

The opinion in support of the decision being entered today was **not** written for publication and is **not** binding precedent of the Board.

Paper No. 16

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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*Ex parte* JON C. SCHAEFFER,  
RUSSELL L. MCCARRON and DENNIS M. GRAY

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Appeal No. 1998-2295  
Application No. 08/435,902

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ON BRIEF

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Before WALTZ, LIEBERMAN and JEFFREY T. SMITH, *Administrative Patent Judges*.  
JEFFREY T. SMITH, *Administrative Patent Judge*.

***DECISION ON APPEAL***

Applicants appeal the decision of the Primary Examiner finally rejecting claims 1 to 4, 6 to 13 and 15 to 20.<sup>1</sup> We have jurisdiction under 35 U.S.C. § 134.

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<sup>1</sup> The Examiner has indicated that the subject matter of claim 21 was allowable. However the claim has been objected to as depending on a rejected claim. (Final Rejection, p. 7).

### ***BACKGROUND***

Appellants' invention relates to materials used in aircraft turbine engines. More specifically the invention is directed to titanium based alloys coated with a protective coating. The protective coating is composed of a mixture of matrix metal and ceramic particles. The ceramic particles are embedded in the matrix metal. The coating is said to provide protection against diffusionally based oxidation and hot corrosion and hot erosion. (Specification, pp. 2 and 3). The coating is also said to avoid the creation of thermal strains and stress that would result due to differences in thermal expansion coefficients of the coating and metallic substrate. (Specification, p. 3). The coefficient of thermal expansion of the coating relates to the relative amount of metallic constituents, which have a high coefficient of thermal expansion, and the ceramic constituents, which have a low coefficient of thermal expansion. Thus the components of the coating are selected to provide a coefficient of thermal expansion that matches the substrate. (Specification, p. 4). Claims 1, 9 and 12, which are representative of the claimed invention, appear below:

1. An article comprising:  
a substrate formed of a first metal comprising a titanium-based alloy; and  
a coating directly in contact with the substrate, the coating being formed of a mixture comprising a second metal and a ceramic, wherein the ceramic is selected from the group consisting of an oxide, a nitride, and a silicide.
  
9. An article comprising:  
a substrate which is an uncooled component of a gas turbine engine, the substrate being formed of a first metal comprising a titanium-base alloy; and

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a coating directly in contact with the substrate, the coating being formed of a mixture of a ceramic and a second metal, the second metal being selected from the group consisting of a nickel-base alloy and a cobalt-base alloy, wherein the substrate has a substrate coefficient of thermal expansion, and the mixture has a mixture coefficient of thermal expansion, and wherein the relative amounts of the ceramic and the second metal in the mixture are such that the coefficient of thermal expansion of the mixture is about the same as the substrate coefficient of thermal expansion over at least some temperature range.

12. A method for preparing an article, comprising the steps of:  
providing a substrate made of a first metal comprising a titanium-base alloy; and  
applying a coating directly in contact with a surface of the substrate, the coating being formed of a mixture of a second metal and a ceramic, wherein the step of applying includes the steps of  
determining the thermal expansion coefficient of the substrate, and  
selecting a coating proportion of the second metal and the ceramic such that the thermal expansion coefficient of the coating has a selected relation to the thermal expansion coefficient of the substrate.

#### ***CITED PRIOR ART***

As evidence of unpatentability, the Examiner relies on the following references:

Hodshire et al. (Hodshire)	3,785,785	Jan. 15, 1974
Wolfla	3,864,093	Feb. 04, 1975
Wilbers et al. (Wilbers)	4,250,610	Feb. 17, 1981
Blackburn et al. (Blackburn)	4,292,077	Sep. 29, 1981
Quets	5,223,332	Jun. 29, 1993

The Examiner rejected claims 9, 10, 12, 13 and 15 to 20 as unpatentable under 35 U.S.C. § 103(a) as obvious over the combination of Quets and Wilbers. Claim 11 is rejected

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as unpatentable under 35 U.S.C. § 103(a) as obvious over the combination of Quets, Wilbers and Blackburn. Claims 1, 3, 4, 6 to 9, 12, 13, 15, 16 and 18 to 20 are rejected as unpatentable under 35 U.S.C. § 103(a) as obvious over the combination of Wolfla and Hodshire. Claims 2, 10, 11 and 17 are rejected as unpatentable under 35 U.S.C. § 103(a) as obvious over the combination of Wolfla, Hodshire and Blackburn. (Answer, pp. 4 to 9).

### **DISCUSSION**

We have carefully reviewed the claims, specification and applied prior art, including all of the arguments advanced by both the Examiner and Appellants in support of their respective positions. This review leads us to conclude that the rejections of claims 2, 6 and 9 to 20 are not well founded. However, we will sustain the rejection of claims 1, 3, 4, 7 and 8. Our reasons appear below.

The Examiner has rejected claims 1, 3, 4, 6 to 9, 12, 13, 15, 16 and 18 to 20 as unpatentable under 35 U.S.C. § 103(a) as obvious over the combination of Wolfla and Hodshire. The subject matter of claim 1 describes an article comprising a titanium substrate and a coating directly on the substrate that comprises a mixture of a metal matrix and ceramic particles. Wolfla describes coating substrates, useful as turbine engine blades, with a coating comprising a metal and ceramic particles. (Col. 1, l. 68 to col. 2, l. 58). Wolfla discloses suitable substrate material is used in various corrosive environments

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and is selected from a variety of metals and metal alloys. Wolfla discloses refractory metal alloys are suitable substrate materials however, titanium base alloy is not disclosed. (Col. 3, ll. 15 to 40). Hodshire describes substrates useful as turbine engine blades. Hodshire discloses suitable substrates include refractory metal alloys such as titanium alloys. (Col. 1, ll. 14 to 17 and 52 to 59). Thus, the use of titanium-based alloys as the substrate in the Wolfla invention would have been obvious to one of ordinary skill in the art because titanium base alloys are known refractory metal alloys.

Wolfla discloses the coating is usually about 0.003 inches or thicker and formed from a metal matrix and ceramic particles that include aluminum oxide, chromium oxide and silicon dioxide. (Col. 2, ll. 29 to 36). Nickel and cobalt alloys are disclosed to be suitable for the metal alloy matrix coating. (Col. 2, ll. 53 to 58). These disclosures meet the limitations of claims 3, 4, 7 and 8.

The combination of Wolfla and Hodshire does not render the subject matter of claims 6, 9 and 12 obvious. These claims describe the selection of the substrate and coating so that there is a relation of the coefficient of thermal expansion for the substrate and the coating. Neither reference discloses or describes the need for the coefficient of thermal expansion for the substrate and the coating to be about the same. The references also do not discuss the determination of the coefficient of thermal expansion for the substrate and the selection of

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the coating based on this determination so that the coefficient of thermal expansion of the substrate and coating are about the same. Consequently, the rejection of claims 6, 9, 12, 13, 15, 16 and 18 to 20 over Wolfla and Hodshire is reversed.

The Examiner added the Blackburn reference to the combination of Wolfla and Hodshire to reject claims 2, 10, 11 and 17.

Claims 2, 10, 11 and 17 define the substrate of the claimed invention as comprising an alloy of titanium and aluminum or titanium, niobium and aluminum. The Examiner relies on Blackburn to disclose that the use of alloys comprising titanium, aluminum and/or niobium is known to be used in turbine engines. The Examiner concludes that the teachings of Hodshire and Blackburn would have rendered obvious the use of a titanium-aluminum-niobium alloy as the substrate in Wolfla. (Answer, p. 9). The mere fact that the prior art could be modified would not have made the modification obvious unless the prior art suggested the desirability of the modification. *In re Gordon*, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed. Cir. 1984); *In re Laskowski*, 871 F.2d 115, 117, 10 USPQ2d 1397, 1398 (Fed. Cir. 1989). The record indicates that the motivation relied upon by the Examiner for selection of a particular substrate comes from the Appellants' description of their invention in the specification rather than coming from the applied prior art and that, therefore, the Examiner used impermissible hindsight in rejecting the claims. *See W.L. Gore &*

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*Associates v. Garlock, Inc.*, 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983);  
*In re Rothermel*, 276 F.2d 393, 396, 125 USPQ 328, 331 (CCPA 1960). Accordingly, we reverse the Examiner's rejection under 35 U.S.C. § 103(a) over Wolfla, Hodshire and Blackburn.

The Examiner relies on the combined teachings of Quets and Wilbers to reject claims 9, 10, 12, 13 and 15 to 20 under 35 U.S.C. § 103(a). The Examiner adds Blackburn to the teaching of Quets and Wilbers to reject claim 11 under 35 U.S.C. § 103(a). We reverse each of these rejections.

Quets describes duplex coatings for various substrates. Suitable substrates include titanium alloys. (Col. 4). The duplex coating is the combination of an undercoat layer comprising a metal matrix such as tungsten carbide-cobalt, and a top coat layer formed of a ceramic material. The coating of Quets differs from the coating of claims 9 and 12 in that the ceramic material is not mixed with the metal matrix. Quets does not disclose that the top coat and undercoat are mixed together. The Examiner does not rely on Wilbers to remedy this deficiency. The Examiner cites Wilbers to teach "matching coefficients of thermal expansion between gas turbine part substrates". (Answer, p. 5). The matching of thermal expansion coefficients would not motivate a person of ordinary skill in the art to form a coating that is a mixture of a metal matrix and a ceramic material as required by claims 9

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and 12. The addition of the Blackburn reference also does not remedy the deficiency in the teachings of Quets. We therefore reverse the rejection of claims 9, 10, 11, 12, 13 and 15 to 20.

We note the Examiner has taken official notice regarding several features of the claimed invention throughout the prosecution of this application. The Examiner has refused to provide evidence of the various embodiments of the claimed invention even though the Appellants have seasonably requested the Examiner provide this information. (See MPEP § 2144.03). Once Appellants have seasonably and adequately challenged the facts alleged to be common knowledge, the burden of proof is on the Examiner to provide evidence to support his findings. *Cf. In re Lee*, 277 F.3d 1338, 1342-43, 61 USPQ2d 1430, 1433 (Fed. Cir. 2002).

### ***CONCLUSION***

The rejection of claims 1, 3, 4, 7 and 8 under 35 U.S.C. § 103(a) as obvious over the combination of Wolfla and Hodshire is affirmed. The 35 U.S.C. § 103(a) rejections of claims 2, 6, 9, 10, 11, 12, 13 and 15 to 20 are reversed.

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

**AFFIRMED-IN -PART**

THOMAS A. WALTZ  
*Administrative Patent Judge*

PAUL LIEBERMAN  
*Administrative Patent Judge*

JEFFREY T. SMITH  
*Administrative Patent Judge*

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