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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte FUTOSHI KUNIYOSHI, RINTARO ISHII,
TAKESHI NISHIUCHI, and TSUNEHIRO KAWATA

Appeal 2019-004860
Application 14/780,860
Technology Center 1700

Before MICHAEL P. COLAIANNI, JULIA HEANEY, and
MICHAEL G. McMANUS, *Administrative Patent Judges*.

McMANUS, *Administrative Patent Judge*.

DECISION ON APPEAL

Pursuant to 35 U.S.C. § 134(a), Appellant¹ seeks review of the Examiner's decision to reject claims 7, 10, 11, and 13–15. We have jurisdiction under 35 U.S.C. § 6(b).

We affirm.

¹ We use the word “Appellant” to refer to “applicant” as defined in 37 C.F.R. § 1.42. Appellant identifies the real party in interest as Hitachi Metals, Ltd. See Appeal Brief dated Aug. 28, 2018 (“Appeal Br.”) 2.

CLAIMED SUBJECT MATTER

The present application generally relates to certain sintered magnets that contain a rare-earth metal, a transition metal, and boron (often referred to as “R-T-B-based” sintered magnets). Specification filed Sept. 28, 2015 (“Spec.”) ¶ 2. The Specification teaches that R-T-B-based sintered magnets have been known for high performance and have been used in motors for hybrid vehicles, electric vehicles, and home appliances. *Id.*

The Specification further indicates that, conventionally, dysprosium (often referred to by its symbol “Dy”) has been used to increase coercivity (“ H_{cJ} ”) in R-T-B sintered magnets. *Id.* ¶ 4. Dysprosium, however, “has problems such as unstable supply and price fluctuations.” *Id.* ¶ 5. Additionally, it may cause the residual magnetic flux density (“ B_r ”) of the magnet to decline. *Id.* Accordingly, “there is a need to develop technology for improving H_{cJ} of the R-T-B-based sintered magnet without using heavy rare-earth elements such as Dy.” *Id.* The Specification describes a magnet that “has been made so as to solve the above problems and an object thereof is to provide an R-T-B-based sintered magnet having high B_r and high H_{cJ} without using Dy.” *Id.* ¶ 9. This is done “by optimizing the contents of R, B, and Ga.” *Id.* ¶ 18.

Claim 7 is illustrative of the subject matter on appeal and is reproduced below with certain limitations bolded for emphasis:

7. An R-T-B based sintered magnet including an $\text{Nd}_2\text{Fe}_{14}\text{B}$ compound as a main phase comprising:

the main phase,

a first grain boundary phase located **between two main phases,** and

a second grain boundary phase located **between three or more main phases,**

wherein the composition of the R-T-B based sintered magnet comprises:

R: 29.0% by mass or more and 31.5% by mass or less, wherein R is Nd and/or Pr,

B: 0.86% by mass or more and 0.90% by mass or less,

Ga: 0.4% by mass or more and 0.6% by mass or less,

Al: 0.5% by mass or less, including 0% by mass,

balance being T, wherein T is Fe or transition metal elements comprising Fe, and inevitable impurities,

wherein **an R-Ga phase including R: 70% by mass or more and 95% by mass or less, Ga: 5% by mass or more and 30% by mass or less, and Fe: 20% by mass or less, including 0% by mass, is present in the first grain boundary phase,**

wherein the R-T-B based sintered magnet does not contain Dy, and

wherein the R-T-B based sintered magnet has a Br value in a range of 1.35-1.40 T.

Appeal Br. 22 (Claims App.) (emphasis added; reformatted for clarity).

REJECTIONS

The Examiner maintains the following rejections:

1. Claims 7, 10, 11, and 13–15 are rejected under 35 U.S.C. §

103 as being unpatentable over Kato et al. (US 2014/0290803 A1, published Oct. 2, 2014 (“Kato”)). Final Action dated Mar. 30, 2018 (“Final Act.”) 3–5.

2. Claims 7, 10, 11, and 13–15 are rejected under 35 U.S.C. § 112(b) as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventors regard as the invention. Examiner’s Answer dated April 2, 2019 (“Answer”) 3.

DISCUSSION

Rejection 1. The Examiner rejects claims 7, 10, 11, and 13–15 as obvious over Kato. Final Action 3–5. In support of the rejection, the Examiner finds that Kato teaches an R-T-B magnet that “contains 29.5-33 mass% R, 0.7-0.95 mass% B, 0.03-1.5 mass% M (M is at least one selected from the group consisting of Al, Ga, Si, Ge and Sn), Fe accounts for balance.” *Id.* at 3. The Examiner determines that “[s]ince M can be Ga in the magnet of Kato et al., the magnet composition disclosed by Kato et al. overlap the recited composition in claim 7 and 10 and therefore is a prima facie case of obviousness.” *Id.* at 4. The Examiner further refers to Sample 13 of Kato which teaches a magnet “that contains 31.5 mass% Nd, 0.87 mass% B, 0.3 mass% Ga, 0.2 mass% Al and the balance is Fe.” *Id.* (citing Kato, Table 1).

The Examiner further finds that, because Kato teaches a magnet having an overlapping composition made by the same sequence of processing steps, “one of ordinary skill in the art would [expect] the R-rich grain boundary phase in the magnet of Kato et al. to meet the composition

limitations of the first grain boundary phases recited in claims 7 and 13.” *Id.* at 5.

Appellant alleges error on several bases. We first address Appellant’s arguments regarding the Examiner’s prima facie case and next consider its arguments regarding criticality.

Prima Facie Case

Appellant argues that the Examiner has not established a prima facie case of obviousness because the Examiner has not adequately shown the composition of the first grain boundary phase. Appeal Br. 20.

Claim 7 requires

[a]n R-T-B based sintered magnet . . . wherein an R-Ga phase including R: 70% by mass or more and 95% by mass or less, Ga: 5% by mass or more and 30% by mass or less, and Fe: 20% by mass or less, including 0% by mass, is present in the first grain boundary phase.

Id. at 22 (Claims App.). The Examiner finds that one of ordinary skill in the art would expect this limitation to be met because the magnet of Kato has the same composition as the claimed magnet and is made by the same process steps. Final Act. 5.

Appellant argues that such finding is in error because not all process conditions overlap. Appeal Br. 20. Appellant contends that the heat treatment times and molding pressure taught by Kato differ from those taught by the Specification. *Id.*

In the Answer, the Examiner determines as follows:

Kato discloses that the grain boundary in Example 13 contains an Nd-Ga phase that contains 90 at% or more Nd (Paragraph

[0079]). Assuming the grain boundary phase contains 90 at% Nd and 10at% Ga, the Nd-Ga phase composition by mass% is 94.9 mass% Nd and 5.1 mass% Ga. Thus, the Nd-Ga grain boundary phase in Example 13 of Kato contains the amount of Nd and Ga overlaps the recited grain boundary composition in claim 7 and therefore is a prima facie case of obviousness.

Answer 10–11. Appellant does not address such finding in its Reply Brief.

As persons of scientific competence in the fields in which they work, examiners are responsible for making findings, informed by their scientific knowledge, as to the meaning of prior art references to persons of ordinary skill in the art. Absent legal error or contrary factual evidence, those findings can establish a prima facie case of obviousness. *In re Berg*, 320 F.3d 1310, 1315 (Fed. Cir. 2003). Here, the Examiner finds that the methods and materials taught by Kato would yield a first grain boundary phase having the claimed composition. Final Act. 5. This is supported by Kato's teaching of a specific embodiment found to have a grain boundary phase having the claimed composition. Answer 10–11 (citing Kato ¶ 79). Appellant does not address this embodiment in its Reply Brief.

Given the foregoing, we determine that Appellant has not shown error in the Examiner's finding that Kato teaches a first grain boundary phase having the claimed composition. Accordingly, we further determine that Appellant has not shown error in the Examiner's prima facie case of obviousness.

Criticality

Appellant argues that, even if the Examiner had established a prima facie case of obviousness, such showing is overcome by evidence of “the criticality of the claimed invention.” Appeal Br. 19; *see id.* 8–19.

Appellant argues that coercivity and residual magnetic flux density are conventionally known to have an inverse relationship. *Id.* at 8. Appellant further argues that the “present inventors found that by limiting the R amount to 29.0% to 31.5% by mass, relatively high H_{cj} and B_r can be achieved.” *Id.* Appellant further asserts that “the present inventors also found that, when the amount of B is limited to an extremely narrow range as well as the amount of Ga being limited to 0.4% to 0.6% by mass, the R-T-B based sintered magnet having the R amount of 29.0% to 31.5% by mass can achieve an almost highest-spec of the magnetic properties such as H_{cj} and B_r .” *Id.* at 8–9.

Appellant argues that “there is a critical significance to the upper limit (0.90% by mass) and lower limit (0.86% by mass) of the B amount.” *Id.* at 14; *see id.* at 10–14. In support of this contention, Appellant cites to data from the Specification showing the coercivity and residual magnetic flux density of certain magnets having fixed amounts of components other than boron (B). *Id.* at 10–14. Appellant groups the data into Table A (Nd 29.00% by mass), Table B (Nd 30.00% by mass), and Table C (Nd 31.50% by mass). Each table shows results for tests conducted on samples having the neodymium content constant while varying the concentration of boron. Appellant asserts that the data shows that “at least one of B_r and H_{cj} significantly deteriorate when the B amount is less than 0.86% by mass or when the B amount is more than 0.90% by mass.” *Id.* at 13. Appellant

contends that as a result “there is a critical significance to the upper limit (0.90% by mass) and lower limit (0.86% by mass) of the B amount.” *Id.* at 14.

Appellant cites to similar information in support of its contention that “there is a critical significance to upper limit (0.4% by mass) and lower limit (0.6% by mass) of the Ga amount.” *Id.* at 14–15.

In general, an applicant may overcome a prima facie case of obviousness by establishing “that the [claimed] range is *critical*, generally by showing that the claimed range achieves unexpected results relative to the prior art range.” *In re Geisler*, 116 F.3d 1465, 1469–70 (Fed. Cir. 1997) (alteration in original) (citation omitted). “Although it is well settled that comparative test data showing an unexpected result will rebut a prima facie case of obviousness, the comparative testing must be between the claimed invention and the closest prior art.” *In re Fenn*, 639 F.2d 762, 765 (CCPA 1981). Moreover, “[i]t is well settled that unexpected results must be established by factual evidence. Mere argument or conclusory statements in the specification does not suffice.” *In re De Blauwe*, 736 F.2d 699, 705 (Fed. Cir. 1984), *quoted with approval in In re Soni*, 54 F.3d 746, 750 (Fed. Cir. 1995).

“It is the established rule that ‘objective evidence of non-obviousness must be commensurate in scope with the claims which the evidence is offered to support.’” *Allergan, Inc. v. Apotex Inc.*, 754 F.3d 952, 965 (Fed. Cir. 2014) (quoting *In re Tiffin*, 448 F.2d 791, 792 (CCPA 1971)). This is as true for evidence of unexpected results as it is for any other type of objective evidence of non-obviousness. *See In re Peterson*, 315 F.3d 1325, 1329 (Fed.

Cir. 2003) (“the applicant’s showing of unexpected results must be commensurate in scope with the claimed range”).

Establishing unexpected results requires providing a comparison of the claimed invention with the closest prior art which is commensurate in scope with the claims, and showing that the result would have been unexpected by one of ordinary skill in the art. *See In re Baxter Travenol Labs.*, 952 F.2d 388, 392 (Fed. Cir. 1991); *see also In re De Blauwe*, 736 F.2d 699, 705 (Fed. Cir. 1984) (“When an article is said to achieve unexpected (i.e. superior) results, those results must logically be shown as superior compared to the results achieved with other articles.”).

In the Answer, the Examiner finds that “even though Example 13 and Example 14 of Kato do not have the claimed amount of Ga and B, the magnetic properties of B_r and H_{c_j} in Kato’s Examples are within the ranges defined by the Appellants’ Examples 3-5, 8-10 and 13-15.” Answer 5.

The Examiner further finds that “the effects of B and Ga contents on coercivity (H_{c_j}) and residual flux density (B_r) of a sintered R-T-B magnet are well-known to one of ordinary skill in the art.” *Id.* The Examiner relies upon U.S. Application No. 2015/0170810 A1, titled “Sintered Magnet,” to Miwa et al. (hereafter “Miwa”) (of record). *Id.* at 5–6. The Examiner finds that Miwa teaches an R-T-B magnet having a boron concentration of 0.7 to 0.95 mass %. *Id.* at 5. The Examiner quotes Miwa’s teaching that “[w]hen the content of B is less than the above-described range . . . H_{c_j} is likely to decrease. On the other hand, when the content of B is more than the above-described range, H_{c_j} is also likely to decrease.” *Id.* at 6 (quoting Miwa ¶ 28). In the same paragraph, Miwa teaches that “[t]he content of B may be

0.75 to 0.93 mass%. With this range, further better Br and HcJ can be obtained.” *Id.*

The Examiner further relies on Miwa as teaching that “[i]n order to obtain HcJ and Br more successfully, the content of Ga may be 0.13 to 0.8 mass%.” *Id.* at 6 (quoting Miwa ¶ 31).

In view of these teachings of Miwa, the Examiner concludes that “it would be obvious to one of ordinary skill in the art to optimize the amount of B and Ga in a sintered R-T-B magnet in order to make a magnet having desired Hcj and Br.” *Id.* at 6.

Appellant does not address such findings in its Reply Brief.

Considering the foregoing, including the coercivity and residual magnetic flux density characteristics of the claimed sintered magnets relative to those of Kato, we determine that Appellant has not established that its result would have been unexpected by one of ordinary skill in the art.

In view of all of the above, considered collectively, we determine that Appellant has not shown error in the Examiner’s determination that claims 7, 10, 11, and 13–15 would have been obvious over Kato.

Rejection 2. Pursuant to 37 C.F.R. § 41.39(a)(2), the Examiner issued a new ground of rejection in the Answer determining claims 7, 10, 11, and 13–15 to be indefinite. Answer 3. Rather than reopen prosecution, Appellant elects to continue its appeal. Reply Br. 3–5; 37 C.F.R. § 41.39(b).

Claim 7 requires, in part, as follows:

An R-T-B based sintered magnet including an Nd₂Fe₁₄B compound as a main phase comprising:

the main phase,

a first grain boundary phase located between **two main phases**,
and

a second grain boundary phase located between **three or more
main phases**.

Appeal Br. 22 (Claims App.) (emphasis added). In the Answer, the
Examiner determines as follows:

It is unclear whether there is only one main phase or if there is more than one main phase. During the examination for the purposes of applying prior art, the examiner interpreted “between two main phases” as “between two main phase grains” and interpreted “between three or more main phases” as “between three or more main phase grains.” However, it is now appreciated that this is not what is recited in the claims.

Answer 3.

In its Reply Brief, Appellant asserts that one of skill in the art would understand that “a first grain boundary phase located between two main phases” as used in claim 7 “refers to a boundary phase between two grains each comprising the main phase, such that there are two main phases in total in that case.” Reply Br. 4 (emphasis in original). In support, Appellant refers to the Specification which provides, in part, that “the inventors have found that an R-Ga phase is present in a first grain boundary phase located between two main phases (hereinafter sometimes referred to as a ‘two-grain boundary phase’).” Spec. ¶ 18. In a similar vein, Appellant argues that the claim limitation “a second grain boundary phase located between three or more main phases” “refers to a boundary phase between three or more grains each comprising the main phase, such that there are three or more main phases in total in that case.” Reply Br. 4–5.

During prosecution, a claim is examined for compliance with 35 U.S.C. § 112, ¶ 2 by determining whether the claim meets threshold requirements of clarity and precision. *In re Skvorecz*, 580 F.3d 1262, 1268 (Fed. Cir. 2009) (quoting MPEP § 2173.02). A claim should be rejected as indefinite when it is amenable to two or more plausible claim constructions. *Ex Parte Miyazaki*, 89 U.S.P.Q.2d 1207, 1211 (B.P.A.I. 2008); *In re Packard*, 751 F.3d 1307, 1324 (Fed. Cir. 2014) (“There are good reasons why unnecessary incoherence and ambiguity in claim constructions should be disapproved”).

Here, Appellant asserts that “main phases” as used in lines 4 and 5 of claim 7 should be construed to mean grains comprising the main phase. This, however, is not consistent with the plain language of the claim. As drafted, claim 7 requires “a main phase comprising: the main phase [and] two main phases, and . . . three or more main phases.” Accordingly, there is ambiguity as to the meaning of the limitations “main phase” and “main phases” as used in claim 7. All other claims at issue depend from claim 7. Accordingly, they are subject to the same defect.

CONCLUSION

For the reasons set forth in the Final Action, the Examiner's Answer, and above, the Examiner's rejections are affirmed.

In summary:

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
7, 10, 11, 13-15	103	Kato	7, 10, 11, 13-15	
7, 10, 11, 13-15	112(b)	Indefiniteness	7, 10, 11, 13-15	
Overall Outcome			7, 10, 11, 13-15	

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

AFFIRMED