3. This interpretation is flawed, for the reasons discussed above. The Examiner does not provide any evidence or technical reasoning to explain why, in this case, Shmyreva's disclosure of a microcrystalline phase comprising particles having grain sizes falling within a particular range would be interpreted in this manner. The second interpretation is that "the grain size of this phase ranges from .1-1μm and an equal distribution will be assumed in light of the lack of evidence to the contrary." *Id.* This interpretation is likewise flawed, in that it is based on an unfounded assumption or speculation.

The Examiner also reasons that "it would have been obvious to choose something higher in the range of .1-1 [μ]m for the micro phase since [Shmyreva] teaches that costs increase as particle size decreases . . . so the higher end of the range (.5-1[μ]m) becomes an even more obvious choice." Adv. Act. 2 (citing Shmyreva ¶ 51). This reasoning takes Shmyreva's

[3] *See* Ans. 5 (stating that Shmyreva "actually discloses .6μm in [the 0.1–1.0 μm] range").

statement regarding costs increasing as particle size decreases somewhat out of context and mischaracterizes the point Shmyreva is making. Shmyreva teaches that "[t]he average particle size of each raw material powder is preferably no less than 0.1 microns and more preferably no less than 0.2 microns, but preferably no more than 10 microns" because costs may increase if the average particle size "is too small" (i.e., falls below the lower end of this range), and the powder may become difficult to disperse uniformly if the average particle size "is too large" (i.e., is greater than 10 microns). Shmyreva ¶ 51. In other words, Shmyreva sets forth a feasible operating range for the particle size of the raw material powder to control costs while maintaining acceptable dispersibility characteristics. Shmyreva gives no indication that costs will vary significantly for different particle sizes within the disclosed operating range. Thus, the passage of Shmyreva cited by the Examiner would not have made the higher end of the microcrystalline grain size range "an even more obvious choice" (Adv. Act. 2) as the Examiner states.

The Examiner emphasizes that the question of whether or not Keshavan and Shmyreva recognize the percent volume of particles less than 0.5 μm as a result effective variable is not germane to the rejection because the Examiner's rejection is not grounded on a routine optimization rationale. Ans. 4. Nonetheless, the Examiner finds that Shmyreva "does recognize particle size and particle size distribution as a result effective variable." *Id.* (citing Shmyreva ¶ 26).

Shmyreva teaches:

> Thermally sprayed coatings having more than about 95 volume percent of amorphous phase have very good corrosion resistance but have less wear resistance because of the lack of

> hard nanocrystalline and microcrystalline phases. Thermally sprayed coatings having more than about 80 volume percent of nanocrystalline phase and about 90 volume percent of microcrystalline phase are hard but brittle (having decreased erosion resistance) because the coatings do not have a sufficient amount of more elastic amorphous based binder between the hard precipitants.

Shmyreva ¶ 26. In other words, the passage cited by the Examiner teaches that providing too much of one of the phases, to the exclusion of sufficient amounts of the other phases, may sacrifice either corrosion resistance or wear resistance, or be too brittle, and, in this regard, appears to recognize the percentages of each of the phases as result-effective variables. However, this is a far cry from any recognition that the percentage of any particular particle size (or range of particle sizes) within any of the phases is of any particular significance or is a result-effective variable. More specifically, it does not constitute a recognition that the percentage of particles having a grain size less than 0.5 μm would be a result-effective variable.

For the above reasons, the Examiner does not articulate a sufficient reason, objectively based on rational underpinnings, as to why it would have been obvious, in view of the combined teachings of Keshavan and Shmyreva, and in the absence of Appellant's disclosure, to provide a coating comprising "at least 75 vol% tungsten carbide having an average grain size less than 1.0 μm," but "only 40 to 64 vol% tungsten carbide with a grain size less than 0.5 μm," as called for in claim 1. Accordingly, we do not sustain the rejection of claim 1, or claims 2–12 and 14, which depend from claim 1, as unpatentable over Keshavan and Shmyreva.

Rejection II

The aforementioned deficiency in the rejection of claim 1 also pervades the rejection of claim 13, which depends indirectly from claim 1. Appeal Br. 20–21 (Claims App.). The Examiner's application of Shinde does not remedy this deficiency. *See* Final Act. 5. Accordingly, we do not sustain the rejection of claim 13 as unpatentable over Keshavan, Shmyreva, and Shinde.

DECISION

The Examiner's decision rejecting claims 1–14 is reversed.

<u>REVERSED</u>