

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

AFTON CHEMICAL CORPORATION,
Petitioner,

v.

INFINEUM INTERNATIONAL LIMITED,
Patent Owner.

Case IPR2017-01321
Patent 8,076,274 B2

Before JON B. TORNQUIST, JEFFREY W. ABRAHAM, and
MICHELLE N. ANKENBRAND, *Administrative Patent Judges*.

TORNQUIST, *Administrative Patent Judge*.

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

I. INTRODUCTION

A. Background

Afton Chemical Corporation (“Petitioner”) filed a Petition (Paper 1, “Pet.”) requesting *inter partes* review of claims 1–13 of U.S. Patent No. 8,076,274 B2 (Ex. 1001, “the ’274 patent”). Infineum International Limited (“Patent Owner”) filed a Preliminary Response to the Petition. Upon consideration of the Petition, the Preliminary Response, and the parties’ evidence, we determined that Petitioner had demonstrated a reasonable likelihood that it would prevail with respect to claims 1–13 of the ’274 patent (Paper 8, “Dec. on Inst.”). Thus, we instituted review with respect to those claims. We did not, however, institute review on all asserted grounds of unpatentability set forth in the Petition. Dec. on Inst. 5, 26.

On April 27, 2018, pursuant to the Supreme Court’s decision in *SAS Inst., Inc. v. Iancu*, 138 S. Ct. 1348, 1355 (2018), we modified the institution decision to institute review of all challenged claims *on all challenged grounds*. Paper 20, 2.

Following institution of trial, Patent Owner filed a Patent Owner Response (Paper 16, “PO Resp.”), to which Petitioner filed a Reply (Paper 23, “Pet. Reply”). Patent Owner also filed a Supplemental Response addressing the newly-instituted grounds (Paper 22), to which Petitioner filed a Reply (Paper 32).

With its Patent Owner Response, Patent Owner filed a contingent Motion to Amend (Paper 17, “MTA”), to which Petitioner filed an Opposition (Paper 24, “Opp. MTA”), Patent Owner filed a Reply (Paper 29, MTA Reply), and Petitioner filed a Sur-Reply (Paper 33, “MTA Sur-Reply”).

In support of their respective arguments, Petitioner relies on the declaration testimony of Dr. William Y. Lam (Exs. 1004 and 1050) and Mr. Jeremy Styer (Ex. 1006) and Patent Owner relies upon the declaration testimony of Dr. Jack Emert (Exs. 2025, 2035, and 2039).

An oral hearing was held on August 9, 2018, and a transcript of the oral hearing is included in the record. Paper 46 (“Tr.”).

B. Related Proceedings

Petitioner notes that a European Patent Application to which the ’274 patent claims priority is the subject of a “Third Party Observation under Article 115 EPC.” Pet. 1. The parties identify no other related proceedings. *Id.*; Paper 4, 1.

C. The ’274 Patent

The ’274 patent, titled “Lubricating Oil Composition,” is directed to a lubricating oil composition for use in diesel engines. Ex. 1001, (54), 1:6–8. The ’274 patent explains that combustion of fuel in diesel engines “leads to the formation of acidic moieties which can have detrimental effects such as corrosion of parts of the engine and its exhaust system.” *Id.* at 3:16–19. In order to neutralize these acidic moieties, lubricating oils for diesel engines “are usually formulated to have relatively high basicity (e.g. high total base number, TBN),” which is “attained by incorporating basic metal-containing detergents in the lubricating oils.” *Id.* at 3:19–25. The amount of basic metal detergent that can be used is limited, however, “because the metal of the detergent gives rise to ash materials which adversely affect the operation of engine equipment such as exhaust gas filters and exhaust gas purification catalysts.” *Id.* at 3:31–35. Magnesium-containing detergents also “tend to cause bore polishing,” i.e., the wearing of lubricant-containing grooves in

the bore wall, which limits the ability of the grooves to retain lubricant and potentially leads to increased wear and engine failure. *Id.* at 1:33–42, 3:43–48.

According to the '274 patent, the applicants discovered that by selecting an appropriate set of additives, a lubricating oil “containing relatively high concentrations of magnesium from magnesium-containing detergents can be formulated without giving rise to unacceptable levels of bore polishing or unacceptable levels of ash in diesel engines.” *Id.* at 3:51–55. This lubricating oil has the following components: (a) a lubricating oil basestock of lubricating viscosity; (b) an antioxidant component that “is selected from one or more ash-free aminic and/or sulfur-free phenolic compounds in an amount of at least 0.6 mass % and up to 3.0 mass % based on the total mass of the lubricating composition”; (c) a detergent component that “is an overbased magnesium compound having a total base number (TBN) exceeding 350 mg/g KOH”; and optionally (d) one or more metal hydrocarbyl dithiophosphate compounds in an amount of from 0.0 to 1.8 mass % and/or (e) a calcium detergent. *Id.* at 4:1–22, 9:25–27.

D. Illustrative Claims

Claim 1 is the only independent claim of the '274 patent. Claims 1 and 13 are illustrative of the challenged claims and are reproduced below:

1. A lubricating oil composition for a diesel engine, comprising the following components:
 - (a) a lubricating oil basestock of lubricating viscosity;
 - (b) an antioxidant component;
 - (c) a detergent component; and

optionally (d) one or more metal hydrocarbyl dithiophosphate compounds in an amount of from 0.0 to 1.8 mass % and/or (e) a calcium detergent compound;

wherein the antioxidant component (b) is selected from one or more ash-free aminic and/or sulfur-free phenolic compounds in an amount of at least 0.6 mass % up to 3.0 mass % based on the total mass of the composition; and

the detergent component (c) is an overbased magnesium compound having a total base number (TBN) exceeding 350 mg/g KOH selected from one or more magnesium sulfonates, magnesium salicylates, and magnesium phenates and which provide the composition with greater than 0.05 mass % Mg based on the total mass of the composition, and wherein the sulfated ash content of the composition is at least 0.6 mass % to not more than 2.0 mass % as determined by ASTM D874.

Ex. 1001, 9:20–10:3.

13. The composition of claim 1 wherein the detergent component (c) comprises salicylate detergent.

Id. at 10:34–35.

E. Instituted Grounds of Unpatentability

We instituted trial to determine whether claims 1–13 of the '274 patent are unpatentable based on the following grounds (Pet. 26; Paper 20, 2):

Reference(s)	Basis	Claim(s) Challenged
Colclough ¹	§ 102	1–11
Nicholson ² and ACEA 2004 ³	§ 103	1–12

¹ EP Patent Publication No. 0 280 579 A2, published Aug. 31, 1988 (Ex. 1007).

² EP Patent Publication No. 0 663 436 A1, published July 19, 1995 (Ex. 1009).

³ *ACEA European Oil Sequences, Service Fill Oils for Gasoline Engines, Light Duty Diesel Engines, Engines with After Treatment Devices & Heavy*

Reference(s)	Basis	Claim(s) Challenged
Fetterman ⁴ and Arrowsmith ⁵	§ 103	1–12
Colclough and Arrowsmith	§ 103	13
Nicholson, ACEA 2004, and Arrowsmith	§ 103	13

F. Proposed Grounds of Unpatentability for Proposed Amended Claims 14–25

As noted above, Patent Owner filed a contingent Motion to Amend seeking to add substitute claims 14–25 in place of original claims 1–13. MTA 27. Petitioner contends the proposed amended claims are unpatentable based on the following grounds (Opp. MTA 5):

Reference(s)	Basis	Claim(s) Challenged
Colclough	§ 102	14–23
Arrowsmith '299 ⁶	§ 103	14–25
Nicholson, ACEA 2004, and Stepina ⁷	§ 103	14–24
Nicholson, ACEA 2004, Stepina, and Arrowsmith '371	§ 103	25
Locke ⁸	§ 103	14–24

Duty Diesel Engines, EUR. AUTOMOBILE MANUFACTURERS ASS'N (2004) (Ex. 1012).

⁴ EP Patent Publication No. 0 311 318 A1, published Apr. 12, 1989 (Ex. 1010).

⁵ U.S. Patent Publication No. 2004/0127371 A1, published July 1, 2004 (Ex. 1020) (“Arrowsmith” or “Arrowsmith '371”).

⁶ U.S. Patent Publication No. 2006/0116299 A1, published June 1, 2006 (Ex. 1013) (“Arrowsmith '299”).

⁷ V. Stepina & V. Vesely, *Lubricants & Special Fluids*, Elsevier, 1992 (Ex. 1018).

⁸ U.S. Patent No. 6,423,670 B2, issued July 23, 2002 (Ex. 1002).

Reference(s)	Basis	Claim(s) Challenged
Diggs ⁹	§ 102	14–16 and 20–23
Diggs	§ 103	17–19, 24, and 25
Bloch ¹⁰ and Stepina	§ 103	14–24

II. ANALYSIS OF ORIGINAL CLAIMS 1–13

A. Claim Construction

In an *inter partes* review, “[a] claim in an unexpired patent . . . shall be given its broadest reasonable construction in light of the specification of the patent in which it appears.” 37 C.F.R. § 42.100(b) (2016); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2142 (2016) (upholding the use of the broadest reasonable interpretation standard). In determining the broadest reasonable construction, we presume that claim terms carry their ordinary and customary meaning. *See In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). A patentee may define a claim term in a manner that differs from its ordinary meaning; however, any special definitions must be set forth in the specification with reasonable clarity, deliberateness, and precision. *See In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994).

Petitioner provides a proposed construction for the claim phrase “selected from one or more ash-free aminic and/or sulfur-free phenolic compounds” and for the term “optionally.” Pet. 12–15. Patent Owner does not address Petitioner’s proposed constructions or identify any other claim terms of the ’274 patent that it contends require construction. PO Resp. 10.

⁹ U.S. Patent No. 8,513,169 B2, issued Aug. 20, 2013 (Ex. 1045).

¹⁰ U.S. Patent No. 6,004,910, issued Dec. 21, 1999 (Ex. 2033).

Upon review of the parties' arguments and supporting evidence, we determine that no claim terms of the '274 patent require express construction for purposes of this Decision. See *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (citing *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. Principles of Law

A claim is anticipated under 35 U.S.C. §102 if a single prior art reference discloses, either expressly or inherently, each limitation of the claim. *In re Cruciferous Sprout Lit.*, 301 F.3d 1343, 1349 (Fed. Cir. 2002).

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. See *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) the differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) if in the record, objective evidence of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

C. Level of Ordinary Skill in the Art

Dr. Lam testifies that one of ordinary skill in the art at the time of the earliest effective filing date of the '274 patent “would have had an undergraduate degree in Chemistry or Chemical Engineering, or equivalent

work experience of five to ten years of experience in the field of lubricants or tribology, and an understanding of formulation science.” Ex. 1004 ¶ 13. Dr. Emert generally agrees with this proposed level of ordinary skill in the art, but clarifies that five years of work experience in the field of lubricants or tribology (as opposed to ten years) “would be sufficient when coupled with an undergraduate degree in a relevant field” and that “[f]ive additional years of work experience could compensate for any missing formal academic training, including, for instance, an ungraduated degree in a non-chemical field.” Ex. 2025 ¶ 31.

Upon review of the arguments set forth by Drs. Lam and Emert, we adopt Dr. Emert’s description of one of ordinary skill in the art, as it is consistent with the prior art of record and persuasively considers how the necessary level and type of education may be offset by work experience in the relevant field. We note, however, that neither party contends that the difference in education and experience level Drs. Lam and Emert assert for an ordinarily skilled artisan would have any impact on the parties’ arguments or conclusions in this case. *See, e.g.*, Ex. 2025 ¶ 32.

D. Anticipation of Claims 1–11 by Colclough

Petitioner contends claims 1–11 of the ’274 patent are anticipated by Colclough. Pet. 26–34.

1. Colclough

Colclough discloses “lubricating compositions, especially automobile crankcase lubricants, containing low or zero amounts of phosphorus and zinc.” Ex. 1007, 2:3–4. These lubricants have “antiwear, corrosion inhibition and antioxidant performance appropriate for modern oil

requirements,” but do not require “large amounts and/or expensive forms of antioxidant.” *Id.* at 2:56–58.

Colclough discloses Comparative Examples I–VI and Examples 1 and 2. *Id.* at 6:55–7:14, Table 1. Additives A–H and J–M are utilized in one or more of these examples, and are described in the reference as follows:

A is a dispersant V.I. additive comprising an oil solution containing 21% of a multifunctional ethylene-propylene copolymer and containing 0.29 wt % N.

B is an ashless dispersant comprising a 50 wt % oil solution of borated polyisobutenyl succinimide having a polyisobutenyl radical with a molecular weight of approximately 950 and containing 1.6 wt % N and 0.35 wt % B.

C is an oil solution of an overbased magnesium sulphonate having a TBN of 400 and a magnesium content of 9.2 wt % and a sulphur¹¹ content of 1.7 wt %.

D is an oil solution of an overbased calcium sulphonate having a TBN of 300 and a calcium content of 11.9 wt % and a sulphur content of 1.9 wt %[.]

E is an oil solution of copper oleate containing 4 wt % copper.

F is a 30 wt % solution in oil of a hindered methylene bis-phenol antioxidant.

G is an alkylated diphenylamine antioxidant, commercially available as Irganox L-57 from Ciba-Geigy.

H is a 50 wt % oil solution of a zinc diamyl dithiocarbamate containing 6 wt % of zinc and 12 wt % sulphur.

¹¹ The '274 patent refers to sulfur, whereas several of the prior art references refer to sulphur. We understand these terms to be synonymous and we use them interchangeably.

J is an orthoborate ester made from ethoxyethanol comprising 5 to 6 wt % of boron.

K is 2,5-bis(nonyldithio)-1,3,4-thiadiazole, commercially available as Amoco 158 from Amoco Chemical Company, comprising 33 wt % sulphur.

L is an oil solution containing 12 wt % of molybdenum as the octoate.

M is a sulphurized ester sperm oil substitute, commercially available as Emery 9844 from Emery Corporation, and comprising 11.5 wt % sulphur.

Id. at 6:59–7:13.

According to Table 1 of Colclough, Comparative Examples V and VI contain the following additives:

Additive	Example V	Example VI
A	8.5 wt%	8.5 wt%
B	3.0 wt%	3.0 wt%
C	1.6 wt%	1.6 wt%
D	-	0.9 wt%
E	-	0.3 wt%
F	1.0 wt%	1.0 wt%
G	0.4 wt%	0.4 wt%
H	1.5 wt%	1.5 wt%
J	1.0 wt%	-

2. The Parties' Arguments

Petitioner demonstrates that the lubricating compositions of Comparative Examples V and VI include a basestock of lubricating viscosity, antioxidants, and a magnesium sulfonate detergent having a TBN of 400 and contributing 0.15 wt% magnesium to the total mass of the composition. Pet. 26–28 (citing Ex. 1004 ¶ 43; Ex. 1007, 6:57–58, 6:64–65, 7:4–5, Table 1). Petitioner also provides calculations and experimental evidence to establish that the lubricants of Comparative Examples V and VI

have a sulfated ash (SASH) content of 0.89 mass % and 1.18 mass %, respectively.¹² *Id.* at 28–29 (citing Ex. 1004 ¶¶ 51–52; Ex. 1006 ¶¶ 29, 46).

With respect to the specific type and level of antioxidants used in Comparative Examples V and VI, Petitioner demonstrates that Components F and G in Colclough are “ash-free aminic and/or sulfur-free phenolic compounds” and calculates that these antioxidants are present “at a combined 0.7 wt.%.” *Id.* at 27–28 (citing Ex. 1004 ¶ 43; Ex. 1007, Table 1). Dr. Lam, testifying in support of Petitioner, explains that this total was derived by “adding Component G (0.4 wt.%) and taking the active percent of the solution for Component F (1.0 wt.% * (30%) = 0.3 wt.%) to arrive at 0.7 wt.% (0.4 + 0.3 = 0.7 wt.%).”¹³ Ex. 1004 ¶ 43.

Patent Owner asserts that Petitioner’s calculations with respect to the level of antioxidants in Colclough are flawed because there is no factual basis for presuming that Component G contains 100% alkylated diphenylamine. PO Resp. 16–17, 20–21. According to Patent Owner, material data safety sheets (MSDS) for Irganox L-57 indicate that the level of alkylated diphenylamine in this product can vary from 60% to 100%. *Id.* at 25. Applying the lowest level of active ingredient for Irganox L-57 reported in these references, Patent Owner calculates that the ash-free aminic

¹² Dr. Lam testifies that the experiments were conducted according to ASTM D-874 and correlate closely with the calculated SASH values for these experiments. Ex. 1004 ¶¶ 45–48, 53.

¹³ The prior art references disclose wt.% not mass %. Dr. Lam testifies that any differences between “[t]he wt.% reported in the prior art references” and the “mass % recited in the claims” would be “inconsequential.” Ex. 1004 ¶ 101 n.4. Patent Owner has not contested this assertion and we accept it for purposes of this Decision.

and/or sulfur-free phenolic antioxidant content of Examples V and VI of Colclough could be 0.54 wt.%, which is outside the range recited in claim 1 of the '274 patent. *Id.* (citing Ex. 2025 ¶ 59).

In reply, Petitioner asserts Patent Owner is attempting to “inject ambiguity into Colclough’s disclosure where none exists.” Pet. Reply 3. According to Petitioner, rather than accept Colclough’s disclosure of using 0.4 wt.% of an alkylated diphenylamine, Patent Owner is attempting to re-write this disclosure “to read 0.4 wt.% of Irganox L-57.” *Id.* at 3–4 (citing Ex. 1007, 7:5, 8:1–67). Petitioner further asserts that, even if Colclough actually required the addition of 0.4 wt.% Irganox L-57, it is evident that the material used in Colclough was 100% pure as every component in Colclough that contains less than 100% of an identified ingredient is specifically identified as such. *Id.* at 5–6 (identifying additives A, B, C, D, F, H, and L of Colclough as containing less than 100% active ingredient). Petitioner also asserts that the material safety data sheets relied upon by Patent Owner do not reflect the contents of the Irganox L-57 used in Colclough as these references do not report the precise concentration of the product and each of these references was published after Colclough issued. *Id.* at 6–7 n.5.

3. Analysis

Upon review of the record as a whole, we are persuaded that Colclough discloses using 0.4 wt% of an alkylated diphenylamine. First, Colclough discloses that Component G “is an alkylated diphenylamine antioxidant,” not that Component G “contains” an alkylated diphenylamine antioxidant. Ex. 1007, 7:5; Pet. Reply 3–4. Second, each additive component that contains less than 100% active ingredient in Colclough is

specifically identified as such in the reference. Pet. Reply 5–6; Ex. 1007, 7:4 (“F is a 30 wt % solution in oil of a hindered methylene bis-phenol antioxidant.”). These disclosures support Petitioner’s argument that Colclough discloses using 0.4 wt.% of an alkylated diphenylamine antioxidant in the lubricating compositions of Comparative Examples V and VI.

Although Colclough goes on to explain that the disclosed alkylated diphenylamine antioxidant of Component G is “commercially available as Irganox L-57 from Ciba-Geigy” (Ex. 1007 7:5), it is not clear from Patent Owner’s arguments why this disclosure requires the use of commercially-sourced Irganox L-57, as opposed, for example, to alkylated diphenylamine antioxidants manufactured on site or sourced from an alternate supplier. *See, e.g.*, Pet. Reply 4. Patent Owner also does not explain persuasively why one of ordinary skill in the art, if he or she contemplated that a particular batch of Irganox L-57 had less than 100% alkylated diphenylamine antioxidant, would not ensure that 0.4 wt.% of the alkylated diphenylamine antioxidant is added to the lubricant, as is expressly disclosed in Colclough, as opposed to applying unknown levels of antioxidant that may be below the level recited in the reference. *See* PO Resp. 20 (Patent Owner contending that Colclough “instructs that the commercial product be used for Component G regardless of the amount of active antioxidant actually present in that product”).¹⁴

¹⁴ Irganox L-57 is composed of “Benzamine, N-phenyl-, reaction products with 2,4,4-trimethylpentene.” Ex. 2017, 2; 2018, 1. Mr. Styer testified during cross-examination that, to the extent a particular batch of Irganox L-57 is not composed of 100% alkylated diphenylamine, the remaining components in this product would be “other by-products” of the reaction,

In view of Colclough's express disclosure of using 0.4 wt % of Component G (which "is an alkylated diphenylamine antioxidant") in combination with 1.0 wt.% of Component F (provided as a 30 wt.% solution), we find that Colclough expressly discloses the use of "one or more ash-free aminic and/or sulfur-free phenolic compounds in an amount of at least 0.6 mass % up to 3.0 mass % based on the total mass of the composition." Ex. 1004 ¶¶ 43, 122. As noted above, Petitioner persuasively identifies where the remaining limitations of claim 1 are disclosed, either expressly or inherently, by Comparative Examples V and VI of Colclough. Pet. 27–29. Patent Owner does not dispute that these remaining limitations of claim 1 are disclosed in Colclough. Thus, we determine that Petitioner has demonstrated by a preponderance of the evidence that Colclough anticipates claim 1 of the '274 patent.

With respect to dependent claims 2–11, Petitioner identifies where Colclough discloses each limitation of these claims. Pet. 31–34. For example, Petitioner demonstrates that the lubricating compositions of Comparative Examples V and VI of Colclough: (1) contain 0.15 wt% magnesium (claims 2 and 3) (*id.* at 31 (citing Ex. 1007, 8, Table 1)); (2) contain one or more nitrogen-containing dispersants that provide the composition with at least 0.073 wt % nitrogen (claims 4–7) (*id.* at 32 (citing Ex. 1007, 6:59–63, Table 1; Ex. 1004 ¶ 105 (Dr. Lam calculating the nitrogen content provided by the dispersants of Colclough))); (3) contain

"which would, in themselves, be aminic antioxidants." Ex. 2026, 70:24–71:19. As claim 1 of the '274 patent allows any type of ash-free aminic antioxidant, this testimony is consistent with our finding that Colclough discloses a composition having 0.7 wt.% of the claimed antioxidants.

antioxidant components that are ash-free (claim 8) (*id.* at 32–33 (citing Ex. 1007, 7:4–5)); and (4) have experimentally derived SASH levels of 0.89 mass % (Example V) and 1.18 mass % (Example VI) that fall within the ranges of dependent claim 9 (Example V) and dependent claims 9–11 (Example VI) (*id.* at 33–34 (citing Ex. 1006 ¶¶ 29, 46; Ex. 1004 ¶¶ 49–52)).

Patent Owner does not address Petitioner’s arguments with respect to dependent claims 2–11 in its Patent Owner Response.

Upon review of the arguments and evidence of record, we determine that Petitioner has demonstrated by a preponderance of the evidence that claims 2–11 are anticipated by Colclough.

E. Obviousness of Claims 1–12 over Nicholson and ACEA 2004

Petitioner contends the subject matter of claims 1–12 would have been obvious over the combined disclosures of Nicholson and ACEA 2004. Pet. 34–45.

1. Nicholson

Nicholson discloses dispersants for use as additives in natural and synthetic lubricating oils “that have reduced reactivity towards fluoroelastomers coupled with effective dispersancy.” Ex. 1009, 2:1–4. Nicholson provides four illustrative examples. *Id.* at 12:12–13. Example IV of Nicholson is one of these illustrative examples and contains the following components (*id.* at 13:38–53):

Component	Percentage
a)	3.11
b)	1.10
c)	1.06
d)	2.28
e)	1.40
Base oil, VI Improver, Diluent Oils	Balance to 100%

As shown in the figure above, Example IV contains components a) – e) and a “Base oil,” a “VI Improver,” and “Diluent oils.” *Id.* Component a) of Example IV is an “AG dispersant”; component b) is an oil-soluble ashless dispersant; component c) is a metal hydrocarbyl dithiophosphate; component d) is a 400 TBN overbased magnesium alkylbenzene sulfonate detergent; and component e) consists of one or more oxidation, foam, rust, corrosion, or friction inhibitors. *Id.* at 3:49–12:10, 12:36–38 (explaining that component e) in Example I is “a mixture of 0.8% tertiary butylated phenolic antioxidant, 0.2% aromatic amine antioxidant, 0.4% sulfurized olefin oxidation inhibitor, and less than 0.001% of silicon type foam inhibitor”), 13:38–40 (explaining that component e) of Example IV is formulated “as in Example I”).

Nicholson reports that lubricating compositions containing the disclosed dispersants “gave excellent results” and that “a 10W-40 lubricant of [the] invention exhibited excellent dispersancy and varnish control performance, as well as good wear performance.” *Id.* at 14:11–12, 15:1–3.

2. ACEA 2004

ACEA 2004, published by the European Automotive Manufacturers Association, “details the ACEA 2004 European Oil Sequences for Service-fill Oils for Gasoline engines, for Light Duty Diesel engines, for Gasoline & Diesel engines with after treatment devices and for Heavy Duty Diesel

engines.” Ex. 1012, 1–2.¹⁵ ACEA 2004 instructs that its sequences “define[] the minimum quality level of a product” required “for presentation to ACEA members.” *Id.* at 13.

With respect to “Heavy Duty Diesel engine oils” (class E), ACEA 2004 indicates that the SASH limits in 2004 to achieve E6 and E7 quality were ≤ 1.0 and ≤ 2.0 % m/m, respectively, as measured by ASTM D874. *Id.*; see also *id.* at 4 (explaining the nomenclature used in ACEA 2004). ACEA 2004 explains that “E6 quality is strongly recommended for engines fitted with particulate filters and is designed for use in combination with low sulphur diesel fuel (max 50 ppm).” *Id.* at 6.

3. Analysis

a. Claim 1

Petitioner persuasively demonstrates, and Patent Owner does not contest, that the lubricant of Nicholson’s Example IV contains a lubricating basestock of lubricating viscosity, an antioxidant component, and a detergent component, as recited in elements (a)–(c) of claim 1. Pet. 34–35 (citing Ex. 1009, 12:36–38, 13:38–40, 13:42–52 (Table)). Petitioner also persuasively demonstrates that the lubricant of Nicholson Example IV contains aminic and/or sulfur-free antioxidants that, in combination, constitute 1.0 wt.% of the composition. *Id.* at 35 (citing Ex. 1009, 12:36–38 (noting component e) contains 0.8 wt.% tertiary butylated phenolic antioxidant and 0.2 wt.% aromatic amine antioxidant)).

Petitioner concedes that Nicholson does not expressly indicate the wt.% of magnesium its 400 TBN overbased magnesium alkylbenzene

¹⁵ Citations are to the page numbers in the lower left corner of the document.

sulphonate detergent imparts, but Dr. Lam persuasively demonstrates that there is simply no way to formulate the 400 TBN magnesium alkylbenzene sulphonate detergent of Nicholson such that it would not provide the lubricating composition with greater than 0.05 mass % Mg, as recited in claim 1. *Id.* at 36–38; Ex. 1004 ¶ 64 (Dr. Lam testifying that “for a magnesium alkylbenzene sulfonate detergent to have 400 TBN, the detergent must contain a minimum of 8.66 wt.% magnesium,” which would provide the lubricating composition with a minimum of 0.197 wt.% magnesium). Patent Owner does not contest Dr. Lam’s testimony on this point.

To determine the SASH content of Example IV of Nicholson, it is necessary to identify what type of 400 TBN magnesium sulfonate detergent one of ordinary skill in the art would have selected in seeking to reproduce the lubricant of Example IV of Nicholson. On this point, Dr. Lam testifies that “most commercially available 400 TBN magnesium sulfonate detergents are around 9 wt.% magnesium,” and that the highest percent magnesium value he had ever seen for such detergents was 9.4 wt.%. Ex. 1004 ¶¶ 61–62, 72. Applying a practical range of between 8.66 wt.% magnesium (the lowest possible value of Mg in a 400 TBN detergent) and 10 wt.% magnesium for the detergent (higher than any value Dr. Lam had seen), Dr. Lam calculates that the composition of Example IV of Nicholson has a SASH value between 1.17 wt.% and 1.23 wt.%— a range that falls within the “at least 0.6 mass % to not more than 2.0 mass %” range recited in claim 1. Pet. 37–39 (citing Ex. 1004 ¶¶ 58–62, 76); *see also* Ex. 1006 ¶ 76 (Dr. Styer experimentally determining that the SASH content of

Example IV of Nicholson would be 1.12 mass % as measured by ASTM D874 if a conventional 400 TBN detergent with 9.2 wt.% Mg was used).

As further support for selecting a “a conventional 400 TBN detergent” as the magnesium sulfonate detergent in Example IV of Nicholson, Petitioner argues that one of ordinary skill in the art would have selected such a detergent in view of the need to maintain the SASH values of the lubricants within at least the E7 range of the ACEA 2004 specification. Pet. 39 (citing Ex. 1004 ¶ 34–36, 123–125).

Patent Owner contends Petitioner has not demonstrated sufficiently that one of ordinary skill in the art would have sought to combine the relevant disclosures of Nicholson and ACEA 2004 to arrive at the claimed lubricating compositions. PO Resp. 28–31. Patent Owner asserts that Nicholson is directed to “novel dispersant compositions” that are meant to be compatible with fluoroelastomer seals, whereas the ’274 patent is directed to lubricants with reduced bore polishing. *Id.* at 28–29. Patent Owner further asserts that, in contrast to the ’274 patent, Nicholson’s disclosure does not specifically direct one of ordinary skill in the art to use the claimed types of magnesium detergents or instruct that the amount of detergent employed should be higher than that of typical prior art compositions. *Id.* at 29 (asserting that Nicholson allows “virtually any ‘metal-containing detergent’”). Patent Owner also argues that Nicholson does not direct one of ordinary skill in the art to the claimed types and amounts of antioxidants, or discuss the importance of sulfated ash content. *Id.* at 30 (asserting that Nicholson permits ash-forming antioxidants). According to Patent Owner, in view of the differences between the ’274 patent and Nicholson, “there is no reason why one of ordinary skill in the art, when attempting to formulate

a lubricant in the 2006 time frame, would have started with a single example” from Nicholson, much less Example IV of Nicholson. *Id.* (citing Ex. 2025 ¶¶ 64–68).

Patent Owner contends the 2004 ACEA specification would not have made up for Nicholson’s deficiencies. *Id.* at 31. Patent Owner reasons that the 2004 ACEA specification “is nothing more than a series of non-mandatory performance goals” that provides no examples or instructions on how to formulate lubricating compositions to meet those goals. *Id.* Patent Owner further contends that the 2004 ACEA specification would have actually deterred one of ordinary skill in the art from using Nicholson’s examples, as industry standards are constantly changing and becoming more stringent over time, and one of ordinary skill in the art would have understood that compositions meeting 1995 standards “would be very unlikely to be in compliance with 2004 standards.” *Id.* at 31–32.

Finally, Patent Owner contends the claimed compositions provide unexpected results. *Id.* at 33–34. Specifically, Patent Owner contends it was unexpected that increased levels of magnesium could be used in a lubricating composition “without giving rise to bore polishing problems.” *Id.* (citing Ex. 1001, 8:49–67, Table 1). In support of this argument, Patent Owner relies upon test results provided in the ’274 patent that compare bore polishing levels for lubricating compounds having varying levels of magnesium and antioxidants. *Id.* at 33–35.

In reply, Petitioner asserts that its evidence demonstrating that Example IV of Nicholson teaches or suggests the claimed levels of magnesium and SASH remains unrebutted. Pet. Reply 9. Petitioner also asserts that a person of ordinary skill in the art would have known that any

heavy-duty lubricant would have had to possess good seal performance, which would have directed such an ordinarily skilled artisan to look to Nicholson's lubricants. *Id.* at 9–10 (citing Ex. 1009, 14:13–15 (reporting that the lubricants had “excellent fluoroelastomer seal performance”)). And, according to Petitioner, it was common and routine to follow industry standards, which would have motivated one of ordinary skill in the art to keep the SASH levels of Nicholson's lubricating compositions below the 2.0% limit of the E7 category for engine oil/lubricants disclosed in ACEA 2004. *Id.* at 10 (citing Pet. 39).

Upon review of the record as a whole, we find that Nicholson Example IV teaches or suggests a lubricating composition having magnesium and SASH values that fall within the ranges recited in claim 1 of the '274 patent. First, Petitioner's evidence and arguments discussed above persuasively demonstrate that the level of magnesium the 400 TBN detergent of Example IV imparts is necessarily above 0.05 mass %. Pet. 36–38; Ex. 1004 ¶¶ 56, 64. Second, Petitioner's evidence and arguments discussed above persuasively demonstrate that the selection of any practical 400 TBN detergent would provide a SASH value that falls within the range recited in claim 1. Pet. 37–39; Ex. 1004 ¶¶ 34–36, 58–62, 72, 76, 123–125. We accept and adopt Petitioner's evidence and arguments as our own, and as Petitioner points out, Patent Owner does not challenge Petitioner's evidence regarding these limitations.

We recognize, as Patent Owner notes, that Nicholson does not expressly state that the type and amount of additives used in Example IV would permit an increase in magnesium content without a corresponding increase in bore polishing. PO Resp. 30. The prior art need not address,

however, “the exact problem that the patentee sought to resolve,” as long as an obvious combination of prior art elements would result in the claimed composition. *See Tyco Healthcare Grp. LP v. Ethicon Endo-Surgery, Inc.*, 774 F.3d 968, 977 (Fed. Cir. 2014) (“[A]ny need or problem known in the relevant field of endeavor at the time of invention can provide a reason to combine.”).

With respect to Patent Owner’s argument that one of ordinary skill in the art would not have selected the lubricant of Example IV for further modification, we note that Nicholson’s lubricants are not in need of further modification. All that is required is selection of an appropriate type of 400 TBN overbased magnesium alkylbenzene sulfonate detergent in Example IV, and Petitioner provides a persuasive explanation based on the knowledge of one of ordinary skill in the art and the “guidance of industry standards such as the ACEA 2004” as to why one of ordinary skill in the art would have selected a conventional 400 TBN detergent for use in Example IV of Nicholson. Pet. 38–39.

Moreover, even if Petitioner needed to establish that one of ordinary skill in the art would have selected the lubricant of Example IV of Nicholson for further development, Petitioner persuasively demonstrates that one of ordinary skill in the art would have looked to Nicholson’s lubricants for further development as they are reported to provide excellent results and reduced reactivity towards elastomer seals. *Id.* at 39; Pet. Reply 10; Ex. 1009, 2:1–4 (noting that the disclosed dispersants have “reduced reactivity towards fluoroelastomers coupled with effective dispersancy”), 2:7–9 (“The commercial reality is that if the lubricant is unable to pass the applicable test or tests [for fluoroelastomer degradation], it is unlikely to

meet acceptance in the market-place.”), 14:11–12 (noting that a 10W-40 lubricant of the invention “exhibited excellent dispersancy and varnish control performance, as well as good wear performance”), 15:1–3 (explaining that Tables I, II, and III demonstrate that lubricant compositions of the invention “gave excellent results” and that “[s]imilar excellent results have been achieved with other compositions” of the invention).

With respect to unexpected results, the ’274 patent reports results from comparative testing of nine different lubricating compositions containing low levels of magnesium (samples 1–3), high levels of magnesium in the absence of increased levels of the claimed antioxidants (samples 4–8), and high levels of magnesium in combination with increased levels of the claimed antioxidants. Ex. 1001, 7:50–8:67. Patent Owner contends this testing demonstrates that lubricating compositions with high levels of magnesium and lower levels of antioxidants failed bore polishing tests, whereas samples containing high levels of magnesium in combination with the claimed antioxidants, in the claimed amounts, passed bore polishing tests. PO Resp. 33–34. Patent Owner contends this result was unexpected because it had previously been found that lubricating oils containing magnesium tend to have reduced performance with respect to bore polishing. *Id.*; Ex. 1001, 8:65–67.

In reaching a conclusion of obviousness, “[a]ll of the *Graham* factors must be considered, including the objective indicia when present.” *Millennium Pharms., Inc. v. Sandoz Inc.*, 862 F.3d 1356, 1367 (Fed. Cir. 2017). Indeed, “[e]vidence of objective indicia ‘can be the most probative evidence of nonobviousness in the record.’” *Id.* (citing *Leo Pharm. Prods., Ltd. v. Rea*, 726 F.3d 1346, 1358 (Fed. Cir. 2013)). “To be particularly

probative,” however, “evidence of unexpected results must establish that there is a difference between the results obtained and those of the closest prior art, and that the difference would not have been expected by one of ordinary skill in the art at the time of the invention.” *Bristol-Meyers Squibb Co. v. Teva Pharm. USA, Inc.*, 752 F.3d 967, 977 (Fed. Cir. 2014).

Patent Owner does not compare the results achieved by the lubricants of the '274 patent with those of the closest prior art, much less identify what constitutes the closest prior art. *See In re de Blauwe*, 736 F.2d 699, 705 (Fed. Cir. 1984) (“Moreover, an applicant relying on comparative tests to rebut a prima facie case of obviousness must compare his claimed invention to the closest prior art.”). This lack of analysis significantly reduces the probative value of Patent Owner’s “unexpected results” evidence, especially when there is no dispute that Nicholson expressly teaches a lubricating composition having the specific combination of additives that Patent Owner contends provides the unexpected results reported in the '274 patent, i.e., “greater than 0.05 mass % Mg based on the total mass of the composition” in combination with “one or more ash-free aminic and/or sulfur-free phenolic compounds in an amount of at least 0.6 mass % up to 3.0 mass %.” PO Resp. 33–34; *see In re Dillon*, 919 F.2d 688, 694 (Fed. Cir. 1990) (rejecting an unexpected results argument because the applicant “produced no evidence that her compositions possessed properties not possessed by the prior art compositions. Nor did she show that the prior art compositions and use were so lacking in significance that there was no motivation for others to make obvious variants.”).

In the absence of any comparison between the properties of the lubricants of the '274 patent and those of the closest prior art, Patent

Owner's evidence of secondary considerations is weak, at best. *See In re Baxter Travenol Labs.*, 952 F.2d 388, 392 (Fed. Cir. 1991) ("Mere recognition of latent properties in the prior art does not render nonobvious an otherwise known invention."). When this relatively weak evidence of secondary considerations is considered in combination with Petitioner's strong evidence of obviousness, we determine that Petitioner has demonstrated by a preponderance of the evidence that the subject matter of claim 1 of the '274 patent would have been obvious over the combined disclosures of Nicholson and ACEA 2004.

b. Claim 3

Claim 3 depends from claim 1 and further requires a magnesium content that "is at least 0.06 mass up to 0.15 mass % based on the total mass of the composition." Ex. 1001, 10:7–9. Petitioner calculates that the lubricant of Example IV of Nicholson would have a magnesium content of between 0.197 wt.% and 0.228 wt.%—a range that is higher than the range recited in claim 3. Pet. 36, 41 (citing Ex. 1004 ¶ 64). Petitioner contends, however, that because the E6 category of oil disclosed in ACEA 2004 requires SASH values of ≤ 1.0 mass %, one of ordinary skill in the art would have found it obvious to reduce the magnesium level of Example IV to 0.15 wt.% to achieve a SASH value of 0.975 mass %. *Id.* at 41 (citing Ex. 1004 ¶¶ 38, 66).

We are not persuaded by this argument. The 400 TBN detergent of Nicholson is added to the lubricant to provide an adequate level of detergency. PO Resp. 39–40 (citing Ex. 2025 ¶¶ 85–86). Petitioner does not explain sufficiently how the magnesium content in the detergent in Nicholson Example IV could be reduced from roughly 0.20 to 0.15 wt.%

and still impart an adequate amount of detergency to the lubricant. Nor does Petitioner argue in the Petition that one of ordinary skill in the art would have replaced the magnesium detergent with another type of detergent to achieve a constant level of detergency. As such, Petitioner has not persuasively explained how or why one of ordinary skill in the art would have reduced the magnesium content of Example IV to 0.15 wt.%.

In view of the foregoing, Petitioner has not demonstrated by a preponderance of the evidence that the subject matter of claim 3 would have been obvious over the combined disclosures of Nicholson and ACEA 2004.

c. Claims 6 and 7

Claim 6 depends from claim 5 and requires that the lubricating composition contain a nitrogen-containing dispersant that provides “at least 0.07 mass %” nitrogen to the composition. Ex. 1001, 10:14–16. Claim 7 depends from claim 6 and further requires that the nitrogen-containing dispersant(s) provide a nitrogen content “in the range of from 0.07 to 0.25 mass %.” *Id.* at 10:17–19.

Dispersants a) and b) in Nicholson Example IV contain nitrogen, but Nicholson does not report how much nitrogen these components contribute to the overall composition. Ex. 1009, 5:44–46, 7:19–20, 13:38–52; Ex. 1004 ¶¶ 77–78. To determine the amount of nitrogen dispersants a) and b) impart, Mr. Styer synthesized these two dispersants—which were not commercially available at the time of Mr. Styer’s experiments—according to the instructions provided in Nicholson. Ex. 1006 ¶¶ 47–56; Ex. 1009, 13:13, 13:38–40 (explaining that dispersant a) is made as in Example A-37 and dispersant b) is made as in Example B-4 of Nicholson).

Mr. Styer experimentally determined that synthesized dispersants a) and b) contained 1.9 wt.% nitrogen. Ex. 1006 ¶¶ 55–56. Using Mr. Styer’s results, Dr. Lam calculates that at the treat rates disclosed in Nicholson, the lubricant of Example IV would contain 0.08 wt.% nitrogen, which falls within the ranges recited in claims 6 and 7. Ex. 1004 ¶ 78.

Patent Owner asserts Nicholson simply lacks sufficient information to determine the nitrogen content in Example IV. According to Patent Owner, dispersant a) of Nicholson is synthesized using succinic anhydride and polymer, with the ratio of succinic anhydride to polymer serving to limit the amount of nitrogen that can be incorporated into the dispersant. PO Resp. 43–44. And because Nicholson does not disclose the ratio between these two precursors, Dr. Emert testifies that the actual nitrogen level in Nicholson Example IV could be significantly different from that Mr. Styer determined experimentally. *Id.* at 43 (citing Ex. 2025 ¶¶ 99–100).

Dr. Emert also testifies that it is highly unlikely that the nitrogen content of dispersants a) and b) would be 1.9 wt.%, as Mr. Styer reports. *Id.* at 44 (citing Ex. 2025 ¶ 101). Applying certain assumptions he claims would have been made by one of ordinary skill in the art, Dr. Emert calculates that the highest nitrogen content the dispersants impart would be 0.065 wt.%, and could be significantly less than this amount depending on: the type of polyisobutylene succinic anhydride used, the polymer to succinic anhydride ratio, and the types of filtering and processing steps used. Ex. 2025 ¶ 114.

Patent Owner also contends that Petitioner and Mr. Styer fail to provide sufficient information to allow one of ordinary skill in the art to assess the validity of the measurements Mr. Styer made, as 37 C.F.R.

§ 42.65 requires. PO Resp. 42. In particular, Patent Owner contends Mr. Styer fails to provide information regarding the chemical makeup of the raw materials used to make dispersants a) and b), does not list any assumptions he made, and does not state that the materials he used were the only possible materials that would be within the scope of Nicholson's disclosure. *Id.*

In reply, Petitioner contends Mr. Styer used a standard ASTM-D5291 test to measure nitrogen content and 37 C.F.R. § 42.65 does not require the disclosure of testing data for this type of routine test. Pet. Reply 19–21. Petitioner further asserts that Dr. Emert's calculated levels of nitrogen are not reliable because (1) he calculates the theoretical amount of nitrogen in the reagents, not the dispersant product; (2) he fails to account for the loss of volatile products during testing; and (3) his calculations are "riddled with errors." *Id.* at 22–23. According to Petitioner, each of these problems in Dr. Emert's calculations and assumptions results in under-calculating the nitrogen content in Nicholson Example IV. *Id.*

Here, Petitioner argues that Nicholson Example IV contains a specific amount of nitrogen, not that it would have been obvious to adjust the types and amounts of nitrogen-containing dispersants to achieve the nitrogen ranges set forth in dependent claims 6 and 7. Thus, Petitioner must show that the lubricating composition of Nicholson Example IV necessarily contains nitrogen levels within the ranges recited in claims 6 and 7 of the '274 patent. *See Par Pharm., Inc. v. TWI Pharms., Inc.*, 773 F.3d 1186, 1196 (Fed. Cir. 2014).

Neither the Petition, Dr. Lam, nor Mr. Styer provide a detailed description of the precursors chosen to synthesize dispersants a) and b) of Example IV of Nicholson, or a persuasive explanation as to why the

selection of a ratio of precursor compounds would not affect the experimentally determined nitrogen levels for Example IV of Nicholson. In contrast, Dr. Emert provides extensive explanation as to why the instructions and disclosures provided in Nicholson are simply insufficient to determine with any certainty the nitrogen level of Example IV of Nicholson. Ex. 2025 ¶¶ 88–116. Thus, we credit Dr. Emert’s conclusion that one of ordinary skill in the art would not have been able to determine with any certainty that the nitrogen levels of Example IV of Nicholson are within the range recited in claim 1 of the ’274 patent. *See Par Pharm.*, 773 F.3d at 1195 (explaining that a party must meet a high standard in order to rely on inherency in an obviousness analysis). As such, we are not persuaded that Petitioner’s experimental results establish by a preponderance of the evidence that the lubricating composition of Nicholson Example IV contains at least 0.07 mass % nitrogen.

In its Reply, Petitioner asserts Dr. Emert calculated that the nitrogen content in Nicholson Example IV could be 0.065%, which falls within the range recited in claim 1 when rounded to 0.07%. Pet. Reply 24–25. Petitioner further asserts that there is no evidence the range of nitrogen used in the ’274 patent is critical. *Id.* at 25 (citing *In re Woodruff*, 919 F.2d 1575 (Fed. Cir. 1990)). We do not find this argument persuasive because there is no range of nitrogen content expressly disclosed in Nicholson and Dr. Emert testifies that the actual nitrogen level in Nicholson Example IV could be significantly less than 0.065%, depending on the precursors and filtering equipment used.¹⁶ Ex. 2025 ¶ 114.

¹⁶ To the extent Petitioner is not relying on overlapping nitrogen ranges to support its obviousness arguments, we are directed to no case law that would

In view of the foregoing, we determine that Petitioner has not demonstrated by a preponderance of the evidence that the subject matter of dependent claims 6 and 7 would have been obvious over the combined disclosures of Nicholson and ACEA 2004.

d. Dependent claims 2, 4, 5, and 8–12

Petitioner presents persuasive evidence that the combination of Nicholson and ACEA 2004 teaches or suggests the subject matter of dependent claims 2, 4, 5, and 8–12. Pet. 40–45. In particular, Petitioner persuasively demonstrates: (1) that the use of a conventional 400 TBN detergent in Nicholson Example IV would provide a composition with a magnesium content that does not exceed 0.3 mass % (claim 2) (*id.* at 40 (citing Ex. 1004 ¶¶ 61–63, 74–76)); (2) Nicholson Example IV uses a dispersant (claim 4) that is nitrogen-containing (claim 5) (*id.* at 42–43 (citing Ex. 1009, 13, Example IV)); (3) Nicholson Example IV uses an ash-free antioxidant (claim 8) (*id.* at 43 (citing Ex. 1009, 12:36–38, 13:38–40)); (4) that the sulfated ash content of Nicholson Example IV would be between 1.12 and 1.23 mass %, which is within the ranges recited in claims 9–11 (*id.* at 43–45 (citing Ex. 1004 ¶¶ 76, 112; Ex. 1006 ¶ 60)); and (5) component c) of Nicholson Example IV contains 0.11 wt.% of a metal hydrocarbyl

allow us to read the nitrogen content limitations of claims 6 and 7 out of the claims due to a lack of criticality. *See In re Wilson*, 424 F.2d 1382, 1385 (Fed. Cir. 1970) (“All words in a claim must be considered in judging the patentability of that claim against the prior art.”). And, as noted above, the Petition does not assert that it would have been obvious to adjust the type or amount of nitrogen-containing additives in Nicholson Example IV to achieve the nitrogen levels recited in the claims.

dithiophosphate, which falls within the range recited in claim 12 (*id.* at 45 (citing Ex. 1009, 12:32–33; Ex. 1004 ¶ 79)).

Patent Owner does not expressly contest Petitioner’s evidence and reasoning with respect to dependent claims 2, 4, 5, and 8–12.

Upon review of the evidence of record and the parties’ arguments, we determine that Petitioner has demonstrated by a preponderance of the evidence that the subject matter of dependent claims 2, 4, 5, and 8–12 would have been obvious over the combined disclosures of Nicholson and ACEA 2004.

F. Claim 13 over Nicholson, ACEA 2004, and Arrowsmith ’371

Claim 13 depends from claim 1 and further requires that detergent component (c) comprise a salicylate detergent. Ex. 1001, 10:34–35. Petitioner contends the subject matter of claim 13 would have been obvious over the combined disclosures of Nicholson, ACEA 2004, and Arrowsmith ’371. Pet. 57–59.

Nicholson contemplates the use of magnesium salicylate detergents. Ex. 1009, 10:5–13. Arrowsmith ’371 discloses that salicylate detergents are preferred “over phenate and sulfonate detergents” in view of the need in the art to reduce sulfur in lubricating compositions. Ex. 1020 ¶ 66. Petitioner contends these disclosures would have led one of ordinary skill in the art to substitute the 400 TBN overbased magnesium alkylbenzene sulfonate detergent of Nicholson Example IV with a salicylate detergent. Pet. 57–58 (citing Ex. 1004 ¶¶ 123–125, 150).

Patent Owner does not address Petitioner’s arguments with respect to claim 13 of the ’274 patent.

In view of Nicholson's disclosure of using salicylate detergents, Arrowsmith '371's disclosure that salicylate detergents are preferred over sulfonate detergents, and the then-existing market pressures to reduce levels of sulfur in lubricating compositions, we find persuasive Petitioner's argument that one of ordinary skill in the art would have found it obvious to modify the detergent in Nicholson Example IV from a sulfonate detergent to a salicylate detergent. Thus, Petitioner has demonstrated by a preponderance of the evidence that the subject matter of claim 13 of the '274 patent would have been obvious over the combined disclosures of Nicholson, ACEA 2004, and Arrowsmith '371.

G. Remaining Grounds

Having determined that every claim of the '274 patent is anticipated by Colclough and that claims 1, 2, 4, 5, and 8–13 of the '274 patent would have been obvious in view of the Nicholson-based grounds, we do not address Petitioner's additional obviousness grounds based on Arrowsmith '371 and either Fetterman or Colclough. Pet. 46–57.

III. PATENT OWNER'S CONTINGENT MOTION TO AMEND

Patent Owner filed a contingent Motion to Amend original claims 1–13 and replace them with substitute claims 14–25. MTA 3–4, 27–29. Because we have found that original claims 1–13 of the '274 patent are unpatentable, we proceed to address Patent Owner's contingent Motion to Amend.

A. Illustrative Proposed Substitute Claim

Proposed substitute claim 14 is illustrative of the proposed amended claims¹⁷ and is reproduced below:

14 (substitute for claims 1 and 2): A lubricating oil composition for a diesel engine, comprising the following components:

- (a) a lubricating oil basestock of lubricating viscosity;
 - (b) an antioxidant component;
 - (c) a detergent component; ~~and~~
 - ~~optionally~~ (d) one or more metal hydrocarbyl dithiophosphate compounds in an amount ~~of from 0.0 up to 1.8 mass %; and~~ up to 1.8 mass %; and ~~[[/or]]~~
 - (e) a calcium detergent compound;
- wherein the antioxidant component (b) is selected from one or more ash-free aminic and/or sulfur-free phenolic compounds in an amount of at least 0.6 mass % up to 3.0 mass % based on the total mass of the composition; and the detergent component (c) is an overbased magnesium compound having a total base number (TBN) exceeding 350 mg/g KOH selected from one or more magnesium sulfonates, magnesium salicylates, and magnesium phenates and which provide the composition with greater than 0.05 mass up to 0.15 mass % Mg based on the total mass of the composition, and wherein the sulfated ash content of the composition is at least 0.6 mass % to not more than 2.0 mass % as determined by ASTM D874.

MTA 27.

B. Claim Construction

Proposed substitute claim 14 strikes the term “optionally” and amends the limitation “of from 0.0 to 1.8 mass %” to read “up to 1.8 mass %.”

¹⁷ According to Patent Owner, claim 14 is the only claim that has been substantively amended, with all other substitute claims amended “only to update their dependency.” MTA 3.

MTA 27. The parties dispute whether these modifications now require that component (d) be present in the claimed lubricating oil composition and, if so, whether there is adequate written description support for such an amendment. Opp. MTA 1–4; MTA Reply 2–4. We need not address these issues, however, because we find that proposed substitute claims 14–25 would have been obvious under either parties’ proposed construction. See *Nidec Motor*, 868 F.3d at 1017.

*C. Obviousness of Claims 14–25 over Arrowsmith ’299*¹⁸

Petitioner contends the subject matter of proposed substitute claims 14–25 would have been obvious over the disclosures of Arrowsmith ’299. Opp. MTA 9–11.

1. Arrowsmith ’299

Arrowsmith ’299 discloses lubricating oil compositions having “reduced levels of sulfated ash, phosphorous and sulfur (low ‘SAPS’).” Ex. 1013 ¶ 1. Arrowsmith ’299 explains that environmental concerns and the need to ensure compatibility with pollution control devices used in modern engines has led to “a continued effort to reduce the content of sulfated ash, phosphorus and sulfur” in crankcase lubricants. *Id.* ¶ 4. Arrowsmith ’299 discloses that one particular goal for formulators was to

¹⁸ Petitioner bears the burden of proving unpatentability by a preponderance of the evidence. 35 U.S.C. § 316(e). Patent Owner, however, bears the burden of demonstrating that the requirements of 35 U.S.C. § 316(d)(A)–(B) and § 316(d)(3) and 37 C.F.R. § 42.121 for motions to amend are met. See *Aqua Prods., Inc. v. Matal*, 872 F.3d 1290, 1305–06 (Fed. Cir. 2017). Because we find proposed amended claims 14–25 would have been obvious over the disclosures of Arrowsmith ’299, we do not address whether Patent Owner has met these statutory and regulatory requirements.

create lubricants with sufficiently low SAPS to meet the requirements of the E6 category of oil in ACEA. *Id.* ¶¶ 4, 6.

Arrowsmith '299 explains that in order to achieve low SAPS, practitioners have sought to reduce the overbasing of detergents. *Id.* ¶ 6. This reduction in overbasing, however, also reduces the acid neutralization capacity of the lubricating oil. *Id.* (speculating that the reduced performance in reduced overbasing compositions was due to “acid corrosion in the top-groove area of the engine piston”). Arrowsmith '299 determined that this problem could be overcome by adding “relatively small amounts of compounds containing molybdenum and sulfur,” resulting in a low SAPS lubricating oil composition demonstrating excellent performance in diesel engines. *Id.* ¶ 7.

Table 2 of Arrowsmith '299, reproduced below, shows the composition of Comparative Examples 1–3, Inventive Examples 4 and 5, and Comparative Example 6 (*id.* ¶ 124).

TABLE 2						
Component	1 (Comp.)	2 (Comp.)	3 (Comp.)	4 (Inv.)	5 (Inv.)	6 (Comp.)
Det(s).	A, B	A, B	A, B	A, B, C	A, B, C	A, B
Tot. Det.	8.62	7.15	6.95	5.65	5.65	7.15
MoDTC	—	—	—	0.09	0.09	0.50
ZDDP	1.47	0.88	0.80	1.00	1.00	1.00
Other Add.	20.71	21.50	22.50	22.01	22.51	22.40
Basestock	69.20	70.47	69.75	71.25	70.75	68.95
Total	100.00	100.00	100.00	100.00	100.00	100.00

As shown in Table 2, Inventive Examples 4 and 5 contain detergents A, B, and C, a molybdenum dithiocarbamate (MODTC) compound, zinc dihydrocarbyl dithiophosphate (ZDDP), a basestock, and “other additives.” *Id.* ¶¶ 82, 124–125, Table 2.

Detergent A is an overbased 168 BN calcium salicylate detergent, detergent B is a neutral 64 BN calcium salicylate detergent, and detergent C is a highly overbased 400 BN magnesium sulfonate detergent. *Id.* ¶ 125. Arrowsmith '299 reports that the “other additives” used in the disclosed examples are “a combination of a low molecular weight borated dispersant, a high molecular weight non-borated dispersant, antioxidant, corrosion inhibitor, viscosity modifier and lubricating oil flow improver (LOFI).” *Id.* Arrowsmith '299 does not identify the type of antioxidant used in the “other additives,” but discloses that:

[p]referably, lubricating oil compositions in accordance with the present invention contain from about 0.05 to about 5 mass %, preferably from about 0.10 to about 3 mass %, most preferably from about 0.20 to about 2.5 mass % of phenolic antioxidant, aminic antioxidant, or a combination thereof, based on the total weight of the lubricating oil composition.

Id. ¶ 113.

2. *The Parties' Arguments*

Petitioner persuasively demonstrates that the lubricating compositions of Inventive Examples 4 and 5 of Arrowsmith '299 contain: (1) ZDDP (a metal hydrocarbyl dithiophosphate compound) in an amount of 1.0 mass % (Opp. MTA 9 (citing Ex. 1013, Table 2)); (2) a calcium salicylate detergent (*id.* (citing Ex. 1013 ¶ 125)); and (3) an overbased magnesium sulfonate detergent providing 0.07 wt.% magnesium to the composition (*id.* (citing Ex. 1013 ¶ 125, Table 3)). Petitioner also demonstrates that the lubricating compositions of Inventive Examples 4 and 5 have a SASH content of 1.0 mass % (*id.* (citing Ex. 1013, Table 3)).

Petitioner concedes that Tables 2 and 3 of Arrowsmith '299 do not identify the amount of antioxidant used in Inventive Examples 4 and 5, but

contends the reference discloses a most preferred range of antioxidants of “about 0.2 to about 2.5 mass %,” which overlaps with the range recited in claim 14. *Id.* at 10 (citing Ex. 1013 ¶ 113). According to Petitioner, one of ordinary skill in the art seeking to formulate the lubricating compositions of Inventive Examples 4 and 5 of Arrowsmith ’299 “would have had no choice but to consult” this guidance when determining the amount of antioxidant to use in these Examples. *Id.* (citing Ex. 1013 ¶¶ 113, 125).

With respect to the particular type of antioxidant, Petitioner contends Arrowsmith ’299 discloses the use of hindered phenols (a sulfur free antioxidant) and amines (which may be ash-free) as antioxidants. *Id.* at 10 (citing Ex. 1013 ¶¶ 111–112). Petitioner further contends that one of ordinary skill in the art would have found it obvious to select an ash-free aminic and/or a sulfur-free hindered phenol antioxidant for use in Inventive Examples 4 and 5 of Arrowsmith ’299, as it was understood in the art that these compounds do not increase SASH or sulfur levels. *Id.* (citing Ex. 1013 ¶¶ 1, 7, 11, 120) (asserting that Arrowsmith ’299 formulates for low SAPS); *see also id.* at 10 n.2 (asserting that experiments conducted by Ciba (provided as Exhibit 1043) corroborate that the general trend in the industry was to formulate for low SAPS, especially by using ash-free and sulphur-free antioxidants).

In reply, Patent Owner asserts that one of ordinary skill in the art would not have sought to use the claimed types or amount of antioxidants in Arrowsmith ’299, because Examples 4 and 5 already include a sulfur-containing molybdenum compound that is meant to act as an antioxidant and Arrowsmith ’299 is “open to the use of virtually any antioxidant.” MTA Reply 8 (citing Ex. 1013 ¶¶ 111, 113; Ex. 2039 ¶¶ 28–34).

3. Analysis—Proposed Substitute Claim 14

Inventive Examples 4 and 5 of Arrowsmith '299 expressly include an additional antioxidant that is added as part of the “other additives.”

Ex. 1013 ¶ 125, Table 2. Thus, we agree with Petitioner that Arrowsmith '299 expressly contemplates using the molybdenum compound in combination with an additional antioxidant. Opp. MTA 9–10.

With respect to the type of additional antioxidant used in Arrowsmith '299's Example lubricants, we find that one of ordinary skill in the art, needing to select an antioxidant for use in Inventive Examples 4 and 5, would have found it obvious to select from the preferred types of antioxidants identified in the reference, i.e., a “phenolic antioxidant, aminic antioxidant, or a combination of thereof.” Ex. 1013 ¶ 113; Opp. MTA 10. We also find that one of ordinary skill in the art, needing to comply with Arrowsmith '299's express goal of producing lubricating compositions with low SAPS, would have been directly led to select an ash-free aminic and/or a sulfur-free phenolic antioxidant from the group of preferred antioxidants. Opp. MTA 10; Ex. 1013 ¶¶ 1 (explaining that “the present invention is directed to lubricating oil compositions that . . . have reduced levels of sulfated ash, phosphorus and sulfur (low ‘SAPS’”), 6 (noting that, in formulating low SAPS lubricants for the ACEA E6 category, the ash produced by the ash-producing compounds must remain below the 1.0 mass % ash content limitation of the specification); *see also* Pet. 25–26 (citing Ex. 1020 ¶ 66 (“[T]he use of sulphur-containing additives should be minimized or avoided where possible.”)).

With respect to the amount of ash-free aminic and/or a sulfur-free phenolic antioxidant to be used in Inventive Examples 4 and 5 of

Arrowsmith '299, as Petitioner notes, the preferred range of antioxidants in Arrowsmith '299 is from “about 0.05 to about 5 mass %” and the most preferred range is “from about 0.20 to about 2.5 mass %.” Ex. 1013 ¶ 113. These ranges fully encompass (the preferred range) or significantly overlap (the most preferred range) the claimed range of “0.6 mass % up to 3.0 mass %.” This overlap in ranges shifts the burden of production to Patent Owner to come forward with evidence explaining why the claimed range would not have been obvious. *See E.I. duPont de Nemours & Co. v. Synvina C.V.*, 2018 WL 4390796, at * 7–9 (Fed. Cir. Sept. 17, 2018); *Galderma Labs, L.P. v. Tolmar, Inc.*, 737 F.3d 731, 738–39 (Fed. Cir. 2013) (citing *Novo Nordisk A/S v. Caraco Pharm. Labs., Ltd.*, 719 F.3d 1346, 1352–54 (Fed. Cir. 2013)); *In re Peterson*, 315 F.3d 1325, 1330 (Fed. Cir. 2003) (“The normal desire of scientists . . . to improve upon what is already generally known provides the motivation to determine where in a disclosed set of percentage ranges is the optimum combination of percentages.”).

Evidence that the claimed range provides “unexpected results” may satisfy Patent Owner’s burden of production. *See Iron Grip Barbell Co. v. USA Sports, Inc.*, 392 F.3d 1317, 1322 (Fed. Cir. 2004). As noted above, however, Patent Owner does not compare the claimed invention to the closest prior art when assessing unexpected results or address the fact that lubricating compositions with elevated magnesium levels in combination with the claimed antioxidants were known in the art. Thus, Patent Owner’s evidence of unexpected results is not persuasive. Moreover, Patent Owner does not address Arrowsmith '299’s disclosure that, despite the known problem of “increased bore polishing” resulting from the use of magnesium-based detergents, its composition containing 0.07 wt.% magnesium and the

disclosed antioxidants “surprisingly” provided “superior cylinder wear performance.” Ex. 1013 ¶¶ 5 (noting that it was understood in the art that magnesium-based detergents “increased bore polishing”), 128 (noting that, despite the presence of 0.07 wt.% magnesium in Inventive Examples 4 and 5, “surprisingly, the magnesium-containing inventive lubricating oil compositions provided superior cylinder wear performance”). Thus, we are not persuaded that Patent Owner has produced evidence of “unexpected results” sufficient to overcome the presumption of obviousness based on overlapping ranges.

Patent Owner contends Petitioner’s obviousness arguments based on Arrowsmith ’299 should be rejected because they rely “solely on attorney conjecture.” MTA Reply 8 (citing *Ebit Sys. of Am., LLC v. Thales Visionix, Inc.*, 881 F.3d 1354, 1359 (Fed. Cir. 2018)). On this point, we recognize that only Patent Owner has presented declaration testimony directed to the disclosures of Arrowsmith ’299. Petitioner does, however, persuasively cite to the express disclosures of Arrowsmith ’299 to support its conclusions. In contrast, Dr. Emert fails to adequately address the express teachings of Arrowsmith ’299, including its express disclosure that Inventive Examples 4 and 5 contain both a molybdenum compound and an additional antioxidant, its disclosure that the lubricating compositions should have low SAPS, and its disclosure of preferred levels of antioxidants that fully encompass or significantly overlap the range recited in proposed substitute claim 14. Thus, we do not find Petitioner’s lack of supporting declaration testimony to be dispositive in this case.

In view of the foregoing, we find that Petitioner has explained sufficiently why Arrowsmith ’299 teaches or suggests every limitation of

proposed substitute claim 14. Thus, we determine that Petitioner has demonstrated by a preponderance of the evidence that the subject matter of proposed substitute claim 14 would have been obvious over Arrowsmith '299.

4. Analysis—Substitute Dependent Claims 15–25

Petitioner presents evidence that Arrowsmith '299 teaches or suggests every limitation of proposed substitute claims 15–25. Opp. MTA 11. For example, Petitioner demonstrates that Arrowsmith '299 teaches or suggests: (1) a lubricating composition containing 0.07 mass % magnesium, which falls within the range of claim 15 (*id.* (citing Ex. 1013, Table 3)); (2) the use of a borated and a non-borated dispersant that provide 0.17 mass % (example 4) and 0.16 mass % (example 5) nitrogen to the lubricant composition (claims 16–19) (*id.* (citing Ex. 1013, Table 3)); (3) an ash-free antioxidant (claim 20) (*id.* (citing Ex. 1013 ¶ 120)); (4) a SASH content of 1.0 mass % (claims 21–23) (*id.* (citing Ex. 1013, Table 3)); (5) a phosphorus content of 0.08 mass % that is provided by ZDDP (a metal hydrocarbyl dithiophosphate), which falls within the range recited in claim 24 (*id.* (citing Ex. 1013, Table 3)); and (6) a calcium salicylate detergent (claim 25) (*id.* (citing Ex. 1013 ¶ 125)).

Patent Owner does not expressly dispute that Arrowsmith '299 teaches or suggests the limitations of proposed substitute claims 15–25.

Upon review of Petitioner's arguments and supporting evidence, we determine that Petitioner has demonstrated by a preponderance of the evidence that the subject matter of proposed substitute claims 15–25 would have been obvious in view of the disclosures of Arrowsmith '299.

D. Petitioner's Remaining Grounds

Petitioner contends that proposed substitute claims 14–23 are anticipated by Colclough, claims 14–16 and 20–23 are anticipated by Diggs, and that one or more of claims 14–25 would have been obvious in light of the recited grounds based on Nicholson, Locke, Diggs, and Bloch. Opp. MTA 5. In view of our determination that proposed substitute claims 14–25 would have been obvious in view of Arrowsmith '299, we do not address these additional grounds.

E. Duty of Candor

Petitioner contends Patent Owner was aware of the Arrowsmith '299 and Diggs references prior to filing its Motion to Amend, but failed to disclose these references to the Board. Opp. MTA 23–24. In view of this lack of disclosure, Petitioner requests that we deny the Motion to Amend. *Id.* at 24–25.

Our determination that proposed substitute claims 14–25 would have been obvious over Arrowsmith '299 renders Petitioner's requested relief moot. Thus, we do not address this issue.

IV. MOTIONS TO EXCLUDE

Petitioner and Patent Owner both filed motions to exclude. Paper 36 ("Pet. MTE"); Paper 39 ("PO MTE"). We address these motions in turn.

A. Petitioner's Motion to Exclude

Petitioner moves to exclude Exhibits 2014, 2017, 2018–2020, 2024, 2025, 2037, and 2038. Pet. MTE.

1. Exhibits 2014, 2017, 2018, and 2024

Exhibits 2014, 2017, 2018, and 2024 are directed to the composition of Irganox L-57 and are all dated after the earliest filing dates of the '274

patent and Colclough. Pet. MTE 3–4. Petitioner contends there is a “significant danger of using post-filing evidence” to determine the antioxidant content of Colclough, as Patent Owner’s arguments are based on “assumptions that may not have existed prior to the relevant date.” *Id.* at 4. Thus, Petitioner requests that the identified exhibits be excluded as irrelevant and unfairly prejudicial. *Id.*

Post-filing evidence may be used to show the state of the art existing at the time of filing of the patent-at-issue. *See Plant Genetic Sys. v. DeKalb Genetics Corp.*, 315 F.3d 1335, 1344 (Fed. Cir. 2003). In addition, the question of whether Patent Owner’s post-filing evidence is sufficiently probative of the contents of the Irganox L-57 product used in Colclough goes to the weight to be given the evidence, not its admissibility. Thus, we decline to exclude Exhibits 2014, 2017, 2018, and 2024.

2. Exhibits 2019 and 2020

Exhibits 2019 and 2020 are material safety data sheets for Irganox 5057. Petitioner contends these exhibits should be excluded because Irganox 5057 is not Irganox L-57 and Patent Owner is purposely trying to mislead the Board by referring to Exhibits 2019 and 2020 as Irganox L-57. Pet. MTE 5 (citing Paper 16).

Patent Owner contends Irganox 5057 is made using the same materials and the same reaction as Irganox L-57, so data sheets relating to this compound are relevant to show what one of ordinary skill in the art would have understood the composition of Irganox L-57 to have been when used in Colclough. Paper 41, 7 (“Opp. Pet MTE”) (citing Ex. 2025 ¶ 57).

Although Patent Owner’s Response is less than precise in identifying Exhibits 2019 and 2020 as relating to “Irganox L 57” (PO Resp. iv) and in

citing to Exhibits 2019 and 2020 for propositions relating to the contents of Irganox L-57 (*id.* at 22), Dr. Emert's testimony is clear that the data sheets relate to Irganox 5057 and are relied upon to show a consistent effort by the manufacturer of Irganox L-57 and Irganox 5057 to improve product purity. Ex. 2025 ¶ 57. Accordingly, we do not agree that Exhibits 2019 and 2020 were used to mislead the Board. Moreover, the question of what these Exhibits ultimately demonstrate with respect to the Irganox L-57 product identified in Colclough goes to the weight to be given the evidence, not its admissibility. Thus, we decline to exclude Exhibits 2019 and 2020.

3. Exhibit 2025

Exhibit 2025 is the first declaration of Dr. Emert. Petitioner moves to exclude this document in view of Dr. Emert's reliance on post-filing evidence and in view of Dr. Emert's allegedly unreliable calculations with respect to the nitrogen content of Nicholson. Pet. MTE 5.

We are not persuaded that this exhibit should be excluded. First, as noted above, Dr. Emert's reliance on post-filing evidence is not, per se, improper. Second, the question of whether Dr. Emert's nitrogen calculations are incorrect goes to the weight to be given to this evidence, not its admissibility.

4. Exhibits 2037 and 2038

Exhibit 2037 is a declaration of Jacob Levine and Exhibit 2038 is an email relied upon by Patent Owner to demonstrate the date a draft patent application was provided to counsel. Petitioner moves to exclude these documents in view of an undefined and unexplained redaction for attorney-client privilege. Pet. MTE 8–9.

Exhibits 2037 and 2038 were submitted to address Petitioner's asserted ground of unpatentability based on Diggs (Ex. 1045). Opp. MTA 19–21; MTA Reply 4–5, 10. Because we do not discuss this ground of unpatentability in addressing the Motion to Amend, Petitioner's motion to exclude Exhibits 2037 and 2038 is moot.

5. Conclusion

For the reasons stated above, we deny Petitioner's motion to exclude Exhibits 2014, 2017, 2018–2020, 2024, and 2025 and dismiss Petitioner's motion to exclude Exhibits 2037 and 2038 as moot.

B. Patent Owner's Motion to Exclude

Patent Owner moves to exclude paragraphs 54–56 of Mr. Styer's declaration, paragraph 77 of Dr. Lam's declaration, and paragraphs 9–17, 19–20, 33–37, and 41 of Dr. Lam's supplemental declaration. PO MTE 1. Patent Owner also moves to exclude Exhibits 1051, 1052, and 1053. *Id.* at 5–7.

1. Testimony of Mr. Styer and Dr. Lam

Patent Owner contends Mr. Styer's experimental results relating to the level of nitrogen in Nicholson's dispersants is flawed and unsupported by the information reported in Nicholson itself. PO MTE 2–5. Patent Owner further contends that Dr. Lam's reliance on Mr. Styer's results is likewise flawed. *Id.* In view of these alleged deficiencies, Patent Owner moves to exclude paragraphs 54–56 of Mr. Styer's declaration, paragraph 77 of Dr. Lam's declaration, and paragraphs 9–17, 19, 20, 33–37, and 41 of Dr. Lam's supplemental declaration. *Id.*

Whether Mr. Styer's experiments are sufficiently reflective of the nitrogen content in Nicholson Example IV goes to the weight we should

give his testimony. Thus, we deny Patent Owner's motion to exclude the identified paragraphs of Mr. Styer's and Dr. Lam's declarations.

2. Exhibits 1051–1053

Patent Owner contends Exhibits 1051–1053 are cited in Dr. Lam's second declaration, but are not cited in Petitioner's Reply to Grounds 3 and 4. PO MTE 6–7. Because we have not considered the grounds based on Fetterman addressed in Petitioner's Reply to Grounds 3 and 4, we dismiss Patent Owner's motion to exclude Exhibits 1051–1053 as moot.

3. Conclusion

For the reasons set forth above, we deny Patent Owner's motion to exclude the above-identified portions of Dr. Lam's and Mr. Styer's testimony and dismiss its motion to exclude Exhibits 1051–1053 as moot.

V. CONCLUSION

For the reasons set forth above, we determine:

Petitioner has demonstrated by a preponderance of the evidence that claims 1–11 of the '274 patent are anticipated under 35 U.S.C. § 102 by Colclough;

Petitioner has demonstrated by a preponderance of the evidence that claims 1, 2, 4, 5, and 8–12 of the '274 patent are unpatentable under 35 U.S.C. § 103 as having been obvious over Nicholson and ACEA 2004;

Petitioner has demonstrated by a preponderance of the evidence that claim 13 of the '274 patent is unpatentable under 35 U.S.C. § 103 as having been obvious over Nicholson, ACEA 2004, and Arrowsmith '371; and

Petitioner has demonstrated by a preponderance of the evidence that proposed substitute claims 14–25 are unpatentable under 35 U.S.C. § 103 as having been obvious over Arrowsmith '299.

VI. ORDER

In view of the foregoing, it is hereby:

ORDERED that claims 1–13 of the '274 patent are unpatentable;

FURTHER ORDERED that Patent Owner's Motion to Amend is *denied*;

FURTHER ORDERED that Petitioner's Motion to Exclude is *denied* with respect to Exhibits 2014, 2017, 2018–2020, 2024, and 2025 and dismissed as *moot* with respect to Exhibits 2037 and 2038;

FURTHER ORDERED that Patent Owner's Motion to Exclude portions of the testimony of Dr. Lam and Mr. Styer is *denied* and Patent Owner's Motion to Exclude Exhibits 1051–1053 is dismissed as *moot*; and

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

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