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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE, INC.,
Petitioner,

v.

REALTIME DATA LLC,
Patent Owner.

Case IPR2016-01737
Patent 8,880,862 B2

Before DEBRA K. STEPHENS, GEORGIANNA W. BRADEN, and JASON J. CHUNG, *Administrative Patent Judges*.

BRADEN, *Administrative Patent Judge*.

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

I. INTRODUCTION

We have jurisdiction to hear this *inter partes* review under 35 U.S.C. § 6, and this Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons that follow, we determine that Petitioner has shown by a preponderance of the evidence that claims 1–4, 6, 7, 13, 23–34, 47–58, 83–96, 99, 100, 105–111, 113, and 116 ("the challenged claims") of U.S. Patent No. 8,880,862 B2 (Ex. 1001, "the '862 Patent") are unpatentable. Additionally, we grant Patent Owner's Contingent Motion to Amend with respect to proposed substitute claims 118–173.

A. Procedural History

Apple, Inc. ("Petitioner") filed a Petition (Paper 2, "Pet.") requesting an *inter partes* review of the challenged claims of the '862 Patent. Realtime Data, LLC ("Patent Owner") timely filed a Preliminary Response (Paper 6, "Prelim. Resp.").

Pursuant to 35 U.S.C. § 314(a), we instituted an *inter partes* review of (1) all claims challenged as unpatentable under 35 U.S.C. § 103(a)[1] in view of Sukegawa[2] and Dye[3]; (2) all claims challenged as unpatentable under 35 U.S.C. § 103(a) in view of Sukegawa, Dye, and Settsu[4]; (3) all claims

[1] The Leahy-Smith America Invents Act ("AIA") included revisions to 35 U.S.C. § 100 et seq. effective on March 16, 2013. The '862 patent issued from an application filed before March 16, 2013; therefore, we apply the pre-AIA versions of the statutory bases for unpatentability.
[2] U.S. Patent No. 5,860,083, issued Jan. 12, 1999 (Ex. 1005, "Sukegawa").
[3] U.S. Patent No. 6,145,069, filed Apr. 26, 1999, issued Nov. 7, 2000 (Ex. 1008, "Dye").
[4] U.S. Patent No. 6,374,353 B1, filed Mar. 3, 1999, issued Apr. 16, 2002 (Ex. 1006, "Settsu").

challenged as unpatentable under 35 U.S.C. § 103(a) in view of Sukegawa, Dye, and Burrows[5]; (4) all claims challenged as unpatentable under 35 U.S.C. § 103(a) in view of Sukegawa, Dye, Settsu, and Burrows; and (5) all claims challenged as unpatentable under 35 U.S.C. § 103(a) in view of Sukegawa, Dye, Settsu, and Zwiegincew[6]. *See* Paper 7 ("Dec. to Inst."), 24.

After institution of trial, Patent Owner filed a Patent Owner Response (Paper 20, "PO Resp."), to which Petitioner filed a Reply (Paper 23, "Reply"). In addition, Patent Owner filed a Motion to Amend Claims (Paper 19, "Mot. to Amend."), which was opposed by Petitioner (Paper 24, "Opp."). Patent Owner submitted a Reply in Support of its Motion to Amend. Paper 31, "PO Reply." During the intervening time, new case law was issued by the Court of Appeal for the Federal Circuit,[7] and the parties submitted additional briefing based on the new case law. Papers 37 ("Pet. Suppl. Opp."), 39 ("PO Suppl. Brief in Support of Mot. to Amend").

Patent Owner also filed objections to Evidence in Petitioner's Reply (Papers 25, 44) and a Motion to Exclude Evidence (Paper 46). Petitioner opposed the Motion to Exclude (Paper 48) and Patent Owner submitted a Response in support of its Motion to Exclude (Paper 49). In addition Patent Owner filed a list of alleged improper reply arguments (Paper 32) to which Petitioner filed a Reply (Paper 33).

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[5] Michael Burrows et al., *On-line Data Compression in a Log-structured File System* (1992) (Ex. 1007, "Burrows").
[6] U.S. Patent No. 6,317,818 B1, filed Mar. 30, 1999, issued Nov. 13, 2001 (Ex. 1010, "Zwiegincew").
[7] *See Aqua Products, Inc. v. Matal*, 872 F.3d 1290 (Fed. Cir. 2017), discussed *infra* Section II.

An oral argument was held on January 8, 2018. A transcript of the oral argument is included in the record.[8] Paper 56 ("Tr.").

B. Related Proceedings

The parties identify the following cases as related to the challenged patent: *Realtime Data, LLC v. Microsoft Corporation*, Case No. 4:14-cv-00827 (E.D. Tex.), *Realtime Data, LLC v. Microsoft Corporation*, Case No. 6:15-cv-00885 (E.D. Tex.), and *Realtime Data, LLC v. Apple, Inc.*, Case No. 3:16-cv-02595 (N.D. Cal.) (transferred from *Realtime Data, LLC v. Apple, Inc.*, Case No. 6:15-cv-00885 (E.D. Tex.)). Pet. 1; Paper 5, 2.

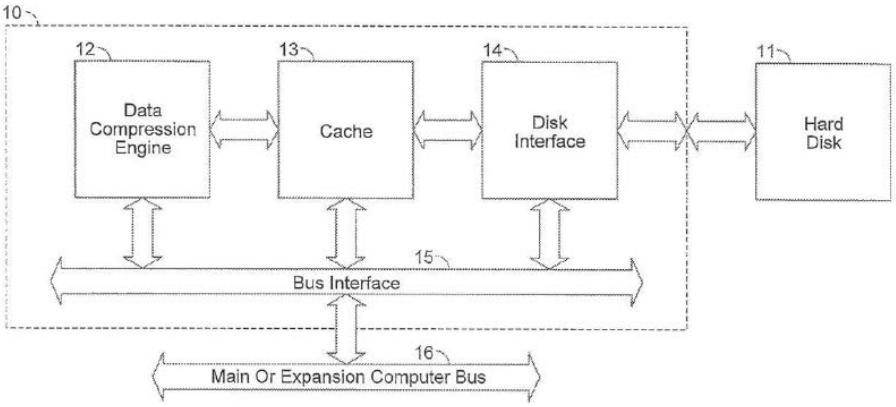
C. The '862 Patent

The '862 Patent relates to "providing accelerated loading of operating system and application programs upon system boot or application launch," and the use of data compression and decompression techniques for such purpose. Ex. 1001, 1:20–26. The specification discusses the limits of prior art storage devices, particularly the significant bandwidth limitations of "mass storage devices" such as hard disk drives. *Id.* at 1:43–57, 2:9–18. According to the specification,

> "[A]ccelerated" data storage comprises receiving a digital data stream at a data transmission rate which is greater than the data storage rate of a target storage device, compressing the input stream at a compression rate that increases the effective data storage rate of the target storage device and storing the compressed data in the target storage device.

[8] Petitioner filed Objections to Demonstrative Exhibits. Paper 52. In this Final Written Decision, we rely directly on the arguments presented properly in the parties' briefs and the evidence of record. The demonstrative exhibits were only considered to the extent they are consistent with those arguments and evidence; therefore, the objections are overruled.

Id. at 5:41–47. One embodiment of the '862 Patent is illustrated in Figure 1, reproduced below.



As shown in Figure 1, data storage controller 10 is "operatively connected" to hard disk 11 and to host system's bus 16. *Id.* at 5:63–6:53. Controller 10 includes cache 13 for data storage/preloading, and data compression engine 12 for data compression/decompression. *Id.* at 5:63–6:53, 20:50–22:11. The '862 Patent explains that, following reset or power on of a computer system, the "initial bus commands inevitably instruct the boot device controller [e.g., controller 10] to retrieve data from the boot device (such as a disk) [e.g., hard disk 11] for the operating system." *Id.* at 20:36–49.

D. Illustrative Claims

As noted above, an *inter partes* review was instituted as to claims 1–4, 6, 7, 13, 23–34, 47–58, 83–96, 99, 100, 105–111, 113, and 116 of the '862 Patent. Dec. to Inst. 24. Claims 1, 7, 22, and 27 are independent. Claim 1 is illustrative of the challenged claims, and is reproduced below:

1. A method for providing accelerated loading of an operating system in a computer system, the method comprising:
loading a portion of boot data in a compressed form that is associated with a portion of a boot data list for booting the computer system into a memory;

accessing the loaded portion of the boot data in the compressed form from the memory;
decompressing the accessed portion of the boot data in the compressed form at a rate that decreases a boot time of the operating system relative to loading the operating system utilizing boot data in an uncompressed form; and
updating the boot data list,
wherein the decompressed portion of boot data comprises a portion of the operating system.

Ex. 1001, 26:38–51.

II. ANALYSIS

A. Claim Construction

In an *inter partes* review, claim terms in an unexpired patent are interpreted according to their broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b); *see Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016) ("We conclude that the regulation represents a reasonable exercise of the rulemaking authority that Congress delegated to the Patent Office."). Under that standard, and absent any special definitions, we give claim terms their ordinary and customary meaning, as would be understood by one of ordinary skill in the art at the time of the invention. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). An inventor, however, may provide a meaning for a term that is different from its ordinary meaning by defining the term in the specification with "reasonable clarity, deliberateness, and precision." *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994). Limitations, however, are not to be read from the specification into the claims. *In re Van Geuns*, 988 F.2d 1181, 1184 (Fed. Cir. 1993). In addition, the Board may not "construe claims during [an *inter partes* review] so broadly that its constructions are unreasonable under general claim

construction principles." *Microsoft Corp. v. Proxyconn, Inc.*, 789 F.3d 1292, 1298 (Fed. Cir. 2015).

The parties dispute the proper construction of the terms "boot data list" and "non-accessed boot data."

1. "boot data list"

Patent Owner contends the term "boot data list" should mean "record used to identify and load boot data into memory." PO Resp. 19. According to Patent Owner, both the '862 patent's specification and the provisional application to which the '862 patent claims priority establish that the claimed "boot data list" is a record of boot data separate from the boot data itself. *Id.* at 20. Patent Owner argues that "[b]oot data comprises information such as program code relating to portions of the operating system and certain application programs." *Id.* (citing Ex. 1001, 3:48–50; Ex. 2010, 58). Patent Owner reasons that the system stores boot data in a compressed form on a boot device (*id.* (citing Ex. 1001, 3:51–52, 3:60–61; Ex. 2010, 58)), loads boot data into memory upon initialization of the computer system (*id.* (citing Ex. 1001, 3:45–46, 4:16–17; Ex. 2010, 58)), and services requests for boot data using the loaded boot data (*id.* (citing Ex. 1001, 3:46–47, 4:1–3, 4:17–19, 21:45–59, Fig. 7B)). Patent Owner then argues that "the intrinsic evidence describes a 'boot data list' as comprising a list of data—specifically, boot data—that is to be used for booting a computer system." *Id.* (citing Ex. 1001, 3:44–45, 4:15–16; Ex. 2010, 58). Patent Owner further argues that "[i]n one exemplary embodiment, a data storage controller retrieves and reads the 'boot data list' upon power-on/reset and preloads the boot data specified on the list into memory." *Id.* at 21 (citing Ex. 1001, 21:43–48, Figs. 7B, 8A, 8B).

Petitioner contests Patent Owner's proffered construction arguing that is it overly narrow and improperly imports limitations. Reply 1. Petitioner contends boot data list should be given its ordinary meaning and at least be construed broadly enough to include a list of data associated with data requests expected to result from a system power-on/reset. *Id.* at 2 (citing Pet. 3–6, 10–13). According to Petitioner, Patent Owner improperly attempts to import functional use to the term "boot data list," which renders other claim language directed to use of the boot data list redundant and unnecessary. *Id.* Specifically, Petitioner argues that Patent Owner's reliance on dependent claim 6 is misplaced, because claim 6 explicitly defines the "boot data list" as being "***used for booting the system***," not "used to identify and load boot data into memory." *Id.* at 2–3 (citing PO Resp. 21). Petitioner also argues that the terms "load" and "into memory" are additional features added in claim 6 that would be rendered duplicative and redundant if also imported into the term "boot data list." *Id.* at 3. Petitioner additionally notes that the term "identify" is not used in the claims (or elsewhere in the specification). Petitioner concludes that the claims do not support Patent Owner's attempt to limit "boot data list" as being "used to identify and load boot data into memory." *Id.*

Petitioner further contends that Patent Owner's proposed claim construction is not supported by the '862 patent's specification, specifically the description of Figure 7B. *Id.* at 3 (citing PO Resp. 21–24). According to Petitioner, Patent Owner recognizes that this description is merely "one exemplary embodiment" of the '862 patent, but fails to explain sufficiently why the claimed boot data list should be limited to this embodiment. *Id.* (citing PO Resp. 21). Additionally, Petitioner argues that the '862 patent does not limit use of the boot data list "to identify and load boot data into

memory," as Patent Owner contends, citing to the '862 patent's disclosure of "a list of boot data ***used for booting a computer system***." *Id.* at 2 (citing Ex. 1001, Abstract, 3:42–59).

We are charged with interpreting claim terms according to their broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b). Therefore, we consult the patent's specification to help clarify the meaning of claim terms. *Trading Techs. Int'l, Inc. v. eSpeed, Inc.*, 595 F.3d 1340, 1352 (Fed. Cir. 2010) (holding claims "must be read in view of the specification, of which they are a part" (quoting *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 979 (Fed. Cir. 1995) (en banc), *aff'd,* 517 U.S. 370 (1996))). We must be careful, however, not to import improperly limitations into the claims or to read a particular embodiment appearing in the written description into the claim if the claim language is broader than the embodiment. *In re Van Geuns*, 988 F.2d 1181, 1184 (Fed. Cir. 1993). Given our mandate under 37 C.F.R. § 42.100(b) and the patent's various descriptions of "boot data list," we understand that the examples laid out in the specification are exemplary and are not to be read as limitations in the claims.

Patent Owner's proffered claim construction imports selected limitations from specific embodiments in the specification into the claim and provides an overly narrow interpretation of the claim term. Additionally, Patent Owner has not pointed to any definitions or disavowals in the specification or otherwise clearly explained why the specification's disclosure of "boot data lists" should not guide our claim construction analysis. Thus, we are unpersuaded by Patent Owner's contentions, which appear to be based on a narrow reading of the claim that is inconsistent with the broadest reasonable interpretation of the claims.

Accordingly, we decline to adopt Patent Owner's claim construction as it would limit unnecessarily the scope of the claims. Instead, we find the broadest reasonable construction of "boot data list" to encompass a "list of boot data."

2. "non-accessed boot data"

Patent Owner contends that the term "non-accessed boot data," as used in claims 96, 100, 102, and 106, should mean "boot data identified in the boot data list that was not requested during system boot-up." PO Resp. 25 (citing Ex. 2008 ¶¶ 60–65, 66–71). According to Patent Owner, "the specification explains that 'non-accessed boot data' is boot data that has been retrieved and recorded in the boot data list during a previous system boot-up but was not requested during a subsequent system boot-up." *Id.* at 25–26. Patent Owner argues that if the boot data is not requested during system boot-up, then that boot data is "excluded" from the boot data list. *Id.* at 28 (citing Ex. 1001, Fig. 7B, 22:5–11).

Petitioner contests Patent Owner's position, arguing that the intrinsic record does not limit functionally the term "non-accessed" to "not requested" or limit temporally the term "non-accessed" to "during system boot-up." Reply 5. Rather, according to Petitioner, under the broadest reasonable interpretation, a person of ordinary skill in the art would have viewed the term "non-accessed boot data" per its ordinary meaning as simply boot data that was not accessed. *Id.* (citing Ex. 1003 ¶¶ 654–662). Petitioner argues that the embodiments in the specification are non-limiting examples. *Id.* at 5–6. Petitioner further argues that Patent Owner's reliance on the embodiment of Figure 7B is misplaced because the very next embodiment illustrated in Figures 8a and 8b includes references to a "non-requested data block" "[d]uring the ***application launch process***." *Id.* at 6

(citing Ex. 1001, 22:12–23:26; Ex. 1002 (Part 1), 156–157, 160–162). Petitioner notes that Patent Owner's citations include the application launch embodiment, which contradicts limiting non-accessed boot data to only data "not requested during system boot-up." *Id*. Petitioner concludes that adopting Patent Owner's construction would exclude improperly a specific embodiment (during application launch) that Patent Owner cites now in support of its construction and also cited during prosecution to show written description support for the disputed term. *Id.*

We determine that Patent Owner's proposed construction is unduly narrow and improperly attempts to import limitations from the specification. Rather, we agree with Petitioner's position and we construe "non-accessed boot data" as "boot data that has not been accessed."

3. Additional claim terms

We determine that no additional claim terms require express construction at this stage (*see Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (Only terms which are in controversy need to be construed, and only to the extent necessary to resolve the controversy)).

B. Principles of Law

A claim is unpatentable under 35 U.S.C. § 103(a) if "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including (1) the scope and content of the prior art;

(2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) objective evidence of nonobviousness, i.e., secondary considerations. *See Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17–18 (1966).

"A determination of whether a patent claim is invalid as obvious under § 103 requires consideration of all four *Graham* factors, and it is error to reach a conclusion of obviousness until all those factors are considered." *Apple v. Samsung Elecs. Co., Ltd.*, 839 F.3d 1034, 1048 (Fed. Cir. 2016) (en banc) (citations omitted). "This requirement is in recognition of the fact that each of the *Graham* factors helps inform the ultimate obviousness determination." *Id.*

"In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable." *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify "with particularity . . . the evidence that supports the grounds for the challenge to each claim")). This burden never shifts to Patent Owner. *See Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (citing *Tech. Licensing Corp. v. Videotek, Inc.*, 545 F.3d 1316, 1326–27 (Fed. Cir. 2008)) (discussing the burden of proof in *inter partes* review). Furthermore, Petitioner cannot satisfy its burden of proving obviousness by employing "mere conclusory statements." *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016).

Thus, to prevail in an *inter partes* review, Petitioner must explain how the proposed combinations of prior art would have rendered the challenged claims unpatentable. At this final stage, we determine whether a

preponderance of the evidence of record shows that the challenged claims would have been obvious over the proposed combinations of prior art.

We analyze the instituted grounds of unpatentability in accordance with the above-stated principles.

C. Level of Ordinary Skill in the Art

In determining whether an invention would have been obvious at the time it was made, we consider the level of ordinary skill in the pertinent art at the time of the invention. *Graham*, 383 U.S. at 17. "The importance of resolving the level of ordinary skill in the art lies in the necessity of maintaining objectivity in the obviousness inquiry." *Ryko Mfg. Co. v. Nu-Star, Inc.*, 950 F.2d 714, 718 (Fed. Cir. 1991). The person of ordinary skill in the art is a hypothetical person who is presumed to have known the relevant art at the time of the invention. *In re GPAC, Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995). The level of ordinary skill in the art may be reflected by the prior art of record. *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001). Factors that may be considered in determining the level of ordinary skill in the art include, but are not limited to, the types of problems encountered in the art, the sophistication of the technology, and educational level of active workers in the field. *GPAC*, 57 F.3d at 1579. In a given case, one or more factors may predominate. *Id.* Generally, it is easier to establish obviousness under a higher level of ordinary skill in the art. *Innovention Toys, LLC v. MGA Entm't, Inc.*, 637 F.3d 1314, 1323 (Fed. Cir. 2011) ("A less sophisticated level of skill generally favors a determination of nonobviousness . . . while a higher level of skill favors the reverse.").

Petitioner's declarant, Charles J. Neuhauser, Ph.D. ("Dr. Neuhauser"), opines that a person of ordinary skill in the art relevant to the '685 patent

would have had "a Bachelor's Degree in electrical engineering, computer engineering, or a related area of study" as well as "between three and five years of practical experience in the design and implementation of computer systems, such as personal computers." Dr. Neuhauser further opines that, in the alternative, a person with "a Master's Degree in the area of electrical engineering, computer engineering, or a related area of study and somewhat less practical experience would be similarly qualified." Ex. 1003 ¶ 15.

Patent Owner does not dispute Dr. Neuhauser' testimony. *See generally* PO Resp. Patent Owner's Declarant, Dr. Godmar Back ("Dr. Back"), however, provides his own assessment regarding a person of ordinary skill in the art relevant to the '862 patent and agrees with Dr. Neuhauser's testimony. Ex. 2008 ¶ 55.

We do not observe a meaningful differences between the parties' assessments of a person of ordinary skill in the art. We further note that either assessment appears consistent with the level of ordinary skill in the art at the time of the invention as reflected in the prior art in the instant proceeding. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001). Our analysis in this Decision is supported by either assessment. Based on our review of the '862 patent, the types of problems and solutions described in the '862 patent and cited prior art, and the testimony of Dr. Neuhauser and Dr. Back, we adopt and apply Dr. Back's definition of a person of ordinary skill in the art at the time of the claimed invention for purposes of this Decision.

D. Overview of the Asserted Prior Art

1. Sukegawa

Sukegawa is a U.S. Patent titled "Data Storage System Having Flash Memory and Disk Drive" and relates to "a data storage system using a flash

memory unit and an HDD [(hard disk drive)]." Ex. 1005, [54], [57]. Figure 1 of Sukegawa is reproduced below.

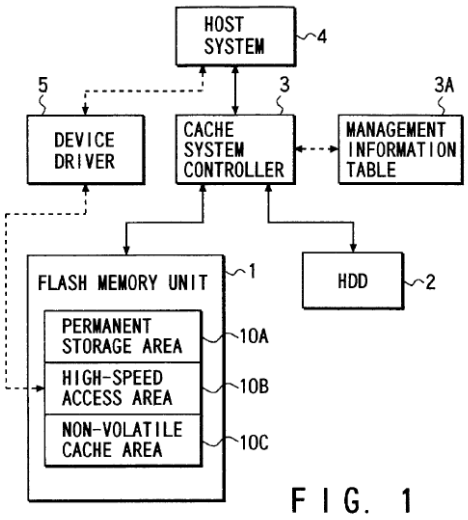
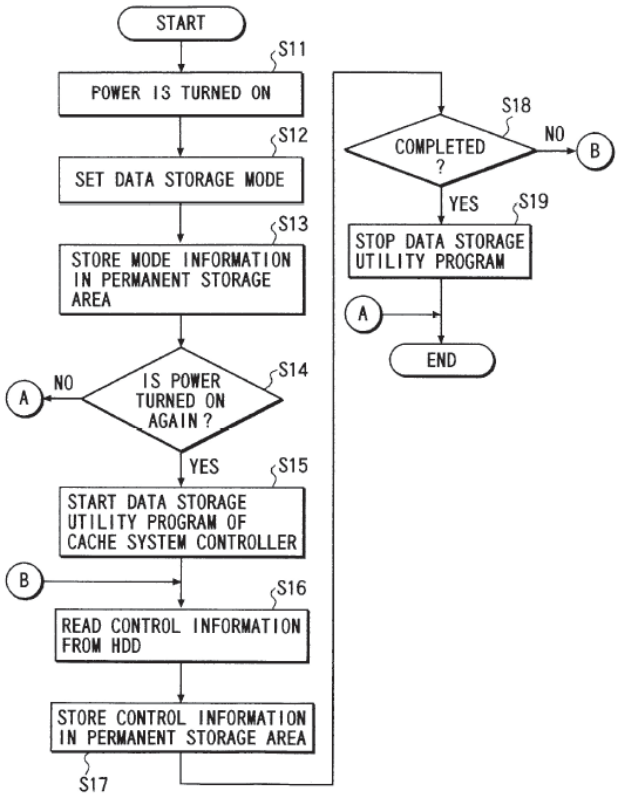


FIG. 1

Figure 1 is "a block diagram showing a main part of a data storage system according to the present invention." *Id.* at 3:44–45. As shown in Figure 1, a data storage system includes flash memory unit 1, hard disk drive (HDD) 2, cache system controller 3, and device driver 5. *Id.* at 4:4–14. Sukegawa teaches device driver 5 controls flash memory 1 under management of the operation system of host system 4. *Id.* at 4:12–14. Controller 3 performs data input/output control for flash memory unit 1 and HDD 2 via respective device driver 5. *Id.* at 4:17–21. The flash memory unit is used, for example, to store "data which is used frequently for a relatively long time period." *Id.* at Abstract. Such data could include "control information necessary for starting an application program (AP) and an OS [(operating system)]." *Id.* at 2:65–3:3. Although such control information is stored on the HDD, the data may be stored also on the flash memory unit so that the OS may be started using the control information on the flash memory unit instead of the HDD. *Id.* at 6:45–54. This is advantageous because the flash memory unit has a

"higher access speed," which allows the OS to be started more quickly. *Id.* at 6:54–58.

Figure 4 of Sukegawa, reproduced below, teaches an embodiment of a system having a data storage mode for storing control information necessary for storing the OS in the permanent storage area 10A of flash memory unit 1, when the OS is started in a series of operations from turn-on of power to completion of the starting operation. *Id.* at 6:20–26.



As illustrated in Figure 4 of Sukegawa, above, when the system is switched on and the user sets the data storage mode via the user interface, controller 3 stores control information in permanent storage area 10A in flash memory unit 1 and when the OS is started at the time of the next turning-on of power, the control information necessary for starting the OS is read out not from permanent storage area 10A or cache memory area, and transferred to the host system 4. *Id.* at 6:27–54. "Thus, the control

information can be accessed from the permanent storage area 10A in the flash memory unit 1 having a higher access speed than the HDD 2. As a result, the OS can be started at higher speed." *Id.* at 6:45–58.

2. Dye

Dye is a U.S. Patent titled "Parallel Decompression and Compression System and Method for Improving Storage Density and Access Speed for Non-Volatile Memory and Embedded Memory Devices." Ex. 1008, at [54]. Dye relates to controllers for flash or embedded memory that include data compression and decompression engines "for increased effective memory density and improved bandwidth." *Id.* at 1:17–22, 2:42–46. According to Dye, such a controller enables conventional flash memory to "achieve higher bandwidth, more effective density, with less system power and noise." *Id.* at 3:3–12, 3:23–28. The technology permits data to be "saved in either a normal or compressed format, retrieved from the Flash Memory Array for MPU [(microprocessing unit)] execution in a normal or compressed format, or transmitted and stored on a medium in a normal or compressed format." *Id.* at 3:66–4:8.

Figure 10B of Dye is reproduced below.

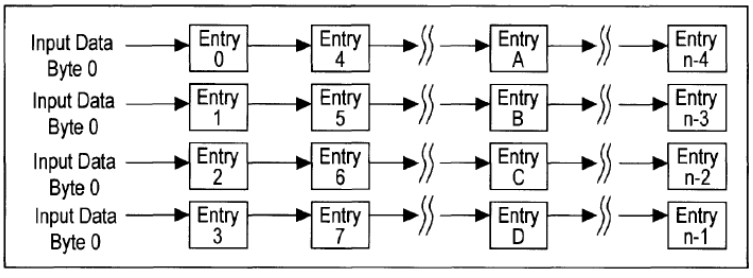


Fig. 10B
(New Art)

Figure 10B, above, illustrates a preferred embodiment "provid[ing] a parallel implementation of dictionary based (or history table based)

compression/decompression." Ex. 1008 18:61–63. In the preferred embodiment illustrated in Dye's Figure 10B, the history table becomes a four symbol parallel flow. *Id.* at 19:15–17. "[Four] symbols are analyzed in parallel, and multiple compressed outputs may also be provided in parallel." *Id.* at 19:17–19. "Other alternate embodiments may contain a plurality of compression windows for decompression of multiple streams." *Id.* at 19:19–21.

Figure 13 of Dye is reproduced below.

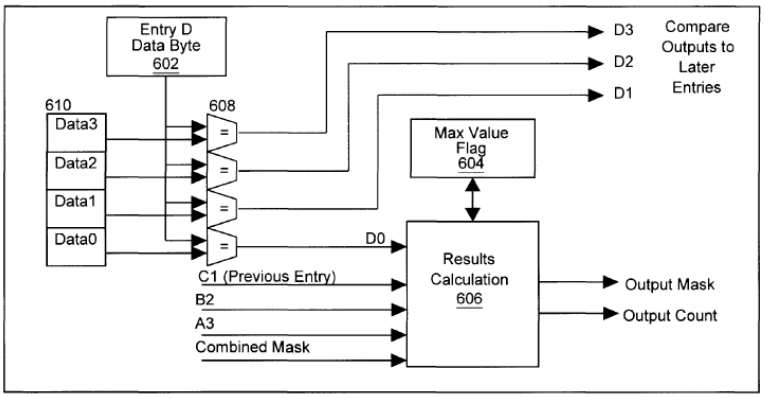


Fig. 13

Figure 13, above, is a hardware diagram illustrating "operation of the parallel compression algorithm." *Id.* at 22:66–67. Each entry of the history table contains a symbol of data, which is compared with the input stream. *Id.* at 23:1–3. In Figure 13, Entry D Data Byte 602 is compared with each symbol of input data stream 610, shown as four data bytes, Data 0, 1, 2, and 3. *Id.* at 23:5–7. Comparators 608 compare each data byte to Entry D Data Byte 602, generating four compare signals (D0 through D3), with D1 through D3 being used by the next entry in the history table and D0 being used by Results Calculation 606. *Id.* at 23:7–55. Results Calculation 606

sends Output Mask and Output Count to logic shown in Dye's Figure 14. *Id.* at 23:19–24.

3. Settsu

Settsu is a U.S. Patent titled "Information Processing Apparatus Method [sic] of Booting Information Processing Apparatus at a High Speed" and relates to "[a] method of booting up an information processing apparatus." Ex. 1006, [54], [57]. One embodiment taught in Settsu involves dividing the main body of an operating system into modules and storing each module as compressed files on a boot device. *Id.* at 14:58–63. Each of these modules is decompressed each time it is loaded into memory, and "the time required for I/O [(input/output)] processing can be reduced" as a result, which "provides an advantage of being able to further reduce the time required for booting up the information processing apparatus." *Id.* at 14:64–15:4.

4. Burrows

Burrows is a conference report titled "On-line Data Compression in a Log-Structured File System," which "appeared in the proceedings of the Fifth International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS-V), 12–15 October, 1992, published by ACM Press." Ex. 1007, Title, iv. According to Burrows, "[b]uilding a file system that compresses the data it stores on disk is clearly an attractive idea," at least because "more data would fit on the disk" and using a "fast hardware data compressor" would "increase the effective disk transfer rate by the compression factor, thus speeding up the system." *Id.* at 1. Burrows teaches a particular type of file system utilizing data compression and reports the results of tests of that system.

5. *Zwiegincew*

Zwiegincew is a U.S. Patent titled "Pre-Fetching of Pages Prior to a Hard Page Fault Sequence," and it recognizes problems of slow boot that result when hard page faults occur during the boot process. Ex. 1010, [54], 1:45–51, 2:12–15, 5:50–51. To improve boot speed, Zwiegincew proposes pre-fetching, from a hard disk to memory, pages that are expected to be requested during the boot process, thereby reducing occurrence of hard page faults. *Id.* at [57], 1:5–3:55. "Copies of, or references to, the . . . pages are stored in a scenario file" and, "[w]hen a hard page fault scenario is detected, a corresponding scenario file is fetched from disk storage and the determined pages, or copies thereof, are transferred into RAM." *Id.* at [57]. Zwiegincew also recognizes benefits of compressing pre-fetched page data. For instance, Zwiegincew's system includes "a disk compressor/decompressor," which employs "compression algorithms" on pre-fetched data to achieve pre-fetch time improvements. *Id.* at 8:66–9:13, Figs. 1–2.

E. Alleged Obviousness of the Challenged Claims in View of Sukegawa and Dye

Petitioner contends the combination of Sukegawa and Dye teaches or suggests each element of claims 1–4, 6, 7, 13, 23–34, 47–58, 83–96, 99, 100, 105–111, 113, and 116. Pet. 6–59; Reply 7–11. Patent Owner disputes Petitioner's contentions. PO Resp. 29–36, 41–74. For reasons that follow, we determine, based on the entirety of the record before us, Petitioner has established by a preponderance of the evidence that the challenged claims of the '862 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over Sukegawa and Dye.

1. *Analysis of Cited Art as Applied to Independent Claims 1, 6, and 13*

Petitioner contends the combined teachings of Sukegawa and Dye render every element of claims 1, 6, and 13 of the '862 patent obvious. Pet. 6–24, 29–33, 36–38. Patent Owner disputes Petitioner's contentions. PO Resp. 29–36, 41–74. Patent Owner specifically argues that Petitioner fails to show that (1) Sukegawa teaches "a boot data list" (*id.* at 29–36); (2) Sukegawa or Dye discloses "a portion of boot data" be "associated with a portion of a boot data list" at the time the boot data is loaded into memory (*id.* at 45–53); and (3) "compressed data "resides on "the boot device" in Dye (*id.* at 69–74). We address the issues disputed by Patent Owner in more detail below.

a. "loading . . . boot data in a compressed form that is associated with . . . a boot data list" (claim 1) / "loading boot data in a compressed form that is associated with a boot data list from a boot device" (claim 13)

For the recited step of "load[ing] . . . boot data in [a/the] compressed form that is associated with . . . a boot data list," Petitioner identifies teachings in Sukegawa relating to maintaining "control information" necessary for starting an OS or an application program as boot data used for booting a computer system. *Id.* at 8–9. For the step of "loading," Petitioner asserts that Sukegawa's controller 3 loads boot data out of HDD2 and into flash memory 1 in performing "data input/output control (including cache operation control) for flash memory unit 1 and HDD." Pet. 9 (citing Ex. 1005, 4:1–21, 5:1–7:2). According to Petitioner, Sukegawa teaches two techniques for loading boot data: (1) user selection of data to load, and (2) automatic selection of data to load. *Id.* (citing Ex. 1005, 5:10–6:58, 7:28–55).

(1) "boot data list"

Petitioner contends Sukegawa discloses multiple forms of boot data lists that are associated with loaded boot data, and that are used in the loading process. *Id.* at 10 (citing Ex. 1003 ¶¶ 122–123). Petitioner further contends that by loading files (or portions of files) of application/OS control information into flash memory 1, Sukegawa's controller 3 loads a portion of boot data associated with a portion of a boot data list for booting the computer system. *Id.* at 11 (citing Ex. 1003 ¶¶ 122–124). Petitioner relies on the testimony of Dr. Neuhauser to support its position.

Dr. Neuhauser specifically opines that one of ordinary skill would have recognized that a file of control information, as described by Sukegawa, is a "list" (that is, a list of data). Ex. 1003 ¶ 122 (citing Ex. 1014 for a definition of the term "file" as "[a] complete, named collection of information, such as a program, a set of data used by a program, or a user-created document" that "binds a conglomeration of instructions . . . into a coherent unit that a user can retrieve, change, delete, save, or send to an output device"). Relying on the cited definition, Dr. Neuhauser testifies one of ordinary skill would have understood Sukegawa's OS and AP program files to be lists of data (including, e.g., program instructions). *Id.* Dr. Neuhauser then testifies that because the files of control information maintained by controller 3 are necessary for starting the corresponding AP or OS, and because they may be used directly as a result of the turn-on of power, these files are, in this example, the claimed "list of boot data." Based on Dr. Neuhauser's testimony, Petitioner concludes that Sukegawa's loaded boot data (e.g., application/OS control information) becomes part of a boot

data list (e.g., part of a file or files of boot data) and, thus, is associated with that boot data list. *Id.* at 11–12 (citing Ex. 1003 ¶¶ 122–124).

Patent Owner contests Petitioner's position arguing that a person of ordinary skill in the art would not have understood that storage of a single file of OS control information would constitute a "boot data list." PO Resp. 29. Patent Owner further argues that Sukegawa's management information Table 3A is a directory that does not meet the claimed "boot data list" because Table 3A is not a record used to identify and load boot data into memory. *Id.* at 29–30. Patent Owner then argues that Petitioner's position is not supported by the definition of the term "file," because the definition does not state that a "file" includes a list of its contents. *Id.* at 30–31. Rather, according to Patent Owner, the definition emphasizes that a file is a "basic unit of storage" that can contain a variety of contents. *Id.* at 31. Patent Owner contends that a person of ordinary skill in the art would have understood that files do not necessarily contain a list of their contents. *Id.* at 32 (citing Ex. 2008 ¶ 78).

We do not agree with Patent Owner. Regardless of whether we use our construction of the term "boot data list" as a "list of boot data," or Patent Owner's overly broad construction, Sukegawa's Table 3A qualifies as a "boot data list." *See supra*, Section II.A.1. As Patent Owner notes, Table 3A functions as a directory that includes entries of information for *correlating file names of control information* stored in flash storage area 10A" and Dr. Back testifies that Table 3A "references the locations of *control information files* stored in flash memory 1." *See* PO Resp. 34 (emphasis added); Ex. 2008 ¶ 83 (emphasis added). By including entries or references to control information files, which include boot data, we find that Sukegawa's Table 3A is a boot data list, as recited by the challenged claims.

See Ex. 1003 ¶¶ 125–126. Additionally, the claims do not recite a temporal limitation, and we will not import any such limitation into the claims at issue. Therefore, even if the boot data list is in flash storage and not in cache memory, Table 3A would still meet the claim requirements, because Sukegawa's Table 3A is used to manage Sukegawa's memory unit 1 by determining whether control information has been loaded or needs to be loaded.

(2) "a portion of boot data" "associated with a portion of a boot data list"

Patent Owner contends that a person of ordinary skill in the art would have understood that loading boot data "*that is* associated with . . . a boot data" list requires that the boot data be "associated with" the boot data list prior to loading the boot data into memory. PO Resp. 46 (citing Ex. 1001, 3:42–47, 3:53–59, 3:64–4:3, 4:14–19, 21:43–48, 22:42–45, 22:57–62, Figs. 7A–7B, 8A–8B; Ex. 2008 ¶¶ 102–103; Ex. 2011, 25:21–26:16). According to Patent Owner, Sukegawa's alleged "boot data" is not associated with the alleged "boot data list" prior to loading the boot data into flash memory 1. *Id.* at 48–49 (citing Ex. 2008 ¶¶ 105–107). Patent Owner relies on the declaration of Dr. Back, who testifies that if Sukegawa's Table 3A is Petitioner's "boot data list," then the boot data Sukegawa loads into its cache does not become associated with that list until after it has been loaded into the cache, not before. *Id.* at 49; Ex. 2008 ¶ 107. Dr. Back further testifies that Sukegawa's system updates its management information table only when loading data into the cache. Ex. 2008 ¶ 107.

We do not agree with Patent Owner's arguments, however, because there is no temporal restriction in the challenged claims that require the association of the boot data to the boot data list prior to loading. And we

will not import any such limitation into the claims at issue. Accordingly, we find that Sukegawa's Table 3A meets the recited claim limitation.

(3) boot data in a compressed form that is associated with . . . a boot data list from a boot device"

Petitioner contends that with its description of HDD2, Sukegawa discloses a boot device. Pet. 37 (citing Ex. 1003 ¶ 414). According to Petitioner, the '862 Patent equates a hard disk drive with "a boot device." *Id.* (citing Ex. 1001, 20:36–49; Ex. 1003 ¶¶ 412–414). Thus, Petitioner argues that Sukegawa and Dye render obvious loading boot data in a compressed form that is associated with a boot data list from a boot device. *Id.* (citing Ex. 1003 ¶¶ 412–419).

For the requirement that the boot data be compressed, Petitioner relies on Dye's description of data compression and decompression engines to compress data for storage and U.S. Patent Application No. 09/239,659 (issued as U.S. Patent No. 7,190,284 B2 ("Dye '284," Ex. 1009), which is related to and incorporated by reference into Dye, as teaching compressing data on a hard drive. Pet. 13–14. Petitioner argues that Dye describes a controller that "uses data compression and decompression for improved system cost and performance." *Id.* at 13–14 (citing Ex. 1008, [57], 2:42–4:55, 7:34–9:5, 10:19–41). Based on the testimony of its expert, Dr. Neuhauser, Petitioner argues a person of ordinary skill would have been motivated to apply these teachings of Dye, with the teachings of Dye '284, to the control information of Sukegawa, and to modify Sukegawa, to increase the effective density and read access rate of the non-volatile storage devices in Sukegawa's system, and to thereby achieve further reduction in the time required for booting up. *Id.* at 13–15 (citing Ex. 1003 ¶¶ 79–91, 130–139).

Patent Owner contests Petitioner's position, arguing Petitioner improperly relies on Dye for the "compressed data" residing on "the boot device." PO Resp. 69. According to Patent Owner, Dye does not disclose loading compressed data from a hard disk drive because Dye's disclosure is limited to storing compressed data in flash memory. *Id.* at 71–72. Patent Owner further argues that Petitioner does not rely on Sukegawa to disclose or suggest this claim element. *Id.* at 70. Patent Owner further contends that Petitioner improperly bases its argument about Dye on a separate reference, specifically Dye '284. PO Resp. 72. According to Patent Owner, Petitioner improperly relies on Dye '284, because this proceeding was not instituted on the basis of Dye '284. *Id.* Rather, only Dye in combination with Sukegawa forms the basis of the instituted challenge. *Id.* Patent Owner further argues that Dye '284 was not properly incorporated by reference into Dye because Dye does not identify specifically the portions of Dye '284 that allegedly are incorporated by reference. *Id.* at 72–73.

We disagree with Patent Owner. Here, unlike in the cases cited by Patent Owner (PO Resp. 47, n.150), Dye specifically states the U.S. patent application (now Dye '284, Ex. 1009) is "incorporated by reference in its entirety as though fully and completely set forth herein." Ex. 1008, 6:3–9. Indeed, the specific material to be incorporated is identified with detailed particularity:

> U.S. patent application Ser. No. 09/239,659 titled "Bands width Reducing Memory Controller Including Scalable Embedded Parallel Data Compression and Decompression Engines[,]" which was filed on Jan. 29, 1999 (5143-01700), is hereby incorporated by reference in its entirety as though fully and completely set forth herein.

Id.; *see also id.* at 3:66–4:19 (discussing specific features discussed in Ex. 1009). We further note that Dye is a continuation-in-part of Dye '284 and thus, has a significant amount of overlapping disclosure. *See id.* at 1:9–13, [63]. Thus, Dye cited Dye '284 in a manner that makes clear that Dye '284 is effectively part of Dye, as if it were explicitly therein and therefore, Dye properly incorporates Dye '284 by reference.

Petitioner disputes Patent Owner characterization of Dye, arguing that, as noted in the Petition, "Dye [Ex. 1008 not Ex. 1009] describes a controller that 'uses data compression and decompression *for improved system cost and performance*'" and "Dye [not Dye '284] uses the controller's 'fast parallel compression and decompression technology...to *increase the effective density and read access time* of non-volatile storage devices,' *including hard disk drives* and flash memories." Reply 25 (citing Pet. 13–17). According to Petitioner, these cited portions of Dye explain how compression "improves *system wide* memory density and data bandwidth" and "allows *lower cost systems* due to smaller data storage" and "reduced bandwidth requirements." *Id.* (citing Ex. 1008, Abstract). Thus, Petitioner concludes that from Dye's description alone, a person of ordinary skill in the art would have been motivated to use compression in Sukegawa "system wide" to achieve Dye's bandwidth, density, performance, and cost benefits. *Id.* at 25–26 (citing Ex. 1008, Abstract, 2:42–4:55, 7:34–9:5, 10:19–41; Ex. 1003 ¶¶ 130–139).

We agree with Petitioner that Dye alone is sufficient when considered in combination with the teachings of Sukegawa. Dye teaches use of parallel compression and decompression technology. Ex. 1008, Abstract. In particular, Dye teaches Compression Enhanced Flash Memory controller (CEFMC) allow data to be stored in normal or compressed format or

transmitted and stored on a medium in normal or compressed form. *Id.* at 3:66–4:8, 7:35–43, 8:6–12. We credit Dr. Neuhauser's testimony that a person of ordinary skill would have been motivated to apply the teachings of Dye regarding compression to the control information of Sukegawa, and to modify Sukegawa, to increase the effective density and read access rate of the non-volatile storage devices in Sukegawa's system, and to thereby achieve further reduction in the time required for booting up. *See* Ex. 1003 ¶¶ 79–91, 130–139.

Moreover, Dye '284 teaches data may be stored in compressed form on non-volatile memory (Ex. 1009, 4:16–24) and that such data may include program data and operating system data. *Id.* at 11:32–35, 38:30–42, Figs. 22, 23. As set forth by Dr. Neuhauser, Dye '284 "describes benefits of using compression in several types of computer system memory devices, including hard disks and flash memory." Ex. 1003 ¶ 45 (citing Ex. 1009, 4:16–24, 11:28–37, 12:19–22; Ex. 1008, Abstract, 7:34–43). Dr. Neuhauser specifically testifies that "through incorporated disclosure from Dye '284, Dye confirms that the controller 'may couple to any of various types of memory, as desired,' enabling it to 'greatly increas[e] the performance of the computer system.'" Ex. 1003 ¶ 256 (citing Ex. 1009, 10:19–41). We credit Dr. Neuhauser's testimony that Sukegawa's HDD2 and flash memory unit 1 are "hard disks and flash memory" as described in Dye '284. *Id.* ¶¶ 45, 130–139, 228. We further credit Dr. Neuhauser's statement that "[b]ased on the clear teachings of Dye with respect to the advantages of data compression, one of ordinary skill [would] have been motivated to apply Dye to the system of Sukegawa to obtain improved performance of [Sukegawa's] Flash Memory Unit 1." *Id.* ¶ 87; *see also id.* ¶¶ 112–114.

Accordingly, given the entirety of the record, we determine this limitation is taught or suggested by the combined teachings of Sukegawa and Dye.

b. "access[ing] the loaded . . . boot data in the compressed form," and "decompress[ing] the accessed . . . boot data in the compressed form at a rate that decreases a boot time of the [operating] system"

Petitioner contends that a person of ordinary skill in the art would have modified Sukegawa's controller 3 to include Dye's compression/decompression engine. Pet. 17 (citing Ex. 1003 ¶¶ 151–155). According to Petitioner, in servicing requests, controller 3 would access compressed control information from flash memory 1 and use Dye's decompression engine to decompress the compressed control information at a rate that increases flash memory 1's effective access rate. *Id.* (citing Ex. 1003 ¶¶ 151–153; Ex. 1008, at [57], 7:34–43).

Patent Owner does not provide specific arguments regarding Petitioner's contentions for this limitation. The burden, however, remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378.

Based on the entirety of the record and evidence, we credit the testimony from Dr. Neuhauser (*see* Ex. 1003 ¶¶ 151–155) and determine this limitation would have been obvious to a person of ordinary skill in art in view of the combined teachings of Sukegawa and Dye.

c. "wherein the decompressed portion of boot data comprises a portion of the operating system"

Petitioner contends Sukegawa describes that controller 3 services requests for control information necessary for booting the OS using control information that has been loaded into areas 10A/10C of flash memory 1.

Pet. 23 (citing Ex. 1003 ¶¶ 188–189; Ex. 1005, 2:11–16, 5:10–6:58, 7:28–55). As Petitioner notes, Sukegawa states that "the control information, which is pre-stored in the HDD 2 and necessary for starting the OS, is read out and stored in the permanent storage area 10A (steps S16 and S17)." *Id.* (citing Ex. 1005, 6:36–39). Sukegawa further states, "[a]ccordingly, when the OS is started at the time of the next turning-on of power, the control information necessary for starting the OS is read out not from the HDD 2 but from the permanent storage area 10A . . . ." *Id.* (citing Ex. 1005, 6:49–54). From this description, Petitioner argues that a person of ordinary skill in the art would have understood that Sukegawa's control information, which is "necessary for starting" an operating system, includes a portion of the operating system. *Id.* at 23–24 (citing Ex. 1003 ¶ 189). Dr. Neuhauser supports this position by citing to Sukegawa's description of "the OS and AP [being] permanently stored in the flash memory." Ex. 1003 ¶ 189 (citing Ex. 1005, 2:11–16). Petitioner further contends that a person of ordinary skill in the art would have modified Sukegawa's controller 3 to service requests from Sukegawa's host system by using Dye's compression/decompression engine to decompress compressed data accessed from flash memory 1. Pet. 23 (citing Ex. 1003 ¶ 190).

Patent Owner does not provide specific arguments regarding Petitioner's contentions for this limitation. The burden, however, remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378.

Based on the entirety of the record and evidence, we credit the testimony from Dr. Neuhauser (*see* Ex. 1003 ¶¶ 188–189) and determine this limitation would have been obvious to a person of ordinary skill in art in view of the combined teachings of Sukegawa and Dye.

d. Alleged Rationale to Combine Asserted Art

Patent Owner argues that Petitioner fails to articulate a sufficient motivation to combine Sukegawa and Dye without the benefit of impermissible hindsight analysis. PO Resp. 53–59. Specifically, Patent Owner argues that Petitioner offers little, if any, rationale to establish why or how a person of ordinary skill would have simultaneously made all of the various proposed changes to modify Sukegawa. *Id.* at 55. Moreover, Patent Owner notes the mere fact that individual changes might have been obvious to a person of ordinary skill does not make obvious doing all of the changes simultaneously. *Id.* According to Patent Owner, Petitioner does not present evidence that a person of ordinary skill saw a need to further improve the boot speed mechanisms disclosed by Sukegawa and Dye. Instead, Patent Owner contends the motivation to combine comes only from the '862 patent itself. *Id.*

Patent Owner further contends that because Sukegawa has a non-volatile store medium that permanently stores copies of the OS and frequently used AP files from the HDD into flash memory (Ex. 1005, 1:50–16), while Dye teaches compression and decompression techniques that are pared specifically to the storage properties of flash memory (Ex. 1008, 2:42–3:3, 5:41–67), a person of ordinary skill would not have combined these teachings. PO Resp. 56–57. Rather, Patent Owner argues that such disparate teachings indicate that Petitioner's argument is based on impermissible hindsight reconstruction. *Id.* at 57.

Patent Owner relies on the declaration of Dr. Back to support its position. Dr. Back testifies that to the extent a person of ordinary skill would have modified Sukegawa's system in view of Dye, such a modification results in Dye's data compression/decompression engine being

embedded in Sukegawa's flash memory unit. Ex. 2008 ¶ 114. Dr. Back further testifies that Petitioner's proposed combination of Sukegawa and Dye is complex and a person of ordinary skill would have used the simpler approach taught in Dye to compress/decompress data transferred into and out of a flash memory. *Id.* ¶ 115.

Petitioner contends, however, that a person of ordinary skill would have been motivated to combine Sukegawa's system with Dye's compression and decompression teachings because Dye's compression/decompression engine is located in the flash memory controller (e.g., Sukegawa's cache controller 3), not the flash memory array itself (e.g., Sukegawa's flash memory unit 1). Reply 19 (citing Ex. 1008, Abstract, 2:42–3:12, 7:59–8:61. Petitioner argues that Sukegawa's controller 3 aligns exactly with Dye's controller 200, which includes Dye's compression/decompression engine. *Id.* (citing Pet. 8, 14, 16; Ex. 1005, Fig. 1; Ex. 1008, 3).

Petitioner relies on the declaration of Dr. Neuhauser to support its position. Dr. Neuhauser testifies that a person of ordinary skill would have been motivated to use Dye's compression/decompression engine in Sukegawa's controller 3 to increase the effective density and read access rate of the non-volatile storage devices in Sukegawa's system, and to thereby achieve further reduction in the time required for booting up. Ex. 1003 ¶¶ 79–91, 130–39, 165–168; *see* Pet. 13, 15, 19, 41. According to Petitioner, contrary to Patent Owner's position, systems implementing Dye's compression/decompression technology load compressed data from a hard disk into flash memory. Pet. 14–15 (citing Ex. 1009, 4:16–24, 11:28–12:33).

Based on (1) the teachings of Dye that are directed to improved memory capacity and performance, specifically improved data density, efficiency, and bandwidth (Ex. 1008, at [57], 2:42–46), (2) the teachings of Dye '284 directed to implementing Dye's techniques to hard disk drives and flash memory, and (3) crediting of the persuasive testimony of Dr. Neuhauser demonstrating both the applicability of Dye to Sukegawa and explaining why a person of ordinary skill in the art would have combined the prior art teachings, we find Petitioner has articulated sufficient reasoning with rational underpinning to combine the references as asserted.

2. Analysis of Cited Art as Applied to Dependent Claims 29, 53, and 89

Dependent claims 29, 53, and 89 recite that the clamed "boot data" includes "a program code associated with…an application program." Ex. 1001, 29:26–32:19.

Petitioner contends the combined teachings of Sukegawa and Dye render every element of claims 29, 53, and 89 of the '862 patent obvious. Pet. 46, 51, 53. Patent Owner disputes Petitioner's contentions. PO Resp. 29–36, 41–74. Patent Owner specifically argues that a person of ordinary skill in the art would have understood that AP control information stored on Sukegawa's flash memory 1 is not "boot data" because that control information is accessed by the user only after completion of the system's boot-up process. *Id.* at 64 (citing Ex. 2008 ¶ 124). According to Patent Owner, because Sukegawa's AP control information stored in flash memory 1 is not "boot data," a person of ordinary skill in the art would not have considered program code associated with application programs accessed by this AP control information stored on Sukegawa's flash memory 1 to be the claimed "boot data." *Id.*

Petitioner argues that Patent Owner recognizes that Sukegawa describes program code associated with an application program, but argues that Sukegawa's AP control information is not boot data. Petitioner contends, however, that boot data includes application data, such as Sukegawa's AP control information. Reply 21 (citing Pet. 3–6; Ex. 1001, 3:47–50). According to Petitioner, similar to Sukegawa's preloaded, frequently-used AP, applications preloaded in the '862 patent are boot data, but not used to boot the system. *Id.* at 21–22 (*comparing* Ex. 1005, 2:11–22, 2:65–3:3, 5:10–14, 6:3–17, *with* Ex. 1001, 20:36–21:23, 22:12–23:19).

Sukegawa discloses modification of a system mode for storing control information for starting the OS ("operating system") (Ex. 1005, 6:20–26) and describes that "flash memory 1 is used as a cache memory area" enabling a user "to start a frequently used application program (AP) at high speed at all times" (*id.* at 5:10–40). Given Sukegawa's disclosure, we credit the testimony from Dr. Neuhauser that a person of ordinary skill in the art would have understood that Sukegawa's control information, which is "necessary for the start of the OS" and "AP," is boot data that includes program code associated with the operating system and an application program. *See* Ex. 1003 ¶¶ 519–520 (citing Ex. 1005, 5:29–30, 6:36–41). Therefore, based on the entirety of the record and evidence, we agree with Petitioner and determine these claims would have been obvious to a person of ordinary skill in art in view of the teachings of Sukegawa.

3. Analysis of Cited Art as Applied to Independent Claims 34, 58, and 94

Dependent claims 34, 58, and 94 each requires "a plurality of encoders" to encode the claimed compressed boot data. Ex. 1001, 29:44–32:34.

Petitioner contends the combined teachings of Sukegawa and Dye render every element of claims 34, 58, and 94 of the '862 patent obvious. Pet. 49–50; Reply 22–24. Patent Owner disputes Petitioner's contentions. PO Resp. 64–69. Patent Owner specifically argues that a person of ordinary skill in the art would have understood that Dye does not disclose a "plurality of encoders" but rather uses a single algorithm that is distributed among several stages. *Id.* at 66 (citing Ex. 2008 ¶ 130). According to Patent Owner, each stage is not a separate encoder but instead, each unit is a part of Dye's single encoder. *Id.* (citing Ex. 1008, 18:44–19:30).

Petitioner contends Dye teaches a compression/decompression engine. Pet. 49–50. Petitioner relies on the declaration of Dr. Neuhauser to support its position. Dr. Neuhauser testifies that Dye uses a "parallel lossless compression/decompression" "designed to process stream data at more than a single byte or symbol (character) at one time." Ex. 1003 ¶ 538 (citing Ex. 1009, 4:9–30). Dr. Neuhauser further testifies "Dye's compression algorithm analyzes multiple symbols in parallel, and provides 'multiple compressed outputs' in parallel, and provides 'multiple compressed outputs' in parallel." *Id.* ¶ 409 (citing Ex. 1008, 18:43–19:30, 22:66–23:24, Fig. 13; Ex. 1009, 12:61–13:7, 13:52–56). Petitioner explains that Figure 13 of Dye "serves 'as an encoder of the Input Stream' 'because this logic ***encodes*** four bytes of the input stream 610 against the four bytes in the history table," and Dye further discloses in Figure 13 logic, for one stream – "there are 16 such encoders used in the system of Dye." Reply 22 (citing Ex. 1003 ¶¶ 43–61, 537–541).

Petitioner further contends "a POSITA would have modified Sukegawa's controller 3 to include Dye's compression/decompression

engine to provide compressed boot data." Pet. 49 (citing Ex. 1003 ¶ 532, 537).

Having reviewed Dye, we find that it teaches, in Figure 10B, entries A, B, C, and D. *See* Ex. 1008, Fig. 10B. Specifically, Figure 13 teaches processing using entry D, and, as such, logic shown in Figure 13 would be present for processing each of entries A, B, and C. *Id.* at Figs. 10B, 13. Additionally, we interpret "encoder" as "any hardware or software that converts information to a particular form or format." In light of this interpretation, we determine Dye teaches a plurality of encoders. Moreover, we credit the testimony of Dr. Neuhauser that Dye teaches the logic shown in Figure 13 would be present for each Data Entry (e.g., Data Entry A, B, C, D) and thus, teaches a plurality of encoders. *See* Ex. 1003 ¶¶ 205–209; Ex. 1008, Figs. 10B, 13. We further find Dye teaches these encoders may be in a parallel configuration. *See* Ex. 1008, 18:60–63, 22:64–23:4, Figs. 10B, 13. Thus, based on the entirety of the record before us, we find Dye teaches "a plurality of encoders are utilized to provide said at least a portion of compressed data in compressed form," as recited in claims 9 and 16 and "a plurality of encoders utilized to encode the portion of boot data in the compressed form" (claim 34), "a plurality of encoders configured to encode the boot data in the compressed form" (claim 58), and "a plurality of encoders was utilized to encode the compressed boot data" (claim 94). It follows, Petitioner has established by a preponderance of the evidence that claims 34, 58, and 94 of the '862 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over Sukegawa and Dye.

4. *Analysis of Cited Art as Applied to Independent Claims 96, 100, and 106*

Claims 96, 100, and 106, which depend from claims 1, 6, and 13, each recites that the "updating" limitation further requires "disassociating non-accessed boot data from the boot data list."

Petitioner contends the combined teachings of Sukegawa and Dye render every element of claims 96, 100, and 106 of the '862 patent obvious. Pet. 55–57; Reply 13–16. Patent Owner disputes Petitioner's contentions. PO Resp. 41–45. Patent Owner specifically argues that a person of ordinary skill in the art would have understood that Sukegawa's removal of control information from Table 3A does not meet the "disassociating" limitation. *Id.* at 41. According to Patent Owner, Petitioner's position fails because a person of ordinary skill in the art would not have considered deletion of files from Sukegawa's flash memory 1 corresponds to the claimed "disassociating non-accessed boot data from the boot data list." *Id.* at 42. Patent Owner further argues that a person of ordinary skill in the art would not have understood that Sukegawa's purported automated deletion of control information from flash cache area 10C corresponds to the claimed "disassociating" limitation. *Id.* at 43. Patent Owner contends that Sukegawa does not disclose or suggest that OS control information (the alleged "boot data") is stored in flash cache area 10C and is not subject to the purported automated technique of flash cache area 10C. *Id.* (citing 2008 ¶ 99).

Petitioner contends, however, that Sukegawa's user deletion and automatic deletion techniques disassociate non-accessed boot data. Reply 13. Petitioner further contends that Sukegawa's boot data includes application data, such as AP control information. *Id.* at 14–15 (citing Pet. 3–6; Ex. 1001, 3:47–50). According to Petitioner, Sukegawa's automated

deletion of AP control information from cache area 10C involves disassociation of non-accessed boot data from the boot data list. Petitioner concludes that Patent Owner ignores the presence of OS control information in Sukegawa and the obviousness of managing the OS control information similarly to the AP control information. *Id.* at 15 (citing Ex. 1005, 2:11–16, 2:65–3:3, 4:58–63, 6:19–66; Ex. 1003 ¶¶ 33, 123–129).

We agree with Petitioner, because we find that Sukegawa describes updating boot data lists by removing an association of control information that is associated with management information Table 3A. Specifically, we credit the testimony of Dr. Neuhauser, who explains how and why Sukegawa renders obvious updating a boot data list by disassociating non-accessed boot data from the boot data list. *See* Ex. 1003 ¶¶ 655–662 (citing Ex. 1005, 5:1–7:2). Dr. Neuhauser concludes an ordinarily skilled artisan "would have found it obvious to remove from table 3A the recorded correlation of the deleted file of control information with the OS/AP." Ex. 1003 ¶ 658. Accordingly, we find Petitioner has established by a preponderance of the evidence that claims 96, 100, and 106 of the '862 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over Sukegawa and Dye.

Remaining Challenged Claims

The Petition sets forth detailed contentions and supporting evidence alleging that claims 2–4, 7, 23–28, 30–33, 47–52, 54–57, 83–88, 90–93, 95, 99, 105, 107–111, 113, and 116 are obvious in light of the combined teachings of Sukegawa and Dye. Pet. 29–59. For instance, as discussed above, Sukegawa teaches "a second memory configured to store boot data" in the form of control information stored on HDD2, which the Petition applies to the limitations of claims 6 and 7. *Id.* at 29, 33. With respect to

the claims reciting Huffman or Lempel-Ziv encoding in claims 33, 57, and 93, Petitioner identifies disclosures in Dye that reference these encoding schemes. *Id.* at 49, 52, 54. As for the "plurality of files" limitation of claims 23, 28, 30, 47, 52, 54, 83, 88, and 90, Petitioner relies on Sukegawa's teachings that controller 3 reads OS control information out of HDD2 and stores it "as one file in the permanent storage area 10A," and stores "control information necessary for starting" an application program as another file. Pet. 38 (citing Ex. 1005, 5:10–25, 6:21–23, 6:50–53, 7:2, Fig. 4). According to Petitioner, as supported by Dr. Neuhauser's testimony, a person of ordinary skill in the art would have understood that boot data loaded by Sukegawa represents a plurality of files. *Id.* (citing Ex. 1003 ¶¶ 487–489).

Patent Owner generally presents the same or similar arguments for the remaining claims as presented for claims 1, 6, and 13, which are unpersuasive on the present record for similar reasons as for claims 1, 6, and 13.

Having reviewed the entirety of the record and evidence, we find that the cited prior art references teach the relevant claim elements as asserted by Petitioner. Accordingly, we are persuaded Petitioner has established by a preponderance of the evidence that claims 2–4, 7, 23–28, 30–33, 47–52, 54–57, 83–88, 90–93, 95, 99, 105, 107–111, 113, and 116 of the '862 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over Sukegawa and Dye.

F. Alleged Obviousness in View of Sukegawa, Dye, and Settsu, Burrows, and/or Zwiegincew

For the remaining asserted grounds of unpatentability for claims 1–4, 6, 7, 13, 23–34, 47–58, 83–96, 99, 100, 105–111, 113, and 116, Petitioner principally relies on the same arguments and evidence as in the ground based solely on Sukegawa and Dye, which is discussed above. Pet. 59.

Petitioner presents additional arguments relating to Settsu, Burrows, and Zwiegincew as to specific limitations in certain claims. *Id.* at 60–70. For example, for claim 1, Petitioner contends that by loading an OS main body module into memory 2 as a plurality of compressed files, Settsu loads a portion of boot data in a compressed form for booting the computer system into a memory. *Id.* at 61; *see* Ex. 1006, 8:21–35, 8:66–9:11, 11:7–9. Settsu indicates doing so reduces the time required for booting up (Ex. 1006, 14:58–15:5), which Petitioner argues provides further motivation for a person of ordinary skill to combine the system of Sukegawa with teachings about compression/decompression, such as in Dye and Settsu. Pet. 61–62. Similarly, Petitioner notes that both Burrows and Zwiegincew teach that compression/decompression was well-known to increase the speed of accessing data from a hard drive, which it contends would have further motivated a skilled artisan to combine the system of Sukegawa with the teachings of Burrows and Dye to apply compression/decompression to store the control information on the hard disk drive in compressed format. *Id.* at 65 (citing Ex. 1003 ¶¶ 40–42, 63–68, 147; Ex. 1007, 1 ¶¶ 2–3; Ex. 1010, at [57], 1:5–3:55, 5:50–51, 8:66–9:13, Figs. 1–2).

Patent Owner opposes Petitioner's position. PO Resp. 36–41, 59–63, 76–77. In addition to its arguments relating to the asserted combination of Sukegawa and Dye, Patent Owner argues against the combinations of Sukegawa with Settsu, Burrows, and/or Zwiegincew. *Id.* Patent Owner specifically argues that Petitioner's alleged motivation to combine based on Settsu is insufficient because "[t]he teachings of Burrows, Settsu, and Zwiegincew do not cure the deficiencies of [Petitioner's] alleged motivation to combine Sukegawa and Dye. In fact, they teach away from combining Sukegawa and Dye." *Id.* at 59. According to Patent Owner, the

combinations of cited are based on impermissible hindsight analysis. *Id.* at 59–63. Specifically, Patent owner argues the Petition fails to describe how a person of ordinary skill in the art would have approached the required modification to Sukegawa, and relies again on impermissible hindsight to cherry pick portions of different references to further modify Sukegawa's system by using the '862 patent as a blueprint. *Id.* at 62.

Patent Owner further argues that Zwiegincew is incompatible with Sukegawa because Zwiegincew discloses techniques for reducing hard page faults that may occur in a computer's virtual memory. *Id.* at 37. According to Patent Owner, Zwiegincew does not "recognize[] problems of slow boot" or propose "to improve boot speed" by "prefetching…pages that are expected to be requested during the boot process." *Id.* Patent Owner specifically contends that (1) Zwiegincew does not disclose that its pre-fetching technique relates to loading boot data or to associating data to a boot data list, and (2) Zwiegincew teaches away from the claimed loading of compressed boot data because module 265 must decompresses data before it is saved to RAM 220. *Id.*

Petitioner contests Patent Owner's hindsight arguments and characterization of Zwiegincew. Reply 11–13, 20–21. Specifically, Petitioner contends it provided Burrows, Settsu, and Zwiegincew as additional motivation for using compression throughout Sukegawa's system. *Id.* at 20. Regarding Burrows, Petitioner argues that Patent Owner only focuses on slower algorithms and ignores the primary teachings of the benefits of using compression and does not adequately address Dr. Neuhauser's opinion that Burrows provides further motivation for the combination of Sukegawa and Dye. *Id.* (citing Ex. 1003 ¶¶ 40–42, 94–96, 147; Ex. 1007, 1 ¶¶ 2–3).

Regarding Settsu, Petitioner argues that Patent Owner merely asserts, without evidentiary support, that modification of Sukegawa's system in view of Settsu would "require significant changes." *Id.* (citing PO Resp. 61–62). Petitioner contends, however, that Settsu clearly describes compressing boot data stored on a hard drive boot device to speed the boot process and Patent Owner fails to address how this disclosure alone would not have motivated a person of ordinary skill in the art to compress control information stored on Sukegawa's HDD2. *Id.* at 20–21 (citing Ex. 1003 ¶¶ 140–141).

Regarding Zwiegincew, Petitioner argues that Patent Owner's characterization of the reference are inaccurate, because Zwiegincew's scenario files ordering is applicable to boot. *Id.* at 12. Petitioner cites to Zwiegincew's explicit disclosure that "[s]trategically ordering pages…tends to work best" in situations, such as "boot." *Id.* (citing Ex. 1010, 2:12-15). Petitioner relies on the declaration of Dr. Neuhauser to support its position. Dr. Neuhauser testifies that because "Zwiegincew's scenario files are *ordered* copies of pages or *ordered* references to pages," a person of ordinary skill in the art would have found it obvious that Zwiegincew's scenario files are useful during "boot," a process where Zwiegincew itself recognized that page ordering "tends to work best." Ex. 1003 ¶¶ 148–149 (citing Ex. 1010, 2:12–15). Dr. Neuhauser further testifies that a person of ordinary skill in the art would have considered Zwiegincew as additional motivation for compressing Sukegawa's OS/AP control information. Ex. 1003 ¶¶ 63–68, 147 (citing Ex. 1010, Abstract, 1:5–3:55, 5:50–51, 8:66–9:13, Figs. 1–2).

Having reviewed the entirety of the record, we agree with Petitioner's position. We credit the testimony of Dr. Neuhauser that based on his proffered construction of "boot data list" as a "file," a person of ordinary

skill in the art would have considered Zwiegincew's scenario file as used during boot, to be a boot data list. Ex. 1003 ¶¶ 66–68. Additionally, we agree with and adopt as our own Petitioner's identification of specific and detailed portions of Settsu, Burrows, and Zwiegincew that support its contentions. *See* Pet. 59–60, 62, 64, 70, 73, and 76.

Accordingly, we are persuaded Petitioner has established by a preponderance of the evidence that claims 1–4, 6, 7, 13, 23–34, 47–58, 83–96, 99, 100, 105–111, 113, and 116of the '862 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over (1) Sukegawa, Dye, and Settsu; (2) Sukegawa, Dye, and Burrows; (3) Sukegawa, Dye, Settsu, and Burrows, and (4) Sukegawa, Dye, and Zwiegincew.

G. Remaining Patent Owner Arguments

Patent Owner makes additional arguments stating that post grant review proceedings, such as this trial, are unconstitutional and are an impermissible taking of a private right without Article III oversight. PO Resp. 74–76. We decline to consider the constitutional challenge as, generally, "administrative agencies do not have jurisdiction to decide the constitutionality of congressional enactments" where consideration of the constitutional question would "require the agency to question its own statutory authority or to disregard any instructions Congress has given it." *Riggin v. Office of Senate Fair Employment Practices*, 61 F.3d 1563, 1569–70 (Fed. Cir. 1995).[9]

[9] On June 12, 2017, the United States Supreme Court granted a petition for a writ of certiorari in *Oil States Energy Services, LLC v. Green's Energy Group, LLC,* 639 Fed. App'x 639 (Fed. Cir 2016), cert. granted, 198 L. Ed. 2d 677 (U.S. Jun. 12, 2017) (No. 16-712). The Court will answer the question of whether the USPTO's statutorily created IPR process is unconstitutional.

II. MOTION TO AMEND

Patent Owner filed a contingent Motion to Amend to replace the unpatentable claims with proposed substitute claims 118–173. Paper 19 ("Mot."). Petitioner opposes Patent Owner's Motion. Paper 24 ("Opp."). In light of the Federal Circuit's *en banc* decision in *Aqua Products, Inc. v. Matal*, 872 F.3d 1290 (Fed. Cir. 2017), that provided guidance regarding Motions to Amend before the Board, we authorized supplemental briefing from the parties. Papers 37, 39.

Because we find claims 1–4, 6–7, 13, 23–34, 47–58, 83–96, 99–100, 105–111, 113, and 116 unpatentable, we address Patent Owner's contingent Motion to Amend. As discussed below, we grant the Motion to Amend.

A. Analysis of the 37 C.F.R. § 42.121 Requirements

In an *inter partes* review, amended claims are not added to a patent as of right, but rather must be proposed as a part of a Motion to Amend. 35 U.S.C. § 316(d). The Board must assess the patentability of proposed substitute claims "without placing the burden of persuasion on the patent owner." *Aqua Products*, 872 F.3d 1290. Yet, Patent Owner's proposed substitute claims still must meet the statutory requirements of 35 U.S.C. § 316(d) and the procedural requirements of 37 C.F.R. § 42.121. *See also* "Guidance on Motions to Amend in view of *Aqua Products*" (Nov. 21, 2017) (https://www.uspto.gov/sites/default/files/documents/guidance_on_motions_to_amend_11_2017.pdf) ("Guidance"). Accordingly, Patent Owner must demonstrate (1) the amendment responds to a ground of unpatentability involved in the trial; (2) the amendment does not seek to enlarge the scope of the claims of the patent or introduce new subject matter; (3) the amendment proposes a reasonable number of substitute claims; and

(4) the proposed claims are supported in the original disclosure. *See* Guidance.

For reasons set forth below, we determine Patent Owner has satisfied its burden with respect to the above-discussed requirements of 37 C.F.R. § 42.121. Patent Owner seeks to add fifty-five (55) substitute claims to replace the fifty-five (55) challenged claims found unpatentable, and each substitute claim adds limitations that purport to narrow the scope of the original claim it replaces. *See* Mot. 2–4, Claim Appendix, iii–xii. Patent Owner also identifies disclosures in the originally-filed application that fall within the scope of proposed substitute claims 118–173. Mot. 4–17 (citing Ex. 2010; Ex. 2017; Ex. 2022). Patent Owner further identifies support in the original specification for the limitation in substitute independent claims 118, 122, and 124 that the preloading may occur into volatile memory. Mot. 5–6 (citing Ex. 2017, 12:16–18 ("[T]he cache 13 may comprise volatile or non-volatile memory, or any combination thereof. Preferably, the cache 13 is implemented in SDRAM (static dynamic random access memory), 41:4–9, 42:17–20, 43:13–14, Fig. 7B), 8–15." According to the testimony of Dr. Back, a person of ordinary skill in the art would have understood that SDRAM is volatile memory. *See* Ex. 2022 ¶ 23.

We note that further support for substitute claims 118–173 can be found in the original specification's discussion of preloading portions of the computer operating system from the boot device (e.g., hard disk) into the on-board cache memory. Ex. 2017, 41:4–5. We, thus, find written description support for Patent Owner's proposed substitute claims.

Moreover, Patent Owner proposes a narrowing limitation in each proposed substitute claim in direct response to the grounds of unpatentability involved in this trial. Therefore, Patent Owner has satisfied the procedural

requirements of 37 C.F.R. § 42.121. Accordingly, we now focus on whether proposed substitute claims 118–173 are patentable over the prior art of record.

B. Analysis of the Patentable Distinction of Proposed Claims Over the Prior Art

As discussed above, Patent Owner does not have the burden of persuasion with respect to the patentability of the substitute claims presented in its Motion to Amend. *See Aqua Products*, 872 F.3d at 1327; Guidance. We determine whether the substitute claim is unpatentable by a preponderance of the evidence based on the entirety of the record, including any opposition made by the petitioner. *See Aqua Products*, 872 F.3d at 1325–26; *see* Guidance. For the reasons explained below, considering the entirety of the record before us, we determine that the preponderance of the evidence shows the proposed substitute claims are patentable over the prior art of record. Specifically, we determine that Petitioner fails to establish that proposed substitute claims 118–173 are obvious over (1) Sukegawa and Dye, (2) Sukegawa, Dye, and Settsu, (3) Sukegawa, Dye, and Burrows, (4) Sukegawa, Dye, Settsu, and Burrows, (5) Sukegawa, Dye, and Zwiegincew, (6) Settsu and Zwiegincew, (7) Sukegawa, Dye, and Esfahani, (8) Sukegawa, Dye, and Kroeker, (9) Settsu, Zwiegincew, and Esfahani, and (10) Settsu, Zwiegincew, and Kroeker.

1. Analysis of Proposed Substitute Claim 118, 122, and 124

As a replacement for independent claim 1, Patent Owner proposes claim 118. Mot., Claim Appendix, iii. Proposed independent claim 118 is identical to claim 1 but for the addition of four new limitations:
(1) preloading a portion of boot data, (2) into a volatile memory, the portion

of boot data in the compressed form being associated; (3) wherein the preloading comprises transferring the portion of boot data in the compressed form into the volatile memory, and wherein the preloading occurs during the same boot sequence in which a boot device controller receives a command over a computer bus to load the portion of boot data; and (4) accessing the preloaded portion of the boot data in the compressed form from the volatile memory. *Id.* Proposed dependent claims 119–121, 125–136, 161–162, 167–171 depend directly or indirectly from proposed independent claim 118 and do not have any additional new limitations. *Id.* at iii–iv, vi–vii, xi–xii.

As a replacement for independent claims 6, Patent Owner proposes claim 122. Claim Appendix, iv–v. Proposed independent claim 122 is identical to claim 6 but for the addition of four new limitations listed above and for specifying that the first memory is a "first volatile memory." *Id.* at iv. Proposed dependent claims 123, 137–148, 163–164, 172, which do not have new limitations, depend directly or indirectly from proposed independent claim 122. *Id.* at v, viii–ix, xi–xii.

As a replacement for independent claim 13, Patent Owner proposes claim 124. *Id.* at v–vi. Proposed independent claim 124 is identical to claim 13 but for the addition of four new limitations listed above. Proposed dependent claims 149–160, 165–166, 173 depend directly or indirectly from proposed independent claim 122 and do not have any additional new limitations. *Id.* at iv–xii.

Patent Owner contends that none of Petitioner's prior art references teaches the additional limitations recited in the proposed substitute claims. Mot. 19. Patent Owner specifically argues that none of the references, alone or in combination, teaches or suggests "preloading" compressed boot data

into a "volatile" memory, as each proposed substitute claim requires. *Id.* at 20 (citing 2022 ¶ 57).

(1) Sukegawa

Patent Owner contends Sukegawa expressly is directed to using a **non**-volatile memory to permanently store data needed for system startup, rather than using a volatile cache. *Id.* (citing Ex. 1005, 2:11–16; Ex. 2022 ¶ 58). Thus, Patent owner argues that Sukegawa teaches that its control information is stored in "permanent storage area 10A" or "nonvolatile cache area 10C" of flash memory unit 1. *Id.* (citing Ex. 1005, 7:17–65; Ex. 2022 ¶ 58). And, Patent Owner notes that Sukegawa distinguishes its flash memory from memory such as DRAM, which is volatile: "The flash memory, unlike the main memory, is a non-volatile storage medium and has a higher access speed than the HDD." *Id.* (citing Ex. 1005, 1:53–55). Patent Owner further argues that Sukegawa specifically teaches that its proposed solution to the "problem" identified in that reference is to use a "nonvolatile storage medium" that can retain data "even if the power is switched off." *Id.* (citing Ex. 1005, 1:50–59). Accordingly, Patent Owner asserts that Sukegawa never teaches or suggests "preloading" boot data into a "volatile" memory, as each proposed substitute claim requires; it instead teaches the opposite. *Id.* (citing 2022 ¶ 58).

Petitioner contests Patent Owner's position arguing that Sukegawa's disclosure of main memory 23, which Sukegawa describes as "storing the AP and OS of the host system," is used in conjunction with Sukegawa's non-volatile flash memory. Opp. 7 (citing Ex. 1005, 1:5–49, 4:38–46, 7:66–8:33, Fig. 2). Petitioner further argues that Sukegawa's background section establishes that it was known to cache frequently used data, including AP and OS data, in volatile main memory, because the relatively low access

speed of a hard disk otherwise elongates the time needed to start these programs, which is a "serious problem." *Id.* (citing Ex. 1005, 1:5–49). From this description, Petitioner contends that a person of ordinary skill in the art would have understood that Sukegawa's main memory 23 is volatile memory, and would have further understood that caching AP and OS data in main memory 23 is preferable to storing that data on disk. *Id.* Petitioner further postulates that a person of ordinary skill in the art would have been aware that nonvolatile flash memory was both expensive and not of unlimited capacity, and would have been faced with design choices of how to best preload in a situation where cost precludes preloading all of the boot data into non-volatile flash memory. *Id.* In this situation, according to Petitioner, the person of ordinary skill in the art still would have been motivated by Sukegawa to preload boot data that does not fit into the flash memory as quickly as possible after power-on. *Id.* at 7–8. Petitioner then argues that Sukegawa seeks to preload data as soon as possible and, to the extent the non-volatile flash memory lacks capacity to store all OS/AP control information (e.g., all OS/AP control information selected by a user), a person of ordinary skill in the art would have found it obvious to preload as much information into flash memory as possible and then preload any remaining data into volatile memory upon power-on. *Id.* at 8. In this regard, Petitioner reasons that a person of ordinary skill in the art would have looked to Sukegawa's description of main memory used for caching AP and OS data, and would have found it obvious to transfer boot data expected to be needed most quickly after power-on into the nonvolatile flash memory, and to preload the remaining boot data into main memory upon power-on. *Id.* (citing Ex. 1005, 1:5–49, 4:38–46, 5:10–6:58, 7:66–8:33, Figs. 1–2).

We disagree with Petitioner's characterization of Sukegawa, because Sukegawa warns against using volatile memory from the main memory storage area due to the low access speed and longer boot up from the HDD, which is a "serious problem." Ex. 1005, 1:17–49. Sukegawa proposes to address that problem by using non-volatile flash memory. *Id.* at 1:50–61. Sukegawa does suggest cooperative function between the flash memory and HDD due to the limited space of flash memory. *Id.* at 2:29–33. Specifically, Sukegawa teaches that if a large file cannot be stored in non-volatile high-speed access area 10B or cache area 10C, then it can be stored in the storage area of HDD 2. *Id.* at 8:34–44. According to Sukegawa, the cooperative function of the flash memory with HDD storage can be realized so that there is a system with high access performance and large storage capacity. *Id.* at 11:31–41. Therefore, we understand Sukegawa to use non-volatile memory for booting activities to ensure high access speed, while potentially using HDD memory for large files in order to ensure sufficient memory storage capacity. We do not, however, understand such a cooperative function in Sukegawa to teach or suggest "preloading" boot data into a "volatile" memory. Rather, Sukegawa specifically teaches the control information, pre-stored in HDD2, is read out and stored in permanent storage area 10A and "when the OS is started at the time of the next turning-on of power, the control information necessary for starting the OS is read out . . . from the permanent storage area 10A or cache memory area." Ex. 1005, 6:36–54. Sukegawa does not disclose reading out the OS control information during the same boot sequence in which the controller receive the command over the computer bus to load the boot data.

(2) Zwiegincew

Patent Owner contends that although Zwiegincew references "boot" in its Background of the Invention when discussing prior art approaches to avoiding page faults just after completion of the boot process, the use of "boot" in the Background does not relate to preloading boot data into a volatile memory. Mot. 21 (citing 2022 ¶ 59). Patent Owner also argues that Burrows and Dye likewise do not teach or suggest "preloading" boot data into a "volatile" memory. *Id.* Patent Owner notes that Petitioner relies on both Burrows and Dye for their teachings regarding the use of compression/decompression and not for any purported teaching as to "preloading" boot data into "volatile" memory, which those references do not disclose. *Id.* (citing Pet. 21; Ex. 2022 ¶ 60).

Petitioner does not address Zwiegincew, Burrows, or Dye individually.

We agree with Patent Owner and find that Petitioner fails to establish that Zwiegincew, Burrows, or Dye teach or suggest "preloading" boot data into "volatile" memory.

(3) Settsu

Regarding Settsu, Patent Owner argues that the reference does not teach or suggest "*preloading*" boot data into any memory, much less volatile memory. *Id.* at 21–22 (citing Ex. 2022 ¶ 61). According to Patent Owner, Settsu only teaches loading boot data when it is accessed or requested by the system, and not before. *Id.* at 22 (citing Ex. 1006, Claim 3 ("said OS loading processing module loads each of said plurality of functional modules into said memory *and then* generates and starts execution of a thread for said OS initialization module every time it loads of each said plurality of functional modules"); Ex. 2022 ¶ 61). Moreover, Patent Owner argues that

Settsu does not disclose whether its memory 2 is volatile or non-volatile memory, and it is conceivable that the memory 2 could be non-volatile. *Id.* (citing Ex. 2022 ¶ 61).

Petitioner contests Patent Owner's position arguing that Settsu describes "a method of booting" by "loading an operating system into the memory" where the system includes a "memory 2" and a "boot device 3." Opp. 11 (citing Ex. 1006, 1:67–2:37:65–8:23, Fig. 12). According to Petitioner, a person of ordinary skill in the art would have understood that Settsu's memory 2 could be either volatile or non-volatile memory. *Id.* at 12 (citing Ex. 1030 ¶¶ 27–28). Indeed, according to Petitioner, a person of ordinary skill in the art would have understood that Settsu's method of reducing the time required for an information processing apparatus to boot itself, which involves a series of operations starting from "[w]hen the information processing apparatus is powered on," could work with either volatile or non-volatile memory, but that relatively fast volatile memory would be preferable for use in Settsu's system. *Id.* at 12–13 (citing Ex. 1030 ¶¶ 27–28). For at least this reason, Petitioner contends, a person of ordinary skill in the art would have had a reason to implement Settsu's memory 2 as volatile memory. *Id.*

Patent Owner argues that Petitioner mischaracterizes Settsu, because Settsu's alleged "boot device" only begins loading boot data *after* receiving an alleged request for that data over computer bus—never before—and Settsu thus does not teach "preloading" within the broadest reasonable interpretation of that term. PO Reply 7–8 (citing Ex. 2025 ¶ 15; Ex. 2022 ¶ 61 ("Settsu only teaches loading boot data when it is accessed or requested by the system, not ahead of time.")).

Patent Owner argues that Petitioner's declarant, Dr. Neuhauser, supports its position. *Id.* at 7. According to Patent Owner, Dr. Neuhauser testified during his deposition that the process in Settsu that he calls "preloading"—transferring the OS main body module 8 from boot device 3 into memory 2—*only begins after* the mini OS module 7 (his "boot device controller") has, under his own theory, received a command over a computer bus to load the boot data. *Id.* (citing Ex. 2024, 112:2–10). Patent Owner further argues that Dr. Neuhauser testified that the alleged "boot device controller" in Settsu—mini OS module 7—"*does not transfer any data*" into memory *before* it has received a command over computer bus to load that data. *Id.* (citing Ex. 2024, 111:3–15). Patent Owner then cites to its own declarant, Dr. Back, for additional support regarding the timing of the transfer of data. *Id.* (citing Ex. 2025 ¶¶ 13–14).

We are unmoved by Petitioner's arguments that due to the ambiguous context of Settsu, memory 2 easily could be non-volatile memory. Additionally, we do not agree with Petitioner's reading of Settsu to include preloading during the same boot sequence in which a boot device controller receives a command over a computer bus to load the portion of boot data. Rather, we understand Settsu to load after a command has been received over a computer bus. Additionally, we do not understand Settsu to access the preloaded portion of the boot data in compress form from the volatile memory. Therefore, Settsu fails to teach or suggest the limitations in the proposed substitute claims.

(4) Settsu in combination with Zwiegincew

Based on our findings above regarding Settsu and Zwiegincew individually, we do not find that the combination of the references would

have rendered the proposed substitute claims obvious to a person of ordinary skill in the art at the time of the invention.

(5) Esfahani in combination with Sukegawa

Patent Owner identifies Esfahani (Ex. 2020) as a reference that was at issue during the prosecution of the application that matured into the '862 patent. Mot. 24. According to Patent Owner, Esfahani fails to teach or suggest decompressing the accessed portion of the boot data in the compressed form at a rate that decreases a boot time of the operating system relative to loading the operating system utilizing boot data in an uncompressed form, as each proposed substitute claim requires. *Id.* at 25 (citing Ex. 2022 ¶ 69). Patent Owner further argues that Esfahani fails to teach "preloading" as specified in the proposed substitute claims, which requires that the "preloading" must begin before a request for the boot data has been received over the computer bus. PO Reply 11; Ex. 2027 ¶¶ 70, 74. Rather, according to Patent Owner, Esfahani teaches that its Open Firmware first initializes, and then locates its "Boot Info file (40)," which Open Firmware then loads into RAM (12). *Id.* (citing Ex. 2020, Fig. 6A, 8:40-9:6). It further teaches that "[b]y default, the Boot Info file 40 is located by . . . searching for a file with a predetermined file type." *Id.* (citing Ex. 2020, 8:5–10). Specifically, Patent Owner argues that Esfahani teaches that its boot data is loaded into volatile RAM only ***after*** the CPU, system bus, and a low-level firmware OS have all been initialized. PO Suppl. Resp. 10–11 (citing Ex. 2027 ¶ 72). Therefore, Patent Owner concludes that a person of ordinary skill in the art would have understood Esfahani to teach that its boot data is first *requested* and *located* in response to a command over computer bus, and only begins to load after such a request has been received, and is thus not "preloaded." PO Reply 12 (citing Ex. 2025 ¶ 28).

Petitioner contends that Esfahani's disclosures regarding the RAM and disk space being inexpensive would have motivated a person of ordinary skill in the art to modify Sukegawa to preload OS data into both non-volatile and volatile memories, so as "to reduce time to market, development costs, and manufacturing costs for computer systems." Pet. Suppl. Brief 2 (citing Ex. 2025, 2:1–3; Ex. 1043 ¶ 47). Petitioner suggests that in modifying Sukegawa, a person of ordinary skill in the art would have been guided by Esfahani's suggestion to preload compressed OS data into RAM "during start-up," and to thereafter decompress the same to allow execution consistent with requests that would subsequently be received in a typical boot process. *Id.* (citing Ex. 2025, 5:41–53, 10:28–41; Figs. 6A–7D).

Patent Owner, however, refutes Petitioner's contentions that RAM or DRAM was a more economical choice compare to flash memory. Specifically, Patent Owner provides evidence that DRAM was more expensive than flash on a per-megabyte basis or at least equally as expensive, not less. PO Suppl. Brief 9–10, 3–4 (citing Ex. 2027 ¶¶ 25–33); Ex. 2028, 3–4; Ex. 2029, 4–5; Ex. 2030, 4–5). Patent Owner's evidence indicates that a person of ordinary skill in the art could have bought flash memory more cheaply than DRAM as of February 2000, which undercuts Petitioner's reason to modify Sukegawa's system with Esfahani's teachings.

Moreover, as discussed above, we do not read Esfahani to teach "preloading" boot data during the same boot sequence because the boot data appears to be loaded into volatile RAM only after the CPU, system bus, and a low-level firmware OS have all been initialized.

(6) Kroeker alone or in combination with Sukegawa

Patent Owner identifies Kroeker (Ex. 2021) as a reference that was at issue during the prosecution of the application that matured into the '862

patent. Mot. 24. According to Patent Owner, the Examiner during prosecution recognized that "Kroeker does not teach about accessing compressed boot data," which is a limitation of each proposed substitute claim. Mot. 25 (citing Ex. 1002, 683). Patent Owner also argues that Kroeker fails to teach or suggest decompressing the accessed portion of the boot data in the compressed form at a rate that decreases a boot time of the operating system relative to loading the operating system utilizing boot data in an uncompressed form, as each proposed substitute claim requires. *Id.* (citing Ex. 2022 ¶ 69).

Petitioner contends that Kroeker suggests reducing Sukegawa's flash by preloading boot data into volatile memory. Pet. Suppl. Brief 5. According to Petitioner, Kroeker recognizes the same problem as the '862 Patent and proposes the same solution as the amended claims – preloading boot data associated with a boot data list by transferring data into volatile memory during the same boot sequence in which a boot device controller receives a command over a computer bus to load the boot data. *Id.* (citing Ex. 2021, Abst., 2:29–47; Ex. 1043 ¶ 15). Petitioner notes Kroeker's disclosure that, "[w]hen a computer undergoes a hardware reset (i.e., a power-on or reset), the computer" and its "hard disk drive" execute "power on/reset procedures." *Id.* (citing Ex. 2021, 1:14–29). Petitioner argues that Kroeker recognizes that computers wait for these procedures to complete before "request[ing] data from the disk" to initialize an OS. *Id.* (citing Ex. 2021, 1:14–29). Seeking to speed the boot process, Petitioner further argues that Kroeker proposes taking advantage of unused time "*before* the host computer is ready for program transfer." *Id.* (citing Ex. 2021, 1:55–64). In particular, Petitioner argues that Kroeker uses a "prefetch table" to access OS data from the disk and "cop[y] it onto the cache of the disk drive, from

where it is transferred to the host computer" "*before* the host computer is ready for a data request *but after* the disk drive has completed its reset routine." *Id.* (citing Ex. 2021, Abst.). Petitioner contends that this approach allows Kroeker to speed data transmission to the host computer, yielding "*increas[ed] boot speed* of a host computer" consistent with preloading. *Id.* (citing Ex. 2021, Abst., 1:9–12).

Petitioner further contends that a person of ordinary skill in the art would have been motivated by Kroeker to update Sukegawa's system to take advantage of the period "*before* the host computer is ready for data *but after* the disk drive has completed its reset routine" to further "*increas[e] boot speed* of a host computer" by "*shortening* the load time." Pet. Suppl. Brief 6 (citing Ex. 2021, Abst., 1:9–12; 1:55–2:14; Ex. 1043 ¶ 22). Indeed, according to Petitioner, a person of ordinary skill in the art would have found it obvious for at least some portion of the operating system to be stored on Sukegawa's HDD 2 given capacity/cost issues for flash memory. *Id.* (citing. Ex. 1043 ¶ 22). Petitioner argues that a person of ordinary skill in the art also would have been motivated to apply Kroeker's preloading techniques to shorten the load time from the hard disk and, thereby, increase boot speed. *Id.* (citing Ex. 2021, Abst., 1:9–12; 1:55–2:14).

Petitioner then contends that a person of ordinary skill in the art would have been motivated to modify Sukegawa and apply Kroeker preloading techniques to shorten the load time from the hard disk and, thereby, increase boot speed. *Id.* (citing Ex. 2021, Abst., 1:9–12; 1:55–2:14; Ex. 1043 ¶ 22). Petitioner then argues that a person of ordinary skill in the art also would have been motivated by Kroeker to transfer some portion of OS boot data stored on Sukegawa's HDD 2 into Kroeker's volatile cache "*before* the host computer is ready for data *but after* the disk drive has completed its reset

routine." *Id.* at 7 (citing Ex. 2021, Abst.). According to Petitioner, a person of ordinary skill in the art would have found leveraging RAM during the period when the disk drive is ready, but the host computer is not, to be an "easy to use and cost-effective" solution "for increasing boot speed" that reduces the amount of flash memory used. Pet. Suppl. Brief 7 (citing Ex. 1043 ¶ 23; Ex. 2021, Abst., 1:9–2:14).

Patent Owner, however, refutes Petitioner's contentions that RAM or DRAM was a more economical choice compare to flash memory. Specifically, Patent Owner provides evidence that DRAM was more expensive than flash on a per-megabyte basis or at least equally as expensive, not less. PO Suppl. Brief 3–4 (citing Ex. 2027 ¶¶ 25–28; Ex. 2028, 3–4; Ex. 2029, 4–5; Ex. 2030, 4–5). Patent Owner's evidence indicates that a person of ordinary skill in the art could have bought flash memory more cheaply than DRAM as of February 2000, which undercuts Petitioner's reason to modify Sukegawa's system with Kroeker's teachings.

Petitioner must articulate a *reason why* a person of ordinary skill in the art would combine the prior art references. *In re NuVasive*, 842 F.3d 1376, 1382 (Fed. 2016); *Metalcraft of Mayville, Inc. v. The Toro Company*, 848 F.3d 1358, 1366 (Fed. Cir. 2017) ("[I]t is insufficient to simply conclude the [prior art] combination would have been obvious without identifying any reason why a person of skill in the art would have made the combination."); *see Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015) ("obviousness concerns whether a skilled artisan not only *could have made* but *would have been motivated to make* the combinations or modifications of prior art to arrive at the claimed invention"). Conclusory statements alone, even those provided by a declarant, are inadequate to demonstrate a rationale for why a person of ordinary skill in the art would

combine the teachings from prior art references. *NuVasive*, 842 F.3d at 1383. Instead, Petitioner's arguments must be supported by a "reasoned explanation." *Id.* (citing *In re Lee*, 277 F.3d 1338, 1342, 1345 (Fed. Cir. 2002)). Petitioner's arguments must also be supported by evidence. We understand that a person of ordinary skill is a person of ordinary creativity, not an automaton, but "[w]ithout any explanation as to how or why the references would be combined to arrive at the claimed invention, we are left with only hindsight bias that *KSR* warns against." *Metalcraft*, 848 F.3d at 1367 ("'[T]he obviousness analysis cannot be confined by a formalistic conception of the words teaching, suggestion, and motivation,' we also recognize that we cannot allow hindsight bias to be the thread that stitches together prior art patches into something that is the claimed invention." (quoting *KSR*, 550 U.S. at 420–21)). Accordingly, we agree with Patent Owner that Petitioner fails to offer sufficient explanation as to why a person of ordinary skill in the art would have combined the teachings of Sukegawa and Kroeker.

(7) Summary of Analysis for Proposed Substitute Independent Claims 118, 122, and 124

As discussed in detail above, we determine that the cited prior art reference in the record would not have rendered proposed substitute claims 118, 122, and 124 obvious to a person of ordinary skill in the art at the time of the invention. Accordingly, we find that when considering the entirety of the record before us, we determine that the preponderance of the evidence fails to establish that the proposed substitute independent claims are unpatentable.

2. Analysis of Proposed Substitute Dependent Claims 119, 123, and 125–173

Neither Patent Owner nor Petitioner proffer different arguments and evidence for proposed claims 119, 123, and 125–173. Accordingly, for the same reason articulated with respect to proposed substitute independent claims 118, 122, and 124 we find that when considering the entirety of the record before us, we determine that the preponderance of the evidence fails to establish that the proposed substitute dependent claims are unpatentable.

III. MOTION TO EXCLUDE EVIDENCE

Patent Owner also filed objections to Evidence in Petitioner's Reply (Papers 25, 44) and then a Motion (Paper 46) seeking to exclude evidence presented by Petitioner. Specifically, Patent Owner seeks to exclude Exhibits 1038, 1040, 1048, and 1049. Paper 46, 1. Because our Decision does not rely on the challenged exhibit, we dismiss Patent Owner's motion as moot.

IV. CHALLENGE TO PETITIONER'S REPLY ARGUMENTS

Patent Owner filed a list of alleged improper reply arguments (Paper 32) to which Petitioner filed a Reply (Paper 33). Patent Owner lists several portions of Petitioner's Reply and evidence allegedly beyond the scope of what can be considered appropriate for a reply. *See* Paper 32.

We have considered Patent Owner's listing, but disagree that the cited portions of Petitioner's Reply and reply evidence are beyond the scope of what is appropriate for a reply. Replies are a vehicle for responding to arguments raised in a corresponding patent owner response. Petitioner's arguments and evidence that Patent Owner objects to are not beyond the

proper scope of a reply; rather, we find that they fairly respond to Patent Owner's arguments raised in Patent Owner's Response. *See Idemitsu Kosan Co., LTD. v. SFC Co. LTD*, 870 F.3d 1376, 1381 ("This back-and-forth shows that what Idemitsu characterizes as an argument raised 'too late' is simply the by-product of one party necessarily getting the last word. If anything, Idemitsu is the party that first raised this issue, by arguing—at least implicitly—that Arkane teaches away from non-energy-gap combinations. SFC simply countered, as it was entitled to do."). We also note for each of the items in Patent Owner's list, Petitioner cites to pages in the Petition for support. *See e.g.*, Paper 33, 2 ("Support for Petitioner's argument can be found at, for example, pages 7–17 of the Petition.").

V. CONCLUSION

For the foregoing reasons, we conclude Petitioner has shown by a preponderance of the evidence that claims 1–4, 6, 7, 13, 23–34, 47–58, 83–96, 99, 100, 105–111, 113, and 116 of the '862 patent would have been obvious in view of (1) Sukegawa and Dye, (2) Sukegawa, Dye, and Settsu, (3) Sukegawa, Dye, and Burrows, (4) Sukegawa, Dye, Settsu, and Burrows, and (5) Sukegawa, Dye, and Zwiegincew.

In addition, we conclude that when considering the entirety of the record before us, we determine that the preponderance of the evidence fails to establish that proposed substitute claims 118–173 unpatentable.

VI. ORDER

Accordingly, it is

ORDERED that, by a preponderance of the evidence, claims 1–4, 6, 7, 13, 23–34, 47–58, 83–96, 99, 100, 105–111, 113, and 116 of the ’862 patent are unpatentable;

FURTHER ORDERED that Patent Owner’s Motion to Exclude is *dismissed as moot*;

FURTHER ORDERED that Patent Owner’s Motion to Amend is *granted* with respect to proposed substitute claims 118–173; and

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

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