Paper No. 16

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte KENNETH HARRIS and JACQUELINE B. WAHL

Appeal No. 2003-1930
Application No. 09/797,326

ON BRIEF

Before OWENS, DELMENDO and JEFFREY T. SMITH, ***Administrative Patent Judges***.

JEFFREY T. SMITH, ***Administrative Patent Judge.***

DECISION ON APPEAL

Applicants appeal the decision of the Primary Examiner finally rejecting claims 1, to 20, all of the claims in the application.[1,] We have jurisdiction under 35 U.S.C. § 134.

[1] In rendering our decision, we have considered Appellants, arguments presented in the Brief, filed Febuary 10, 2003, and the Reply Brief, filed May 22, 2003.

BACKGROUND

The subject matter of Appellants' invention relates to a nickel base superalloy. According to Appellants, Brief page 2, the claimed invention exhibits "outstanding high temperature stress-rupture properties, creep-rupture properties and reduced rejectable grain defects as compared with conventional directionally solidified columnar grain casting alloys and single crystal alloys." Claim 1, which is representative of the claimed invention, appears below:

> 1. A nickel-base superalloy comprising, in percentages by weight, from about 4.3% to about 5.3% chromium, (Cr), from about 9.0% to about 10.0% cobalt (Co), from about 0.6% to about 0.8% molybdenum (Mo), from about 8.4% to about 8.8% tungsten (W), from about 4.3% to about 4.8% tantalum (Ta), from about 0.6% to about 0.8% titanium (Ti), from about 5.6% to about 5.8% aluminum (Al), from about 2.8% to about 3.1% rhenium (Re), from about 0.9% to about 1.5% hafnium (Hf), from about 0.06% to about 0.08% carbon (C), from about 0.012% to about 0.020% boron (B), from about 0.004% to about 0.010% zirconium (Zr), the balance being nickel and incidental impurities.

CITED PRIOR ART

As evidence of unpatentability, the Examiner relies on the following references:

Harris et al. (Harris)	5,069,873	Dec. 03, 1991
Yoshinari et al. (Yoshinari)	5,611,670	Mar. 18,1997
Wukusick et al (Wukusick)	6,074,602	Jun. 13, 2000

The Examiner has rejected claims 1 to 15 and 17 to 20 as unpatentable under 35 U.S.C. § 103(a) as obvious over Yoshinari; claim 16 as unpatentable under 35 U.S.C.

§ 103(a) as obvious over Yoshinari as applied to claim 1 and combined with Wukusick; and claims 1 to 10 as unpatentable under 35 U.S.C. § 103(a) as obvious over Harris. (Answer, pp. 3 to 7).

DISCUSSION

Rather than reiterate the conflicting viewpoints advanced by the Examiner and Appellants concerning the above-noted rejections, we refer to the Answer and the Briefs.

Appellants state "[f]or purposes of Appeal only, all claims will stand or fall together." (Brief, p. 3).[2] We interpret this statement to mean that for each ground of rejection the claims stand or fall together. We will select one claim for each rejection to determine the issues on appeal. 37 CFR § 1.192 (c)(7) and (8) (2001).

The Examiner has concluded that the teachings of Yoshinari render the invention of claims 1 to 15 and 17 to 20 ***prima facie*** obvious. (Answer, pp. 3 to 5). We select claim 1 as representative of the rejected claims.

Yoshinari a nickel base superalloy. According to the Examiner, the ranges of Yoshinari's Cr and Co overlap the subject matter of claim 1. (Answer, p. 4). Yoshinari discloses that the cobalt and chromium content affects the hot corrosion resistance of the

[2] The Examiner disagrees with Appellants' grouping of the claims. (Answer, p. 2). The Examiner asserts that claims 11 to 16 should represent a second group. However, neither of Appellants' Briefs contain separate arguments for claims 11 to 16.

superalloy. Cobalt also affects the high temperature strength of the superalloy. (Col. 8). Yoshinari also provides a description of the remaining components and their properties in columns 8 and 9. The Examiner determined that the claimed invention would have been obvious to a person of ordinary skill in the art. (Answer, p. 4).[3]

The following description of the elements included in the Ni-base superalloys appears in columns 8 and 9 of Yoshinari:

> Carbon dissolves in matrix or grain boundaries in particular and forms carbides to improve high-temperature tensile strength. However, if it is added excessively, the melting point of grain boundaries is lowered, thereby deteriorating high-temperature strength and toughness. Consequently, an appropriate additive amount of carbon is in a range of 0.05 to 0.2%, preferably 0.03 to 0.1%.
>
> Co dissolves in matrix to improve high temperature strength and also contributes to improvement of hot corrosion resistance. If it is added excessively, it promotes precipitation of harmful intermetallic compounds,

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[3]

	CLAIMED INVENTION weight percent	Yoshinari '670 column 3 weight percent
Cr	about 4.3 to about 5.3	5 to 14
Co	about 9.0 to about 10.0	up to 10
Mo	about 0.6 to about0.8	up to 6
W	about 8.4 to about 8.8	2 to 15
Ta	about 4.3 to about 4.8	up to 12
Ti	about 0.6 to about 0.8	0.5 to 5
Al	about 5.6 to about 5.8	4 to 7
Re	about 2.8 to about 3.1	up to 4
Hf	about 0.9 to about 1.5	up to 2
C	about 0.06 to about 0.08	up to 0.20
B	about 0.012 to about 0.020	up to 0.035
Zr	about 0.004 to about 0.010	up to 0.035
Nb	n/a	up to 3
Ni	balance	balance 58%

thereby deteriorating high-temperature strength. An appropriate additive amount of Co is 10.5% or less, preferably 9 to 10.5%.

Cr improves hot corrosion resistance. However, if it is added excessively, it causes precipitation of harmful σ-phase and coarsening of carbides, thereby deteriorating high-temperature strength. An appropriate additive amount of Cr is in a range of 5 to 14%, preferably 5.5 to 9%.

A1 and Ti contribute to improvement of high-temperature strength by forming γ'-phase, i.e., Ni_3 (A1, Ti), which is a strengthening factor of the Ni-base alloy. Appropriate additive amounts of A1 and Ti are, respectively, in ranges of 4.0 to 7.0 % and 0.5 to 5.0%, and preferably 5 to 6% of A1 and 0.5 to 1.0 % of Ti.

Nb, Ta and Hf dissolve in γ'-phase which is a strengthening factor, and improve high-temperature strength of the alloy. However, if they are added excessively, they segregate at grain boundaries and reduce the strength of the alloy. Appropriate additive amounts of Nb, Ta and Hf are, respectively, 3% or less, 12% or less and 2% or less, and preferably 0.2 to 3.0% of Nb, 3 to 4% of Ta and 0.5 to 1.0% of Hf.

Zr and boron (B) strengthen grain boundaries and improve high-temperature strength of the alloy. However, if Zr and boron (B) are added excessively, ductility and toughness are reduced, and the melting point of grain boundaries is lowered, thereby deteriorating high temperature strength of the alloy. Appropriate additive amounts of Zr and B are, respectively, up to 0.035% and up to 0.035%. Preferably, considering the relationship with carbon content, they should be within a range defined by A (C=0.20%, B+Zr=0%), B (C=0.05%, B+Zr=0 % C (C=0%, B+Zr=0.01%), D (C=0%, B+Zr=0.035%) and E (C=0.1%, B+Zr=0.025%), or one or both of boron (B) and Zr should be 0.005 to 0.025%.

W (tungsten) and Mo dissolve in γ-phase of the matrix and strengthen the alloy, and W and Mo are particularly effective for improving long-term strength of the alloy. However, if W and Mo are added excessively, there is a precipitation of a harmful phase such as σ-phase, thereby deteriorating strength of the alloy. Appropriate additive amounts of W and Mo are,

> respectively, 2 to 15% and 6.0% or less, and preferably 8.0 to 11.0% of W and 0.3 to 1.0% of Mo.
>
> Re improves hot corrosion resistance of the alloy. However, if Re exceeds a certain amount, the effect is saturated, and ductility and the toughness of the alloy are degraded. An appropriate additive amount of Re is 4% or less, and preferably 2.5 to 3.5%. In the case where a difference of crystal orientations of the single crystal is 8 degrees or less, suitably there is no grain boundary in the Ni-base superalloy as the single crystal. If a difference of crystal orientations of columnar grains is 15 degrees or less, a satisfactory strength can be obtained as the columnar grains.

Appellants argue that "[t]he Yoshinari et al. patent does not provide motivation or guidance that would lead those having ordinary skill in the art to optimize the broad disclosure at col. 3, lines 8-12 or the Yoshinari et al. patent so as to arrive at the claimed invention." (Brief, p. 5). Appellants also argue that "[t]he closest prior art must be an actual composition that is either disclosed or suggested by the prior art, not a hypothetical composition arrived at by assuming that one having ordinary skill in the art would select from the broad disclosures of the prior art a composition that otherwise meets the requirements of the claims but has a tantalum content of 4.0% and a chromium content of 5.5% (while containing an incidental impurity amount of niobium)." (Reply Brief, p. 6).

We disagree. A ***prima facie*** case of obviousness typically exists when the ranges of a claimed composition overlap the ranges disclosed in the prior art. ***See In re Peterson,*** 315 F.3d 1325, 1329, 65 USPQ2d 1379, 1382 (Fed. Cir. 2003); ***In re Geisler***, 116 F.3d 1465, 1469, 43 USPQ2d 1362, 1365 (Fed. Cir. 1997); ***In re Woodruff,*** 919 F.2d

1575, 1578, 16 USPQ2d 1934, 1936-37 (Fed. Cir. 1990); ***In re Malagari,*** 499 F.2d 1297, 1303, 182 USPQ 549, 553 (CCPA 1974). Such is the case here. As can be seen from the above description of Yoshinari, a person of ordinary skill in the art would have reasonably expected that the chromium content affects the hot corrosion resistance of the superalloy and cobalt content affects the hot corrosion resistance and the high temperature strength of the superalloy. Thus, a person of ordinary skill in the art would have been recognized the suitability of adjusting the content of the disclosed elements within the disclosed ranges. Yoshinari discloses that niobium can be present in an amount of up to 3 wt%. Thus, Yoshinari discloses that niobium can be excluded from the composition. Appellants have not cited an authority that stipulates results must be a comparison of an "actual composition".

Since the ranges of claim 1 overlaps the invention of Yoshinari, the burden is shifted to Appellants to establish that the claimed invention would not have been obvious. ***In re Peterson,*** 315 F.3d at 1330, 65 USPQ2d at 1383. Thus, we now turn to Appellants evidence presented to rebut the ***prima facie*** case of obviousness. Appellants assert that table 1 of the specification demonstrates that the claimed invention exhibits an unexpected improvement in high temperature stress-rupture properties. Specifically, Appellants assert the superalloy CMSX®-486 exhibits superior results. (Brief, p. 6).

Appellants evidence of unexpected results is not persuasive. Appellants can over come a ***prima facie*** case of obviousness by establishing the claimed range achieves unexpected results relative to the prior art range. ***In re Peterson,*** 315 F.3d at 1330, 65 USPQ2d at 1383 *quoting* ***In re Geisler,*** 116 F.3d at 1469-70, 43 USPQ2d at 1365. Having reviewed the data present, we conclude that the showing in Table 1 is not commensurate in scope with the degree of protection sought by the claimed subject matter. Specifically, appellants have not explained why a single example is representative of the entire claimed range. Appellants have not explained why the comparative four superalloys, outside of the scope of the claimed invention, are representative of the superalloy described in the Yoshinari reference. Further, Appellants have not explained why results obtained are unexpected.

Appellants in the Reply Brief presented arguments based on the preferred embodiments of the Yoshinari reference. These arguments are not persuasive because a reference is available for all of the disclosed the embodiments, not only the preferred embodiments. ***Merck & Co. Inc. v. Biocraft Labs. Inc.,*** 874 F.2d 804, 807, 10 USPQ2d 1843, 1846 (Fed. Cir. 1989). ("That the [prior art reference] discloses a multitude of effective combinations does not render any particular formulation less obvious.").

The Examiner rejected claim 16 as unpatentable under 35 U.S.C. § 103(a) as obvious over Yoshinari as applied to claim 1 and combined with Wukusick. (Answer,

p. 5). In response to this rejection, the Appellants argue that "[c]laim 16 is allowable for the reasons generally set forth above with respect to claims 1-15 and 17-20, to the extent that claim 16 is dependent from claim 11."

The Examiner has presented factual determinations regarding the suitability of combining the teachings of the Wukusick reference with Yoshinari. The Examiner's determinations seem reasonable and are based on the evidence of record. Since Appellants have failed specifically to challenge the factual determinations, we presume that they are in agreement with the Examiner. Thus, for the reasons presented above regarding claim 1 and the reasons presented by the Examiner we will uphold the rejection.

The Examiner rejected claims 1 to 10 as unpatentable under 35 U.S.C. § 103(a) as obvious over Harris. (Answer, pp. 5-7). We select claim 1 as representative of the rejected claims.

Harris describes a nickel-base superalloy that is similar to the claimed invention. According to the Examiner, the ranges of Harris's Cr and Ta fails to overlap the subject matter of claim 1. However, because the claimed subject matter uses the term "about" for the describing the ranges of Cr and Ta, the Examiner determined that the claimed subject matter would have been obvious because a person of ordinary skill in the art would have

expected the properties of Harris to be the same as the claimed invention. (Answer, p. 6).[4]

The Federal Circuit has held that a ***prima facie*** case of obviousness exists when the claimed range and the prior art range do not overlap but are close enough such that one skilled in the art would have expected them to have the same properties. ***Titanium Metals,*** 778 F.2d at 783, 227 USPQ at 779 (Fed. Cir. 1985) (The court determined that a claim directed to an alloy containing "0.8% nickel, 0.3% molybdenum, up to 0.1% maximum iron, balance titanium" would have been prima facie obvious in view of a reference disclosing alloys containing 0.75% nickel, 0.25% molybdenum, balance titanium and 0.94% nickel, 0.31% molybdenum, balance titanium.). In the present case the claimed range and the Harris range for Cr and Ta do not overlap but are very close. As stated above, with regard to the Yoshinari, a person of ordinary skill in the art would

[4]

	CLAIMED INVENTION weight percent	Harris '873 table 1 weight percent
Cr	about 4.3 to about 5.3	5.5 to 7.0
Co	about 9.0 to about 10.0	9.0 to 9.5
Mo	about 0.6 to about0.8	0.3 to 0.7
W	about 8.4 to about 8.8	8.0 to 9.0
Ta	about 4.3 to about 4.8	3.0 to 4.0
Ti	about 0.6 to about 0.8	5.5 to 6.0
Al	about 5.6 to about 5.8	2.8 to 3.1
Re	about 2.8 to about 3.1	1.2 to 1.8
Hf	about 0.9 to about 1.5	1.2 to 1.8
C	about 0.06 to about 0.08	0.05 to 0.09
B	about 0.012 to about 0.020	0.01 to 0.024
Zr	about 0.004 to about 0.010	0.004 to 0.010
Ni	balance	balance

have been recognized the suitability of adjusting the content of the elements in Ni-based superalloys. Specifically, a person of ordinary skill in the art would have recognized that Ta affects the strengthening factor of the superalloy and Cr affects the hot corrosion resistance of the superalloy. Thus, we determine that the Examiner has established a ***prima facie*** case of obviousness because a person of ordinary skill in the art would have reasonably recognized the results that would have been obtained by adjusting the content of Ta and Cr.

We now turn to Appellants evidence presented to rebut the ***prima facie*** case of obviousness. Appellants assert the superalloy CMSX®-486 exhibit superior results compared to superalloy CM 186 LC® which is representative of the Harris invention. Appellants assert that tables 2 to 4 of the specification demonstrates that the claimed invention exhibits an unexpected improvement in high temperature stress-rupture properties. (Brief, p. 9).

Appellants evidence of unexpected results is not persuasive. The burden is on the Appellants to show why the comparative data establishes unexpected results. ***See In re Klosak,*** 455 F.2d 1077, 1080, 173 USPQ 14, 16 (CCPA 1972). Appellants have not explained why results obtained are unexpected. Appellants have not shown why these comparisons are believed to be representative of the closest embodiments of Harris. ***See In re Burckel,*** 592 F.2d 1175, 1179, 201 USPQ 67, 71 (CCPA 1979).

We find that the showing in Tables 1 to 4 does not compare the disputed subject matter. The issue present is whether the result obtained by the claimed invention would have been unexpected from the supper alloy described by Harris. Appellants have not explained why the superalloy CM 186 LC® is representative of the closest embodiment of the claimed invention. Further, Appellants have not explained why the superalloy CMSX®-486 is representative of the closest embodiment of Harris. Thus, the data presented is not probative for comparison of the closest claimed embodiment to the closest prior art embodiment.

Based on our consideration of the totality of the record before us, having evaluated the ***prima facie*** case of obviousness in view of Appellants' arguments and evidence, we conclude that the subject matter of claims 1 to 20 would have been obvious to a person of ordinary skill in the art from the cited prior art references.

CONCLUSION

The Examiner's rejections of claims 1 to 15 and 17 to 20 as unpatentable under 35 U.S.C. § 103(a) as obvious over Yoshinari; claim 16 as unpatentable under 35 U.S.C. § 103(a) as obvious over Yoshinari as applied to claim 1 and combined with Wukusick; and claims 1 to 10 as unpatentable under 35 U.S.C. § 103(a) as obvious over Harris are affirmed.

Time for taking action

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

AFFIRMED

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	)	
TERRY J. OWENS	)	
Administrative Patent Judge	)	
	)	
	)	
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Administrative Patent Judge	)	**AND**
	)	**INTERFERENCES**
	)	
	)	
JEFFREY T. SMITH	)	
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