

NOTE: This disposition is nonprecedential.

**United States Court of Appeals
for the Federal Circuit**

HITACHI METALS, LTD.,
Appellant

v.

**ALLIANCE OF RARE-EARTH PERMANENT
MAGNET INDUSTRY,**
Appellee

2016-1824, 2016-1825

Appeals from the United States Patent and Trade-
mark Office, Patent Trial and Appeal Board in Nos.
IPR2014-01265, IPR2014-01266.

Decided: July 6, 2017

MARC A. HEARRON, Morrison & Foerster LLP, Wash-
ington, DC, argued for appellant. Also represented by
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Before LOURIE, TARANTO, and CHEN, *Circuit Judges*.

LOURIE, *Circuit Judge*.

Hitachi Metals, Ltd. (“Hitachi”) appeals from final written decisions of the U.S. Patent and Trademark Office (“the PTO”) Patent Trial and Appeal Board (“the Board”) in two *inter partes* reviews (“IPRs”), concluding that claims 1, 5, and 6 of U.S. Patent 6,537,385 (“the ’385 patent”) and claims 1–4, 11, 12, and 14–16 of U.S. Patent 6,491,765 (“the ’765 patent”) would have been obvious at the time of their respective inventions and that claim 1 of the ’385 patent was anticipated. *See All. of Rare-Earth Permanent Magnet Indus.*, IPR 2014-01265, 2016 Pat. App. LEXIS 1082, at *41 (P.T.A.B. Feb. 8, 2016) (“’385 Decision”); *All. of Rare-Earth Permanent Magnet Indus.*, IPR 2014-01266, 2016 Pat. App. LEXIS 1083, at *56 (P.T.A.B. Feb. 8, 2016) (“’765 Decision”). For the reasons set forth below, we *affirm* in part and *vacate and remand* in part.

BACKGROUND

Hitachi owns the ’385 and ’765 patents (together, “the challenged patents”), which have almost identical written descriptions and are directed to a process for manufacturing a powder used to produce rare-earth magnets. *See, e.g.*, ’765 patent col. 1 ll. 7–9.¹ Claim 1 of the ’385 patent is representative and reads as follows:

A method for manufacturing alloy powder for R–Fe–B rare earth magnets, comprising a first pulverization step of coarsely pulverizing an R–Fe–B

¹ Because the challenged patents have almost identical written descriptions, we will refer only to the ’765 patent written description for simplicity when discussing either patent.

alloy for rare earth magnets produced by a rapid cooling method and a second pulverization step of finely pulverizing the material alloy,

wherein said second pulverization step comprises a step of removing at least part of the powder in which the concentration of rare earth element is greater than the average concentration of rare earth element contained in the entire powder.

'385 patent col. 13 ll. 19–37. The “R–Fe–B” designation refers to a mixture of a rare earth element (R), iron (Fe), and boron (B). Dependent claim 5 requires the further step of cooling “a molten material alloy at a cooling rate in a range between 10^2 °C./sec and 10^4 °C./sec.” *Id.* col. 14 ll. 1–4. Dependent claim 6 requires that the molten material alloy be cooled by a “strip casting method.” *Id.* col. 14 ll. 5–6.

Claim 1 of the '765 patent is representative and reads as follows:

A method for manufacturing alloy powder for R–Fe–B rare earth magnets, comprising a first pulverization step of coarsely pulverizing a material alloy for rare earth magnets and a second pulverization step of finely pulverizing the material alloy,

wherein said first pulverization step comprises a step of pulverizing the material alloy by a hydrogen pulverization method, and

said second pulverization step comprises a step of removing at least part of fine powder having a particle size of $1.0 \mu\text{m}$ or less to adjust the particle quantity of the fine powder having a particle size of

1.0 μm or less to 10% or less of the particle quantity of the entire powder.

'765 patent col. 13 ll. 21–33. Dependent claim 3 requires that the fine pulverization step be performed “in a high-speed flow of gas,” which dependent claim 4 requires to be “oxygen.” *Id.* col. 13 ll. 39–43. Dependent claims 11 and 12 resemble claims 5 and 6, respectively, of the '385 patent, as discussed above. *Id.* col. 14 ll. 16–21.

The Alliance of Rare-Earth Permanent Magnet Industry (“the Alliance”) filed requests for IPR of the challenged patents, which the PTO granted. The Board concluded that claims 1, 5, and 16 of the '385 patent and claims 1–4, 11, 12, and 14–16 of the '765 patent would have been obvious over various combinations of: (1) Japanese Patent 1993-283217 to Hasegawa (“*Hasegawa*”); (2) U.S. Patent 4,992,234 to Ohashi et al. (“*Ohashi*”); (3) U.S. Patent 5,383,978 to Yamamoto et al. (“*Yamamoto*”); and (4) Shuixiao He, *Rare Earth Permanent Magnet Milling Equipment – Jet Mill Closed Loop System*, 21 MAGNETIC MATERIALS AND PARTS, 48–51 (Oct. 1990) (“*He*”). The Board also concluded that claim 1 of the '385 patent was anticipated by *He*.

I. '385 Patent

The Board concluded that claims 1, 5, and 6 of the '385 patent would have been obvious over either *Hasegawa*, *Ohashi*, or *He* and *Yamamoto*, and that claim 1 was anticipated by *He*. In making its obviousness determinations, the Board relied on *Hasegawa*, *Ohashi*, and *He* for teaching every element of claim 1 except the “rapid cooling method,” for which it relied on *Yamamoto*. Hitachi did not dispute those findings. Hitachi argued only that one of ordinary skill in the art would not have been motivated to combine those references.

A. Obviousness over *Ohashi/Hasegawa* and *Yamamoto*

The Board, crediting the Alliance's arguments, found that one of ordinary skill would have been motivated to combine *Ohashi* or *Hasegawa* with *Yamamoto* because it was understood that *Yamamoto*'s rapid cooling method produces a more uniform alloy, so one of ordinary skill would have been motivated to combine the references "in order to pulverize a more uniform R-Fe-B material alloy." '385 *Decision*, 2016 Pat. App. LEXIS 1082, at *16-17, *21-22. Hitachi did not dispute that *Yamamoto*'s rapid cooling method would result in a more uniform alloy, but rather argued that one of ordinary skill would not have been motivated to pulverize a more uniform alloy because the consequence would have been a 50% or more reduction in yield. *See id.* at *18-19.

The Board rejected Hitachi's arguments, explaining that, even if Hitachi were correct that the combination would have resulted in a significantly diminished yield, such commercial considerations "do[] not control the obviousness determination," especially since the claims do not require a certain minimum yield. *Id.* at *21. Instead, the Board relied on the Alliance's evidence that the claimed steps were each known in the art and used for their known purpose and that the result of the combination would have been predictable. *Id.* at *21, *27-28. The Board found that a skilled artisan would have known how to combine the references because the ingot (*Ohashi* and *Hasegawa*) and strip casting (*Yamamoto*) methods were "interchangeable to those skilled in the art." *Id.* at *13, *27. Furthermore, the Board found that "design incentives," such as "lower cost [and a] more productive [process] better suited for higher volume manufacturing," would have led one of ordinary skill to pursue the combination. *Id.* at *21-22, *27-28.

Hitachi did not dispute that *Yamamoto* teaches the limitations of claims 5 and 6 of the '385 patent, and the

Board concluded that those claims would also have been obvious over *Ohashi* or *Hasegawa* and *Yamamoto* for the same reasons as claim 1.

B. Obviousness over *He* and *Yamamoto*

The Board also concluded that claims 5 and 6 would have been obvious over *He* and *Yamamoto*. The Board relied on *He* for teaching every limitation except for the cooling rate range of claim 5 and the “strip casting method” of claim 6, for which it relied on *Yamamoto*. Hitachi did not dispute that the references teach those limitations, but rather argued that there would not have been a motivation to combine them. The Board rejected the Alliance’s argument that one of ordinary skill would have been motivated to combine *He* with *Yamamoto*’s cooling rate because *Yamamoto*’s method would result in a more uniform alloy. *Id.* at *38–39. The Board found that the Alliance’s evidence was lacking because it did not explain how *Yamamoto*’s particular cooling rate would differ from *He*’s disclosed “quick quenching,” Joint Appendix (“J.A.”) 705. ’385 *Decision*, 2016 Pat. App. LEXIS 1082, at *38. However, the Board found persuasive the Alliance’s evidence that the claims encompass nothing more than the “combination of prior art elements according to known methods to yield a predictable result.” *Id.* at *39–40. Thus, the Board concluded that claims 5 and 6 would have been obvious over *He* and *Yamamoto*.

C. Anticipation by *He*

The Board found that *He* anticipated claim 1. The dispute before the Board focused on whether *He*’s disclosed “quick quenching,” J.A. 705, constitutes the claimed “rapid cooling method,” ’385 patent col. 13 l. 22. Thus, the Board first construed “rapid cooling method.” ’385 *Decision*, 2016 Pat. App. LEXIS 1082, at *10–11. Hitachi argued that a skilled artisan would have interpreted *He*’s disclosed “quick quenching” method to be a “super-rapid cooling,” rather than a “rapid cooling,”

method. Specifically, Hitachi argued, one of ordinary skill would have interpreted “quick quenching” as referring to “melt spinning,” a super-rapid cooling method that employs cooling rates “in excess of 10^6 K s^{-1} ,” because strip casting methods were not known in 1990. *Id.* at *32–33. Hitachi argued that the written description defines the range of cooling rates covered by the term “rapid cooling” as being between 10^2 – 10^4 °C./sec and thus *He* does not disclose the “rapid cooling method” as properly construed.

The Board rejected Hitachi’s construction based on principles of claim differentiation—it found that, because dependent claim 5 recites “a cooling rate in a range between 10^2 °C./sec and 10^4 °C./sec,” claim 1’s recitation of “rapid cooling method” must “encompass a broader range of cooling rates” and thus does not “necessarily exclude super-rapid cooling methods.” *Id.* at *10–11. Under that construction, the Board found that *He*’s disclosed “quick quenching” constitutes the claimed “rapid cooling method” and that claim 1 was anticipated by *He*. *Id.* at *34.

II. ’765 Patent

A. Obviousness over *Ohashi* and *Hasegawa*

The Board concluded that claims 1–4, 14, and 16 of the ’765 patent would have been obvious over *Ohashi* and *Hasegawa*. In making its obviousness determination, the Board relied on *Ohashi* for teaching every element of claim 1, except the requirement that the “first pulverization step comprises a step of pulverizing the material alloy by a *hydrogen* pulverization method,” ’765 patent col. 13 ll. 26–28 (emphasis added), for which it relied on *Hasegawa*. Hitachi did not dispute those findings, but rather argued only that one of ordinary skill in the art would not have been motivated to combine the references.

The Board found that one of ordinary skill would have been motivated to employ *Hasegawa*’s hydrogen pulverization method to “improve the coarse pulverization” taught

by *Ohashi* because the Alliance's evidence shows that hydrogen pulverization "more easily crush[es] the material alloy." '765 *Decision*, 2016 Pat. App. LEXIS 1083, at *16–18. The Board credited the Alliance's evidence that hydrogen pulverization allows the process to occur "in one-fourth of the time required by [*Ohashi*'s] mechanical pulverization" and that it also "improves pulverization yield and pulverization efficiency." *Id.* at *29, *30 (internal quotation marks omitted). Further, the Board found that one of ordinary skill would have had a reasonable expectation of success in combining the references, which disclose "well-known and common technique[s]," and that the results would have been predictable. *Id.* at *29.

As for dependent claims 2, 3, 14, and 16, Hitachi made no additional arguments and the Board concluded that those claims would have been obvious over *Ohashi* and *Hasegawa* for the same reasons as claim 1. *Id.* at *31.

Hitachi did, however, assert separate arguments relating to the Board's obviousness determination of claim 4, which depends from claim 3 and requires that the "pulverization step" be conducted "in a high-speed flow of gas" (claim 3), "wherein the gas comprises oxygen" (claim 4). '765 patent col. 13 ll. 39–43. Hitachi argued that *Ohashi* teaches the use of a high-speed flow of gas (i.e., an "air stream," J.A. 699) for *particle classification* only, not for *finely pulverizing* the alloy, as required by claim 4.

The Board rejected that argument, determining that claim 1, from which claim 4 depends, comprises two pulverization steps: (1) a *first pulverization* step of coarse pulverization; and (2) a *second pulverization* step, which in turn comprises the two "sub-step[s]" of (i) fine pulverization, a.k.a. "milling," and (ii) particle classification, i.e. removal of particles having a particular size. '765 *Decision*, 2016 Pat. App. LEXIS 1083, at *37. The Board concluded that the two sub-steps constitute one *continu-*

ous process under the umbrella “second pulverization step”—thus, a reference teaching the second sub-step necessarily teaches the umbrella “second pulverization step.” *Id.* at *35–37. And the Board interpreted claim 4 as requiring a high-speed flow of oxygen for the umbrella step, not the first sub-step. *Id.* at *37–38. Under that interpretation, the Board found that *Ohashi* teaches “pulverization” using a “high-speed flow of [oxygen] gas,” as recited in claim 4, because it teaches using an “air stream” for particle classification (i.e., the second sub-step) and an “air stream” necessarily includes some amount of oxygen gas. *Id.* at *38.

B. Obviousness over *Ohashi*, *Hasegawa*, and *Yamamoto*

The Board concluded that dependent claims 11 and 12 would have been obvious over *Ohashi*, *Hasegawa*, and *Yamamoto*. Hitachi again disputed only the combinability of those references for the same reasons it had previously articulated. The Board rejected those arguments, finding a motivation to combine *Ohashi* and *Hasegawa* for the same reasons as for claim 1 of the ’765 patent and a motivation to combine either *Ohashi* or *Hasegawa* with *Yamamoto* for the same reasons as for claim 1 of the ’385 patent.

Hitachi timely appealed to this court. We have jurisdiction pursuant to 28 U.S.C. § 1295(a)(4)(A).

DISCUSSION

We review the Board’s legal conclusions de novo and its factual findings for substantial evidence. *In re Gartside*, 203 F.3d 1305, 1316 (Fed. Cir. 2000). A finding is supported by substantial evidence if a reasonable mind might accept the evidence as adequate to support the conclusion drawn therefrom. *Consol. Edison Co. v. NLRB*, 305 U.S. 197, 217 (1938). Obviousness is a question of law based on underlying facts. *Apple Inc. v. Samsung Elecs. Co.*, 839 F.3d 1034, 1047 (Fed. Cir. 2016) (en

banc). What the prior art teaches, whether a person of ordinary skill in the art would have been motivated to combine references, and whether a reference teaches away from the claimed invention are questions of fact. *Id.* at 1047–48; *In re Mouttet*, 686 F.3d 1322, 1330 (Fed. Cir. 2012).

On appeal, Hitachi argues that the Board erred in: (1) finding a motivation to combine the references in its obviousness determinations for both of the challenged patents; (2) construing “rapid cooling method” and finding, under that construction, that *He* anticipates claim 1 of the ’385 patent; and (3) construing claim 4 of the ’765 patent and thus in its obviousness determination of that claim. We discuss each of the challenged patents in turn.

I. ’385 Patent

A. Obviousness over *Ohashi* or *Hasegawa* and *Yamamoto*

The Board concluded that claims 1, 5, and 6 of the ’385 patent would have been obvious over *Hasegawa* or *Ohashi* in view of *Yamamoto*.

Hitachi makes almost identical arguments for both of the combinations relied upon by the Board—namely, that one of skill in the art would not have been motivated to combine *Ohashi* or *Hasegawa* with *Yamamoto* because the results of pulverizing the more uniform alloy produced by *Yamamoto*’s rapid cooling method would be a 50% or more reduction in yield and a lower quality magnet.

Hitachi argues that the Board erred in dismissing its evidence regarding the potentially lower yield as a “commercial [consideration that] does not control the obviousness determination.” ’385 *Decision*, 2016 Pat. App. LEXIS 1082, at *20. Hitachi notes the apparent contradiction between that reasoning and the Board’s subsequent finding that one of skill in the art would be motivated to combine the references due to “design incentives,” such as “lower cost [and a] more productive [process] better suited

for higher volume manufacturing.” *Id.* at *21–22, *27, *28. Hitachi also disputes the Board’s findings that all of the claims would have been obvious because they “represent the combination of prior art elements according to known methods to yield a predictable result.” *See, e.g., id.* at *21 (citing *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007)). Hitachi argues that those findings are merely “boilerplate” recitations that state a *conclusion*, not a *reason* to combine the references.

The Alliance responds that the factual findings underpinning the Board’s obviousness determinations were supported by substantial evidence.

We conclude that the Board did not err in determining that claims 1, 5, and 6 of the ’385 patent would have been obvious over *Ohashi* or *Hasegawa* in view of *Yamamoto*. We do agree with Hitachi that the Board applied internally inconsistent reasoning in rejecting Hitachi’s evidence on the basis that “commercial [considerations] do[] not control the obviousness determination,” *id.* at *20, while also finding that one of skill in the art would have been motivated to combine the references due to “design incentives,” *id.* at *21. If the Board’s analysis had stopped there, we might remand for further analysis that is not internally inconsistent.

However, the Board made additional findings to support its obviousness determinations, including that one of skill in the art would have known to mitigate the alleged reduction in yield by adjusting the jet mill settings during pulverization. *See, e.g., id.* at *19, *28 (citing expert testimony that “a person of ordinary skill would have known to adjust basic, fundamental jet milling settings to accommodate the uniform particle size and shape distribution of the strip cast alloy” (internal quotation marks and brackets omitted)). That finding was supported by substantial record evidence. *See J.A.* 788.

Hitachi points to countervailing testimony by the same expert that, while a skilled artisan would have known *to* adjust the settings, they would not have known *how* to do so, as the “multi-parameter compositional experimentation” required would be beyond the capabilities of one of ordinary skill. J.A. 972. However, we do not “reweigh evidence on appeal.” *In re NTP, Inc.*, 654 F.3d 1279, 1292 (Fed. Cir. 2011). We must accept the Board’s finding so long as a “reasonable mind might accept [the evidence upon which it relied] as adequate to support [its] conclusion.” *Consol. Edison Co.*, 305 U.S. at 217. The Board reviewed the competing evidence and made a factual determination that a skilled artisan would not have been demotivated by the potential reduction in yield. We see no error in that finding, which was a reasonable interpretation of the record evidence.

In light of the foregoing, the Board found that the claims were directed to nothing more than a “combination of prior art elements according to known methods to yield a predictable result.” ’385 *Decision*, 2016 Pat. App. LEXIS 1082, at *21, *24. The Supreme Court has advised that a combination of known elements is likely to be obvious when it yields predictable results. *KSR*, 550 U.S. at 416. And substantial evidence supports the Board’s findings that the prior art elements were well-known, one of ordinary skill would have known how to combine them, and the results of so doing would have been predictable. *See* ’385 *Decision*, 2016 Pat. App. LEXIS 1082, at *18, *20, *27, *39.

B. Obviousness over *He* and *Yamamoto*

The Board found that claims 5 and 6 would have also been obvious over *He* and *Yamamoto*. As for those claims, Hitachi repeats several of its arguments regarding the Board’s determinations of obviousness over *Ohashi* or *Hasegawa* and *Yamamoto*. Namely, Hitachi disputes the Board’s finding that the claims are directed to nothing

more than the “combination of prior art elements according to known methods to yield a predictable result.” *Id.* at *39–40. Hitachi argues that such findings are merely boilerplate recitations that state a *conclusion*, not a *reason* to combine the references. Furthermore, Hitachi challenges the credibility of the Alliance’s expert declaration, relied upon by the Board, as making bald assertions that lack evidentiary support.

We affirm the Board’s conclusion that claims 5 and 6 would have been obvious over *He* and *Yamamoto* for the reasons discussed above regarding the obviousness of claim 1, 5, and 6 over *Ohashi/Hasegawa* and *Yamamoto*. We see no legal error in the Board’s analysis, and we do not reweigh evidence on appeal.

C. Anticipation by *He*

The Board found that *He* anticipated claim 1. On appeal, Hitachi challenges the Board’s construction of “rapid cooling method,” arguing, as it did before the Board, that one of ordinary skill would have understood “rapid cooling method” to be distinct from “super rapid cooling.” Hitachi asserts that, at the time of the invention, one of ordinary skill would have recognized three categories of methods for preparing alloys for sintered rare-earth magnets: (1) traditional cooling methods, such as ingot casting; (2) rapid cooling methods, such as strip casting; and (3) super-rapid cooling methods, such as melt spinning. Hitachi submitted evidence—expert testimony and other printed publications—indicating that one of ordinary skill would have understood the three categories to be distinct, such that “rapid cooling” refers to a method that is faster than ingot casting, but not so fast that it enters the domain of super-rapid cooling. Hitachi argues that the written description defines the range of cooling rates covered by the term because it states: “In the rapid cooling method, the molten alloy is cooled at a rate in the range between 10^2 °C./sec and 10^4 °C./sec.” ’385 patent

col. 1 ll. 46–47. In contrast, Hitachi argues, super rapid cooling methods were understood by those of skill in the art as exceeding 10^6 degrees per second. Therefore, Hitachi argues, one of skill in the art would have understood *He*'s disclosed “quick quenching” to be a “super rapid cooling” method rather than the claimed “rapid cooling method” and thus *He* did not anticipate claim 1.

The Alliance responds that the Board correctly construed “rapid cooling method.” The Alliance argues that the written description provides a clear definition of the term when it describes rapid cooling as “typified by a strip casting method,” wherein “a molten material alloy is put into contact with a single chill roll, twin chill rolls, a rotary chill disk, a rotary cylindrical chill mold, or the like, to be rapidly cooled thereby producing a solidified alloy thinner than an ingot cast alloy.” *Id.* col. 1 ll. 39–45. The Alliance contends that the Board correctly adopted that definition, finding in it no exclusion of rates in excess of 10^6 °C./sec. Furthermore, the Alliance argues, claim 5, which depends from claim 1, recites “a cooling rate in a range between 10^2 and 10^4 °C./sec,” *id.* col. 14 l. 4, and claim 6, which depends from claim 5, specifies that the rapid cooling method is a “strip casting method,” *id.* col. 14 l. 6. Thus, the Alliance maintains, claim 1's recitation of “rapid cooling method” must encompass rates outside of the range recited in claim 5 and methods other than the strip casting recited in claim 6, and therefore claim 1 was anticipated by *He*.

We agree with the Alliance that the doctrine of claim differentiation requires that the scope of “rapid cooling method” covered by claim 1 be broader than the range specified in dependent claim 5 (10^2 – 10^4 °C./sec). *See id.* col. 14 ll. 1–4. Hitachi argues that, even if claim differentiation requires the range of claim 1 to be slightly broader than 10^2 – 10^4 °C./sec, it does not require the range to be so broad as to include rates in excess of 10^6 degrees per

second, which one of ordinary skill would understand to constitute super-rapid cooling.

However, nowhere does the written description accord with Hitachi's argument, nor does it anywhere indicate that "rapid cooling" must exclude cooling at rates in excess of 10^6 degrees per second. Rather, the written description states that "[i]n a *preferred embodiment*, the material alloy for rare earth magnets is obtained by cooling a molten material alloy at a cooling rate in the range between 10^2 °C./sec and 10^4 °C./sec." *Id.* col. 3 ll. 51–54 (emphasis added). The patent expressly refers to the range recited by claim 5 as a "preferred embodiment." *Id.* Thus, "rapid cooling method," as recited in claim 1, must encompass a broader range than that recited in claim 5 and nowhere does the specification cap the range at 10^6 degrees per second. Consequently, the Board's construction of "rapid cooling method" as not *excluding* "super rapid cooling" is supported by the intrinsic record and we affirm that construction.

Hitachi premises the remainder of its challenges to the Board's anticipation finding on its proposed construction of "rapid cooling method." Thus, because we affirm the Board's construction, we affirm its finding that *He* anticipated claim 1. Accordingly, the Board was correct in concluding that claim 1, as properly construed, was anticipated by *He*.

II. '765 Patent

A. Obviousness over *Ohashi* and *Hasegawa*

The Board concluded that claims 1–4, 14, and 16 of the '765 patent would have been obvious over *Ohashi* and *Hasegawa*. Hitachi challenges the Board's findings that one of ordinary skill would have been motivated to employ *Hasegawa's* hydrogen pulverization to "improve the coarse pulverization" taught by *Ohashi* because the Alliance's evidence shows that hydrogen pulverization "more easily

crush[es] the material alloy,” and hydrogen pulverization was a “well-known and common technique” that would have yielded predictable results when substituted for *Ohashi*’s mechanical pulverization. ’765 *Decision*, 2016 Pat. App. LEXIS 1083, at *16–18, *29 (internal quotation marks omitted).

Hitachi contends that the Board erred in accepting the bald assertions of the Alliance’s expert that lacked supporting evidence. Hitachi points to its evidence that, in order to substitute *Hasegawa*’s hydrogen pulverization for *Ohashi*’s mechanical pulverization, the solid alloy must accordingly be changed to the proper microstructure, but changing the microstructure of the solid alloy would completely alter *Ohashi*’s operating principle. Thus, Hitachi argues, the combination would have required more than ordinary skill. Furthermore, Hitachi contends that the Board improperly shifted the burden by requiring Hitachi to show that the combination would have been *beyond* the capability of one of ordinary skill.

The Alliance responds that substantial evidence supports the Board’s finding of a motivation to combine.

We agree with the Alliance that substantial evidence supports the Board’s findings for claims 1, 2, 14, and 16. The Board credited the Alliance’s evidence that one of ordinary skill would have been motivated to employ *Hasegawa*’s hydrogen pulverization to “improve the coarse pulverization” taught by *Ohashi* because the Alliance’s evidence shows that hydrogen pulverization “more easily crush[es] the material alloy,” *id.* at *16–18; hydrogen pulverization allows the process to occur “in one-fourth of the time required by [*Ohashi*’s] mechanical pulverization,” *id.* at *29; hydrogen pulverization “improves pulverization yield and pulverization efficiency” over mechanical pulverization, *id.* at *29 (internal quotation marks omitted); one of ordinary skill would have had a reasonable expectation of success in combining the references, which

disclose “well-known and common technique[s],” *id.* at *29; and the results would have been predictable, *id.* We conclude that the foregoing constitutes substantial evidence to support the Board’s determination.

Hitachi primarily disputes the credibility of the Alliance’s evidence and presents its own competing evidence. But we do not reweigh the evidence considered by the Board and, in this case, we conclude that its interpretation of the evidence was reasonable.

B. Obviousness of Claim 4

Hitachi separately argues that claim 4 would not have been obvious over *Ohashi* and *Hasegawa*. Hitachi contends that the Board improperly construed claim 4.

Hitachi argues that the specification contradicts the Board’s construction—i.e., that a high-speed flow of gas for *particle classification*, as taught by *Ohashi*, satisfies the limitations of claims 3 and 4—because it distinguishes between the two sub-steps of fine pulverization and particle classification as *separate* steps, rather than one continuous step. Hitachi points to the language of claim 1, which recites that the “second pulverization step of finely pulverizing the material alloy . . . comprises a step of *removing at least part of the fine powder*,” ’765 patent col. 13 ll. 24–31 (emphasis added), and argues that the fine pulverization step must be *finished* before the particle classification step, otherwise there would be no fine powder to remove. Furthermore, Hitachi argues, the written description repeatedly distinguishes the act of fine pulverization conducted in the milling chamber of the apparatus from the particle classification performed in the classifier, and requires a high-speed flow of gas for the *pulverization*. Finally, Hitachi argues that *Ohashi* leads away from claim 4 by teaching that the pulverization should be conducted in a “non-oxidizing or inert gas” and oxygen is indisputably an oxidizing gas.

The Alliance responds that the Board properly interpreted the specification. First, the Alliance argues, claim 1 recites “a second pulverization step of *finely pulverizing* the material alloy, . . . wherein *said second pulverization step comprises a step of removing* at least part of the fine powder,” *id.* col. 13 ll. 24–31 (emphasis added), and thus indicates that the particle classification (i.e., “remov[al]”) is *part of* the “second pulverization step.” Second, the Alliance contends that the written description repeatedly describes “fine pulverization” as including a step of removing the fine powder. *See, e.g., id.* Abstract (“In the second pulverization step, easily oxidized super-fine powder . . . is removed . . .”); *id.* col. 4 ll. 56–62 (“In the method according to the present invention, after a material alloy . . . is coarsely pulverized and *before a fine pulverization step is finished*, at least part of R-rich super-fine powder . . . is removed. . .”) (emphasis added).

We agree with Hitachi that the Board misconstrued claim 4. As an initial matter, the parties seem to agree that, as recited in claim 1, the *fine pulverization* and *particle classification* are sub-steps of the umbrella “second pulverization step.” They disagree only as to whether claim 4’s requirement of a high-speed flow of gas comprising oxygen pertains to the umbrella step or to the first sub-step. We agree with Hitachi that claim 4 requires the use of a high-speed flow of gas comprising oxygen for the first *sub-step* of claim 1—the fine pulverization—rather than the umbrella “second pulverization step.”

The passages of the written description which the Alliance cite merely confirm that the particle classification step is a sub-step of the umbrella “second pulverization step,” which, as we noted above, the parties do not dispute. The issue is whether claim 4 requires a high-speed oxygen-containing gas for the umbrella step, or for the first sub-step. We conclude that it refers to the latter; and the passages relied on by the Alliance do not contradict that interpretation.

The written description explains that “[i]n the second pulverization step, the alloy is preferably finely pulverized using a high-speed flow of gas” containing oxygen, *id.* col. 3 ll. 27–30, and that “[t]he alloys may be finely pulverized using a jet mill,” *id.* col. 3 l. 46. Thus, it is clear that the high-speed gas is associated with the fine pulverization *conducted in the jet mill*. And the written description clearly distinguishes the jet milling apparatus from the particle classifier for performing the two *distinct* sub-steps—fine pulverization and particle classification, respectively. For example, the patent explains that “when a *jet mill is used to perform fine pulverization under a high-speed flow of inert gas*, a gas flow classifier . . . may be provided *following the jet mill* to enable effective removal of R-rich super-fine powder [A] *jet mill is used for the fine pulverization.*” *Id.* col. 5 ll. 23–30 (emphases added). *See also, e.g., id.* col. 3 ll. 47–50 (“The alloys may be finely pulverized *using a jet mill*. In a preferred embodiment, a *classifier is provided following the jet mill* for classifying powder output from the jet mill.” (emphases added)); *id.* col. 6 ll. 55–57 (“Next, the coarsely pulverized powder . . . is finely pulverized (or milled) *with a jet mill*. To the jet mill used in this embodiment, a *cyclone classifier is connected* for removal of the fine powder.” (emphasis added)).

In fact, in every instance where the written description refers to pulverization using a high-speed flow of gas, it refers to the milling apparatus, i.e., “jet mill” or “pulverizer,” rather than the particle “classifier.” *See, e.g., id.* col. 5 ll. 23–26 (“[W]hen a *jet mill is used to perform the fine pulverization under a high-speed flow of inert gas*, a gas flow classifier . . . may be provided *following the jet mill* to enable effective removal of R-rich super-fine powder” (emphasis added)); *id.* col. 6 l. 58–col. 7 l. 13 (discussing Figure 2, which shows the jet milling chamber, i.e., “pulverizer 14,” and the “classifier 16,” and explaining that the “material [is] pulverized with the pulverizer 14

[and] . . . classified with the cyclone classifier 16,” wherein “*pulverizer 14 includes . . . nozzle fittings 28 for receiving nozzles through which an inert gas . . . is jet at high speed*” (emphases added); *id.* col. 8 ll. 15–20 (“The material to be pulverized fed into the pulverizer 14 is rolled up with high-speed jets of inert gas . . . and *swirl[ed] together with high-speed gas flows inside the pulverizer 14*. While swirling, the particles of material are *finely milled* by mutual collision with each other.” (emphases added)); *id.* col. 10 l. 47–53 (referring to “the jet mill and the cyclone classifier connected to each other” and “a high speed flow gas for the jet mill.” (emphasis added)).

Thus, we reverse the Board’s construction of claim 4 and conclude that it requires a high-speed flow of gas (claim 3) comprising oxygen (claim 4) for the “fine pulverization” that occurs in the first *sub-step*—for example, by “pulverizer 14” shown in Figure 2. Under the correct construction, the Board’s obviousness determination as to claim 4 must therefore be vacated. The Board premised its finding that *Ohashi*’s use of an air stream for *particle classification* (the second sub-step) taught the limitations of claim 4 on its interpretation that claim 4 requires a high-speed flow of gas for the *umbrella step* and that the two sub-steps constitute one *continuous* process under the umbrella step. Under that interpretation, the Board found that *Ohashi*’s disclosure of a high-speed flow of gas for the second sub-step constituted a teaching of gas for the entire umbrella step. But the correct construction precludes such a finding. *Ohashi*’s use of an air stream for *particle classification only* cannot meet the limitation of claim 4, which requires the use of a high-speed flow of gas comprising oxygen for *fine pulverization*.

Therefore, because we reverse the Board’s claim construction, we vacate its obviousness determination as to claim 4 and remand for further consideration under the proper construction. We note that, on appeal, Hitachi did not argue claim 3 separately from claim 1, as it did for

claim 4. However, our conclusion with respect to the construction of claim 4 necessarily raises a question with respect to the construction and obviousness of claim 3. Thus, because we reverse the Board's construction of claim 4, we also vacate its obviousness determination as to claim 3.

We also suggest that, on remand, the Board consider Hitachi's argument that *Ohashi* teaches away from the invention of claim 4 because *Ohashi* teaches that the pulverization should be conducted in a "non-oxidizing or inert gas," and oxygen, even under the Board's definition of "oxidizing gas," see, e.g., '765 Decision, 2016 Pat. App. LEXIS 1083, at *21–22, is undeniably an oxidizing gas. In fact, the written description explains that oxygen is employed to *intentionally* oxidize the alloy and thus "control[] . . . the oxygen content of the finely pulverized alloy powder." '765 patent col. 9 ll. 30 ("The finely pulverized powder particles are *coated with an oxide layer* as described above." (emphasis added)).

Although Hitachi raised that argument before the Board, the Board's explanation in rejecting it was seemingly non-responsive. See '765 Decision, 2016 Pat. App. LEXIS 1083, at *38–39. In fact, the Alliance acknowledged during oral argument that the Board did not address Hitachi's argument and asserted that, if we reverse the Board's claim construction, we should remand for the issue to be decided by the Board. Oral argument at 18:30–19:50, *Hitachi Metals, Ltd. v. All. of Rare-Earth Permanent Magnet Indus.*, Nos. 16-1824, -1825 (Fed. Cir. June 8, 2017) ("At APPX53 is where the Board addresses the argument and doesn't reach it."), available at <http://oralarguments.cafc.uscourts.gov/default.aspx?fl=2016-1824.mp3>.

C. Obviousness over *Ohashi*, *Hasegawa*, and *Yamamoto*

The Board concluded that dependent claims 11 and 12 would have been obvious over *Ohashi*, *Hasegawa*, and

Yamamoto. Hitachi makes the same arguments regarding the combinability of *Ohashi* and *Hasegawa* with *Yamamoto* that it asserts in connection with the '385 patent, as discussed above. Thus, we affirm the Board's obviousness determinations as to claims 11 and 12 for the same reasons we stated above.

In sum, we affirm the Board's conclusion that claims 1, 5, and 6 of the '385 patent would have been obvious over *Ohashi*, *Hasegawa*, or *He* and *Yamamoto*, and that claim 1 was anticipated by *He*. We also affirm the Board's conclusion that claims 1, 2, 14, and 16 of the '765 patent would have been obvious over *Ohashi* and *Hasegawa* and that claims 11 and 12 would have been obvious over *Ohashi*, *Hasegawa*, and *Yamamoto*. However, we reverse the Board's construction of claim 4 of the '765 patent and thus vacate its obviousness determination as to claims 3 and 4 and remand for further consideration consistent with this opinion.

CONCLUSION

We have considered the remaining arguments but find them to be unpersuasive. For the foregoing reasons, we affirm-in-part and vacate-in-part the decision of the Board and remand for further consideration consistent with this opinion.

AFFIRMED-IN-PART, VACATED-IN-PART, AND REMANDED

COSTS

No costs