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(54) MANUFACTURING METHOD OF A POLISHED BLADED ROTOR USING ROBOTIC POLISHING DEVICE

(57) A manufacturing method includes controlling a robotic polishing device (46), at a controller (48), to polish a plurality of first zones (88A; 90A) of a bladed rotor (20) for an aircraft engine based on a first operating parameter associated with the robotic polishing device (46). An exterior (56) of the bladed rotor (20) includes the first zones (88A; 90A) and a plurality of second zones (88B-F; 90B-F). The first zones (88A; 90A) are distributed circumferentially about an axis (22) of the bladed rotor (20) in a first array. The second zones (88B-F; 90B-F) are distributed circumferentially about the axis (22) of the bladed rotor (20) in a second array. The method further includes controlling the robotic polishing device (46), at a controller (48), to polish the second zones (88B-F; 90B-F) using the robotic polishing device (46) based on a second operating parameter. The second operating parameter for the robotic polishing device (56) is different than the first operating parameter.

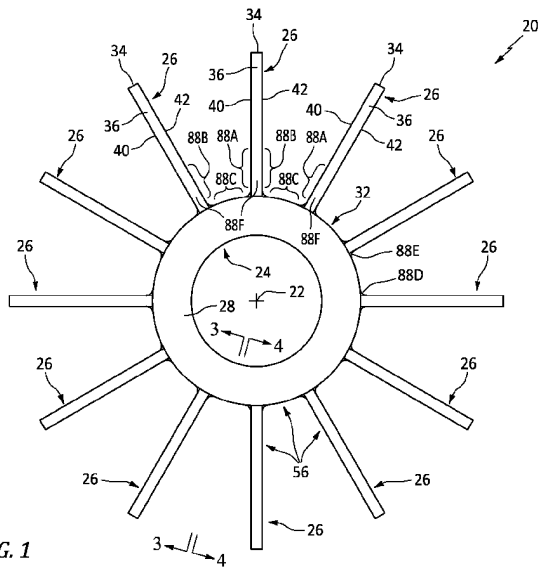

FIG. 1

EP 4 393 642 A3

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EUROPEAN SEARCH REPORT

Application Number
EP 23 22 0614

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	US 2012/124834 A1 (CHOLET STEPHANE [FR] ET AL) 24 May 2012 (2012-05-24) * figures 1,2 * * claims 10, 11 * * paragraphs [0020] - [0023] * * paragraph [0050] * * *	1-14	INV. B24B19/14 B24B19/26 B24B21/16 B24B21/20 B24B27/00 B24B49/16 B24B51/00
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TECHNICAL FIELDS SEARCHED (IPC)
B24B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	23 July 2024	Herrero Ramos, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
O : non-written disclosure
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E : earlier patent document, but published on, or after the filing date
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& : member of the same patent family, corresponding document

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Application Number
EP 23 22 0614

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	ZHAO TAO ET AL: "Surface roughness prediction and parameters optimization in grinding and polishing process for IBR of aero-engine", THE INTERNATIONAL JOURNAL OF ADVANCED MANUFACTURING TECHNOLOGY, SPRINGER, LONDON, vol. 74, no. 5, 8 June 2014 (2014-06-08), pages 653-663, XP035394311, ISSN: 0268-3768, DOI: 10.1007/S00170-014-6020-3 [retrieved on 2014-06-08]	13-15	
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X	XIAO GUIJIAN ET AL: "Path planning method for longitudinal micromarks on blisk root-fillet with belt grinding", THE INTERNATIONAL JOURNAL OF ADVANCED MANUFACTURING TECHNOLOGY, SPRINGER, LONDON, vol. 95, no. 1, 3 November 2017 (2017-11-03), pages 797-810, XP036437879, ISSN: 0268-3768, DOI: 10.1007/S00170-017-1254-5 [retrieved on 2017-11-03]	13-15	TECHNICAL FIELDS SEARCHED (IPC)
Y	* abstract *	1-12	

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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	WANG ZHIWEI ET AL: "Reducing roughness of freeform surface through tool orientation optimization in multi-axis polishing of blisk", THE INTERNATIONAL JOURNAL OF ADVANCED MANUFACTURING TECHNOLOGY, SPRINGER, LONDON, vol. 108, no. 3, 1 May 2020 (2020-05-01), pages 917-929, XP037186450, ISSN: 0268-3768, DOI: 10.1007/S00170-020-05433-4 [retrieved on 2020-05-24]	13-15	
Y	* abstract *	1-12	
X	US 2017/087684 A1 (HAGAN JOHN S [US] ET AL) 30 March 2017 (2017-03-30)	13-15	
Y	* figures 1, 2, 4, 5, 6 * * paragraphs [0004], [0007], [0037] * * paragraphs [0049], [0057], [0103] *	1-12	
			TECHNICAL FIELDS SEARCHED (IPC)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
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EP 23 22 0614

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due 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 those claims for which no payment was due.

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:

☐ The present supplementary 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 (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 23 22 0614

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: 1-12

A manufacturing method, comprising:
polishing a first zone (88A; 90A) of a component (20) for an aircraft engine using a robotic polishing device (46) based on a first operating parameter
polishing a second zone (88B-F; 90B-F) of the component (20) using the robotic polishing device (46) based on a second operating parameter;
wherein the second operating parameter for the robotic polishing device (46) is different than the first operating parameter,
characterised by the special technical feature that
the component is a bladed rotor of an aircraft engine,
a plurality of first and second zones are defined,
distributed circumferentially about the axis of the bladed rotor in a first and second arrays.
Problem solved: particular definition of the polishing zones for a bladed rotor of an aircraft engine.

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2. claims: 13-15

A manufacturing method, comprising:
polishing a first zone (88A; 90A) of a component (20) for an aircraft engine using a robotic polishing device (46) based on a first operating parameter
polishing a second zone (88B-F; 90B-F) of the component (20) using the robotic polishing device (46) based on a second operating parameter;
wherein the second operating parameter for the robotic polishing device (46) is different than the first operating parameter,
characterised by the special technical feature that,
the first and second zones are on an exterior of the component, and the operating parameter comprises one of:
an abrasive polishing belt tension;
an abrasive polishing belt speed;
a pressure exerted by the robotic polishing device (46) against the component (20);
an angle of inclination (92) between a head (52) of the robotic polishing device (46) and the exterior of the component (20) being polished;
a tool path speed of the robotic polishing device (46) along the exterior (56) of the component (20);
an offset (94) between adjacent passes of the robotic polishing device (46) along the exterior (56) of the component (20); or
a tool head configuration for the robotic polishing device (46).
Problem solved: particular definition of the polishing

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 23 22 0614

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:

parameters.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 22 0614

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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23-07-2024

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