UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte DANIEL P. DELUCA and CHARLES M. BIONDO

Appeal 2008-1285
Application 09/943,150
Technology Center 1700

Decided: March 25, 2008

Before THOMAS A. WALTZ, PETER F. KRATZ, and
JEFFREY T. SMITH, *Administrative Patent Judges*.

WALTZ, *Administrative Patent Judge*.

DECISION ON APPEAL

This is a decision on an appeal under 35 U.S.C. § 134 from the Primary Examiner's final rejection of claims 1, 4-11, and 24-28, which are the only claims pending in this application. We have jurisdiction pursuant to 35 U.S.C. § 6(b).

According to Appellants, the invention is directed to a nickel base superalloy of a specified composition, where this superalloy has a microstructure which is pore free, eutectic γ-γ' free, and has a gamma prime morphology with a bimodal distribution of large γ' particles and fine γ' particles within a continuous gamma matrix (App. Br. 2-3). Independent claim 1 is illustrative of the invention and a copy of this claim is reproduced below:

1. A nickel base superalloy consisting of 3.0 to 12 wt % chromium, up to 3.0 wt% molybdenum, 3.0 to 10 wt% tungsten, less than 5.0 wt% rhenium, 6.0 to 12 wt% tantalum, 4.0 to 7.0 wt% aluminum, up to 15 wt% cobalt, up to 0.05 wt % carbon, up to 0.02 wt % boron, up to 0.1 wt% zirconium, up to 0.8 wt% hafnium, up to 2.0 wt% niobium, up to 1.0 wt% vanadium, up to 0.7 wt% titanium, up to 10 wt% of at least one element selected from the group consisting ruthenium, rhodium, palladium, osmium, iridium, platinum, and mixtures thereof, and the balance essentially nickel, said nickel base superalloy having a microstructure which is pore free and eutectic γ-γ' free, said microstructure having a gamma prime morphology which includes a bimodal γ' distribution having a uniform distribution of large γ' particles in a continuous gamma matrix and a second and uniform distribution of fine γ' particles within said matrix.

The Examiner has relied on the following references as evidence of obviousness:

Kenton	US 4,302,256	Nov. 24, 1981
Erickson	US 5,366,695	Nov. 22, 1994
DeLuca	US 5,605,584	Feb. 25, 1997

ISSUES ON APPEAL

The claims on appeal stand rejected under 35 U.S.C. § 103(a) as unpatentable over Erickson in view of Kenton and DeLuca (Ans. 3).

Appellants contend that Erickson does not teach or suggest a superalloy composition with less than 5.0 wt% Re, as required by the claims, and Kenton and DeLuca do not remedy this deficiency (App. Br. 10). Appellants further contend that Erickson does not define the term "about," the Examiner can't rely on such a vague term, and the reference "teaches away" from less than 5.0 wt% by disclosing a preference for Re values greater than 5.0 wt% (App. Br. 10-11).

Appellants contend that Kenton doesn't teach how to form an alloy with the claimed composition that is "pore free" since this reference only teaches "substantially complete removal" of micropores (App. Br. 11; Reply Br. 2). Appellants further contend that neither Erickson nor Kenton disclose the necessary heat treatments to form an alloy which is eutectic γ-γ' free, and the Examiner has not supplied any technical reasoning that full solutionization inherently achieves this condition (App. Br. 12; Reply Br. 3). Appellants also contend that all fully solutionized compositions of Erickson have Cr contents of less than 3 wt% while the claims are limited to higher Cr values (App. Br. 13; Reply Br. 4).

Appellants have also presented contentions for some of the dependent claims (App. Br. 13-14, 16, and 20).

The Examiner contends that the composition disclosed by Erickson overlaps the claimed composition, and that the term "about" includes such values that are so close to the claimed values that prima facie obviousness is established (Ans. 3 and 7).

The Examiner contends that Erickson teaches a process that includes a step of solutionizing where up to 100% of the γ' is taken into solution, i.e.,

the composition is free from eutectic γ-γ', and also that the alloy has gamma prime morphology with a bimodal distribution (Ans. 3-4 and 7-8).

The Examiner contends that Erickson teaches HIP processing to achieve "nearly complete pore closure," and Kenton teaches a method of removing cast defects such as micropores by varying the conditions of HIP processing (Ans. 4 and 7). The Examiner contends that DeLuca teaches desirable γ' particle sizes for a nickel base superalloy (Ans. 5 and 8).

Accordingly, the issues presented from the record in this appeal are as follows: (1) Have Appellants established that the Examiner reversibly erred in finding that the claimed nickel base superalloy composition would have been prima facie obvious in view of the Erickson disclosure; and (2) Have Appellants established that the Examiner reversibly erred in determining that the claimed microstructure of the nickel base superalloy would have been prima facie obvious over the combined teachings of Erickson, Kenton, and DeLuca?

We determine that the Examiner has established a prima facie case of obviousness in view of the reference evidence, which prima facie case has not been adequately rebutted by Appellants' arguments. Therefore, we AFFIRM the sole ground of rejection presented in this appeal essentially for the reasons stated in the Answer, as well as those reasons set forth below.

OPINION

We determine the following Factual Findings (FF) presented in the record of this appeal:

(1) Erickson discloses a single crystal nickel-based superalloy with overlapping ranges of each and every component as required by

claim 1 on appeal, with the exception of rhenium (Re), which is taught by Erickson to be within the range of "about 5.0-7.0 wt%" compared to the claim 1 range of "less than 5.0 wt%" (Ans. 3 and 7; Erickson, Abstract; col. 2, ll. 30-65; col. 3, ll. 40-55);[1]

(2) Erickson teaches that first-generation nickel-based superalloys contained no rhenium, second-generation nickel-based superalloys had a "moderate" rhenium content of "about 3 weight percent" (which includes values in the range of 2.8-3.2 wt%), and the Erickson invention has higher total refractory element content (W+Re+Mo+Ta) and improved mechanical properties (col. 1, ll. 30-50);

(3) Erickson teaches the amounts of rhenium and its function, alone and associated with other components, provides examples with differing rhenium contents to improve creep strength, with such rhenium values as "around 5%" (with examples of 4.8 and 4.9 wt %) and in the range of 4.8-6.3 wt% (col. 4, ll. 11-12; col. 4, l. 35-col. 5, l. 5; col. 7, l. 32; col. 8, ll. 35-38; Table 1; col. 9, ll. 24-25 and 53-56; col. 12, l. 62-col. 13, l. 2; col. 14, ll. 2-54; col. 17, ll. 16-17; col. 19, l. 26; and col. 29, ll. 19-20);

(4) Erickson teaches that more complete gamma prime solution is desired, allowing for "nearly complete" solutioning, with full gamma prime solutioning for some samples, and high temperature aging heat treatment to optimize the creep-rupture properties of

[1] We note that independent claims 6, 10, and 24 do not recite any specific amounts of rhenium.

the alloys by effecting a more desirable gamma prime particle size and distribution, with secondary gamma prime aging to effect precipitation of conventional gamma prime particles along with ultra-fine gamma prime particles; Erickson also teaches that variations in properties can be caused by variations in the alloy composition or the casting process conditions, such as solution heat treatment and primary gamma prime aging treatment (e.g., to provide the optimum gamma prima particle size) (col. 1, ll. 63-64; col. 2, ll. 8-9; col. 8, ll. 13-22; col. 11, l. 63-col. 12, l. 20; Table 4, e.g., alloys 10D, 10E, 10I, and 12D; col. 15, ll. 44-51; col. 17, l. 66-col. 18, l. 17; col. 23, ll. 48-60; col. 26, ll. 1-5; col. 29, ll. 19-28; col. 30, ll. 19-21; col. 33, ll. 59-61; and col. 37, ll. 55-58);

(5) Kenton discloses that nickel-based superalloys are characterized by defects such as micropores, and these defects and other mechanical properties are improved by hot isostatic pressure (HIP) processing at elevated temperatures and pressures, where micropores are "substantially eliminated" (Abstract; col. 1, ll. 5-39; col. 3, ll. 25-35; col. 4, ll. 10-11and 30-37; col. 5, l. 58-col. 6, l. 17; and col. 11, ll. 63-65); and

(6) DeLuca discloses that single crystal nickel-base superalloys can be heat treated to provide a damage tolerant microstructure, where the microstructure contains large irregularly-shaped "barrier" γ' particles interspersed in an ordered array of smaller cuboidal γ' particles in a γ phase matrix, where the size of the large gamma prime particles is 5-15 microns, the smaller cuboidal gamma prime

particles have a size of 0.3-0.7 microns, and fatigue crack growth is highly dependent on this bimodal morphology (Abstract; col. 1, ll. 9-12; col. 2, ll. 30-33; col. 3, ll. 2-3 and 29-54; and col. 4, l. 56-col. 5, l. 8).

Under 35 U.S.C. § 103, the factual inquiry into obviousness requires a determination of: (1) the scope and content of the prior art; (2) the differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) secondary considerations, if any. *See Graham v. John Deere Co.,* 383 U.S. 1, 17-18 (1966). "[T]he analysis [of obviousness] need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ." *KSR Int'l Co. v. Teleflex, Inc.,* 127 S. Ct. 1727, 1740-41 (2007). The meaning of the word "about" allows for values slightly above or below the specified value in a range. *See In re Woodruff,* 919 F.2d 1575, 1578 (Fed. Cir. 1990). Overlapping ranges disclosed by the prior art for every component in a claim establishes a prima facie case of obviousness. *See In re Geisler,* 116 F.3d 1465, 1469-70 (Fed. Cir. 1997).

Applying the preceding legal principles to the Factual Findings (FF) present in the record of this appeal, we determine that the Examiner has properly established a prima facie case of obviousness which has not been adequately rebutted by Appellants' arguments. With regard to the nickel base superalloy composition as recited in claim 1 on appeal, we determine that every element positively required by the claim is disclosed in overlapping ranges by Erickson, with the exception of the amount of

rhenium (Re) (*see* FF (1) listed above). As shown by FF (2) and (3) listed above, we determine that the "about 5 wt%" lower limit disclosed by Erickson certainly includes values slightly less than 5 wt%. *See also In re Woodruff, supra.* Accordingly, we determine that the composition of Erickson and the composition as recited in claim 1 on appeal have overlapping ranges for all required elements and thus the claim composition is prima facie obvious in view of the Erickson composition.

With regard to the microstructure required by claim 1 on appeal, we determine that one of ordinary skill in this art, following the teachings of Erickson, Kenton, and DeLuca, would have used HIP processing conditions and subsequent aging heat treatments sufficient to eliminate micropores, achieve full gamma prime solutioning, and produce the optimum bimodal gamma prime particle size and distribution to improve the creep-rupture properties of the alloy, remove cast defects, reduce fatigue crack growth, and provide a damage tolerant microstructure (*see* FF (4), (5), and (6) listed above).

Appellants argue that the HIP processing conditions taught by Kenton do not result in the here claimed "pore free" microstrucure (App. Br. 11; Reply Br. 2). Appellants also argue that neither Erickson nor Kenton disclose the necessary heat treatments to form an alloy which is eutectic γ-γ' free, and the Examiner has not supplied any technical reasoning that full solutioning inherently achieves this condition (App. Br. 12; Reply Br. 3). Appellants further argue that the fully solutionized compositions of Erickson are limited to higher Cr values (App. Br. 13; Reply Br. 4).

These arguments are not persuasive. According to Appellants' Specification, the process for producing the claimed alloy properties includes subjecting the cast object to hot isostatic processing "to close any as-cast microporosity" and to provide partial solutioning, followed by solution heat treating the cast object to "fully solution the eutectic γ-γ' phase" (Spec. 2:10-16). As shown by FF (5) listed above, we determine that Kenton teaches HIP processing under the same or similar conditions to "substantially eliminate" microporosity. As shown by FF (4) listed above, we determine that Erickson teaches solution heat treating the cast object to fully solutionize the object (this is achieved for at least for some examples). Therefore, we determine that the burden has been shifted to Appellants to establish that these same or similar processing conditions do not achieve the properties or characteristics relied upon for patentability of the claimed subject matter. *See In re Best,* 562 F.2d 1252, 1255 (CCPA 1977); *see also In re Spada,* 911 F.2d 705, 708 (Fed. Cir. 1990). With regard to the amounts of chromium, we adopt the Examiner's comments (Ans. 7-8), noting that Erickson discloses Example 10-D with 4 wt% chromium achieving full solutioning (*see* Tables 1 and 4).

With regard to the octet shaped particles recited in claims 4, 11, and 28 (App. Br. 13-14 and 20), we also adopt the Examiner's comments (Ans. 9). With regard to Appellants' argument concerning claims 6, 10, and 24 (App. Br. 16), we note that this limitation is specifically taught by DeLuca (*see* FF (6) listed above).

For the foregoing reasons and those stated in the Answer, we affirm the rejection of claims 1, 4-11, and 24-28 under § 103(a) over Erickson in view of Kenton and DeLuca. The decision of the Examiner is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

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