UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte YIPING HU, WILLIAM F. HEHMANN,
and FEDERICO RENTERIA

Appeal 2007-1852
Application 10/936,925
Technology Center 1700

Decided: July 6, 2007

Before CHUNG K. PAK, 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 10-13 and 15-18, the only claims pending in this application. We have jurisdiction over the appeal pursuant to 35 U.S.C. § 6(b).

We affirm.

Appellants' invention relates to methods for coating turbine engine components, such as turbine blades, to prevent erosion due to wear,

corrosion, oxidation, thermal fatigue, foreign particle impact, and other hazards. (Specification [0001]). The method utilizes a cold gas-dynamic spray technique to coat high pressure turbine (HPT) component surfaces with mixtures of MCrAlY alloys and abrasive materials. (Specification [0012]). Independent claim 10 is illustrative of the invention:

10. A method for coating a surface of a turbine component with an environment-resistant and wear-resistant material, comprising the step of:

forming an abrasive coating by cold gas-dynamic spraying a powder material on the turbine component surface, the powder materia1 comprising a mixture of:

MCrAlY powder, with M being selected from Ni, Co and mixtures thereof, and

an abrasive powder being selected from the group consisting of carbides, and oxides; and

heat treating the turbine component at a temperature sufficiently high to consolidate and homogenize the abrasive coating after the cold gas-dynamic spraying.

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

Matarese	US 4,744,725	May 17, 1988
Benoit	US 5,551,840	Sep. 3, 1996
Howard	US 2002/0197155	Dec. 26, 2002
Seth	US 2003/0126800	Jul. 10, 2003

The Examiner made the following rejections:

1. Claims 10-13, 15, 16, and 18 under 35 U.S.C § 103(a) as unpatentable over Seth in view of Howard and Benoit.

2. Claim 17 under 35 U.S.C § 103(a) as unpatentable over Seth in view of Howard, Benoit, and Matarese.

ISSUE

The Examiner contends that it would have been obvious to one of ordinary skill in the art at the time of the invention to have modified Seth's MCrAlY cold spraying process to include the abrasive oxides or abrasive carbides disclosed by Benoit. Appellants contend that the Examiner has failed to establish the requisite teaching, suggestion, or motivation for this modification within the meaning of 35 U.S.C. § 103. The issue for us to decide is: Has the Examiner identified sufficient factual basis in the prior art to establish that one of ordinary skill in the art would have been motivated to combine Seth and Benoit in the manner claimed?

For the reasons discussed below, we answer this question in the affirmative.

RELEVANT FINDINGS OF FACT

1) The cold gas dynamic spray process is referred to as a "cold gas" process because the particles are mixed and applied at a temperature that is well below their melting point. The kinetic energy of the particles on impact with the target surface, rather than particle temperature, causes the particles to plastically deform and bond with the target surface. Therefore, bonding to the HPT component surface takes place as a solid state process with insufficient thermal energy to transition the solid powders to molten droplets. (Specification [0014]).

2) In an exemplary embodiment of the invention, the MCrAlY powder includes one or more alloys with M being Ni, Co, or

combinations of Ni and Co. Exemplary abrasive materials include diamond, cubic boron nitride (CBN), and various carbides and oxides. (Specification [0016]).

3) Seth discloses that it is known in the art to electrodeposit a coating of hard particles embedded within a matrix on the surface of certain gas turbine engine components. (Seth [0006]).

4) Seth discloses that known metallic bond coat materials include MCrAlY and MCrAlRe, where M may be nickel, cobalt or iron or a mixture thereof. (Seth [0004]).

5) According to Seth, a drawback of the electrodeposition process, as well as other similar processes employing solutions such as electroplating or electroless plating, is lack of precise control in the placement of abrasive particles on the blade tips. (Seth [0007]).

6) Seth is directed to overcoming the drawbacks of the prior art by means of a cold spray process which co-deposits hard particles with a matrix material on the substrate. According to Seth, the co-deposition of the matrix material and hard particles may be effected by directing relative quantities of their constituent particles toward the substrate surface at a velocity sufficiently high to cause at least some of the matrix material particles to deform and to bond to the substrate surface while entrapping at least a portion of the hard particles within the matrix material to form a matrix composition on the substrate. The matrix composition forms an abrasive coating on the substrate. (Seth [0012]).

7) Seth teaches that the matrix material may be a MCrAlY composition or other suitable compositions provided the matrix material entraps the hard particles, forms a sufficient bond strength with the substrate, is resistant to high temperatures and oxidation, and has sufficient mechanical properties to maintain its shape on the substrate. (Seth [0010]).

8) The hard particles utilized in Seth's process include cubic boron nitride, diamond or other suitable particles having an appropriate level of hardness. (Seth [0010]). The hard particles have an average nominal particle diameter of between about 0.005 and 0.010 inches. (Seth [0024]).

9) According to Benoit, a known problem which occurs in the compressor and turbine sections of gas turbine engines is that the blade tips come into proximity to the inner wall of the engine case, rubbing the case wall, or an abradable seal or rubstrip located on the case wall. (Benoit, col. 1, ll. 17-20).

10) Benoit discloses that a known method of extending the life of a blade tip is to apply abrasive layers to the blade tip surface. Methods of applying the abrasive layers include powder metallurgy techniques, plasma spray techniques, and electroplating techniques. (Benoit, col. 1, ll. 62-64).

11) Benoit references specific prior art techniques for providing an abrasive layer on a blade wherein the layer is described as abrasive particulates entrapped within or encapsulated by the metal matrix. (*See* Benoit, col. 1, l. 64 – col. 2, l. 30).

12) Benoit states that a goal of his coating method is to deliberately place abrasive coating material on the airfoil surfaces in the corner areas where the leading and trailing edges of the blade intersect the blade tip surface. (Benoit, col. 2, l. 67 – col. 3, l. 4).

13) Benoit states that the disclosed coating method is applicable to known types of compressor and turbine blades such as those made of a cobalt or nickel superalloy, especially a single crystal nickel superalloy, titanium, or a titanium alloy. (Benoit, col. 3, l. 65 – col. 4, l. 2).

14) Benoit teaches that the disclosed blade tip abrasive coatings may be applied to the blade by electroplating, plasma spraying, powder metallurgy techniques, laser welding, and brazing. (Benoit, col. 4, ll. 6-10).

15) In an exemplary embodiment, Benoit discloses application of a coating to a component by electrodepositing nickel, followed by submersion of the component in a slurry of plating solution and particulates. (Benoit, col. 6, ll. 10-16).

16) Benoit teaches the use of CBN particulate abrasive, as well as "the use of other abrasive materials, including but not limited to alumina and alumina-zirconia" (col. 5, ll. 7-10), in particular aluminum oxide/zirconium oxide and aluminum oxide (Example 1).

ANALYSIS AND CONCLUSIONS

Appellants' traversal of the Examiner's final rejection is based solely on the Examiner's proposed combination of Benoit and Seth. In particular,

Appellants contend that the Examiner failed to establish a teaching, suggestion, or motivation for modifying Seth's MCrAlY cold spraying process to include the abrasive oxides or abrasive carbides disclosed by Benoit. (Br. 3).

Contrary to Appellants' contention, we find that the facts and reasons set forth by the Examiner provide a reasonable basis to conclude that one of ordinary skill in the art would have been motivated to combine the references in the manner claimed. Accordingly, we affirm the Examiner's rejection of claims 10-13 and 15-18 for the reasons well-stated in the Examiner's Answer.

A prima facie case of obviousness is established where the Examiner demonstrates that the invention is nothing more than the predictable result of a combination of familiar elements according to known methods. *See KSR Int'l Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1739, 82 USPQ2d 1385, 1395 (2007). In this case, the Examiner found that both Benoit and Seth are directed to methods of extending the life of blade tips by applying abrasive layers to the blade tip surface. (*See* Findings of Fact 3-6 and 10-12). Both Benoit and Seth disclose that known methods of applying the abrasive layers include powder metallurgy techniques, plasma spray techniques, and electroplating techniques. (Findings of Fact 3 and 10). Benoit teaches that alumina and alumina-zirconia are suitable abrasives for use in these conventional processes of applying abrasive layers. (Finding of Fact 16). Seth discloses that a cold spraying process may be used to apply abrasive layers and provides improved results over the afore-mentioned conventional processes. (Finding of Fact 6). Therefore, one of ordinary skill in the art

would reasonably conclude that alumina and alumina-zirconia could be used as the abrasive in a cold spraying process.

Accordingly, the rejection of claims 10-13, 15, 16, and 18 under 35 U.S.C. § 103(a) as unpatentable over Seth in view of Howard and Benoit is affirmed. Because Appellants have not presented any additional substantive arguments with respect to claim 17, the rejection of claim 17 under 35 U.S.C. § 103(a) as unpatentable over Seth in view of Howard, Benoit, and Matarese is also 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)(1)(iv).

AFFIRMED

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