

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

NISSAN NORTH AMERICA, INC.,
HITACHI AUTOMOTIVE SYSTEMS, LTD., and
HYUNDAI MOTOR AMERICA,
Petitioners,

v.

DIAMOND COATING TECHNOLOGIES, LLC,
Patent Owner.

Case IPR2014-01548¹
Patent 6,354,008 B1

Before CHRISTOPHER L. CRUMBLEY, JO-ANNE M. KOKOSKI, and
BRIAN P. MURPHY, *Administrative Patent Judges*.

KOKOSKI, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

¹ Case IPR2014-01553 has been joined with this proceeding.

I. INTRODUCTION

Nissan North America, Inc. (“Nissan”) and Hitachi Automotive Systems, Ltd. (“Hitachi Automotive”) filed a Petition (Paper 2, “Pet.”) to institute an *inter partes* review of claims 3–5 of U.S. Patent No. 6,354,008 B1 (Ex. 1001, “the ’008 patent”). On April 21, 2015, we instituted an *inter partes* review of claims 3–5 based on our determination that the information presented in the Petition demonstrated that there was a reasonable likelihood that Nissan and Hitachi Automotive would prevail in challenging claims 3 and 5 as unpatentable under 35 U.S.C. § 102(b) as anticipated by Hirano I,² and claim 4 as unpatentable under 35 U.S.C. § 103(a) as obvious over the combination of Hirano I and Noda.³ Paper 26 (“Dec. on Inst.”).

Hyundai Motor America (“Hyundai”) filed a separate petition challenging the same claims of the ’008 patent in *Hyundai Motor America v. Diamond Coating Techs., LLC*, Case IPR2015-01553 (“1553 IPR”). 1553 IPR, Paper 2. Hyundai asserted the same grounds of unpatentability, and relied on the same arguments and evidence, as presented by Nissan and Hitachi Automotive in their Petition. *See id.* On April 21, 2015, we instituted an *inter partes* review of claims 3–5 of the ’008 patent on the same grounds instituted upon in this proceeding. *Id.*, Paper 17.

On May 21, 2015, Diamond Coating Technologies, LLC (“Patent Owner”), Nissan, Hitachi Automotive, and Hyundai filed a Joint Motion for

² Hirano I, Japanese Unexamined Patent App. Pub. No. H8 [1996]-45022, published Feb. 16, 1996 (Ex. 1003 and Ex. 1004 (English translation)). We refer to Hirano I as the English translation of the original reference. Petitioners provided an affidavit attesting to the accuracy of the translation. *See* Ex. 1004; 37 C.F.R. § 42.63(b).

³ Noda, U.S. Patent No. 5,864,452, published Jan. 26, 1999 (Ex. 1005).

Joinder of the 1553 IPR with this proceeding. Paper 30. On May 28, 2015, we granted the motion and joined the 1553 IPR with this case. Paper 31. Patent Owner filed a Patent Owner Response (Paper 36, “PO Resp.”). Nissan, Hitachi Automotive, and Hyundai (collectively, “Petitioners”) filed a Reply (Paper 40, “Reply”).

Patent Owner filed a Motion to Exclude (Paper 45) certain lines in the deposition transcript of Dr. Richard B. Kaner (Ex. 1024), and Exhibits 1025–1027. Petitioners filed an Opposition (Paper 49), and Patent Owner filed a Reply (Paper 51).

An oral hearing was held on January 6, 2016. A transcript of the hearing is included in the record. Paper 54 (“Tr.”).

We have jurisdiction under 35 U.S.C. § 6(b). This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons that follow, we determine that Petitioners have shown by a preponderance of the evidence that claims 3–5 of the ’008 patent are unpatentable.

A. *The ’008 Patent*

The ’008 patent, titled “Sliding Member, Inner and Outer Blades of an Electric Shaver and Film-Forming Method,” is directed to sliding members having a sliding surface for sliding contact with a cooperative member. Ex. 1001, 1:7–9. According to the ’008 patent, forming a protective film on the sliding surface of an inner or outer blade of an electric shaver “results in delamination thereof from the sliding surface or in cutout therefor at the edges of sliding surface, which causes wear of the sliding surface.” *Id.* at 1:26–33. The object of the ’008 patent, therefore, is “to prevent delamination or cutout of a protective film provided on a sliding surface of a

sliding member,” where the protective film “exhibits a reduced level of wear and is excellent in sliding characteristics.” *Id.* at 1:60–67. The Specification states that, although “[t]he sliding member of the present invention is illustrated as the electric shaver inner blade in the first embodiment and as the electric shaver outer blade in the second embodiment,” it is also applicable to other sliding members such as rotary compressor parts, thin film magnetic heads used in hard disk drives, and sliding parts of a video tape recorder. *Id.* at 4:20–30.

Figure 1 of the '008 patent is reproduced below.

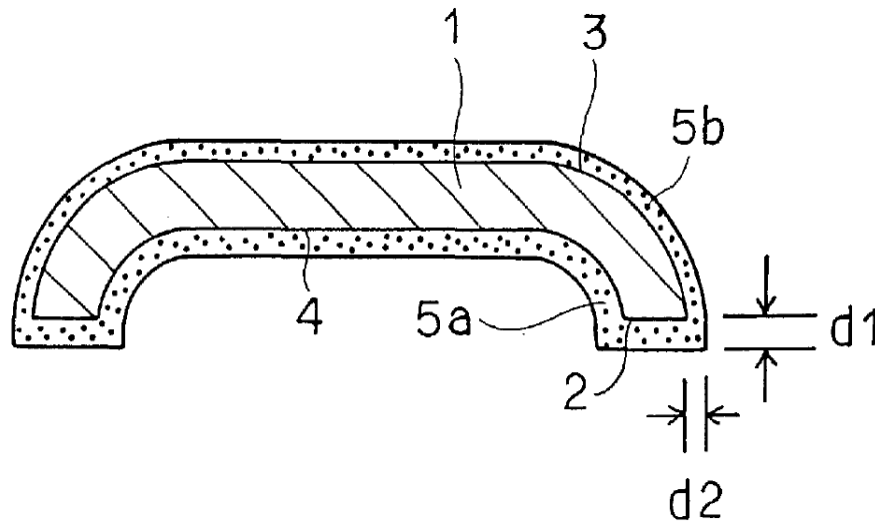


Figure 1 depicts a sectional view of an outer blade of an electric shaver, comprising outer blade 1, sliding surface 2, outer surface 3, and inner surface 4. *Id.* at 10:66–11:5. Protective film 5a, of thickness $d1$, is provided on inner surface 4, and protective film 5b, of thickness $d2$, is provided on outer surface 3. *Id.*

Figure 2 of the '008 patent is reproduced below.

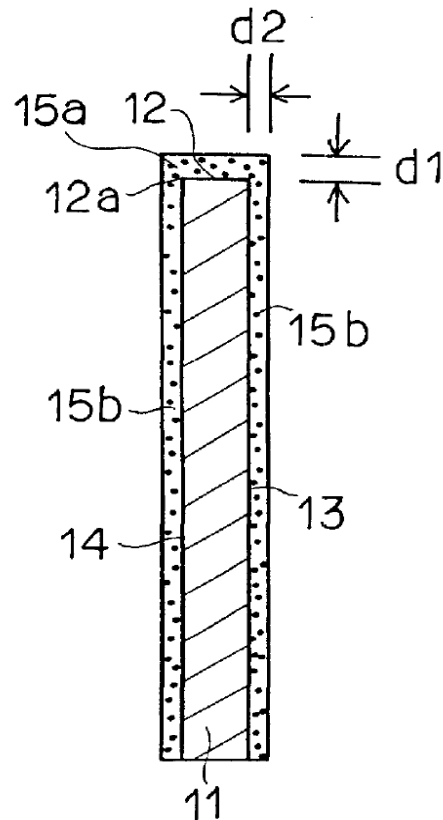


Figure 2 depicts a sectional view of an inner blade of an electric razor, comprising electric shaver inner blade 11, sliding surface 12, and sides 13 and 14. Ex. 1001, 11:12–17. Protective film 15a, having thickness d1, is provided on sliding surface 12, and protective film 15b, having thickness d2, is provided on sides 13 and 14. *Id.* at 11:19–22.

The Specification states that protective films 5a, 5b, 15a, and 15b “are respectively provided such that the ratio $d1/d2$ is not less than 1, preferably in the range of 1.05~5.0, more preferably in the range of 1.1~3.3.” *Id.* at 11:7–11, 20–27. Examples “of the protective film are hard carbon films comprised of diamond and/or amorphous carbon having a diamond structure,” such as “crystalline diamond film, an amorphous diamond-like

carbon film and a diamond-like carbon film partly containing a crystalline structure.” Ex. 1001, 3:56–62. The hardness of the protective film preferably is not less than 1000 Hv, and more preferably is not less than 1500 Hv (Vickers hardness). *Id.* at 3:5–7. The Specification further states that depositing the protective film not only on the sliding surface, but also on the area immediately adjacent to the sliding surface, “effectively prevents the occurrence of delamination or cutout of the protective film.” *Id.* at 2:51–55.

Claim 3 is independent, and reads as follows:

3. A sliding member having a sliding surface for sliding contact with a cooperative member, said sliding member having a protective film deposited not only on said sliding surface but also on a surface region immediately adjacent the sliding surface in such a manner that $d1/d2$ is controlled to be within a range of 1.1–3.3, where $d1$ is a thickness of the protective film deposited on the sliding surface and $d2$ is a thickness of the protective film deposited on the surface region immediately adjacent to the sliding surface, the protective film comprising a hard carbon film formed of a diamond and/or amorphous carbon containing a diamond structure and wherein the protective film having a thickness $d1$ is disposed across the entire sliding surface of the sliding member during a sliding operation.

Claim 4 depends from claim 3, and further recites that “said protective film has a hardness of not less than 1000 Hv.” Claim 5 also depends from claim 3, and further requires that “said surface region adjacent the sliding surface is on a surface angularly oriented with respect to the sliding surface.”

II. ANALYSIS

A. *Claim Interpretation*

We interpret claims of an unexpired patent using the “broadest reasonable construction in light of the specification of the patent in which [the claims] appear[.]” 37 C.F.R. § 42.100(b). The Board, however, may not “construe claims during IPR so broadly that its constructions are *unreasonable* under general claim construction principles. . . . ‘[T]he protocol of giving claims their broadest reasonable interpretation . . . does not include giving claims a legally incorrect interpretation.’” *Microsoft Corp. v. Proxyconn, Inc.*, 789 F.3d 1292, 1298 (Fed. Cir. 2015) (citation omitted). “Rather, ‘claims should always be read in light of the specification and teaching in the underlying patent’” and “[e]ven under the broadest reasonable interpretation, the Board’s construction ‘cannot be divorced from the specification and the record evidence.’” *Id.* (citations omitted).

In the Decision on Institution, we determined that the terms in the challenged claims did not need to be construed expressly, and we see no reason to modify that determination in light of the record developed at trial.

B. *Anticipation of Claims 3 and 5 by Hirano I*

To prevail on its patentability challenge, Petitioners must establish facts supporting its challenge by a preponderance of the evidence. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d). Petitioners assert that claims 3 and 5 are unpatentable under 35 U.S.C. § 102(b) as anticipated⁴ by Hirano I, and rely on the Declaration of Dr. Mark C. Hersam (Ex. 1002, “the Hersam Declaration”). Pet. 14–22; Reply 5–23. Patent Owner disagrees with

⁴ Petitioners’ contentions are directed to express, not inherent, anticipation.

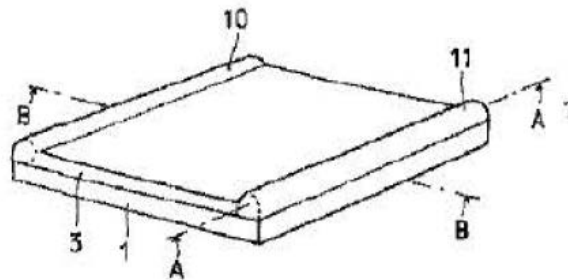
Petitioners' assertions, and relies on the Declaration of Dr. Richard B. Kaner (Ex. 2026, "the Kaner Declaration"). PO Resp. 19–49.

1. *Overview of Hirano I*

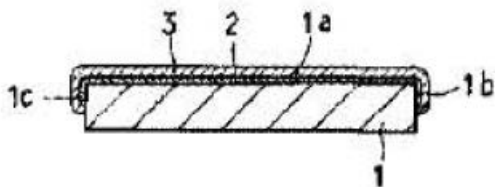
Hirano I is directed to a thin film magnetic head used in a magnetic disk device. Ex. 1004 ¶ 1. Hirano I describes "a thin film magnetic head for writing and/or reading out information by relatively moving over a magnetic recording medium." *Id.* ¶ 8. The thin film magnetic head includes a slider surface that faces the magnetic recording medium, and "is covered by a carbon film with a film thickness of at most 200 Å, and an intermediate layer is formed in at least part of a region between the carbon film and the slider surface of the thin magnetic head." *Id.* The carbon film can be a crystalline diamond film or an amorphous diamond-like film. *Id.* ¶ 18.

Figures 1, 2, and 3 of Hirano I are reproduced below.

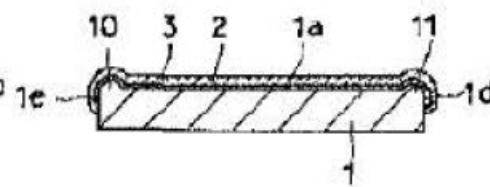
[FIG. 3]



[FIG. 1]



[FIG. 2]



Figures 1, 2, and 3 illustrate an embodiment of a thin film magnetic head described by Hirano I. *Id.* ¶ 22. Figure 3 is a perspective view, Figure 1 is a cross-sectional view along the line A–A in Figure 3, and Figure 2 is a cross-sectional view along the line B–B in Figure 3. *Id.* Intermediate layer 2 is formed on slider surface 1a of thin film magnetic head 1, which is configured to face a magnetic recording medium. *Id.* “Rail portions 10 and 11 are formed on both edge portions of thin film magnetic head 1.” *Id.* Carbon film 3 is formed on intermediate layer 2 “so as to cover not only the slider surface 1a, but also side portions 1b to 1e in the vicinity of the edges of” slider surface 1a. *Id.*

Figure 4 of Hirano I is reproduced below.

[FIG. 4]

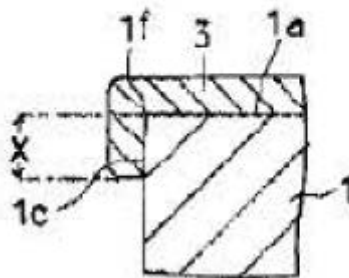


Figure 4 is a partial side view of the thin film magnetic head described by Figures 1, 2, and 3, and illustrates the side portions in the vicinity of the edges of slider surface 1a. *Id.* ¶ 23. Carbon film 3 covers slider surface 1a and side surface portion 1c in the vicinity of edge 1f of slider surface 1a. *Id.* Length X from edge 1f of carbon film 3 covering side surface portion 1c “is typically preferably formed within the range of approximately from 5 μm to 150 μm .” *Id.* Hirano I states that the film thickness of carbon film 3 covering side surface portion 1c “is ordinarily formed so as to be the same as

or less than the thickness of” carbon film 3 covering slider surface 1a. *Id.* According to Hirano I, “[a] thickness of at most 200 Å is typically preferable.” *Id.*

2. *Claim 3*

The parties focus their arguments on three elements present in claim 3 of the '008 patent: (1) “a sliding surface for sliding contact with a cooperative member,” (2) “a surface region immediately adjacent the sliding surface,” and (3) “a protective film deposited . . . in such a manner that d1/d2 is controlled to be within a range of 1.1–3.3 . . . wherein the protective film having a thickness d1 is disposed across the entire sliding surface of the sliding member.” As to the other elements of claim 3, we have reviewed the evidence and arguments presented in the Petition and find that Petitioners have shown sufficiently that those elements are disclosed. Pet. 14–22. We address the arguments regarding the disputed elements in turn.

a. *A sliding surface for sliding contact
with a cooperative member*

Petitioners contend that Hirano I discloses this element of claim 3 because slider surface 1a on thin magnetic head 1 makes contact with a magnetic recording medium during the starting and stopping process. Pet. 16 (citing Ex. 1004 ¶¶ 8, 18, 21); *see id.* at 20 (citing Ex. 1004 ¶¶ 3, 20). Petitioners contend that Hirano I “disclose[s] the use of a carbon film on both a ‘slider surface’ and ‘a side surface portion which is close to an edge of the slider surface’ of the magnetic head to resist abrasion.” *Id.* at 15 (citing Ex. 1004 ¶¶ 8, 18, 21).

Patent Owner makes two arguments with respect to this element of claim 3. First, Patent Owner argues that, because “rails 10 and 11 project outward from the slider surface 1a along the edge portions,” the rails

“prevent slider surface 1a from contacting the magnetic recording medium.”

PO Resp. 42. Patent Owner also argues that Figure 1 of Hirano I does not identify rail 10 or 11 and therefore “illustrates a cross-section *between* the rails, not through one of the rails.” *Id.* at 21–22. In support of this contention, Patent Owner relies on the following testimony from Dr. Kaner:

The cross-section in Figure 1 could be anywhere along the length of B–B. Despite the placement of line A–A along one of the rails, there is no label in Figure 1 to indicate that a portion of the rail is represented. In contrast, labels for the rails appear in Figures 2 and 3. As such, Figure 1 more likely represents a cross-section down the middle of B–B in Figure 3.

Ex. 2026 ¶ 96.

We disagree with Patent Owner. Hirano I refers to Figures 1 and 2 when describing slider surface 1a. Ex. 1004 ¶ 22. Figure 1, which is a cross-sectional view of line A–A cut vertically through rail 11, shows slider surface 1a (covered by intermediate layer 2 and carbon film 3) extending across the top of rail 11. *Id.* at Fig. 1; *see also* Reply 10 (“Because Figure 1 does **not** show a rail behind the cutting plane, it must reflect a cross section through the rail, precisely consistent with Hirano I’s description.”). Figure 2, a cross-sectional view of line B–B cut through the center of the thin film magnetic head illustrated in Figure 3, similarly shows slider surface 1a extending over rails 10 and 11 (with cross-hatching that shows rails 10 and 11 as part of the structure of thin film magnetic head 1). Ex. 1004, Fig. 2; *see also id.* ¶ 22 (“FIG. 3 is a perspective view, and FIGS. 1 and 2 are cross-sectional views along the line A–A in FIG. 3 and the line B–B in FIG. 3, respectively.”) Hirano I, therefore, teaches that rails 10 and 11 are part of slider surface 1a. Neither Patent Owner nor Dr. Kaner explain persuasively

why Figures 1, 2, and 3 illustrate something other than what Hirano I expressly describes.

Second, Patent Owner argues that Hirano I's discussion of a "slider surface," without more, is not sufficient to establish that Hirano I's slider surface performs a sliding operation as recited in claim 3. PO Resp. 23. Patent Owner argues that "the thin film magnetic head is designed to fly above the recording medium" during operation, and "[t]he thin film magnetic head in Hirano I only comes in contact with the magnetic recording medium when the disk operation is stopped." *Id.* at 42 (emphasis omitted). Patent Owner further argues that "[r]esting contact is [] not the same as sliding contact," and, therefore, Hirano I does not disclose sliding contact during the operation of the magnetic recording medium. *Id.* at 43. According to Patent Owner, "while literally [referring to] a 'slider surface,' Hirano I does not teach a '*sliding* surface' as arranged in the claim because claim 3 requires that the 'sliding surface' have '*sliding contact* with a cooperative member." *Id.* at 43–44.

We are persuaded by Petitioners' argument that Hirano I's thin film magnetic head makes sliding contact with the magnetic recording medium. In support of its argument to the contrary, Patent Owner and Dr. Kaner cite to Hirano I's statement that "[w]hen the operation of the magnetic recording medium is stopped, the slider surface of the thin film magnetic head comes into direct contact with the magnetic recording medium." PO Resp. 42; Ex. 2026 ¶ 73 (citing Ex. 1004 ¶ 3). Considered in its entirety, however, Hirano I teaches sliding contact between the thin film magnetic head and the magnetic recording medium during the starting and stopping operations, as well as contact between the thin film magnetic head and the recording

medium when the recording operation is completely stopped. See Reply 18 (citing Ex. 1004 ¶¶ 3, 21; Ex. 1002 ¶¶ 23, 63).

Specifically, Petitioners cite the following disclosures in Hirano I with respect to the “sliding surface for sliding contact with a cooperative member” limitation of claim 3:

When a magnetic recording medium is activated and rotated, such a thin film magnetic head rises upward slightly from the magnetic recording medium so that a lubricating air film is formed between the slider surface of the thin film magnetic head and the magnetic recording medium. However, when the operation of the magnetic recording medium is stopped, the slider surface of the thin film magnetic head comes into direct contact with the magnetic recording medium. Therefore, the slider surface of the thin film magnetic head must have abrasion resistance.

Ex. 1004 ¶ 3.

As described above, when the magnetic recording medium is activated and rotated, the thin film magnetic head rises upward slightly from the surface of the magnetic recording medium, and when the operation stops, the thin film magnetic head comes into contact with the magnetic recording medium. At this time, the thin film magnetic head is slightly inclined with respect to the magnetic recording medium, so one of the edge portions of the slider surface of the thin film magnetic head comes into contact with the magnetic recording medium.

Id. ¶ 21.

Although Hirano I describes the thin film magnetic head resting on the magnetic recording medium when the magnetic recording medium is fully stopped as Patent Owner and Dr. Kaner contend, it goes on to state that when the magnetic recording medium is activated and rotated, a lubricating air film forms that lifts the thin film magnetic head slightly upward off of the magnetic recording medium. Ex. 1004 ¶¶ 3, 21. The reverse is true during

the stopping operation; Hirano I describes that the thin film magnetic head is slightly inclined with respect to the magnetic recording medium as the operation stops, such that the edge portions come into contact with the magnetic recording medium. *Id.* ¶ 21. Accordingly, the thin film magnetic head is in contact with the rotating magnetic recording medium when the magnetic recording medium first starts rotating, and as it slows to a stop. Patent Owner's contention that Hirano I only describes contact between the thin film magnetic head and the recording medium when the recording medium is fully stopped ignores the starting and stopping operations also described by Hirano I, and is unsupported by the record.

We are also persuaded that the contact between the thin film magnetic head and the rotating magnetic recording medium during the starting and stopping operations is "sliding contact with a cooperative member" as recited in claim 3. As Petitioners note, "Hirano I teaches that the carbon film is preferably amorphous diamond-like film 'from the perspective of slidability.'" Reply 20 (citing Ex. 1004 ¶ 18) (emphasis omitted). Although Patent Owner argues that Hirano I's use of the term "slider surface" does not imply "sliding contact," Patent Owner does not direct us to any disclosure in Hirano I, nor have we identified any, that indicates that a "slider surface" is something other than a surface that slides. *See* PO Resp. 23–24, 43–44. Patent Owner also does not argue that the specification of the '008 patent provides a definition for "sliding contact" that differs from its plain and ordinary meaning. Moreover, the '008 patent confirms that the claimed invention is applicable to thin film magnetic heads. *See* Ex. 1001, 4:28–30, 21:24–27. Because Hirano I teaches that slider surface 1a of thin film magnetic head 1 contacts the magnetic recording medium during starting

and stopping operations, it follows that the slider surface 1a makes sliding contact with the magnetic recording medium as required by claim 3.

b. A surface region immediately adjacent to the sliding surface

Petitioners contend that Hirano I discloses this element of claim 3 because Hirano I “discloses carbon film formed on both the slider surface and a side surface portion, which is close to an edge of the slider surface.” Pet. 17 (citing Ex. 1004 ¶¶ 8, 9, 21, 22). Petitioners further contend that “all of the embodiments of the thin-film magnetic head depicted in the figures of [Hirano I] show a side surface portion 1b–1e” that is “oriented at an angle (e.g., 90°) with respect to the slider surface.” *Id.* at 19 (citing Ex. 1004, Figs. 1–8).

Patent Owner argues that “Hirano I’s side surface portions cannot be ‘a surface region immediately adjacent the sliding surface’ because they too come into contact with the magnetic recording medium.” PO Resp. 37. According to Patent Owner, “Hirano I indicates that the side surface portions are coated specifically to protect those surfaces from abrasion during contact with the magnetic recording medium.” *Id.* at 34. Patent Owner further argues that the combination of Hirano I’s statement that the side surface portions are coated to protect them from severe contact and Hirano I’s statement that the thin film magnetic head is slightly inclined with respect to the magnetic recording medium when the operation stops such that one of the edge portions of the slider surface contacts the magnetic recording medium “compel an interpretation of Hirano I where both the slider surface and the side surface portions contact the magnetic recording medium.” *Id.* at 37–38.

Petitioners reply that Patent Owner “does not cite any portion of the disclosure or claims of the ’008 Patent that excludes the ‘surface region immediately adjacent’ from ever making sliding contact.” Reply 15. According to Petitioner, “Hirano I explains that the slider surface, and in particular ‘the edge portions of the slider surface,’ makes contact with the recording medium.” *Id.* (citing Ex. 1004 ¶¶ 3, 21).

We agree with Petitioner. Hirano I describes, with reference to Figures 1 and 2, that “carbon film 3 is formed so as to cover not only the slider surface 1a, but also side surface portions 1b to 1e in the vicinity of the edges of slider surface 1a.” Ex. 1004 ¶ 22. Referring to Figure 4, Hirano I describes side surface portion 1c as being “in the vicinity of the edge 1f of the slider surface 1a.” *Id.* ¶ 23. Similarly, Hirano I describes Figure 6 as illustrating “another embodiment in which the intermediate layer 2 is formed on the side surface portion 1c.” *Id.* ¶ 24. Hirano I, therefore, consistently identifies side surface portions 1b to 1e as structural features distinct from slider surface 1a.

Moreover, as Petitioners note, “Hirano I never states that there is abrasive contact on the side surface portions,” and, “after explaining that the edge portions of the *slider surface* come into contact during starting and stopping, Hirano I explains that coating the side surface portions effectively protects the *magnetic head* from severe contact.” Reply 16 (citing Ex. 1004 ¶ 21). Hirano I also states that “the carbon film is also formed on the side surface portions in the vicinity of the edges, so the thin film magnetic head can be positioned even closer to the medium, which makes it possible to improve the output and to achieve high densification.” *Id.* We agree with Petitioners’ argument that, in order for the side surface portions to contact

the magnetic recording medium, “the magnetic head would need to be at a very large angle” and “[t]he close positioning of the head to the recording medium severely limits the angle that the magnetic head could achieve prior to contact with the recording medium.” Reply 16.

In light of these express disclosures in Hirano I, Patent Owner does not provide sufficient objective evidence or analysis to support its contention that “the skilled artisan would have understood that both edge portions of the slider surface and the side surface portions in the vicinity of the edges make contact with the magnetic recording medium.” PO Resp. 38. In any event, as Petitioners note, Patent Owner “does not cite to any portion of the disclosure or claims of the ’008 patent that excludes the ‘surface region immediately adjacent’ from ever making sliding contact” with the magnetic recording medium. Reply 15. Petitioners’ argument and supporting evidence, as a whole, persuasively supports its position by a preponderance of the evidence that Hirano I discloses “a side surface region immediately adjacent the sliding surface,” as recited in claim 3. Pet. 15–17, 20–21; Reply 15–16.

- c. *A protective film deposited not only on said sliding surface but also on a surface immediately adjacent the sliding surface in such a manner that $d1/d2$ is controlled to be within a range of 1.1–3.3, where $d1$ is a thickness of the protective film deposited on the sliding surface and $d2$ is a thickness of the protective film deposited on the surface region immediately adjacent the sliding surface . . . wherein the protective film having a thickness $d1$ is disposed across the entire sliding surface of the sliding member*

Petitioners contend that Hirano I discloses this limitation of claim 3 because it “discloses carbon films formed on both the slider surface and a

side surface portion, which is close to an edge of the slider surface.” Pet. 17 (citing Ex. 1004 ¶¶ 8, 9, 21, 22). Specifically, Petitioners point to Hirano I Embodiment 11, which describes a 100 Å thick (d1) carbon film on the slider surface and a 50 Å thick (d2) carbon film on the side surface portions. *Id.* (citing Ex. 1004 ¶ 56). According to Petitioners, Hirano I therefore “discloses a protective film deposited to have a ratio d1/d2 of 2.0,” which meets claim 3’s requirement that d1/d2 be controlled to be within the range of 1.1–3.3. *Id.* Petitioners also contend that “all of the embodiments of the thin-film magnetic head depicted in the figures of Hirano I . . . show a hard carbon film present across the entire slider surface 1a,” and “[t]hus, at least by the depiction of the figures,” Hirano I teaches that “the protective film having thickness d1 is disposed across the entire sliding surface of the sliding member during a sliding operation” as recited in claim 3. *Id.* at 19 (citing Ex. 1004, Figures 1–8).

Patent Owner argues that “Embodiment 11 does not associate the thickness of 100 Å with the ‘slider surface 1a’ or rail 10 and 11.” PO Resp. 25–26. According to Patent Owner, “to the extent that the thin film magnetic head of Hirano I makes any contact with the magnetic recording medium, such contact is on the rails 10 and 11,” and a skilled artisan would have understood that “the carbon thickness is likely to vary along the radius of the rails.” *Id.* at 27 (citing Ex. 2026 ¶¶ 94, 104).

Petitioners reply that claim 3 does not “require that the thickness be an ‘average,’” and the ’008 patent, “like Hirano I, provides single values for thickness of a surface, including for an inner blade having a curved surface.” Reply 13 (citing Ex. 1001, 15:24–26, Figs. 2, 5). Petitioners further contend that, even if there is some variation in the thickness of the carbon film along

the rail surfaces, Patent Owner does not show “such a significant variance that the ratio would change from the expressly taught 2:1 all the way down to 1:1.” *Id.* at 14 (emphasis omitted). According to Petitioners, “[a]t most, [Patent Owner’s] evidence, cited for the premise that coating thickness on curved surfaces varies, shows a variation of approximately 20%,” and that with a 20% variation, “the thickness would be 80 Å resulting in a ratio of 80/50 (or 1.6), well within the scope of the claim.”) *Id.* at 15.

We are persuaded by Petitioner’s arguments. Hirano I states that, in Embodiment 11, “a carbon film with a thickness of 100 Å was formed” on an intermediate layer with a film thickness of 20 Å. Ex. 1004 ¶ 56. Hirano I further states that the carbon film in Embodiment 11 “can cover not only the slider surface portion, but also the edge portions by wrapping over the side surface portions, as illustrated in FIGS. 1 to 3.” *Id.* Embodiment 11 also discloses that “the value of X illustrated in FIG. 4 was 100 μm,” and “the thickness of the carbon film was 50 Å on the side surface portions.” *Id.* Because Embodiment 11 explicitly refers to Figures 1–4 in describing the carbon film applied on the thin film magnetic head, it follows that the 100 Å thick carbon film described therein is associated with slider surface 1a, which includes rails 10 and 11. Patent Owner’s contention that Embodiment 11 does not associate the thickness of 100 Å with slider surface 1a or rails 10 and 11 is inconsistent with Hirano I’s explicit disclosure, and is unpersuasive based on the evidence of the record.

Accordingly, based on the explicit description in Hirano I described above, we are persuaded that Embodiment 11 expressly discloses a carbon film having a thickness d1 of 100 Å disposed across sliding surface 1a (including rails 10 and 11) as depicted in Figures 1–4, and a carbon film

having a thickness d_2 of 50 Å on side surface portions 1c to 1e. As a result, Embodiment 11 discloses a d_1/d_2 ratio of 2, which is within the 1.1. to 3.3 range recited in claim 3. Patent Owner has not provided persuasive reasoning or evidence in support of its assertion that the thickness measurements reported in Embodiment 11 are not consistent across the surfaces with which the measurements are associated.

d. Conclusion

After considering Petitioners' and Patent Owner's positions, as well as their supporting evidence, we determine that Petitioners have shown, by a preponderance of the evidence, that claim 3 is unpatentable under 35 U.S.C. § 102(b) as anticipated by Hirano I.

3. Claim 5

Claim 5 depends from claim 3, and further recites "wherein said surface region adjacent the sliding surface is on a surface angularly oriented with respect to the sliding surface." Petitioners assert that Hirano I discloses this additional element of claim 5 because "all of the embodiments of the thin-film magnetic head depicted in the figures" illustrate side surface portions 1b–1e "oriented at an angle (e.g., 90°) with respect to the slider surface." Pet. 19–20 (citing Ex. 1004, Figs. 1–8). Patent Owner relies on the arguments it made with respect to claim 3, and does not present an argument directed to the additional limitation recited in claim 5. PO Resp. 44.

As set forth above, we are persuaded that Petitioners have established that Hirano I discloses all of the limitations of claim 3. We are also persuaded by Petitioners' argument and supporting evidence regarding claim 5, and find that Hirano I discloses a surface region adjacent to the sliding

surface that is angularly oriented with respect to the sliding surface. Pet. 19–22.

Accordingly, we determine that Petitioners have shown, by a preponderance of the evidence, that claim 5 is unpatentable under 35 U.S.C. § 102(b) as anticipated by Hirano I.

C. Obviousness of Claim 4 over Hirano I and Noda

Petitioners assert that claim 4 is unpatentable under 35 U.S.C. § 103(a) as being obvious over the combination of Hirano I and Noda. Pet. 18–19; Reply 23–25. Petitioners explain how the combination of Hirano I and Noda allegedly discloses or suggests the claimed subject matter, and also rely on the Hersam Declaration. *Id.* Patent Owner disagrees with Petitioners’ assertions, and relies on the Kaner Declaration. PO Resp. 49–53.

A claim is unpatentable under 35 U.S.C. § 103 if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious to a person having ordinary skill in the art to which the subject matter pertains. *KSR Int’l Co. v. Teleflex, Inc.*, 550 U.S. 398, 406 (2007). A party that petitions the Board for a determination of obviousness must show that “a skilled artisan would have been motivated to combine the teachings of the prior art references to achieve the claimed invention, and that the skilled artisan would have had a reasonable expectation of success in doing so.” *Procter & Gamble Co. v. Teva Pharms. USA, Inc.*, 566 F.3d 989, 994 (Fed. Cir. 2009) (citing *Pfizer, Inc. v. Apotex, Inc.*, 480 F.3d 1348, 1361 (Fed. Cir. 2007)).

1. *Overview of Noda*

Noda is directed to a sliding member that includes a diamond film having a low coefficient of friction and a high degree of wear resistance, which does not cause wear to any mating part. Ex. 1006, 1:6–10. Noda states that the diamond film preferably has a thickness of 0.5 to 100 microns, and has a Vickers hardness of 8000 or more. *Id.* at 2:66–3:4. Noda further states that hard carbon film can be used in place of the diamond film, in which case “it is most desirable to form a film having a Vickers hardness of at least 5000, as any film having lower hardness is liable to deformation or wear as a result of a sliding motion.” *Id.* at 4:33–37. According to Noda, “[t]he mating part may be one which is made of a relatively hard material having a Vickers hardness of at least 400.” *Id.* at 5:4–6. If the mating part has a Vickers hardness lower than 400, contact with the hard diamond film will result in deformation and abrasion of the mating part, which results in a higher coefficient of friction. *Id.* at 5:11–16.

2. *Analysis*

Claim 4 depends from claim 3, and further recites “wherein said protective film has a hardness of not less than 1000 Hv.” Petitioners contend that it would have been obvious to use hard carbon films with a hardness exceeding 1000 Hv as described in Noda in the structures described in Hirano I “to obtain additional resistance to abrasion and wear as taught by Noda.” Pet. 19. Petitioners contend that a person having ordinary skill in the art “would have been motivated to do so based on the teachings of Noda that hardness above 5000 Hv are preferred for reliable protection to wear and deformation as a result of the sliding motion.” *Id.* (citing Ex. 1002 ¶ 68).

Patent Owner makes two arguments with respect to claim 4. First, Patent Owner states that Noda “indicates that the appropriately selected diamond film typically has a Vickers hardness of ‘8000 or more.’” PO Resp. 50. Patent Owner argues that Noda’s disclosure of 8000 Hv or more “does not overlap significantly” with the range “not less than 1000 Hv” recited in claim 4. *Id.* at 51.

We agree with Petitioner’s arguments regarding obviousness. As Petitioners note, Noda’s diamond films having a hardness of 8000 Hv or more are “encompassed in the range recited in claim 4 as there is no upper end limit claimed.” Reply 25. Noda also teaches that film hardness above 5000 Hv is preferred for reliable protection against wear and deformation as a result of the sliding motion. Because claim 4 only requires a hardness of “not less than 1000 Hv,” there is substantial overlap between the claimed range and the range of wear-resistant film hardness disclosed by Noda. In cases involving overlapping ranges, the Federal Circuit and its predecessor court have consistently determined that overlapping ranges establish a *prima facie* case of obviousness. See *In re Peterson*, 315 F.3d 1325, 1330 (Fed. Cir. 2003) (citing, for example, *In re Woodruff*, 919 F.2d 1575, 1578 (Fed. Cir. 1990) (concluding that a claimed invention was rendered obvious by a prior art reference whose disclosed range (“about 1–5% carbon monoxide”) abutted the claimed range (more than 5% to about 25% carbon monoxide”)); *In re Geisler*, 116 F.3d 1465, 1469 (Fed. Cir. 1997) (acknowledging that a claimed invention was rendered *prima facie* obvious by a prior art reference whose disclosed range (50–100 Angstroms) overlapped the claimed range (100–600 Angstroms)); *In re Malagari*, 499 F.2d 1297, 1303 (CCPA 1974) (concluding a claimed invention was rendered *prima facie* obvious by a prior

art reference whose disclosed range (0.020–0.035% carbon) overlapped the claimed range (0.030–0.070% carbon))).

Patent Owner has not provided a persuasive justification for its contention that the hardness range of diamond films disclosed in Noda do not significantly overlap with the claimed range. For example, Patent Owner argues that “a gap in the range from 1000 Hv to 8000 Hv would have been considered significant to the skilled artisan, because the increase in hardness between these two values is substantial, and produces distinct and divergent physical effects in application,” and “the skilled artisan would have regarded Noda’s requirement of hardness in excess of 8000 Hv to contradict the claimed tolerance for hardness of not less than 1000 Hv.” PO Resp. 51 (citing Ex. 2026 ¶ 121). Patent Owner cites Dr. Kaner’s testimony in support of this contention, but Dr. Kaner’s statements regarding what a person having ordinary skill in the art would have considered to be significant are not supported by any objective evidence or analysis. Neither Patent Owner nor Dr. Kaner points to anything in the ’008 patent that supports Patent Owner’s contention that using a diamond film with a hardness of 8000 Hv or greater contradicts the claimed tolerance for hardness of not less than 1000 Hv. Claim 4, moreover, does not recite an express upper limit on film hardness.

Second, Patent Owner argues that “[t]he skilled artisan would have understood that film properties, such as thickness and hardness, can vary widely depending on the application,” and therefore “would not have looked to Noda for its hardness teaching, given that Noda’s applications require diamond film thicknesses of 5,000 Å to 1,000,000 Å.” PO Resp. 52 (citing Ex. 2026 ¶¶ 123–124). According to Patent Owner, “Hirano I’s requirement

that the film not exceed 200 Å (in order to avoid output reduction) teaches away from a combination with the teachings of Noda, where Noda requires that the film must not be smaller than 5,000 Å (to ensure sufficient concavities).” *Id.* at 53 (citing Ex. 2026 ¶ 124).

As an initial matter, demonstrating there are differences between the prior art references is insufficient, by itself, to conclude the references teach away from Petitioners’ proposed combination. *See In re Beattie*, 974 F.2d 1309, 1312–13 (Fed. Cir. 1992). “Under the proper legal standard, a reference will teach away when it suggests that the developments flowing from its disclosure are unlikely to produce the objective of the [patented] invention.” *Syntex (U.S.A.) LLC v. Apotex, Inc.*, 407 F.3d 1371, 1380 (Fed. Cir. 2005) (citing *In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994)). A prior art reference must be considered for everything it teaches by way of technology and is not limited to the particular invention it is describing and attempting to protect. *See EWP Corp. v. Reliance Universal Inc.*, 755 F.2d 898, 907 (Fed. Cir. 1985).

We do not agree that a person having ordinary skill in the art, upon reading Hirano I, would be discouraged from combining it with the teachings of Noda. Patent Owner cites Dr. Kaner’s testimony in support of its contention that a person having ordinary skill in the art would not have looked to Noda for its hardness teaching because film properties can vary depending on the application. Dr. Kaner’s statements regarding what a person having ordinary skill in the art would have understood, however, are not supported by any objective evidence or analysis. *See Ex. 2026 ¶ 123.* Moreover, as Petitioners note, Dr. Kaner testified at deposition that the hardness of a crystalline diamond film does not vary with thickness, only

that it may be more difficult to measure hardness as the film gets thinner. Reply 25 (citing Ex. 1024, 71:19–72:23). Given the inconsistency in Dr. Kaner’s testimony, we do not credit Dr. Kaner’s opinion that a person having ordinary skill in the art would not have looked to Noda for its hardness teaching.

After considering Petitioners’ and Patent Owner’s positions, as well as their supporting evidence, we determine that Petitioners have shown, by a preponderance of the evidence, that claim 4 is unpatentable under 35 U.S.C. § 103(a) as obvious over the combination of Hirano I and Noda.

III. PATENT OWNER’S MOTION TO EXCLUDE

Patent Owner moves to exclude lines 26:23–27:23, 29:5–20, 32:2–15, 34:2–14, 36:18–25, and 121:6–122:4 of Exhibit 1024 (Kaner Deposition Transcript), and Exhibits 1025–1027. Paper 45. Because our Decision does not rely on any of the challenged exhibits, we dismiss Patent Owner’s Motion to Exclude as moot.

IV. CONCLUSION

For the reasons given, Petitioners have shown, by a preponderance of the evidence, that claims 3 and 5 of the ’008 patent are unpatentable under 35 U.S.C. § 102(b) as anticipated by Hirano I, and that claim 4 of the ’008 patent is unpatentable under 35 U.S.C. § 103(a) as obvious over the combination of Hirano I and Noda.

V. ORDER

In consideration of the foregoing, it is

ORDERED that claims 3–5 of the '008 patent are determined to be *unpatentable*;

FURTHER ORDERED that Patent Owner's Motion to Exclude (Paper 45) is *dismissed*; and

FURTHER ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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