

NOTE: This disposition is nonprecedential.

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

DAIKIN INDUSTRIES, LTD,
Appellant

v.

THE CHEMOURS COMPANY FC, LLC,
Appellee

**ANDREW HIRSHFELD, PERFORMING THE
FUNCTIONS AND DUTIES OF THE UNDER
SECRETARY OF COMMERCE FOR
INTELLECTUAL PROPERTY AND DIRECTOR OF
THE UNITED STATES PATENT AND TRADEMARK
OFFICE,**
Intervenor

2020-1616

Appeal from the United States Patent and Trademark
Office, Patent Trial and Appeal Board in No. IPR2018-
01558.

Decided: February 24, 2021

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ROBERT MCBRIDE, Office of the Solicitor, United States Patent and Trademark Office, Alexandria, VA, for intervenor. Also represented by SARAH E. CRAVEN, THOMAS W. KRAUSE, FARHEENA YASMEEN RASHEED.

Before LOURIE, WALLACH, and CHEN, *Circuit Judges*.

CHEN, *Circuit Judge*.

Daikin Industries, Ltd. (Daikin) appeals a decision of the Patent Trial and Appeal Board (Board) in IPR2018-01558 finding claims 1–5 of U.S. Patent No. 9,574,123 ('123 patent) unpatentable as obvious under 35 U.S.C. § 103. For the reasons stated herein, we *affirm*.

BACKGROUND

A

Daikin owns the '123 patent, which is directed to mixtures of hydrofluorocarbons (HFCs), hydrofluoroolefins (HFOs), and one or more of a chlorofluorocarbon (CFC), hydrochlorofluorocarbon (HCFC), chloromethane (HCC), and/or 3,3,3-trifluoropropyne (TFP). *See, e.g.*, '123 patent col. 3 ll. 35–40, claim 1. The '123 patent explains that mixtures of HFCs and HFOs have become preferred refrigerants because they have a lower environmental and global warming impact, measured in terms of global-warming potential (GWP), compared to chlorine-containing compounds, such as CFC, HCFC, and HCC. *Id.* at col. 1 ll. 12–25. The drawback of using HFCs and HFOs, according to the '123 patent, is that their “lubrication performance” “is lower than those of CFC and/or HCFC” such that they are generally used with a lubricating oil in refrigeration

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systems. *Id.* at col. 1 ll. 57–63. The patent claims to solve the relatively poor lubrication performance of HFC/HFO mixtures, *id.* at col. 2 ll. 15–17, by adding TFP or one or more chlorine-containing compounds—i.e., CFCs, HCFCs, or HCCs—known to exhibit enhanced lubricity, *see, e.g., id.* at col. 2 ll. 32–34 (exemplary third components).

The '123 patent provides test results showing enhanced lubricity for HFC/HFO mixtures including chloride-containing compounds relative to those same mixtures without such compounds. *See id.* at col. 8 l. 1–col. 11 l. 25 (Tables 2–10). Each test was conducted with 0.5 mass percent of the third component(s), comprising at least one chlorine-containing compound and no more than 0.05 mass percent TFP. *Id.* Relative to their non-chlorine-containing counterparts, the mixtures containing chlorine exhibited enhanced lubricity in the form of decreased abrasion loss¹ between 7–10 percent and an increased baking load² of 6–7 percent. *See id.*

Claim 1 of the '123 patent, the only independent claim at issue, is reproduced below:

1. A composition comprising HFC and HFO, wherein the composition comprises:
 - 1) HFC-32, HFC-125, HFC-134a, and HFC-134 as the HFC;
 - 2) at least one of HFO-1234yf and HFO-1234ze as the HFO;

¹ “Abrasion loss” was tested “[u]sing a [pin-on-disk] thrust-type friction and abrasion tester” as depicted in Figure 1. '123 patent col. 7 ll. 50–52.

² “Baking load” was measured by pressing a rod to a rotating disk while applying a load. *See* '123 patent col. 7 ll. 53–55.

3) at least one member selected from the group consisting of HCC-40, HCFC-22, HCFC-124, CFC-115, HCFC-1122, CFC-1133, and 3,3,3-trifluoropropylene as a third component.

Id. at claim 1.

Claim 2 requires the combined amount of HFC and HFO to be “95 mass % or more” of the composition. *See id.* at claim 2. Claim 3 limits claim 1’s composition to a “refrigerant composition,” and claim 4 requires that claim 1’s composition comprise “a refrigerant oil in an amount of 10 to 50 mass %.” *See id.* at claims 3–4. Claim 5 also depends from claim 1 and requires HCC-40 be “contained in an amount of 1 mass % or less.” *See id.* at claim 5.

B

On August 21, 2018, The Chemours Company FC, LLC (Chemours) petitioned for *inter partes* review of claims 1–5 of the ’123 patent. J.A. 80, 149. Relevant here, Chemours asserted that each of the challenged claims would have been obvious in view of International App. Pub. No. WO 2015/077134 (Van Horn) in combination with U.S. Patent App. Pub. No. 2015/0322317 (Collier) in view of a 2014 Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standard.

Van Horn teaches various “heat transfer compositions” “possess[ing] reduced global warming potential” for use as, *inter alia*, refrigerants. Van Horn at 1. Van Horn recognizes that CFCs and HCFCs are substances with high ozone depletion potential (ODP) and that HFCs are a “leading replacement” for such compounds. *Id.* at 3. Table 2 of Van Horn discloses refrigerant mixtures comprising differing concentrations of HFCs and HFOs. *Id.* at 10. For example, as shown below, Van Horn’s Table 2 discloses ten mixtures comprising the following HFCs:

- 1) HFC-32 (R-32), HFC-125 (R-125), HFC-134(a) (R-134a), and HFC-134 (R-134);

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and the following HFOs:

2) HFO-1234yf (R-1234yf) and HFO-1234ze (R-1234ze).³

See id. Van Horn states that “slight variations in the compositions should be considered as being within the scope of the present invention; including . . . compositions within +/- 2wt%, preferably within +/- 1 wt%.” *Id.*

Collier discloses “compositions comprising [HFO-1234yf]” for use “in many fields of application,” including refrigeration. Collier ¶ 1. Like the ’123 patent and Van Horn, Collier considers environmental impact a “very important parameter in the choice of a composition.” *Id.* ¶ 2. Collier teaches that various byproducts can accompany the manufacture of HFO-1234yf, including chlorine-containing compounds HCFC-115⁴ and/or HCC-40. *See id.* ¶¶ 4, 6. Collier notes that such byproducts have similar boiling points to HFO-1234yf and thus form azeotropic compositions, which makes complete separation of those components from HFO-1234yf difficult and expensive. *See id.* ¶ 3. Collier discloses an embodiment of HFO-1234yf containing HCFC-115 and, “preferably,” HCC-40, *see id.* ¶ 7, “represent[ing] at most 500 ppm and particularly preferably represent[ing] at most 50 ppm” of the mixture, *id.* ¶ 8. Collier further discloses that “all of the additional compounds [in its HFO-1234yf mixtures] represent[] at most 1% by weight . . . and advantageously at most 0.5% by weight.” *Id.* ¶¶ 5, 11.

³ Van Horn and the AHRI Standard refer to commonly used refrigerant compounds with an “R” prefix.

⁴ The parties do not dispute that the “HCFC-115” disclosed by Collier is the same as CFC-115. *See Chemours Co. FC, LLC v. Daikin Indus., Ltd.*, 2020 WL 402064 at *6 n.4 (P.T.A.B. Jan. 23, 2020).

The AHRI Standard provides “guidance” to the “industry” concerning, among other things, “purity specifications” for certain refrigerants. J.A. 724. Relevant here, the AHRI Standard’s purity specification for refrigerants, including HFO-1234yf (R-1234yf), requires the refrigerants have no “more than 0.5% by weight of volatile impurities including other refrigerants.” J.A. 728. The AHRI Standard “does not certify or guarantee the safety of any products, components or systems designed . . . in accordance with this standard/guideline.” J.A. 721.

C

On January 23, 2020, the Board issued its Final Written Decision finding claims 1–5 of the ’123 patent unpatentable as obvious. *Chemours Co. FC, LLC v. Daikin Indus., Ltd.*, 2020 WL 402064 at *1 (P.T.A.B. Jan. 23, 2020). As there was no material dispute that Van Horn and Collier collectively disclose all the elements in the challenged claims, *id.* at *7, the Board’s obviousness analysis focused on (1) whether a skilled artisan would have recognized Collier’s preferred HFO-1234yf embodiment, containing small amounts of HCC-40 and/or CFC-115, as a substitute for the HFO-1234yf in Van Horn’s mixture, (2) whether a skilled artisan would have been otherwise motivated to combine Collier’s HFO-1234yf with Van Horn’s mixture, and (3) whether any unexpected increases in lubricity related to the claimed invention should be accorded substantial weight in the obviousness inquiry.

With respect to substitution, the Board held that a skilled artisan would have considered Collier’s HFO-1234yf, containing up to 0.5 wt. percent CFC-115 and/or HCC-40, a reasonable, interchangeable substitute for the HFO-1234yf in Van Horn’s refrigerant mixture. *See id.* at *9. The Board noted that both Van Horn and Collier “disclose refrigeration as a primary application for their compositions,” and Collier’s HFO-1234yf was similar or nearly identical in purity to Van Horn’s HFO-1234yf, as taught by

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the AHRI Standard. *See id.* The Board rejected Daikin's arguments that a skilled artisan would have been dissuaded from using Collier's HFO-1234yf in Van Horn's mixture because of safety, reliability, environmental, or system performance concerns. *See id.* at *10–14.

The Board also found a skilled artisan would have been motivated to combine Collier's HFO-1234yf with Van Horn's mixture to increase lubricity. The Board determined that at the time of the invention it was known that at least some chlorine-containing refrigerants had increased lubricity compared to compounds without chlorine, and that the mechanism by which lubricity was affected was known or suspected. *See id.* at *15. The Board thus concluded that a skilled artisan would have reasonably expected a refrigerant mixture containing HCC-40 and CFC-115 to have enhanced lubricity compared to non-chlorine-containing mixtures. *See id.* at *18.

The Board then rejected Daikin's argument that any unexpected lubricity increases related to its invention overcomes the evidence of obviousness. The Board found that the test results disclosed by the patent failed to show increased lubricity for the full scope of the claimed inventions and, as explained above, that increased lubricity from the addition of a chloride containing compound was expected. *See id.* at *19–20.

DISCUSSION

On appeal, Daikin first argues that the Board violated the Administrative Procedure Act (APA) by finding the claims unpatentable based on grounds not advanced in the petition. As to the merits, Daikin contests the Board's findings that (1) a skilled artisan would have considered Collier's HFO-1234yf a substitute for Van Horn's, (2) a skilled artisan would have been motivated to combine Collier's HFO-1234yf with Van Horn's mixture to enhance lubricity,

and (3) Daikin's objective evidence of nonobviousness was insufficient to overcome the evidence of obviousness.⁵

Because we conclude that the petition properly set forth a substitution theory, and because we find no error in the Board's substitution analysis or in its consideration of Daikin's objective indicia of nonobviousness, we affirm without addressing the Board's alternative obviousness theory based on improved lubricity.

A

Daikin argues that the Board violated the APA by relying on a substitution theory that was not advanced in the petition. We disagree. As recognized by the institution decision, *Chemours Co. FC, LLC v. Daikin Indus., Ltd.*, No. IPR2018-01558, 2019 WL 387388, at *6 (P.T.A.B. Jan. 29, 2019), and the Final Written Decision, *Chemours Co.*, 2020 WL 402064, at *7, 9, the petition provided adequate notice of Chemours's substitution theory, *see, e.g.*, J.A. 125 ("Finally, it would have been obvious to substitute the HFO-1234yf, HCC-40, HCFC-115 of [Collier] into the disclosed composition of [Van Horn], at least because it would be simply substituting a known composition (HFC-1234yf, HCC-40, and HCFC-115) for its intended use as a

⁵ Daikin also purports to "reserv[e] its [r]ights under [p]ending *Arthrex*-[b]ased [c]hallenges." Appellant's Br. at 66. This court's holding in *Arthrex* was expressly limited "to those cases where final written decisions were issued." *Arthrex, Inc. v. Smith & Nephew, Inc.*, 941 F.3d 1320, 1340 (Fed. Cir. 2019). As "*Arthrex* issued before the Board's final written decision in this case," "the Board judges were constitutionally appointed as of" that date, and no remand is required. *Caterpillar Paving Prods. Inc. v. Wirtgen Am., Inc.*, 957 F.3d 1342, 1342–43 (Fed. Cir. 2020). *See also Infineum USA L.P. v. Chevron Oronite Co.*, No. 2020-1333, 2021 WL 210722, at *8 (Fed. Cir. Jan. 21, 2021).

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refrigerant composition.”). Daikin was thus on notice of this obviousness theory from the beginning of the proceeding and directly addressed it in both its Patent Owner Response, *see* J.A. 350–61, and surreply, *see* J.A. 455–464. The Board therefore appropriately considered it in its decision.

B

We now turn to whether the Board erred in its substitution analysis. “Whether a claimed invention is unpatentable as obvious under § 103 is a question of law based on underlying findings of fact.” *In re Gartside*, 203 F.3d 1305, 1316 (Fed. Cir. 2000). “The Board’s legal conclusion of obviousness is reviewed *de novo*.” *Id.* This court reviews the Board’s factual determinations in an obviousness analysis for substantial evidence. *See id.*

“[W]hen a patent claims a structure already known in the prior art that is altered by the mere substitution of one element for another known in the field, the combination must do more than yield a predictable result.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007). Stated differently, “when a patent simply arranges old elements with each performing the same function it had been known to perform and yields no more than one would expect from such an arrangement, the combination is obvious.” *Id.* at 417 (internal quotation marks omitted).

According to Daikin, the unpredictability of certain unspecified refrigerant properties precludes a finding of obviousness. Appellant’s Br. at 24–26, 47–48. We see several problems with Daikin’s position. First, Daikin itself argues that the proposed substitution would lead to *predictable* changes in the environmental, safety, and reliability properties of Van Horn’s mixture. *See id.* at 47. Second, the Board found that the resulting lubricity increases in the claimed compositions were *expected*. *See Chemours Co.*, 2020 WL 402064, at *16. Third, the Board credited Chemours’s argument that a skilled artisan would have

regarded any effect on system performance as “trivial.” *See id.* at *14 (“Presented with this competing expert testimony, we credit the testimony of [Chemours’s expert] Dr. Bivens at least because it is consistent [with the prior art of record] indicating that minor differences due to minor composition changes are acceptable.”). As the Board’s factual findings in this regard are supported by substantial evidence, we conclude that it is not improper to apply *KSR*’s substitution rationale to the claimed compositions.

Daikin’s core arguments are that a skilled artisan would have been dissuaded from substituting Collier’s HFO-1234yf for Van Horn’s because of deleterious effects on the resulting mixture’s ODP/GWP, safety, reliability, and performance properties. Appellant’s Br. at 24–46. These arguments were thoroughly addressed and rejected by the Board. As to increased ODP/GWP, the Board thoroughly analyzed the parties’ competing positions and reasonably credited Dr. Biven’s testimony that the “trivial increase [in ODP and GWP] would not have prevented a [skilled artisan] from making such a substitution.” *Chemours Co.*, 2020 WL 402064, at *11–12, at *12 (“We credit Petitioner’s arguments and Dr. Bivens’ supporting testimony because we find them to be more consistent with the record as a whole than Patent Owner’s arguments and evidence.”). Similarly, the Board weighed the parties’ arguments with respect to safety concerns and ultimately credited Dr. Bivens’s testimony “that, at the relevant concentrations, a [skilled artisan] would not have been dissuaded from making the proposed combination by concerns regarding toxicity or flammability,” finding the testimony “consistent with both Collier and the AHRI Standard.” *Id.* at *10. The Board likewise determined that a skilled artisan would not have been dissuaded from making the proposed substitution based on reliability concerns after it reviewed the prior art of record. *See id.* at *11. And, as noted above, the Board credited Dr. Bivens’s testimony that a skilled artisan would have viewed any effect on the

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proposed mixture’s performance properties “trivial.” *Id.* at *14.

Moreover, the Board expressly found that Van Horn and Collier demonstrate that a skilled artisan, aware of the issues raised by Daikin, would not have been concerned about adding relatively small amounts of chlorine-containing impurities to Van Horn’s mixture. *See id.* at *9–14. The Board found that both Van Horn and Collier disclose refrigeration as a primary application for their disclosed mixtures. *See id.* at *9. The Board also found that Collier, like Van Horn, considered the “impact on the environment” a “very important parameter in the choice of a composition for use in the field[] of refrigeration,” yet nonetheless regarded HFO-1234yf mixtures including HCC-40 as preferred. *Id.* at *10 (internal quotation marks omitted). Further, the Board found that Collier’s preferred maximum concentration of such compounds—up to 0.5 percent by weight—was consistent with the AHRI Standard’s “guidelines employing state-of-the-art and accepted industry practices,” and credited additional evidence of record stating that “minor amounts” “of impurities and/or byproducts . . . do not materially affect the novel and basic characteristics of the refrigerant mixture.”). *Id.*

In sum, we find the Board’s factual determinations underlying its substitution analysis supported by substantial evidence.

C

Daikin further argues that, even if the Board did not err in its substitution analysis, its claimed compositions exhibit an unexpected increase in lubricity, and that such unexpected results overcome any evidence of obviousness. Appellant’s Br. at 65–66. Daikin’s arguments are unavailing.

Daikin again challenges factual determinations by the Board that are supported by substantial evidence. The

Board determined that any purported unexpected lubricity increase disclosed by the patent was not commensurate with the full scope of the claimed invention. *See Chemours Co.*, 2020 WL 402064, at *11–12. In reaching that conclusion, the Board correctly noted that each comparison test disclosed in the '123 patent involved mixtures comprising only 0.5 mass percent of the third component, '123 patent col. 8 l. 1–col. 11 l. 25, but the claims permit the third component to comprise nearly all of the mixture (e.g., claims 1, and 3–5). Similarly, the third component of each of the test mixtures comprised 90–100 percent of chlorine-containing compounds, yet most of the claims permit TDP—a non-chlorine-containing compound—to be the entirety of the third component (e.g., claims 1–4). More problematic for Daikin are the Board's findings that lubricity increases from the addition of chlorine-containing compounds were *expected*, *Chemours Co.*, 2020 WL 402064, at *16, and that Daikin failed to submit any evidence that the magnitude of any increased lubricity was unexpected, *id.* at *20 (“We discern no persuasive evidence of record that the magnitude of the lubricity improvement was so great as to be unexpected at any particular concentration of chlorine-containing compound, and Patent Owner does not raise any specific arguments concerning the magnitude of the improvement.”).

We conclude that the Board's factual findings related to Daikin's proffered secondary considerations are supported by substantial evidence. We therefore discern no error in the Board's analysis or its conclusion that Daikin's proffered objective indicia fail to overcome the evidence of obviousness.

CONCLUSION

We have considered Daikin's remaining arguments and find them unpersuasive. For the reasons set forth above, we *affirm* the Board's decision finding claims 1–5 of the '123 patent unpatentable as obvious.

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AFFIRMED