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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MEXICHEM AMANCO HOLDING S.A. de C.V.
Requester and Respondent

v.

HONEYWELL INTERNATIONAL INC.
Patent Owner and Appellant

Appeal 2016-006365
Reexamination Control 95/001,920
Patent US 8,053,404 B2[1]
Technology Center 3900

Before MARK NAGUMO, JEFFREY B. ROBERTSON, and
RAE LYNN P. GUEST, *Administrative Patent Judges*.

GUEST, *Administrative Patent Judge*.

DECISION ON APPEAL

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[1] US Patent 8,053,404 B2 issued on November 8, 2011, to Rajiv R. Singh, et al. (hereinafter "the '404 patent").

Patent Owner Honeywell International Inc. ("Patent Owner") appeals under 35 U.S.C. §§ 134(b) and 315(a) the Examiner's decision to reject claims 1-19 and 24-37. Patent Owner Appeal Brief 1, filed May 4, 2015 (hereinafter "PO App. Br."). We have jurisdiction under 35 U.S.C. §§ 134(b) and 315(a).

A Request for reexamination of the '404 patent was filed March 2, 2012, by Third Party Requester Mexichem Amanco Holdings S.A. de C.V. (hereinafter "Requester"). We heard oral arguments from both Patent Owner and Requester on September 21, 2016, a written transcript of which was entered into the record on October 14, 2016.

U.S. Patent 8,623,808 (hereinafter "the '808 patent"), which is a division of the application that became the '404 patent, is the subject *Inter Partes* Review IPR2015-001309, which was instituted on December 9, 2015. Requester Mexichem's Respondent Brief 1, filed June 4, 2015 (hereinafter "Req. Res. Br.").[2]

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[2] We also note others of Patent Owner's patents directed to similar technology. U.S. Patent 8,033,120 (hereinafter "the '120 patent") is the subject of reexamination control 95/001,783 (Appeal 2015-000616). U.S. Patent 7,279,451 (hereinafter "the '451 patent") is the subject of reexamination control 95/000,576 (Appeal 2015-000615). U.S. Patent 8,065,882 (hereinafter "the '882 patent") is the subject of reexamination control 95/002,030 (Appeal 2015-007833). U.S. Patent 7,534,366 (hereinafter "the '366 patent") is the subject of merged reexaminations 95/002,189 and 95/002,030 (Appeal 2015-007833). Decisions regarding the appeals in each of these cases were mailed on March 29, 2016. In response to the Board Decisions with respect to the '120 patent, the '451 patent, and the '882 patent, Patent Owner filed a Request for Rehearing on May 2, 2016 and Requester filed a response thereto on June 2, 2016. Patent

We AFFIRM.

STATEMENT OF THE CASE

The ’404 patent relates to the use of heat transfer compositions comprising tetrafluoropropene (e.g., HFO-1234) in a variety of applications, including: vapor compression heating and cooling systems; blowing agents; aerosol propellants; solvent compositions; and fire suppressing agents. ’404 patent, col. 2, ll. 46-55 and col. 3, l. 62 to col. 4, l. 2. The claimed compositions are said to have low ozone depletion potential (“ODP”) and to have other advantages such as lower global warming potential (“GWP”). ’404 patent, col. 4, ll. 59 to col. 5, l. 17. Claim 1, which is illustrative of the

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Owner appealed the Board’s Decision regarding the ’366 patent to the Federal Circuit on May 3, 2016.

U.S. Patent 8,444,874 (hereinafter “the ’874 patent”) was subject to *Inter Partes* Review IPR2013-00576, in which a final decision was entered on February 26, 2015. The decision in IPR2013-00576 cancelled all of the claims of the ’874 patent except for claim 2, which recited a heat transfer composition comprising “at least about 90% by weight” of the trans-isomer of 1,3,3,3-tetrafluoropropene. Patent Owner appealed the Board’s Final Decision to the Federal Circuit. The Federal Circuit heard oral arguments on October 6, 2016 and issued an affirmance of the Board decision on October 11, 2016.

The ’451, ’366, ’120, and ’882 patents are also the subject of a litigation in the United States District Court for the Eastern District of Pennsylvania styled *Arkema, Inc. and Arkema France v. Honeywell International Inc.*, Civil Action No. 10-2886 (E.D. Pa.), which is stayed pending the outcome of the reexaminations of each of the involved patents.

appealed subject matter, reads as follows (with brackets and underlining showing language deleted and added, respectively, during reexamination):

> 1. A heat transfer composition comprising from about 1 to about 40 percent by weight of carbon dioxide (CO_2) and from about 60 to about 99 percent by weight of one or more compounds of Formula I, XCF_zR_{3-z} (I)[, where X is a C_2 or a C_3 unsaturated, substituted or unsubstituted, radical, each R is independently Cl, F, Br, I or H, and z is 1 to 3] <u>selected from the group consisting of trans-1,1,1,3-tetrafluoropropene (HFO-1234ze) and 1,1,1,2-tetrafluoropropene (HFO-1234yf)</u>.

PO App. Br. 33, Claims App'x.

Patent Owner contests the Examiner's decision to reject the claims as follows:

I. Claims 1-7, 14-19, 24, 25, 29-33, and 37 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Kruse[3] in view of Inagaki.[4] RAN 5 (Rejection I).

II. Claims 8, 26-28, and 34-36 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Kruse in view of Inagaki and Bivens.[5] RAN 8 (Rejection II).

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[3] DE 41 16 274 A1, published November 19, 1992, and naming Horst Kruse et al. as inventors. All references to "Kruse" are to the translation filed on March 2, 2012 with Requester's original Request for *Inter Partes* Reexamination.

[4] JP H04-110388, published April 10, 1992, and naming Sadayasu Inagaki et al. as inventors. All references to "Inagaki" are to the translation filed on March 2, 2012, with Requester's original Request for *Inter Partes* Reexamination.

[5] US Patent 6,783,691 B1, issued August 31, 2004, to Donald Bernard Bivens, et al.

III. Claims 11, 26-28, and 34-36 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Kruse in view of Inagaki, Bivens, and Mahler.[6] RAN 8 (Rejection III).

IV. Claims 9 and 10 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Kruse in view of Inagaki and Mahler. RAN 9 (Rejection IV).

V. Claims 12 and 13 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Kruse in view of Inagaki and Nimitz.[7] RAN 10 (Rejection V).

VI. Claims 1 and 19 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Kruse in view of Inagaki and Butler.[8] RAN 12 (Rejection VII).

Requester relies on the following evidence in support of the Examiner's maintained rejections:

Declaration of Stuart Corr executed July 27, 2012 (Ex. 5, Req. Res. Br. 11; hereinafter "Corr Decl.") and attached exhibits.

Declaration of Takashi Shibanuma executed July 26, 2014 (Ex. 6, Req. Res. Br. 11 (hereinafter "Shibanuma Decl.") and attached exhibit.

JP H5-85970A, published April 6, 1993 and naming Yukio Omure et al. as inventors, and certified English language translation submitted therewith, dated April 30, 2013 (hereinafter "Omure").

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[6] US Patent 6,991,744 B2, issued January 31, 2006, to Walter Mahler et al.
[7] US Patent 5,611,210, issued March 18, 1997, to Jonathan S. Nimitz, et al.
[8] US Patent 3,723,318, issued March 27, 1973, to Anthony J. Butler.

Bogdan, et al., "Status Report on the Development of HFC-245fa as a Blowing Agent," POLYURETHANES EXPO '96, pp. 394-403 (Singh Decl., Exhibit C) (hereinafter "Bogdan").

Transcript of Deposition of Stuart Corr taken 24 April 2014 in *Inter Partes* Review Case No. IPR2013-00576 (hereinafter "Corr Deposition Tr.").

Patent Owner relies on the following rebuttal evidence:

1. Declaration of Rajiv Ratna Singh executed June 27, 2012 (Ex. A, App. Br. 37; hereinafter "Singh Decl.") and attached exhibits.
2. Declaration of Donald B. Bivens executed August 22, 2014 (Ex. B, App. Br. 38; hereinafter "First Bivens Decl.") and attached exhibits.
3. Declaration of Richard D. Chambers executed August 22, 2014 (Ex. C, App. Br. 38; hereinafter "Chambers Decl.") and attached exhibits.
4. Declaration of Raymond H. Thomas executed August 22, 2014 (Ex. D, App. Br. 39; hereinafter "First Thomas Decl.") and attached exhibits.

OBVIOUSNESS REJECTIONS BASED ON KRUSE AND INAGAKI

The Rejections

Independent claims 1 and 2 stand rejected over Kruse in view of Inagaki. Independent claims 1 and 19 further stand rejected over Kruse in view of Inagaki and Butler. Dependent claims stand rejected based on these references either with or without additional prior art.

The Examiner finds, and Patent Owner does not dispute, that Kruse teaches a heat transfer composition comprising CO_2 and "a partially

fluorinated hydrocarbon" in the amounts recited in the claims. RAN 5-6. The Examiner finds that Kruse teaches mixtures having the following advantages:

1. desirable boiling points, such that the mixture is a suitable substitute for different chlorinated cooling agents as, for example, R-22;
2. non-flammability, despite containing flammable partially fluorinated hydrocarbons;
3. no ozone depletion potential;
4. low direct global warming potential, i.e., "more favorable than the respective pure partially fluorinated hydrocarbons;"
5. immediate use, due to CO_2 being known to be non-toxic and non-flammable without additional studies required.

RAN 5-6. The Examiner finds that Kruse does not teach combining CO_2 with the unsaturated hydrofluorocarbons recited in the claims. RAN 6.

The Examiner finds, and Patent Owner does not dispute, that Inagaki teaches HFO-1234ze[9] and HFO-1234yf,[10] refrigerants, which fall within the

[9] The '404 patent uses HFO-1234ze as a common name for 1,1,1,3-tetrafluoropropene, which has the structure $F_3C–CH=CHF$. '404 patent, col. 4, ll. 3-13 and claim 2. HFO-1234ze has also been identified as 1,3,3,3-tetrafluoro-1-propene. *See e.g.*, '120 patent, col. 4, ll. 53-54 and '882 patent, col. 4, ll. 46-48.

[10] The '404 patent uses HFO-1234yf to refer to "1,1,1,2-tetrafluoropropene." '404 patent, col. 3, ll. 13-14 and claim 4. However, HFO-1234yf has the structure $F_3C–CF=CH_2$ and is more often identified as 2,3,3,3-tetrafluoropropene. *See e.g.*, the '366 patent, col. 4, ll. 47-48 and the '120 patent, col. 4, ll. 54-55.

scope of Formula I, and are specifically recited in the claims on appeal. RAN 6-7; Inagaki 4–5 (Embodiments 2 and 5, respectively).

The Examiner further finds that Inagaki describes that the disclosed refrigerants "excel in characteristics as fluids for heat transfer and their coefficient of performance, freezing capacity, condensation pressure, and discharge temperature are well balanced" and have boiling points similar to the known refrigerants R-12, R-22, R-114, and R-502. RAN 7 (citing Inagaki 2) and 40. The Examiner finds that Inagaki's heat transfer compounds "are compatible with lubricants." RAN 8.

Accordingly, the Examiner determines that it would have been obvious to one having ordinary skill in the art at the time the invention to have used Inagaki's unsaturated fluorinated hydrocarbons "in a nonpolluting cooling agent for cooling units and heat pumps comprising CO_2 and at least a partially fluorinated hydrocarbon as taught by Kruse" because Inagaki describes the excellent heat transfer characteristics of the refrigerants. RAN 7 and 18-19. In other words, the Examiner determines that it would have been obvious to add Inagaki's refrigerants to the refrigerants described in Kruse.

The Examiner reinforces this determination in additionally rejecting claims 1 and 19 further in view of Butler. The Examiner finds that Butler teaches "the successful use of unsaturated fluorocarbons in combination with CO_2." RAN 12. In particular, the Examiner finds that Butler teaches combining trifluoropropene ($CF_3CH{=}CH_2$)[11] with CO_2. *Id.* (citing Butler,

[11] Butler indicated that the trifluoropropene is $CF_3CH{=}CH_2$. Butler, Abstract. This structure is the same as that described in Embodiment 1 of

column 2, lines 15-29; column 4, lines 44-57; and claim 4). According to the Examiner, "Butler demonstrates that these two types of refrigerants are both compatible and known corefrigerants" and provides further evidence of the obviousness to combine Inagaki with the CO_2-containing refrigerant composition of Kruse. *Id.*

Discussion

Group I: Claims 1, 7-16, 18, and 19

Issue

Although dependent claim 8 is separately rejected in combination with Bivens, claims 9 and 10 are separately rejected in combination with Mahler, claim 11 is separately rejected in combination with Bivens and Mahler, and claims 12 and 13 are separately rejected in combination with Nimitz, Patent Owner argues claims 1, 7-16, 18, and 19 as a group based on the Examiner's similar reliance on the teachings of Kruse in view of Inagaki. PO App. Br. 13. Accordingly, we address claim 1 as representative of the rejection of the claims, with the understanding that our comments apply equally to the rejections of dependent claims 7-16, 18, and 19.

Patent Owner contends that Kruse teaches problems associated with using CO_2 as a refrigerant, namely an unfavorable triple point and unfavorable pressure, and the teachings of Kruse are limited to the particular mixtures of CO_2 and the identified refrigerants to overcome these problems. PO App. Br. 10; *see also* Patent Owner's Rebuttal Brief 3-4, filed December

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Inagaki, which is identified as 3,3,3-trifluoro-1-propene. Inagaki 2. We take notice that 3,3,3-trifluoro-1-propene is also commonly referred to as HFO-1243zf. *See e.g.*, Singh Decl. ¶ 26.

23, 2105 (hereinafter "PO Reb. Br."). Patent Owner argues that nothing in Inagaki or Kruse suggests that the disadvantages of CO_2 are eliminated with any refrigerants other than those disclosed therein. PO App. Br. 12.

Patent Owner contends that Kruse's teaching that using ammonia as a refrigerant is undesirable because of ammonia's both toxic and flammable properties would have discouraged the skilled artisan from using Inagaki's fluoropropenes because unsaturated HFOs as a class were considered to be toxic and/or flammable at the time of the present invention. PO App. Br. 10-11 and 13. Patent Owner asserts that Kruse teaches "a non-toxic, non-flammable substitute" having a "low toxicity advantage" and that there was no expectation that such an advantage would have existed by substituting an unsaturated halogenated compound of Inagaki. *Id.* at 3, 13; PO Reb. Br. 4-9. Further, Patent Owner argues that the low toxicity taught by Kruse teaches away from combining with unsaturated hydrofluoroolefins because of the skilled artisan's understanding that HFOs were considered toxic. PO App. Br. 12; PO Reb. Br. 4-9.

Patent Owner argues that the Examiner articulates no reason the skilled artisan would have used HFOs in the composition described in Kruse combining CO_2 and known HFC refrigerants, particularly in light of the concerns regarding toxicity, flammability and reactivity. *Id.* at 16 and 18.

Patent Owner further argues that, at the time of the invention, there was a long-felt need in the art for a refrigerant having low GWP and low ODP and that were not reactive, unstable, flammable, and toxic. PO App. Br. 5-9. Patent Owner also argues that skepticism of finding such a

refrigerant in the art is persuasive evidence that the claimed invention, having such properties, was not obvious to the skilled artisan. *Id.*

The issue with respect to these claims is:

Did the Examiner err in determining that one of ordinary skill in the art would have formulated a heat transfer composition comprising HFO-1234yf or transHFO-1234ze and CO_2 from the teachings of Kruse and Inagaki, either alone or further in view of Butler, particularly in light of the evidence of secondary consideration, namely unexpected results, long-felt-but-unmet need, and skepticism?

Analysis

Although Kruse discloses express reasons for using CO_2 along with known "partially fluorinated hydrocarbons" in the amounts recited in the claims (Kruse 2-3), we agree with the Patent Owner that Kruse does not expressly teach combining CO_2 with HFO-1234yf or transHFO-1234ze and does not expressly teach the heat transfer composition as recited in claim 1. However, we note that the Examiner's rejection is not an anticipation rejection, but an obviousness rejection under 35 U.S.C. § 103(a).

The evidence of record does not support Patent Owner's argument that Kruse is limited to the combination of CO_2 with the particular identified refrigerants disclosed therein as a means for addressing triple point and pressure problems of CO_2.[12] Rather, Kruse uses CO_2 to solve the problem of finding "nonpolluting" substitutes for known chlorofluorocarbon (CFC)

[12] While Kruse identifies that CO_2 has a recognized problem with triple point and unfavorable pressure, Kruse does not teach that the combination with partially fluorinated hydrocarbons solves or alleviates this problem. Kruse is silent as to the triple point and pressure of its proposed mixtures.

cooling agents, particularly R-22, which depletes ozone and thus its use has been prohibited in Germany after 2000 and for which a substitute is difficult to find due to its low boiling point that is 10-20 K lower than for R-12. Kruse, 3, last ¶, 4, first ¶, and Abstract. According to Kruse, a "mixture consisting of CO_2 and at least a partially fluorinated hydrocarbon is an excellent substitute for the cooling agent R 22 and, consequently, also for the cooling agent R 502," which itself is a mixture comprising R-22. Kruse, 4, third ¶. Kruse indicates that the particular partially fluorinated hydrocarbons of claim 2 are preferred because they also have low GWP. *Id.*, 3, fifth full ¶. Kruse also indicates that the particular partially fluorinated hydrocarbons of claim 5 are particularly preferred because they are non-toxic, non-flammable, and have good boiling points, material performance, and environmentally relevant properties. *Id.*, 4, fourth ¶. However, Kruse does not expressly limit the partially fluorinated hydrocarbons to those described in claim 2 or claim 5. In fact, claim 1 of Kruse states, "A cooling agent for cooling units or heat pumps consisting of a mixture comprising CO_2 and at least a partially fluorinated hydrocarbon," and is open to any partially fluorinated hydrocarbon. Kruse, 5, claim 1.

The Examiner recites the enumerated advantages recited in Kruse for the general combination of CO_2 and partially fluorinated hydrocarbons. RAN 5-6 (citing Kruse's number paragraphs on pages 2-3). These advantages include: (1) being able to vary the boiling point to make the composition suitable as a substitute for R-22, (2) rendering flammable cooling agents non-flammable, (3) no ozone depletion potential (ODP), (4) a global warming potential (GWP) that is "considerably lower than" R-12, and

(5) the non-toxic and non-flammable properties of CO_2 are known and do not "require long and costly toxicological examinations." *Id.*

Thus, Kruse teaches combining CO_2 with partially fluorinated hydrocarbons to achieve a boiling point close to R-22 with no ozone depletion. Kruse is not limited to using only low GWP partially fluorinated hydrocarbons. Kruse particularly identifies that R-152a (CHF_2-CH_3)[13] and R-32 (CH_2F_2),[14] which have a lower GWP, are more preferred, and completely fluorinated hydrocarbons (R-218 and RC-318), which have a high GWP, are "less preferred." *Id.*, 3, ¶ 4. Kruse teaches that the low GWP of CO_2 can be used to form mixtures with a GWP "more favorable than the respective pure partially fluorinated hydrocarbons." *Id.*[15]

Kruse is not limited to non-flammable partially fluorinated hydrocarbons. In fact, Kruse teaches that some flammable partially fluorinated hydrocarbons, which cannot be used as a cooling agent alone, such as R-218 and RC-318 (*see id.* 3, ¶ 4), can form a non-flammable mixtures with CO_2. *Id.*, 3, ¶ 2 and 5, Example 2 (R-152a). We also cannot agree with Patent Owner that Kruse teaches a "low toxicity advantage" that is "critical" in its refrigerant mixtures. PO App. Br. 12 and 20. To the

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[13] R-152a is reported to have a GWP of 140. *See* Singh Decl., Exhibit J, at 50, col. 1.

[14] R-32 is reported to have a GWP of 675. *See* <http://en.wikipedia.org/wiki/Difluoromethane>, accessed October 19, 2016.

[15] Because GWP is defined as a measurement relative to the global warming potential of CO_2 (*see* '404 patent, col. 5, ll. 12-17), one of ordinary skill in the art would have a reasonable expectation that adding CO_2 would improve the GWP of all partially fluorinated hydrocarbons having a GWP greater than 1, including HFO-1234yf, which has a very low GWP of 4.

contrary, Kruse teaches that CO_2 does not require "long and costly examinations" because it has already been determined to be non-toxic. Kruse is otherwise silent as to the toxicity of the partially fluorinated hydrocarbons, except to say that non-toxic and non-flammable partially fluorinated hydrocarbons, such as recited in claim 5, are "[e]specially preferred." Kruse, 4, fourth ¶.

Inagaki teaches a generic refrigerant having the formula $C_3H_mF_n$, wherein m and n are integers from 1–5 and the sum of m and n is equal to 6, which has no destructive effects on the ozone layer, because such refrigerants contain no chlorine or bromine atoms. Inagaki 2. More critically, Inagaki exemplifies five refrigerants, including $F_3C–CH=CHF$, also known in the art as HFO-1234ze, and $F_3C\text{-}CF=CH_2$, also known in the art as HFO-1234yf, which as noted above, are refrigerants falling within the scope of claim 1. *Id.* at 2 and 4 (Embodiments 2 and 5, respectively). Inagaki teaches that the coefficient of performance (COP) and freezing effect results for HFO-1234ze were similar to that obtained for R-22, R-12 and R-502, all commonly used refrigerants. *Id.* at 4. Inagaki also teaches that COP and freezing capacity for HFO-1234yf were similar to those obtained for HFO-1243zf of embodiment 1 (*id.*), for which Inagaki shows "excellent" COP values and "higher" freezing capacity than control refrigerant (R-12). *Id.* at 3. Accordingly, Inagaki evinces that at the time of the invention that any of the exemplified hydrofluoroolefins were known to those of skill in the art to be refrigerants with good COP and good freezing effect with no destructive effects on the ozone layer. Inagaki further teaches

that the boiling points of its compounds are similar to those of R-12, R-22 and R-502. Inagaki 2.

Accordingly, we agree with the Examiner that it would have been obvious to one of ordinary skill in the art to have used the compounds of Inagaki as, or in addition to, the partially fluorinated hydrocarbons described in Kruse, as such a mixture would have been expected to have the benefits of no ODP, good cooling performance, and be a suitable replacement for R-22 as a refrigerant. RAN 7 and 13-14.

Moreover, Inagaki teaches combining these heat transfer compounds with other known heat transfer compositions having a low boiling point, including saturated hydrofluorocarbons (HFCs) (R-32, R-134a, R-143, and R-152) and hydrochlorofluorocarbons (HCFCs) (R-22, R-124, and R-142b) to enhance freezing capacity and coefficient of performance (COP) and improve solubility in cooling machine oil. Inagaki 2. In fact, the evidence of record is replete with examples of mixing known refrigerants to achieve refrigerant properties closer to that of the ideal refrigerant, such as non-flammability boiling point (Kruse), better environmental properties and compatibility with lubricants (Inagaki). *See also* Bivens, Abstract; Nimitz, Abstract; Butler, col. 2, ll. 15-34.; Singh Decl., Exhibit I[16] (discussing at page 3 "binary, tertiary and quaternary combination" of refrigerants for good azeotrope properties); Singh Decl., Exhibit F[17], 40, col. 1 (discussing azeotrope and non-azeotrope mixtures of refrigerants).

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[16] J. Jones and C.J. Morrissey, NASA JPL, *Nearly Azeotropic Mixtures to Replace Refrigerant 12*, 16(8) NASA TECH BRIEF 122 (1992).
[17] W.L. Kopko, *Beyond CFCs: Extending the Search for New Refrigerants*, Proceedings Of ASHRAE's 1989 CFC Technology Conference 39 (1989).

Patent Owner's arguments directed to the expected toxicity, flammability, and reactivity of the hydrofluoroolefins taught by Inagaki are not persuasive. A skilled artisan would have had a reasonable expectation that a mixture of CO_2 and either HFO-1234yf or HFO-1234ze would have been successful for use *as a heat transfer composition* despite any expectation of toxicity or reactivity.

Patent Owner's arguments do not consider that refrigerant applications exist for which toxicity and flammability of the refrigerants, while undesirable, would not prevent the use of thereof, despite such deficiencies. *See* Singh Decl., Exhibit F, 40, col. 2 ("While all of these criteria are important, a deficiency in some areas can sometimes be acceptable if the equipment is designed to take them into account. For example, *ammonia is still an important refrigerant for large industrial applications despite its toxicity, flammability, oil insolubility, and incompatibility with copper*. Its advantages of low cost, good cycle efficiency, and good thermal properties make it worth the trouble to design around these problems.") (emphasis added); Bivens Decl. ¶ 25 ("problems [of toxicity and other problems] were of little to no concern for the heat pump application for which the molecules were being considered [in Inagaki]."); Butler, col. 2, ll. 31-34 ("[T]he choice of a refrigerant for a specific application is determined by the thermodynamic properties, physical properties and chemical properties needed for that application"); Bivens

Decl., Exhibit B[18], 2, ¶ 5, ("It must be emphasised that a substance that may not suitable for use as a medical propellant *may be suitable for safe use as an industrial refrigerant*.") (emphasis added); Corr Decl., Attachment C[19], ¶ spanning 33-34 ("These [properties of non-flammability and very low order of toxicity] can be compromised *in some industrial applications* as evidenced by the use of hydrocarbons and ammonia.") (emphasis added).

Evidence of record further disputes Patent Owner's contention that unsaturated hydrofluorocarbons were considered "as a class" unsuitable for use a refrigerant at the time of the invention. PO App. Br. 7, 13; PO Reb. Br. 10; Bivens Decl. ¶ 10; Chambers Decl. ¶ 6. Butler teaches using HFO-1243zf[20] as both a refrigerant and a propellant in combination with a variety of refrigerants, including CO_2. Butler, col. 2, ll. 16-29 and Abstract. Similarly, Omure teaches using HFO-1243zf, having "relatively superior thermal stability" with PAG, as a refrigerant "in the existing refrigerating machines"). Omure ¶ [0014]. Accordingly, Patent Owner cannot dispute that skilled artisans explored and tested HFOs for use *as heat transfer compositions*, prior to the date of the invention. *See* Inagaki, Butler, and Omure. Moreover, Omure and Butler teaches using HFO-1243zf as a refrigerant despite the fact that Butler also expressly teaches that HFO-

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[18] *Consideration of Hydrofluoroolefins (HFOs) as Potential Candidate Medical Propellants* (2010) (also referred to in the briefs as the "Mexichem's White Paper").

[19] M. McLinden et al., "Quest for Alternatives: A molecular approach demonstrates tradeoffs and limitations are inevitable in seeking refrigerants," ASHRAE Journal, December 1987, 32-42.

[20] Inagaki also exemplifies $CF_3CH{=}CH_2$, also known in the art as HFO-1243zf. *Id.* (Embodiment 1).

1243zf is "flammable." Butler, col. 2, l. 41. Also, contrary to the assertions of Patent Owner that the HFOs "as a class" were considered too toxic at the time of the invention (*see* Bivens Decl. ¶ 22, Exhibit G[21] and Singh Decl. ¶ 29, Exhibit I), HFO-1243zf and transHFO-1234ze were believed to be relatively nontoxic based on acute toxicity data available at the time. *See* Butler, col. 2, ll. 41-42 (identifying that "acute studies [of HFO-1243zf] indicate it to be relatively nontoxic."); Singh Decl., Exhibit F, Table 2 (identifying HFO-1243zf as having "low" toxicity based on the small amount of acute toxicity testing available); Singh Decl., Exhibit G[22], 2 (discussing that HFC-1243zf has "very little acute toxicity" and "a lack of mutagenic activity"); Reply Br. 11; Singh Decl., Exhibit C (Bodgen), 399, ¶ spanning col. 1-2 (stating that transHFO-1234ze, a recognized decomposition product of HFC-145a which appears in the trans-isomer in a 4:1 ratio, is "not highly toxic or mutagenic."). Thus, at the time of the invention, the skilled artisan would not have discounted all unsaturated hydrofluorocarbons as being too toxic or too reactive for all refrigerant purposes.

Patent Owner's evidence indisputably shows that *some* unsaturated hydrofluorocarbons[23] were tested and identified as being too reactive or too

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[21] Joel R. Hall, Mexichem Fluor letter to EPA East, dated December 20, 2010.

[22] *Toxicity of Possible Impurities and By-products in Fluorocarbon Products*, European Centre for Ecotoxicology and Toxicology of Chemicals, ECETOC Technical Report No. 103, ISSN-0773-8072-103, Brussels (Dec. 2008).

[23] Because the evidence shows that these components were tested to determine whether or not they were too reactive or too toxic, the argument

toxic *for some purposes*, namely automobile air conditioning systems and medical inhalants, where toxicity and reactivity are deemed critical to the particular application. *See* Singh Decl., Exhibit I (finding 1243zf too reactive for a *full replacement* of R-12, including in automobile air conditioning systems); Singh Decl., Exhibit J[24] (stating after finding HFO-1234yf a good refrigerant, as taught by Inagaki, that "[i]t is necessary to wait for the conclusion of the toxicity studies and for the very moderate flammability of this refrigerant *to be considered as acceptable by the automobile manufacturers*"); and Bivens Decl., Exhibit B, ("It must be emphasized that a substance that may not suitable for use *as a medical propellant* may be suitable for safe use as an industrial refrigerant.").

However, the claims recite only a generic "heat transfer composition" or a generic "process for changing the heat content of a body" and do not recite any particular application for which these references were particularly testing. Claim 29 further recites "transferring heat between said composition and air," which is broad enough to encompass a variety of air cooling applications, including industrial cooling application for which toxicity, reactivity, or flammability may not be of particular concern, as discussed further below with respect to Group VII claims.

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that the skilled artisan would have not have even considered the class of HFO compounds particularly for purposes where toxicity and reactivity are of great concern is not persuasive.

[24] D. Clodic, *Automobile Air-Conditioning: Environmental Stakes and Future Technical Options*, National School of Mines Library, May 2008 (English language translation).

The evidence also supports a finding that the particular concerns with stability, flammability, toxicity, and reactivity were known in the art and that the testing of prospective refrigerants for these properties was routine at the time of the invention. *See* Singh Decl. ¶¶ 10-12 (citing a Declaration of George Rusch (attached as Exhibit K to the Singh Decl.), which discusses testing "by standard methods known in the art" of HFO-1225zc performed by Dupont that is dated April 17, 2000); Singh Decl. ¶ 8 (citing Exhibit C (Bogden) and Exhibit D[25], identifying that "HFC-1234ze trans" was tested in 1996 as the primary decomposition product of HFC-245a and found "not highly toxic or mutagenic").

Thus, the discovery that HFO-1234yf and HFO-1234ze (cis- and trans-) had other desirable properties for more nuanced application, namely for automobile air conditioning systems, is not an inventive contribution to the art of air conditioning or refrigeration generally, but the result of routine testing at the time of known good refrigerants for general use. The properties of the particular refrigerants are inherent to the *refrigerant*, whether specifically disclosed or not.[26] It is enough that the prior art

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[25] AlliedSignal, *Status Report on the Development of HFC-245fa as a Blowing Agent*, PowerPoint.

[26] Such inherent properties of refrigerants include their specific toxicity, flammability, miscibility with specific lubricants, GWP, and ODP, whether or not these properties are predictable. One cannot obtain a patent for a composition of matter based on the inherent properties of an otherwise known refrigerant. "Inherency is not necessarily coterminous with the knowledge of those of ordinary skill in the art. Artisans of ordinary skill may not recognize the inherent characteristics or functioning of the prior art." *In re Cruciferous Sprout Litig.*, 301 F.3d 1343, 1349 (Fed. Cir. 2002). The new realization alone does not render that prior art

reference describes excellent COP, freezing effect, and low ODP to provide sufficient reasons for the skilled artisan to use Inagaki's compounds as a partially fluorinated hydrocarbon refrigerant in a mixture with CO_2 as taught by Kruse. "[A]ny need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed." *KSR Int'l v. Teleflex, Inc.*, 550 U.S. 398, 420 (2007).

Thus, we are not persuaded that any expected difficulties or problems associated with the use of HFO-1234yf or HFO-1234ze, such as potential toxicity and potential flammability, would have deterred an ordinary artisan from using HFO-1234yf or HFO-1234ze as a refrigerant in known refrigerant applications, as evidenced by Inagaki, and mixing the refrigerant with CO_2 to further improve the properties thereof as taught by Kruse. Even if Inagaki's refrigerants were expected to be toxic, flammable, reactive, etc., the skilled artisan would have recognized the tradeoff of these properties for the benefits of good cooling with little effect on the ozone layer and would have used Inagaki's refrigerants in air conditioning equipment accordingly, as taught by Inagaki. *See* Singh Decl., Exhibit F, 40, col. 2 (quoted above);

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patentable. "From the standpoint of patent law, a compound and all of its properties are inseparable; they are one and the same thing." *In re Papesch*, 315 F.2d 381, 391 (CCPA 1963). "[T]he discovery of a previously unappreciated property of a prior art composition, or of a scientific explanation for the prior art's functioning, does not render the old composition patentably new to the discoverer." *Atlas Powder Co. v. Ireco, Inc.*, 190 F.3d 1342, 1347 (Fed. Cir. 1999). *See also In re Skoner,* 517 F.2d 947, 950 (CCPA 1975) ("Appellants have chosen to describe their invention in terms of certain physical characteristics . . . . Merely choosing to describe their invention in this manner does not render patentable their method.").

Corr Decl., Attachment C (a 1987 ASHRE journal article from McLinden, et al., entitled "*Quest for Alternatives: A Molecular Approach Demonstrates Tradeoffs and Limitations Are Inevitable in Seeking Refrigerants*").

Secondary Considerations

Patent Owner contends that there is evidence of long felt need and, despite the need, the art shows a 10 year gap in the industries acknowledgement of using CO_2 (Kruse) and hydrofluoroolefins (Inagaki) as refrigerants. PO App. Br. 4 (citing *Leo Pharm. Prods., Ltd. v. Rea*, 726 F.3d 1346, 1354 (Fed. Cir. 2013)). In particular, Patent Owner argues that there was a long-felt need in the art for a refrigerant that possessed "much lower GWP than HFC-134a but still possessed the other required properties, such as acceptable reactivity, low toxicity and low flammability" and skepticism that the combination of all such properties could be met. *Id.* at 6 and 8.

After careful review of the evidence as a whole, we determine that Patent Owner's evidence is unpersuasive as to the legal conclusion that the use of HFO-1234yf or HFO-1234ze as a refrigerant in combination with CO_2 would not have been obvious to one of ordinary skill in the art.

We disagree that, in this case, the ages of the prior art are particularly relevant. Initially, *Leo* states that "[t]he length of the intervening time between the publication dates of the prior art and the claimed invention *can also qualify as an objective indicator* of nonobviousness." *Leo*, 726 F.3d at 1359 (emphasis added) (citing *Ecolochem, Inc. v. S. Cal. Edison Co.*, 227 F.3d 1361, 1376–77 (Fed. Cir. 2000)). Yet, *Leo*, like *Ecolochem* (*id.*), discusses the ages of the references only in the context of whether the record

showed that an unsolved need in the art was long-felt. *Leo*, 726 F.3d at 1359 ("it was not until the '013 patent's filing in 2000—*twenty-two years* after Turi and *fourteen years* after Dikstein-that the solution to the long felt but unsolved need for a combined treatment of vitamin D and corticosteroid was created.") (emphasis in original). In discussing the age of the reference only in context with a showing a long-felt but unmet need in the art, the holding in *Leo* regarding the age of the reference is consistent with Federal Circuit holding that the age of references is not determinative of obviousness. *See Nike, Inc. v. Adidas AG*, 812 F.3d 1326, 1338 (Fed. Cir. 2016) ("our decision in *Leo Pharmaceutical* is entirely consistent with established precedent that '[t]he mere age of the references is not persuasive of the unobviousness of the combination of their teachings, absent evidence that, notwithstanding knowledge of the references, the art tried and failed to solve the problem.'" *In re Wright*, 569 F.2d 1124, 1127 (CCPA 1977)) (additional citations omitted).

In this case, the ages of the references are consistent with and responsive to the constantly changing regulations on types of refrigerants in the same relevant time period. Chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) were considered "safe and effective" before they were prohibited by the Montreal Protocol of 1987 in a phased out approach beginning in 1989 due to high ODP of the CFCs and HCFCs. Singh Decl., Exhibit I, p. 2; Bogdan 394, second full ¶; Bivens Decl., Exhibit B, p. 3, first and second full ¶. HFC's, particularly HFC-134a, which have no ozone depletion potential, were not subject to the Montreal Protocol and were a recognized replacement for CFCs. Corr Decl. ¶¶ 15-16,

20; Shibanuma Decl. ¶¶ 9-11; Bogdan 394, 3rd full ¶ (1996 article describing HFC-245a as a replacement blowing agent for CFCs and HCFCs, with good non-toxic, non-flammable properties); Bivens Decl., Exhibit B, p. 3, third full ¶. The 1992 United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, adopted in 1997 and entered into force in 2005, called upon committed countries to also phase out the use of HFCs due to their high global warming potential (GWP). *See* Bivens Decl., Exhibit E[27], ¶ [0004]; Corr Decl. ¶ 17; Singh Decl., Exhibit J, ¶ spanning pp. 40-50. Due to its commitment under the Kyoto Protocol, the European Union issued a directive in 2006 mandating the phase out of HFC-134a in mobile air conditioning systems by 2011. Bivens Decl., Exhibit E, ¶¶ [0002]-[0003]; cf. Shibanuma Decl. ¶ 17 and Exhibit A[28] (indicating that the European Directive was first *proposed* in 2003, but not yet passed). At the time of the invention, in 2004, HFCs were recognized as global warming producing refrigerants but were not yet prohibited anywhere for use as refrigerants.[29] *Id.*

Kruse, which was published in 1992, identifies that low GWP partially fluorinated hydrocarbons are preferred, but these "low GWP"

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[27] U.S. Patent Publication Number 2011/0312101 Al, published December 22, 2011 and naming Tsuchiya et al. as inventors.
[28] Commission of the European Communities, *Proposal for a Regulation of the European Parliament and of the Council on certain fluorinated greenhouse gases*, Document 2003/0189 (COD), Brussels, August 11, 2003.
[29] A brief search indicates that the United States may not phase out HFC-134a for use in light duty vehicles until 2025. *See* Alec Johnson, Owner of Refrigerant HQ ("a site dedicated to the refrigeration industry as well as everything and anything that goes with it."), http://refrigeranthq.com/epa-announces-phaseouts-of-hfc-refrigerants/, accessed October 24, 2016.

hydrocarbons includes relatively high GWP containing fluorinated hydrocarbons, such as the commonly used R-134a. *See* Kruse 3, first unnumbered ¶. Thus, Kruse identifies, but is not particularly concerned with high GWP partially fluorinated hydrocarbons. Similarly, Inagaki is silent as to the GWP of its refrigerants because, in 1992, the Montreal Protocol only prohibited ozone depleting materials. At the time of the invention in 2004, the skilled artisan likely recognized that there would *eventually* be a need in the art for a replacement to HFC-134a due to its high GWP. *See* PO App. Br. 5-6; Corr Deposition Tr. 30:24-32:20 (discussing that, in the 1989-1995 time frame, there was "some concerns" about the global warming potential of R-134a, but it "probably wasn't" considered "as big an issue as today" and that it did not really change much into the year 2000 "as the HFC fluids became commercially adopted to scale"). We cannot agree that that need was "long-felt" as of 2004, the earliest filing date of the present invention, because at that time HFC-134a still was widely used and the refrigeration community was just beginning to discuss the prohibition of HFC-134a and the need for lower GWP refrigerants. *See* Bivens Decl., Exhibit B, p. 3, fourth full ¶ (a 2010 article stating, "HFCs are now becoming subject to regulation in some industrial applications, with some discussions about HFC regulation at Montreal Protocol meetings. At present there is no declared regulatory intention to seek to control the use of HFCs in MDI [Metered Dose Inhalers] applications.") (footnote omitted); Shibanuma Decl. ¶¶ 11 ("R-134a and refrigerants like it were already (and still are) considered to be desirable refrigerants because of their non-toxic, non-flammable, and non-

ozone damaging characteristics, as well as because they could be produced cost-effectively.”).[30]

In order for evidence of secondary considerations to be persuasive, the Patent Owner has the burden to show a “nexus” or link between what is claimed and the evidence of secondary considerations. *See In re GPAC Inc.*, 57 F.3d 1573, 1580 (Fed. Cir. 1995). Secondary considerations are generally not persuasive when the prior art possesses the same characteristics relied upon by the patent owner in the evidence of the secondary consideration. *In re Baxter Travenol Labs*., 952 F.2d 388, 392 (Fed. Cir. 1991); *J.T. Eaton & Co., Inc. v. Atlantic Paste & Glue Co*., 106 F.3d 1563, 1571 (Fed. Cir. 1997). For a secondary consideration to be persuasive evidence of nonobviousness, it must be connected directly to claimed features of the claimed invention, and provide properties beyond what would have been expected based on the prior art. *Baxter,* 952 F.2d at 392 (“[W]hen unexpected results are used as evidence of nonobviousness, the results must be shown to be unexpected compared with the closest prior art.”).

Most of Patent Owner’s evidence shows that a particular *refrigerant* having all of the desirable properties sought after in the particular art, namely environmentally friendly, non-toxic, miscible and stable with lubricants, and good cooling characteristics (i.e., good COP) was elusive to

[30] Though not dispositive, we note that the ’404 patent does not describes the discovery of new refrigerants as a “long-felt need” in the art. *See* ’404 patent, col. 1, ll. 47 (“[I]t is *desirable* to use hydrofluorocarbon or other fluorinated fluids having global warming potentials as low as possible while maintaining the desired performance in use properties.”) (emphasis added).

those in the art for a long time. Yet, such refrigerants existed and were known as good refrigerants at the time, as described in Inagaki. Accordingly, a solution to the need for a refrigerant was taught or suggested in the art well before the Patent Owner's identification of the additional beneficial properties of HFO-1234yf and HFO-1234ze. *Asyst Techs., Inc. v. Emtrak, Inc.*, 544 F.3d 1310, 1316 (Fed. Cir. 2008) ("[T]here was no evidence that the success of the commercial embodiment . . . was attributable to the . . . *only material difference between [the prior art] and the patented invention*.") (citation omitted, emphasis added); *In re Kao*, 639 F.3d 1057, 1068 (Fed. Cir. 2011) ("Where the offered secondary consideration actually results from something other than what is both claimed and *novel* in the claim, there is no nexus to the merits of the claimed invention").

Here, the difference between the closest prior art and the claims is not the selection of HFO-1234yf or HFO-1234ze as a refrigerant, because the use of this compound as a refrigerant is taught expressly by Inagaki for common refrigerant purposes. Rather, we need only consider evidence related to the specific properties of the combination of HFO-1234yf or HFO-1234ze and CO_2, since it is only the combination of components that is novel in the prior art. Patent Owner produces no evidence that the combination of HFO-1234yf or HFO-1234ze and CO_2 exhibit any unexpected properties.

Patent Owner does not provide arguments that skilled artisan were skeptical that Inagaki's refrigerant could be combined with CO_2 *to be used as a refrigerant*, as required by the claims. Rather, Patent Owner's

arguments are directed to the skepticism in the art as to inherent properties the refrigerants taught by Inagaki. *See* PO App. Br. 7-8. These properties, though not realized, were nonetheless present in the prior art,[31] and Inagaki's teaching of low ODP and good refrigeration COP and capacity provide a sufficient reason for the skilled artisan to look to these refrigerants. As discussed above, the particular concerns with stability, toxicity, and reactivity and the testing of prospective refrigerants for these properties were known and routine in the art at the time of the invention. Thus, the skepticism in the art regarding the unrealized properties of HFO-1234yf and HFO-1234ze would not have rendered the combination of these refrigerants with CO_2 as taught by Kruse non-obvious for use as a generic refrigerant in the art for the reasons discussed above.

Accordingly, we affirm the Examiner's rejection of claims 1, 7-16, 18, and 19 under 35 U.S.C. § 103(a) as obvious over Kruse in view of Inagaki, alone or further in view of Butler, Bivens, Mahler, and/or Nimitz.

Group II: Claims 2, 3, and 5 (and claim 30)[32]

Issue

In Group II, Patent Owner presents separate arguments for claims 2, 3, and 5. PO App. Br. 22. Claim 2, from which claims 3 and 5 depend,

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[31] *See also* n.15, supra.

[32] Claim 30 was not separately argued in Patent Owner's Appeal Brief. Claim 30 was either grouped with claim 1 (*see* PO App. Br. 9 (listing claims 29-31, 33, and 34 with Group 1 in the Argument section)) or with claim 29. *See* PO App. Br. 9 (listing claims 29-31, 33, and 34 as separately argued "Group VII" in the "Grouping of the Claims" section)). Claim 29 is argued alone as Group VII in the arguments section of the Appeal Brief. *See* PO

specifically recites that the heat transfer composition comprises "from about 60 to about 99 percent by weight of trans-1,1,1,3-tetrafluoropropene (HFO-1234ze)." Claims 2, 3, and 5 are rejected under 35 U.S.C. § 103(a) as being obvious over Kruse in view of Inagaki.

The Examiner finds that Inagaki's disclosure of HFO-1234ze would necessarily include both transHFO-1234ze and cisHFO-1234ze. RAN 7.

Patent Owner contends that Inagaki is silent as to the trans-isomer of HFO-1234ze and thus there is no suggestion in the art to use this unnamed component in combination with CO_2. PO App Br. 22.

The issue with respect to claims 2, 3, and 5 is:

Did the Examiner err in determining that a heat transfer composition comprising 60-99 percent transHFO-1234ze would have been obvious to one of ordinary skill in the art from the teachings of Kruse and Inagaki?

Analysis

The Examiner does not make any finding as to the amount of transHFO-1234ze in the HFO-1234ze compound of Inagaki except to note that some transHFO-1234ze was present. RAN 7. Rather, the Examiner and the Requester rely on the teachings of the broad range of partially fluorinated hydrofluorocarbons described in Kruse, namely 1-99 percent, preferably 20-96%, as evidence that it would have been obvious to use 60-

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App. Br. 30-31. Patent Owner argues claim 30 separately with a new claim interpretation for the first time in Patent Owner's Rebuttal Brief. PO Reb Br. 14-16. We exercise our discretion to consider Patent Owner's belated argument regarding the interpretation of claim 30, not because it is critical to this appeal, but because it relates to a question of law that would be considered *de novo* by the Federal Circuit upon appeal thereto.

95% transHFO-1234ze in a heat transfer composition. Patent Owner does not dispute the Examiner's finding that Inagaki's HFO-1234ze compound includes transHFO-1234ze. Patent Owner also does not dispute the Examiner's reasoning that Kruse evinces using a partially fluorinated hydrocarbon in the amount recited in the claims.

The record before us supports the Examiner's determination of obviousness. Inagaki teaches that its HFO-1234ze compound has a boiling point of -16° C. Inagaki 2, col. 2. Dr. Corr testifies that the boiling point of transHFO-1234ze is -19° C and the boiling point of cis-HFO-1234ze is 9° C, and notes that the boiling point of Inagaki's compound is significantly closer to that of the trans-isomer. Corr Decl. ¶ 27; *see* Bivens Decl. ¶ 32. The boiling point of Inagaki's compound is evidence that the HFO-1234ze product included more trans-isomer than cis-isomer because the recorded boiling point was substantially closer to the trans-isomer boiling point than to the cis-isomer boiling point. Thus, we find that that Inagaki's HFO-1234ze isomer mixture, i.e., Embodiment II, comprising more than 50% transHFO-1234ze.[33] Thus, we agree with the Examiner that a heat transfer composition having 60-99% by weight of transHFO-1234ze would have been obvious to the skilled artisan because a composition comprising up to 99%, preferable up to 96% of the HFO-1234ze composition of Inagaki would have been obvious for the reasons discussed above from the teachings of Kruse and Inagaki. Thus, the burden properly shifted to Patent Owner to

[33] In fact, Dr. Corr testifies that Inagaki's reference, having a boiling point of -16°C, has closer to 80% transHFO-1234ze and 20% cisHFO-1234ze. *See* PO Reb. Br. 15 (citing Corr Deposition Tr. 249:7-250:2).

demonstrate error in the Examiner's reasoning. Patent Owner provided no such demonstration. *See* PO App. Br. 22; *see generally* PO Reb. Br.

For the first time in its rebuttal brief, Patent Owner argues that claim 30 is properly interpreted as requiring *only* the trans-isomer of HFO-1234ze to the exclusion of any other Formula I refrigerants, and that the composition of Inagaki, which at best describes a mixture of the cis- and trans- isomers, is excluded from the claims. PO Reb. Br. 14-15. We disagree with Patent Owner's claim interpretation.

Patent Owner argues that the *Markush*[34] language reciting "one or more compounds of Formula I, XCF_zR_{3-z} (I) selected from the group consisting of" in claim 1 closes the claim to all other Formula I compounds other than those expressly recited in the clause of claim 1. PO Reb. Br. 14.

Claim 1 recites:

> A heat exchange composition *comprising*
>
> from about 1 to about 40 percent by weight CO_2 and
>
> from about 60 to about 99 percent by weight of one or more *compounds* of Formula I, XCF_zR_{3-z} (I) selected from *the group consisting of* HFO-1234ze and HFO-1234yf.

(Emphasis added.)

Claim 30 depends from claim 1 and recites the additional limitation,

> wherein said one or more compounds of Formula I comprises HFO-1234ze.

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[34] "A Markush group is a listing of specified alternatives of a group in a patent claim, typically expressed in the form: a member selected from the group consisting of A, B, and C." *Abbott Labs. v. Baxter Pharma. Prods. Inc.*, 334 F.3d 1274, 1280 (Fed. Cir. 2003).

The relation of "open" transitional phrases preceding the body of a claim (here, "comprising") and subordinate "closed" limitations within the body of the claim (here the *Markush* language "the group consisting of") can be confusing. The cases are clear, however, that an open claim transitional phrase cannot override the specific requirements of a closed subordinate limitation. However, when the scope of a closed subordinate limitation is defined by reciting individual members of a larger group, the claim must contain adequate language to maintain the exclusion of non-recited members of the larger group in addition to the inclusion of the recited members.

A concrete example helps make the point clearer. At one extreme, claim 1 is met by a composition comprising about 1 weight percent CO_2, about 60 weight percent of one or both of transHFO-1234ze and HFO-1234yf, and about 39 percent "other" substances, the identity of which we now consider. There is no language in claim 1 that excludes non-recited substances, including compounds that are within the scope of Formula I from being part of the "other" substances. Similarly, claim 30 requires the presence of a measurable amount of the transHFO-12345ze compound. For example, such language might be provided by express limitations, which may take the form of suitable functional language, or adequately crafted definitions of terms in the supporting specification, among other approaches.

Thus, the subordinate limitation (*Markush* limitation) of claim 1 is closed to alternative Formula I compounds, but the *claim* is open to the inclusion of additional compounds, including additional Formula I compounds. In other words, an anticipating composition (or an infringing composition) *must have* one of the disclosed Formula I compounds and CO_2,

because the subordinate limitation is closed to other Formula I compounds, but the infringing (or anticipating) composition *could also include* other Formula I compounds, because the claim itself is open to any "other" substances. Additionally, claim 30, which recites "wherein said one or more compounds of Formula I [from claim 1] comprises trans-1,1,1,3-tetrafluoropropene" *must include* transHFO1234ze, but *may also include* other Formula I compounds, including cisHFO-1234ze.

Patent Owner does not direct us to case law inconsistent with our interpretation.[35]

Accordingly, we affirm the Examiner's rejection of claims 2, 3, 5, and 30 under 35 U.S.C. § 103(a) as obvious over Kruse in view of Inagaki.

Group III: Claim 4

Issue

Patent Owner presents separate arguments for claim 4 as the sole claim of Group III. PO App. Br. 22. Claim 4 specifically recites that the heat transfer composition comprises HFO-1234yf and "has a vapor pressure of at least about 30 psia at 35°F." Claim 4 is rejected under 35 U.S.C. § 103(a) as being obvious over Kruse in view of Inagaki.

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[35] Patent Owner cites to *Sakano v. Rutemiller*, 158 USPQ 47, 51 (BPAI 1968), which interprets the transitional phrase "consisting of" rather than the transitional phrase "comprising." Yet here, claim 1 uses "comprising" as the transitional phrase. Patent Owner also cites *Ex parte Davis*, 80 USPQ 448, 450 (BPAI 1948), which interprets the phrase "consisting essentially of" as open to other substances except those that "materially changes the fundamental character of the three-ingredient composition." The claims at issue here do not use the phrase "consisting essentially of."

Patent Owner argues that the Examiner has not made a prima facie case of obviousness given that the prior art is silent as to vapor pressure. PO App. Br. 22-23.

The issue with respect to claim 4 is:

Did the Examiner err in determining that a heat transfer composition comprising HFO-1234yf and CO_2 and a vapor pressure of at least 30 psia at 35°F (about 1.7°C) would have been obvious to one of ordinary skill in the art from the teachings of Kruse and Inagaki?

Analysis

The Examiner makes no particular findings with respect to claim 4. RAN 5-6. However, the Examiner adopts the rejection of the Requester, who contents that HFO-1234yf and CO_2 both have a vapor pressure greater than 30 psia at 35°F, and thus any binary combination of the two refrigerants necessarily has a vapor pressure greater than 30 psia at 35°F. *See* Requester's Request for *Inter Partes* Reexamination 13. We are not persuaded of any error in the Examiner's adoption of the rejection of claim 4.

Patent Owner presents no arguments disputing the facts and reasoning regarding the recited vapor pressure asserted by Requester. Rather, Patent Owner argues that Requester did not support this finding with underlying evidence. PO App. Br. 22-23. While it is true that Examiner has the burden of establishing obviousness, unlike other factual findings, the vapor pressure of these components is a property inherent thereto that Patent Owner could readily dispute if untrue. We find no reason, and Patent Owner presents no

basis, for finding Requester's factual findings and conclusions erroneous.[36] For the reasons discussed above, we determined that heat transfer composition comprising HFO-1234yf and CO_2 would have been obvious one of ordinary skill in the art. Requester's position that such a combination, having both components with a vapor pressure greater than 30 psia at 35°F, would have a vapor pressure greater than 30 psia at 35°F is reasonable. Patent Owner presents no arguments disputing Requester's scientific reasoning.

Accordingly, we affirm the Examiner's rejection of claim 4 under 35 U.S.C. § 103(a) as obvious over Kruse in view of Inagaki.

Group IV: Claims 6, 24-26 and 32

Issue

Patent Owner presents separate arguments for claims 6, 24-26 and 32 as Group IV. *See* PO App. Br. 23-25. Claims 6, 24 and 32 recite that the composition is "nonflammable." Although dependent claim 26 is separately rejected in combination with Bivens, Patent Owner argues claims 6, 24-26, and 32 as a group based on the Examiner's similar reliance on the teachings of Kruse in view of Inagaki.

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[36] To the contrary, we find Requester's statement that the vapor pressure for both HFO-1234yf and CO_2 are greater than 30 psia at 35°F is credible. The normal boiling point of HFO-1234yf is about –30°C (–22 °F) (*see* Singh Decl., Exhibit J, ¶ spanning 51-52; Bivens Decl., Exhibit B, at 8 and 9 (–29.4°C or –21°F)), and CO_2 sublimes at about −78°C (–108°F) (at one atmosphere: liquification requires a pressure of 5.2 atm at −56.6°C or about –70°F) (CRC Handbook, 49th Ed. (1969)). Both boiling points are well below 35°F (or 1.7°C).

Patent Owner contends that neither Kruse nor Inagaki supports a conclusion that a nonflammable composition would have been obvious, because hydrofluoroolefins were expected to be flammable. Patent Owner also points out that Inagaki is silent as to the flammability of its hydrofluoroolefins, which include highly flammable HFO-1243zf, and urges that flammability of refrigerant mixtures was not a predictable property. PO App. Br. 23-25. Patent Owner further contends that inherency is not a proper basis for a rejection because no compositions comprising CO_2 and HFO-1234yf or transHFO-1234ze existed in the prior art. *Id.* at 25; PO Reb. Br. 12-13.

The issue with respect to claims 6, 24-26 and 32 is:

Did the Examiner err in determining that a non-flammable heat transfer composition comprising HFO-1234yf or transHFO-1234ze and CO_2 would have been obvious to one of ordinary skill in the art based on the teachings of Kruse and Inagaki?

Analysis

Inagaki evinces that at the time of the invention HFO-1234yf and HFO-1234ze were known to those of skill in the art to be a refrigerant with good COP, good freezing effect, no destructive effects on the ozone layer, and a boiling point similar to that of R-22. For these reasons, as discussed above, it would have been obvious to a skilled artisan to use HFO-1234yf or HFO-1234ze as the partially fluorinated hydrocarbon taught by Kruse.

We agree with the Examiner that the flammability of a particular refrigerant mixture is inherent to the mixture, whether specifically disclosed

or not.[37] RAN 20. Patent Owner argues that the Examiner's reasoning is contrary to law. *See* PO App. Br. 20 (citing e.g., *In re Newell*, 891 F.2d 899 (Fed. Cir. 1989)); PO Reb. Br. 12-13 (citing *In re Spormann*, 363 F2d 444, 448 (Fed. Cir. 1966)). However, in the cases cited by Patent Owner, the prior art did not provide a sound basis, in the first instance, for the obviousness combination upon which the inherency position was relied. However, our reviewing court has recognized that inherency may supply a missing claim limitation in an obviousness analysis where there is a sound basis for determining that modification of the prior art would have been obvious in the first instance. *See, e.g., PAR Pharm., Inc. v. TWI Pharm., Inc.*, 773 F.3d 1186, 1195–96 (Fed. Cir. 2014) ("[I]n order to rely on inherency to establish the existence of a claim limitation in the prior art in an obviousness analysis—the limitation at issue necessarily must be present, or the natural result of the combination of elements explicitly disclosed by the prior art."); *Alcon Research, Ltd. v. Apotex Inc.*, 687 F.3d 1362, 1369 (Fed. Cir. 2012) (finding a claimed result inherent in the otherwise obvious method of applying a known composition in a human eye); *In re Kao*, 639 F.3d 1057, 1070 (Fed. Cir. 2011); *In re Kubin*, 561 F.3d 1351, 1357 (Fed. Cir. 2009) (finding that a recited binding property was inherent where the prior art taught that the protein itself was obvious in view of the prior art); *In re Napier*, 55 F.3d 610, 613 (Fed. Cir. 1995) ("The inherent teaching of a prior art reference . . . arises both in the context of anticipation and obviousness."). Here, the Examiner's reasoning that a skilled artisan would have used HFO-1234yf or HFO-1234ze due to the good COP and capacity,

[37] *See* n.15, supra.

ozone friendly properties, and boiling point close to that of R-22, as described in Inagaki, as the partially fluorinated hydrocarbon taught by Kruse, is sound and based on the teachings of the prior art. One cannot obtain a patent for a composition of matter based on the inherent properties of an otherwise obvious refrigerant mixture.[38]

We are not persuaded that the potential, though not realized, high flammability of HFO-1234yf or HFO-1234ze would have deterred an ordinary artisan from using Inagaki's refrigerants as Kruse's partially fluorinated hydrocarbon in combination with CO_2. Kruse teaches that mixtures of CO_2 with flammable partially fluorinated hydrocarbons can result in a non-flammable mixture. Kruse 3, ¶ 2. Thus, Kruse is not particularly concerned with and does not teach away from mixing CO_2 and flammable partially fluorinated hydrocarbon. Even if a mixture of CO_2 and HFO-1234yf and HFO-1234ze were flammable, the skilled artisan would have recognized the tradeoff of flammability in some applications for the benefits of good cooling with little effect on the ozone and boiling point close to that of R-22. As discussed above, the particular issues with respect to flammability were known in the art at the time of the invention and the testing of prospective refrigerants for these properties was routine in the art at the time of the invention.

Accordingly, we affirm the Examiner's rejection of claim 6, 24-26 and 32 under 35 U.S.C. § 103(a) as obvious over Kruse and Inagaki.

[38] *See also* n.15, supra.

Group V: Claim 17

Issue

Patent Owner presents separate arguments for claim 17 as Group V. PO App. Br. 25. Claim 17 recites "heat transfer fluid having a refrigeration capacity substantially matching that of R-404A." Claim 17 is rejected under 35 U.S.C. § 103(a) as being obvious over Kruse in view of Inagaki.

Patent Owner contends that the prior art is silent as to the capacity of a mixture of HFO-1234yf or transHFO-1234ze and CO_2 having a capacity substantially matching that of R-404A, and, thus, it would not have been obvious to one skilled in the art to have achieved the capacity of R-404A by combining the refrigerants of Inagaki with CO_2. PO App. Br. 25-26.

The issue with respect to claim 17 is:

Did the Examiner err in determining that a heat transfer composition having a refrigerant with a capacity substantially matching that of R-404A would have been obvious to one of ordinary skill in the art from the teachings of Kruse and Inagaki?

Analysis

Patent Owner's arguments are not persuasive. The capacity of a mixture of CO_2 and HFO-1234yf or HFO-1234ze relative to R-404A also is an inherent property of the obvious mixture. For the reasons discussed above, recognition of this inherent property cannot be basis for the non-obviousness of an otherwise obvious composition.[39]

Accordingly, we affirm the Examiner's rejection of claim 17 under 35 U.S.C. § 103(a) as obvious over Kruse in view of Inagaki.

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[39] *See* n.15, supra.

Group VI: Claims 27, 28, and 35-37[40]

Issues

Patent Owner presents separate arguments with respect to claims 27, 28, and 35-37, as Group VI. *See* PO App. Br. 26-30. Claim 27, which depends indirectly from claim 2, and claim 35, which depends indirectly from claim 30, recite a heat transfer composition comprising CO_2, transHFO-1234ze, and a polyol ester (POE) lubricant. Claims 27, 28, and 35-37 stand rejected under 35 U.S.C. § 103(a) as being obvious over Kruse, Inagaki and Bivens.[41]

The Examiner finds that Bivens describes the use of polyalkylene glycols and polyol esters along with hydrofluorocarbon refrigerants. RAN 8 (citing Bivens, col. 1, lines 39–59). The Examiner determines that it would have been obvious to use conventional lubricants, as taught by Bivens, in an optimized amount with the CO_2 and HFO-1234 refrigerant mixtures of Kruse and Inagaki "because heat transfer equipment requires a lubricant to be circulated in the heat transfer fluid." *Id*. The Examiner further finds that the miscibility and stability of a refrigerant/lubricant pair are inherent

[40] We accept as true Patent Owner's contention that claim 34 contains a typographical error and should properly depend from claim 33 and not claim 31.

[41] Because claim 37 depends from claim 36, we find the Examiner's clear error in grouping claim 37 with claim 1 as obvious over Kruse and Inagaki, instead of with claim 36 as obvious over Kruse, Inagaki, and Bivens to be harmless error. The Examiner's application of the teachings of Kruse and Inagaki to the "centrifugal chiller" limitation of claim 37 applies equally to a rejection further in view of Bivens. *See* RAN 7.

properties of the refrigerant/lubricant pair taught by the combination of Kruse, Inagaki and Bivens. RAN 22 (citing Dr. Chambers' statement that "a refrigerant/lubricant combination is a function of the chemical structures of each").

Patent Owner contends that Bivens teaches the drawbacks of using POE as a lubricant, namely that it is extremely hygroscopic, which can lead to instability, corrosion and "intractable sludges." PO App. Br. 26-27. Thus, Patent Owner contends that Bivens teaches away from using POE and, instead teaches the advantages of using mineral oil or alkylbenzene lubricants. *Id.* Patent Owner further contends that the acids formed by POEs and POE functional groups capable of forming radicals would have been expected to react with the double bond of an HFO compound. *Id.* at 27. Thus, according to Patent Owner, the skilled artisan would have expected a transHFO-1234ze and POE combination "to be reactive and unstable and thus unsuitable for use in any heat transfer composition." *Id.* at 28 (citing Bivens Decl. ¶ 36 and Chambers Decl. ¶¶ 8-15).

Patent Owner contends that, although Inagaki describes "compatibility" with lubricants, Inagaki does not explain what it means by "compatibility," and does not include any reason to expect that transHFO-1234ze would have been miscible with any particular lubricant, particularly with POE, as taught by Bivens. PO App. Br. 29-30.

Patent Owner further argues that the skilled artisan would have had an expectation that the hydrofluoroolefins would have been combined with immiscible lubricants because (a) Inagaki specifically states combining the HFOs with known HCFCs and CFCs to "improve solubility," (b) Inagaki's

disclosure is only theoretical or speculative and would have been considered as such, and (c) Inagaki demonstrates an operational embodiment that includes an oil separator. *Id.* (citing Bivens Decl. ¶ 33).

Patent Owner further contends that, although stability and miscibility are an inherent property of the combination of lubricant and refrigerant, inherency is not appropriate where the prior art does not expressly teach a lubricant/refrigerant pair. *Id.* at 28.

The issue with respect to claims 27, 28, and 35-37 is:

Did the Examiner err in determining that a heat transfer composition comprising CO_2, transHFO-1234ze, and POE would have been obvious to one of ordinary skill in the art from the teachings of Kruse, Inagaki and Bivens?

Analysis

We are not persuaded that the skilled artisan would not have combined Inagaki's transHFO-1234ze with POE.[42] The reason a skilled artisan would have combined Inagaki's unsaturated HFO-based refrigerants with a lubricant, in the first instance, can be found in Inagaki itself. Inagaki teaches that its HFO refrigerants have good COP and freezing effect, are ozone friendly, and are "compatible with lubricants." Any of these properties would have led the skilled artisan to use HFO-1234ze with lubricants known for use with refrigerants. The Examiner only relies on Bivens for demonstrating that POE was a known lubricant for use with

[42] Patent Owner's arguments are silent as to the combination of CO_2 and POE. *See* PO App. Br. 26-30. Accordingly, we limit our discussion to the argued combination of transHFO-1234ze and POE.

refrigerants. Thus, it is of no moment that Bivens does not describe the use of POE with unsaturated HFO-based refrigerants, because the combination of lubricants and unsaturated HFO-based refrigerants is expressly described in Inagaki. One cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. *See In re Keller*, 642 F.2d 413 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091 (Fed. Cir. 1986).

The record includes evidence that the use of lubricants with refrigerants was well known at the time of the invention. *See e.g.*, Inagaki 3, col. 1, first ¶ (describing refrigerant compatibility with lubricants); Thomas Decl. ¶ 8 (describing three known classes of lubricants); Patent Owner's '882 patent, col. 2, ll. 7–17 ("It is generally considered important, however, that any potential substitute refrigerant must also possess . . . lubricant compatibility. . . . [I]t is highly desirable for refrigeration fluids to be compatible with the lubricant utilized in the compressor unit, used in most refrigeration systems.").

We agree with Patent Owner that Kruse and Inagaki do not describe any particular lubricants or "cooling machine oil." *See* PO App. Br. 26. However, using lubricants known to those of ordinary skill in the art at the time of the invention would have been obvious based on the teachings of Inagaki. Inagaki 3, col. 1, first ¶ (describing refrigerant compatibility with lubricants). Although Patent Owner argues that Inagaki's teaching is only "theoretical," Patent Owner has not demonstrated that the skilled artisan would have understood this teaching to be inaccurate or false on its face.

Rather, the skilled artisan would have expected that the five exemplified refrigerant compounds to have good compatibility with lubricants.

Again, the preponderance of the evidence of record indicates that polyol ester (POE) was known in the art as a conventional lubricant in refrigerant systems, i.e., "cooling machine oils," at the time of the invention. *See* Bivens, col. 1, ll. 37–50 (identifying PAG and POE as known alternative lubricants for HFC-based refrigeration systems); Thomas Decl. ¶ 8. Even the '404 patent identifies that POE was well known in the art at the time of the invention. '404 patent, col. 2, ll. 20-23 ("suitable lubricants, which are generally those *commonly used in refrigeration machinery* using or designed to use hydrofluorocarbon (HFC) refrigerants, chlorofluorocarbon refrigerants and hydrochlorofluorocarbons refrigerants, include mineral oil, silicone oil, polyalkyl benzenes (sometimes referred to as PABs), polyol esters (sometimes referred to as POEs), polyalkylene glycols (sometimes referred to as PAGs).") (emphasis added). *See also* Patent Owner's '882 patent, col. 6, ll. 54-60 ("*Commonly used refrigeration lubricants* such as Polyol Esters (POEs) . . . may be used with the refrigerant compositions of the present invention.") (emphasis added). Since Inagaki evinces that it would have been obvious to one of ordinary skill in the art at the time of the invention to have used HFO-1234ze in combination with known lubricants, Inagaki would have also suggested the use of HFO-1234ze with, for example, POE in a refrigerant composition.

Patent Owner's arguments that Bivens teaches away from POE is not persuasive. Dr. Bivens[43] testifies that, due to drawback in the use of POEs, the skilled artisan would have only considered combining hydrofluoroolefins and mineral oils, not POE. Bivens Decl. ¶¶ 36-39. A reference "teaches away" when it suggests that the developments flowing from its disclosures are unlikely to produce the objective of the Appellants' invention. *See In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994). While Bivens describes drawbacks associated with the use of POE as a lubricant, Bivens specifically teaches that POE has been used and is one of known "suitable lubricants for HFC-based refrigeration systems," particularly for refrigerants that are not miscible in mineral oil or alkylbenzene. Bivens, col. 1, ll. 17–18 and 37-50. *See also* Mahler, col. 1, ll. 39-45; Nimitz, col. 5, ll. 33-36.[44] Thus, the skilled artisan would have recognized POE as a conventional alternative lubricant for use with HFC refrigerants that are insoluble with mineral oil or alkyl benzenes. "A known or obvious composition does not become patentable simply because it has been described as somewhat inferior to some other product for the same use." *Gurley*, 27 F.3d at 552–53. The skilled artisan would have had a reasonable expectation that Inagaki's

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[43] Although Patent Owner also cites to the testimony of Dr. Chambers, Dr. Chambers testifies only to the specific chemistry involved with the combinations of HFO-1234yf and polyalkylene glycol (PAG), which is not relevant to the claims at issue directed to transHFO-1234ze and POE.
[44] Consistent with this understanding, the testing performed by Mr. Thomas shows that transHFO-1234ze is, in fact, not miscible with mineral oil, but is miscible with POE. Thomas Decl., Exhibit D. Thus, despite the known drawbacks, POE would have been a reasonable lubricant alternative, as taught by Bivens.

unsaturated HFO compounds were miscible either with mineral oils and alkyl benzenes or alternatively with PAG and POE. *In re O'Farrell*, 853 F.2d 894, 903-04 (Fed. Cir. 1988) ("For obviousness under §103, all that is required is a reasonable expectation of success.") (citations omitted).

Moreover, Dr. Bivens' testimony that miscibility is unpredictable is not persuasive of non-obviousness. First of all, none of the claims of the '404 patent require that POE and transHFO-1234ze be miscible. Patent Owner's arguments suggesting that Inagaki only describes using its refrigerants with immiscible lubricants does not undermine the fact that Inagaki suggests using its refrigerants with known lubricants.

Further, because there is evidence that acceptable heat transfer systems do not require miscibility between the refrigerant and the lubricant (*see* Thomas Decl. ¶ 4 (describing immiscibility as a condition for which an oil separator may be useful)), a composition comprising a known lubricant, such as POE, and transHFO-1234ze would have been suggested by the prior art even without any express teachings as to miscibility. "[T]he law does not require that the references be combined for the reasons contemplated by the inventor." *In re Beattie*, 974 F.2d 1309, 1312 (Fed. Cir. 1992); *see In re Dillon*, 919 F.2d 688, 693 (Fed. Cir. 1990) (en banc) ("In particular, the statement that a *prima facie* obviousness rejection is not supported if no reference shows or suggests the newly-discovered properties and results of a claimed structure is not the law."). It is enough that the prior art reference describes excellent COP and freezing effect and compatibility with lubricants as a sufficient reason for the skilled artisan to use transHFO-1234ze as a refrigerant with known lubricants. POE would have

been an obvious lubricant for the skilled artisan to use with a refrigerant, as described in Bivens. As discussed above, Inagaki expressly suggests such a combination.

Accordingly, we affirm the Examiner's rejection of claims 27, 28, and 35-37 under 35 U.S.C. § 103(a) as obvious over Kruse, Inagaki and Bivens.

Group VII: Claims 29-31, 33, and 34[45]

Issues

Patent Owner presents separate arguments with respect to claims 29-31, 33, and 34 as Group VII. *See* PO App. Br. 9. Claims 29, which depends indirectly from claim 19, recites a method of "transferring heat between said composition and air." Claims 27, 28, and 35-37 stand rejected under 35 U.S.C. § 103(a) as being obvious over Kruse and Inagaki.

The Examiner finds that Kruse teaches the use of CO_2 and partially fluorinated hydrocarbons in "cooling units and heat pumps" and that Kruse and Inagaki both teach "cooling units, heat pumps, and refrigerators." RAN 7. The Examiner further finds the step of transferring heat between said composition and air occurs within a heat pump. RAN 21.

Patent Owner contends that the Examiner's finding that a heat pump meets the step of the claim is not supported by evidence and is thus an improper basis for rejection. PO App. Br. 31. Patent Owner also argues that the skilled artisan, given the expected toxicity of Inagaki's compounds,

[45] Except for the particular arguments directed to claim 30, we group claims 30, 31, 33, and 34 with claim 29, based on their dependency therefrom. *See* n.19, supra.

would not have expected success using them safely to cool air due to the potential for "consumer exposure." *Id.* at 31

The issue with respect to claims 29-31, 33, and 34 is:

Did the Examiner err in determining that a method of transferring heat between a composition comprising CO_2 and HFO-1234yf and air would have been obvious to one of ordinary skill in the art from the teachings of Kruse and Inagaki?

Analysis

Patent Owner's arguments are not persuasive. In addition to the Examiner's findings that Kruse teaches applications that can be used to cool air, we also find that Inagaki specifically teaches using refrigerants in "refrigeration and air-conditioning equipment." Inagaki 1, col. 2. Thus, we agree with the Examiner that the skilled artisan would have expected success in using Inagaki's refrigerants in combination with CO_2 in applications in which heat is transferred between the composition and air, including refrigeration and air-conditioning systems.

Patent Owner's arguments that the expected toxicity would suggest a lack of expectation of success for these purposes is unfounded. It is not disputed that Inagaki's refrigerants would be expected to work as refrigerants and thus would be capable of transferring heat between the composition and air in a variety of applications. The claims do not recite any particular heat transfer applications and encompass a variety of applications where toxicity is of little or no concern. Certainly, the claims are not directed to a particular method where there is an "increased potential . . . for consumer exposure to such compounds." PO App. Br. 31.

Accordingly, we affirm the Examiner's rejection of claims 29-31, 33, and 34 under 35 U.S.C. § 103(a) as obvious over Kruse and Inagaki.

DECISION

In sum, we affirm all of the Examiner's rejections on appeal.

TIME PERIOD FOR RESPONSE

In accordance with 37 C.F.R. § 41.79(a)(1), the "[p]arties to the appeal may file a request for rehearing of the decision within one month of the date of: . . . [t]he original decision of the Board under § 41.77(a)." A request for rehearing must be in compliance with 37 C.F.R. § 41.79(b). Comments in opposition to the request and additional requests for rehearing must be in accordance with 37 C.F.R. § 41.79(c) & (d), respectively. Under 37 C.F.R. § 41.79(e), the times for requesting rehearing under paragraph (a) of this section, for requesting further rehearing under paragraph (d) of this section, and for submitting comments under paragraph (c) of this section may not be extended.

An appeal to the United States Court of Appeals for the Federal Circuit under 35 U.S.C. §§ 141–144 and 315 and 37 C.F.R. § 1.983 for an *inter partes* reexamination proceeding "commenced" on or after November 2, 2002 may not be taken "until all parties' rights to request rehearing have been exhausted, at which time the decision of the Board is final and appealable by any party to the appeal to the Board." 37 C.F.R. § 41.81. *See also* MPEP § 2682 (8th ed., Rev. 7, July 2008).

AFFIRMED

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