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Paper No. 19
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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SFC CO. LTD,
Petitioner,

v.

IDEMITSU KOSAN CO., LTD.,
Patent Owner.

Case IPR2015-00564
Patent 8,334,648 B2

Before GRACE KARAFFA OBERMANN,
JENNIFER MEYER CHAGNON, and JEFFREY W. ABRAHAM,
Administrative Patent Judges.

ABRAHAM, *Administrative Patent Judge.*

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

I. INTRODUCTION

SFC Co. Ltd. ("Petitioner") filed a Corrected Petition seeking *inter partes* review of claims 1–15 of U.S. Patent No. 8,334,648 B2 (Ex. 1001, "the '648 patent"). Paper 5 ("Pet."). Patent Owner, Idemitsu Kosan Co., Ltd., filed a Patent Owner Preliminary Response to the Corrected Petition. Paper 6 ("Prelim. Resp."). On August 7, 2015, we instituted trial on a single ground of unpatentability: whether claims 1–5, 7–11, 13, and 14 would have been obvious over Arakane[1] under 35 U.S.C. § 103. Paper 9 ("Dec. on Inst.").

After institution, Patent Owner filed a Patent Owner Response (Paper 12, "PO Resp."), and Petitioner filed a Reply (Paper 13, "Reply"). An oral hearing was held on May 3, 2016. A transcript of the hearing has been entered into the record of the proceeding as Paper 18 ("Tr.").

We have jurisdiction under 35 U.S.C. § 6(c). This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons that follow, we determine that Petitioner has shown by a preponderance of the evidence that claims 1–5, 7–11, 13, and 14 are unpatentable.

A. Related Proceedings

Petitioner identifies two patent applications, U.S. Application No. 13/675,037, filed on November 13, 2012 (now abandoned), which was a divisional of U.S. Application No. 12/773,307 (the application number of the '648 patent), and U.S. Application No. 13/964,203, filed on August 12, 2013, which is a continuation of the '037 application. Pet. 2.

[1] Arakane et al., WO 02/052904 A1, published July 4, 2002 ("Arakane," Ex. 1002; certified translation provided at Ex. 1003).

B. The ’648 Patent

The ’648 patent, titled “Organic Electroluminescence Device and Organic Light Emitting Medium,” issued on December 18, 2012. The ’648 patent explains that an organic electroluminescence (“EL”) device “is a spontaneous light emitting device which utilizes the principle that a fluorescent substance emits light b[y] energy of recombination of holes injected from an anode and electrons injected from a cathode when an electric field is applied.” Ex. 1001, 1:26–30.

The ’648 patent discloses an organic light emitting medium and an organic EL device that includes a layer of an organic light emitting medium disposed between two electrodes, wherein the organic light emitting medium comprises a specific arylamine compound (“component (A)”) and at least one compound selected from specific anthracene derivatives, spirofluorene derivatives, compounds having condensed rings, and metal complex compounds (“component (B)”). *Id.* at 2:26–32. The Specification of the ’648 patent provides general formulas representing components (A) and (B) and lists the various potential chemical groups that can be used as variables or substituents in the formulas. *See, e.g.*, *id*. at 2:38–4:42. According to the ’648 patent, an EL device having an organic light emitting medium that includes components (A) and (B) exhibits a “high purity of color, has excellent heat resistance and a long life and efficiently emits bluish to yellowish light.” *Id*. at 2:21–23.

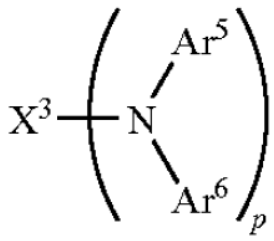
C. Illustrative Claim

Claim 1 of the ’648 patent is reproduced below:

1. An electroluminescence device comprising a pair of electrodes and a layer of an organic light emitting medium disposed between the pair

of electrodes, wherein the layer of an organic light emitting medium is present as a light emitting layer and comprises:

(A) an arylamine compound represented by formula V:



(V)

wherein X^3 is a substituted or unsubstituted pyrene residue,

Ar^5 and Ar^6 each independently represent a substituted or unsubstituted monovalent aromatic group having 6 to 40 carbon atoms, and

p represents an integer of 1 to 4; and

(B) at least one compound selected from the group consisting of anthracene derivatives and spirofluorene derivatives, wherein

said anthracene derivatives are represented by formula I:

$$A^1\text{-}L\text{-}A^2 \quad (I)$$

wherein A^1 and A^2 may be the same or different and each independently represent a substituted or unsubstituted monophenylanthryl group or a substituted or unsubstituted diphenylanthryl group, and L represents a single bond or a divalent bonding group,

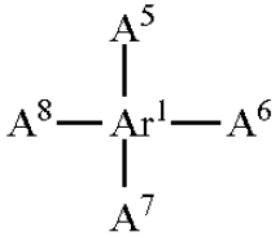
and by formula II:

$$A^3\text{-}An\text{-}A^4 \quad (II)$$

wherein An represents a substituted or unsubstituted divalent anthracene residue, A^3 and A^4 may be the same or different and each independently represent a substituted or unsubstituted aryl group having 6 to 40 carbon atoms, at least one of A^3 and A^4 represents a substituted or

unsubstituted monovalent condensed aromatic ring group or a substituted or unsubstituted aryl group having 10 or more carbon atoms; and

said spirofluorene derivatives are represented by formula III:



(III)

wherein Ar^1 represents a substituted or unsubstituted spirofluorene residue, A^5 to A^8 each independently represent a substituted or unsubstituted aryl group having 6 to 40 carbon atoms;

provided that the organic light emitting medium does not include a styryl aryl compound.

Ex. 1001, 132:2–64.

Claim 13, the only other independent challenged claim, is directed to an organic light emitting medium present in a light emitting layer, and includes identical limitations for the organic light emitting medium recited in claim 1.

II. ANALYSIS

A. Claim Construction

In an *inter partes* review, claim terms in an unexpired patent are interpreted according to their broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b); Office Patent Trial Practice Guide, 77 Fed. Reg. 48,756, 48,766 (Aug. 14, 2012); *see Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144–46

(2016) (upholding the use of the broadest reasonable interpretation standard). We determine that no express claim construction is required for purposes of this decision. *See Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) ("[O]nly those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy.").

B. Discussion of Challenged Claims in view of Arakane

We instituted *inter partes* review on the sole question of whether independent claims 1 and 13 and dependent claims 2–5, 7–11 (which depend from claim 1), and 14 (which depends from claim 13) would have been obvious over Arakane. Dec. on Inst. 15–16.

In resolving the question of the obviousness of the claims, we consider the following underlying factual determinations: (1) the scope and content of the prior art; (2) the level of skill in the art; (3) any differences between the claimed subject matter and the prior art; and (4) secondary considerations of nonobviousness. *See Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966). Petitioner bears the burden of establishing obviousness of the challenged claims by a preponderance of the evidence. 35 U.S.C. § 316(e).

As an initial matter, Patent Owner argues that Petitioner failed to address all of the *Graham* factors "in a meaningful way," and therefore failed to carry its burden of proof. PO Resp. 5. For example, with regard to the scope and content of the prior art, Patent Owner contends that Petitioner ignores aspects of Arakane that would have led a person of ordinary skill in the art away from the claims of the '648 patent, and has "shed light on only selected non-preferred elements without providing any reasons why the non-preferred elements should be selected over Arakane's preferred elements."

Id. at 6. Patent Owner also argues that Petitioner (1) failed to include a discussion of the level of ordinary skill in the art, (2) does not identify any differences between the claimed invention and Arakane and (3) does not discuss secondary considerations of non-obviousness. *Id.* at 6–9.

We, however, are persuaded that Petitioner, through the Petition and Reply, has addressed sufficiently the underlying factual determinations set forth in *Graham*. Our analysis below similarly addresses these factors.

For example, as discussed in further detail below, Petitioner's presentation of evidence regarding Arakane's disclosure of an organic EL device having a light emitting layer comprising a mixture of a hole transporting compound and electron transporting compound, including its claim charts, addresses the scope and content of the prior art and any differences between the claimed invention and the prior art.

As to the level of ordinary skill in the art, "the absence of specific findings on the level of skill in the art does not give rise to reversible error 'where the prior art itself reflects an appropriate level and a need for testimony is not shown.'" *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (quoting *Litton Indus. Prods., Inc. v. Solid State Sys. Corp.*, 755 F.2d 158, 163 (Fed. Cir. 1985)). Here, Arakane's disclosure of organic EL devices reflects an appropriate level of skill in the art, and neither party has demonstrated a need for testimony on the subject.

With regard to secondary considerations of non-obviousness, Patent Owner has not demonstrated adequately that any such secondary considerations are present here for Petitioner or the Board to address. *See Geo M. Martin Co. v. Alliance Machine Systems Intern. LLC*, 618 F.3d 1294, 1304 (Fed. Cir. 2010) ("Secondary considerations of non-obviousness

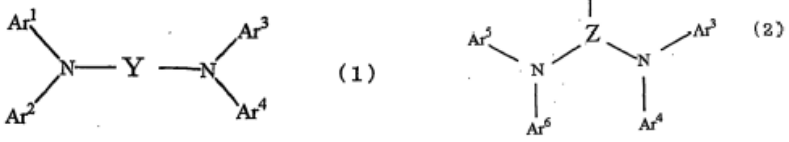
must be considered *when present*.") (emphasis added). Patent Owner's statement that "the '648 patent includes experimental evidence demonstrating nonobviousness of the claims" is insufficient to establish the presence of secondary considerations such as commercial success, long felt but unsolved needs, or failure of others. PO Resp. 9; *Graham*, 383 U.S. at 17–18. The absence of secondary considerations is therefore a neutral factor. *See Custom Accessories, Inc. v. Jeffrey-Allan Indus., Inc*., 807 F.2d 955, 960 (Fed. Cir. 1986).

1. Arakane (Ex. 1003)

Arakane discloses an organic EL device that includes a pair of electrodes and an organic luminescent medium layer disposed between the electrodes. Ex. 1003, 1. Arakane's organic luminescent medium layer comprises (A) at least one hole transporting compound and (B) at least one electron transporting compound, wherein the energy gap Eg1 of the hole transporting compound and the energy gap Eg2 of the electron transporting compound satisfy the relation Eg1<Eg2. *Id*. According to Arakane, an organic EL device that includes an organic luminescent medium layer wherein the energy gap Eg1 of the hole transporting compound is smaller than the energy gap Eg2 of the electron transporting compound (i.e., Eg1<Eg2) has a longer life and can emit light with higher efficiency than conventional organic EL devices. *Id*. at 3–4.

Arakane teaches that the hole transporting compound may be aromatic amine, diamine, and triamine compounds having the structures represented by Formulas (1), (2), and (7) to (11). *Id*. at 9. Arakane discloses that the hole transporting compound is preferably an aromatic amine having a

condensed ring structure, and preferably represented by Formula (1) or Formula (2):



and that "[p]referably, the compounds of Formulae (1) and (2) are represented by any of Formulae (7) to (11)." *Id.* at 5–6.

Arakane teaches that the electron transporting compound is preferably a nitrogen-containing heterocyclic compound or a nitrogen-containing complex, represented by Formulas (3) and (4). *Id*. at 14–16. Arakane also discloses that the electron transporting compound may be an anthracene derivative represented by Formula (5) or Formula (6):

$$A^1\text{-}L\text{-}A^2 \qquad (5)$$

$$A^3\text{-}An\text{-}A^4 \qquad (6)$$

Id. at 18.

Arakane lists the acceptable and preferred chemical groups and substituents for use in the recited formulas, including Y and Ar^1 to Ar^4 in Formula (1) and L, An, and A^1 to A^4 in Formulas (5) and (6). *See, e.g.*, *id*. at 6–14, 18–21.

Arakane further teaches that "[t]he use of the mixture of the components (A) and (B) in the organic light emitting medium layer makes the organic light emitting medium layer more amorphous while suppressing crystallization in the organic light emitting medium layer, leading to improved stability and good heat resistance." *Id.* at 21–22.

2. Claims 1 and 13[2]

In our Decision on Institution, we determined that Petitioner, through its claim charts and substantive arguments, had made a threshold showing that, based on Arakane's disclosures regarding Formula (1) for hole transporting compounds and Formulas (5) and (6) for electron transporting compounds, it would have been possible for a person of ordinary skill in the art to select variables for these formulas to obtain compounds within the scope of claims 1 and 13. Dec. on Inst. 8.

Patent Owner disputes that Petitioner has met its burden to demonstrate that a person of ordinary skill in the art, in view of Arakane, would have been led to (1) component (A), (2) component (B), and (3) the use of component (A) and component (B) together in the light emitting layer of an organic EL device, as required in claims 1 and 13.[3] PO Resp. 19–20.

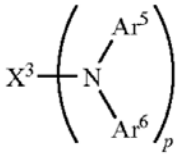
a. Component (A)

Petitioner contends that Arakane discloses an EL device that includes an "organic luminescent medium layer [having] a mixture layer containing (A) at least one hole transporting compound and (B) at least one electron transporting compound." Pet. 15 (emphasis omitted); Ex. 1003, 1.

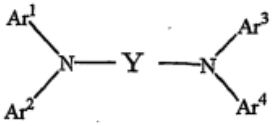
Claims 1 and 13 recite that component (A) is an arylamine compound represented by Formula V:

[2] We address the claims in the same order and groupings as the parties have in the Petition and Patent Owner Response.

[3] Patent Owner "ignore[s]" any additional features recited in claims 1 and 13. PO Resp. 20. In the Scheduling Order, we cautioned Patent Owner that any arguments for patentability not raised in the Response would be deemed waived. Paper 10, 3.



wherein X^3 is a substituted or unsubstituted pyrene residue. Ex. 1001, 132:8–18, 136:5–14. Petitioner asserts that Formula (1) of Arakane:



corresponds to Formula V of the '648 patent, and that Arakane teaches that aromatic radicals derived from pyrene are one of several preferred materials for component Y of Formula (1). Pet. 16 (citing Ex. 1003, 5–6).

Claims 1 and 13 also require that Ar^5 and Ar^6 in Formula V represent a substituted or unsubstituted monovalent aromatic group having 6 to 40 carbon atoms. Ex. 1001, 132:19–21, 136:15–17. Petitioner contends that that Ar^1 to Ar^4 in Formula (1) of Arakane correspond to Ar^5 and Ar^6 in Formula V of the '648 patent, and include substituted or unsubstituted C_6 to C_{40} aromatic hydrocarbons. Pet. 16–17 (claim chart, citing Ex. 1003, 5–6, 30).

As shown above, Formula V in claims 1 and 13 includes a subscript p around the $–NAr^5Ar^6$ group, and claims 1 and 13 recite that p can equal an integer of 1 to 4. Ex. 1001, 132:10–22, 136:5–19. Petitioner contends that Arakane teaches that Ar^1 to Ar^4 in Formula (1) may each comprise the same or different aromatic hydrocarbon groups. Pet. 18 (citing Ex. 1003, 5–6). Accordingly, Petitioner argues that embodiments in Arakane wherein Ar^1 to Ar^4 in Formula (1) are all different correspond to p being equal to 1 in Formula V of the '648 patent, and embodiments in Arakane wherein Ar^1 to

Ar^4 are the same correspond to Formula V of the '648 patent when p is equal to 2. *Id*. at 17.

Patent Owner asserts that Arakane discloses several preferred compounds that could correspond to component (A) in claims 1 and 13, but ultimately leads a person of ordinary skill in the art to the specific structures of formulas (7)–(11), which Patent Owner refers to as "the 'preferred' among the 'preferred' formulas," instead of structures of "more general formula (1)" upon which Petitioner relies. PO Resp. 25–32. Patent Owner further contends that Arakane not only fails to express a specific preference for Formula (1) itself, but also fails to direct a person of ordinary skill in the art to "specifically select pyrene as the variable Y of the formula (1)." *Id.* at 28, 30 (noting that "numerous possible variations in structure are encompassed by formula (1)" of Arakane). In this regard, Patent Owner notes that Arakane only discloses one specific example of hole transporting compound (A), DC5, which does not include pyrene as the variable Y in Formula (1). *Id.* at 31–32.

Upon consideration of the evidence and arguments presented by Patent Owner and Petitioner, we conclude that Petitioner has shown by a preponderance of the evidence that Arakane discloses or suggests component (A) recited in claims 1 and 13.

Arakane discloses the use of a hole transporting compound that is preferably an aromatic amine having a condensed ring structure, and the aromatic amine is preferably represented by Formula (1). Ex. 1003, 5–6. Arakane further discloses that aromatic radicals derived from pyrene are one of several preferred compounds that can be substituted for Y in Formula (1), and also discloses that Ar^1 to Ar^4 represent a substituted or unsubstituted C_6–

C_{40} aromatic hydrocarbon group, such that a compound represented by Formula (1) corresponds to a compound represented by Formula V in claim 1. *Id.* at 6; Ex. 1001, 132:8–21, 136:5–17.

Arakane's disclosure that the hole transporting compounds may also be represented by Formula (2) instead of Formula (1), and that the compounds of Formulas (1) and (2) are preferably represented by Formulas (7)–(11), does not detract from the fact that Arakane discloses a compound represented by Formula (1) that corresponds to a compound represented by Formula V in claim 1. *See Allergan, Inc. v. Apotex Inc.*, 754 F.3d 952, 964 (Fed. Cir. 2014) (the "mere disclosure of alternative preferences does not teach a person of ordinary skill away from the broad swath of compounds within the scope of the [claims at issue]"); *Merck & Co. v. Biocraft Labs. Inc.*, 874 F.2d 804, 807 (Fed. Cir. 1989) ("[I]n a section 103 inquiry, 'the fact that a specific [embodiment] is taught to be preferred is not controlling, since all disclosures of the prior art, including unpreferred embodiments, must be considered.'") (quoting *In re Lamberti*, 545 F.2d 747, 750 (CCPA 1976)). Accordingly, we are not persuaded by Patent Owner's argument that a person of ordinary skill in the art reviewing Arakane would have been led away from compounds represented by Formula (1) and instead led only towards compounds represented by Formulas (7)–(11). The evidence presented by Petitioner demonstrates sufficiently that a person of ordinary skill in the art, considering the disclosure of Arakane in its entirety, would have understood Arakane to disclose or suggest a compound represented by Formula (1) that corresponds to a compound represented by Formula V in claims 1 and 13.

b. Component (B)

As to component (B), claims 1 and 13 require at least one compound selected from the group consisting of anthracene derivatives and spirofluorene derivatives, and recite that the anthracene derivatives may be represented by Formula I:

$$A^1\text{-}L\text{-}A^2$$

wherein A^1 and A^2 can be the same or different, and represent a substituted or unsubstituted monophenylanthryl group or diphenylanthryl group, and L represents a single bond or a divalent bonding group. Ex. 1001, 132:23–35, 136:19–28. Petitioner asserts that Arakane discloses, as an electron transporting compound used in an EL device, an anthracene derivative depicted as Formula (5), which is identical to Formula I of the '648 patent, and wherein A^1 and A^2 may be a monophenylanthryl or diphenylanthryl group and L represents a single bond or divalent linking group. Pet. 19–20 (citing Ex. 1003, 3, 18). Petitioner also contends that Formula (6) and A^3 and A^4 in Arakane correspond to Formula II and A^3 and A^4 in claims 1 and 13 of the '648 patent. *Id.* at 20–22; Ex. 1001, 132:36–47, 136:30–39.

As with component (A), Patent Owner argues that Arakane would have led a skilled artisan towards a preferred nitrogen-containing heterocyclic compound or nitrogen-containing complex (specifically Alq), which is different from the "non-preferred anthracene derivatives of formulas (5) and (6)" (PO Resp. 35), upon which Petitioner relies. *Id.* at 32–36. Patent Owner contends that Petitioner "zeroed-in on component (B) of claim 1 from amongst different general formulas in Arakane – not because Arakane as a whole would have led one to component (B), but because [Petitioner] viewed Arakane using claim 1 as a guide or roadmap." *Id.* at 36.

Upon consideration of the evidence and arguments presented by Patent Owner and Petitioner, we conclude that Petitioner has shown by a preponderance of the evidence that Arakane discloses or suggests component (B) recited in claims 1 and 13.

Arakane discloses that the electron transporting compound may be an anthracene derivative represented by Formulas (5) or (6), which are identical to Formulas I and II, respectively, recited in claims 1 and 13. Ex. 1003, 18; Ex. 1001, 132:29–39, 136:23–33. As discussed above, the fact that Arakane discloses different, alternative preferred electron transporting compounds does not detract from the disclosure of Formulas (5) and (6) as acceptable electron transporting compounds. *Allergan*, 754 F.3d at 964; *Merck*, 874 F.2d at 807. Accordingly, we are not persuaded by Patent Owner's argument that a person of ordinary skill in the art reviewing Arakane would have been led away from the compounds represented by Formulas (5) and (6) and instead led only towards the preferred nitrogen-containing heterocyclic compounds and nitrogen-containing complexes. The evidence presented by Petitioner demonstrates sufficiently that a person of ordinary skill in the art, considering all disclosures of Arakane, would have understood Arakane to disclose or suggest a compound represented by Formulas (5) and (6) that corresponds to a compound represented by Formulas I and II, respectively, in claims 1 and 13.

c. The Combination of Components (A) and (B)

Petitioner contends that it would have been obvious to a person of ordinary skill in the art to arrive at the claimed subject matter because Arakane teaches (i) that the hole transporting compound can be an arylamine compound corresponding to Formula (V) of claims 1 and 13, (ii) that the

electron transporting compound can be anthracene derivatives corresponding to Formulas (I) and (II) of claims 1 and 13, and (iii) that the hole transporting compound and electron transporting compound are mixed in the organic light emitting medium. Pet. 24–26 (citing *Merck*, 874 F.2d at 806–08, for the point that a claimed combination is obvious in view of a prior art reference disclosing "a multitude of effective combinations" especially when "the claimed composition is used for the identical purpose taught by the prior art").

Patent Owner argues that Petitioner "does not explain why a skilled artisan would have been led to use the pyrene-centered diaryl amine compounds together with the anthracene-based electron transporting compounds." PO Resp. 41. Patent Owner further argues that the energy gap relationship disclosed in Arakane limits the possible combinations of compounds (A) and (B) encompassed by Arakane, such that only certain disclosed hole transporting compounds can be used with certain disclosed electron transporting compounds. *Id*. at 21, 40–41. According to Patent Owner, Arakane teaches that "you can't just pick one [compound] from column B and one from column A at random." Tr. 36:16–18. Instead, according to Patent Owner, Arakane teaches that you must select compounds so that they meet the energy gap relationship specified in the disclosure. *Id.* at 36:15–16; *see also id.* at 30:6–12 (distinguishing Arakane from the prior art reference in *Merck*, where "there was no rule to be followed," and there was unequivocal testimony that "you could pick any one of A and B and everybody expected to get the results").

Patent Owner directs us to the device in comparative Example 4 of Arakane as evidence of the significance of the energy gap relationship. PO

Resp. 40. In Comparative Example 4, Eg1 is greater than Eg2, meaning the energy gap relationship is not satisfied. Ex. 1003, 33. When compared with the performance of the device in Example 1, which included components that did satisfy the energy gap relationship, Arakane states that the device of Example 1 was superior in both luminous efficiency and life, and that having Eg1 greater than or equal to Eg2 is "problematic in practical use." *Id.* at 33–34; PO Resp. 40.

Patent Owner contends that Arakane only provides energy gap values for three compounds, DC5, Alq, and TPD, which are not within the scope of components (A) and (B) in claims 1 and 13, and are not among the pyrene-centered diaryl amine hole transporting compounds or anthracene-based electron transporting compounds upon which Petitioner relies. PO Resp. 40, 44; Tr. 34:1–3. Patent Owner further contends that, other than the information provided for DC5, Alq, and TPD, "there's nothing in the record that tells us which compound has which energy gap." Tr. 35:17–19.

In view of this, Patent Owner asserts that Petitioner, in taking the position that it would have been obvious to use any hole transporting compound with any electron transporting compound mentioned in Arakane, improperly ignores the energy gap relationship discussed in Arakane. PO Resp. 21, 41. Patent Owner thus argues that because Petitioner failed to show that its selection of compounds (A) and (B) of Arakane satisfy Arakane's energy gap relationship, Petitioner has failed to meet its burden of demonstrating that Arakane suggests the specific combination of compounds (A) and (B) recited in claims 1 and 13. *Id.* at 21, 41–44. For reasons that follow, however, we are not persuaded that the lack of energy gap data undercuts Arakane's suggestion to combine compounds (A) and (B).

In response to Patent Owner's arguments regarding an alleged energy gap requirement, Petitioner takes the position that Arakane "tells you [that] you want this preferred energy gap relationship, and then it tells you these are the compounds to use, [and] that presumptively those compounds have that desired energy gap relationship." Tr. 45:7–13; *see id.* at 44:17–23, 47:4–7 (agreeing that it is reasonable to read Arakane's disclosure as saying "if you take any one of these As and any one of these Bs and put them together, it will work"). Petitioner further contends that Patent Owner's reliance on Comparative Example 4 is misplaced, because Comparative Example 4 utilizes a hole transporting compound (TPD) that does not fall within Arakane's preferred group of hole transporting compounds, i.e., it is not an aromatic amine having a condensed ring structure. Reply 12. In contrast, Examples 1–4 utilize preferred hole transporting compounds. *Id.*

Under 35 U.S.C. § 103, an obviousness inquiry must focus on whether the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious to a person of ordinary skill in the art to which the claimed invention pertains. 35 U.S.C. § 103; *see also Merck*, 874 F. 2d at 808.

Claims 1 and 13 of the '648 patent require the combination of components (A) and (B) in a light emitting layer. Claims 1 and 13 do not include any limitations directed to the energy gap characteristics of the individual components or particular performance characteristics of the light emitting layer, such as half-life or efficiency. Thus, the "claimed invention as a whole" is the combination of the recited components in a light emitting layer. As discussed in detail below, Arakane's disclosure would have informed an ordinary artisan that combining components (A) and (B) would

produce a light emitting layer. The sufficiency of that disclosure to establish the obviousness of the combination does not depend on whether the resulting light emitting layer would satisfy Arakane's energy gap relationship or the desired stability and heat resistance criteria.

Arakane states that its "organic luminescent medium layer has a mixture layer containing (A) at least one hole transporting compound and (B) at least one electron transporting compound." Ex. 1003, 1. As Patent Owner correctly argues, Arakane also teaches that "[t]he energy gap Eg1 of the hole transporting compound and the energy gap Eg2 of the electron transporting compound satisfy the relation Eg1<Eg2." *Id.* According to Arakane, satisfying the relation Eg1<Eg2 provides for an organic EL device that can emit light with higher efficiency and has a longer life than conventional organic EL devices. *Id.* at 3–4.

This teaching regarding the energy gap relationship, however, does not diminish Arakane's disclosure of the fundamental concept of forming a light emitting layer containing a mixture of at least two components, (A) a hole transporting compound and (B) an electron transporting compound. *Id.* at 1; *Allergan*, 754 F.3d at 963–964; *Syntex (U.S.A.) LLC v. Apotex, Inc.*, 407 F.3d 1371, 1380 (Fed.Cir.2005) ("What a reference teaches or suggests must be examined in the context of the knowledge, skill, and reasoning ability of a skilled artisan."). In this regard, Arakane explains that "[t]he use of the mixture of the components (A) and (B) in the organic light emitting medium layer makes the organic light emitting medium layer more amorphous while suppressing crystallization in the organic light emitting medium layer, leading to improved stability and good heat resistance." Ex. 1003, 21–22.

As to Comparative Example 4 of Arakane, we note that although Arakane states that the device of Example 1 was superior in terms of both luminous efficiency and half-life, Arakane also states that the organic EL device of Comparative Example 4 did produce green light. Therefore, a person of ordinary skill in the art would have understood, after reviewing Arakane, that satisfying the energy gap relationship is not essential to providing a "light emitting layer"—rather, the combination disclosed in Comparative Example 4 of Arakane did not satisfy the energy gap relationship, but nonetheless provided a "light emitting layer." *See Allergan, Inc. v. Sandoz Inc.*, 726 F.3d 1286, 1292 (Fed. Cir. 2013) ("[T]he person of ordinary skill need only have a reasonable expectation of success of developing the *claimed invention*.") (emphasis added). Claims 1 and 13 do not require any particular efficiency or half-life, but recite only a "light emitting layer." Additionally, "[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." *In re Gurley*, 27 F.3d 551, 554 (Fed. Cir. 1994).

We, therefore, are not persuaded that Arakane discloses "that only certain hole transporting compounds must be used with certain electron transporting compounds." PO Resp. 40–41. We also disagree that Petitioner was required to present evidence of energy gap, electron affinity, and ionization energy values of the various Arakane components in order to satisfy its burden of proving obviousness. *Id.* at 42–43. It is enough that Arakane suggests the claimed combination of compound (A) and (B) in a light emitting layer.

In addressing the question of obviousness, the Federal Circuit has stated that "'the question is whether there is something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination,' not whether there is something in the prior art as a whole to suggest that the combination is the most desirable combination available." *In re Fulton*, 391 F. 3d 1195, 1200 (Fed. Cir. 2004) (quoting *In re Beattie*, 974 F.2d 1309, 1311 (Fed. Cir. 1992)). Although *Fulton* dealt with the combination of two separate prior art references, we see no reason why the same reasoning does not apply to the combination of two components disclosed in the same prior art reference. Arakane, as a whole, suggests to a person of ordinary skill in the art that the combination of any of the disclosed hole transporting compounds and any of the disclosed electron transporting compounds would provide a light emitting layer, and "makes the organic light emitting medium layer more amorphous while suppressing crystallization in the organic light emitting medium layer, leading to improved stability and good heat resistance." Ex. 1003, 21–22, 32.

Patent Owner asserts that Petitioner has "cited no legal authority for the proposition that that which is *encompassed* by a prior art reference is *suggested* by such prior art reference." PO Resp. 11 (citing *In re Baird*, 16 F.3d 380, 382 (Fed. Cir. 1994)). Patent Owner contends that Petitioner must provide evidence demonstrating a reason why a person of ordinary skill in the art would have combined the specific components allegedly disclosed in the prior art to arrive at the claimed subject matter. *Id.* at 11–15; *see also id.* at 20 (arguing that Petitioner cannot merely demonstrate that it is possible to find the claimed features within the broad disclosure of Arakane, but must demonstrate that a person of ordinary skill in the art "*would have been led*

to" the claimed invention). In this regard, Patent Owner argues that the Federal Circuit's decision in *Merck* "does not relieve a patent challenger of its obligation to affirmatively demonstrate that the selections necessary to identify a subgenus or species from a dominating genus would have been obvious to a skilled artisan." PO Resp. 14–15.

As Petitioner points out, however, after discussing the energy gap relationship, Arakane directs a person of ordinary skill in the art to aromatic amines having a condensed ring structure represented by Formula (1), which Arakane describes as being among the preferred structures for hole transporting compounds. Tr. 45:7–13; Ex. 1003, 4–7. Arakane also states that Y in Formula (1) is preferably an aromatic radical derived from pyrene, among other compounds. Ex. 1003, 6. Arakane later teaches that the electron transporting compounds may be an anthracene derivative represented by Formulas (5) or (6). *Id.* at 18. As discussed above, Arakane's disclosures of Formulas (1), (5), and (6), along with the different compounds that may be used as the variables in those formulas, correspond to the compounds represented by Formulas (V), (I), and (II), respectively, in claims 1 and 13. Thus, we agree with Petitioner that Arakane at least suggests to a person of ordinary skill in the art, as an acceptable combination of hole transporting and electron transporting compounds, a combination that corresponds to the combination of compounds recited in claims 1 and 13. Reply 12; Tr. 45:7–13, 44:17–23, 47:4–7; *Merck*, 874 F.2d at 807 ("As is apparent, 'success' is not dependent upon random variation of numerous parameters."); *cf In re Baird*, 16 F.3d 380, 382–83 (Fed. Cir. 1994) (stating that "[w]hile the [prior art] Knapp formula unquestionably encompasses bisphenol A when specific variables are chosen, there is nothing in the

disclosure of Knapp suggesting that one should select such variables" and that of fifteen "typical diphenols" recited in Knapp, "[n]one of them, or any of the other preferred phenols recited above, is or suggests bisphenol A"). Additionally, Arakane's disclosure of "a multitude of effective combinations does not render any particular formulation less obvious. This is especially true because the claimed composition is used for the identical purpose taught by the prior art." *Merck*, 874 F.2d at 807.

Patent Owner argues that this reasoning from *Merck* is inapplicable here because the combinations of compounds suggested by Arakane function in an entirely different way from the combination of compounds encompassed by claims 1 and 13. PO Resp. 45–48. Specifically, Patent Owner contends that Arakane's examples indicate that the performance of organic EL devices decreases, as indicated by a "precipitous drop in half-life," as the relative amount of hole transporting compound decreases. *Id.* at 45–46. In contrast, according to Patent Owner, the examples of the '648 patent indicate that "it is possible to obtain excellent performance even when small amounts of component (A) are present." *Id.* at 48. Patent Owner attributes this enhanced performance to a "host-dopant relationship" between components (A) and (B) in the '648 patent, whereas Arakane "explicitly teaches away from combinations of compounds that operate in a host-dopant relationship." *Id.*

Patent Owner's arguments are unconvincing. We reject Patent Owner's attempt to distinguish *Merck* based on a theory that Arakane's compositions operate differently than the claimed composition. Our reviewing court in *Merck* directs us to consider similarities between the *purpose* of the claimed invention and prior art. Here, both the compounds of

Arakane and the ’648 patent are used for the same purpose, forming organic EL devices having a mixture of components in a light emitting layer. As Petitioner points out, moreover, Arakane discloses hole transporting and electron transporting compounds that correspond to components (A) and (B), respectively, recited in claims 1 and 13. Reply 10.

Finally, representative Example 4 of Arakane has a higher luminous efficiency than Example 3, but has a lower relative amount of hole transporting compound. *Id.* at 11; PO Resp. 46; Ex. 1003, 31–32. Similarly, representative Example 3 of Arakane had a higher half-life than Examples 1 and 2, but includes a lower relative amount of hole transporting compound. Reply 11; PO Resp. 45–46; Ex. 1003, 30–32. The evidence of record thus does not fully support Patent Owner’s argument that the examples of Arakane demonstrate a decrease in performance as the relative amount of hole transporting compound decreases. For all of the foregoing reasons, we are not persuaded by Patent Owner’s argument that Arakane operates in a different way from the combinations of compounds of claims 1 and 13.

With regard to Patent Owner’s argument that Petitioner has attempted to satisfy its burden of proving obviousness by “using the claims as a roadmap and relying improperly on hindsight” (PO Resp. 14), we note the following:

> Any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning, but so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made and does not include knowledge gleaned only from applicant’s disclosure, such a reconstruction is proper.

In re McLaughlin, 443 F.2d 1392, 1395 (CCPA 1971). For the reasons stated above, we are persuaded that Petitioner has shown Arakane teaches or suggests the combination of components (A) and (B) as recited in claims 1 and 13. As such, this is not a case where the prior art "provides 'no direction as to which of many possible choices is likely to be successful,'" such that Petitioner could only have arrived at the claimed invention by "'re-trac[ing] the path of the inventor with hindsight.'" *Shire LLC v. Amneal Pharms. LLC*, 802 F.3d. 1301, 1308 (Fed. Cir. 2015) (quoting *Unigene Labs., Inc. v. Apotex, Inc.*, 655 F.3d 1352, 1361 (Fed. Cir. 2011) and *Ortho-McNeil Pharm., Inc. v. Mylan Labs., Inc.*, 520 F.3d 1358, 1364 (Fed. Cir. 2008)). Nor is this a case where Petitioner is relying on a broad disclosure of a chemical genius to "render[] obvious any species that falls within it." *In re Jones*, 958 F.2d 347, 350 (Fed. Cir. 1992).

Upon consideration of the evidence and arguments presented by Patent Owner and Petitioner, we conclude that Petitioner has shown by a preponderance of the evidence that Arakane discloses or suggests the use of component (A) and component (B) together in the light emitting layer of an organic EL device, as required in claims 1 and 13.

d. Conclusion

In view of Petitioner's arguments and evidence presented concerning the claim elements of claims 1 and 13 (Pet. 14–26; Reply 1–14), weighed against the arguments and evidence presented by Patent Owner in response (PO Resp. 2–49), we conclude that Petitioner has shown by a preponderance of the evidence that the subject matter of claims 1 and 13 would have been obvious over Arakane.

3. Claims 2 and 3

Petitioner argues that Arakane discloses the additional limitations specified in dependent claims 2 and 3, including the requirement in claim 2 that "at least one of A^{15} to A^{18} [represents a] substituted or unsubstituted secondary or tertiary alkyl group having 3 to 10 carbon atoms," and the requirement in claim 3 that "at least one of R^{24} and R^{25} represents a substituted or unsubstituted secondary or tertiary alkyl group having 3 to 10 carbon atoms," such that the claimed subject matter would have been obvious to a person of ordinary skill in the art. Pet. 26–37.

Patent Owner argues that Petitioner

> merely points out that Arakane refers to isopropyl and t-butyl as examples of substituents, and does not show why a skilled artisan would have specifically selected secondary or tertiary alkyl groups among numerous other substituents described in Arakane. Arakane merely provides a general description of various possible substituents, and nothing in Arakane would have directed a skilled artisan to pick the specific secondary or tertiary alkyl group in the specific positions in the specific formula of claim 2 or 3.

PO Resp. 54. Patent Owner thus asserts that Petitioner fails to explain sufficiently how a person of ordinary skill in the art would have arrived at the specific substituents recited in claims 2 and 3. *Id.*[4]

As Petitioner points out, however, Arakane includes substituted and unsubstituted alkyl groups among the list of "preferred substituents," and

[4] Patent Owner also addresses Petitioner's alternative argument that claims 2 and 3 do not require substituents A^{15}–A^{18}, R^{24}, and R^{25} to be present. *See* PO Resp. 51–54; Pet. 28–37. We need not address this argument in view of our determination that Petitioner has shown by a preponderance of evidence that claims 2 and 3 are unpatentable as obvious over Arakane under the interpretation that claims 2 and 3 require the presence of these substituents.

includes isopropyl and t-butyl among the various examples of the preferred substituted and unsubstituted alkyl groups. Pet. 33, 36; Ex. 1003, 9:17–10:3. Thus, for reasons similar to those expressed above with regard to claims 1 and 13, namely Arakane's identification of isopropyl and t-butyl as examples of preferred substituents, and the fact that Arakane uses these materials for the same purpose for which they are used in the claimed invention (organic EL devices), we are persuaded that Arakane discloses or suggests the use of isopropyl and t-butyl as substituents in Formula (1). *See Merck*, 874 F.2d at 807.

In view of Petitioner's arguments and evidence presented concerning the claim elements of claims 2 and 3 (Pet. 26–37; Reply 14–17), weighed against the arguments and evidence presented by Patent Owner in response (PO Resp. 54), we conclude that Petitioner has shown by a preponderance of the evidence that the subject matter of claims 2 and 3 would have been obvious over Arakane.

4. Claims 4, 5, 7–11, and 14

a. Claims 4 and 5

Petitioner argues that Arakane discloses the additional limitations of dependent claims 4 and 5, including an anthracene derivative represented by formulas I-a or I-b in claim 4, or formula II-a in claim 5, such that the subject matter of claims 4 and 5 would have been obvious to a person of ordinary skill in the art in view of Arakane. Pet. 37–44.

Patent Owner argues that Petitioner has not satisfied its burden of proving obviousness because Petitioner "provides no explanation of why a skilled artisan would have been led to select such anthracene derivatives (instead of other electron transporting compounds disclosed in Arakane) for

combination with a hole transporting compound having the particular structure required in claim 1." PO Resp. 56.

As discussed above in connection with claim 1, however, Arakane's disclosure of "a multitude of effective combinations does not render any particular formulation less obvious. This is especially true because the claimed composition is used for the identical purpose taught by the prior art." *Merck*, 874 F.2d at 807.

Thus, for reasons similar to those expressed above with regard to claims 1 and 13, namely Arakane's disclosure that certain anthracene derivatives may be used as electron transport compounds, and the fact that Arakane uses these materials for the same purpose for which they are used in the claimed invention (organic EL devices), we are persuaded that Arakane suggests the use of anthracene derivatives represented by formulas I-a, I-b, and II-a.

In view of Petitioner's arguments and evidence presented concerning the claim elements of claims 4 and 5 (Pet. 37–44; Reply 17–18), weighed against the arguments and evidence presented by Patent Owner in response (PO Resp. 56), we conclude that Petitioner has shown by a preponderance of the evidence that the subject matter of claims 4 and 5 would have been obvious over Arakane.

b. Claim 7

Claim 7 depends from claim 1, and further requires that that the weight ratio of component A and component B is 1:99 to 20:80. Petitioner directs us to page 22 of Arakane, which states that "[t]he component (A) is preferably mixed with the component (B) in a weight ratio of 8:92 to 92:8 . . . . The components (A) and (B) are preferably mixed in a weight

ratio ranging from 15:60 to 85:40. Within this range, a longer life of the device can be ensured." Ex. 1003, 22; Pet. 45 (noting that 15:60 is equal to 20:80). Thus, in combination with the arguments made with regard to claim 1, Petitioner asserts that that the subject matter of claim 7 would have been obvious to a person of ordinary skill in the art in view of Arakane. Pet. 45.

Patent Owner argues that Petitioner failed to provide an explanation as to why a person of ordinary skill in the art would have been led to employ the particular amounts of hole transporting and electron transporting compounds disclosed in claim 7. PO Resp. 57. Patent Owner also argues that the examples in Arakane "would have led a skilled artisan away from the amounts of hole transporting and electron transporting compound required in claim 7." *Id.*

In view of Arakane's disclosure of a range of weight ratios of component A to component B that overlaps the range in claim 7, there is a presumption of obviousness. *Iron Grip Barbell Co., Inc. v. USA Sports, Inc.*, 392 F.3d 1317, 1322 (Fed. Cir. 2004) ("[W]here there is a range disclosed in the prior art, and the claimed invention falls within that range, there is a presumption of obviousness."). We are not persuaded by Patent Owner's teaching away argument because, as Petitioner points out, Arakane explains that "a longer half-life of the device can be ensured" by using a weight ratio of component A to component B that falls within the claimed range. Reply 18. Additionally, Example 4 of Arakane uses a ratio that falls within the range specified by claim 7. *Id.* at 11, 18; Ex. 1003, 32.

In view of Petitioner's arguments and evidence presented concerning the claim elements of claim 7 (Pet. 45; Reply 18), weighed against the arguments and evidence presented by Patent Owner in response (PO Resp.

57), we conclude that Petitioner has shown by a preponderance of the evidence that the subject matter of claim 7 would have been obvious over Arakane.

c. Claims 8–10

Petitioner argues that Arakane discloses the additional features recited in dependent claims 8–10, which recite additional layers that can be added to the claimed EL device, or particular thickness of the light emitting layer. Pet. 45–47. Patent Owner argues that Petitioner has not satisfied its burden of proving obviousness because Petitioner "provides no explanation of why a skilled artisan would have been led to select such features in the device of claim 1." PO Resp. 58.

We are not persuaded by Patent Owner's arguments because, as Petitioner notes, Arakane explains that the features recited in claim 8 are preferred, and that the features in claims 9 and 10 provide an organic EL device with additional benefits. Pet. 46–47 (stating that the structure recited in Arakane corresponding to claim 9 "enable[es] low-voltage driving of the device," and that the structure recited in Arakane corresponding to claim 10 allows for the application of a "considerably low voltage"); Ex. 1003, 21, 25.

Thus, in addition to the reasons discussed above with regard to claims 1 and 13, we are persuaded that Arakane suggests features recited in claims 8–10.

In view of Petitioner's arguments and evidence presented concerning the claim elements of claims 8–10 (Pet. 45–47; Reply 18–19), weighed against the arguments and evidence presented by Patent Owner in response (PO Resp. 58), we conclude that Petitioner has shown by a preponderance of

the evidence that the subject matter of claims 8–10 would have been obvious over Arakane.

d. Claims 11 and 14

Claim 11 depends from claim 1, and requires that the electroluminescence device comprises "at least one of said anthracene derivatives." Claim 14 depends from claim 13, and requires that the light emitting medium comprises "at least one of said anthracene derivatives." Relying on the arguments presented with regard to claims 1 and 13, Petitioner argues that Arakane discloses the use of anthracene derivatives. Pet. 47–48.

Patent Owner argues that Petitioner has not satisfied its burden of proving obviousness because Petitioner "provides no explanation of why a skilled artisan would have been led to select such anthracene derivatives (instead of other electron transporting compounds disclosed in Arakane) for combination with a hole transporting compound having the particular structure required in claim 1 or claim 13." PO Resp. 58–59.

As discussed above in connection with claims 1 and 13, however, Arakane's disclosure of "a multitude of effective combinations does not render any particular formulation less obvious. This is especially true because the claimed composition is used for the identical purpose taught by the prior art." *Merck*, 874 F.2d at 807.

Thus, for reasons similar to those expressed above with regard to claims 1 and 13, namely Arakane's disclosure that certain examples of anthracene derivatives may be used as electron transport compounds, and the fact that Arakane uses these materials for the same purpose for which they

are used in the claimed invention (organic EL devices), we are persuaded that Arakane suggests the use of anthracene derivatives.

In view of Petitioner's arguments and evidence presented concerning the claim elements of claims 11 and 14 (Pet. 47–48; Reply 17–18), weighed against the arguments and evidence presented by Patent Owner in response (PO Resp. 58–59), we conclude that Petitioner has shown by a preponderance of the evidence that the subject matter of claims 11 and 14 would have been obvious over Arakane.

III. CONCLUSION

For the foregoing reasons, we determine that Petitioner has shown by a preponderance of the evidence that Arakane renders claims 1–5, 7–11, 13, and 14 of the '648 patent unpatentable as obvious.

IV. ORDER

For the reasons given, it is

ORDERED that claims 1–5, 7–11, 13, and 14 of the '648 patent have been shown to be unpatentable;

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

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