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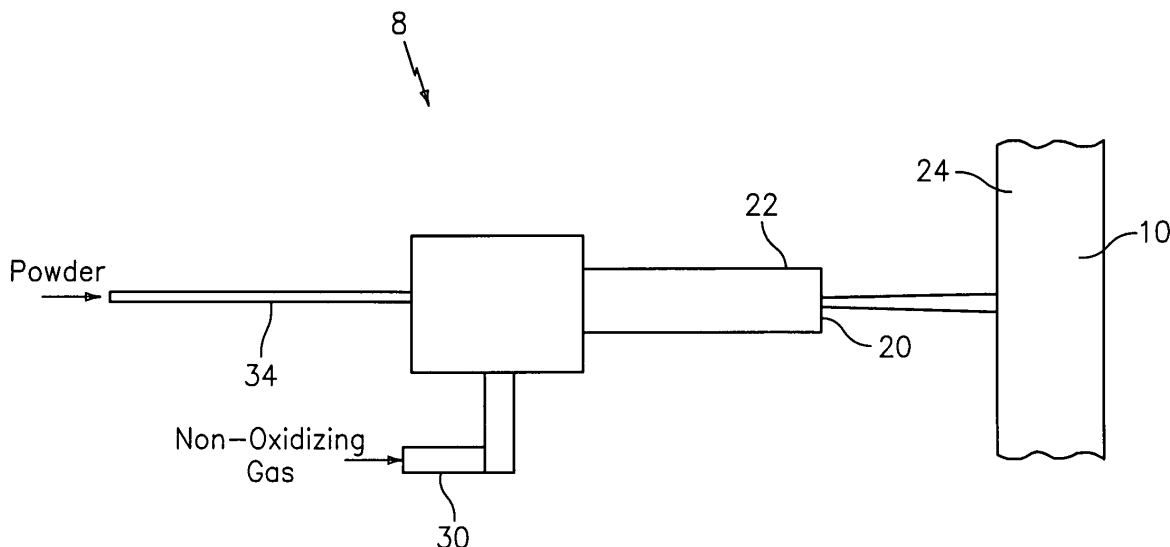
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(54) **Applying bond coat to engine components using cold spray**

(57) A process for applying a coating to a component (10) used in an engine is provided. The process includes the steps of providing a component (10) with at least one surface (24) to be coated, and depositing at least one layer of powder coating material onto the at least one surface (10) using a non-oxidizing carrier gas so that the

powder coating material plastically deforms without melting and bonds to the at least one surface upon impact with the at least one surface. The process of the present invention has particular utility in applying bond coats to airfoil portions of turbine blades or vanes and to applying bond coats to combustion chamber liners.



**FIG. 1**



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# EUROPEAN SEARCH REPORT

Application Number  
EP 06 25 1532

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 398 394 A (HOWMET RESEARCH CORPORATION) 17 March 2004 (2004-03-17) * abstract; figure 1 * * paragraphs [0001], [0016], [0018], [0021], [0022] *	1-21	INV. C23C24/04 F01D5/00
X	US 6 365 222 B1 (WAGNER GREGG P ET AL) 2 April 2002 (2002-04-02) * abstract * * column 1, line 4 - line 8 * * column 4, line 18 - line 22 *	1,18	
X	US 2004/110021 A1 (SETH BRIJ B ET AL) 10 June 2004 (2004-06-10) * abstract; figure 3 * * paragraphs [0007], [0024], [0026] *	1,18,20	
X	US 2002/073982 A1 (SHAIKH FURQAN ZAFAR [US] ET AL) 20 June 2002 (2002-06-20) * abstract; figures 2,3 * * paragraphs [0016], [0019], [0023] *	1,22	
E	EP 1 659 195 A2 (UNITED TECHNOLOGIES CORP [US]) 24 May 2006 (2006-05-24) * abstract; claim 10; figure 1a * * paragraph [0020] *	1,22	TECHNICAL FIELDS SEARCHED (IPC) C23C F01D
A	US 5 302 414 A (ALKHIMOV ET AL) 12 April 1994 (1994-04-12) * abstract * * column 5, line 29 - line 31 *	3,4	
A	GB 2 394 479 A (* UNITED TECHNOLOGIES CORPORATION) 28 April 2004 (2004-04-28) * abstract; claim 3 * * page 4, line 10 - line 29 *	7-10, 14-17	
-/-			
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 30 October 2006	Examiner VON ZITZEWITZ, A
<p>CATEGORY OF CITED DOCUMENTS</p> <p>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</p> <p>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 &amp; : member of the same patent family, corresponding document</p>			

3  
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# EUROPEAN SEARCH REPORT

Application Number  
EP 06 25 1532

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2003/126800 A1 (SETH BRIJ B ET AL) 10 July 2003 (2003-07-10) * abstract * * paragraphs [0010], [0023], [0024] * -----	20	
			TECHNICAL FIELDS SEARCHED (IPC)
The present search report has been drawn up for all claims			
Place of search <b>Munich</b>		Date of completion of the search <b>30 October 2006</b>	Examiner <b>VON ZITZEWITZ, A</b>
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			

3  
EPO FORM 1503 03/02 (P04C01)



European Patent  
Office

Application Number

EP 06 25 1532

### CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

- ☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

### LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- ☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- ☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:



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LACK OF UNITY OF INVENTION  
SHEET B

Application Number  
EP 06 25 1532

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-21

The concept is to set parameters of the cold spray process such as the gas flow rate, which is defined in claims 7-10 and 14-17.

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2. claims: 1, 22

The concept is to apply the cold spray process to a combustion chamber liner, being a specific engine component, as defined in claim 22.

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

EP 06 25 1532

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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30-10-2006

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 1398394	A	17-03-2004	CA 2433613 A1	13-02-2004
			JP 2004076157 A	11-03-2004
-----				
US 6365222	B1	02-04-2002	WO 0234967 A1	02-05-2002
-----				
US 2004110021	A1	10-06-2004	NONE	
-----				
US 2002073982	A1	20-06-2002	DE 10160958 A1	04-07-2002
-----				
EP 1659195	A2	24-05-2006	JP 2006183135 A	13-07-2006
			US 2006108031 A1	25-05-2006
-----				
US 5302414	A	12-04-1994	DE 69016433 D1	09-03-1995
			DE 69016433 T2	20-07-1995
			EP 0484533 A1	13-05-1992
			WO 9119016 A1	12-12-1991
-----				
GB 2394479	A	28-04-2004	CA 2444917 A1	18-04-2004
			DE 10346836 A1	06-05-2004
			FR 2845937 A1	23-04-2004
			JP 2004137602 A	13-05-2004
-----				
US 2003126800	A1	10-07-2003	NONE	
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