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(54) **METHOD OF PRODUCING A COMPONENT**

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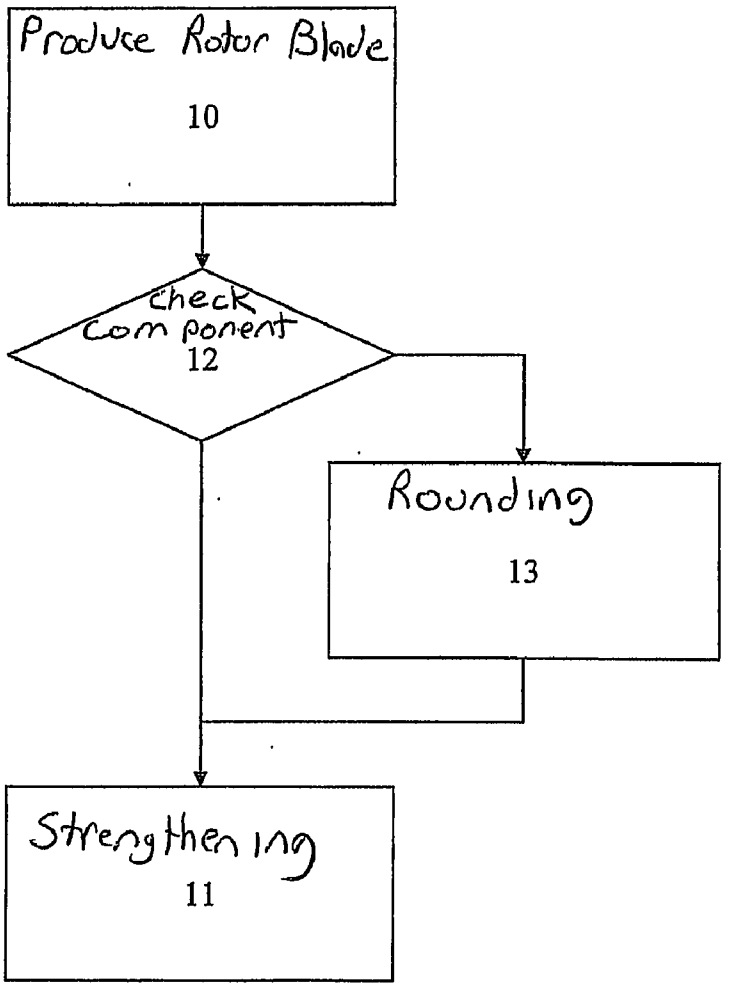
(57) **ABSTRACT**

The present technology relates to a method for producing a component, especially a gas turbine component, with at least the following steps: a) production of a component with several component surfaces, in which at least one transitional area between two component surfaces has a transition radius that is greater than 0.05 mm and less than 0.30 mm; b) strengthening of the component, at least on the transitional area or each transitional area, by ultrasonic shot peening.



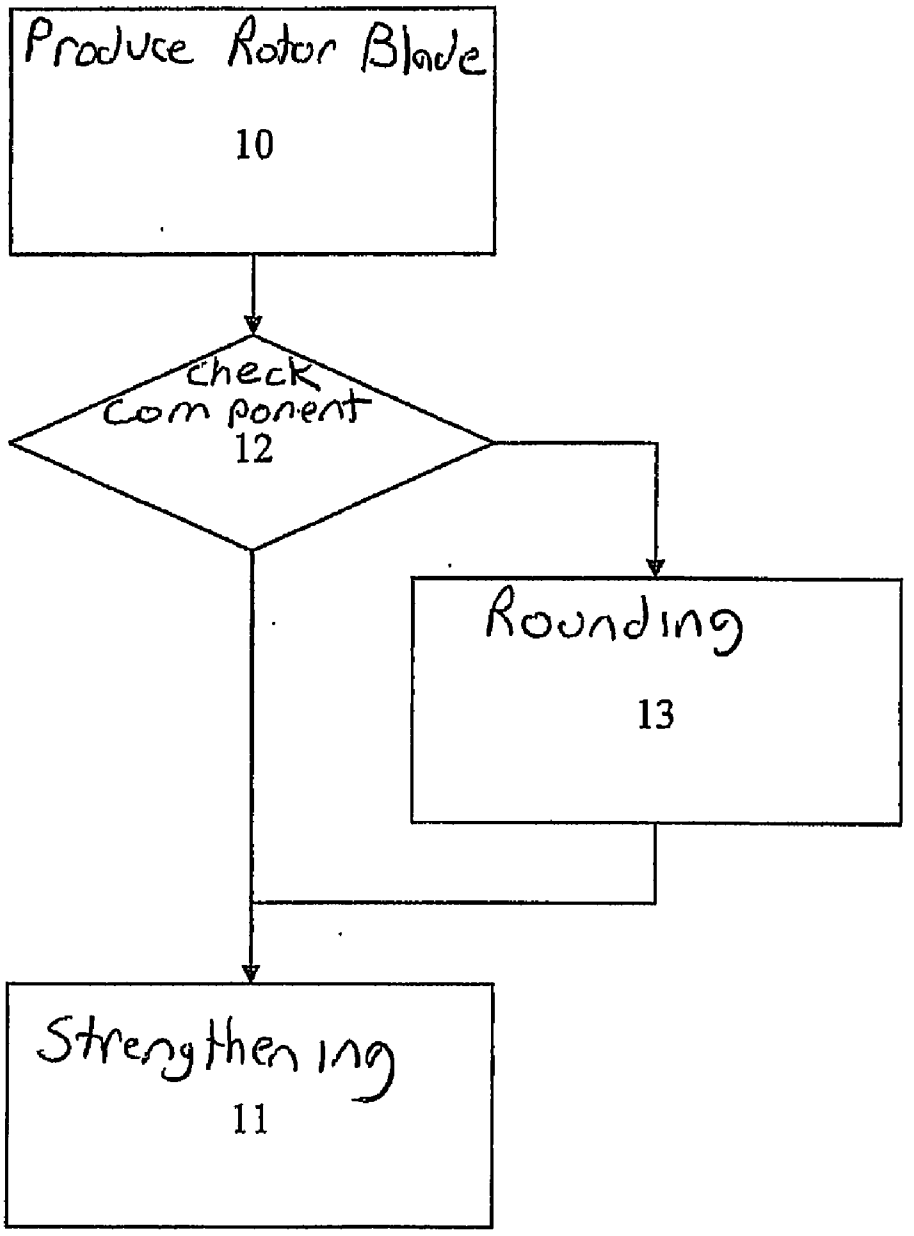

Produce Rotor Blade
10
Check Component
12
Rounding
13
Strengthening
11

FIGURE 1

METHOD OF PRODUCING A COMPONENT

RELATED APPLICATIONS

[0001] This application is a continuation of International Application Serial No. PCT DE/2007/000610 (International Publication Number WO 2007/115550), having an International filing date of Apr. 4, 2007 entitled "Verfahren Zum Herstellen Eines Bauteils" ("Method of Producing a Component"). International Application No. PCT DE/2007/000610 claimed priority benefits, in turn, from German Patent Application No. 10 2006 016 949.2, filed Apr. 11, 2006. International Application No. PCT DE/2007/000610 and German Application No. DE 10 2006 016 949.2 are hereby incorporated by reference herein in their entireties.

FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] [Not Applicable]

MICROFICHE/COPYRIGHT REFERENCE

[0003] [Not Applicable]

BACKGROUND OF THE INVENTION

[0004] The present technology generally relates to a method for producing a component, in particular a gas turbine component.

[0005] Modern gas turbines, in particular aircraft engines, must meet the highest demands with respect to reliability, weight, power, economic efficiency and lifetime. Choice of material, the search for new appropriate materials and the search for new manufacturing methods play a decisive role in the development of gas turbines. The most important materials used nowadays for aircraft engines or other gas turbines are titanium alloys, nickel alloys and high-strength steels. The high-strength steels are used for shaft parts, transmission parts, compressor housings and the turbine housing. Titanium alloys are typical materials for compressor parts, nickel alloys are suitable for hot turbine parts of the aircraft engine.

[0006] Fine casting, as well as forging, are known as manufacturing methods for gas turbine components made of titanium alloys, nickel alloys or other alloys from the prior art. All highly stressed gas turbine components are forged parts. Components for a turbine, on the other hand, are generally made as fine castings. Powder metallurgical injection molding represents an alternative for the manufacture or production of complex components. Powder metallurgical injection molding is used, for example, with plastic injection molding techniques, and is also referred to as metal injection molding or the metal injection molding method (MIM method).

[0007] Gas turbine components are components with complex geometries and surface contours, in which gas turbine blades, in particular, have transitional areas between component surfaces that are characterized by relatively small transition radii. In the area of a blade trailing edge of a blade body of a rotor blade, small transition radii between a suction side surface and a pressure side surface are desired, in particular, in order to optimize the aerodynamic behavior of such blades. Small transition radii between a dendritic or dovetail profiled surface and a front surface are also desirable in the area of a blade foot, in order to increase the support surface of the blade foot.

[0008] To increase the lifetime of such components, the components are strengthened by shot peening on the surface areas of the components, as well as in the transitional areas having relatively small transition radii. According to methods known in the state of the art, conventional shot peening is used, in which peening elements formed as balls are directed onto the component being strengthened by means of compressed air. To avoid undesired deformations of the component on the transitional areas between component surfaces of the component, characterized by a limited transition radius, minimal transition radii of 0.3 mm must be maintained according to the prior art. It follows from this that in the area of a blade trailing edge of a blade body, a minimal thickness of 0.6 mm can be set according to the methods presently known in the state of the art. However, there remains a demand for a method to produce a component, with which smaller transition radii can be achieved on transitional areas between two component surfaces of the component being produced.

BRIEF SUMMARY OF THE INVENTION

[0009] It is an aspect of the present technology to devise a method for producing a component achieving the desired outcomes noted above. This can be achieved by a method for the production of a component as set forth herein and according to the claims. According to the present technology, the method includes at least the following steps: a) production of a component with several component surfaces, in which at least one transitional area between two component surfaces has a transition radius that is greater than 0.05 mm and less than 0.30 mm; and b) strengthening of the component, at least on the transitional area or each transitional area, by ultrasonic shot peening.

[0010] With the present technology, a process chain is proposed for the production of a component, in which transition radii between 0.05 mm and 0.30 mm can be preferably maintained between two component surfaces in transitional areas, without the hazard of damage to the transitional areas characterized by relatively small transition radii during strengthening of the overall component.

[0011] Preferred and other modifications of the present technology are apparent from the appending claims and the following description. Practical examples of the present technology are further explained with reference to the drawing, without being restricted to it.

BRIEF DESCRIPTION OF SEVERAL VIEWS OF THE DRAWINGS

[0012] FIG. **1** illustrates a flow diagram for a process for producing a component according to one embodiment of the present technology.

DETAILED DESCRIPTION OF THE INVENTION

[0013] FIG. **1** illustrates a strongly schematized process diagram of the method according to the present technology for producing a component. In particular, the present technology concerns a method for producing a component, preferably a method for producing a rotor blade of a gas turbine rotor. With reference to FIG. **1**, the present technology is described below for the preferred practical example of producing a rotor blade. However, the present technology is not restricted to this specific application. One skilled in the art will appreciate from the description herein and appended claims that other applications are envisaged.

[0014] In a first step **10** of the method according to the present technology, a rotor blade of a gas turbine is produced. Such a rotor blade has several component surfaces, in which transitional areas between two component surfaces are characterized by a transition radius. According to the present technology, a rotor blade is prepared in step **10**, which has a transitional area with a relatively small transition radius that is greater than about 0.05 mm and less than about 0.30 mm.

[0015] This transitional area with the relatively small transition radius can be a transitional area on a blade trailing edge of a blade body of the rotor blade, i.e., a transitional area between a suction side surface and a pressure side surface of the blade body. At a transition radius of about 0.05 mm, a thickness of the blade trailing edge of about 0.10 mm can be produced.

[0016] In addition, the transitional area with the relatively small transition radius can be a transitional area on a blade foot of the rotor blade, namely a transitional area between a dendritic or dovetail profiled support surface, running essentially in the longitudinal surface of the rotor blade, and an end surface of the blade foot, running essentially in the transverse direction of the rotor blade.

[0017] In step **10**, the rotor blade is produced by forging or by fine casting, or also by powder metallurgical injection molding (MIM).

[0018] After producing the blade according to step **10**, strengthening of the component preferably follows immediately according to a step **11**, at least on the or each transitional area, by ultrasonic shot peening. Precision balls with a smooth surface are then used as peening elements.

[0019] During ultrasonic shot peening, the precision balls, used as peening elements, are not directed onto the transitional areas of the rotor blade being peened as in conventional shot peening by means of a directed compressed air jet, but instead the precision balls are accelerated by means of a sonotrode vibrating in the ultrasonic range, so that the precision balls encounter the transitional area or each transitional area of the component being strengthened in a stochastic distribution and therefore in undirected fashion. This is an advantage over conventional processing of such components.

[0020] Optionally, after production according to step **10** and before strengthening according to step **11**, the component is checked, according to a step **12**, whether, because of the manufacturing tolerance of step **10**, before strengthening of the or each transitional area, its rounding is required. If this is required, a step **13** is resorted to and rounding of the transitional area or each transitional area is carried out by means of a brush-like tool.

[0021] If the manufacturing quality of step **10**, however, is sufficiently good, rounding according to step **13** can be dispensed with and strengthening according to step **11** can occur directly after production of the component according to step **10**.

[0022] With the method according to the present technology, it is possible for the first time to produce transitional areas with transition radii of less than about 0.30 mm on rotor blades of a gas turbine rotor and strengthen them without hazard of damage.

[0023] The present technology has now been described in such full, clear, concise and exact terms as to enable a person familiar in the art to which it pertains, to practice the same. It is to be understood that the foregoing describes preferred embodiments and examples of the present technology and that modifications may be made therein without departing from the spirit or scope of the present technology as set forth in the claims. Moreover, while particular elements, embodiments and applications of the present technology have been shown and described, it will be understood, of course, that the present technology is not limited thereto since modifications can be made by those familiar in the art without departing from the scope of the present disclosure, particularly in light of the foregoing teachings and appended claims. Moreover, it is also understood that the embodiments shown in the drawings, if any, and as described above are merely for illustrative purposes and not intended to limit the scope of the present technology, which is defined by the following claims as interpreted according to the principles of patent law, including the Doctrine of Equivalents. Further, all references cited herein are incorporated in their entirety.

1. A method for producing a component comprising the following steps:

a) Producing a component having two or more component surfaces, in which at least one transitional area between two component surfaces has a transition radius that is greater than about 0.05 mm and less than about 0.30 mm, and

b) Strengthening the component in at least one transitional area or each transitional area by ultrasonic shot peening.

2. The method according to claim **1**, wherein the method is used to produce a gas turbine component.

3. The method according to claim **1**, wherein the component is produced by forging, by fine casting, or by powder metallurgical injection molding.

4. The method according to claim **1**, wherein the component produced is a gas turbine blade having a transitional area between a suction side surface and a pressure side surface on a blade trailing edge of a blade body that is greater than about 0.05 mm and less than about 0.30 mm.

5. The method according to claim **4**, wherein the gas turbine blade is a rotor blade.

6. The method according to claim **3**, wherein the component produced is a gas turbine blade having a transitional area between a suction side surface and a pressure side surface on a blade trailing edge of a blade body that is greater than about 0.05 mm and less than about 0.30 mm.

7. The method according to claim **5**, wherein the gas turbine blade is a rotor blade.

8. The method according to claim **1**, wherein the component produced is a gas turbine blade having at least on one blade foot having a transitional area between a dendritic or dovetail profiled surface, running in the longitudinal direction of the gas turbine blade, and an end surface, running in the transverse direction of the gas turbine blade, with a transition radius that is greater than about 0.05 mm and less than about 0.30 mm.

9. The method according to claim **5**, wherein the gas turbine glad is a rotor blade.

10. A method according to claim **1**, wherein the ultrasonic shot peening step is carried out with precision balls having a smooth surface.

11. A method according to claim **8**, wherein the ultrasonic shot peening step is carried out with precision balls having a smooth surface.

12. A method according to claim **1**, further comprising the optional step of rounding the transitional area by a brush-like

tool before the component is strengthened by the ultrasonic shot peening.

13. A method according to claim **5**, further comprising the optional step of rounding the transitional area by a brush-like tool before the component is strengthened by the ultrasonic shot peening.

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