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- **MOISEI, Dorel M.**
West Hartford, CT 06110 (US)
- **SAXTON, Bruce R.**
West Suffield, CT 06093 (US)
- **RIEHL, John D.**
Hebron, CT 06248 (US)
- **FANG, Xiaomei**
Glastonbury, CT 06073 (US)
- **BRINDLEY, William J.**
Hebron, CT 06248 (US)

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(71) Applicant: **United Technologies Corporation**
Farmington, CT 06032 (US)

(74) Representative: **de Bresser, Sara Jean**
Dehns
St Bride's House
10 Salisbury Square
London EC4Y 8JD (GB)

(72) Inventors:
• **BOGUE, William**
Hebron, CT 06248 (US)

(54) **LOCAL REPAIR OR REMANUFACTURE OF POLYMERIC EROSION COATINGS**

(57) A method including applying a paint primer onto a substrate and applying a filled epoxy paste to the paint primer to provide erosion and corrosion protection to a substrate.

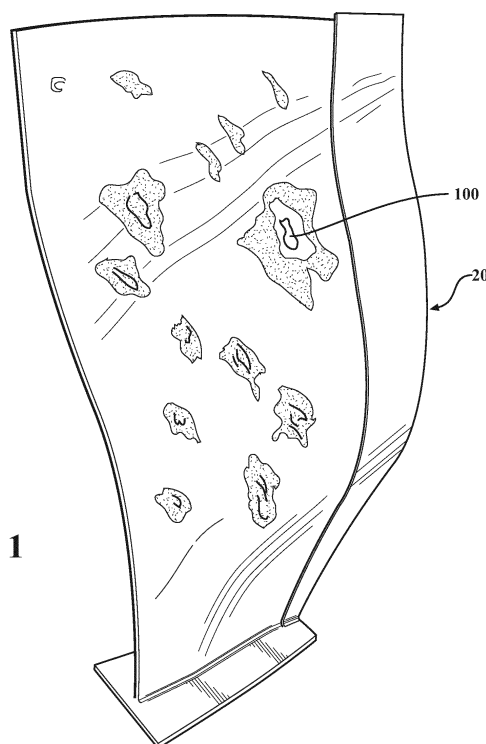


FIG. 1

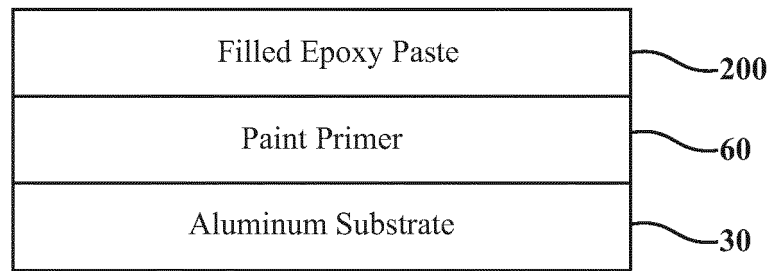


FIG. 3

Description

BACKGROUND

[0001] The present disclosure relates generally to a remanufactures process and, more particularly, to a repair process for aluminum fan blades.

[0002] Gas turbine engines, such as those that power modern commercial and military aircraft, generally include a fan section, a compressor section to pressurize an airflow, a combustor section to burn a hydrocarbon fuel in the presence of the pressurized air, and a turbine section to extract energy from the resultant combustion gases.

[0003] The fan section often includes aluminum fan blades designed with a multi-layer polyurethane erosion coating to protect both sides of the airfoil from operational erosion and subsequent corrosion. The erosion coatings sustain erosion, FOD and local damage in service, but there is only minimal repair capability for these coatings.

SUMMARY

[0004] A method according to one disclosed non-limiting embodiment of the present disclosure e.g. a method for repairing a component or a multi-layer polyurethane erosion coating can include applying a paint primer onto a substrate of a flowpath surface; and applying a filled epoxy paste to the paint primer.

[0005] A further embodiment of the present disclosure may include, wherein the method is applied to a local area.

[0006] A further embodiment of the present disclosure may include, wherein the method provides for a local repair to an erosion coating on a flowpath surface.

[0007] A further embodiment of the present disclosure may include, wherein the method provides for a local repair to an airfoil surface of a fan blade.

[0008] A further embodiment of the present disclosure may include finishing the filled epoxy paste.

[0009] A component according to one disclosed non-limiting embodiment of the present disclosure can include a local area of missing erosion coating with a filled epoxy paste over a substrate that forms an airfoil surface.

[0010] A further embodiment of the present disclosure may include, wherein the substrate is aluminum.

[0011] A further embodiment of the present disclosure may include a paint primer between the filled epoxy paste and the substrate.

[0012] A further embodiment of the present disclosure may include, wherein the paint primer is a corrosion inhibiting paint primer.

[0013] A further embodiment of the present disclosure may include a component obtained by the methods as herein described.

[0014] The foregoing features and elements may be combined in various combinations without exclusivity, unless expressly indicated otherwise. These features

and elements as well as the operation of the invention will become more apparent in light of the following description and the accompanying drawings. It should be understood, however, the following description and drawings are intended to be exemplary in nature and non-limiting.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] Various features will become apparent to those skilled in the art from the following detailed description of the disclosed non-limiting embodiment. The drawings that accompany the detailed description can be briefly described as follows:

Figure 1 is a general schematic view of an exemplary component as a representative workpiece;

Figure 2 is an expanded cross section of the component illustrating the OEM coating system; and

Figure 3 is an expanded cross section of a repair to the component illustrating the repair coating system

DETAILED DESCRIPTION

[0016] Figure 1 schematically illustrates a general perspective view of an exemplary component 20, e.g., a fan blade with a multi-layer erosion coating system for a gas turbine engine. It should be appreciated that although a particular component type is illustrated in the disclosed non-limiting embodiment, other components with a multi-layer erosion coating system such as a part in the air-stream of the engine with an erosion resistant coating, more specifically an airfoil, and even more specifically, a guide vane or a fan blade will also benefit herefrom.

[0017] With reference to Figure 2, a cross-section of the component 20 is illustrated for an aluminum substrate 30 such as a 2000, 6000, or 7000 series aluminum with a multi-layer coating 35. It should be appreciated other materials such as titanium may be provided. The coating 35 includes a phosphoric acid anodize layer 40, a corrosion inhibiting epoxy bond primer 50, a corrosion inhibiting paint primer 60, and an elastomeric erosion coating 70 such as a urethane or fluoroelastomer as the outer layer. It should be appreciated that various materials may be utilized in accords with this layer structure.

[0018] With reference to Figure 3, a local repair 100 for the component 20 may be performed on an airflow surface. That is, the local repair of damage may be performed in response to damage into the erosion coating system 35 and as deep as the aluminum substrate 30. The local repair 100 may be initiated by abrading thru some or all layers in the erosion coating system and may be as deep as the aluminum substrate 30 or for damage that has reached down to the aluminum substrate 30. The erosion coating system adjacent to the damage may be abraded, feathered or otherwise prepared and

cleaned with, for example aluminum oxide and an acetone wipe to provide for adhesion of the repair coating system.

[0019] Next, the corrosion inhibiting paint primer 60 is applied over the aluminum substrate 30. The corrosion inhibiting paint primer 60 provide corrosion protection to the aluminum substrate 30 and also facilitates receipt of a filled epoxy paste 200 such as Duralco 4525 manufactured by Cotronics Corp., of Brooklyn NY USA. It is recognized that for other composite or metallic substrates, the paint primer may not need to provide corrosion protection to the substrate and the use of the primer layer may be optional or a non-corrosion inhibiting primer may be utilized. The epoxy paste provides for relatively faster thickness build rates than elastomeric coating material options facilitating faster overall repair process times. The filled epoxy paste 200 may then be sanded or otherwise finished to provide an acceptable flowpath surface.

[0020] The filled epoxy paste 200 facilitates field repairs, provides erosion protection and protects primer layers within the repair coating system.

[0021] The use of the terms "a," "an," "the," and similar references in the context of description (especially in the context of the following claims) are to be construed to cover both the singular and the plural, unless otherwise indicated herein or specifically contradicted by context. The modifier "about" used in connection with a quantity is inclusive of the stated value and has the meaning dictated by the context (e.g., it includes the degree of error associated with measurement of the particular quantity). All ranges disclosed herein are inclusive of the endpoints, and the endpoints are independently combinable with each other. It should be appreciated that relative positional terms such as "forward," "aft," "upper," "lower," "above," "below," and the like are with reference to the normal operational attitude of the vehicle and should not be considered otherwise limiting.

[0022] Although the different non-limiting embodiments have specific illustrated components, the embodiments of this invention are not limited to those particular combinations. It is possible to use some of the components or features from any of the non-limiting embodiments in combination with features or components from any of the other non-limiting embodiments.

[0023] It should be appreciated that like reference numerals identify corresponding or similar elements throughout the several drawings. It should also be appreciated that although a particular component arrangement is disclosed in the illustrated embodiment, other arrangements will benefit herefrom.

[0024] Although particular step sequences are shown, described, and claimed, it should be appreciated that steps may be performed in any order, separated or combined unless otherwise indicated and will still benefit from the present disclosure.

[0025] The foregoing description is exemplary rather than defined by the limitations within. Various non-limiting

embodiments are disclosed herein, however, one of ordinary skill in the art would recognize that various modifications and variations in light of the above teachings will fall within the scope of the appended claims. It is therefore to be appreciated that within the scope of the appended claims, the disclosure may be practiced other than as specifically described. For that reason the appended claims should be studied to determine true scope and content.

Claims

1. A method, comprising:

applying a paint primer onto a substrate of a flow-path surface; and
applying a filled epoxy paste to the paint primer.

2. The method as recited in claim 1, wherein the method is applied to a local area.

3. The method as recited in claim 1 or claim 2, wherein the method provides for a local repair to an erosion coating on a flowpath surface.

4. The method as recited in any preceding claim, wherein the method provides for a local repair to an airfoil surface of a fan blade.

5. The method as recited in any preceding claim, further comprising finishing the filled epoxy paste.

6. The method as recited in any preceding claim wherein the method provides for repair of a multi-layer polyurethane erosion coating.

7. A component comprising:

a local area of missing erosion coating with a filled epoxy paste over a substrate that forms an airfoil surface.

8. The component as recited in claim 7, wherein the substrate is aluminum.

9. The component as recited in claim 7 or claim 8, further comprising a paint primer between the filled epoxy paste and the substrate.

10. The component as recited in any one of claims 7-9 wherein said component is a gas turbine engine component.

11. The component as recited in claim 10 wherein said component is a part in the airstream of the engine.

12. The component as recited in any one of claims 7 to

11 wherein said component is an airfoil.

- 13.** The component as recited in any one of claims 7 to 12 wherein said component is a guide vane or a fan blade.

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- 14.** The component as recited in any one of claims 7 to 13 wherein the erosion coating is a multi-layer polyurethane erosion coating.

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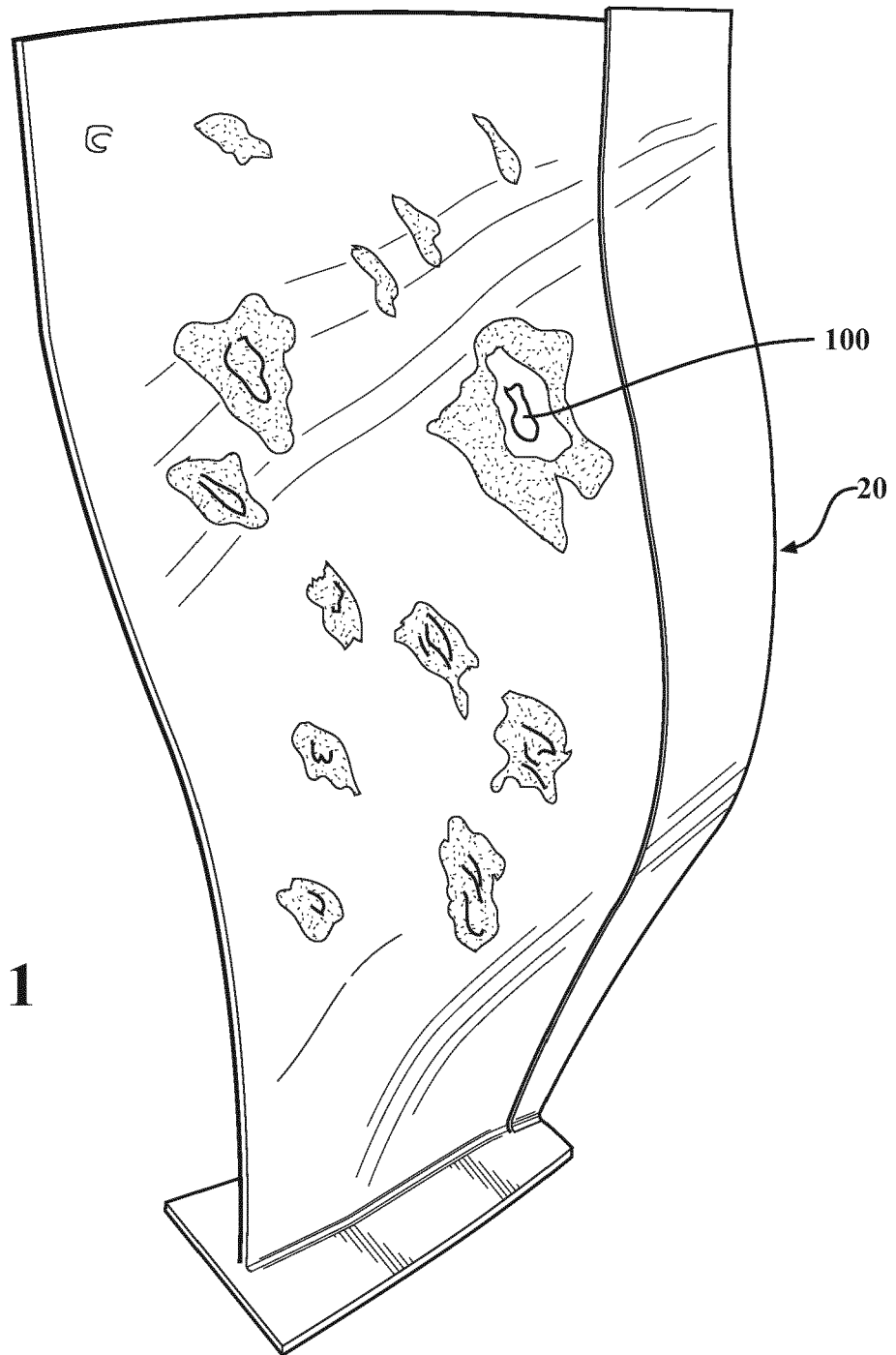
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FIG. 1



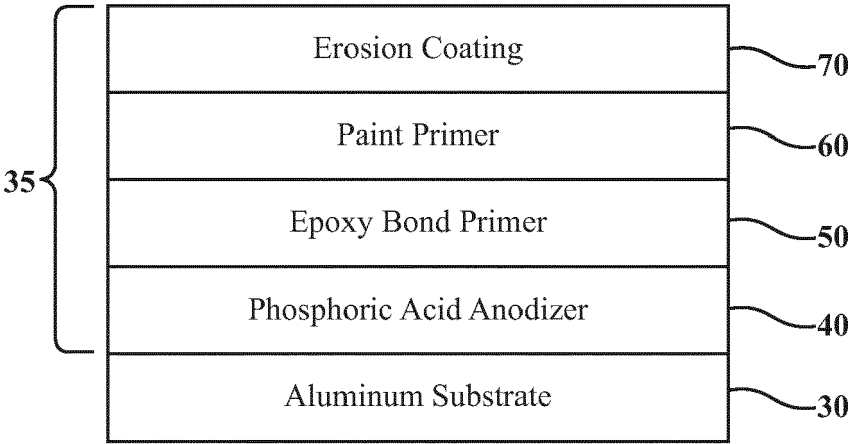


FIG. 2

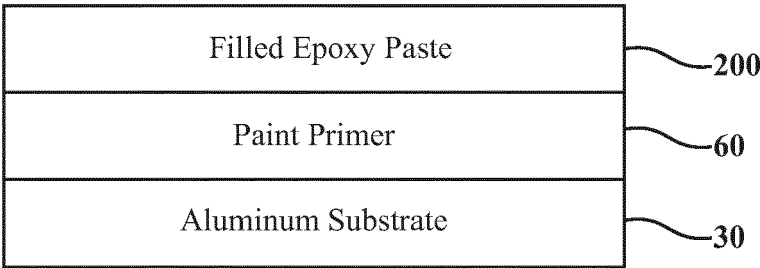


FIG. 3



EUROPEAN SEARCH REPORT

 Application Number
 EP 16 20 4712

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X	US 6 171 704 B1 (MOSSER MARK F [US] ET AL) 9 January 2001 (2001-01-09) * column 4, line 55 - line 62 * * column 5, line 1 - line 8 * * column 6, line 55 - column 8, line 31 * * column 11, line 4 - line 30 * * column 12, line 42 - line 52 * * column 13, line 44 - line 45 *	1-14	INV. B05D5/00 F01D5/00 F01D5/28 ADD. B05D7/00
X	US 2005/019589 A1 (WIEDEMANN KARL ERIK [US] ET AL) 27 January 2005 (2005-01-27) * paragraph [0021] * * paragraph [0057] - paragraph [0060] * * paragraph [0067] - paragraph [0071] *	1-14	
A	US 2005/271881 A1 (HONG SHEK C [US]) 8 December 2005 (2005-12-08) * paragraph [0004] - paragraph [0005] * * paragraph [0007] - paragraph [0014] * * paragraph [0074] - paragraph [0076] *	1-14	
			TECHNICAL FIELDS SEARCHED (IPC)
			B05D F01D
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 15 May 2017	Examiner Maxisch, Thomas
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 16 20 4712

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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