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 KATHARINA SEITZ,
STEPHAN SÜßBRICH,
MICHAEL HORNUNG,
HEINRICH KÜHN,
and
FRANK HILTMANN

_____

Appeal No. 2002-0895
Application No. 09/402,552

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ON BRIEF

_____

Before PAK, WALTZ, and TIMM, *Administrative Patent Judges*.

PAK, *Administrative Patent Judge*.

DECISION ON APPEAL

This is a decision on an appeal under 35 U.S.C. § 134 from the examiner's final rejection of claims 20 and 21. Claims 1 through 10 and 12 through 16, the remaining claims in the above-identified application, have been indicated to be allowable.

APPEALED SUBJECT MATTER

The subject matter on appeal is directed to a process for producing a coating having a titanium diboride content of at least 80% by weight. Details of the appealed subject matter are defined by claims 20 and 21 which are reproduced below:

> 20. A process for producing a coating having a titanium diboride content of at least 80% by weight, which comprises applying a spray powder coating of titanium diboride having a thickness of from 0.1 mm to 1 mm, a porosity of not more than 10% by volume and an oxygen content of less than 1% by weight to the surface of a substrate by plasma spraying in an atmosphere which is virtually or completely free of oxygen, with no metal powder being added to the spray powder, and wherein a spray powder having a mean powder particle size of from 10 to 55 µm is substantially or completely melted in a plasma flame in order to apply the coating, the spray powder having an oxygen content in the absence of carbon in the powder of less than or equal to 1% by weight.
>
> 21. The process as claimed in claim 20, wherein plasma spraying is carried out in a virtually or completely oxygen-free atmosphere at a pressure of at least 500 mbar.

THE EVIDENCE

The examiner relies on the following prior art references:

Boxall et al. (Boxall)	4,354,918	Oct. 19, 1982
Gruenr	4,808,487	Feb. 28, 1989

Mills, et al., "Surface Cleaning, Finishing, and Coating," *Metal Handbook*, pp. 363-366 and 368 (9th Ed., Vol. 5, Am. Society for Metals 1982)(hereinafter referred to as "Mills").

Appellants rely on the following reference:

Ananthapadmanabhan et al., "Electrical resistivity of plasma-sprayed titanium diboride coatings," *Journal of Materials Science*, p. 1655 (1993)(hereinafter referred to as "Ananthapadmanabhan").[1]

THE REJECTION

Claims 20 and 21 stand rejected under 35 U.S.C. § 103 as unpatentable over the combined disclosures of Boxall, Mills, and Gruenr.

OPINION

We have carefully reviewed the claims, specification, and evidence, including all of the arguments advanced by both the examiner and the appellants in support of their respective positions. This review has led us to conclude that the examiner's Section 103 rejection is well founded. Accordingly, we will sustain the examiner's Section 103 rejection for the reasons set forth in the Answer and below.

The examiner finds (the Answer, pages 3-4), and we agree, that:

[1] We observe that the appellants have proffered only the first page of this article. We presume that the remaining pages of this article are not material to the examination of this application since the appellants have not submitted them to the examiner in compliance with 37 CFR § 1.56.

> Boxall teaches [a] method for producing a coating having a titanium diboride of at least 80% by weight. Column 4, lines 40-55 and column 2, line 50 through column 3, line 10 (the coating can be 100% titanium diboride). A coating of about 10 mils (about .25 mm) can be applied. Column 4, lines 45-55. The coating is applied by plasma spraying. Column 4, lines 40-55. The porosity of the coating is less than 10% by volume. Column 3, lines 35-45 (the coating is desired to be nonporous). The titanium diboride is to be sprayed at using argon/hydrogen gas. Column 4, lines 40-55. The spray powder is of 100% titanium diboride, so the oxygen content of the powder to be sprayed would be less than 1% by weight.

The examiner states that Boxall does not expressly state that its plasma spraying is carried out in an inert atmosphere and its spray powder has a mean particle size of from 10 to 55 micrometer. See the Answer, page 4. To remedy this deficiency, the examiner relies on the disclosures of Mills and Gruenr. Mills teaches that "throughout the coating industry," plasma spraying is carried out in an inert atmosphere and/or low pressure chamber. See page 364, column 1. The inert atmosphere chamber restricts the formation of undesired oxide, minimizes changes in chemistry of the coating and reduces environmental problems, such as dust and noise. See page 364, columns 2 and 3. Mills teaches (page 364, column 2) that:

> In any good inert gas chamber, oxygen levels can be easily maintained below 30 ppm. Metal powders tend to cleanup when sprayed in an inert gas chamber by the

> reduction of surface oxides. By the same mechanism, some oxide powders tend to reduce when sprayed in an inert atmosphere.

Mills further states that the optimum spray conditions will vary with the chemistry and the particle size of each spray material. See page 364, column 3. Consistent with Mills' and Boxall's teachings, Gruenr also teaches forming a 100% titanium diboride coating or intermediate layer having the claimed thickness by plasma spraying a spray powder having an optimum particle size of 25 micrometer maximum. See column 3, lines 41-60 and column 4, lines 13-27. Specifically, Gruenr teaches (column 3, lines 53-60) that:

> The grade of sprayed powder is advantageously 25 µm maximum, which ensures that all spray powder particles form the spray layer as molten drops not only during the spraying of the coating layer of the adherence layer but also particularly during the spraying of the intermediate layer. In this way and including the effect of the high mechanical impact energy, the compactness of the spray layer is ensured.

Given the above circumstances, we concur with the examiner that one of ordinary skill in the art would have been led to plasma spray titanium diboride powder having the claimed characteristics, including the optimum particle size, such as that claimed, in an inert atmosphere chamber virtually free of oxygen to form a spray powder coating of titanium diboride having the claimed thickness, motivated by a reasonable expectation of

successfully obtaining the advantages indicated *supra*.

The appellants argue that Boxall does not teach or suggest forming a spray powder coating of titanium diboride having an oxygen content of less than 1% by weight. See, e.g., the Brief, page 3. This argument fails at the outset since it is well settled that an applicant cannot show nonobviousness by attacking prior art references individually where, as here, the rejection is based on a combination of prior art references. *In re Young*, 403 F.2d 754, 757, 159 USPQ 725, 728 (CCPA 1968). It is important to recognize that the test for obviousness is what the combined teachings of the prior art references would have suggested to those of ordinary skill in the art. *See In re Keller*, 642, F.2d 413, 425, 208 USPQ 871, 881 (CCPA 1981).

In the present case, we determine that the combined teachings of the prior art references would have suggested forming a spray powder coating of titanium diboride in an inert gas chamber virtually free of oxygen (30 ppm oxygen or less) as indicated *supra*. This inert gas chamber, as indicated *supra*, is said to prevent the formation of undesirable oxides, reduce any oxide present and minimize changes in chemistry of the coating. It then follows that the applied prior art references as a whole would have suggested to one of ordinary skill in the art to form

a spray powder coating of titanium diboride having a low or no oxygen content, such as that claimed, via the employment of an inert gas chamber. The spray powder coating of titanium diboride having the claimed oxygen content would necessarily follow from the suggestions of the prior art references. *See, e.g., Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Int. 1985).

The appellants rely on Ananthapadmanabhan to demonstrate that Boxall does not form a spray powder coating of titanium diboride having the claimed oxygen content. Specifically, the appellants state (the Brief, page 4) that:

> Ananthapadmanabhan et al[.] (J. Mat. Sci., copy attached) have shown that partial oxidation could not be avoided, even when Ar is used as a shield gas. Therefore, it is not within ordinary skill to modify the process of Boxall such that high quality coatings as obtainable from the claimed process herein can be produced (see for example, specification page 5, lines 29-33 and Page 6, lines 21-36).

The appellants again improperly focus on individual prior art references. *Young*, 403 F.2d at 757, 159 USPQ at 728. Considering the applied prior art references as a whole, as we must, we determine that the examiner correctly pointed out at pages 8 and 9 of the Answer that they would not only have suggested employing a shield gas (argon and hydrogen (reducing gas)), but have also suggested using an inert gas chamber to prevent partial oxidation during plasma spraying. The appellants

do not argue, much less point to any evidence, including Ananthapadmanabhan, that one of ordinary skill in the art would not have reasonably expected to form a spray powder coating of titanium diboride having the claimed oxygen content from the process suggested by the applied prior art references, i.e., plasma spraying of a 100% titanium diboride in an inert gas chamber. See the Brief in its entirety.

The appellants argue that the applied prior art references do not teach or suggest the claimed spray powder having a mean particle size of 10 to 55 microns. See. e.g., the Brief, page 4. We do not agree.

As indicated *supra*, Mill teaches that spray powder particles sizes are a result effective variable in a plasma spray coating process. *See In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936-37 (Fed. Cir. 1990) (when the difference between the claimed invention and the prior art is some variable within the claims, the appellants must show that the particular variable is critical); *In re Boesch*, 617 F.2d 272, 276, 205 USPQ 215, 219 (CCPA 1980)(the optimization of result effective variables is well within the ambit of one of ordinary skill in the art). Thus, we conclude that it would have been *prima facie* obvious to employ the optimum plasma spray particle sizes, such as those

claimed, in the process suggested by Boxall and Mills to obtain a desired titanium diboride coating. This is especially true in this case since as indicated *supra*, Gruenr teaches that plasma spray particles having the claimed sizes, i.e., 10 to 25 microns, are useful for forming a desired titanium diboride coating having the claimed thickness. See also the Answer, page 8.

The appellants argue that the prior art references do not teach or suggest a titanium diboride coating having a porosity of not more than 10% by volume. See the Brief, page 4. According to the appellants (the specification, page 6),

> the porosity should be at most 10% by volume . . . . Preference is given to a porosity of from 4 to 6% by volume, since here the pores do not allow bonding between substrate and medium even at relatively low layer thicknesses . . . .

We find that Boxall teaches that it is desirable to form a spray powder coating of titanium diboride on studs made of, e.g., a stainless steel material. See, e.g., column 3, lines 35-40. We find that Boxall states that "a non-porous or impervious coating is most desirable." See column 3, lines 40-42. We find that Boxall subsequently bonds titanium diboride to stainless steel materials in the form of a coating using a plasma spraying technique. See column 4, lines 15-52. We find that Boxall does not suffer from any bonding problem. See Boxall in its entirety.

Under these circumstances, it is reasonable to conclude that Boxall necessarily or inherently forms a titanium diboride coating having the claimed porosity since being able to bond, as indicated *supra*, is dependent on the porosity of a coating.

In any event, the tenor of Boxall indicates that the formation of a substantially non-porous or impervious corrosion-resistant coating is well within the level of one of ordinary skill in the art. See, e.g., column 3, lines 19-60. Thus, we determine that Boxall would have at least suggested the formation of a titanium diboride coating having the claimed porosity. This is buttressed by Mills which teaches the formation of coatings having higher densities and higher bond strength using plasma spraying. See page 363, column 1.

The appellants argue that the pressure condition recited in dependent claim 21 is not taught or suggested by the applied prior art references. We disagree for the reasons well articulated by the examiner at page 9 of the Answer. In particular, we agree with the examiner that the claimed pressure of "at least 500 mbar" includes any pressure above approximately 0.493 atmosphere, thus including the normal or close to normal, atmospheric condition or pressure taught by both Mills and Boxall. Moreover, we determine that the optimization of

pressure conditions is well within the ambit of one of ordinary skill in the art since Mills teaches at page 364 that different pressures (normal or low pressures) can be used in plasma spraying to form desired coatings. *Woodruff*, 919 F.2d at 1578, 16 USPQ2d at 1936-37.

Thus, on this record, we concur with the examiner that the claimed subject matter as a whole would have been obvious to one of ordinary skill in the art within the meaning of 35 U.S.C. § 103. Accordingly, we affirm the examiner's decision rejecting all of the claims on appeal under 35 U.S.C. § 103.

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

AFFIRMED

CHUNG K. PAK Administrative Patent Judge	)	
THOMAS A. WALTZ Administrative Patent Judge	)	BOARD OF PATENT APPEALS AND INTERFERENCES
JAMES T. MOORE Administrative Patent Judge	)	

CKP:hh

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