

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD. and
SAMSUNG ELECTRONICS AMERICA, INC.,
Petitioner,

v.

IMAGE PROCESSING TECHNOLOGIES LLC,
Patent Owner.

Case IPR2017-00353
Patent 8,983,134 B2

Before JONI Y. CHANG, MICHAEL R. ZECHER, and
JESSICA C. KAISER, *Administrative Patent Judges*.

KAISER, *Administrative Patent Judge*.

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

I. INTRODUCTION

Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (collectively, “Petitioner”) filed a Petition pursuant to 35 U.S.C. §§ 311–19 requesting an *inter partes* review of claims 1 and 2 of U.S. Patent No. 8,983,134 B2, issued on March 17, 2015 (Ex. 1001, “the ’134 patent”). Paper 2 (“Pet.”). Image Processing Technologies LLC (“Patent Owner”) filed a Preliminary Response. Paper 6 (“Prelim. Resp.”). Applying the standard set forth in 35 U.S.C. § 314(a), which requires demonstration of a reasonable likelihood that Petitioner would prevail with respect to at least one challenged claim, we granted Petitioner’s request and instituted an *inter partes* review of all challenged claims. Paper 12 (“Inst. Dec.”), 29.

Following institution, Patent Owner filed a Response to the Petition (Paper 17, “PO Resp.”), and Petitioner filed a Reply (Paper 22, “Pet. Reply”). A final oral hearing was held on February 21, 2018. A transcript of that hearing has been entered in the record. Paper 33 (“Hr’g Tr.”).

For the reasons discussed below, Petitioner has shown by a preponderance of the evidence that all challenged claims of the ’134 patent are unpatentable.

II. BACKGROUND

A. The '134 Patent (Ex. 1001)

The '134 patent is titled "Image Processing Method." Ex. 1001, at [54]. The Abstract describes the subject matter as follows:

A method and apparatus for localizing an area in relative movement and for determining the speed and direction thereof in real time is disclosed. Each pixel of an image is smoothed using its own time constant. A binary value corresponding to the existence of a significant variation in the amplitude of the smoothed pixel from the prior frame, and the amplitude of the variation, are determined, and the time constant for the pixel is updated. For each particular pixel, two matrices are formed that include a subset of the pixels spatially related to the particular pixel. The first matrix contains the binary values of the subset of pixels. The second matrix contains the amplitude of the variation of the subset of pixels. In the first matrix, it is determined whether the pixels along an oriented direction relative to the particular pixel have binary values representative of significant variation, and, for such pixels, it is determined in the second matrix whether the amplitude of these pixels varies in a known manner indicating movement in the oriented direction. In each of several domains, histogram of the values in the first and second matrices falling in such domain is formed. Using the histograms, it is determined whether there is an area having the characteristics of the particular domain. The domains include luminance, hue, saturation, speed (V), oriented direction (DI), time constant (CO), first axis (x(m)), and second axis (y(m)).

Id. at [57].

Figure 17 depicts x axis and y axis histograms of the head of a user in a video conference. *Id.* at 22:4–6, 22:55–67. The face V of the user is approximately defined by the peaks in the two histograms. *Id.* at 23:1–9.

Figure 22 of the '134 patent is reproduced below.

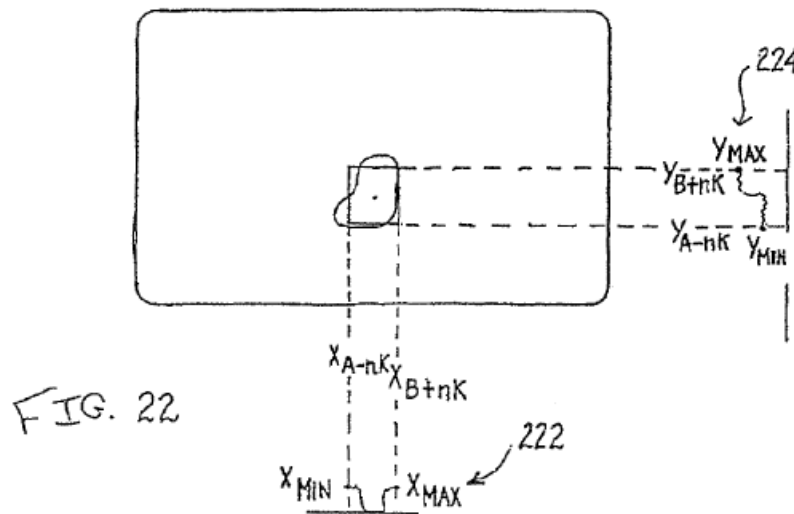


Figure 22 depicts a circumstance where an area under consideration begins to cross the borders of the target. *Id.* at 24:38–42. In particular, histograms 222 and 224 for x and y projections include pixels in which there is a significant variation, and, thus, the histograms detect the target edge in the x and y axis. *Id.* at 5:18–21, 24:38–42. The '134 patent discloses that in a preferred embodiment, the center of the area “is determined to be $(X_{MIN}+X_{MAX})/2$, $(Y_{MIN}+Y_{MAX})/2$, where X_{MIN} and X_{MAX} are the positions of the minima and maxima of the x projection histogram, and Y_{MIN} and Y_{MAX} are the positions of the minima and maxima of the y projection histogram . . . Other methods of relocating the center of the target box may be used if desired.” *Id.* at 24:46–54.

B. Illustrative Claim

Of the challenged claims, claim 1 is independent and is reproduced below:

1. A process of tracking a target in an input signal implemented using a system comprising an image processing system, the input signal comprising a succession of frames, each frame comprising a succession of pixels, the target comprising pixels in one or more of a plurality of classes in one or more of a plurality of domains, the process performed by said system comprising, on a frame-by-frame basis:

forming at least one histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains, said at least one histogram referring to classes defining said target; and

identifying the target in said at least one histogram itself, wherein forming the at least one histogram further comprises determining X minima and maxima and Y minima and maxima of boundaries of the target.

Id. at 26:36–50.

C. Related Proceedings

Petitioner and Patent Owner identify a related litigation in the U.S. District Court for the Eastern District of Texas involving the '134 patent, as well as other patents, titled: *Image Processing Techs. LLC v. Samsung*

Elecs. Co., No. 2:16-cv-00505-JRG (E.D. Tex.). Pet. 1; Paper 4, 2.

Petitioner indicates that it has concurrently filed *inter partes* review petitions for the other patents asserted in that litigation, and Patent Owner also identifies those *inter partes* reviews. Pet. 1; Paper 4, 2.

D. Level of Skill in the Art

Petitioner contends that a person having ordinary skill in the art [at] the time of the alleged invention of the '134 Patent would have had either (1) a Master's Degree in Electrical Engineering or Computer Science or the equivalent plus at least a year of experience in the field of image processing, image recognition, machine vision, or a related field[;] or (2) a Bachelor's Degree in Electrical Engineering or Computer Science or the equivalent plus at least three years of experience in the field of image processing, image recognition, machine vision, or a related field.

Pet. 4. Petitioner further contends "[a]dditional education could substitute for work experience and vice versa." *Id.* (citing Ex. 1002 (Declaration of Dr. John C. Hart) ¶¶ 45–48). Patent Owner contends a person of ordinary skill "would be someone with an undergraduate degree in electrical engineering or image processing or a related field, followed by at least two years of graduate coursework and also at least early-stage thesis research, in digital image processing." PO Resp. 3; Prelim. Resp. 9. We 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). We determine that our analysis in this Decision is supported by either assessment.

E. References and Other Evidence

We instituted trial based on the following references:

1. "Gilbert" (Alton L. Gilbert, et al., *A Real-Time Video Tracking System*, PAMI-2 No. 1 IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE 47–56 (1980)) (Ex. 1005);

2. “Hashima” (U.S. Patent No. 5,521,843; issued May 28, 1996) (Ex. 1006); and
3. “Ueno” (U.S. Patent No. 5,150,432; issued Sept. 22, 1992) (Ex. 1007).

In addition, Petitioner submitted an expert declaration from Dr. Hart (Ex. 1002, “Hart Decl.”).

Patent Owner relies on an expert declaration of Dr. Alan Bovik (Ex. 2007, “Bovik Decl.”). In addition, the deposition transcript for Dr. Bovik (Ex. 1011) has also been filed.

F. Instituted Grounds

Trial was instituted on the following grounds:

References	Basis	Claims
Gilbert and Hashima	35 U.S.C. § 103(a)	1 and 2
Ueno and Gilbert	35 U.S.C. § 103(a)	1 and 2
Hashima and Ueno	35 U.S.C. § 103(a)	1 and 2

Inst. Dec. 29; Paper 36, 3.

II. ANALYSIS

A. Claim Construction

Claims of an expired patent are given their ordinary and customary meaning in accordance with *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). See *In re Rambus Inc.*, 694 F.3d 42, 46 (Fed. Cir. 2012). Petitioner and Patent Owner agree that the ’134 patent has expired and thus the claim construction standard applicable to expired patents—namely, the district court-type claim construction standard—applies to this proceeding. Pet. 3–4; Prelim. Resp. 10; Hr’g Tr. 49:18–19. Under that

standard, the “words of a claim ‘are generally given their ordinary and customary meaning,’” as would be understood by a person of ordinary skill in the art in question at the time of the invention. *Phillips*, 415 F.3d at 1312 (quoting *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996)). “In determining the meaning of the disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence.” *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing *Phillips*, 415 F.3d at 1312–17). We also can consider extrinsic evidence, although it is “less significant than the intrinsic record.” *Phillips*, 415 F.3d at 1317.

In the Petition, Petitioner stated it did “not believe any term needs an explicit construction.” Pet. 4. In its Preliminary Response, Patent Owner proposed constructions for “domain,” “class,” “forming at least one histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains,” and “said at least one histogram referring to classes defining said target.” Prelim. Resp. 10–21. In our Institution Decision, we determined we needed to address only the construction of “forming at least one histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains” to resolve the issues before us. Inst. Dec. 9. In particular, we determined that “forming at least one histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains” is not limited to “forming at least one histogram of the pixels in two or more classes that are in two or more domains,” as Patent Owner had proposed. *Id.* at 10.

Following institution, in its Patent Owner Response, Patent Owner does not reargue our determination not to construe “domain” and “class” or our construction of the “forming” step, and instead states that it has applied our construction of the “forming” step and the plain and ordinary meaning of “class” and “domain” in its Patent Owner Response. PO Resp. 4–5. We determine we need not further construe these terms. *See Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (holding that “only those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy”); *see also Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (citing *Vivid Techs.* in the context of an *inter partes* review). In the Patent Owner Response, Patent Owner proposes constructions for “said at least one histogram referring to classes defining said target” and “wherein forming the at least one histogram further comprises determining X minima and maxima and Y minima and maxima of boundaries of the target.” PO Resp. 5–14. We address those claim limitations further below.

1. “*said at least one histogram referring to classes defining said target*”

Patent Owner contends “forming at least one histogram . . . said at least one histogram referring to classes defining said target” should be construed as “forming at least one histogram . . . at least one histogram being formed of pixels in the one or more classes that define said target.” PO Resp. 5 (citing Ex. 2006, 46). Patent Owner further contends that “said at least one histogram referring to classes defining said target” requires the histogram to be “made up of only the data for the pixels whose properties match the classes that define the target.” *Id.* at 6. In particular, Patent

Owner argues this limitation allows for the histogram to contain classes that include all values in a domain “if and only if those classes all define the target.” *Id.* Patent Owner contends its proposed construction is consistent with the language of claim 1 because the histogram is formed of “the one or more of a plurality of classes in the one or more of a plurality of domains,” with the emphasized “the” referring back to the plurality of classes of the pixels which comprise the target. *Id.* at 8–9 (citing Ex. 2007 ¶¶ 25–37). Patent Owner also points to examples in the specification of the ’134 patent, which Patent Owner contends include only classes defining the target. *Id.* at 9–11 (citing Ex. 1001, Figs. 12, 17).

Petitioner contends neither the claim language nor the Specification requires that the recited histogram include “no pixels except those falling into classes that define the target” or “every pixel defining the target.” Pet. Reply 4–8 (emphasis omitted).

We do not agree with Patent Owner’s proposed construction. Claim 1 recites “forming at least one histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains, said at least one histogram *referring* to classes defining said target.” Ex. 1001, 26:43–46 (emphasis added). Patent Owner’s proposed construction attempts to read “only” into the language of the claim. PO Resp. 7 (“Accordingly, although the target may contain pixels not in classes defining it, the histogram must refer *only* to classes defining said target.”) (italicized emphasis added), 11 (“Patent Owner’s proposed construction that the histogram only includes values in the target classes”). The claim language, however, does not include the term “only” or require that classes not defining the target be

excluded from the histogram. In other words, the claim language requires only that the recited histogram refer to classes defining the target.

We have reviewed the portions of the specification cited by Patent Owner (i.e., Figures 12 and 17 and the associated description of those figures) and find that they do not require limiting the recited histogram to only classes defining the target. We “depart from the plain and ordinary meaning of claim terms based on the specification in only two instances: lexicography and disavowal,” *Hill-Rom Services, Inc. v. Stryker Corp.*, 755 F.3d 1367, 1371 (Fed. Cir. 2014), and Patent Owner has pointed to nothing in the specification that amounts to either lexicography or disavowal. In such a circumstance, and in light of the Federal Circuit’s caution “against limiting the claimed invention to preferred embodiments or specific examples in the specification,” *Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1346–47 (Fed. Cir. 2015); *Superguide Corp. v. DirecTV Enterprises, Inc.*, 358 F.3d 870, 875 (Fed. Cir. 2004) (noting that “it is important not to import into claim limitations that are not a part of the claim”), we decline to limit the broad language of claim 1 to the specific examples Patent Owner cites.

Accordingly, we determine “said at least one histogram referring to classes defining said target” is not limited to “said at least one histogram referring to only classes defining said target.” We also determine we need not further construe this term to resolve the issues before us.

2. *“wherein forming the at least one histogram further comprises determining X minima and maxima and Y minima and maxima of boundaries of the target”*

Patent Owner contends that “wherein forming the at least one histogram further comprises determining X minima and maxima and Y minima and maxima of boundaries of the target” does not encompass creating a histogram and then determining the X minima and maxima and Y minima and maxima of the boundaries of the target from that histogram. PO Resp. 12–13 (citing Ex. 2007 ¶¶ 38–42). In our Institution Decision, in analyzing one of Petitioner’s challenges, we determined “claim 1 does not preclude creating a histogram, and then determining X minima and maxima and Y minima and maxima of boundaries of the target from that histogram, from both being part of the ‘forming’ step. That is, the histogram of claim 1 is not formed until after X minima and maxima and Y minima and maxima of boundaries of the target have been determined.” Inst. Dec. 20–21.

Patent Owner contends this interpretation is incorrect because (1) it reads the wherein clause out of the claim, PO Resp. 13; (2) a person of ordinary skill in the art would have understood that “forming the histogram” requires “adding data to the histogram,” *id.* at 13–14; and (3) general purpose dictionary definitions of “forming” support that a person of ordinary skill in the art would have understood that “forming a histogram” is the same as “creating a histogram,” *id.* at 14. We do not agree with these arguments. First, we disagree that our preliminary interpretation reads the wherein clause out of the claim. As we stated in our Institution Decision, “claim 1 does not preclude creating a histogram, and then determining X minima and maxima and Y minima and maxima of boundaries of the target from that

histogram, from both being part of the ‘forming’ step.” Inst. Dec. 20–21. In other words, we determined that under our preliminary construction, “determining X minima and maxima and Y minima and maxima of boundaries of the target” would still be part of the “forming” step.

We also do not agree that a person of ordinary skill in the art would have understood that “forming” a histogram is limited to adding data to the histogram, as Patent Owner contends. PO Resp. 13–14 (citing Ex. 2007 ¶¶ 40–41). Patent Owner and its expert cite portions of the specification that mention “forming a histogram for pixels of the output signal within the classes selected by the classifier within each domain selected by the validation signal,” and the process “further includes the steps of forming histograms along coordinate axes for the pixels within the classes selected by the classifier within each domain selected by the validation signal.” PO Resp. 14 (quoting Ex. 1001, 6:11–18); Ex. 2007 ¶¶ 40–41 (quoting same). Patent Owner’s expert, Dr. Bovik, testifies that each of these involves adding data to the histogram. Ex. 2007 ¶¶ 40–41. These portions of the specification, however, do not show the “forming” step is *limited to* adding data to the histogram. We have also considered the general purpose dictionaries cited by Patent Owner (PO Resp. 14 (citing Ex. 2008; Ex. 2009)), but we find this extrinsic evidence is inconclusive and does not outweigh the intrinsic evidence we discuss below.

In particular, Petitioner contends that Patent Owner’s proposed construction is inconsistent with the embodiment disclosed in Figure 17 of the ’134 patent. Pet. Reply 9. Figure 17 is reproduced below.

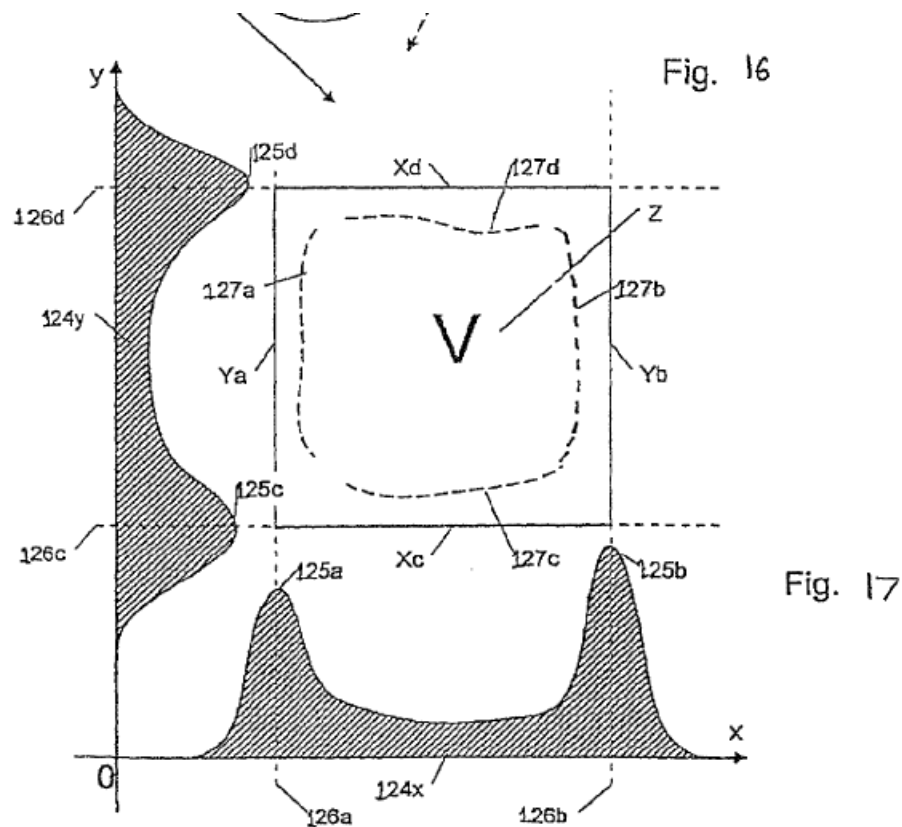


Figure 17 depicts x axis and y axis histograms of the head of a user in a video conference. Ex. 1001, 22:4–6, 22:55–67. As Petitioner points out in Figure 17, (Pet. Reply 9), histograms 124x and 124y are created and then analyzed to determine peaks 125a, 125b, 125c, and 125d. Ex. 1001, 22:55–26:9. We agree with Petitioner that the embodiment in Figure 17 is consistent with a construction of this claim limitation which encompasses determining the recited points (i.e., peaks 125a, 125b, 125c, and 125d) from a created histogram (i.e., histograms 124x and 124y). In other words, Figure 17 is consistent with our preliminary determination that “claim 1 does not preclude creating a histogram, and then determining X minima and maxima and Y minima and maxima of boundaries of the target from that histogram, from both being part of the ‘forming’ step.” Inst. Dec. 20–21.

Patent Owner's contention at the oral hearing that Figure 17 is not an embodiment of claim 1 (*see* Hr'g Tr. 30:13–15, 34:17–19, 36:8–9) is undermined by its reliance on Figure 17 to support its interpretation of other limitations of claim 1 (PO Resp. 9–10) and its contention that the asserted prior art differs from Figure 17 (*id.* at 41–42). Dr. Bovik similarly relied on Figure 17 in his declaration. *See* Ex. 1007 ¶¶ 31–34, 106–108. Indeed, Patent Owner conceded that the first time either Patent Owner or Dr. Bovik contended Figure 17 was not an embodiment of claim 1 was during Dr. Bovik's deposition (i.e., that contention does not appear in Patent Owner's briefs). *See* Hr'g Tr. 40:19–42:19. We have reviewed Dr. Bovik's deposition testimony regarding Figure 17 and do not find it helpful because it assumes, without analyzing, the correctness of Patent Owner's construction of this claim limitation. *See* Ex. 1011, 51:1–8.

For the first time at the hearing, Patent Owner changed tack to assert its proposed claim construction for this limitation is supported by the prosecution history and other disclosures in the specification of the '134 patent not cited in its briefs. *See, e.g.*, Hr'g Tr. 35:4–17, 36:18–39:6, 43:1–18. Petitioner objected to Patent Owner raising new arguments at the oral hearing. *Id.* at 57:5–21. We agree with the Petitioner that these arguments were not made in the briefs. We need not consider Patent Owner's arguments raised for the first time at the oral hearing. *See Dell Inc. v. Accleron, LLC*, 884 F.3d 1364, 1369 (Fed. Cir. 2018) (holding that the Board was not obligated to consider an “untimely argument . . . raised for the first time during oral argument”). In any event, we do not agree with Patent Owner's new arguments for the reasons discussed below.

Patent Owner's counsel relied on the prosecution history for the first time at the oral hearing. See Hr'g Tr. 35:4–17, 43:1–18. Although the prosecution history is in the record (Ex. 1004), neither party relied on the prosecution history in its briefs. Hr'g Tr. 43:13–18, 65:3–17. During the oral hearing, Patent Owner's counsel contended that the applicant added this claim limitation by amendment and pointed to the embodiment in column 24 for support. *Id.* at 35:4–13; see *id.* at 43:4–9. We have reviewed the prosecution history in Exhibit 1004, and do not find support for Patent Owner's construction. Patent Owner is correct that claim 1 was amended during prosecution to add this limitation (specifically, the Examiner found a dependent claim that included that limitation would be allowable if rewritten in independent form and the applicant amended that claim accordingly). See Ex. 1004, 86, 88, 146, 197, 198. We do not find, and Patent Owner has not pointed us to, any disavowal of claim scope or any other statement in the prosecution history that clearly limits claim 1 to a particular embodiment in the specification. See *id.*

During the oral hearing, Patent Owner also relied on a statement in the specification that “[f]or the histogram formed in memory 100, key characteristics for that histogram are simultaneously computed in a unit 112,” including “the minimum (MIN) of the histogram [and] the maximum (MAX) of the histogram” (Ex. 1001, 19:41–45). Hr'g Tr. 36:18–39:6. As Petitioner points out (*id.* at 14:10–24), and we agree, this disclosure refers to computing the minimum and maximum of *the histogram*, whereas claim 1 recites determining minima and maxima of boundaries of *the target*.

Patent Owner also relied extensively at the oral hearing on the embodiment in Figures 21–23 of the '134 patent, as well as the associated

description of that embodiment. In particular, Patent Owner contends that the last histogram formed in the iterative process in that embodiment maps to the “at least one histogram” recited in claim 1, such that steps occurring prior to the formation of that last histogram can be part of the recited “forming” step. *See, e.g.*, Hr’g Tr. 38:21–24. Even if we were to accept these contentions (i.e., even if we were to agree that that embodiment meets the limitations of claim 1), we see nothing in the specification limiting the “forming” step or this limitation of claim 1 to that embodiment, and Patent Owner has not pointed us to any limiting language in the specification. Indeed, Dr. Bovik characterized this embodiment as “one way of . . . practicing claim 1.” Ex. 1011, 16:7–12. As discussed above, we are mindful not to limit “the claimed invention to preferred embodiments or specific examples in the specification.” *Williamson*, 792 F.3d at 1346–47.

Thus, even considering Patent Owner’s belated arguments made during the oral hearing, we conclude our preliminary determination remains correct: “claim 1 does not preclude creating a histogram, and then determining X minima and maxima and Y minima and maxima of boundaries of the target from that histogram, from both being part of the ‘forming’ step.” Inst. Dec. 20–21. We determine we need not further construe this limitation to resolve the issues before us.

B. Asserted Obviousness Over Gilbert and Hashima

1. Overview of Gilbert and Hashima

Gilbert is titled “A Real-Time Video Tracking System,” and dated January 1980. Ex. 1005, 47.¹ Gilbert relates to an object identification and tracking system, which includes an image processing system comprising a video processor, a projection processor, a tracker processor, and a control processor. *Id.* at 47–48. Gilbert’s video processor receives a digitized video signal in which each field consists of pixels. *Id.* at 48. Gilbert discloses that “[e]very 96 ns, a pixel intensity is digitized and quantized into eight bits (256 gray levels), counted into one of six 256-level histogram memories, and then converted by a decision memory to a 2-bit code indicating its classification (target, plume, or background.).” *Id.* Gilbert’s projection processor then uses pixels identified as being part of the target to create x- and y-projections. *Id.* at 50. Figure 4 of Gilbert is reproduced below.

¹ We refer to the original page numbers at the top of the pages in Exhibit 1005 rather than the page numbers added by Petitioner.

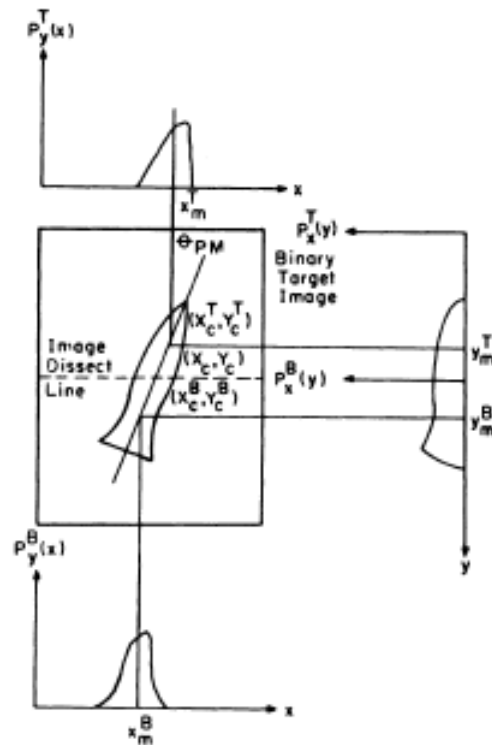


Fig. 4. Projection location technique.

Figure 4 of Gilbert depicts a Y-projection and X-projections of the target. Gilbert's system uses these projections to determine the center of the upper and lower portions of the target, and those points are then used to determine the center of the target (X_C , Y_C). *Id.* at 50–51.

Hashima is titled “System for and Method of Recognizing and Tracking Target Mark,” and issued on May 28, 1996. Ex. 1006, at [45], [54]. Hashima relates to a system and method of recognizing and tracking a target mark with a video camera. *Id.* at [57]. In Hashima, the target mark can be a black circle with a white triangle as depicted in Figure 3 (reproduced below).

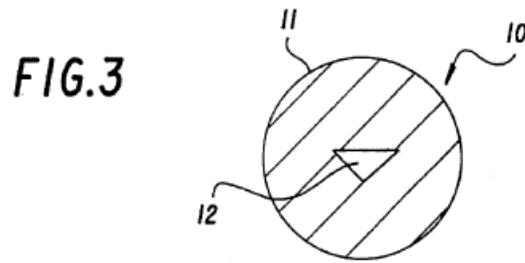


Figure 3 depicts Hashima's target mark. Figure 6 of Hashima is reproduced below.

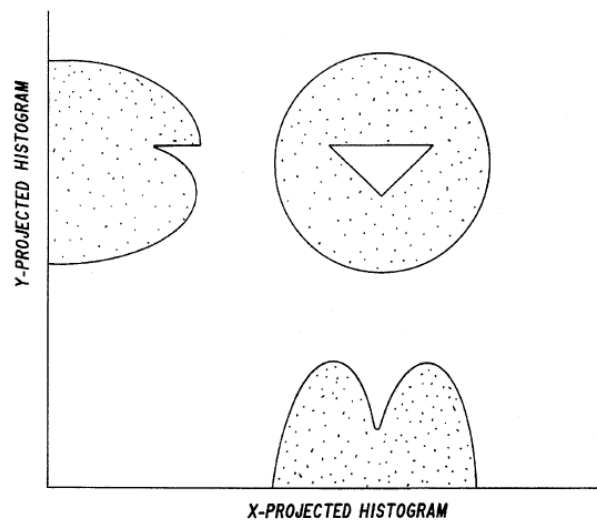


FIG.6

Figure 6 depicts x- and y-projected histograms of a target mark. Hashima describes creating these histograms by summing the number of black pixels at each x- or y- location. *Id.* at 8:18–9:7. Hashima also describes finding the central position of the detected mark as shown in Figure 15 below.

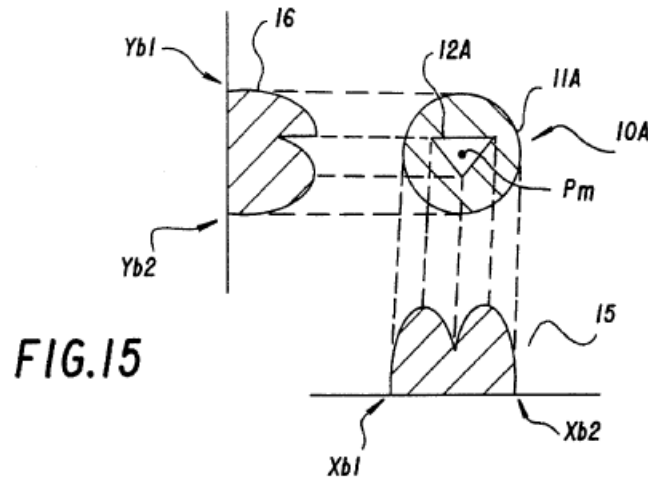


Figure 15 depicts a process of finding central position P_m of the target mark. Hashima describes finding P_m (m_x , m_y) using the equations (1) $m_x = (X_{b1} + X_{b2})/2$ and (2) $m_y = (Y_{b1} + Y_{b2})/2$. *Id.* at 11:6–25.

2. Analysis

Petitioner contends that claims 1 and 2 would have been obvious over Gilbert and Hashima. Pet. 34–50. We have reviewed the information provided by Petitioner, including the relevant portions of the supporting Hart Declaration (Ex. 1002), and, taking into account the arguments presented in the Patent Owner Response, Petitioner has demonstrated by a preponderance of the evidence that claims 1 and 2 are unpatentable as obvious over Gilbert and Hashima.

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. *See KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying

factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) when in the record, objective evidence of non-obviousness.² See *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). In that regard, an obviousness analysis “need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.” *KSR*, 550 U.S. at 418.

Petitioner’s obviousness analysis, as supported by the Hart Declaration, demonstrates where each element of the challenged claims is taught in Gilbert and Hashima. Pet. 39–48; Ex. 1002 ¶¶ 89–108. We agree with and adopt Petitioner’s analysis and Dr. Hart’s testimony as our own.

For example, for the preamble of claim 1, Petitioner contends Gilbert discloses a process of tracking a target (i.e., a missile) and uses a video signal (i.e., input signal) comprising digitized fields with a frame rate of 60 fields/s (i.e., 30 frames/s in a succession of frames), each image frame comprising a matrix of digitized points (i.e., a succession of pixels). Pet. 39–40 (citing Ex. 1005, 47–48; Ex. 1002 ¶¶ 89–91). Petitioner further contends that Gilbert tracks the target by categorizing pixels into 256 gray-scale levels (i.e., a plurality of classes) according to their pixel intensity (i.e., domain), and Gilbert discloses that a plurality of other domains, such as “texture, edge, and linearity measures” could also be used. *Id.* at 40 (citing

² Patent Owner does not present arguments or evidence of such secondary considerations in its Patent Owner Response.

Ex. 1005, 48; Ex. 1002 ¶¶ 92–93). Petitioner contends Hashima also teaches the preamble. *Id.* at 40–41.

Petitioner contends Gilbert and Hashima each disclose the step of “forming at least one histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains, said at least one histogram referring to classes defining said target,” as recited in claim 1. *Id.* at 41. Specifically, Petitioner relies on Gilbert’s intensity histogram (discussed above), Gilbert’s X- and Y-projection histograms, as well as Hashima’s X- and Y-axis histograms. *Id.* at 41–43 (citing Ex. 1005, 48, 50–51, Fig. 4; Ex. 1006, 8:22–30; Ex. 1002 ¶¶ 94–98, 100). For the limitation of “identifying the target in said at least one histogram itself,” Petitioner contends the histograms in both Gilbert and Hashima are used to identify a target. *Id.* at 43–44 (citing Ex. 1005, 48–50; Ex. 1006, 8:18–10:24; Ex. 1002 ¶¶ 101–102).

Regarding “wherein identifying the target in said at least one histogram further comprises determining X minima and maxima and Y minima and maxima of boundaries of the target,” as recited in claim 1, Petitioner contends “Gilbert uses the center of areas of the target’s upper and lower halves to find a center point,” and teaches that “‘target nose and tail points’ could be used.” *Id.* at 44 (citing Ex. 1005, 50; Ex. 1002 ¶ 103). Petitioner further contends that Hashima discloses “determining X maxima and minima and Y maxima and minima of the boundaries of the target in the histogram to calculate the center point of the target using the equations $(X_{\text{MIN}} + X_{\text{MAX}})/2$ and $(Y_{\text{MIN}} + Y_{\text{MAX}})/2$.” *Id.* (citing Ex. 1006, 11:13–24, Fig. 15; Ex. 1002 ¶¶ 103–104).

Although Petitioner appears to contend Gilbert discloses all of the limitations of claim 1, Petitioner contends that, “[t]o the extent Patent Owner argues Gilbert does not disclose the claimed plurality of domains or method of finding the X- and Y-minima and maxima, it would have been obvious to replace these features of Gilbert with those of Hashima.” *Id.* at 44–45 (citing Ex. 1002 ¶ 100). Petitioner further argues the combination of Hashima and Gilbert teaches “an input signal comprising a succession of frames, each frame comprising a succession of pixels,” as recited in claim 1. *Id.* at 45.

Petitioner also provides a sufficiently persuasive rationale for combining the teachings of Gilbert and Hashima. For example, Petitioner contends that a person of ordinary skill reading Gilbert would have been motivated to plot histograms in other domains to increase the likelihood of successfully recognizing the target “because each additional domain provides another opportunity for correlation between that domain and the unique target being tracked.” *Id.* at 36. Petitioner also contends that it would have been obvious for a person of ordinary skill in the art to modify Gilbert with “simpler location tracking and camera movement based on the end-points of a target in a histogram (i.e., X-minima and maxima and Y-minima and maxima), such as the calculation disclosed by Hashima.” *Id.* at 38. Petitioner contends a person of ordinary skill would have been motivated to do so

because (1) it would enable drawing a tracking box, which can be used to more efficiently track a target, and (2) it would reduce the number of calculations needed to determine the center, which can be used to reposition the camera, resulting in faster, more efficient processing to improve tracking of a target.

Id. at 38–39 (citing Ex. 1002 ¶ 88). To support its rationales for combine the teachings of Gilbert and Hashima, Petitioner relies upon the supporting testimony of Dr. Hart. Ex. 1002 ¶¶ 78–88.

Petitioner provides further analysis of claim 2, detailing where it contends each limitation of that claim is taught by Gilbert and Hashima. *Id.* at 45–48. We have reviewed Petitioner’s evidence and argument, and find that Petitioner has shown the cited references teach each limitation of the challenged claims, and that Petitioner has provided a sufficiently persuasive rationale for combining those teachings.

In the Patent Owner Response, Patent Owner argues that neither Gilbert nor Hashima teaches “wherein forming the at least one histogram further comprises determining X minima and maxima and Y minima and maxima of boundaries of the target” (PO Resp. 29–32), and neither teaches “forming at least one histogram of the pixels in the one or more of a plurality of classes in the one or more of a plurality of domains, said at least one histogram referring to classes defining said target” (*id.* at 36–42). These arguments, however, are based on Patent Owner’s proposed constructions of those claim limitations, which as discussed above, we do not adopt. *See supra* Section II.A.

Patent Owner also argues that Gilbert does not teach “identifying the target in said at least one histogram itself.” PO Resp. 43–47. As Petitioner points out, Patent Owner has not addressed Petitioner’s contentions that Hashima also teaches this limitation. Pet. Reply 19. In addition, as we found in the Institution Decision, identifying the target in the intensity histograms does not preclude the target from also being identified in the projection histograms. Inst. Dec. 20. As shown in Gilbert’s Figure 4

(depicted above), Gilbert’s projection histograms display target pixels and identify the target in the x- and y- domains. *See* Ex. 1002 (Hart Decl.) ¶ 54. Patent Owner and its expert, Dr. Bovik, contend that the “identifying” step requires a previously unidentified target, but they fail to explain persuasively why this is so. Ex. 2007 ¶ 86; PO Resp. 45–47. We find that Petitioner has shown Gilbert and Hashima teach this limitation.

Regarding Petitioner’s rationale to combine Gilbert and Hashima, Patent Owner contends a person of ordinary skill in the art would not have combined Gilbert and Hashima because Hashima is directed to tracking a low speed known target, whereas Gilbert is directed to tracking a high speed unknown target. PO Resp. 47–50. In addition to the reasons provided in the Petition, with which we agree, Petitioner notes Hashima expressly states its system can also track fast-moving targets: “The image processor can thus achieve a high-speed processing and is capable of tracking a target mark that moves at a high speed.” Pet. Reply 25 (quoting Ex. 1006, 25:31–34).

In addition, as we stated in our Institution Decision, it is well-settled that simply because two references have different objectives does not preclude a person of ordinary skill in the art from combining their respective teachings. *In re Heck*, 699 F.2d 1331, 1333 (Fed. Cir. 1983) (“The use of patents as references is not limited to what the patentees describe as their own inventions or to the problems with which they are concerned.”) (quoting *In re Lemelson*, 397 F.2d 1006, 1009 (CCPA 1968)); *see also EWP Corp. v. Reliance Universal Inc.*, 755 F.2d 898, 907 (Fed. Cir. 1985) (“A reference must be considered for everything that it teaches, not simply the described invention or a preferred embodiment.”). Here, Petitioner provides sufficiently persuasive reasoning for combining the teachings of Hashima

with Gilbert, including that a person of ordinary skill would have been motivated to modify Gilbert to (1) enable drawing a tracking box, which can be used to more efficiently track a target; and (2) reduce the number of calculations needed to determine the center, which can be used to reposition the camera, resulting in faster, more efficient processing to improve tracking of a target. Pet. 38–39 (citing Ex. 1002 ¶ 88). Petitioner’s reasoning is supported by its expert’s testimony. Ex. 1002 (Hart Decl.) ¶¶ 78–88.

For the reasons discussed above, we determine Petitioner has shown by a preponderance of the evidence that claims 1 and 2 are unpatentable as obvious over Gilbert and Hashima.

C. Asserted Obviousness Over Ueno and Gilbert

1. Overview of Ueno

Ueno is titled “Apparatus for Encoding/Decoding Video Signals to Improve Quality of a Specific Region,” and issued on September 22, 1992. Ex. 1007, at [45], [54]. Ueno’s abstract describes its subject matter as follows:

An image encoding apparatus comprises a region detecting circuit for detecting a specific region from input image signals and outputting the region specifying signals for discriminating the specific region from other regions, a low-pass filter for selectively filtering and outputting the image signals of regions other than the specific region in the input image signals, and an encoding circuit for encoding the image signal output from the low-pass filter.

Id. at [57]. Figure 3 of Ueno is reproduced below.

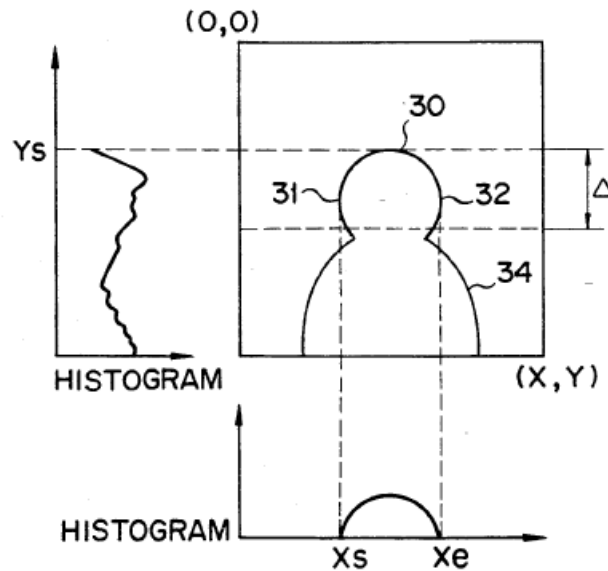


FIG. 3

Figure 3 shows x- and y-axis histograms in Ueno. Ueno states:

FIG. 3 shows an interframe difference image input to the facial region detecting circuit 102. Information for the interframe difference image is converted into binary data of “0” or “1” by the preset first threshold level. Then the number of pixels having the binary data value of “1” or the value equal to or more than the first threshold value is counted in the vertical and horizontal directions of the screen and histograms of the pixels (x-and y-axis histograms) are formed. Facial detection is executed according to the histograms.

Ex. 1007, 7:7–16. Ueno detects the top of the head in the y-axis histogram by identifying point Y_s , which exceeds a threshold value. Ueno then determines the left and right sides of the head by selecting points X_s and X_e , which exceed a threshold. Finally, Ueno determines a width Δ from the top of the head so that the region with the shoulders is not detected. *Id.* at 7:17–30.

2. *Analysis*

Petitioner contends that claims 1 and 2 would have been obvious over Ueno and Gilbert. Pet. 60–73. We have reviewed the information provided by Petitioner, including the relevant portions of the supporting Hart Declaration (Ex. 1002), and, taking into account the arguments presented in the Patent Owner Response, Petitioner has demonstrated by a preponderance of the evidence that claims 1 and 2 are unpatentable as obvious over Ueno and Gilbert.

Petitioner’s obviousness analysis, as supported by the Hart Declaration, demonstrates where each element of the challenged claims is taught in Ueno and Gilbert. Pet. 53–58, 64–71; Ex. 1002 ¶¶ 143–167. We agree with and adopt Petitioner’s analysis and Dr. Hart’s testimony as our own.

For example, Petitioner contends Gilbert teaches the preamble of claim 1 as discussed above, and contends Ueno also teaches the preamble by describing a process of tracking a target (i.e., a human face) from a video signal (i.e., an input signal) comprising a succession of frames, each frame comprising a succession of pixels. Pet. 53–54 (citing Ex. 1002 ¶¶ 115–121; Ex. 1007, 7:7–16), 64. Petitioner further contends a face in Ueno is identified in the histograms of the X- and Y-domains (i.e., a plurality of domains). *Id.* at 55 (citing Ex. 1007, 7:7–16; Ex. 1002 ¶¶ 125–127), 64–67. Petitioner further relies on Ueno as teaching “wherein identifying the target in said at least one histogram further comprises determining X minima and maxima and Y minima and maxima of boundaries of the target,” and contends Ueno “determines X minima and maxima and Y minima and maxima in the X and Y histograms and draws a rectangle around the target

using the X and Y minima and maxima to mark the target on the display screen.” *Id.* at 67–68 (citing Ex. 1007, 7:17–45, 13:3–26; Ex. 1002 ¶¶ 161–162).

Petitioner also provides a sufficiently persuasive rationale for combining the teachings of Ueno and Gilbert. For example, Petitioner contends a person of ordinary skill would have been motivated to modify Gilbert to include histograms in other domains, as discussed above, and to include simpler methods of marking a target on a screen, such as those taught in Ueno, to be less visually distracting. Pet. 61–63. To support its rationales for combining the teachings of Ueno and Gilbert, Petitioner relies upon the supporting testimony of Dr. Hart. Ex. 1002 ¶¶ 137–143.

We have addressed Patent Owner’s arguments regarding Gilbert’s teachings above, and do not agree with those arguments for the reasons discussed in Section II.B.2.

Patent Owner further contends Ueno does not teach “wherein forming the at least one histogram further comprises determining X minima and maxima and Y minima and maxima of boundaries of the target.” PO Resp. 33–35. This argument, however, is based on Patent Owner’s proposed construction of this claim limitation, which as discussed above, we do not adopt. *See supra* Section II.A.

Patent Owner also contends a person of ordinary skill in the art would not have combined Ueno and Gilbert because Ueno uses a “low-speed known-target” tracking algorithm, whereas Gilbert uses a “high-speed unknown-target” tracking algorithm. PO Resp. 50–54. Patent Owner further argues a person of ordinary skill would have understood that Ueno

and Gilbert are incompatible. *Id.* at 52. Patent Owner contends Petitioner has not shown a credible reason to combine Ueno and Gilbert. *Id.* at 53.

We are not persuaded by these arguments because it is well-settled that simply because two references have different objectives does not preclude a person of ordinary skill in the art from combining their respective teachings. *See Heck*, 699 F.2d at 1333. Moreover, as discussed above, Petitioner provides sufficiently persuasive reasoning for combining the teachings of Ueno and Gilbert, which is supported by its expert’s testimony. Ex. 1002 (Hart Decl.) ¶¶ 137–142. That is, we agree with Petitioner’s contention that a person of ordinary skill would have been motivated to modify Gilbert to include histograms in other domains, as discussed above, and to include simpler methods of marking a target on a screen, such as those taught in Ueno, to be less visually distracting. Pet. 61–63. We have considered Dr. Bovik’s testimony (Ex. 2007 ¶¶ 139–150), but find that testimony does not sufficiently undermine Dr. Hart’s testimony. Indeed, Dr. Bovik recognizes that a person of ordinary skill in the art “would [have understood] that many different approaches to tracking can be taken depending on the context, design goals, processing power, etc.” Ex. 2007 ¶ 150.

For the reasons discussed above, we determine Petitioner has shown by a preponderance of the evidence that claims 1 and 2 are unpatentable as obvious over Ueno and Gilbert.

D. Asserted Obviousness Over Hashima and Ueno

In our Institution Decision, we exercised our discretion and determined not to institute review based on Petitioner’s obviousness challenge to claims 1 and 2 over Hashima and Ueno. Inst. Dec. 28–29. On

May 4, 2018, we issued an order modifying our Institution Decision to institute on all of the grounds presented in the Petition. Paper 36, 2. In that order, we noted that the parties affirmatively waived any additional briefing on this ground, namely, that claims 1 and 2 are unpatentable as obvious over Hashima and Ueno. *Id.* at 3. Because we determine claims 1 and 2 are unpatentable under the grounds discussed above, we do not address Petitioner’s obviousness challenge to those same claims based on the combined teachings of Hashima and Ueno. *Cf. In re Gleave*, 560 F.3d 1331, 1338 (Fed. Cir. 2009) (not reaching other rejections after affirming an anticipation rejection).

III. PROCEDURAL ISSUES

Patent Owner also objects to the constitutionality of this *inter partes* review. PO Resp. 54 (citing *Oil States Energy Services, LLC v. Greene’s Energy Group, LLC*, No. 16-712 (U.S. Nov. 23, 2016, cert. granted June 12, 2017)). However, on April 24, 2018, the Supreme Court held that “inter partes review does not violate Article III or the Seventh Amendment” of the Constitution. *Oil States Energy Servcs., LLC v. Greene’s Energy Grp., LLC*, 2018 WL 1914662, at *12 (U.S. Apr. 24, 2018). Therefore, Patent Owner’s argument is unavailing.

IV. CONCLUSION

Petitioner has demonstrated by a preponderance of the evidence that:

- A. Claims 1 and 2 are unpatentable as obvious over Gilbert and Hashima; and
- B. Claims 1 and 2 are unpatentable as obvious over Ueno and Gilbert.

V. ORDER

For the foregoing reasons, it is

ORDERED that claims 1 and 2 of the '134 patent are unpatentable;
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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