

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

PRIME FOCUS CREATIVE SERVICES CANADA INC.,
Petitioner,

v.

LEGEND3D, INC.,
Patent Owner.

Case IPR2016-01491
Patent 9,286,941 B2

Before MICHAEL R. ZECHER, CARL M. DEFRANCO, and
KAMRAN JIVANI, *Administrative Patent Judges*.

JIVANI, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
Determining Claims 1–3, 5, and 16–19 Unpatentable
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

I. INTRODUCTION

Prime Focus Creative Services Canada Inc. (“Petitioner”) sought *inter partes* review of claims 1–13, 16–19, and 24 of U.S. Patent No. 9,286,941 B2 (Ex. 1001, “the ’941 patent”), owned by Legend3D, Inc. (“Patent Owner”). Paper 1 (“Petition” or “Pet.”). Patent Owner filed a Preliminary Response. Paper 10 (“Prelim. Resp.”). Upon consideration of the Petition and Preliminary Response, we instituted an *inter partes* review pursuant to 35 U.S.C. § 314 of claims 1–3, 5, and 16–19 (the “Instituted Claims”). Paper 13 (“Decision on Institution” or “Dec. on Inst.”), 18. We did not, however, institute review of claims 4, 6–13, and 24 (the “Denied Claims”) because we determined Petitioner had not shown a reasonable likelihood that it would prevail with respect to those claims. *Id.*

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision is entered pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. Based on the record before us, we determine that Petitioner has shown by a preponderance of the evidence that the Instituted Claims are unpatentable.

II. BACKGROUND

A. *Procedural History*

In our Decision on Institution, we instituted review on the following grounds of unpatentability (Dec. on Inst. 13–14, 16–18).

References	Grounds	Challenged Claim(s)
Sandrew ¹	§ 102(b)	1, 3, 5, 16, and 19
Sandrew and Katayama ²	§ 103(a)	2
Sandrew and Porter ³	§ 103(a)	17
Sandrew and Burt ⁴	§ 103(a)	18

After institution, Petitioner and Patent Owner each requested rehearing of our Decision on Institution. Papers 15, 16. Patent Owner requested that we reconsider our decision to institute review of claims 1–3, 5, and 16–19. Paper 16, 1. We considered Patent Owner’s arguments in support of its request and denied Patent Owner’s request pursuant to 37 C.F.R. § 42.71(d) for failure to show that we overlooked or misunderstood any argument made by Patent Owner in the Preliminary Response. Paper 28.

Petitioner requested that we reconsider our decision not to institute review on the asserted ground “that [c]laims 1, 3–5, 11–13, 16, 19, and 24 are obvious over prior art Sandrew in view of Yuille and other references.” Paper 15, 1 (citing Dec. on Inst. 14–16).⁵ Having considered Petitioner’s request in light of the evidentiary record at that point in the proceeding, we

¹ U.S. Patent No. 4,984,072, iss. Jan. 8, 1991 (Ex. 1003, “Sandrew”).

² U.S. Patent No. 6,404,936 B1, iss. June 11, 2002 (Ex. 1004, “Katayama”).

³ Thomas Porter & Tom Duff, *Compositing Digital Images*, Vol. 18 ACM SIGGRAPH Computer Graphics 253–259 (1984) (Ex. 1009, “Porter”).

⁴ U.S. Patent No. 5,991,444, iss. Nov. 23, 1999 (Ex. 1010, “Burt 2”).

⁵ Although Petitioner did not list claims 2, 4, 6–10, 17, and 18, we understood this omission to be unintentional given Petitioner’s citation to the portion of our Decision on Institution discussing these claims along with claims 1, 3–5, 11–13, 16, 19, and 24. *Id.* Therefore, we proceeded with the understanding that Petitioner intended to seek rehearing of our Decision on Institution as to claims 1–13, 16–19, and 24.

granted Petitioner's request and modified our Decision to Institute to include review of the Instituted Claims as obvious over Sandrew alone.⁶ Paper 33. We further amended our Scheduling Order to provide both parties an opportunity to address the newly instituted obviousness ground. Paper 31. We did not, however, institute review of any of the Denied Claims. *Id.* Thus, we proceeded with trial on the following grounds of unpatentability.

References	Grounds	Instituted Claim(s)
Sandrew	§ 102(b)	1, 3, 5, 16, and 19
Sandrew	§ 103(a)	1, 3, 5, 16, and 19
Sandrew and Katayama	§ 103(a)	2
Sandrew and Porter	§ 103(a)	17
Sandrew and Burt 2	§ 103(a)	18

During the trial, Patent Owner filed a Patent Owner Response (Paper 35, "PO Resp."), and Petitioner filed a Reply thereto (Paper 37, "Pet. Reply"). Petitioner also filed a Motion to Exclude certain of Patent Owner's Exhibits (Paper 40). Patent Owner filed an Opposition to Petitioner's Motion (Paper 42), and Petitioner filed a Reply in Support of its Motion to Exclude (Paper 43).

Both parties requested an oral hearing, and a hearing was held on November 3, 2017. Paper 41. A transcript of the oral hearing has been entered into the record (Paper 44, "Tr.").

⁶ In its Reply, Petitioner objected to our institution of this obviousness ground relying on Sandrew alone and not Sandrew in combination with Yuille. Pet. Reply 24–25. Petitioner, however, withdrew this objection during the oral hearing. Tr. 54:16–17.

B. Related Proceedings

The parties identify the following related district court case, wherein Patent Owner sought, but was not granted, leave to assert the '941 patent via a counterclaim: *Prime Focus Creative Services Canada Inc. v. Legend3D, Inc.*, No. 2:15-cv-02340-MWF-PLA (C.D. Cal.), filed on April 21, 2016. *See* Pet. 1; Paper 4, 2.

C. Overview of the '941 patent (Ex. 1001)

The '941 patent relates to an image sequence enhancement system and method that allows for the rapid conversion of a sequence of images. Ex. 1001, 1:33–40. The '941 patent describes two tasks: (1) colorizing black-and-white images; and (2) converting two-dimensional images to three-dimensional images. *Id.* To perform either of these tasks, the '941 patent identifies regions within the images and uses masks to cover objects as they move through the sequence of images. *Id.* at 1:40–42. The masks of the '941 patent are reshaped as the objects they cover move and change shape through the image sequence. *Id.*

According to the '941 patent, “great amounts of labor are required to manually shape and reshape masks for applying depth or Z-dimension data to the objects.” *Id.* at 2:41–43. This is particularly true in the case of large motion pictures, “which may number in the hundreds of thousands of image frames.” *Id.* at 4:30–31. In order to expedite processing of these image frames, the '941 patent describes masking motion elements in a key frame. *Id.* at 6:6–8.

“After the key frame is fully designed and masked, the mask information from the key frame is then applied to all frames in the display” using one of the following three mask fitting techniques: (1) automatic

mask fitting using Fast Fourier Transform and Gradient Decent Calculations; (2) Bezier curve animation with edge detection as an automatic animation guide; and (3) polygon animation with edge detection as an automatic animation guide. *Id.* at 6:11–32. The '941 patent describes technique number 1, the automatic mask fitting, as referencing “the same masked area of the key frame followed by all prior subsequent frames in succession.” *Id.* at 6:17–19. When using this technique, the invention “can reshape at least the outlines of masks from frame to frame,” thereby saving “large amounts of labor . . . from this process that traditionally has been done by hand.” *Id.* at 6:20–22.

D. Illustrative Claim

Claim 1 is independent. This claim is representative of the Instituted Claims and is reproduced below.

1. A system configured to modify a set of time ordered digital images comprising a computer having memory and a program stored in said memory that is configured to:
 - associate a first mask with a motion object in a first image at a first mask location;
 - copy said first mask to create a second mask associated with a second image;
 - move said second mask to a second mask location associated with said motion object in said second image; and,
 - reshape said second mask to fit said motion object in said second image based on underlying image data in said second image.

Ex. 1001, 63:11–22

E. Testimony and Documentary Evidence

Petitioner supports its challenges with a corrected declaration of Dr. David A. Forsyth. Ex. 1012. Dr. Forsyth testified by deposition on April 24, 2017, and a transcript of his testimony has been entered into evidence. Ex. 2007.

Patent Owner adduces three articles in support of its opposition to Petitioner's challenges:

- (i) Forsyth, D.A., and Fleck, M.M. "Automatic Detection of Human Nudes" *Int'l Journal of Computer Vision* 32(1), 63–77 (1999) (Ex. 2004);
- (ii) Karsch, K., et al. "Rendering Synthetic Objects into Legacy Photographs" (undated) (Ex. 2005); and
- (iii) Karsch, Kevin, "Inverse Rendering Techniques for Physically Grounded Image Editing" (2015) (Ex. 2008).

III. ANALYSIS

A. Principles of Law

Petitioner bears the burden of proving unpatentability of the Instituted Claims, and the burden of persuasion never shifts to Patent Owner.

Dynamic Drinkware, LLC v. Nat'l Graphics, Inc., 800 F.3d 1375, 1378 (Fed. Cir. 2015). To prevail in its challenges to the Instituted Claims, Petitioner must demonstrate by a preponderance of the evidence that the claims are unpatentable. 35 U.S.C. § 316(e).

A claim is unpatentable under 35 U.S.C. § 102(b) only if every element set forth in the claims is found, either expressly or inherently described in a single prior art reference. *Verdegaal Bros., Inc. v. Union Oil*.

Co. of Cal., 814 F.2d 628, 631 (Fed. Cir. 1987). “The identical invention must be shown in as complete detail as is contained in the . . . claim.”

Richardson v. Suzuki Motor Co., 868 F.2d 1226, 1236 (Fed. Cir. 1989). The elements must be arranged as required by the claim, but identity of terminology is not required. *In re Bond*, 910 F.2d 831, 832 (Fed. Cir. 1990).

A claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter as a whole would have been obvious at the time of the invention to a person having ordinary skill in the art. *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) when in evidence, objective evidence of non-obviousness, i.e., so-called secondary considerations such as commercial success, long felt but unsolved needs, and failure of others. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). The obviousness inquiry further requires an analysis of “whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.” *KSR*, 550 U.S. at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) (requiring “articulated reasoning with some rational underpinning to support the legal conclusion of obviousness”)).

B. Level of Skill in the Art

Petitioner and Dr. Forsyth state:

A person of ordinary skill in the art at the time of the alleged invention would generally have had at least a Bachelor’s degree education and five to seven years of relevant work experience where that work experience is in the area of image analysis or

image enhancement, or a Master's degree and roughly half that amount of work experience.

Pet. 14; Ex. 1012 ¶ 32.

Patent Owner responds that Petitioner's definition "imparts arbitrary and excessive requirements" and instead asserts that a person of ordinary skill in the art would have had a Bachelor's degree education and nine months of work experience in the area of image analysis or image enhancement. PO Resp. 21–22. In support of its position, Patent Owner cites testimony of Petitioner's witness Dr. Forsyth, wherein Dr. Forsyth opines that he would have considered two of his graduate students to have been persons of ordinary skill at the time, despite each person having a Bachelor's degree and less than a year of professional experience. *Id.* at 21 (citing Ex. 2007, 135:2–18; 135:23–25; 136:6–7; 136:16–25; 149:7–13; 150:9–16).

Our Decision does not turn on the differences between the parties' assertions on the specific amount of work experience required, particularly because neither party asserts that its positions on the asserted grounds of unpatentability depend upon the level of skill. Given Dr. Forsyth's conflicting testimony on the precise amount of work experience, we see no compelling reason to apply the higher level of skill advocated by Petitioner. Accordingly, we adopt the formulation advocated by Patent Owner as more representative of the level of ordinary skill in the art at the time of the invention of the '941 patent. We further find the level of ordinary skill in the art is reflected by the prior art of record—namely, Sandrew, Katayama, Porter, and Burt 2. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001); *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995).

C. *Claim Construction*

We interpret claims of an unexpired patent using the broadest reasonable construction in light of the specification of the patent in which they appear. *See* 37 C.F.R. § 42.100(b); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016) (upholding the use of the broadest reasonable interpretation standard). Under the broadest reasonable interpretation standard, and absent any special definitions, claim terms are given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art, in the context of the entire disclosure. *In re Translogic Tech. Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). Any special definitions for claim terms or phrases must be set forth with reasonable clarity, deliberateness, and precision. *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994). In the absence of such a definition, limitations are not to be read from the specification into the claims. *See In re Van Geuns*, 988 F.2d 1181, 1184 (Fed. Cir. 1993).

In our Decision on Institution, we construed the claim term “mask” to mean “a data structure used to identify a group of picture elements to be acted upon.” Dec. on Inst. 7–8. We did not construe any additional terms. *Id.* at 8–9.

Patent Owner contends in its Response that we should abandon our preliminary construction of the term “mask” and, instead, construe that term to mean “an object mask, e.g., a data structure identifying a motion object with a scalar image that is zero everywhere where no object is present, and non-zero otherwise.” PO Resp. 24. Relying on this proposed construction, Patent Owner contends that the claim limitation “associate a first mask with a motion object,” recited in independent claim 1, means “associate a first

object mask with a motion object, wherein the object mask is 0 everywhere where no object is present, and non-zero otherwise.” *Id.* at 28. Similarly, Patent Owner contends that the claim limitation “reshape said second mask to fit said motion object” means “changing the shape or position of said second object mask, wherein the object mask is 0 everywhere where no object is present, and non-zero otherwise.” *Id.* at 28–29.

Petitioner asks that we maintain our preliminary construction of the term “mask” as set forth in our Decision on Institution. *See* Pet. Reply 3 (“Legend effectively stipulated to a claim construction, and it must be held to that stipulation.”).

We interpret claim terms to the extent necessary to resolve the controversy before us. *Homeland Housewares, LLC v. Whirlpool Corp.*, 865 F.3d 1372, 1373 (Fed. Cir. 2017) (citing *O2 Micro Int’l Ltd. v. Beyond Innovation Tech. Co.*, 521 F.3d 1351, 1360 (Fed. Cir. 2008)) (holding that the Board must resolve the parties’ disputes regarding the proper scope of claims). Accordingly, we construe below the term “mask” in order to resolve the parties’ dispute regarding the scope of that term. We further determine that construction of additional terms is not necessary for our analysis and, therefore, do not construe any additional terms.

1. “mask”

Our construction of the claim term “mask,” as set forth in our Decision on Institution, is based upon the intrinsic and extrinsic evidence. Turning first to the intrinsic evidence, the Specification discloses, as cited by Petitioner, that a “mask accurately conforms to the correct spatial location and two dimensional geometry of [a region of interest].” Pet. 14 (quoting Ex. 1001, 35:60–63). The Specification also discloses using masks for

conversion of images from two-dimensional images to three-dimensional images. *Id.* (citing Ex. 1001, 1:65–66); *see also* Ex. 1001, 6:48–52. The Specification further describes “adding color and/or depth to images using masks for regions in the images.” *Id.* (quoting Ex. 1001, 1:39–40).

Although extrinsic evidence “is generally of less significance than the intrinsic record” in matters of claim construction, here certain extrinsic evidence cited by the parties further supports our preliminary construction. *Wi-LAN, Inc. v. Apple Inc.*, 811 F.3d 455, 462 (Fed. Cir. 2016) (citation omitted). Significantly, the named inventor of the Sandrew reference, Barry B. Sandrew, is also the first named inventor of the ’941 patent. *Compare* Ex. 1001, at [72], *with* Ex. 1003, at [75]. An applicant is entitled to be his own lexicographer and clearly set forth a definition of a term that is different from its ordinary and customary meaning. *See In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994) (holding that an inventor may define specific terms used to describe invention, but must do so “with reasonable clarity, deliberateness, and precision”) (quoting *Intellicall, Inc. v. Phonometrics, Inc.*, 952 F.2d 1384, 1387–88 (Fed. Cir. 1992)). Relying on the ’941 patent’s shared inventorship with Sandrew and the ’941 patent’s specific discussion of Sandrew’s masking technique (Ex. 1001, 1:66–2:31), we observe that Sandrew includes a Glossary of Terms setting forth a specific definition of the term “mask,” which further informs our construction of that term as recited in the ’941 patent. Ex. 1003, 12:20–54 (defining a “mask” as “a data structure used to identify a group of picture elements to be acted upon”).⁷ Additionally, Petitioner proffered the

⁷ Patent Owner similarly relied on Sandrew’s definition of “mask” in its Glossary of Terms when advocating for its proposed construction in the

testimony of its witness Dr. Forsyth in support of the construction we adopted in our Decision on Institution. Pet. 14 (citing Ex. 1012 ¶ 52). Although Patent Owner contends that Sandrew's Glossary of Terms "would have little bearing on how a [person of ordinary skill in the art], as of the Critical Date, would understand the word 'mask,'" Patent Owner does not offer a witness to rebut the testimony of Dr. Forsyth. PO Resp. 23.

Our construction of the term "mask," thus, is supported by the foregoing intrinsic and substantial extrinsic evidence. In light of this evidence, we decline Patent Owner's request that we abandon our preliminary construction and interpret the term "mask" to mean "an object mask, e.g., a data structure identifying a motion object with a scalar image that is zero everywhere where no object is present, and non-zero otherwise." PO Resp. 24. More specifically, we disagree with Patent Owner's new construction theory for at least the following three reasons.

First, Patent Owner's newly proposed construction creates redundancy in the independent claims. Patent Owner would have us limit the claimed "mask" to "an object mask" because, according to Patent Owner, "the mask recited by the challenged claims is an object mask." PO Resp. 26. If we were to apply Patent Owner's construction claim 1, the claim would recite redundantly: "a first [object] mask with a motion object." We see no reason to introduce such circularity into the claim language.

Second, Patent Owner's newly proposed construction improperly narrows the scope of at least dependent claim 17. Applying Patent Owner's

Preliminary Response. Prelim. Resp. 28–29 (citing Ex. 1003, 12:20–54). When arguing for a new construction during trial, Patent Owner now seeks to distance itself from its earlier reliance on Sandrew. PO Resp. 24–25.

construction, dependent claim 17 would recite: “import a first alpha [object] mask.” Patent Owner does not address in its Response the impact of this change to the scope of claim 17. *See generally* PO Resp. 28–29. When questioned on the impact of its proposed construction to claim 17—which is challenged in this proceeding—counsel for Patent Owner stated that “presumably” both object masks and background masks are types of alpha masks. Tr. 49:19–50:7. Thus, according to Patent Owner, construing the term “mask” as Patent Owner proposes would narrow the scope of the alpha mask recited in claim 17 to exclude alpha background masks—a narrowing for which Patent Owner fails to advocate and we decline to undertake.

Third, the majority of Patent Owner’s proposed construction recites an example adapted from a statement contained within a proffered doctoral thesis: “e.g., a data structure identifying a motion object with a scalar image that is zero everywhere where no object is present, and non-zero otherwise.” PO Resp. 24, 27 (citing Ex. 2008, 17 (“an object mask M (scalar image that is 0 everywhere where no object is present, and (0, 1] otherwise.”))). This document bears a copyright stamp of 2015. Ex. 2008, 1. The single use of term “object mask” in Exhibit 2008 to which Patent Owner cites does not address the ’941 patent specifically. *See id.* at 17. Moreover, this document is not contemporaneous with the ’941 patent in that it bears a copyright date fourteen years after the priority date of the ’941 patent. *See id.* at 1. We are not persuaded on the evidentiary record before us that this example of a mask in Exhibit 2008 indicates how an ordinarily skilled artisan at the time would have understood the ’941 patent’s claimed “mask.” On balance, Patent Owner’s attenuated extrinsic evidence of a doctoral thesis (Ex. 2008) does not overcome the intrinsic evidence and the closely-related, substantial

extrinsic evidence in Sandrew as set forth above. *See Wi-LAN, Inc.*, 811 F.3d at 462 (extrinsic evidence “is generally of less significance than the intrinsic record.”).

Accordingly, we maintain our preliminary construction of the claim term “mask,” set forth in our Decision on Institution, as meaning “a data structure used to identify a group of picture elements to be acted upon.” Dec. on Inst. 7–8.

2. *“associate a first mask with a motion object” and “reshape said second mask to fit said motion object”*

Patent Owner contends that we should incorporate its proposed construction of “mask” discussed above into the following limitations of independent claim 1: “associate a first mask with a motion object” and “reshape said second mask to fit said motion object.” PO Resp. 28–29. Having declined to adopt Patent Owner’s proposed construction above, we similarly decline to adopt Patent Owner’s proposed constructions of these limitations. *See supra* Section III.C.1. Patent Owner further contends that we construe the constituent term “reshape” to mean “changing the shape or position of.” PO Resp. 28–29. Patent Owner, however, offers no argument or evidence in support of its construction. *Id.* Accordingly, we do not construe “reshape” as Patent Owner proposes, and instead apply the ordinary and customary meaning of that term—namely, “to change the shape of.”

D. *Anticipation of claims 1, 3, 5, 16, and 19 by Sandrew*

1. *Sandrew*

Sandrew is directed to a system and method for color enhancing an image or a series of images. Ex. 1003, 2:51–53. Figure 1 of Sandrew is reproduced below.

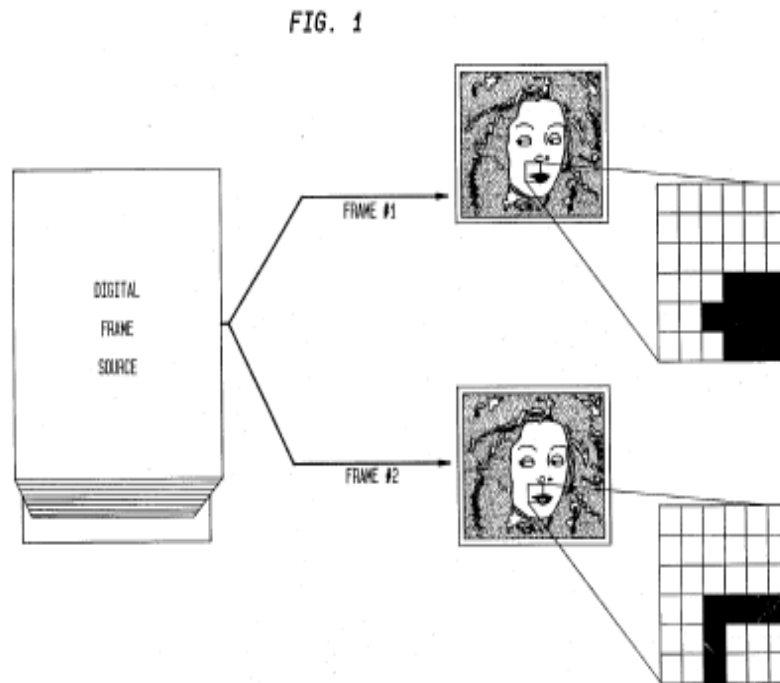


Figure 1 depicts, in schematic form, the creation of two adjacent frames of graphic information, namely Frames 1 and 2. *Id.* at 2:66–67. Sandrew describes selecting, for each scene, a frame that is “representative of the majority of the elements present in the sequence. This ‘key frame’ is used as a template for the enhancement of other frames within the scene sequence.” *Id.* at 3:53–57. “The first task of the key frame colorist is to identify areas of the image which comprise objects which will be designated to be of similar hue.” *Id.* at 4:3–5. Sandrew describes these areas as a “color mask.” *Id.* at 4:38–47.

Figure 2 of Sandrew is reproduced below.

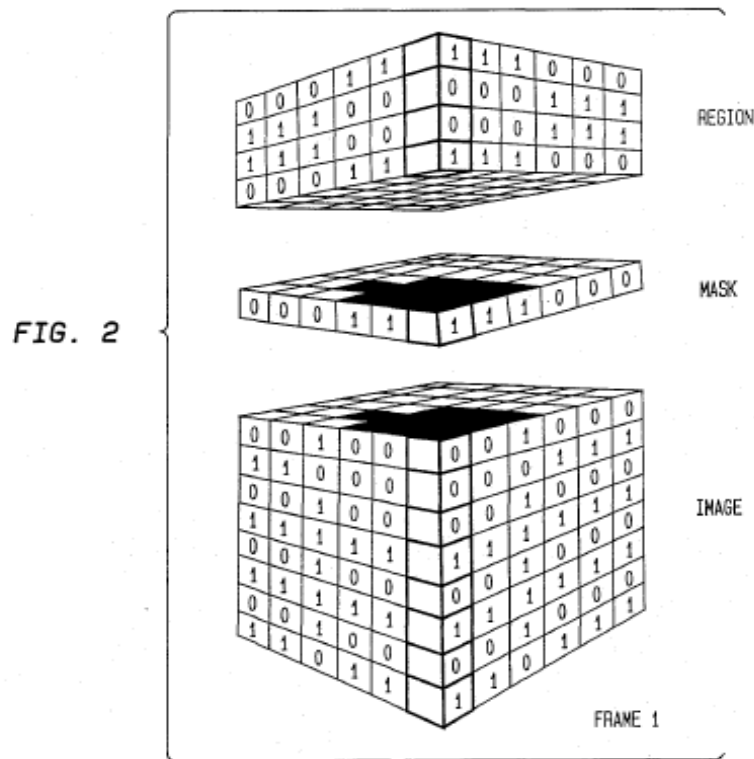


Figure 2 represents of a portion of the image memory structure, wherein a series of digitized monochrome images may be stored in a random access memory of a computer as an array of gray-scale values. *Id.* at 3:1–2; 6:60–63. In the example of Figure 2, “8 bits of information may be used to represent each picture element, thus permitting a total of 256 unique gray-scale values to be represented.” *Id.* at 6:64–66. Sandrew’s region memory is used to identify uniquely each picture element with one of a number of regions, which are depicted as a four bit memory structure in Figure 2. *Id.* at 7:5–8. Finally, Figure 2 also shows a mask plan memory used to identify picture elements. *Id.* at 7:9–11. “After a color mask has been defined, its associated picture elements are identified as a ‘region’, the mask plane is cleared, and additional masks are defined in a similar manner, one for each

hue which will be displayed in the frame.” *Id.* at 4:47–51. “Once all regions are defined, the regions, the underlying frame, and the colors assigned to each region are stored for later retrieval.” *Id.* at 4:52–54.

Figure 3 of Sandrew is reproduced below.

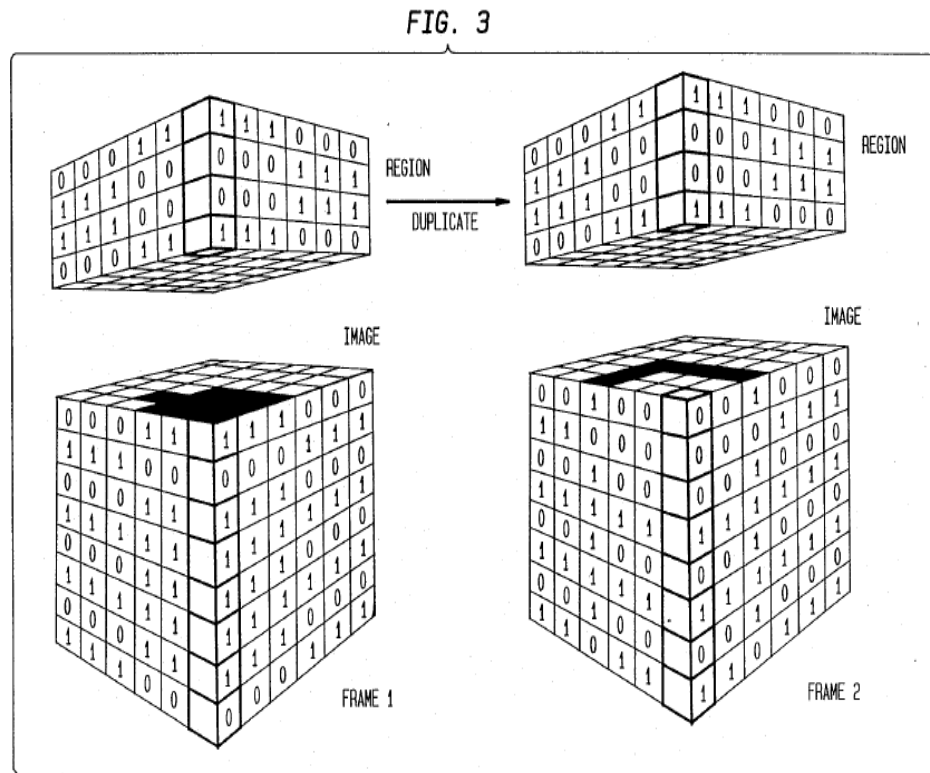


Figure 3 of Sandrew shows replicating a region from Frame 1 to Frame 2 using conventional memory techniques. *Id.* at 3:4–6, 7:11–17. According to Sandrew, “[i]mplicit in all frame-to-frame tracking is the ability to copy predefined parts of the preceding or key frame’s region memory contents and to use those parts in subsequent frame processing.” *Id.* 5:1–4.

Figure 4 of Sandrew is reproduced below.

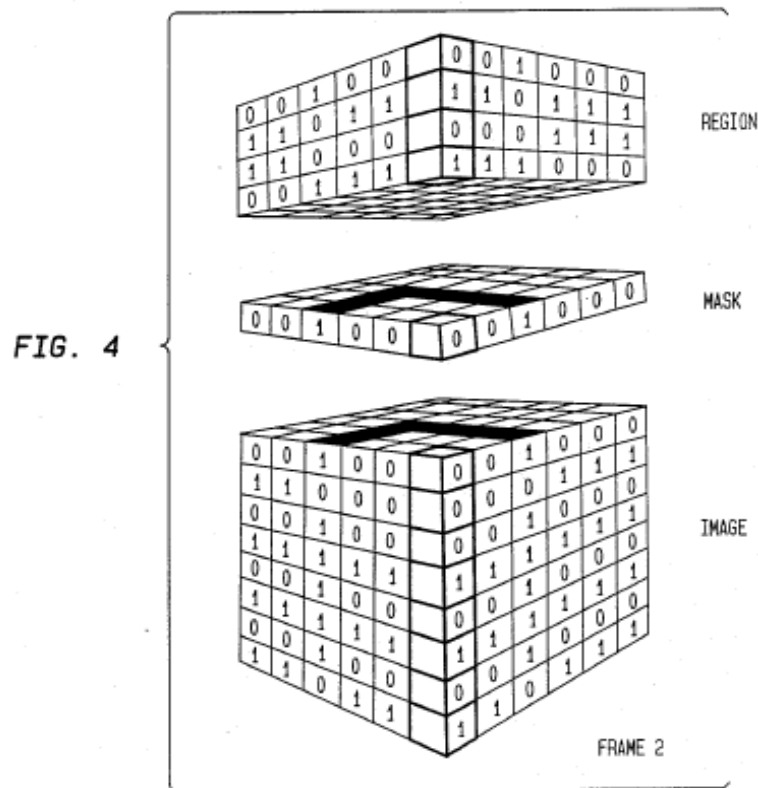


Figure 4 of Sandrew “depicts the correction of a value stored in the replicated region memory portion of [Figure] 3.” *Id.* 3:7–8. Sandrew discloses that “[t]he process of extrapolating color enhancement from key frames to entire scenes is performed by identifying and tracking motion as well as appearances and disappearances of objects.” *Id.* at 4:57–60. “Once motion has been identified, adjustment of the regions and application of the key frames’ predefined colors to those regions is all that is required.” *Id.* at 4:65–68. More specifically, after the copying shown in Figure 3, small adjustments are made to the new region memory contents and are saved with the new frame. *Id.* at 5:4–6. These adjustments can be made using various techniques, including application of an “algorithm for edge detection in gray-scale images” that correlates the previous frame’s region memory,

detects differences, and then causes “the subsequent frame’s regions to be adjusted or deleted, as required.” *Id.* at 5:39–43.

2. *Claim 1*

Petitioner asserts that Sandrew anticipates independent claim 1 in the following manner. Sandrew describes a computer having a memory and a program stored in said memory configured to perform certain steps for enhancing an image or a series of image frames (i.e., “A system configured to modify a set of time ordered digital images comprising a computer having memory and a program stored in said memory that is configured to:”). Pet. 15–16 (citing Ex. 1003, 5:3–4, 6:16–20; Ex. 1012 ¶¶ 53–55). With regard to the claimed “associate a first mask with a motion object in a first image at a first mask location,” Petitioner contends that Sandrew explicitly defines its “regions” as a type of “masks.” *Id.* at 15–16 (citing Ex. 1003, 5:3–4,⁸ 6:16–20; Ex. 1012 ¶¶ 53–55). These regions, and more broadly masks, can be associated with motion objects. Ex. 1003, 7:5–7 (describing how Sandrew’s region memory is used to identify uniquely each picture element with one of a number of regions). Sandrew further describes “the ability to copy predefined parts of the preceding or key frame’s region memory contents and to use those parts in subsequent frame processing” (i.e., “copy said first mask to create a second mask associated with a second image”). Pet. 18 (quoting Ex. 1003, 5:1–4). Thus, according to Petitioner and Dr. Forsyth, “[t]he ‘second mask’ is simply the mask that results from copying the first mask from the first frame into the second image.” *Id.* (citing Ex. 1012 ¶ 12). Petitioner cites Sandrew’s disclosure that, when

⁸ Petitioner cites erroneously to column 55 of Exhibit 1003, but upon review, we understand this citation to be directed to column 5.

“some of the objects of a frame move, a corresponding portion of the region memory may be translated as well” as describing the claimed “move said second mask to a second mask location associated with said motion object in said second image.” *Id.* at 19 (quoting Ex. 1003, 5:21–23). Finally, Petitioner identifies Sandrew’s descriptions that “copied contents may, of course, be altered by the operator to conform to the underlying frame contents,” and that “[a]fter copying, small adjustments may be made to the new region memory contents” because “[o]nce motion has been identified, adjustment of the regions” is necessary (i.e., “reshape said second mask to fit said motion object in said second image based on underlying image data in said second image”). *Id.* at 20 (quoting Ex. 1003, 4:65–66, 5:4–5, 7:17–19).

In response, Patent Owner contends that “Petitioner anchors its entire argument to an underlying but false assumption that the terms ‘region’ and ‘mask’ can be interchanged in the claims of the ‘941 Patent and the related art.” PO Resp. 29–30. Patent Owner elaborates, “the term region, as used in [Sandrew], and mask, as recited in the challenged claims, have different meanings” because Sandrew’s regions do not meet Patent Owner’s proffered construction of the claim term “mask.” *Id.* at 30–32.

Applying our construction of the term “mask,” Patent Owner argues that Sandrew’s mask “still has a different meaning than region as used in [Sandrew].” *Id.* at 32. Patent Owner contends that, in Sandrew, “it is clear that mask and region are referred [to as] distinct objects.” *Id.* at 34. Patent Owner notes that, although Sandrew’s “mask itself is deleted during the colorization process, the region memory stores information identifying the color assigned to each pixel based on the pixel’s association with the

region.” *Id.* at 35. According to Patent Owner, interchanging the words region and mask in Sandrew leads to “nonsensical results.” *Id.* at 35–38.

With regard to specific limitations of claim 1, Patent Owner contends that “in the ‘941 Patent, a moving object mask is associated to a moving object which could contain different colors”—a “situation that is not covered by [Sandrew].” *Id.* at 40. Patent Owner asserts that “the underlying process for copying the region memory, as described in [Sandrew], is different from the process of copying a motion object mask from one frame to the next.” *Id.* at 41. According to Patent Owner, Sandrew does not meet the ‘941 patent’s teaching that, “if a mask is moved from one location to a new location, any underlying mask that was previously defined is not affected.” *Id.* at 42. Finally, Patent Owner contends that Sandrew’s “‘adjusting’ or ‘altering’ region memory contents to conform to underlying frame contents does necessarily equate to ‘reshaping’” because “adjusting or altering could mean changing color values to match the overall lighting or shading in a new frame.” *Id.* at 43. Although Sandrew “does not preclude the possibility that the altering or adjusting of the region memory may include reshaping the region to fit a motion object,” Sandrew “does not teach that altering or adjusting means reshaping.” *Id.* at 43–44.

Having considered the complete trial record, we agree with Petitioner that Sandrew discloses all the limitations of claim 1, as set forth above. In particular, we agree with Petitioner that Sandrew’s regions constitute the “masks” recited in claim 1 based on the factual findings set forth above, which we adopt as our own. *See* Pet. 15–20. With regard to Patent Owner’s arguments, we do not agree with its arguments (PO Resp. 29–32) because they are predicated upon a construction of the claim term “mask”

incommensurate with our construction of that term as set forth in our Decision on Institution and maintained herein. *See supra* Section III.C.1. We also do not agree with Patent Owner’s arguments regarding whether Sandrew’s regions are of commensurate scope with Sandrew’s masks (PO Resp. 32–38) because these arguments are not directed to the relevant inquiry—namely, whether Sandrew’s regions anticipate the masks *claimed in the ’941 patent*, not in Sandrew.

We do not agree with Patent Owner’s other arguments purportedly related to claim 1 (*id.* at 39–44) because these arguments are not commensurate with the claim scope. For instance, claim 1 is not limited to masks for objects of multiple or changing colors, contrary to Patent Owner’s argument. *See id.* at 40. And even if claim 1 were so limited, Petitioner identifies, and we agree, that Sandrew discloses the use of multiple colors within a single object or region. Pet. Reply 14 (citing Ex. 1003, 11:11–19, 11:31). Similarly, whether the “underlying process for copying the region memory, as described in [Sandrew], is different from the process of copying a motion object mask from one frame to the next,” as Patent Owner contends, is immaterial to the scope of claim 1. *See* PO Resp. 41. Claim 1 does not recite that, “if a mask is moved from one location to a new location, any underlying mask that was previously defined is not affected,” and, therefore, this argument is misplaced. *See id.* at 42. Finally, we do not agree that Sandrew’s adjusting and altering of regions fails to describe the claimed reshaping of masks. *Id.* at 43–44. Whether “adjusting or altering *could* mean changing color values” (*id.*, emphasis added) is immaterial because Sandrew explicitly discloses altering the shape of regions. Ex. 1003, 5:39–43 (describing adjustments to motion objects can be made

using various techniques, including application of an “algorithm for edge detection in gray-scale images” that correlates the previous frame’s region memory, detects differences, and then causes “the subsequent frame’s regions to be adjusted or deleted, as required”).

Accordingly, we determine Petitioner has shown by a preponderance of the evidence that claim 1 of the ’941 patent is anticipated by the Sandrew.

We turn next to Petitioner’s assertions regarding dependent claims 3, 5, 16 and 19. Patent Owner does not set forth arguments for these claims beyond those discussed above in the context of claim 1. PO Resp. 45.

3. *Claim 3*

Claim 3 depends from claim 1 and further recites: “move said second mask based on said underlying image data in said second image.” Ex. 1001, 63:34–35. Petitioner and Dr. Forsyth assert, and we agree, that Sandrew meets the additional limitation of claim 3 by disclosing translating corresponding portions of a region in a subsequent frame (i.e., the claimed second mask) “when only some of the objects of a [preceding] frame move.” Pet. 21 (quoting Ex. 1003, 5:12–23) (citing Ex. 1012 ¶ 66). Accordingly, we determine Petitioner has shown by a preponderance of the evidence that Sandrew anticipates claim 3 of the ’941 patent.

4. *Claim 5*

Claim 5 depends from claim 1 and further recites: “track underlying image data in said second image that is contained within said first mask in said first image to adjust said second mask shape in said second image.” Ex. 1001, 63:44–46. Petitioner and Dr. Forsyth assert, and we agree, that Sandrew meets the additional limitation of claim 5 by describing frame-to-frame tracking, correlating creation of the second mask to the previous

frame's region memory, comparing frames to determine the differences in object locations, and adjusting subsequent frames' regions based on detected differences. Pet. 22–23 (citing Ex. 1003, 4:57–59, 5:1, 5:40–43, 14:25–33; Ex. 1012 ¶¶ 67–70). Accordingly, we determine Petitioner has shown by a preponderance of the evidence that Sandrew anticipates claim 5 of the '941 patent.

5. *Claim 16*

Claim 16 depends from claim 1 and further recites: “accept user input to manually adjust said second mask.” Ex. 1001, 64:39. Petitioner and Dr. Forsyth assert, and we agree, that Sandrew meets the additional limitation of claim 16 by disclosing: “that portion of the region memory which is to be moved [in the second frame] is designated by the operator and is moved manually to its new location.” Pet. 24 (quoting Ex. 1003, 5:23–25) (citing Ex. 1003, 5:46–49; Ex. 1012 ¶ 71). Accordingly, we determine Petitioner has shown by a preponderance of the evidence that Sandrew anticipates claim 16 of the '941 patent.

6. *Claim 19*

Claim 19 depends from claim 1 and further recites: “underling [sic] image data is a feature or image feature or image characteristic associated with one or more pixels.” Ex. 1001, 64:52–54. Petitioner and Dr. Forsyth assert, and we agree, that Sandrew meets the additional limitation of claim 19 by disclosing that “the smallest region [i.e., mask] which may be produced is also one pixel.” Pet. 25 (quoting Ex. 1003, 4:17–18) (citing Ex. 1003, 15:12–13; Ex. 1012 ¶¶ 72–73). Accordingly, we determine Petitioner has shown by a preponderance of the evidence that Sandrew anticipates claim 19 of the '941 patent.

E. Obviousness of claims 1, 3, 5, 16, and 19 by Sandrew

In its obviousness challenge, Petitioner relies upon Sandrew as teaching or suggesting the limitations of claims 1, 3, 5, 16, and 19. *See* Pet. 15–26; *see also* Paper 33, 4 (granting Petitioner’s request for rehearing and instituting on ground of obviousness over Sandrew alone). Patent Owner does not address this ground separately from the corresponding anticipation challenge. *See generally* PO Resp. 29–45. Patent Owner does, however, assert in a footnote that “Petitioner failed to identify this particular ground for relief as required by 37 C.F.R. § 42.104, and requests that the ground be denied in its entirety on that basis.” *Id.* at 29, n.2. We previously determined in our Decision granting Petitioner’s Request for Rehearing that Petitioner did identify this ground for relief in the Petition. Paper 33, 3. Accordingly, we decline Patent Owner’s request.

Having reviewed the complete trial record, and based on the findings of facts and reasons set forth above, we determine that Petitioner has shown by a preponderance of the evidence that Sandrew renders obvious claims 1, 3, 5, 9, and 16 of the ’941 patent. *See supra* Section III.D; *see also In re McDaniel*, 293 F.3d 1379, 1385 (Fed. Cir. 2002) (“It is well settled that ‘anticipation is the epitome of obviousness.’”) (citations omitted).

F. Obviousness of claim 2 over Sandrew and Katayama

Claim 2 depends from claim 1 and further recites:

accept user input of at least one threshold associated with said underlying image data;
create said first mask based on said at least one threshold associated with said underlying image data at said first mask location;

wherein said associate said first mask with said motion object comprises storing said first mask in memory.

Ex. 1001, 63:25–31.

1. *Katayama*

Katayama discloses extracting a subject from an input image by identifying a region in the image that includes the subject. Ex. 1004, Abstract. Katayama teaches performing this extraction by creating and contouring a “subject region mask.” *Id.* The subject region mask can be contoured using threshold values for parameters including brightness level and hue. *Id.* at 7:37–49.

2. *Claim 2*

Petitioner asserts dependent claim 2 would have been obvious in light of Sandrew and Katayama. Pet. 37–41. Petitioner relies on Sandrew as teaching or suggesting the limitations of claim 1 incorporated into claim 2. *Id.* at 37. Petitioner further relies on Katayama as teaching or suggesting the claimed acceptance of user input and threshold recited in claim 2. *Id.* Specifically, Petitioner contends, “[i]n order to make the determination of whether a pixel is sufficiently similar such that the computer would consider a pixel part of the object to be masked or part of the background, Katayama requires a user input for a threshold.” *Id.* (citing Ex. 1004, 7:36–37 (“As the parameters for similarity determination, brightness level and hue threshold values I_{th} and H_{th} are input.”)). Petitioner further contends Katayama meets the claimed creation of a first mask by teaching that the initial mask extraction is based, in part, on setting a threshold value and by teaching incorporating pixels of interest into regions based on threshold values I_{th} and H_{th} . *Id.* at 38 (citing Ex. 1004, 7:44–49, Fig. 3). Petitioner also identifies in

Katayama a teaching of storing regions for later retrieval. *Id.* at 39–40 (citing Ex. 1004, 4:52–55).

Petitioner further asserts one of ordinary skill in the art would have had a sufficient reason to combine or modify the teachings of the cited references. *Id.* at 40–41. Relying on Dr. Forsyth, Petitioner asserts that strong market forces would have driven the combination of Sandrew and Katayama because “Sandrew begs to be further automated since adding visual effects to movies that contain hundreds of thousands of frames could be overwhelmingly laborious.” *Id.* at 40 (citing Ex. 1012 ¶ 97). Katayama recognizes that “[i]t is, in fact, very hard to smoothly draw a complicated shape or linear shape using a mouse of the like.” *Id.* (quoting Ex. 1004, 1:37–39). Thus, Petitioner contends one of ordinary skill in the art would have been motivated to combine the teachings of Sandrew and Katayama “in order to improve results by using computers to reduce human error.” *Id.* at 40–41 (citing *KSR*, 550 U.S. at 417).

Patent Owner does not challenge Petitioner’s analysis of Katayama, and, instead, asserts only that “neither the Petitioner nor its expert explain or provide evidence of those ‘strong market forces.’” PO Resp. 46.

Having reviewed the complete trial record, we agree with and adopt as our own Petitioner’s analysis of Sandrew and Katayama as teaching or suggesting the limitations of claim 2. Contrary to Patent Owner’s argument, Petitioner identifies in Dr. Forsyth’s testimony a rationale for the cited combination in order to reduce manual labor and human error in creating masks. Pet. 40–41. Dr. Forsyth elaborates on the commercially desirable, economic benefits constituting strong market forces, including costs saving from reduced artist salaries and competitive advantages related to increased

processing ability. Pet. Reply 18–20 (citing Ex. 2007, 218:21–220:3). Accordingly, we determine Petitioner has shown by preponderant evidence that Sandrew and Katayama render obvious claim 2 of the '941 patent.

G. Obviousness of claim 17 over Sandrew and Porter

Claim 17 depends from claim 1 and further recites:

import a first alpha mask for a computer-generated element in said first image and import a second alpha mask for said second image and further reshape said first mask and reshape said second mask to fit a border of said alpha mask for said computer-generated element.

Ex. 1001, 64:42–46.

1. Porter

Porter discloses methods for combining elements of computer graphics image, where the components have been separately rendered. Ex. 1009, 253.⁹ Porter describes a number of binary compositing operations that can be applied to elements when combining them. *Id.* at 255.

2. Claim 17

Petitioner asserts dependent claim 17 would have been obvious in light of Sandrew and Porter. Pet. 59–64. Petitioner relies on Sandrew as teaching or suggesting the limitations of claim 1 incorporated into claim 17. *Id.* at 63. Petitioner further relies on Porter as teaching or suggesting the claimed importing of alpha masks and reshaping of elements. *Id.* at 59–63. In particular, Petitioner observes that “Porter teaches, for example, the operation ‘A out B’ which crops the mask associated with object A to

⁹ All references to the page numbers in Porter are to the page numbers usually located in the bottom, right-hand corner or bottom, left-hand corner of each page in Exhibit 1009.

account for the mask associated with object B.” *Id.* at 60–62 (citing Ex. 1009, 254, 256–57).

Petitioner further asserts one of ordinary skill in the art would have had a sufficient reason to combine or modify the teachings of the cited references. *Id.* at 63–64. Relying on Dr. Forsyth, Petitioner asserts that strong market forces would have driven the combination of Sandrew and Porter because “not leveraging the foundational toolkit described by Porter could literally preclude incorporating any outside elements into a scene.” *Id.* (citing Ex. 1012 ¶ 134). Petitioner elaborates that Porter teaches: “Separating the image into elements which can be independently rendered saves enormous time. Each element has an associated matte, [i.e.] coverage information which designates the shape of the element [analogous to Sandrew’s regions]. The compositing of those elements makes use of the mattes to accumulate the final image.” Pet. Reply 22 (emphasis omitted) (citing Ex. 1009, 1).

Patent Owner does not challenge Petitioner’s analysis of Porter, and, instead, asserts only that “neither the Petitioner nor its expert explain or provide evidence of those ‘strong market forces.’” PO Resp. 47.

Having reviewed the complete trial record, we agree with and adopt as our own Petitioner’s analysis of Sandrew and Porter as teaching or suggesting the limitations of claim 17. We do not agree with Patent Owner’s argument in light of the teachings of Porter cited by Petitioner that compositing image elements that have been separated independently saves “enormous time.” Pet. Reply 22 (citing Ex. 1009, 1). Rather, we agree with Petitioner that one of ordinary skill in the art would have understood this time saving to be commercially desirable. *Id.* (“Thus, since Sandrew already

outlines objects and creates masks for the purposes of adding color, the final image can be rendered much more quickly by leveraging Porter's techniques to composite those masks."'). Accordingly, we determine Petitioner has shown by a preponderance of the evidence that Sandrew and Porter render obvious claim 17 of the '941 patent.

H. Obviousness of Claim 18 based on Sandrew in view of Burt 2

Claim 18 depends from claim 1 and further recites:

calculate amount of disk space that may be utilized to archive a movie conversion project and signify at least one asset that may be rebuilt from other assets to avoid archival of said at least one asset.

Ex. 1001, 64:48–51.

1. Burt 2

Burt 2 discloses a system for automatically generating a mosaic from a plurality of input images. Ex. 1010, Abstract. Burt 2 describes allowing a user to “easily view the mosaics and extract any individual frame within the mosaic.” *Id.* at 15:26–29. Burt 2 further discloses dividing a mosaic into subparts, called tiles:

By tiling, the display mosaic can be efficiently stored in a display mosaic buffer 705 as a series of sub-mosaics. These sub-mosaics can be recalled from memory, as needed, and combined with other sub-mosaics or input images to recreate any previously displayed mosaic.

Id. at 13:23–29 (bolding omitted).

2. Claim 18

Petitioner asserts dependent claim 18 would have been obvious in light of Sandrew and Burt 2. Pet. 64–68. Petitioner relies on Sandrew as teaching or suggesting the limitations of claim 1 incorporated into claim 18

and relies on Burt 2 as teaching the additional limitations of claim 18. *See id.* at 67. Relying on Dr. Forsyth, Petitioner asserts:

The system of Burt 2 therefore signifies at least one asset (e.g., a particular image frame) that can be rebuilt (i.e., “recovered”) from other assets (e.g., a mosaic) to avoid archival of said at least one asset. . . . Of course, the computer system disclosed by Burt 2 is configured to calculate the amount of disk space that would be used to archive files (such as a movie conversion project) because that is how the system recognizes how much space it needs and how much space it saves through its “efficient” compression process.

Pet. 66 (emphasis omitted) (citing Ex. 1010, 13:24–37, 14:39–50, 15:4–24, 16:65–17:40; Ex. 1012 ¶ 138).

Petitioner further asserts one of ordinary skill in the art would have had a sufficient reason to combine the teachings of the cited references. *Id.* at 67–68. In particular, Petitioner contends that Burt 2 describes its practical use in “publishing applications and image retouching systems,” thereby suggesting its combination with the industrial colorization systems of Sandrew. *Id.* at 67 (quoting Ex. 1010, 1:49–50) (citing Ex. 1012 ¶ 139). Dr. Forsyth and Petitioner further state that, “the problem of storage space is unavoidable” because Sandrew describes converting movies filmed at “24 frames per second”—potentially storing hundreds of thousands of image frames—and thus prompting one of ordinary skill to integrate a compression system such as that disclosed by Burt 2. *Id.* at 67–68 (quoting Ex. 1003, 4:63) (citing Ex. 1012 ¶ 139).

Patent Owner does not challenge Petitioner’s analysis of Burt 2, and, instead, asserts only that “neither the Petitioner nor its expert explain or provide any substantive evidence of a motivation to combine.” PO Resp. 48.

Having reviewed the complete trial record, we agree with and adopt as our own Petitioner's analysis of Sandrew and Burt 2 as meeting the limitations of claim 18. We do not agree with Patent Owner's argument in light of the teachings of Sandrew and testimony of Dr. Forsyth cited by Petitioner that Sandrew's conversion of movies filmed at 24 frames per second would lead one of ordinary skill to integrate a comprehension system, such as that disclosed by Burt 2. Pet. 67–68 (citing Ex. 1003, 4:63; Ex. 1012 ¶ 139). Accordingly, we determine Petitioner has shown by a preponderance of the evidence that Sandrew and Burt 2 render obvious claim 18 of the '941 patent.

IV. MOTION TO EXCLUDE

Petitioner moves to exclude Patent Owner's Exhibit 2008, which purports to be a doctoral thesis, on the basis that it is (1) unauthenticated under Federal Rule of Evidence 901 and (2) constitutes hearsay not subject to the exceptions of Federal Rules of Evidence 803, 804, or 807. Paper 40, 1–6. We dismiss as moot Petitioner's motion to exclude Exhibit 2008 because even without excluding this exhibit, Petitioner has shown by a preponderance of the evidence that claims 1–3, 5, and 16–19 of the '941 patent are unpatentable. *See supra* Section III.C.1.

Petitioner further moves to exclude portions of the deposition transcript of its witness Dr. Forsyth (i.e., Ex. 2007, 125:19–126:5, 226:19–25) on the basis that the questions asked by Patent Owner's counsel were vague, ambiguous, and lacked foundation. Paper 40, 7–10. Petitioner fails to cite to any rule or authority in support of its argument that we should exclude its own witness's testimony on topics about which the witness

opined in his declaration. *See id.* Accordingly, we deny Petitioner's motion to exclude Exhibit 2007.

V. SUMMARY

Petitioner has shown by a preponderance of the evidence that:

Claims 1, 3, 5, 16, and 19 are unpatentable under 35 U.S.C. §§ 102(b) and 103(a) over Sandrew;

Claim 2 is unpatentable under 35 U.S.C. § 103(a) over Sandrew and Katayama;

Claim 17 is unpatentable under 35 U.S.C. § 103(a) over Sandrew and Porter; and

Claim 18 is unpatentable under 35 U.S.C. § 103(a) over Sandrew and Burt 2.

VI. ORDER

It is, therefore,

ORDERED that claims 1–3, 5, and 16–19 of the '941 patent are unpatentable;

FURTHER ORDERED that Patent Owner's Motion to Exclude is *dismissed-in-part* as moot and *denied-in-part*; 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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Patent 9,286,941 B2

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