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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE
THE PATENT TRIAL AND APPEAL BOARD

Ex parte ALFREDO DE LIMA FIGUEIREDO

Appeal 2017-007263
Application 13/130,688
Technology Center 1700


Opinion for the Board filed by NAGUMO, Administrative Patent Judge.

Opinion dissenting filed by GUPTA, Administrative Patent Judge.

NAGUMO, Administrative Patent Judge.

DECISION ON APPEAL

Alfredo De Lima Figueiredo (“Figueiredo”) timely appeals under 35 U.S.C. § 134(a) from the Final Rejection of all pending claims 1–9, 11–17, and 20–24. We have jurisdiction. 35 U.S.C. § 6(b). We reverse.

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1 The real party in interest is identified as Vallourec Mannesmann Oil & Gas France. (Appeal Brief, filed 21 September 2016 (“Br.”), at 1.)
2 Heard 2 April 2019. The Official Transcript will be made of record in due course.
A. Introduction

The subject matter on appeal relates to “low alloy steels with a high yield strength which have an excellent sulphide stress cracking [“SSC”] behaviour.” (Spec. 1, ll. 3–4.) The inventive steels are said to be especially useful as tubular products for hydrocarbon wells containing hydrogen sulfide, H$_2$S. (Id. at ll. 4–5.) The ‘688 Specification reports the gradual development of increases in the minimum specified yield strengths of highly H$_2$S-resistant low alloy steels, up to 758 MPa (110 ksi). (Id. at 1, ll. 18–19.)

Known prior art methods of increasing the SSC resistance of low alloy steels are said to reduce their yield strength. (Id. at 2, ll. 5–6.) On the other hand, some processes of raising the yield strength of low alloy steels by low temperature quenching and tempering heat treatments are said to result in poor SSC behavior due to grain boundary effects. (Id. at ll. 13–17.) A thermal solution to this problem involving an isothermal bainitic transformation is said to provide high yield strength steels having excellent

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4 Application 13/130,688, Low alloy steel with a high yield strength and high sulphide stress cracking resistance, filed 23 May 2011, claiming the benefit of an application filed in France on 09 December 2008. We refer to the “‘688 Specification,” which we cite as “Spec.”

5 The term “low alloy steel” is a rough term of art covering steels (iron-carbon alloys) having less than about 5% alloying elements.

6 The symbol “ksi” stands for kilo-pounds per square inch.
SSC behavior. *(Id. at 3, ll. 5–8, citing Omura*⁷.*) However, industrial use of this process is said to require very tight control, including tube-per-tube monitoring of cooling rates. *(Id. at ll. 9–13.)*

Figueiredo seeks patent protection for a low alloy steel composition said to provide a minimum yield strength of 861 MPa (125 ksi) and excellent SSC. *(Id. at 3, ll. 14–21)* The Specification provides a brief explanation of the role of each added element *(id. at 4–7)*, of which molybdenum (Mo) and tungsten (W) are the most critical in this appeal. Molybdenum is disclosed to be useful “for improving the quenchability of the steel and can also increase the tempering temperature of the steel.” *(Id. at 5, ll. 17–18.)* Molybdenum in excess of 1% is said to favor the formation of coarse carbides M₂₃C₆ and KSI phase after extended tempering. *(Id. at ll. 19–21.)* Tungsten is similar to Mo, in that it is said to improve quenchability and mechanical strength. *(Id. at 6, ll. 25–26.)* Moreover, tungsten is said to suppress the precipitation of coarse M₂₃C₆ and KSI phase after extended tempering. *(Id. at 7, ll. 1–2.)* Thus, tungsten is said to allow more Mo and thus higher tempering temperatures, which in turn reduces the dislocation density and improves SSC resistance. *(Id. at ll. 4–6.)*

Claim 1 is representative and reads:

A low alloy steel comprising the following components, by weight:

- C: 0.2% to 0.5%
- Si: more than 0.1% to 0.5%
- Mn: more than 0.1% to 1%

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the remainder of the chemical composition of said steel comprising Fe and impurities or residuals resulting from or necessary to steel production and casting processes, wherein

\( W \) is present in the steel in a Mo tolerance increasing effective amount.

(Claims App., Br. 10; some formatting, and emphasis added.)

Remaining independent claim 12 is drawn to low alloy steels “consisting essentially of” the same alloying elements present in the same ranges of amounts.

The Examiner maintains the following grounds of rejection: 8, 9

A. Claims 1–9, 11–17, and 20–24 stand rejected under 35 U.S.C. § 103(a) in view of Kushida. 10

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8 Examiner’s Answer mailed 12 January 2017 (“Ans.”).

9 Because this application was filed before the 16 March 2013, effective date of the America Invents Act, we refer to the pre-AIA version of the statute.

B. Claims 1–9, 11–17, and 20–23 stand rejected under 35 U.S.C. § 103(a) in view of Kondo.\textsuperscript{11}

B. Discussion

The Board’s findings of fact throughout this Opinion are supported by a preponderance of the evidence of record.

The Examiner finds that both Kushida and Kondo disclose low alloy steels having overlapping ranges of compositions for the elements required by the appealed claims, wherein the “residual elements” in both references “result from or are necessary to the steel production process.” (FR 3 and 6, respectively.) The Examiner finds that the references are silent as to the limitation, “W being present in the steel in a Mo tolerance increasing effective amount” recited in the claims. Nonetheless, the Examiner determines that because the compositions overlap and the steels are “made using a substantially similar method, one of ordinary skill in the art would have expected the amount of W present in the alloy of [Kushida or Kondo] to inherently be in a Mo tolerance increasing effective amount.” (\textit{Id.} at 3, 1st full para., last sentence; 4, 2d full para., last sentence; 7, ll. 1–4; 8, ll. 3–6.)

Figueiredo urges the Examiner erred harmfully because neither reference teaches or suggests the criticality of the W content, and each reference states that minimal or no W is acceptable. (Br. 6.) In Figueiredo’s

\textsuperscript{11} Kunio Kondo et al., \textit{Process for producing high-strength seamless steel pipe having excellent sulfide stress cracking resistance}, U.S. Patent No. 5,938,865 (1999). (Kunio Kondo and Takahiro Kushida are common inventors on both patents references in this case.)
view, the relatively wide ranges of the references cited by the Examiner (Kushida, 0–1%; Kondo, 0–2%)\(^{12}\) compared to the range required by the claims (0.43–0.46%), coupled with the distant amounts of W present in the closest examples (0.12% (Kushida Table 1 at cols. 9–10, steels K and L); 0.82% and 1.45% (Kondo, Figure 3, steels e and n)) would have provided inadequate guidance or motivation to the ordinary worker to arrive at the claimed low alloy steels having 0.43–0.46% W. (Br. 6–8.) Moreover, Figueiredo points out, Kondo teaches that high SSC resistance steels should have very low contents of Mn and Si, less than 0.1%, whereas the claimed steels require more than 0.1%. (Br. 7, last para., citing Kondo col. 11, ll. 6–9 and 21–25.) When queried at the hearing about Kushida’s teaching of a most preferred upper limit of W of 0.5% (Kushida col. 7, ll. 50–51), relatively close to the range of W recited in claim 1 (0.43–0.46%), counsel for Figueiredo pointed out that Kushida teaches that the improved SSC resistance “appears evidently with zirconium content of 0.1% or more.” (Id. at ll. 44–46.) Thus, the teachings of Kushida regarding the amounts of W do not appear to be general. Because both Kushida and Kondo teach zirconium may be added for specific purposes (Kushida col. 7, ll. 30–39; Kondo col. 13, ll. 35–43), counsel argued that the ordinary worker would not have regarded zirconium as an impurity or residual as required by claims 1 and 12.

A prior art disclosure of an encompassing range may render ranges within that range prima facie obvious. In re Peterson, 315 F.3d 1325, 1329, (Fed. Cir. 2003) (“A prima facie case of obviousness typically exists when

\(^{12}\) Both Kushida and Kondo report amounts of additives as weight percent.
the ranges of a claimed composition overlap the ranges disclosed in the prior art” (citations omitted, underscore added). In particular, the court continued, “[s]electing a narrow range from within a somewhat broader range disclosed in a prior art reference is no less obvious than identifying a range that simply overlaps a disclosed range.” Id., underscore emphasis added. Whether a broader range is only “somewhat” broader than a range recited in a claim is a factual inquiry that requires adequate evidence and findings that the composition would have been expected, on the basis of the prior art of record, to behave in a predictable manner. As our reviewing court has explained, “[t]o render a claim obvious, prior art cannot be ‘vague’ and must collectively, although not explicitly, guide an artisan of ordinary skill towards a particular solution.” Unigene Labs., Inc. v. Apotex, Inc., 655 F.3d 1352, 1361 (Fed. Cir. 2011). The court has further explained three assumptions underlying the Supreme Court’s analysis in KSR13. Eisai Co. Ltd. v. Dr. Reddy’s Labs, Ltd., 533 F.3d, 1353, 1359 (Fed. Cir. 2008). First, that there is a reference point “from which a skilled artisan might identify a problem and pursue potential solutions.” Id. Second, “that the record up to the time of invention would give some reasons, available within the knowledge of one of skill in the art, to make particular modifications to achieve the claimed compound.” Id. Third, that “the record before the time of invention would supply some reasons for narrowing the prior art universe to a ‘finite number of identified, predictable solutions,’ 127 S. Ct. at 1742 [550 U.S. at 402].” 553 F.3d at 1359.

In the present case, the Examiner cites (FR 5, ll. 13–15; Ans. 5, ll. 6–10) the linkage between tungsten (W) and molybdenum (Mo) disclosed by Kondo (Kondo col. 12, l. 46–col. 13, l. 16) as evidence of a reason to adjust the amounts of these elements in the low alloy steels. The Examiner, however, does not identify any evidence that the ordinary worker would have discerned any trends or indications that the range of 0.43–0.46% W would have been likely to provide relatively high yield strength and high SSC resistance. The evidence of record on this matter includes: the explicit statement in Kondo that W is optional (“W is not an indispensable alloying element.” Kondo col. 12, l. 47); the larger amounts of W used in the two examples (e, 0.82%, and n, 1.46%); and the reported “threshold stress of SSC resistance” (e.g., 1.104 kgf/mm\(^2\) [MPa] and n, 105.6 kgf/mm\(^2\)) (Kondo, Figure 4). The highest threshold stress of SSC resistance reported by Kondo is for test No. 14, steel m (110 kgf/mm\(^2\)) (id.), which has 0% W (and the lowest amounts of Si (0.05%) and Mn (0.06%) (Kondo Figure 3)). Aside from a general invitation to experiment among the ranges of the more than 14 elements that can be added for various purposes, there appears to be little if any guidance from Kondo to lead the ordinary worker to the particular solution encompassed by claim 1.

Although the ranges disclosed by Kushida are somewhat narrower, again, as Figueiredo points out (Br. 6, ll. 14–17), Kushida teaches that W is optional (“[t]ungsten may not be added in the steel, but if added . . . .” (Kushida col. 7, l. 41)). Moreover, of the two example steels (K, L; see Kushida, cols. 9–10, Table 1) that contain W (both at 0.12%), although both exhibit high yield strength and high tensile strength (id. at Table 2), only one, K, exhibits excellent (“free from any cracking . . . indicated
[by] . . . ‘○’,” (id. at col. 11, ll. 43–45)) response to the SSC test. In contrast, the other steel, L\textsuperscript{14}, exhibits a poor response (“suffered from a cracking as poor indicated with ‘X’ (id.)). Moreover, as the Examiner recognizes, Kushida, unlike Kondo, does not disclose a relation between W and Mo.\textsuperscript{15} The Examiner has not demonstrated any trends or indications of the likelihood of improving yield strengths and SSC resistance by increasing W content from 0.12% to the range required by claim 1.\textsuperscript{16} Moreover, whether a disclosed prior art range of a substance “narrowly encompasses” a range of a substance recited in a claim is a conclusion based on evidence of record that, throughout the two ranges, more likely than not, similar amounts yield similar, or at least well-predictable, effects. In the absence of such an analysis, the conclusion is merely a numerical comparison. The legal conclusion of obviousness requires a sounder foundation of evidence.

We conclude that the weight of the evidence supports Figueiredo. We therefore reverse.

\textsuperscript{14} Steel L has too much Cr (0.80%) for Kushida (0.7% Cr maximum (Kushida col. 5, ll. 49–64)).

\textsuperscript{15} This may be because Kushida considers a lower Mo content (0.1–0.5%, more preferably 0.2 to 0.4% (Kushida col. 6, ll. 9–10) than Kondo (0.1 to 1.5%, preferably 0.2–1.0%, more preferably 0.3 to 0.8% (Kondo col. 9, ll. 24–27)), and the desired counteracting effects of W on high amounts of Mo are not perceived to be needed.

\textsuperscript{16} The discernment of such a change is more difficult in light of Kushida’s statement that the effect of W on Mo in these steels depends on the presence of 0.1% Zr (Kushida col. 7, ll. 45–46).
C. Order

It is ORDERED that the rejections of claims 1–9, 11–17, and 20–24 are reversed.

REVERSED
I dissent, respectfully, from the majority’s opinion with respect to the rejection of claims 1–9, 11–17, and 20–24 over Kushida because after reviewing all the evidence before us, in my judgment, the evidence of obviousness set forth by the Examiner outweighs the evidence of non-obviousness submitted by Figueiredo.

As the majority opinion acknowledges, Kushida teaches a lower limit of 0% W and a most preferred upper limit of W of 0.5% (Kushida col. 7, ll. 50–51)—a range that narrowly encompasses the range of W recited in claim 1 (0.43%–0.46%). Kushida also teaches that when added to steel, tungsten, like molybdenum, “enhances the hardenability through quenching and the strength . . . and increases a resistance to temper softening thereby improving the SSC resistance.” Kushida col. 7, ll. 41–45. Thus, in my
view, Kushida’s disclosure would have guided one of ordinary skill in the art to selecting a narrow range of W encompassing claim 1’s W range to enhance strength and improve the SSC resistance. *In re Peterson*, 315 F.3d 1325, 1330 (Fed. Cir. 2003) (“The normal desire of scientists or artisans to improve upon what is already generally known provides the motivation to determine where in a disclosed set of percentage ranges is the optimum combination of percentages.”). Accordingly, Kushida’s disclosure, as the Examiner finds, is sufficient to establish a prima facie case of obviousness.

Final Act. 2–3; Ans. 4–6. On this record, Figueiredo has not directed us to sufficient objective evidence showing the particular W range recited in claims 1 and 12 is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range. See *Peterson*, 315 F.3d at 1330 (citations omitted).

Figueiredo’s argument that none of Kushida’s examples (0.12% (Kushida cols. 9–10 (Table 1, steels K and L))), disclose a W content “anywhere close to” claim 1’s W range (Br. 7) is unpersuasive because a reference may be considered for all that it teaches. *In re Applied Materials, Inc.*, 692 F.3d 1289, 1298 (Fed. Cir. 2012) (“A reference must be considered for everything that it teaches, not simply the described invention or a preferred embodiment.”).

Likewise, counsel’s argument at the hearing that because Kushida teaches that the improved SSC resistance “appears evidently with zirconium content of 0.1% or more” (Kushida col. 7, ll. 45–46 (emphasis added)), the ordinary worker would not have regarded zirconium as an impurity or residual as required by claims 1 and 12 is also unpersuasive. In my view, the arguments regarding zirconium raised by Figueiredo’s counsel in the
hearing, which the majority opinion relies on, are untimely because they were not raised in the Appeal Brief, and counsel has not shown good cause for presenting the arguments for the first time during the hearing. 37 C.F.R. § 41.47(e)(1)-(2). Nevertheless, even if we consider counsel’s argument, we find it unpersuasive because it is unsupported by sufficient factual evidence. See In re Pearson, 494 F.2d 1399, 1405 (CCPA 1974) (“Attorney’s argument . . . cannot take the place of evidence.”).

For the foregoing reasons, it is my view that, on this record, the preponderance of the evidence supports the Examiner’s determination that claims 1–9, 11–17, and 20–24 would have been obvious over Kushida. Accordingly, I would affirm the rejection under 35 U.S.C. § 103(a) over Kushida, and I dissent, respectfully, from the Decision to reverse that rejection.