The opinion in support of the decision being entered today
is *not* binding precedent of the Board.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte DAVID EDWIN BUDINGER, BRENT ROSS THOLKE,
MATTHEW NICKLUS MILLER, WARREN DAVIS GROSSKLAUS, JR.,
JOSHUA LEIGH MILLER, and MELVIN ROBERT JACKSON

Appeal 2007-0882
Application 10/702,987
Technology Center 1700

Decided: June 27, 2007

Before PETER F. KRATZ, CATHERINE Q. TIMM, and
LINDA M. GAUDETTE, *Administrative Patent Judges*.

GAUDETTE, *Administrative Patent Judge*.

DECISION ON APPEAL

This is an appeal from the Examiner's final rejection of claims 1-19 and 21, the only claims pending in this application. We have jurisdiction over the appeal pursuant to 35 U.S.C. § 6(b) (2006).

Appellant's invention relates to a process for repairing a nickel-base superalloy article, such as a gas turbine stationary flowpath shroud. Independent claim 1 is illustrative of the invention:

1. A method for repairing a nickel-base superalloy article comprising the steps of

providing the nickel-base superalloy article that has previously been in service; and

applying a restoration to a surface of the article by the steps of

providing a restoration nickel-base superalloy different from that of the nickel-base superalloy article, thereafter

applying a restoration coating of the restoration nickel-base superalloy to the surface of the article by a hyper-velocity oxyfuel metal spray process or a low-pressure plasma spray process, and thereafter

heating the article with the restoration coating applied to the surface thereof to a sufficiently high temperature to diffusion bond the restoration coating to the surface of the article.

The Examiner relies on the following prior art references to show unpatentability:

White	US 5,732,467	Mar. 31, 1998
Bajan	US 2005/0036892 A1	Feb. 17, 2005

The Examiner made the following rejections:

1. Claims 1-11, 13-18, and 21 under 35 U.S.C § 103(a) as unpatentable over White.

2. Claims 12 and 19 under 35 U.S.C § 103(a) as unpatentable over White in view of Bajan.

ISSUES

The Examiner contends that it would have been obvious to one of ordinary skill in the art at the time of the invention to modify White's process to achieve the invention as claimed. Appellants contend that the

Examiner has failed to identify a teaching, motivation, or suggestion in White, alone or in combination with Bajan, of all the recited claim elements. The issue before us is: Has the Examiner properly established a prima facie case of obviousness within the meaning of 35 U.S.C § 103(a)?

For the reasons discussed below, we answer this question in the affirmative. Accordingly, we affirm as to both grounds of rejection.

FINDINGS OF FACT

1) White discloses "methods for repairing surface cracks in structural alloy parts, such as engines, by cleaning, coating, and hot isostatic pressing the part to provide a leak-free repaired area, while maintaining the crystalline structure and mechanical properties of the alloy part." Col. 1, ll. 8-13. White discloses that the method may be used to repair cracks in articles such as turbine blades and turbine shrouds. Col. 2, l. 63 - col. 3, l. 1. "The article may have internal passageways communicating through the end of the article." Col. 3, ll. 2-3.

2) White teaches that "[t]he superalloy may have a superalloy composition of a nickel-base, iron-base, or cobalt-base superalloy, such as is well known and described, for example, in Metals Handbook Tenth Edition, Vol. 1, Properties Selection: Iron, Steel and High-Performance Alloys, ASM International (1990), pages 981-994 and 995-1006, which describes many castable superalloys, and specifically nickel-base superalloys that may be directionally solidified or formed as single crystals." White, col. 4, ll. 22-30.

3) According to White, "[d]uring manufacturing or service life, many directionally solidified superalloy parts, such as blades **1**, experience

cracks **7** and defects in the outer surface **5**. It is important to be able to repair the surface cracks **5** without affecting the internal cooling passages **3**." Col. 4, ll. 56-60.

4) In White's process, "cracks with openings in the outermost surface are coated by Hyper Velocity Oxy-Fuel or other thermal spray process, such as low pressure plasma deposition, to seal the crack region. The preferred method of coating is the Hyper Velocity Oxy-Fuel process. The low pressure plasma deposition process, being chamber contained and therefore more costly and limiting, would be used only if the reduced atmosphere from the process was found to [be] beneficial in reducing oxidation and gas volume in the cracked surface region." Col. 5, ll. 8-17.

5) White teaches that "[t]he coating material to seal the crack prior to hot isostatic pressing, is chosen to match the superalloy substrate material or it can be deliberately made to be different, so as to have enhanced beneficial surface properties, or to allow easy removal of the coating after hot isostatic pressing. The choice of coating must be compatible with the superalloy part material." Col. 5, ll. 20-26. White defines compatibility as "some continuity or similarity of crystal structure, metallurgical structure, or both, between the superalloy article and the repair of the defect by diffusion healing from the coated material." White further states that "compatibility" implies that the superalloy material and the coating material do not adversely affect each other. Col. 5, ll. 26-32.

6) According to White, the coating thickness should be sufficient to be diffusion bonded by hot isostatic pressing ("HIP") and seal the crack. Generally, the thickness is about 0.001 to 0.010 inches thick before HIP diffusion bonding, preferably about 0.010 inches. Col. 5, ll. 32-35.

7) White teaches that the HIP cycle is conducted "at a suitable temperature, time and pressure cycle to prevent recrystallization while effecting a diffusion bond at the crack surface." Col. 5, ll. 37-39.

8) White discloses that "after hot isostatic pressing the part member may still be in an unfinished form, and will, therefore, further require the use of material removal and surface finishing steps such as machining, polishing or other material removal to produce a finished part." Col. 5, ll. 55-60.

9) White discloses examples in which the coating is hot isostatic pressed at 1150 ºC. Examples 1-3.

10) Bajan discloses "a method for applying metallurgical coatings to a superalloy substrate, and more particularly, to a method for preparing the surface of a gas turbine component and subsequently depositing a metallurgical coating on the surface of the component." Bajan [0002].

11) According to Bajan, it is known in the art to use protective metallurgical coatings to increase the life of a gas turbine component. Bajan [0004]. Bajan states that "gas turbine components include, for example, blades, vanes, buckets, shrouds and similar components, which form part of the hot section of the engine." Bajan [0049].

12) According to Bajan, it is known in the art to use the HVOF process to deposit a metallic layer over the substrate of an article that is used in a gas turbine engine. "The metallic layer is formed from high temperature, oxidation-resistant alloys including nickel-based superalloys." Bajan [0007].

13) Bajan teaches subjecting the coated substrate to Hot Isostatic Pressing (HIP) 'to densify and reduce the porosity of the HVOF coating,

and simultaneously eliminate or ‘heal’ any residual porosity in the superalloy casting to which the HVOF coating is applied. The HIP treatment is performed on the coated substrate to obtain a metal product having the desired finished dimensions and diffusion bonding between the coating material and the substrate.” Bajan [0046].

14) Bajan discloses that the thickness of the metallurgical coatings applied to the surfaces of gas turbine components can range from 0.001" to 0.100". Bajan [0049].

ANALYSIS

Appellants argue that the Examiner has failed to identify a teaching or suggestion in White of several of the recited claim elements. For the reasons discussed below, we find these arguments unpersuasive and affirm the rejection of claims 1-19 and 21 for essentially those reasons set forth in the Examiner’s Answer.

Providing a restoration nickel-base superalloy different from that of the nickel-base superalloy article (claims 1-7 and 12-19)

Appellants contend that “[t]here is no suggestion . . . in White that the restoration material is a ‘nickel-base superalloy different from that of the nickel-base superalloy article.’” Reply 4. Appellants argue that unlike the claimed invention, in White’s examples “the applied coating material is different from the substrate, but the applied coating material is not a nickel-base superalloy.” Reply 4.

The Examiner relies on White’s disclosure at col. 5, lines 21-24 which teaches that "[t]he coating material to seal the crack prior to hot isostatic pressing, is chosen to match the superalloy substrate material or it can be deliberately made to be different." Answer 3 and 6. White clearly teaches that the superalloy may have a nickel-base. (Findings of Fact 2 and 5). In our view, these findings are sufficient to establish that one of ordinary skill in the art would have been motivated to use "a restoration nickel-base superalloy different from that of the nickel-base superalloy article" in White's process. *See KSR Int'l Co. Teleflex, Inc.*, 127 S. Ct. 1727, 1741, 82 USPQ2d 1385, 1396 (2007)(*quoting In re Kahn*, 441 F.3d 977, 988, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006)) ("analysis [of whether the subject matter of a claim is obvious] need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.").

Specific compositional limitations (claims 7-11 and 15-19)

Appellants argue that White fails to teach the specific nickel-base superalloy compositions recited in the claims. The Examiner, however, found that White's process is applicable to a broad range of superalloys which would include the claimed compositions. Answer 4. (*See* Finding of Fact 2). Thus, the burden was properly shifted to Appellants to demonstrate that the claimed compositions and those of White are not the same (*see In re Spada*, 911 F.2d 705, 708, 15 USPQ2d 1655, 1657-58 (Fed. Cir. 1990) ("[W]hen the PTO shows sound basis for believing that the products of the applicant and the prior art are the same, the applicant has the burden of showing that they are not"; *In re Best*, 562 F.2d 1252, 1255-56, 195 USPQ 430, 433-34 (CCPA 1977)), or that the claimed composition produce a new and unexpected result which is different in kind and not merely in degree from the prior art (*see In re Huang*, 100 F.3d 135, 139, 40 USPQ2d 1685, 1688-89 (Fed. Cir. 1996)).

Providing the nickel-base superalloy article that has previously been in service (Claims 1-19 and 21)

Appellants argue that there is no teaching in White of the limitation "providing the nickel-base superalloy article that has previously been in service" in respect to White's process. Reply 4. Appellant notes that White is concerned with repairing cracks, and that cracks can arise for reasons other than service. Reply 5.

We are in agreement with the Examiner’s finding that one of ordinary skill in the art would understand that White’s process is applicable to repair of articles that have been in service based on White’s disclosure that cracks may occur when the article is in operation or during manufacture. Answer 4. (*See* Finding of Fact 3). Moreover, because the articles disclosed in White are used in the same applications as the claimed superalloy articles (*see* Finding of Fact 1), we find that the Examiner has reasonably concluded that, when in service, White’s articles would be subjected to temperatures in the range recited in claims 3 and 18. Answer 7.

Providing the nickel-base superalloy article comprising a gas turbine stationary flowpath shroud (Claims 4-6, 8-11, 15-19 and 21)

Appellants argue that “[t]here are at least two distinctly different types of shrouds in a gas turbine engine.” Reply 7. Appellants contend that the Examiner has not explained how the language of White could be construed as directed to a "stationary flowpath shroud" as specified in the claims, e.g. claims 4 and 15. We are in agreement with the Examiner’s finding (*see* Answer 7) that one of ordinary skill in the art would reasonably conclude that White's method is applicable to a stationary flowpath shroud given White's teaching that the invention is applicable to "articles such as turbine shrouds." *See* Finding of Fact 1.

Redrilling the cooling holes (claims 6, 8-11, 16 and 21)

Appellants argue that White's disclosure of "surface finishing steps" is not a teaching of a step of redrilling cooling holes. We again find ourselves in agreement with the Examiner's determination that one of ordinary skill in the art would find this step readily apparent from White's disclosure. Answer 8. White contemplates the repair of articles having a structure that commonly includes holes. Findings of Fact 1 and 3. Moreover, White teaches that "material removal and surface finishing steps such as machining, polishing or other material removal" may be required after coating to produce a finished part." Finding of Fact 6.

Heating the article to specific temperatures and/or times (claims 13-19)

The Examiner determined that it would have been obvious to vary parameters such as time and temperature in White's process to achieve the desired amount of diffusion between layers. Answer 4. Appellants argue that White fails to teach that heating temperature is a result effective variable. Br. 12 & 13, Reply 16 & 17. We are in agreement with the Examiner's determination that the claimed processing times and temperatures are prima facie obvious in view of White's disclosure of comparable operating parameters. *See* Findings of Fact 7 and 9. A prima facie case of obviousness exists where the prior art and claimed ranges overlap, as well as in those cases where the claimed range and the prior art range, though not overlapping, are sufficiently close that one skilled in the art would have expected them to have the same properties. *See In re*

Geisler, 116 F.3d 1465, 1469, 43 USPQ2d 1362, 1365. Thus, the burden was properly shifted to Appellants to provide evidence of unexpected results with respect to the claimed ranges. Appellants have not met this burden.

Coating thickness of from about 0.030 to about 0.150 inches
(claims 12 and 19)

The Examiner concedes that the thickness of White's coatings is less than the thicknesses recited in claims 12 and 19. The Examiner relies on Bajan for a teaching that it was known in the art, at the time of the invention, to deposit coatings having the claimed thickness by the HVOF process on turbine parts which are then subjected to isostatic pressing. The Examiner concluded that it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the White process to result in the claimed coating thickness to achieve a desirable combination of properties, such as both a desired finished dimension and diffusion bonding between the coating material and the substrate following isostatic pressing, as taught by Bajan. Answer 5.

Appellants contend that the Examiner's rejection is based on hindsight reconstruction because Bajan relates to different types of coatings than those claimed, and Bajan's method, unlike White's method, requires initial processing to a special surface morphology.

In an obviousness determination, the relevant inquiry is "what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art." *In re Kotzab*, 217 F.3d 1365, 1370, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000). As noted by the Examiner, both White and Bajan are directed to application of metallurgical coatings to gas turbine components by the HVOF process followed by HIP to densify the coating. Answer 11. Both references are concerned with minimizing damage that can occur in gas turbine components. *See* Findings of Fact 6, 7, 11 & 13. White teaches that the coating thickness prior to HIP is "generally" about 0.001 to 0.010 inches thick before HIP diffusion bonding and Bajan discloses that the thickness of the metallurgical coatings applied can range from 0.001" to 0.100". *See* Findings of Fact 6 and 14. Thus, in our view, the Examiner has set forth a reasonable basis to conclude that one of ordinary skill in the art, upon reading White and Bajan, would have been motivated to increase the thickness of White's coating to within the claim 12 and 19 ranges. *See Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1168, 77 USPQ2d 1865, 1872 (Fed. Cir. 2006) ("normal desire of scientists or artisans to improve upon what is already generally known provides the motivation to determine where in a disclosed set of percentage ranges is the optimum combination of percentages").

ORDER

The rejection of claims 1-11, 13-18, and 21 under 35 U.S.C § 103(a) as unpatentable over White is affirmed.

The rejection of claims 12 and 19 under 35 U.S.C § 103(a) as unpatentable over White in view of Bajan is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(iv)(2006).

AFFIRMED

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