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Paper 50
Entered: January 22, 2016

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VOLKSWAGEN GROUP OF AMERICA, INC.,
Petitioner,

v.

EMERACHEM HOLDINGS, LLC,
Patent Owner.

Case IPR2014-01555
Patent 5,451,558

Before FRED E. McKELVEY, JAMES T. MOORE, and SHERIDAN K. SNEDDEN, *Administrative Patent Judges*.

McKELVEY, *Administrative Patent Judge*.

DECISION
Final Written Decision
37 C.F.R. § 318(a)

I. Introduction

Pending before the Board is entry of a Final Written Decision.

A Petition was filed on 30 September 2014. Paper 1.

An *inter partes* review trial was ordered on 16 March 2015. Paper 21, rehearing granted-in-part, Paper 26 (15 April 2015).

Patent Owner timely filed an Opposition to the Petition. Paper 29.

Petitioner timely filed a Reply. Paper 32.

Patent Owner has also filed a first Motion to Exclude (Paper 34) and a second Motion to Exclude (Paper 37). Petitioner has opposed (Paper 43).

II. Background

A. The Parties

Petitioner is Volkswagen Group of America, Inc. Paper 2, page 1.

Patent Owner is EmeraChem Holdings, LLC. Paper 6, page 2.

B. Involved Patent

The involved patent is expired U.S. Patent 5,451,558 ("the '558 patent") issued 19 September 1995, based on an application filed 4 February 1994. Ex. 1001.

A description of the '558 patent is set out below.

Because the '558 patent has expired, we have not interpreted the claims using the broadest reasonable interpretation. 37 C.F.R. § 42.100(b); *In re Rambus*, 694 F.3d 42, 46 (Fed. Cir. 2012) (Board's claim construction of expired patent similar to district court's) (citing *Ex parte Papst-Motoren*, 1 USPQ2d 1655, 1655–56 (BPAI 1986)).

C. Litigation

The '588 patent is involved in litigation, *viz*., *EmeraChem Holdings, LLC v. Volkswagen Group of America, Inc., Volkswagen AG, and Volkswagen Group of America Chattanooga Operations, LLC*, No. 14-cv-132-PLR-HBG (E.D. Tenn. filed Mar. 31, 2014). Paper 2, page 1; Paper 6, page 1.

An amended complaint was served on defendant Volkswagen Group of America Chattanooga Operations, LLC, on 6 November 2014. Paper 12, page 2.

An amended complaint was served on defendant Volkswagen Group of America, Inc., on 6 November 2014. Paper 12, page 1.

An amended complaint was served on defendant Volkswagen AG on 8 January 2015. *Id*.

D. Evidence Relied Upon

The following prior art, listed in numerical order by exhibit number, is relied upon in support of the Petition:

Name	**Exhibit No.**	**Description**	**Date**
Takeshima et al. "Takeshima"	1004B	International Patent Application PCT/JP92/01279, published as WO 93/07363 A1	15 Apr. 1993
Hoekstra	1005A	U.S. Patent No. 3,849,343	19 Nov. 1974
Kinoshita et al. "Kinoshita"	1006A	U.S. Patent No. 4,369,132	18 Jan. 1983
Inui et al. "Inui"	1007B	Japanese Patent Application Publication No. H4-367724	21 Dec. 1992
Stiles et al. "Stiles"	1008A	U.S. Patent No. 5,362,463	8 Nov. 1994 filed 26 Aug. 1992

E. Grounds

Claims 1–45 appear in the ’588 patent.

An *inter partes* review trial was instituted on the following claims and prior art (I means instituted based on § 102 unless otherwise noted; NI means not instituted).

Claim	**Takeshima Ground 1**	**Hoekstra Ground 2**	**Kinoshita Ground 3**	**Inui Ground 4**	**Stiles Ground 5**
1	I	I	I	I	I
2			I	I	
7	I	I	I	I	I
8	I	I	I	I	I
9		I–§ 103	I	I	
10		I–§ 103	I	I	
11		I–§ 103			
12		I			
14	I	I	I	I	I
15			I	I	I
16					I
17			I	I	I
19			I	I	I
21		I			I–§ 103
22		I			I–§ 103
23		I–§ 103			I–§ 103
24			I	I	
31			I	I	I
32	I	I			
33		I	I	I	
34		I	I	I	
35		I	I	I	
36		NI	I	I	
37			I	I	

Claim	Takeshima Ground 1	Hoekstra Ground 2	Kinoshita Ground 3	Inui Ground 4	Stiles Ground 5
38		I	I		
39		I	I	I	
40		I	I	I	
41		I			
42		I	I	NI	
44			I		

See Decision on Rehearing (Paper 26, pages 3–4). Claims of the '558 patent not challenged have not been listed.

F. Oral Argument

Oral argument was held on 23 November 2015.

Prior to oral argument, and based on the Petition, Opposition, and Reply, the Board invited the parties to address specific issues at oral argument. Paper 46, pages 3–4.

A transcript of oral argument has been placed in the record. Paper 49.

Some of the oral argument presented by both parties was not consistent with oral argument procedure applicable before the Board. In particular, arguments were made that were not based on arguments in the Petition, Opposition, or Reply. In addition, explanations were proffered that are not supported by evidence in the record or arguments previously made in the Petition, Opposition, or Reply. *See, e.g.*, Transcript of Oral Argument, Paper 49, page 18:6 through page 19:12.

Oral argument is governed in part by 37 C.F.R. § 42.70(a) (first sentence) (italics added):

> (a) A party may request oral argument *on an issue raised in a paper* at a time set by the Board.

The Trial Practice Guidelines advise as follows:

> A party may rely upon evidence that has been previously submitted in the proceeding and *may only present arguments relied upon in the papers previously submitted*. *No new evidence or arguments may be presented at the oral argument*.

Office Patent Trial Practice Guide, 77 Fed. Reg. 48756, 48768 (col. 2) (Aug. 14, 2012) (italics added).

The rationale in support of the Rule and Guideline is fundamental fairness to an opponent. 37 C.F.R. § 42.1(b) (Part 42 "shall be construed to secure the just, speedy, and inexpensive resolution of every proceeding."). It is not just to an opponent for a party to raise an argument not based on the Petition, Opposition, or Reply, or to discuss evidence not in the record. Why? There is no meaningful opportunity for the opponent to rebut the argument or address the evidence. Likewise, the Board is at a disadvantage because judges do not prepare for oral argument based on arguments and evidence not present in the record.

To the extent that arguments and discussions took place at oral argument in this case contrary to the principles set out above, those arguments and discussions have not been considered in rendering a decision on the merits.

G. The '558 patent

Figures 1A, 1B, and 1C of the '558 patent are reproduced below.

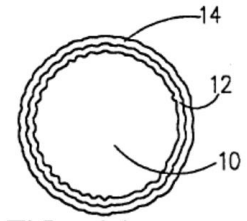


FIG. 1A

Fig. 1A depicts a schematic drawing of a catalyst absorber sphere.

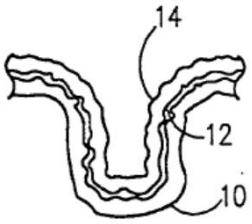


FIG. 1B

Fig. 1B depicts a magnified schematic representation of a portion of a catalyst absorber sphere.

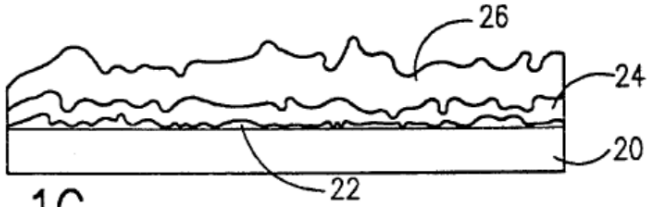


FIG. 1C

Fig. 1C depicts a schematic drawing of the surface of a monolith catalyst absorber.

The ’558 patent explains:

> As shown in FIG. **1**, the catalyst absorber of the present invention can take on different configurations. FIG. **1***a* shows a spherical catalyst absorber made up of an alumina sphere **10** with a platinum coating **12** and a carbonate coating **14** thereon. As shown in FIG. **1***b*, the surface of the sphere is very irregular so that there is an extremely large surface area per gram of material as described herein. As shown in FIG. **1***c*, the catalyst absorber can be in the form of a monolith surface including a ceramic or stainless steel support **20**, an alumina layer **22**, a platinum layer **24** and a carbonate layer **26**.

Ex. 1001A, 4:65–5:8.

With reference to Figures 1A through 1C, independent composition claim 1 of the ’558 patent reads (indentation, drawing element numbers, and matter in brackets added):

> A material for removing gaseous pollutants from combustion exhaust comprising
>
> [1] an oxidation catalyst specie selected from platinum **[12**, **24]**, palladium, rhodium, cobalt, nickel, iron, copper, molybdenum or combinations thereof
>
> [2] disposed on a high surface area support **[10, 20]**,
>
> [3] said catalytic component[1] being intimately and entirely coated with an absorber selected from a hydroxide,

[1] There is no antecedent for “said catalytic compound” in claim 1; we construe “said catalytic component” to refer to “an oxidation catalyst.”

carbonate **[14**, **26]**, bicarbonate or mixtures thereof of an alkali or alkaline earth or mixtures thereof.

Ex. 1001, col. 12:30–38.

Figure 2 of the '558 patent is reproduced below.

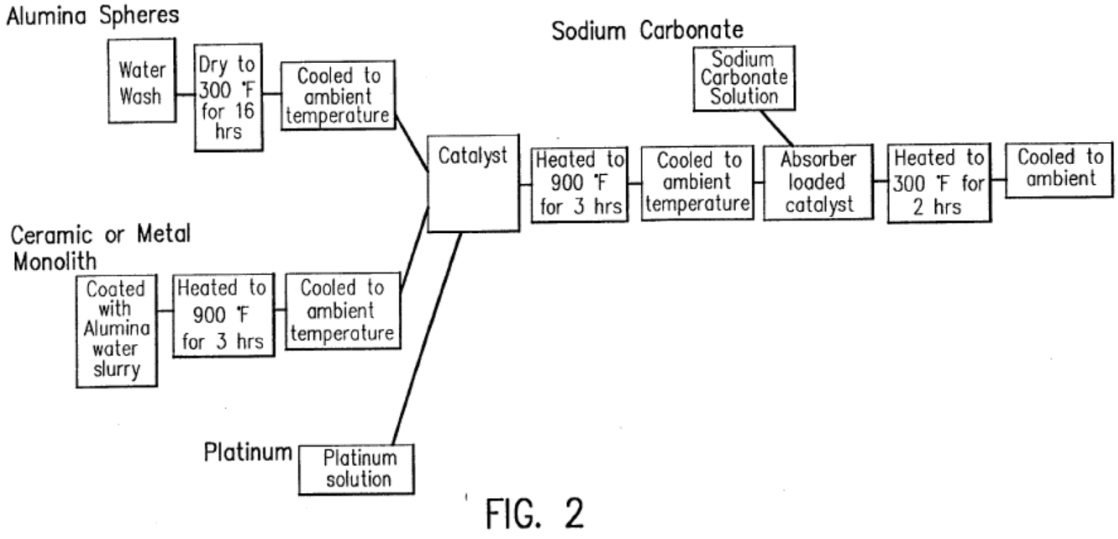


FIG. 2

Fig. 2 depicts a flowchart illustrating a process of making the catalyst.

With reference to Figures 1 and 2, the '558 patent explains:

> The method of making the catalyst absorber is shown in FIG. **2**. The catalyst/absorber of the present invention is made by starting with high surface area alumina spheres [**10**] having a surface area of 50 to 350 square meters per gram . . . . The spheres are approximately 1/8 inch in diameter. . . . The alumina spheres are washed with distilled water to remove small particles bound loosely to the surface. The spheres are then dried for about 16 hours at 300° F. to ensure that all of the cavities and interstices in the spheres are fully dried, and that the surface is free of water. The spheres

> are then stored in an air-tight container until ready for further processing.
>
> A solution of Pt 2-ethylhexanoate [platinum 2-ethylhexanoate] which contained 25% Pt [platinum] was added to toluene to get a concentration of Pt such that the weight of solution equal to the toluene uptake would contain sufficient Pt to give a loading of 0.23 weight percent per weight of alumina. The platinum *coated* spheres [Figs. 1A and 1B, elements **10** and **12**] were then dried for 1 hour at 900º F. in air. The spheres are then cooled to approximately room temperature and stored in an air-tight container again. The platinum *coated* spheres [Figs. 1A and 1B, elements **10** and **12**] are then *coated* with an alkali or alkaline earth carbonate or bicarbonate coating [Figs. 1A and 1B, element **14**], the alkali or alkaline earth carbonate or bicarbonate being selected from lithium, sodium, potassium or calcium carbonate or bicarbonate solution, preferably, a sodium carbonate solution at a concentration of 14 percent by weight in distilled water. The water was heated to dissolve all of the sodium carbonate. The carbonate coated spheres were then dried at 300º F. for two hours. The final catalyst absorber had a coating of platinum in the amount of 0.23 weight percent added to the alumina, and 10.0 weight percent Na_2CO_3 [sodium carbonate] added to the alumina.

Ex. 1001A, 5:9–47 (italics added).

Independent method claim 33 of the ’558 patent reads (indentation and matter in brackets added):

> A process of preparing a material for removing gaseous pollutants comprising

> [1] depositing an oxidation catalyst specie [Fig. 1A, **12**] selected from platinum, palladium, rhodium, cobalt, nickel, iron, copper, molybdenum or combination[s] thereof from a solution onto a high surface area support [Fig. 1A, **10**],
>
> [2] drying said support and
>
> [3] depositing from a solution over said oxidation catalyst specie[s] an absorber [Fig. 1A, **14**] selected from a hydroxide, carbonate or bicarbonate and mixtures thereof of an alkali or alkaline [earth] or mixtures thereof and
>
> [4] drying the support thereby coating said oxidation catalyst specie[s] with said absorber.

Ex. 1001, col. 14:3–13.

III. Analysis—Takeshima (Ground 1)

A. Challenge

According to Petitioner, claims 1, 7, 8, 14, and 32 of the '558 patent are anticipated by Takeshima (Ex. 1004B). Paper 2, pages 12 and 17–25; Paper 32, pages 10–14.

Patent Owner disagrees. Paper 29, pages 11–13.

B. Anticipation

To establish anticipation, a party must show by a preponderance of the evidence that a prior art reference expressly or inherently describes each claim limitation arranged as in the claim said to be anticipated. *Finisar Corp. v. DirecTV Group, Inc.*, 523 F.3d 1323, 1334–35 (Fed. Cir. 2008),

as further amplified by *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1371 (Fed. Cir. 2008).

Whether a reference anticipates a claim is a question of fact. *In re Baxter Travenol Lab.*, 952 F.2d 388, 390 (Fed. Cir. 1991).

C. Claim 1

Claim 1 reads (matter in brackets added; principal limitation in dispute in italics):

> A material for removing gaseous pollutants from combustion exhaust comprising
>
> [1] an oxidation catalyst specie selected from platinum, palladium, rhodium, cobalt, nickel, iron, copper, molybdenum or combinations thereof
>
> [2] disposed on a high surface area support,
>
> [3] said [catalytic] component being *intimately and entirely coated* with an absorber selected from a hydroxide, carbonate, bicarbonate or mixtures thereof of an alkali or alkaline earth or mixtures thereof.

Ex. 1001, col. 12:29–37.

D. Petition

The following appears in Petitioner's claim chart (italics added):

Limitation in claim 1	Takeshima
said catalytic component being *intimately and entirely coated* with an absorber selected from a hydroxide, carbonate, bicarbonate or mixture thereof of an alkali or alkaline earth or mixtures thereof.	Platinum and barium oxide are carried on the alumina carrier. Ex. 1004[B] at Paragraphs [0014-15]. Figs. 5(A)-5(B) depict the barium oxide being *disposed over* the platinum.

Paper 2, page 24 (italics added).

Takeshima Figures 5(A) and 5(B), and a portion of Figure 1, are reproduced below.

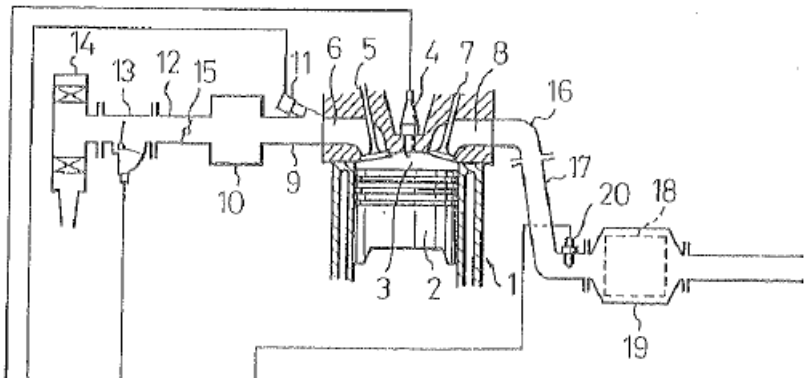
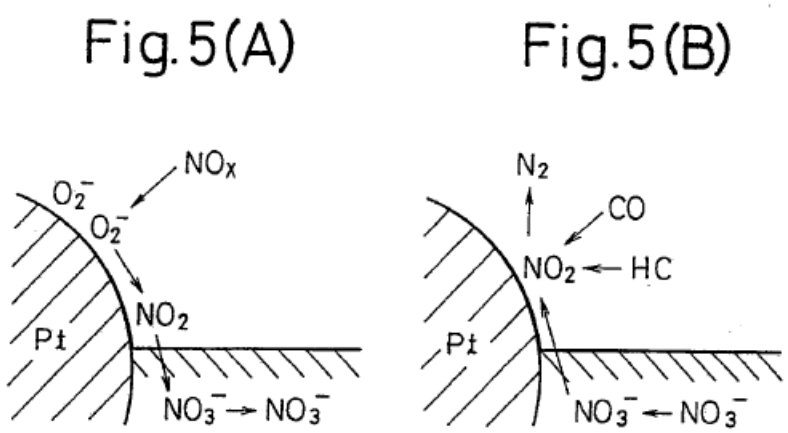


Fig. 1 depicts a gasoline engine



Figs. 5(A) and 5(B) depict a schematic view of the Takeshima catalyst

Paragraphs 0014–0016, and 0018 of Takeshima read in part:

> [0014] The NOx absorbent **18** contained in the casing **19** uses, for example, alumina as a carrier.
>
> [0015] [I]t can be considered that . . . absorption and releasing operation is conducted by the mechanism as shown in Fig. 5. This mechanism will be explained by using as an example a case where platinum Pt and *barium Ba* [in the form of barium oxide] are carried on the carrier . . . .
>
> [0016] Namely, when the inflow of exhaust gas becomes considerably lean, the concentration of oxygen in the inflow of exhaust gas is greatly increased. As shown in Fig. 5(A), the oxygen O2 is deposited on the surface of the platinum Pt in the form of O2. On the other hand, the NO in the inflow of exhaust gas reacts with the O2 on the surface of the platinum Pt and becomes NO2 ($2NO + O2 \rightarrow 2NO2$). Subsequently, a part of the produced NO2 is oxidized on the platinum Pt and absorbed into the

> absorbent. While bonding with the barium oxide BaO, it is diffused in the absorbent in the form of nitric acid ions NO3 as shown in Fig. 5(A). In this way, NOx is absorbed into the NOx absorbent **18**.
>
> [0018] On the other hand, at this time, when the air-fuel ratio of the air-fuel mixture fed into the combustion chamber **3** is made rich and the air-fuel ratio of the inflow of exhaust gas becomes rich . . . a large amount of unburnt HC [hydrocarbons] and CO [carbon monoxide] is discharged from the engine, and these unburnt HC and CO react with the oxygen on the platinum Pt and are oxidized. Also, when the air-fuel ratio of the inflow of exhaust gas becomes rich, the oxygen concentration in the inflow of exhaust gas is extremely lowered, and therefore the NO2 is released from the absorbent. This NO2 reacts with the unburnt HC and CO as shown in Fig. 5(B) and is reduced. In this way, when the NO2 no longer exists on the surface of the platinum Pt, the NO2 is successively released from the absorbent. Accordingly, when the air-fuel ratio of the inflow of exhaust gas is made rich, the NOx is released from the NOx absorbent **18** in a short time.

Petitioner's witness, Dr. Farrauto, testified:

> 35. The oxidation of CO in the "rich" exhaust stream on the platinum catalyst, as described in Paragraph [0018] of Takeshima (Ex. 1004[B]), produces more carbon dioxide in addition to the carbon dioxide produced by the combustion of the fuel.
>
> 36. During the "rich" operations described in Takeshima, barium oxide in the disclosed Pt–BaO–alumina catalyst would convert to barium carbonate in the presence of the carbon dioxide in the exhaust stream.

Ex. 1003A ¶¶ 35–36.

E. Opposition

Patent Owner argues that despite Petitioner's claim chart stating that "Figs. 5(A)–5(B) depict the barium oxide being disposed over the platinum," Petitioner has failed to show "that a barium carbonate absorber is over . . . [a] platinum group metal." Paper 29, pages 11–12 (underlining in original).

Patent Owner further argues that Takeshima does not describe a method for making its catalyst/absorber. *Id.*, page 13.

Patent Owner still further argues that Takeshima does not describe a "high surface area support." *Id.*, page 13:8–9.

F. Reply

Petitioner's Reply suggests that Patent Owner's sole argument is that "Takeshima does not . . . disclose an oxidation catalyst specie[s] intimately and entirely coated with an absorber." Paper 32, page 10.

During prosecution in response to a rejection (Ex. 2002, renumbered pages 70–72) of at least original claim 1 (Ex. 2002, renumbered page 31) based on a Wan patent, Patent Owner added "intimately and entirely coated" in newly presented claim 57 (Ex. 2002, renumbered page 83:2–3).

Further according to Petitioner, the amendment was designed to make clear that any "alkaline earth compound [e.g., barium oxide] is not alloyed within the alumina [support] as a [thermal] stabilizer, but [rather is] disposed on top so that it can function as an absorber." Paper 32, pages 3–4 and 11–12.

G. Discussion

An issue before us is the meaning of "intimately and entirely coated."

The language "intimately and entirely coated" does not appear in the written description portion of the specification. As noted above, the language was added during prosecution in an attempt to avoid a Wan patent.

The language "intimately and entirely coated" is consistent with Figures 1A, 1B, and 1C of the '558 patent. Thus, we disagree with Petitioner that "the '558 patent does not expressly state [i.e., disclose] that . . . platinum, . . . must be coated with an oxide layer." Paper 32, page 8; *see also* Ex. 1001, col. 5:34–35.

The Petition states that "intimately and entirely coated" is to be "construed to require that the absorber material must be disposed over, or on top of, the catalytic component relative to the high surface area support." Paper 2, page 15:14–16.

Patent Owner seems to agree. *See* Paper 29, page 8:5–8. Patent Owner goes on to say that "experts for both parties have interpreted the term 'entirely coated' as meaning the amount of the absorber must be sufficient to form a monolayer on the surface area presented by the high surface area support . . . which itself is at least partially coated with the oxidation catalyst specie." *Id.* at page 8:8–12. Lastly, Patent Owner "agrees that the combustion exhaust must nevertheless have access to the catalyst either *directly*, or *by diffusion* through the overlaying absorber. *Id.* at page 8:12–14. (italics added).

The Reply relies on cross-examination testimony of Patent Owner's witness, Dr. Mark Crocker:

> Q [by counsel for Petitioner]. Okay. Do you know if NO [nitrous oxide] can diffuse through [a] sodium carbonate [layer]?
>
> A [Dr. Crocker]. I have never examined that, but I would imagine that there is some degree of mobility of NOx through sodium carbonate by means of iron [ion?] transport, also possibly by means of molecular diffusion.
>
> Q. Okay. So is there a thickness of sodium carbonate through which no NO could diffuse through?
>
> A. That's a difficult question to answer. What I can say is that the thicker the coating, the slower the diffusion will likely be.
>
> Q. And hence, less effective the catalyst absorber will be?
>
> A. Yes, if the coating is too thick.
>
> Q. Do you have any sense of how thick the sodium carbonate would be that would render the catalyst absorber ineffective to catalyze the NO to NO2?
>
> A. Not having examined this myself, I can't give an answer. What I can -- or I cannot give a precise answer. What I can say is that, if I were designing a catalyst, I would try and restrict the thickness of the coating to not more than a couple of monolayers.
>
> Q. Okay. And is that recommendation stated anywhere in the '558 patent?

A. No.

Ex.1056, page 45: 6 – page 46: 5; Paper 32, page 5.

According to Petitioner, given Dr. Crocker's cross-examination testimony, Patent Owner's claim construction language "must fail" citing *Talbert Fuel Sys. Patents Co.*[2] Paper 32, page 5.

Petitioner has "revised" Dr. Crocker's testimony to suit its case. Dr. Crocker did not testify that the claimed invention would be inoperable. He testified that that the effectiveness of the catalyst could be a function of the thickness of the absorber layer.

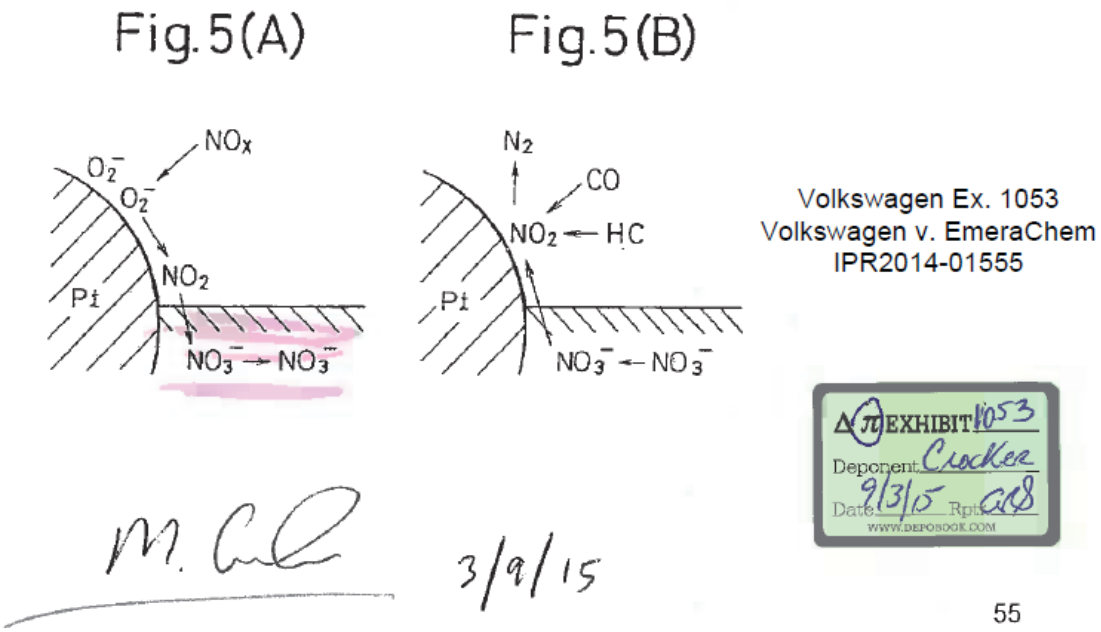
Operativeness (35 U.S.C. § 101) and enablement (35 U.S.C. § 112) *per se* of a challenged patent are not patentability issues that can be raised in an IPR. To the extent that Petitioner seeks to raise the issue here for the sole purpose of establishing that Patent Owner's claim construction "must fail," and therefore claim 1 is anticipated by Takeshima, Petitioner has failed to prove its case. A patent is presumed to enable one skilled in the art to make and use the claimed invention.

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[2] *Talbert Fuel Sys. Patents Co. v. Unocal Corp.*, 275 F.3d 1371, 1376 (Fed. Cir. 2002) (*Talbert I*), *certiorari granted, vacated, and remanded*, 537 U.S. 602 (2003), *judgment aff'd*, *Talbert Fuel Sys. Patents Co. v. Unocal Corp.*, 347 F.3d 1355 (Fed. Cir. 2003) (*Talbert II*). *Talbert I* was cited for the propositions that (1) "a [claim] construction that renders the claimed invention inoperable should be viewed with extreme skepticism" and (2) "Talbert did not demonstrate inoperability. . . ." We believe the propositions survived Supreme Court and *Talbert II* review on remand. However, for reasons given in this opinion, those propositions do not apply in the case before us.

Dr. Crocker did not testify that one skilled in the art could not use the '558 invention; rather, he explained how effectiveness may be a function of absorber layer thickness.

A comparison of Figures 1A, 1B, and 1C of the '558 patent vis-à-vis Figures 5(A) and 5(B) of Takeshima reveals that (1) the "material" of the '558 patent has a layer **14**, **26** covering the entire catalyst layer **12**, **24**, whereas (2) the Takeshima "material" has a corresponding element barium oxide layer (the $NO_3 - NO_3$ portion) that does not cover the entire catalyst (circular P_1 portion) even if the barium oxide layer is intimately connected to the P_1 catalyst. This detail is made clear by Dr. Crocker's cross-examination testimony (Ex. 1056, page 61:10–page 63:17) creating a partially highlighted Exhibit 1053, reproduced below:



Determining the meaning of "intimately and entirely coated" has been somewhat difficult, since the language does not appear in the written

description portion of the specification. Use of "intimately and entirely coated" in claim 1 without a mention of 'intimately and entirely coated" in the written description portion of the specification of the '588 patent raises a concern expressed by Federal Circuit Judge Richard Linn:

> In case after case before my court, the central debate revolves around the meaning of claim terms that, for example, were added during prosecution and do not appear anywhere in the written description. For those cases, the meaning of the claim limitation has to be inferred from other words, leaving the issue open to unnecessary dispute and leading frequently to protracted and costly litigation.

Linn, *Perspectives on Becoming a Successful Examiner*, 91 J. Pat. & Tm. Office Soc'y 418, 421 (6 June 2009).

On the one hand, a claim construction requiring that the absorber layer entirely cover the catalyst layer is entirely consistent with Figs. 1a–1c of the '558 patent and associated discussion in the specification. Ex. 1001, col. 3:38–40 (Fig. 1b showing a magnified view that is depicted as a completely covered catalyst layer) and col. 4:67–5:1 (describing an alumina sphere **10** with a platinum coating **12** and a carbonate coating **14** thereon). There is no hint in the specification as to the thickness of carbonate coating **14**.

On the other hand, both experts seem to believe that "intimately and entirely coated" is broader than Figs. 1a–1c. Both believe that the language includes a material where the catalyst has direct contact with the exhaust gas, as opposed to being limited by a monolayer absorbent where the catalyst

functions via diffusion. The *direct* contact option appears to us to be a post-litigation afterthought when compared to the specification, as filed. It is true that Dr. Crocker and Dr. Farrauto suggest that if the layer is too thick, the '588 material may not be efficient. No degree of efficiency appears in the claim.

The matter was discussed at oral argument:

> JUDGE McKELVEY: Let me ask you this: Why isn't this claim [i.e., claim 1] limited to figure 1A of your patent?
>
> DR. RASSER [counsel for Patent Owner]: Your Honor, I was not present at the time when the prosecution took place. In my view –
>
> JUDGE McKELVEY: It says entirely and intimately coated [actually intimately and entirely coated]. Figure 1 shows that.
>
> DR. RASSER: Right.
>
> JUDGE McKELVEY: And tell me where else something is describe[d in the Specification] that would make it mean something different.
>
> DR. RASSER: There isn't.[3]

[3] Dr. Rasser thereafter attempted to explain why the "intimately and entirely coated" limitation should be given a different construction. However, he candidly conceded that his explanation was not supported by any testimony. Transcript of Oral Argument, Paper 49, page17:16 through page 19:12. In response to a question of "Where is there testimony on that point," the answer was "There isn't." Page 19:10–12.

We hold that "intimately and entirely coated" mean exactly what it says. In other words, it means the embodiment shown in Figs. 1a through 1c of the '558 patent drawings and associated discussion in the written description portion of the specification.

We appreciate why both parties would prefer a broader construction, i.e., "intimately and entirely coated" means (1) coated with a monolayer where catalytic action would occur through diffusion (our construction) *as well as* (2) direct contact with the combustion gas without diffusion. Petitioner would favor a broader construction because Takeshima anticipates a direct contact embodiment. Patent Owner would favor a broader construction because more "material" might infringe claim 1.

Takeshima Figs. 5(A) and 5(B) describe an embodiment where the exhaust gas *directly* contacts the catalyst. A *direct* contact embodiment does not fall within the scope of claim 1 of the '558 patent.

Accordingly, Takeshima does not describe the "intimately and entirely coated" limitation of claim 1.

Therefore, Takeshima does not anticipate claim 1 of the '558 patent.

Claim construction is an issue of law. In the event of an appeal, it is possible the Federal Circuit could disagree with our construction. Because of that possibility, and to mitigate a possibility of a need for a remand, we will address the applicability of Takeshima under the broader interpretation seemingly urged by the parties.

Takeshima Figs. 5(A) and 5(B) do not show the monolayer embodiment; instead they show an embodiment where the exhaust gas

directly contacts the Pt (platinum) catalyst. If it would turn out that "intimately and entirely coated" covers that embodiment, then Takeshima would anticipate claim 1 of the '558 patent.

Patent Owner further argues that there is no anticipation because Takeshima Figs. 5(A) and 5(B) are said not to describe a "high surface area support." Paper 29, page 13:8–9.

Patent Owner's argument limited to Figs. 5(A) and 5(B) is somewhat curious. Manifestly, Takeshima describes the use of "alumina as a carrier." Ex. 1004B, ¶ 0014:1–2. Dr. Farrauto testified that the "alumina carrier disclosed by Takeshima is a high surface area support because it has sufficient irregular internal surface structure to allow the deposition of an amount of platinum that is necessary to allow the catalyzed $2NO + O_2 \rightarrow 2NO_2$ reaction to occur." Ex. 1003, ¶ 29. Patent Owner's Opposition does not address Dr. Farrauto's relevant testimony. We find Dr. Farrauto's testimony credible.

We find, based on Dr. Farrauto's testimony, that one skilled in the art would understand that Takeshima describes a high surface area support.

As noted earlier, Patent Owner also maintains that Takeshima fails to describe a method for making its material. In effect, Patent Owner maintains that Takeshima does not contain an enabling disclosure. Takeshima is presumed to be enabling. *In re Antor Media Corp.*, 689 F.3d 1282 (Fed. Cir. 2012) (*see* Part I: a non-patent prior art publication is presumed to be enabling). Patent Owner has not directed our attention to evidence relating to any alleged lack of enablement.

Patent Owner has not argued the separate patentability of dependent claims 7, 8, 14, and 32. Accordingly, those claims fall with claim 1. *See* Office Patent Trial Practice Guide, 77 Fed. Reg. 48756, 48532 (col. 1, Comment 60) (Aug. 14, 2012) ("a patent owner may waive any argument that a claim is separately patentable") and Paper 22, page 5 ("Patent Owner is cautioned that any argument in support of patentability not raised in the Response will be deemed waived.").

I. Summary

(1) Based on our interpretation of "intimately and entirely coated," we find that challenged claims 1, 7, 8, 14, and 32 are *not* anticipated by Takeshima.

(2) Should our interpretation be set aside on appeal in favor of the parties' proposed construction, then we would find, for the reasons given above, that Takeshima anticipates challenged claims 1, 7, 8, 14, and 32.

J. Decision

We find that Petitioner has failed to establish by a preponderance of the evidence that Takeshima anticipates claim 1.

Since independent claim 1 has not been shown to be anticipated, it follows that dependent claims 7, 8, 14 and 32 likewise have not been shown to be anticipated.

IV. Analysis—Hoekstra (Ground 2)

A. Challenge

According to Petitioner, claims 1, 7–12, 14, 21–23, 32–36 and 38–42 of the '558 patent are anticipated by Hoekstra (Ex. 1005A) and claims 9–11 and 23 are unpatentable under 35 U.S.C. § 103(a) over Hoekstra. Petition (Paper 2), pages 12 and 25–36; Reply (Paper 32), pages 14–18.

Patent Owner disagrees. Opposition (Paper 29), pages 14–19.

We did not institute with respect to claim 36 based on Hoekstra. Paper 26, page 4.

Therefore claim 36 is not before us as to Ground 2.

B. Anticipation

To establish anticipation based on inherency, the evidence must establish that the missing descriptive matter is necessarily present in the thing described in the reference. *Continental Can Co. v. Monsanto Co.*, 948 F.2d 1264, 1268 (Fed. Cir. 1991).

Inherency cannot be established by the mere fact that a certain thing may result from a given set of circumstances. *In re Robertson*, 169 F.3d 743, 745 (Fed. Cir. 1999). *See also Hansgirg v. Kemmer*, 102 F.2d 212, 214 (CCPA 1939) (inherency may not be established by probabilities or possibilities; the mere fact that a certain thing may result from a given set of circumstances is not sufficient); *Rapoport v. Dement*, 254 F.3d 1053, 1063 (Fed. Cir. 2001) (inherency, a question of fact, cannot be established by a preponderance of the evidence based on evidence that a certain thing *may* result from a given set of circumstances).

Whether a reference inherently describes claimed subject matter is a question of fact. *In re Fracalossi*, 681 F.2d 792, 794 (CCPA 1982); *In re Schreiber*, 128 F.3d 1473 (Fed. Cir. 1997).

C. Claim 1

Claim 1 is again reproduced for the convenience of the reader.

Claim 1 reads (matter in brackets added; principal limitation in dispute in italics):

> A material for removing gaseous pollutants from combustion exhaust comprising
>
> [1] an oxidation catalyst specie selected from platinum, palladium, rhodium, cobalt, nickel, iron, copper, molybdenum or combinations thereof
>
> [2] disposed on a high surface area support,
>
> [3] said catalytic] component being *intimately and entirely coated* with an absorber selected from a hydroxide, carbonate, bicarbonate or mixtures thereof of an alkali or alkaline earth or mixtures thereof.

Ex. 1001, col. 12:29–37.

D. Petition

The following appears in Petitioner's claim chart in part (italics added):

Limitation in claim 1	**Hoekstra**
said catalytic component being *intimately and entirely coated* with an absorber selected from a	The platinum-impregnated carrier is *coated* with a selected alkaline earth metal compound. Ex. 1005[A] at

hydroxide, carbonate, bicarbonate or mixture thereof of an alkali or alkaline earth or mixtures thereof.	col. 3, ln. 51-55. The alkaline earth metal solution is applied to the platinum group metal impregnated carrier material, and then dried and calcined. Ex. 1005[A] at col. 4, ln. 24-45. At the completion of the drying step, but before the calcining step, the relevant disclosed catalytic composite would comprise a platinum group metal *disposed* on a high surface area alumina support, *with an outer coating of either barium hydroxide, calcium hydroxide or strontium hydroxide covering the platinum group metal*. Ex. 1003[A], Farrauto ¶¶ 41-43. After the completion of the calcination of the catalytic composite formed using either barium oxide, barium nitrate or barium acetate, the resulting barium oxide outer coating is converted to barium carbonate in the presence of carbon dioxide. See Ex. 1012[A]; Ex. 1009[A] at pp. 3-4; Ex. 1003[A], Farrauto ¶ 44-47.

Paper 2, pages 30–31(italics added).

Portions of Example 1 of Hoekstra are mentioned in the Petition.

Paper 2, page 27.

Example 1 reads:

> 200 grams of ⅛ inch gamma-alumina spheres having an average bulk density of 0.30 grams per cubic centimeter were immersed in 600 milliliters of an

> aqueous solution of chloroplatinic acid and palladium chloride contained in a steam-jacketed rotary dryer. The impregnating solution contained the equivalent of *2.018 grams of platinum* and .075 grams of palladium, and further contained .150 grams of citric acid monohydrate. The spheres were tumbled in the solution, and the solution evaporated to dryness in contact therewith. The impregnated spheres were then immersed in a hot (150 ºF.) stirred 600 milliliter aqueous solution of 40 grams of barium oxide and 0.42 grams of [reducing agent] hydrazine hydrate. After about 1 minute, the solution was decanted and the spheres dried for 2 hours at 250 ºF. in a forced draft oven. The dried spheres were subsequently calcined in a flow of air for 2 hours at 1000 ºF. to yield a catalytic composite containing .009 wt. percent platinum, .036 wt. percent palladium, and about 9 wt. percent barium. *This example demonstrates that the inclusion of a reducing agent, e.g., hydrazine hydrate, obviates leaching of the platinum group metal component from the carrier material during the second impregnation step*.

Ex. 1005, col. 4:60–col. 5:7 (italics added).

E. Opposition

Patent Owner maintains that Hoekstra does not describe, explicitly or inherently, the "intimately and entirely coated" limitation of claim 1. Paper 29, page 14.

Patent Owner further maintains that Petitioner is incorrect when it asserts that "the [Hoekstra hydrazine hydrate] reducing agent prevents the leaching of the platinum group metal from the carried into the alkaline earth

metal solution therefore resulting in a coating of the alkaline earth metal . . . over platinum." *Id*. at 15; *see also* Paper 2, page 26, last paragraph.

Patent Owner's position is based in part on Hoekstra's reported use of 2.018g of platinum which is said to yield a material containing 1.009 wt % platinum prior to exposure to the alkaline earth metal compound, i.e., a barium compound. Paper 29, page 15, last paragraph.

Patent Owner goes on to note that after exposure of reducing agent (i.e., hydrazine hydrate) and alkaline earth metal compound, the reported platinum loading is only 0.009 wt%. Paper 29, page 15, last line.

As a result, says Patent Owner, nearly all of the platinum was leached into the solution of alkaline earth metal. *Id.*

Patent Owner's position is based on the direct testimony of Dr. Crocker:

> I disagree . . . that the alkaline earth metal compound will be coated over the platinum group metal component (paragraph 40 [of Dr. Farrauto's direct testimony—Ex 2003A]). Example 1 in Hoekstra reports the use of an alumina support (200 g) and a platinum solution (containing *2.018 g* Pt) which would yield a material containing 1.009 wt% Pt (prior to exposure to the alkaline earth metal compound). After the subsequent exposure to the mixture of reducing agent and alkaline earth metal compound (in aqueous solution), the reported Pt loading is only 0.009 wt%. Allowing for the increase in the weight of the catalyst due to the deposition of the alkaline earth compound, it can be calculated that the theoretical loading of Pt should have been close to 0.8 wt%. This indicates that nearly all of the Pt initially on the support was leached into the solution of the alkaline earth metal compound. In relative terms, over 98% of the

> Pt was lost from the carrier. In all probability this occurred because the Pt supported on alumina was exposed simultaneously to the reducing agent and the alkaline earth metal compound, and therefore the Pt was not in a reduced state (i.e., the reduction of the Pt was a slow reaction and should therefore have been conducted before the Pt was exposed to the alkaline earth metal compound). With regard to the small amount of Pt remaining on the support, it is impossible to say whether this was Pt that was originally on the support and that was not leached, or was Pt that was leached into solution but was then re-deposited on the catalyst. Consequently, there is no way to determine whether the Pt in the final catalyst could be under, intimately mixed into, or on top of the layer of alkaline earth compound, or some combination thereof.

Ex. 2002 ¶ 23 (italics added).

Patent Owner cross-examined Dr. Farrauto. With respect to the limitation in issue, Dr. Farrauto testified:

> Q [counsel for Patent Owner] Well, I'd like to focus on the platinum, because your conclusion was that you have a platinum-containing catalyst where the platinum is coated--
>
> A [by Dr. Farrauto] Yes.
>
> Q -- with an alkaline earth metal, and my submission to you is that -- or the premise there was that the platinum was immobilized?
>
> A Right. But that doesn't preclude the possibility that the platinum is still covered even though there's only a small amount of it.

> There's two issues to this; one is *does the platinum leach* [into the alkali layer], and the second is, is the alkali covering it. You only have a small amount of platinum and a reasonable amount of palladium, so it is still *possible* that the alkali has covered the platinum and palladium, even though it's only remained in a small amount.
>
> Q Is it also *possible* that the platinum went in solution and deposited back with the barium together, as if from the mixed solution?
>
> A If you believe in this calculation, then obviously that weight percent platinum would include that *which is in the barium*, that which is covered by the barium, et cetera, et cetera. So you can't tell just from -- from that alone as to where the platinum is.
>
> Q We can't tell?
>
> A Well, as I said, it's *possible* that the platinum, such a small amount, might have been covered completely by the alkali. You can't conclude either way.

Ex. 2003, page 142:16–144:4 (italics added).

Based on Dr. Farrauto's above-quoted cross-examination, it is Patent Owner's position that Petitioner has failed to establish that that the "alkali covered the platinum" and therefore Hoekstra does not "*necessarily* disclose all claim limitations," including the "intimately and entirely coated" limitation. Paper 29, page 18.

F. Reply

Based on the cross-examination of Dr. Crocker, Petitioner says that Dr. Crocker agrees that the "2.018" number in Hoekstra Example 1 is a typographical error which should instead be "0.018." Paper 32, page 15.

At the time of cross-examination of Dr. Crocker, as well as when the Reply was filed, "the originally filed Hoekstra application . . . [was] not available from the U.S. Patent Office."[4] *Id*. The significance of the unavailability presumably is that the "2.018" number could not be verified vis-à-vis the original file of the Hoekstra application. However, foreign counterparts report the number as "0.018." For example, counterpart Canadian Patent 1,028,681 reports the number as "0.018." Ex. 1055, page 8:25–26 ("The impregnating solution contained the equivalent of 0.018 g Pt [platinum] . . .").

Both Dr. Farrauto and Dr. Crocker now agree that the proper number is "0.018".[5] *See* (1) Farrauto Second Declaration, Ex. 1015 ¶ 20 ("because all of the foreign counterparts . . . state a 0.018 g starting weight to platinum, I [now] believe that the "2.018 g" number . . . is a typographical error that should read -- 0.018 g --.") and (2) Crocker cross-examination, Ex. 1056, page 69:8–70:3:

---

[4] The Board was able to locate the file wrapper of the Hoekstra patent. The relevant portion of the file wrapper was forwarded to the parties on 16 October 2015 (Paper 38—errata Paper 40) as Ex. 3002.

[5] The Hoekstra file wrapper confirms the typographical error. Ex. 3002, page 9:1 (A208:1) and last page (Rule 312 amendment).

Q [by counsel for Petitioner]. Have you ever been told that there are foreign counterparts to the Hoekstra patent?

A [by Dr. Crocker]. No.

Q. Would it change your opinion stated in Paragraph 23 of your declaration [Ex 2002, ¶ 23 quoted above] if the stated 2.018 grams of platinum is a typographical error that should have read 0.018 grams of platinum?

A. Yes, it would.

Q. Okay. And if I provided to you a counterpart of Hoekstra that shows that it was in fact a typographical error, would you request of your attorneys to submit a corrected declaration that addresses that in Paragraph 23?

A. Yes, I would.

Q. Okay. I'd like to show you the Canadian version [Ex. 1055] of the Hoekstra patent and direct your attention to Page 8, Lines, 23 on, the last paragraph on Page 8 that bridges Pages 8 and 9.

(DOCUMENT HANDED TO WITNESS FOR REVIEW)

BY MR. MEYER [counsel for Petitioner]:

Q. Does this change your opinion rendered in Paragraph 23 of your declaration?

A. Yes, it does.

Dr. Crocker re-calculated assuming "0.018" was a correct number and determined that if 0.018 g were the starting weight of platinum (Ex. 1054), there would have been no leaching of platinum (Ex. 1056, page 69:9–70):

> Q [counsel for Petitioner]. Okay. I'd like to give you a piece of paper [Ex.1054 before calculation] and a calculator, if necessary, and can you do that calculation?
>
> A [Dr. Crocker]. Sure. So I will calculate the theoretical loading?
>
> Q. Um-hmm.
>
> A. Okay. (Witness complies). That is the calculation. That is assuming that barium is present as barium oxide.
>
> (DOCUMENT [Ex. 1054 after calculations] HANDED TO ATTORNEY [for Petitioner])
>
> BY MR. MEYER [attorney for Petitioner]:
>
> Q. Okay. And the reason that you say [in your direct testimony, Ex. 2002, ¶ 23] that it leaches out is because this number 0.84% does not match the .009 weight percent number on Column 5, Line 2 of Hoekstra?
>
> A. That is correct.
>
> Q. Okay. I was wondering if you could just initial and date that calculation?
>
> A. Okay. (Witness complies). Okay. Going to do . . . [the date] it in the American [dating system as opposed to the European dating system].
>
> Q. Okay. Now I'd like to ask you to do another

calculation.

A. Okay.

Q. This time assuming a platinum loading of 0.018 grams.

A. (Witness complies.) 0.018. That is the amount of platinum that is being added.

Q. That is in there, instead of 2.018 use 0.018.

A. Sure. Okay. And I obtain the answer 0.0075 weight percent.

Q. Okay. And that number is in line with the .009 weight percent stated at Column 5, Line 2 of Hoekstra, correct?

A. Correct.

Q. Okay. Can you sign and date that one as well?

A. (Witness complies.)

Q. Okay.

MR. MEYER: And I'd like to have that [the paper showing calculations] marked as the . . . exhibit, 1054.

(WHEREUPON, PETITIONER'S EXHIBIT NUMBER 1054, IS MARKED FOR IDENTIFICATION)

G. Discussion

The issue is: Does Hoekstra describe, explicitly or inherently, the "intimately and entirely coated" limitation of claim 1?

Based in large measure on Dr. Farrauto's direct declaration testimony, Petitioner maintained that Hoekstra describes the "intimately and entirely coated" limitation.

Patent Owner made considerable inroads into Dr. Farrauto's direct testimony during cross-examination. Based on the cross-examination testimony quoted above, we understand Dr. Farrauto to have testified that it was *possible* that platinum leached into the alkali layer, albeit it was *possible* it did not. Since inherency cannot be based on possibilities, based on cross-examination of Dr. Farrauto, one might conclude that Petitioner failed to make out its case.

Patent Owner might have walked away from presenting an opposition case on the merits, arguing that Petitioner failed to make out a *prima facie* case. But, that is not what happened. Patent Owner elected to present its own case on non-inherency, relying on its witness Dr. Crocker. Dr. Crocker, contrary to Dr. Farrauto, was of the opinion that no platinum leached into (i.e., migrated to) the alkali layer. During cross-examination, Dr. Crocker agreed that the "2.018" number (Ex. 1005, col. 5:66) in Hoekstra Example 1 was a typographical error which should have been "0.018." Based on a re-analysis in view of the typographical error, Dr. Crocker continued to conclude that platinum did not leach into the alkali layer—in essence agreeing with that Petitioner that no leaching occurs.

In reply, Patent Owner offered a Second Declaration of Dr. Farrauto in which he agreed that the "2.018" number was a typographical error which should have been "0.018."

During his original cross-examination (Ex. 2003), it is not apparent that Dr. Farrauto was aware of the typographical error.

Not to be overlooked in the back-and-forth occurring from (1) initial arguments in the Petition, (2) subsequent counter arguments in the Opposition, and (3) further responsive arguments in the Reply, is the following: Hoekstra *explicitly* states in describing the result of process steps described in Example 1 that "[t]his example demonstrates that the inclusion of a reducing agent, e.g., hydrazine hydrate, *obviates leaching of the platinum group metal component from the carrier material during the second impregnation step* [i.e., adding a barium oxide layer]." Ex. 1005, col. 5:4–8 (italics added).

Both parties presented evidence, and argument based on that evidence, with respect to the "intimately and entirely coated" argument. We believe it appropriate to consider all the admissible evidence, and arguments pro and con based on that evidence, in resolving anticipation vis-à-vis Hoekstra.

Given (1) the explicit Example 1 description of no leaching, (2) Dr. Crocker's agreement that there is no leaching, (3) taking into account Dr. Farrauto's ultimate agreement with Dr. Crocker with respect to leaching and notwithstanding Dr. Farrauto's cross-examination, which was based on an erroneous "2.018" number, and (4) weighing all the evidence, we find that the evidence establishes by a preponderance of the evidence that Hoekstra describes the "intimately and entirely coated" limitation of claim 1.

We find that Hoekstra anticipates claim 1.

We note that claim 33 does not contain an "intimately and entirely coated" limitation like claim 1. Rather, claim 33 calls for "coating said oxidation catalyst specie with said absorber." Ex. 1001, col. 14:12–13.

Patent Owner agrees that the limitation of claim 33 is broader than the limitation of claim 1. Transcript of Oral Argument, Paper 49, page 28:13–17.

Assuming that Hoekstra does not describe the "intimately and entirely coated" limitation of claim 1, Hoekstra manifestly describes the claim 33 coating step. Ex. 1005A, Example 1 and col. 5:18–21 (claim 1, limitation (b)).

We find that Hoekstra anticipates claim 33 even if Hoekstra does not anticipate claim 1.

Apart from claims 9–11 and 23, Patent Owner has not argued the separate patentability of the remaining claims.

H. Claims 9–11 and 23

1. Introduction

An *inter partes* review trial as to claims 9–11 and 23 was instituted based on likely unpatentability under § 103(a). Paper 21, pages 18–20.

Each of these claims recites a range, but in our institution decisions (Paper 21:18–19) we could not find that the range was anticipated by Hoekstra.

Based on applicable precedent, and because likelihood of obviousness was apparent from the record, we instituted based on § 103(a). Paper 21, paragraph bridging pages 18–19 and page 20, third and fourth paragraphs.

In the Opposition, "Patent Owner respectfully objects to the Board's substitution and amendment to the grounds asserted in the Petition." Paper 29, page 19.

Patent Owner does not state why it "objects." Accordingly, we have no basis for evaluating the objection and find no need to further elaborate on the objection.

By indicating a likelihood of unpatentability in the Decision instituting an *inter partes* review trial, Patent Owner had (1) notice as well as (2) a full and fair opportunity to address obviousness in its Opposition.

2. Claims 9–11

Patent Owner does not address why the subject matter of claims 9–11 would not have been obvious.

The claims set out ranges that overlap with those described by Hoekstra.

The evidence relied upon in the Petition, when considered in light of applicable binding precedent set out in the Institution Decision, supports by a preponderance of the evidence a *prima facie* case of obviousness—the ranges of the claims overlap the ranges described in the prior art. Paper 21, paragraph bridging pages 18–19.

Because Patent Owner has not addressed obviousness, and because the overlapping range precedent, we hold that the subject matter of claims 9–11 would have been *prima facie* obvious within the meaning of § 103(a). Patent Owner has presented no evidence to overcome the *prima facie* case.

Claims 9–11 are unpatentable under § 103(a) over Hoekstra.

3. Claim 23

Patent Owner argues the separate patentability of claim 23. Paper 29, paragraph bridging pages 18–19.

Claim 23 depends from claim 22, which in turn depends from claim 21, which in turn depends from claim 1 (reproduced above).

Claim 23 limits the absorber concentration "to about 10 percent by weight of the material [i.e., the "material" of claim 1]."

Patent Owner relies on direct declaration testimony by Dr. Crocker:

> Claims 21-23 of the '558 patent provide ranges for the amount of absorber, i.e., the hydroxide, carbonate, etc. of an alkali or alkaline earth. Hoekstra expresses the amount of Ba present as the metal. It asserts a range of about 8 to about 10 wt. percent Ba. Petitioner's position is that, due to the calcination in air, the Ba of the Hoekstra composition is present in the form of the carbonate. The atomic weight of Ba is 137; the molecular weight of $BaCO_3$ is 197. The range cited by Hoekstra of 8-10 wt% Ba corresponds to 11.5–14.3 wt% $BaCO_3$. The percentage of claim 23 (about 10%) is well outside the Hoekstra range.

Ex. 2002 ¶ 29.

With respect to ranges, Hoekstra states:

> *The optimum alkaline earth metal content is a function of the density of the selected carrier material*. It will be appreciated that carrier materials of higher density suffer less shrinkage at higher temperatures than do those of lower density, and the optimum alkaline earth metal content will therefore increase in the range of from about 1 to about 20 wt. percent with decreasing density. *Preferably* the refractory carrier material is alumina

> characterized by an average bulk density of from about 0.3 to about 0.5 grams per cubic centimeter, and the alkaline earth content, *preferably* barium, is in the range of from about 8 to about 10 wt. percent.

Ex. 1005, col. 4:11–32 (italics added).

Actually, Hoekstra describes a general range of 1–20 wt%, with a preferred range being 8–10%. No reason is set out in Hoekstra for the preference. Dr. Crocker's calculated range of 11.5–14.3 wt% falls within the broad range described by Hoekstra. The Opposition presents no credible reason why one skilled in the art would not have expected Hoekstra's compositions to be operative within the broad 1–20 wt% range. Hence, we are unable to find anything unobvious about a range of "about 10 weight percent."

Claim 23 is unpatentable under § 103(a) over Hoekstra.

V. Analysis—Kinoshita (Ground 3)

A. Challenge

According to Petitioner, claims 1, 2, 7–10, 14, 15, 17, 19, 24, 31, 33–40, 42, and 44 of the '558 patent are anticipated by Kinoshita (Ex. 1006A). Petition (Paper 2), pages 12 and 36–44; Reply (Paper 32), pages 18–20.

Patent Owner disagrees. Opposition (Paper 29), pages 19–25.

B. Anticipation

The applicable anticipation principles are set out above in connection with the discussion of Takeshima and Hoekstra and need not be repeated here.

C. Claim 1

Claim 1 is again reproduced for the convenience of the reader.

Claim 1 reads (matter in brackets added; principal limitation in dispute in italics):

> A material for removing gaseous pollutants from combustion exhaust comprising
>
> [1] an *oxidation* catalyst specie selected from platinum, palladium, rhodium, cobalt, nickel, iron, copper, molybdenum or combinations thereof
>
> [2] disposed on a high surface area support,
>
> [3] said catalytic] component being *intimately and entirely coated* with an absorber selected from a hydroxide, carbonate, bicarbonate or mixtures thereof of an alkali or alkaline earth or mixtures thereof.

Ex. 1001, col. 12:29–37.

D. Decision to Institute

In instituting an *inter partes* review trial, we discussed Kinoshita Examples 1 and 6, as well as Table 5. Paper 21, page 22.

Insofar as we can tell, the Opposition and Reply do not address Kinoshita Example 6 or Table 5.

Rather, the parties seem satisfied to resolve any anticipation dispute on the basis of Kinoshita Example 3.

Given that the parties have not discussed Kinoshita Example 6 or Table 5, we determine patentability on the basis of Kinoshita Example 3—not Kinoshita Example 6 and Table 5.

E. Petition

The following appears in Petitioner's claim chart (limitations in dispute in italics):

Limitation in claim 1	**Kinoshita**
an *oxidation* catalyst specie selected from platinum, palladium, rhodium, cobalt, nickel, iron, copper, molybdenum or combinations thereof	Kinoshita discloses that the catalyst specie can be platinum, palladium and/or rhodium. See Ex. 1006[A] at col. 2, ln. 56-65; see also col. 2, ln. 29-39. In the catalyst of Example 3, just platinum is used. Ex. 1006[A] at col. 5, ln. 3-8.
said catalytic component being *intimately and entirely coated* with an absorber selected from a hydroxide, carbonate, bicarbonate or mixture thereof of an alkali or alkaline earth or mixtures thereof.	In the catalyst of Example 3, the previously dried and calcined platinum carrying carrier was covered with a potassium carbonate outer coating. Ex. 1006 at col. 5, ln. 3-16; Ex. 1003[A], Farrauto ¶¶ 50-52.

Paper 2, pages 39–40 (italics added).

According to Kinoshita:

> The catalyst according to the . . . [Kinoshita] invention can be produced by an appropriate process in the prior art in which a catalytic element is carried by a carrier. A process of impregnating and/or depositing the carrier with a liquid in which compounds containing the catalytic elements such ·as an alkali metal and Pt [platinum], Pd [palladium] and Rh [ruthenium] are dissolved and/or suspended and then drying it at 300° –

> 800° C., preferably firing at 400° – 600° C. is found recommendable with respect to the durability and performance of the catalyst thus obtained.

Ex. 1006A, col. 2:56–65.

Kinoshita Example 3 reads:

> EXAMPLE 3
>
> 1 l [liter] of Honeycomb carrier coated with active alumina (main component: cordierite; bulk density 0.6 g/cc; cell number 300 cells/in^2; cylinder 130 dia. x 76 mm long) was immersed for 30 minutes in 2 l [liters] of an aqueous solution of chloroplatinic acid equivalent to 1.25 g of Pt [platinum], thereby causing Pt to be carried. After drying at 110° C., the product was fired for 1 hour at 500° C. in the atmosphere. Then, the honeycomb thus carrying Pt was immersed for 1 minute in 2 l [liters] of an aqueous solution of potassium carbonate containing 1 mol of K [potassium], thereby causing K to be carried. The product was dried at 110° C. [drying step] and fired for 1 hour at 500° C. in the atmosphere, thereby yielding a catalyst with Pt and K carried in the honeycomb. The carried volumes of catalytic elements and the results of catalyst evaluation are summarized in Table 4 [not reproduced]. For durability test and catalyst evaluation, a monolith catalyst [30 mm dia. x 28 mm long, (20 cc)] was cut to a specimen.

Ex. 1006A, col. 5:1–21.

According to Dr. Farrauto:

> At the completion of the drying step at 110° C, but before being fired at 500° C, Kinoshita's Example 3 product would comprise Pt [platinum] disposed on a

> high surface area alumina support, *with a coating of potassium carbonate completely covering the Pt*.
>
> If this *coating of potassium carbonate* was subjected to the exhaust conditions described in the '558 patent at column 2, lines 38-55, the potassium carbonate would absorb NO2 disposed within that exhaust in the same manner that the counterpart potassium carbonate absorbent disclosed in the '558 patent would.

Ex. 1006A ¶¶ 51–52 (italics added).

F. Opposition

With regard to claim 1, Patent Owner argues that Kinoshita does not describe the "intimately and entirely coated" limitation of claim 1. Pape 29, page 20.

With regard to claim 33, Patent Owner further argues that Kinoshita does not describe "an oxidation catalyst specie." *Id*.

Relying on direct declaration testimony of Dr. Crocker, Patent Owner maintains that one cannot determine "how much alumina is present in the catalyst and hence impossible to know the corresponding loading of potassium on the platinum-impregnated alumina (in wt%)." Paper 29, page 21.

Dr. Crocker testified:

> I disagree with the assertion that "Kinoshita's Example 3 product would comprise Pt disposed on a high surface area alumina support, with a coating of potassium carbonate *completely covering* the Pt." ([P]etition at page 38; Farrauto, Ex. 1003A, . . . [¶¶] 50–51). Example 3 refers to Table 4 in Kinoshita, which reports the potassium loading as being 0.14 mol per 1 kg catalyst.

> *However, the alumina loading on the honeycomb substrate in Example 3 is not disclosed*, hence it is impossible to know how much alumina is present in the catalyst and hence impossible to know the corresponding loading of potassium on the platinum-impregnated alumina (in wt%). Therefore, *one cannot say whether this amount of potassium (0.14 mol/kg) is sufficient to fully coat the platinum-impregnated alumina*. However, a representative calculation can be performed. If one assumes a typical cordierite honeycomb density of 435 g/L, and an alumina loading of 180 g/L (being fairly typical for the washcoat loading of an automotive catalyst), then 1 kg of catalyst would contain 293 g of alumina (and 707 g of honeycomb). Hence 0.14 mol potassium would be supported on 293 g alumina, equivalent to 1.87 wt%. *This is not sufficient to fully coat the platinum-impregnated alumina*.

Ex. 2002 ¶ 32 (italics added).

Patent Owner cross-examined Dr. Farrauto, calling our attention to the following:

> Q [by counsel for Patent Owner] So I could do two calculations, one for potassium carbonate and one for potassium hydroxide, and then -- well –
>
> A [by Dr. Farrauto] But that *doesn't guarantee that it's going to cover*, because adsorption could be preferred -- in other words, you could get multi-layer adsorption of the potassium hydroxide or the potassium carbonate on the alumina, *so it doesn't necessarily mean that it is going to cover the platinum*, and that was basically what we said yesterday, and that is you're making an assumption just on the cross-sectional area of the material whether it would cover it, but there are cases where you could get clumps, if you may, of the nitrate or

> the carbonate, and *therefore there could possibly be some separate platinum material that is not covered*. But you can't a priori -- it's an ideal calculation, let's put it that way.
>
> Q But the reverse would be true, that if I find that there is not enough to cover even if it were perfectly distributed, then at least I would have that answer?
>
> A You can't even make that conclusion, because perhaps that material will adsorb on -- selectively onto the platinum. In other words, materials are selective, and they adsorb on different surfaces. For example, water adsorbs on glass in a different way than it adsorbs, for example, on alumina, and it could be the same situation, it's just that we don't know for sure unless you understand exactly the selectivity of adsorption on platinum versus, for example, on the alumina. The calculation that we made yesterday was a physical calculation based on the cross-sectional area and the surface area of the material. It doesn't take into account the chemistry of what can happen in the interactions of these materials with different species.

Ex. 2003, pages 124:6–125:21 (italics added).

G. Reply

Based on cross-examination of Dr. Crocker, Petitioner maintains that "there are a sufficient number of potassium atoms to completely cover the Pt [platinum] atoms." Paper 32, page 19.

The following portions of Dr. Crocker's cross-examination have been called to our attention, to which we add the first question and answer:

> Q [by counsel for Petitioner]. At a platinum loading of 0.23 weight percent of alumina, would there be enough

platinum to *entirely cover* all of the platinum support with a layer of platinum?

A [Dr. Crocker]. No, there would not.

Q. Okay. On a microscopic level, what would the surface of the alumina look like when it is so loaded at 0.23 weight percent of alumina?

A. So essential --

Q. Wait, wait. I'm sorry. 0.23 weight percent of platinum.

A. Platinum. So one will have an alumina surface onto which had been deposited nano particles of platinum. These nano particles will contain or will correspond to essentially a cluster of platinum atoms and they will be randomly distributed on the catalyst surface.

Q. Okay. And there would be spaces between?

A. There would be spaces between them, yes.

* * *

Q. Okay. Okay. Now let's do the same exercise for Example 3 which is on Page 6 of Kinoshita from, looks like, Lines 2 through 21 [col. 5:2–21]. Now, there is 1.25 [col. 5:7] grams of platinum, correct?

A. Yes.

Q. And that 1.25 grams of platinum is 0.064 molls [moles] of platinum, correct? And feel free to use the calculator.

A. 0.0064.

> Q. Okay. And if we compare the -- and there is 1 moll [mole] of potassium in the form of potassium carbonate, correct?
>
> A. That is correct.
>
> Q. And if we compare the 1 moll [mole] of potassium to the 0.064 molls [moles] of platinum, there are 156 potassium atoms to each platinum atom, correct?
>
> A. So what did we say it was? One moll [mole] platinum divided by 0.0064 equals -- okay. That's interesting. It's giving me zero for some reason. But I'm willing to -- to believe your *assertion*, so –

Ex. 1056, page 35:25–page 36:16 and page 72:19–73:11 (italics added).

H. Discussion

1. Claim 1

Example 3 of Kinoshita does not explicitly describe a catalyst component, i.e., platinum, "intimately and entirely coated" with an absorber.

Accordingly, Petitioner must establish that the process described in Kinoshita Example 3 necessarily results in a catalyst layer "intimately and entirely coated" with an absorber layer.

Dr. Farrauto says it does.

Dr. Crocker says it does not.

On the one hand, Dr. Farrauto testified that the potassium carbonate completely covered the platinum catalyst. Ex. 1003A ¶ 51.

On the other hand, on cross-examination, Dr. Farrauto testified that there is no "guarantee that it's going to cover" and "there could possibly be some separate platinum material that is not covered." Ex. 2003, page 124:9–10 and 21–23.

Dr. Crocker testified on direct that because Example 3 does not contain sufficient detail, "one cannot say whether . . . [the] amount of potassium . . . is sufficient to fully coat the platinum impregnated alumina." Ex. 2002 ¶ 32.

According to Petitioner, Dr. Crocker conceded on cross-examination that the platinum catalyst layer was entirely coated with the absorber. Paper 32, page 9.

Petitioner has not directed our attention to where Dr. Crocker made any compelling concession. It is true that at the end of the line of questioning quoted above, Dr. Crocker said "I'm willing to . . . believe your assertion." Ex. 1056, page 73:10–11. However in context, cross-examination does not make clear whether "believe your assertion" means (1) agree that the absorber entirely coats the catalyst or (2) agree with counsel's number of 0.064. We have found no follow-up question along the lines: "Then you agree that Kinoshita Example 3 necessarily describes an absorber entirely coating a catalyst layer"?

While the matter of assigning the weight to be given to the testimony of the two witnesses in this case is a close call, based on the direct and cross-examination testimony with respect to Kinoshita and its Example 3, and to the extent that there is a conflict between Dr. Crocker's testimony and that

of Dr. Farrauto, we credit the testimony of Dr. Crocker over that of Dr. Farrauto.

However, even if one were to find the testimony of Dr. Crocker and Dr. Farrauto evenly balanced, then a preponderance of the evidence on inherency does not emerge. Under those circumstances, the party with the burden of proof cannot be said to have proved its case. *See Yamaha Int'l Corp. v. Hoshino Gakki Co.*, 840 F.2d 1572, 1580 n.11 (Fed. Cir. 1988) (where a party is under a burden to establish a fact by a preponderance of the evidence and where the evidence is so evenly balanced that no preponderance emerges, the party having the burden of persuasion necessarily loses).

We are also concerned that Example 3 does not describe enough detail to indicate clearly whether there is enough potassium to cover the platinum-impregnated alumina. Ex. 2002 ¶ 32.

According to Petitioner, Patent Owner "seeks to rewrite claims 1 and 39 [sic—33] to require that the entirety of the *alumina support* be coated by the absorber [potassium carbonate]." Paper 32, page 18 (italics added). But, that is not what Dr. Crocker said. Rather, Dr. Crocker testified that there was not enough potassium to fully coat the "*platinum-impregnated* alumina." Ex. 2002 ¶ 32, last sentence (italics added).

We find that Petitioner has not established that Kinoshita describes the "intimately and entirely coated" limitation of claim 1.

We further find that the subject matter of claim 1 is not inherently described by Kinoshita.

Because we find that the "intimately and entirely coated" limitation is not described by Kinoshita, we need not reach Patent Owner's alternative argument that Kinoshita fails to describe an oxidation catalyst.

2. Claim 33

As noted in connection with our discussion of claim 33 associated with Hoekstra, "coating said oxidation catalyst specie with said absorber" is broader than "intimately and entirely coated."

With respect to claim 33, we credit the testimony of Dr. Crocker and Dr. Farrauto, both of whom testified that the platinum catalyst was coated with absorber.

Accordingly, claim 33 (and the claims 34–40, 42, and 44 dependent on claim 33) are anticipated by Kinoshita even though claim 1 is not anticipated by Kinoshita.

VI. Analysis—Inui (Ground 4)

A. Challenge

According to Petitioner, claims 1, 2, 7–10, 14, 15, 17, 19, 24, 31, 33–37, 39, 40, and 42 of the '558 patent are anticipated by Inui (Ex. 1007B). Petition (Paper 2), pages 12 and 44–53; Reply (Paper 32), pages 20–22.

Patent Owner disagrees. Opposition (Paper 29), pages 25–27.

We did not institute with respect to claim 42 based on Inui. Paper 26, page 4.

Therefore claim 42 is not before us as to Ground 4.

B. Anticipation

The applicable anticipation principles are set out above in connection with the discussion of Takeshima and Hoekstra and need not be repeated here.

C. Claim 1

Claim 1 is reproduced again for the convenience of the reader.

Claim 1 reads (matter in brackets added; principal limitation in dispute in italics):

> A material for removing gaseous pollutants from combustion exhaust comprising
>
> [1] an *oxidation catalyst* specie selected from platinum, palladium, rhodium, cobalt, nickel, iron, copper, molybdenum or combinations thereof
>
> [2] disposed on a high surface area support,
>
> [3] said catalytic] component being intimately and entirely coated with an *absorber* selected from a hydroxide, carbonate, bicarbonate or mixtures thereof of an alkali or alkaline earth or mixtures thereof.

Ex. 1001, col. 12:29–37.

D. Petition

The following appears in Petitioner's claim chart (limitations in dispute in italics):

Limitation in claim 1	**Inui**
an *oxidation* catalyst specie selected from platinum,	"An aqueous solution of dinitrodiammine platinum

palladium, rhodium, cobalt, nickel, iron, copper, molybdenum or combinations thereof	*comprising 5 g of platinum* was added to 100 g of activated alumina having a BET surface area of 100 m^2/g [sic] and mixed therewith, and the mixture was then dried for 2 hours at 120° C and fired for 2 hours at 500° C." Ex. 1007[B] at p. 9, Paragraph [0022] (emphasis added).
said catalytic component being intimately and entirely coated with an *absorber* selected from a hydroxide, carbonate, bicarbonate or mixture thereof of an alkali or alkaline earth or mixtures thereof.	In the catalyst of Exemplary Embodiment 4, the previously dried and calcined platinum-carrying honeycomb support was covered with a potassium carbonate outer coating. Ex. 1007[B] at p. 10, Paragraph [0026] & p. 9, Paragraph [0023]; Ex. 1003[A], Farrauto ¶¶ 57–59.

Paper 2, page 48 (italics added).

Inui Exemplary Embodiments 1 and 4 read:

> [0022] (Exemplary Embodiment 1) An aqueous solution of dinitrodiammine platinum comprising 5 g of platinum was added to 100 g of activated alumina having a BET surface area of 100 m/g^2 and mixed therewith, and the mixture was then dried for 2 hours at 120°C [drying step] and fired for 2 hours at 500°C. The resulting powder was wetground by means of a ball mill in order to obtain an aqueous slurry in which was immersed a commercially available cordierite honeycomb support (produced by Nippon Glass Co., Ltd.; transverse cross section having 400 gas flow cells per square inch; diameter 33 mm ø; length 76 mm; volume 65 ml), after which the excess slurry was blown away by means of compressed air. The material was then dried for 2 hours at 120°C and fired for

> 2 hours at 500°C in order to obtain a honeycomb support covered with platinum-supporting alumina powder.
>
> [0023] In addition, the resulting honeycomb support was immersed in a 4.3 mol/l (litre) aqueous solution of *sodium nitrate*, after which the excess solution was blown away by means of compressed air, and the resulting material was dried for 2 hours at 120°C and 35 fired at 500°C in order to obtain completed catalyst (A). In this catalyst, 5 wt% of platinum and 10 wt% of sodium were supported with respect to the activated alumina.
>
> [0026] (Exemplary Embodiment 4) Completed catalyst (D) was obtained in the same way as in Exemplary Embodiment 1, except that a 2.5 mol/l aqueous solution of *potassium carbonate* was used instead of the 4.3 mol/l aqueous solution of *sodium nitrate* in Exemplary Embodiment 1. In this catalyst, 5 wt% of platinum and 10 wt% of potassium were supported with respect to the activated alumina.

Ex. 1007B ¶¶ 0022, 0023, and 0026 (italics added). *See also* Dr. Farrauto's direct declaration testimony (Ex. 1003A ¶¶ 57–59).

E. Opposition

Patent Owner argues that Inui does not anticipate because:

(1) Inui does not describe an oxidation catalyst;

(2) Inui's potassium carbonate is not an "absorber"; rather it is an adsorber; and

(3) Inui teaches the use of a hydrocarbon.

Paper 29, pages 25–26.

1. Oxidation Catalyst

According to Patent Owner, the Inui catalyst acts as a "Selective Reduction Catalyst (SCR)." Paper 29, page 25.

Cited to support its position is direct declaration testimony of Dr. Crocker:

> The platinum catalyst of Inui is not an oxidation catalyst as this term is used in the '558 patent. The catalyst in Inui is a hydrocarbon-SCR [Selective Reduction Catalyst] catalyst, which reduces NOx present in the hydrocarbon-containing gas stream to N2 instead of oxidizing it to NO2. In the hydrocarbon-containing gas stream of Inui the Pt is not covered with a layer of PtO (although some PtO may be present), as would be the case if the Pt specie were an oxidation catalyst.

Ex. 2002 ¶ 35.

According to Patent Owner, whether the catalyst is an "oxidation" catalyst or a "reduction" catalyst "actually makes a difference for the composition of the catalyst itself." Paper 29, page 26:1–3.

2. Absorber v. Adsorber

According to Patent Owner, the alkali metal carbonate of Inui is not an absorber; it's an adsorber.

Support is said to be cross-examination of Dr. Farrauto:

> Q [by counsel for Patent Owner] Frankly, I interpreted it the same way. And I was wondering what the role is of the sodium component in this catalyst. Do you have a point of view on that?
>
> A [Dr. Farrauto] It's probably to retain NO2. In other words, the platinum still has to *oxidize* the NO to NO2, the NO2 is *adsorbed* in the sodium, and then at some

> critical point that NO2 is *desorbed,* and that's not addressed in 19 [believed to be a reference to ¶ 0019 of Inui]. And then once it is in the gas phase, then the addition of the hydrocarbon will *reduce* the NOx to nitrogen.

Ex. 2003, page 89:4–16 (italics added).

3. Hydrocarbon

According to Patent Owner, Petitioner has failed to prove its case because Inui teaches the addition of a hydrocarbon:

> A method for removing exhaust gas in an oxidizing atmosphere state through a catalyst obtained by covering a monolithic structure with a catalyst active ingredient comprising sodium and/or potassium, and platinum and a refractory inorganic oxide, <u>in the presence of a hydrocarbon</u>.

Paper 29, page 26; Ex. 1007B, page 2:20–25 (underlining in original).

Petitioner's theory is said to require one to deviate from the specific teaching of Inui in order to arrive at an absorber according to the claims of the '558 patent. Patent Owner maintains that "to do so is based on hindsight." Paper 29, page 26.

F. Reply

From its point of view, Petitioner summarizes the situation as follows:

> At the completion of the drying step at 120° C, but before being fired at 500° C, Inui's Exemplary Embodiment 4 product would comprise *Pt* [*platinum*] disposed on a high surface area *alumina support*, with a *coating of potassium carbonate completely covering the Pt*. *Patent Owner does not dispute this*. Moreover, the

> outer coating that Dr. Farrauto testified would adsorb NO_x, as opposed to absorb, was a *sodium* compound, not *potassium carbonate*.

Paper 32, page 20 (italics added; citations omitted).

G. Discussion

Patent Owner does not base its case on a failure of Inui to describe the "intimately and entirely coated" limitation.

Rather, Patent Owner asserts that the Inui catalyst does not comprise an oxidizing catalyst and that the Inui potassium carbonate is an adsorber—not an absorber.

But, what Patent Owner cannot avoid is that the Inui combination comprises the same elements as those set out in claim 1, all arranged in the same order.

With reference to (1) the Specification of the '558 patent (Ex. 1001) and (2) Inui (Ex. 1007B), we find that Inui describes each of the claimed elements arranged in the same order as follows (matter in brackets added):

> A material for removing gaseous pollutants from combustion exhaust [Inui, page 2:5: "a method for removing nitrogen oxides in exhaust gas discharged from an internal combustion engine"; '558 patent, col. 1:9–14: "process for reducing . . . pollutants . . . namely nitrogen oxides (NOx)] catalyst for removing nitrogen oxides] comprising
>
> [1] an oxidation catalyst specie selected from platinum [Inui, page 9:27: platinum supported alumina powder; '558 patent, col. 5:34: platinum; col. 14:16–17: platinum], palladium, rhodium, cobalt, nickel, iron, copper, molybdenum or combinations thereof

> [2] disposed on a high surface area support [Inui, activated alumina having a BET surface areas of 100 m^2/g; '558 patent, col. 5:11–12: high surface area alumina spheres having a surface areas of 50 to 330 square meters per gram],
>
> [3] said catalytic component being intimately and entirely coated with an absorber selected from a hydroxide, carbonate [Inui, page 10:21: potassium carbonate; '558 patent, col. 13:7–8: potassium carbonate], bicarbonate or mixtures thereof of an alkali or alkaline earth or mixtures thereof.

Given that Petitioner has established that Inui describes a composition comprising three ingredients arranged in the same manner as that claimed, Petitioner has made out a *prima facie* case of anticipation. *In re Spada*, 911 F.2d 705, 707 (Fed. Cir. 1990) ("The *prima facie* case is a procedural tool which, as used in patent examination (as by courts in general), means not only that the evidence of the prior art would reasonably allow the conclusion the examiner seeks, but also that the prior art compels such a conclusion if the applicant produces no evidence or argument to rebut it.").

Patent Owner can allege that the Inui platinum is a reducing catalyst whereas its platinum is an oxidation catalyst. Patent Owner can further allege that the Inui potassium carbonate is an adsorber whereas its potassium carbonate is an absorber. Patent Owner can still further allege that hydrocarbons must be present when using the Inui composition. But, as Petitioner mentions, none of these allegations alters the fact that both the claimed combination and the combination described by Inui comprise the

same ingredients arranged in the same way. In our view nothing more is needed to establish by a preponderance of the evidence a *prima facie* case of anticipation.

Patent Owner has not come forward with convincing evidence that the Inui compositions would behave differently from the claimed compositions.

We find that the evidence establishes by a preponderance of the evidence that Inui describes all limitations of claim 1.

We find that Inui anticipates claim 1.

Patent Owner has not argued the separate patentability of the remaining claims involved in Ground 4.

VII. Analysis—Stiles (Ground 5)

A. Challenge

According to Petitioner, claims 1, 7, 8 14–17, 19, 21–23 and 31 of the ’558 patent are anticipated by Stiles (Ex. 1008A) Petition (Paper 2), pages 12 and 53–59; Reply (Paper 32), pages 20–22.

Patent Owner disagrees. Opposition (Paper 29), pages 27–30.

We instituted an *inter partes* review trial as to claims 1, 7, 8, 14–19, and 31 based on anticipation under § 102(e) and as to claims 21–23 based on obviousness under § 103(a). Paper 26, page 3.

Stiles is prior art under 35 U.S.C. §102(e). Patent Owner has made no effort to antedate Stiles.

B. Anticipation

The applicable anticipation principles are set out above in connection with the discussion of Takeshima and Hoekstra and need not be repeated here.

C. Claim 1

Claim 1 is reproduced again for the convenience of the reader.

Claim 1 reads (matter in brackets added; principal limitation in dispute in italics):

> A material for removing gaseous pollutants from combustion exhaust comprising
>
> [1] an *oxidation catalyst* specie selected from platinum, palladium, rhodium, cobalt, nickel, iron, copper, molybdenum or combinations thereof
>
> [2] disposed on a high surface area support,
>
> [3] said [catalytic] component being intimately and entirely coated with an *absorber* selected from a hydroxide, carbonate, bicarbonate or mixtures thereof of an alkali or alkaline earth or mixtures thereof.

Ex. 1001, col. 12:29–37.

D. Petition

We now turn to the arguments made in the Petition, Opposition, and Reply.

The following appears in Petitioner's claim chart (limitations in dispute in italics):

Limitation in claim 1	Stiles
an *oxidation* catalyst specie selected from platinum, palladium, rhodium, cobalt, nickel, iron, copper, molybdenum or combinations thereof	Stiles discloses a preferred embodiment where the absorbent catalyst comprises manganese oxide (MnO) and aluminum oxide (Al_2O_3). Ex. 1008[A] at col. 5, ln. 28-35 & col. 6, ln. 7-13. In an alternative embodiment, "adequately effective materials can also be made by substituting for the manganese oxide such oxides as iron, ***nickel***, ***cobalt***, zinc, ***copper*** and ***molybdenum*** and tungsten, combinations of these oxides plus manganese oxides also are very effective…." Ex. 1008[A] at col. 6, ln. 14-20 (emphasis added); see also Id. at p. 8 (Table 1 at Example Nos. 15 & 16 ($NiOAl_2O_3$)).
said catalytic component being intimately and entirely coated with an *absorber* selected from a hydroxide, carbonate, bicarbonate or mixture thereof of an alkali or alkaline earth or mixtures thereof.	The catalytic component is covered with an outer coating of potassium carbonate. Ex. 1008[A] at col. 5, ln. 40-44; see also Id. at p. 8, Table 1 ("K_2CO_3"). "Although potassium carbonate is preferred, the alkali carbonate can be that of sodium, rubidium [sic] or cesium." Ex. 1008[A] at col. 6, ln. 26-27; col. 13, ln. 3-16 (claim 8). Potassium, sodium, rubidium and cesium are all alkali metals. Ex. 1003[A], Farrauto ¶64.

Paper 2, pages 55–56 (italics added).

A principal difference between Ground 5 and Grounds 1–4 is the catalyst. Stiles does not describe use of platinum; rather Stiles describes use

of other catalysts in the catalyst Markush group set out in claim 1 of the '558 patent, *i.e.*, iron, nickel, cobalt, copper, and molybdenum.

Petitioner's position, based in part on its claim chart, and discussion in the Petition, is that Stiles describes a catalyst described as follows:

> Certain of the catalyst-adsorbent materials are resistant to sulfur dioxide, but the catalyst is most efficient in the absence of sulfur dioxide in the gas from which the nitrogen oxides are to be removed. The most effective agent for the adsorption is *manganese* and aluminum oxide co-precipitated to produce a 50/50 mixture of finely divided mixed manganese and aluminum oxides powder. This powder is milled in a ball mill to produce a paste comprising water, the aluminum oxide-manganese oxide powder and some colloidal cerium oxide to act as strengthening agent for the dried milled paste. After the paste has been dried, the granules are derived by crushing and screening the dried paste. The granules are further treated by adding a solution of potassium carbonate which, on drying, leaves the potassium carbonate *completely covering* the interior and exterior of the granules.

Ex. 1008A, col. 5:28–44 (italics added).

Claim 1 does not include manganese in its catalyst Markush group. However, Stiles teaches that:

> Although manganese oxides appear to be relatively unique as being the most effective, adequately effective materials can also be made by substituting for the manganese oxide such oxides as *iron*, *nickel*, *cobalt*, zinc, *copper* and *molybdenum* and tungsten, combinations of these oxides plus manganese oxides also are very effective and also have some tolerance to SO_x in the gas

> stream from which the nitrogen oxides are being removed.

Ex. 1008A, col. 6:14–22 (italicized metals are included within the catalyst Markush group of claim 1 of the '558 patent).

Stiles also teaches that:

> The ingredients can also be impregnated onto and into a support such as alumina, silica, silica alumina, activated carbon, silicon carbide, and others well known to the art. The form of the supports can be granules, cylinders, rings, honey combs, rods, spheres and others also known to the art.

Ex. 1008A, col. 11:63–col. 12:1.

E. Opposition

According to Patent Owner, "Stiles does not disclose an oxidation catalyst specie disposed *on* a high surface area support." Paper 29, page 27 (italics added).

Patent Owner attacks Petitioner's reliance on Stiles' disclosure of the nature of the support (col. 11:63–col. 12:22) as misplaced because Example 18 (misidentified in the Opposition as "Exhibit 18") is said to relate to reduction catalyst and not the oxidation catalyst. Paper 29, page 28.

Relevant to Patent Owner's position, is direct declaration testimony of Dr. Crocker:

> According to Stiles (Example 18, last line), the adsorbent can have the same forms as the support material used in the preparation of the reduction catalyst, i.e., granules, cylinders, rings, honeycombs, etc. However, there is no statement indicating that the

> adsorbent catalyst can be prepared by impregnating the transition material component (i.e., as soluble salts) onto a support. Consequently, I disagree with the statement that "The adsorbent catalyst is disposed *on* a high surface area alumina support" (petition at p. 56).

Ex. 2002 ¶ 39.

F. Reply

According to Petitioner, "Patent Owner's . . . [Opposition] is limited to arguing that in Stiles the catalyst specie is not disposed *on* a high surface area support." Paper 32, page 23 (italics added).

In response, Petitioner points to cross-examination testimony of Dr. Crocker:

> Q [by counsel for Petitioner]. Okay. I'd like to direct your attention to Paragraph 37 of your declaration [Ex. 2002]. Okay. Paragraph 37 of your declaration states that, "Stiles discloses the oxidizing catalyst is intimately mixed with alumina," correct?
>
> A [Dr. Crocker]. Correct.
>
> Q. What is your understanding of why this is done?
>
> A. I presume that the inventors were trying to prepare a manganese-alumina mixed oxide in order to obtain a high manganese oxide dispersion.
>
> Q. What is the function performed by the alumina in this intimate mixing of an oxidizing catalyst and alumina?
>
> A. Providing that a mixed oxide is actually obtained, then the function of the alumina is to provide a lattice in which the manganese irons can reside.

Q. So it's like a support?

A. Not entirely the same.

Q. Same in some ways?

A. In some ways it's the same.

Q. Okay. Why not just impregnate the oxidizing catalyst with the solution of potassium carbonate?

A. I'm sorry. Can you repeat the question?

Q. Yeah. Why include alumina at all? Why not just impregnate the oxidizing catalyst with the solution of potassium carbonate?

A. Because manganese oxide on its own would not have a very high surface area and because it would be prone to sintering during high-temperature operation.

Q. Okay. So the alumina prevents sintering?

A. Correct.

Q. So it's like a support in that way?

A. In that sense it is like a support providing that a mixed oxide is indeed obtained.

Ex. 1056, page 76:17–77:13.

With respect to the "onto and into" discussion in col. 11: 63–64 of Stiles, Dr. Farrauto testified on cross-examination:

> Q [by counsel for Patent Owner] Then they [i.e., Stiles] say, "The ingredients can also be impregnated onto and into a support such as alumina, silica, silica alumina, activated carbon, silicon carbide and others well known to the art [Stiles, col. 11:63–66]."
>
> So what it [Stiles] is saying here is that you can make the reduction catalyst, instead of making it as a stand-alone powder [Stiles, col. 5:31–40 and col. 6:7–9], you can also put it on a support [Stiles, col. 11:63–66]?
>
> A [Dr. Farrauto] Exactly.

Ex. 2003, page 67:10–19.

G. Discussion

On the issue of whether Stiles describes depositing a catalyst on a support, we credit the testimony of Dr. Farrauto over that of Dr. Crocker.

As Dr. Farrauto explains, that there are what might be referred to as two embodiments described by Stiles. A first embodiment is a description of a catalyst in the form of a powder. A second embodiment is a description of a catalyst in the form of a powder impregnated "onto" a support. It is the second description that counts.

Dr. Crocker notes an adsorber being a co-precipitated metal oxide/aluminum oxide material. Ex. 2002 ¶ 37. As Dr. Crocker further notes, "the oxidizing catalyst [] is not located on the alumina but is instead intimately mixed with it." *Id.* Any intimate mixed catalyst/alumina component would be the powder to which Dr. Farrauto refers in his cross-examination testimony quoted above and would relate to what we refer to

as a first embodiment. The powder is then placed on a support—the second embodiment to which we refer.

In the Reply, Petitioner refers to claim 8 of Stiles. Paper 32, page 23.

Claim 1 of the '558 patent, with limitations from claim 8 of Stiles inserted therein, demonstrates the anticipatory nature of Stiles:

> A material for removing gaseous pollutants from combustion exhaust [Stiles, col. 13:1–2] comprising
>
> [1] an oxidation catalyst specie selected from . . . cobalt, nickel, iron, copper, molybdenum [col. 13:5 and 8–9] or combinations thereof
>
> [2] disposed on a high surface area support [col. 13:4–5],
>
> [3] said catalytic component being intimately [col. 13:4; see also col. 5:40–44] and entirely coated with an absorber selected from a hydroxide, carbonate [col. 13:13–15 (potassium carbonate)], bicarbonate or mixtures thereof of an alkali or alkaline earth or mixtures thereof.

For the reasons given, we find that Petitioner has established by a preponderance of the evidence that Stiles describes the limitations of claim 1 of the '558 patent.

We therefore find that Stiles anticipates claim 1 of the '558 patent.

Apart from claims 21–23, Patent Owner does not argue the separate patentability apart from claim 1 of the remaining claims involved in Ground 5. Accordingly, those claims fall with claim 1.

H. Claims 21–23

We instituted an *inter partes* review trial of claims 21–23 based on a likelihood of those claims being unpatentable under § 103. Paper 21, pages 32–33.

In our institution Decision, we said:

> Claims 21–23 claim ranges of (1) 0.5–20, (2) 5–15, and (3) about 10. Ex. 1008A, 13:16–24.
>
> According to Stiles, the amount of alkali can vary from 5 to 50% of the total weight of the adsorbent. Ex. 1008A, 13:16; *see id.* at 6:30–31, 8:10–15.
>
> The Stiles range does not anticipate the ranges of claims 21–23. *See Atofina*, 441 F.3d at 999–1000.
>
> The claimed ranges overlap with the ranges described by Stiles. On that basis, there is a reasonably likelihood that claims 21-23 are unpatentable under 35 U.S.C. § 103(a).

Paper 21, pages 32–33.

In its Opposition, "Patent Owner respectfully objects to the Board's substitution and amendment to the grounds asserted in the Petition." Paper 29, page 30.

Patent Owner does not state why it "objects." Accordingly, we have no basis for evaluating the objection and find no need to further elaborate on the objection.

By indicating a likelihood of unpatentability in the Institution Decision, Patent Owner had (1) notice as well as (2) a full and fair opportunity to address obviousness in its Opposition.

On the merits, Patent Owner acknowledges that the claimed ranges overlap those described by Stiles but says the ranges of Stiles are meaningless:

> Furthermore, with regard to dependent claims 21–23, Stiles at col. 6, lines 30-31, states that "the quantity of alkali can vary from 5 to 50% of the total weight of the adsorbent." *This range is so broad as to be meaningless.* An even broader range (10–90%) is disclosed at col. 8, lines 14-15 of the reference. The only meaningful guidance provided by Stiles as to the amount of alkali carbonate is that "the 50% content has proved to be optimum." This does not, however, provide the skilled person with any guidance as to the amount of alkali metal carbonate to use in the material of the '558 patent, which comprises a high surface area support material. The ranges of claims 21, 22 and 23 of the '558 patent are based on the total weight of the material of claim 1, including the high surface area support. The adsorbent of Stiles does not include a high surface area support material. The alkali carbonate amount of 50%, stated by Stiles to be optimum, cannot be correlated to the ranges of claims 21-23 of the '558 patent.

Paper 29, pages 29–30.

The discussion quoted above is an argument of counsel and does not refer to any underlying evidence in the record. We are not sure what counsel means by "cannot be correlated." Patent Owner does not deny that the ranges described by Stiles, however broad, overlap the ranges of claims

21–23 of the '558 patent. Rather, Patent Owner maintains that "[t]he adsorbent of Stiles does not include a high surface area support material"—a position with which we disagree for the reasons given above.

We agree with Petitioner's argument set out in its Reply:

> The ranges recited in claims 21-23 for the weight of absorbent overlap with the ranges disclosed by Stiles. See [the Institution] Decision (Paper 21) at pp. 32-33. Therefore, [the subject matter of] claims 21-23 . . . [would have been] *prima facie* obvious. MPEP §2144.05. [See also the cases cited on pages 18–19 of the Decision to institute.] Patent Owner has not rebutted this *prima facie* obviousness by establishing unexpected results in the ranges claimed or that Stiles teaches away from the claimed ranges. *See In re Geisler*, 116 F.3d 1465, 1469 (Fed. Cir. 1997).

Paper 32, page 25.

Claims 21–23 are unpatentable under § 103(a) over Stiles.

VIII. Motions to Exclude

A. Introduction

Patent Owner has filed two motions to exclude. Paper 34 and Paper 37.

A motion to exclude can be based on (1) inadmissibility under the Federal Rules of Evidence (37 C.F.R. § 42.62) or (2) evidence presented contrary to the applicable rules (37 C.F.R. § 42.62 (a) and 37 C.F.R. § 42.61(a) ("[e]vidence that is not taken, sought, or filed in accordance with . . . [Subpart 42] is not admissible.").

B. First Motion

1. Exhibits 1015 and 1055

Exhibit 1015 is the Second Farrauto Declaration.

Exhibit 1055 is Canadian Patent 1,028,681.

The exhibits are objected to basically because they were filed with Petitioner's Reply. Paper 34, page 2.

The fact that evidence is filed with a reply does not mean the evidence is *per se* inadmissible.

The exhibits relate to the issue of whether there is a typographical error in Example 1 of Hoekstra, i.e., is "2.018" a typographical error which should be "0.018."

In presenting the Petition, Petitioner's witness Dr. Farrauto explained why he felt Hoekstra's Example 1 anticipates claim 1 of the '558 patent.

Dr. Crocker, Patent Owner's witness, disagreed with Dr. Farrauto's explanation.

On cross-examination, Dr. Crocker was asked if the basis for his disagreement might be different if the "2.018" number should have been "0.018." The underlying basis for the "2.018"number vis-à-vis the "0.018" number is a description of "0.018" in numerous foreign counterparts of the '558 patent, including Canadian Patent 1028681—the only foreign patent document which we have considered. No objection to admissibility of the Canadian Patent was made during the Crocker cross-examination. 37 C.F.R. § 42.64(a).

As explained above, Dr. Crocker agreed. Based on a "0.018" number, Dr. Crocker came to the view that there would have been no leaching of platinum into the alkali layer.

The Second Farrauto Declaration was submitted with the Reply and establishes that both Dr. Farrauto and Dr. Crocker both agree on the "0.018" number, based *inter alia* on the Canadian Patent.

Petitioner's cross-examination was relevant to direct declaration testimony by Dr. Crocker. Thus, the "first time in the Reply" (Paper 34, page 2) argument came about as a direct result of Dr. Crocker's cross-examination. The objected to portion of the Second Farrauto Declaration is also responsive to, and essentially consistent with, Dr. Crocker's cross-examination. Whether evidence is excluded is discretionary with the Board. How discretion is exercised is determined on the precise facts in each case. This can be seen, for example, in our decision in *Corning, Inc. v. DSM IP Assets B.V.*, IPR2013-00047 (PTAB May 1, 2014) (Paper 84), where some reply evidence was excluded while other reply evidence was not excluded.

Patent Owner would contend, no doubt, that the excluded evidence in *Corning* is similar to the evidence sought to be excluded here.

However, a review of the precise facts will show otherwise.

Here, the factual question is whether limitations in claim 1 are inherently anticipated by Hoekstra.

Unlike *Corning*, the inherency theory matured during cross-examination of Patent Owner's witness, Dr. Crocker.

Ultimately, in our view, Dr. Crocker agreed that no platinum migrated to the alkali metal layer—based on an analysis with a correct "0.018" number.

The Reply evidence, consistent with Dr. Crocker's testimony, agreed that a correct number is "0.018" and on that basis, Petitioner's witness agreed with Dr. Crocker.

Further, unlike *Corning*, a whole new theory of anticipation did not arise in the first instance with the Reply; rather, it was essentially developed during cross-examination of Patent Owner's witness.

Still further, unlike *Corning* where Patent Owner had no chance to counter the evidence based on a first instance new theory in a reply, here the inherency issue based on the "0.018" number came up during cross-examination. Patent Owner had an opportunity to address the "0.018" number on redirect and indeed did so. Ex. 1056, pages 106:23–107:11.

Alternatively, as noted by Petitioner at oral argument, Patent Owner could have addressed the matter in observations. Transcript of Oral Argument, Paper 49, page 32:18 through page 33:5.

Lastly, Patent Owner could have contacted the Board to urge leave to file a sur-reply. *See Nintendo of America, Inc. v. ILife Technologies*, IPR2015-00106 (PTAB Dec. 7, 2015) (Paper 25) and *Masterimage 3D, Inc. v. Realding, Inc.*, IPR2015-00035 (PTAB Nov. 29, 2015) (Paper 58).

The objection is *overruled*.

Petitioner's Reply therefore does not raise an impermissible new argument.

2. Exhibit 1015 ¶ 10

Patent Owner objects to the admissibility of paragraph 10 of Exhibit 1015 (Second Farrauto Declaration). Paper 34, page 3.

According to Patent Owner, the exhibit improperly presents new evidence relevant to how one skilled in the art would understand Figure 5(A) of Takeshima.

Patent Owner has prevailed on whether Takeshima anticipates claim 1 of the '558 patent notwithstanding Petitioner's view on what one skilled in the art would have understood about Takeshima Figure 5(A).

The objection addresses the weight to be assigned testimony as opposed to admissibility.

The objection is *overruled*.

3. Portion of the Reply

Patent Owner objects to what it characterizes as new argument on page 16:7–17:17 (sic—16) of Petitioner's Reply. Paper 34, pages 3–4.

A motion to exclude should address only admissibility of evidence—not whether a Reply makes a "new" argument.

The objection is *dismissed* as improperly made in a motion to exclude.

4. Exhibit 1016

Patent Owner objects to the admissibility of Exhibit 1016. Paper 34, pages 4–5.

Exhibit 1016 is a dictionary definition.

In making our decision, we have not relied upon Exhibit 1016.

Accordingly, the objection is *dismissed* as moot.

C. Second Motion

Filing of the Second Motion was authorized in an order entered 9 October 2015. Paper 36.

In the order, Patent Owner was told the following:

> The motion shall not include argument as to the merits of patentability and shall not serve in any way as supplementing arguments made in Patent Owner's opposition on the merits.
>
> The motion shall be limited to (1) identifying the exhibit sought to be excluded and (2) a very brief discussion as to why it is being improperly relied upon by Petitioner in its Reply:
>
> > "The exhibit sought to be excluded is Ex. ____. The exhibit should be excluded because [explain why]."

Paper 36, page 6.

A purpose in requiring a particular format was to make it easy for Petitioner to respond to the Second Motion and for the Board to analyze and decide the motion. *See* 37 C.F.R. § 42.1(b) (inexpensive resolution of proceeding).

A review of the motion will immediately confirm that Patent Owner did not follow the format ordered and manifestly is an attempt to supplement arguments made in Patent Owner's Opposition.

The Second Motion is *denied* without a consideration on the merits based on a failure to adhere to requirements set out in the order. 37 C.F.R. § 42.12(a)(1).

IX. Large Documents

The parties have filed several large documents, i.e., documents containing many pages.

Examples are (1) the prosecution history (Ex. 1002—164 pages), (2) the Crocker cross-examination (Ex. 1056—140 pages), and (3) the Farrauto cross-examination (Ex. 2003—220 pages).

With respect to these large documents, we have considered only the pages called to our attention by the parties in the Petition, Opposition, Reply or other paper or mentioned in our opinion.

All other pages were not considered and are excluded from evidence.

X. Judgment

Upon consideration of the Petition, Opposition, and Reply, and for the reasons given, it is

ORDERED that based on Ground 1 (Takeshima), Petitioner has not established by a preponderance of the evidence that any challenged claim is unpatentable;

FURTHER ORDERED that based on Ground 2 (Hoekstra), Petitioner has established by a preponderance of the evidence that claims 1, 7, 8, 12, 14, 21, 22, 32–35, and 38–42 of the ’558 patent are unpatentable under 35 U.S.C. § 102(b) and claims 9–11 and 23 of the ’558 patent are unpatentable under 35 U.S.C. § 103(a);

FURTHER ORDERED that based on Ground 3 (Kinoshita), Petitioner has not established by a preponderance of the evidence that claims 1–32 of the ’558 patent are anticipated by Kinoshita.

FURTHER ORDERED that based on Ground 3 (Kinoshita), Petitioner has established by a preponderance of the evidence that claims 33–40, 42, and 44 of the ’558 patent are anticipated by Kinoshita.

FURTHER ORDERED that based on Ground 4 (Inui), the evidence establishes by a preponderance of the evidence that claims 1, 2, 7–10, 14, 15, 17, 19, 24, 31, 33–37, 39, and 40 of the ’558 patent are unpatentable under 35 U.S.C. § 102(b).

FURTHER ORDERED that based on Ground 5 (Stiles), the evidence establishes that claims 1, 7, 8, 14–17, 19, and 31 of the ’558 patent are unpatentable under 35 U.S.C. § 102(b) and that claims 21–23 of the ’558 patent are unpatentable under 35 U.S.C. § 103(a).

FURTHER ORDERED that claims 1, 2, 7–12, 14–17, 19, 21–24, 31–42 of the ’558 patent are unpatentable.

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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