UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

GOOGLE LLC,

Petitioner,

v.

138 EAST LCD ADVANCEMENTS LIMITED,

Patent Owner.

Case No. IPR2024-00958
U.S. Patent No. 8,482,638

REPLY DECLARATION OF ROBERT STEVENSON, PH.D.

GOOGLE EXHIBIT 1022
GOOGLE v. 138 EAST
IPR2024-00958

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1. [7Preamble] "A digital camera having a focusing function and a focal length varying function of a main lens, the digital camera comprising:" 23

2. [7a] "a main imaging unit configured to generate a main image by performing a photoelectric conversion from a subject obtained via the main lens;" 25

3. [7b] "a sub-imaging unit configured to generate a sub-image by performing a photoelectric conversion from the subject obtained via a sub-lens;" 26

4. [7c] "a focal length acquiring unit configured to acquire the focal length of the main lens;" 28

5. [7d] "a magnification setting unit configured to set a level of magnification on the basis of the focal length;" 30

6. [7e] [7e(i)] "a composite image generating unit configured to [1] determine a cutout region in the sub-image, [2] cut out a partial image from the cutout region, [3] magnify at the level of magnification at least one of the main image and the sub-image, and [4] generate a composite image by superimposing the partial image on the main image, [7e(ii)] wherein the generation of the composite image occurs after at least one of the main image and the sub-image is magnified at the level of magnification;" 37

   a. Motivation to Combine Parulski and Safonov 40

   b. Expected Success in Combining Parulski and Safonov 43

7. [7f] "an image display unit configured to display the composite image; and" 44

   a. Motivation to Modify Parulski 46

   b. Expectation of Success 48

8. [7g] "wherein the magnification setting unit is configured to set the level of the magnification in order to match substantially a size of the main image and a size of the sub-image." 50

B. [Claim 8] "The digital camera according to claim 7, wherein the sub-lens is a pan-focus lens." 51

1. Motivation to Modify Parulski 52

2. Expectation of Success 54

C. Claim 10 56

1. [10Preamble] "The digital camera according to claim 7, further comprising" 56

2. [10i] "[a] focusing amount acquiring unit configured to acquire amount [sic] of the focusing, wherein" 56

a. Motivation to Modify Parulski 59

b. Expectation of Success 62

3. [10ii] "misalignment of the composite image decreases as the composite image is in focus with the subject on the basis of the amount and a predetermined cutout rule." 63

D. [Claim 11] "The digital camera according to claim 10, wherein the predetermined cutout rule is based on a principle of triangulation based on an interval between the main lens and the sub-lens, and distance from the digital camera to the subject on the basis of the amount." 67

E. [Claim 12] "The digital camera according to claim 7, wherein the main image of the object is captured from a different angle from the sub-image of the subject." 69

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A. Independent Claim 7 81

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I. Introduction

1. I have been retained by Google LLC ("Petitioner") as an independent expert consultant in this proceeding before the Patent Trial and Appeal Board of the United States Patent and Trademark Office.

2. I am over 21 years of age and, if I am called upon to do so, I would be competent to testify as to the matters set forth herein.

3. My compensation is in no way contingent on the nature of my findings, the presentation of my findings in testimony, or the outcome of any proceeding.

4. I understand that this proceeding involves U.S. Patent No. 8,482,638 ("the '638 patent," Ex. 1001). The application for the '638 patent was filed December 22, 2010. Ex. 1001, cover (item (22)). The '638 patent claims priority to Japanese Application No. 2009-295202, filed December 25, 2009. Ex. 1001, cover (item (30)).

5. I previously prepared a declaration in this proceeding, which I understand was filed as Exhibit 1003. I incorporate that declaration by reference.

6. I understand that Patent Owner, 138 East LCD Advancements Limited, has filed a Non-Contingent Motion to Amend, and proposes cancelling issued claims 1-6 in favor of substitute claims 7-12, respectively.

7. I have been asked by Petitioner to provide my opinion on whether substitute claims 7, 8, and 10-12 of the '638 patent would have been obvious to a person of ordinary skill in the art at the time of the earliest claimed priority date of the '638 patent. In performing this analysis, I have been asked to assume that the priority date is December 25, 2009. My opinions are set forth below.

8. I have been asked by Petitioner to provide my opinion on whether substitute claims 7, 8, and 10-12 of the '638 patent would have been obvious to a person of ordinary skill in the art at the time of the earliest claimed priority date of the '638 patent. In performing this analysis, I have been asked to assume that the priority date is December 25, 2009, which I also assumed in my prior declaration. My opinions are set forth below.

9. I have also been asked by Petitioner to provide my opinion on whether substitute claims 7, 8, and 10-12 of the '638 patent would have been obvious to a person of ordinary skill in the art at the time of the U.S. filing date of the '638 patent. In performing this analysis, I have been asked to assume that the priority date is December 22, 2010. My opinions are set forth below.

10. Throughout this declaration, I refer to specific pages, figures, and/or line numbers of various exhibits. These citations are illustrative and are not intended to suggest that they are the only support for the propositions for which they are cited.

II. Summary of Opinions

11. This declaration considers substitute claims 7, 8, and 10-12 of the '638 patent. Below, I set forth the opinions I have formed, the conclusions I have reached, and the bases for these opinions and conclusions. I believe the statements contained in this declaration to be true and correct to the best of my knowledge.

12. Based on my experience and knowledge of the art at the time of the earliest claimed filing dates, it is my opinion that substitute claims 7, 8, and 10-12 of the '638 patent would have been obvious based on the asserted grounds discussed below.

III. Qualifications and Background

13. My experience and qualifications are recited in my previous declaration filed as Exhibit 1003. My curriculum vitae was previously submitted as Exhibit 1004 and provides a comprehensive description of my academic and employment history. I am competent to write this declaration. In formulating my opinions, I have relied upon my training, knowledge, and experience in the relevant art.

IV. Materials Considered

14. In forming my opinions, I have reviewed the following documents, as well as other documents cited throughout this declaration.

Exhibit	Description
Ex. 1001	U.S. Patent No. 8,482,638 to Shiohara ("the '638 patent")
Ex. 1002	File History of U.S. Patent No. 8,482,638
Ex. 1003	Declaration of Robert Stevenson, Ph.D.
Ex. 1005	U.S. Patent Application Publication No. 2008/0218611 to Parulski et al. ("Parulski")
Ex. 1006	South Korean Patent Publication No. 2007/0046010A to Safonov ("Safonov")
Ex. 1007	Certified Translation of South Korean Patent Publication No. 2007/0046010A to Safonov ("Safonov")[1]
Ex. 1009	U.S. Patent Application Publication No. 2013/0121569 to Yadav ("Yadav")
Ex. 1010	U.S. Patent No. 7,643,082 to Onozawa ("Onozawa")
Ex. 1011	U.S. Patent No. 7,701,500 to Aizawa et al. ("Aizawa")
Ex. 1012	U.S. Patent No. 7,424,215 to Ito et al. ("Ito")
Ex. 1013	U.S. Patent No. 5,317,351 to Takahara et al. ("Takahara")
Ex. 1018	U.S. Patent No. 7,659,923 to Johnson ("Johnson").
Ex. 1019	U.S. Patent Application Publication No. 2008/0239133 to Cazier et al. ("Cazier").
Ex. 1020	U.S. Patent Application Publication No. 2006/0245640 to Szczuka ("Szczuka")

[1] My discussions of Safonov cite to the certified English translation unless otherwise noted.

Exhibit	Description
Ex. 1021	U.S. Patent Application Publication No. 2010/0238325 to Hoshino et al. ("Hoshino")
Paper 9	Patent Owner's Non-Contingent Motion to Amend

15. I have reviewed and considered Patent Owner's Non-Contingent Motion to Amend in this proceeding.

16. I have also relied on my education, experience, research, training, and knowledge in the relevant art, and my understanding of legal principles described in this declaration.

17. All of the opinions contained in this declaration are based on the documents I reviewed and my knowledge and professional judgment. My opinions have also been guided by my understanding of how a POSITA would have understood the claims of the '638 patent at the time of the earliest claimed priority date.

18. I reserve the right to supplement and amend any of my opinions in this declaration based on documents, testimony, and other information that becomes available to me after the date of this declaration.

V. Legal Standards

19. I am an engineer and not a lawyer. My understanding of the legal standards to apply in reaching the conclusions in this declaration is set forth in

Exhibit 1003 and is based on discussions with counsel for Petitioner, my experience applying similar standards in other patent-related matters, and my reading of the documents submitted in this proceeding. I have applied these legal standards in preparing this declaration.

VI. The '638 Patent

20. The '638 patent describes a digital camera with a main lens and a sub-lens. Ex. 1001, Abstract. The '638 patent also describes "a focal length acquiring unit configured to acquire the focal length of the main lens, a magnification setting unit configured to set a level of magnification on the basis of the focal length, a composite image generating unit configured to generate a composite image by combining the main image and the sub-image, after at least one of the main image and the sub-image is magnified at the level of magnification, and an image display unit configured to display the composite image." Ex. 1001, Abstract.

21. Figure 7 below shows the '638 patent's method for creating a composite image. Ex. 1001, 6:46-7:38, Fig. 7. The '638 patent's method includes generating both the main image and the sub-image, steps S110 and S120. Ex. 1001, 6:56-64, Fig. 7 (S110, S120). The method includes inputting the focal length and using the focal length to use a magnification rule to harmonize the magnification of both images. Ex. 1001, 6:18-45, 7:1-35, 10:31-32. The harmonization of the magnification then allows the images to be combined. Ex. 1001, 7:14-18. The

method then cuts out a partial image from the sub-image and superimposes the cutout onto the main image and generates and displays the composite image.

Ex. 1001, 7:8-35, 10:32-34.

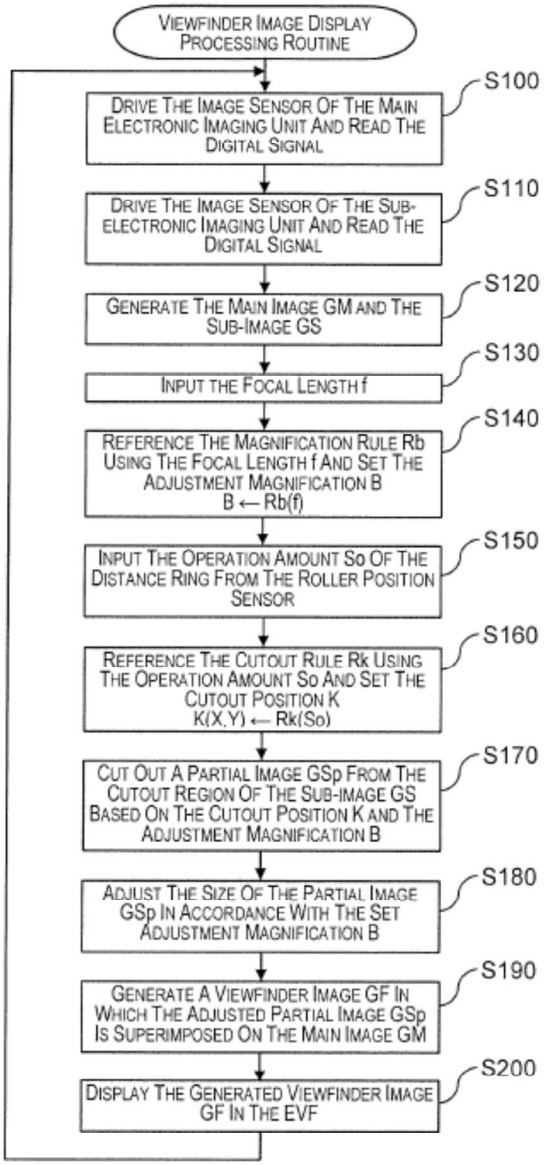


Fig. 7

Ex. 1001, Fig. 7.

VII. Level of Ordinary Skill in the Art

22. In my prior declaration, I explained my opinion that a POSITA in the field of the '638 patent would have had at least a bachelor's degree in electrical engineering, computer science, or related engineering disciplines, and two years of experience in multi-lens camera systems. Relevant work experience can substitute for formal education and additional education could substitute for work experience.

23. I met the criteria for a POSITA at the earliest priority date of the '638 patent. At the time of the invention, I had already received a Ph.D. in Electrical Engineering and had been a professor of Electrical Engineering at the University of Notre Dame for over a decade. I also had worked in the field of image/video processing and analysis for over 15 years. So I would have exceeded the level of ordinary skill in the art.

VIII. Claim Construction

24. I understand that, in this proceeding, the claims are construed according to their ordinary and customary meaning, in light of the specification and prosecution history, as understood by a POSITA at the time of the invention. I understand that this is the same claim construction approach used in district court litigation.

25. As in my previous declaration, it remains my opinion that none of the claim terms require further construction for me to provide my opinions on whether the prior art renders obvious the claims of the '638 patent.

IX. Prior Art

26. As explained in Sections X-XIV below, it is my opinion that substitute claims 7, 8, and 10-12 would have been obvious to a POSITA based on combinations of Parulski and Safonov, Johnson, and/or Hoshino.

A. Parulski

27. Parulski, U.S. Patent Application Publication No. 2008/0218611 (Ex. 1005), was filed March 9, 2007, and published September 11, 2008. Parulski, cover (items (22), (43)). I have been informed that this makes Parulski prior art to the '638 patent.

28. Parulski discloses an "electronic camera for producing an output image of a scene from a captured image signal includ[ing] a first imaging stage comprising a first image sensor for generating a first sensor output and a first lens for forming a first image of the scene on the first image sensor, and a second imaging stage comprising a second image sensor for generating a second sensor output and a second lens for forming a second image of the scene on the second image sensor." Parulski, Abstract. At least one of Parulski's lenses generates an ultra-wide angle view. Parulski, [0115]-[0116]. The images obtained from the first

image sensor and second image sensor are combined to generate an "enhanced, captured image signal" where a portion of the main image is replaced with a corresponding portion of the second image. *See* Parulski, Abstract; *see also* Parulski, [0030]-[0031], [0115]-[0116].

29. To create a combined image, Parulski describes a "rangefinder-based autofocus system[]" that uses a triangulation calculation to calculate the distance to the scene being photographed and then guides the positioning of an adjustable focus lens to produce the best image quality. Parulski, [0008]-[0009], [0097]. Parulski's camera determines the zoom for the main lens when the user adjusts the zoom control, and a control processor processes the user's zoom selection. Parulski, [0079], [0082]. Parulski's first image may be captured using a different focal length and the second image can be "upsampled so that corresponding features in the two autofocus images span the same numbers of pixels." Parulski, [0104]. This process is shown in Figure 4 below.

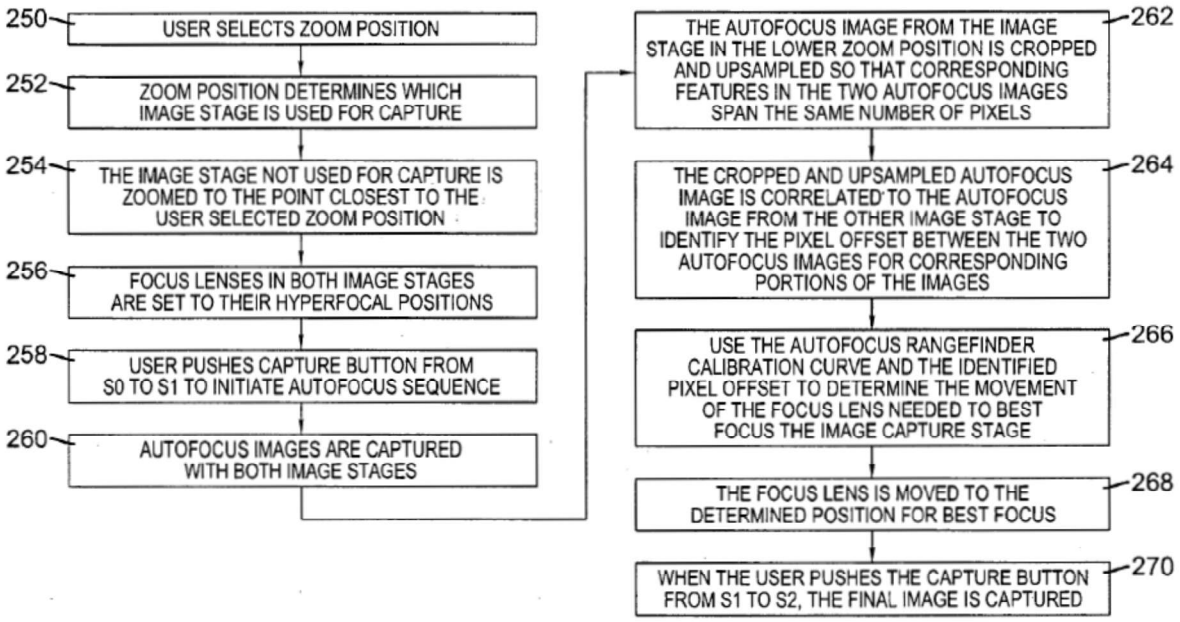


FIG. 4

Parulski, Fig. 4.

30. The combined image can then be displayed on Parulski's LCD display 70. Parulski, [0076], [0087]-[0090].

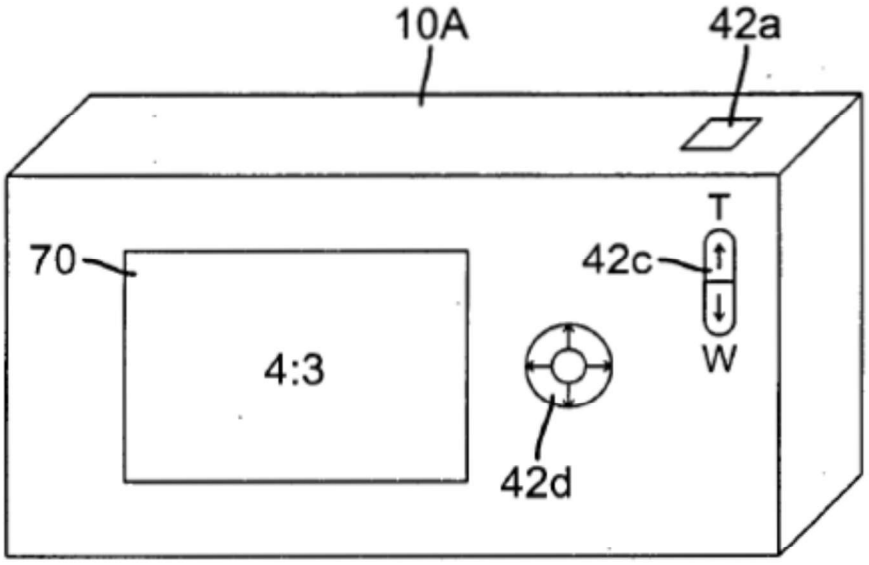


FIG. 2B

Parulski, Fig. 2B.

31. In my opinion, Parulski is analogous art to the '638 patent. Parulski is directed to the same field of endeavor as the '638 patent: digital cameras having multiple lenses. *Compare* Ex. 1001, 1:47-50, *with* Parulski, [0001], [0025]. For example, both the '638 patent and Parulski describe digital cameras using multiple lenses to capture multiple images and combine those images to create a single enhanced image. *Compare* Ex. 1001, Abstract, 1:47-67, *with* Parulski, [0001], [0025]. Alternatively, Parulski seeks to solve at least one of the same problems as the '638 patent: creating an enhanced image by combining multiple images from different lenses of a digital camera. *Compare* Ex. 1001, 1:47-50 ("A main object of

the present invention is to provide a digital camera for generating a composite image in which two images are superimposed ….”), *with* Parulski, [0025] (“The object of this invention is to provide an improved imaging capability in a multi-lens digital camera utilizing both (or more) images to provide an improved output image.”), [0001].

B. Safonov

32. Safonov, Public Patent Notice of Korean Patent Application No. 10-2007-0046010, has a date of disclosure of May 2, 2007. Safonov,[2] 1 (items (11), (43)). I have been informed that this makes Safonov prior art to the ’638 patent.

33. Safonov discloses “a method of digital image enhancement and comprises a step of converting from an RGB color space to the luminance channel of an image, a step of filtering the luminance channel of the image by a bilateral filter, a step of correcting shadow to increase local contrast and luminance, respectively, and correcting highlight[ing] to increase local contrast and decrease luminance at the luminance channel of the image, and a step of converting the corrected image into an RGB color space.” Safonov, Abstract.

[2] Citations to Safonov (Ex. 1006) are to the certified English translation (Ex. 1007).

34. Safonov also discloses using alpha-blending techniques to blend multiple images together to get the desired contrast or luminance for an image. Safonov, Abstract, 7. For example, Safonov states:

> Let's take [a] "detail image" D_s with high local contrast in shadows, and [a] "digital image" D_h with high local contrast in the highlight area, i.e.[,] images that can identify digital correspondingly well in shadows and highlights. It is then possible to increase the local contrast and luminance of the source image I using the following alpha blending formula of I and D_s …. For all pixels (r,c) of Image I, in the above formula, α_s is an alpha-channel of permeability with a value close to 1 in the bright area and a value close to 0 in the dark area, and the factor k'_s controls the amplification level of the local contrast in the shadow.

Safonov, 7.

35. In my opinion, Safonov is analogous art to the '638 patent because the reference, like the '638 patent, is directed to the same field of endeavor: digital cameras using multiple lenses. *Compare* Ex. 1001, Abstract, 1:47-67, *with* Safonov, 7. For example, digital cameras that use multiple lenses capture multiple images and combine those images to create a single enhanced image. *Compare* Ex. 1001, Abstract, 1:47-67, *with* Safonov, 7. Alternatively, Safonov seeks to solve at least one of the same problems as the '638 patent: creating an enhanced image

by combining multiple images. *Compare* Ex. 1001, 1:47-50 ("A main object of the present invention is to provide a digital camera for generating a composite image in which two images are superimposed …."), *with* Safonov, 4 ("The present invention relates generally to the field of digital imaging technology. In particular, it relates to the field of methods for improving digital cameras and grayscale photographs, and more specifically to global (overall) and local tone adjustment of shadow and highlight correction, noise suppression[,] and sharpening.").

C. Johnson

36. Johnson, U.S. Patent No. 7,659,923 (Ex. 1018), was filed June 20, 2006, and issued February 9, 2010. Johnson, cover (items (22), (45)). I have been informed that this makes Johnson prior art to the '638 patent.

37. Johnson discloses a "digital camera" including an "image processing unit" for "identif[ying] regions of difference between … two images that indicate that eyes are partially or fully closed in one of the two images, and creat[ing] a single composite image from the two original images, in which all eyes are open for all subjects in the image." Johnson, Abstract. The image processing unit utilizes an "algorithm" to "compare the characteristics of the first image to the characteristics of the second image," e.g., whether a subject is blinking in one image but not the other, and "blend[s] the two images together to create a third preferred image as the final image." Johnson, 1:51-61, 3:26-34, 4:19-22, Fig. 4.

38. In my opinion, Johnson is analogous art to the ’638 patent because it is directed to the same field of endeavor such as creating a composite image from multiple captured images. Johnson also seeks to solve at least one of the same problems as the ’638 patent: creating an enhanced image by combining multiple images to create a composite image. *Compare* Ex. 1001, 1:47-50, *with* Johnson, Abstract, 3:46-50, Fig. 4.

D. Hoshino

39. Hoshino, U.S. Patent Application Publication No. 2010/0238325 (Ex. 1021), was filed March 19, 2010, and issued September 23, 2010. Hoshino, cover (items (22), (43)). I have been asked to assume that Hoshino is prior art to the ’638 patent.

40. Hoshino discloses a “camera device” including an “image processing subunit” that “extracts [a] subject image D from [a] subject-background picture E1 based on the difference information” and “combines the subject image D” with a “background image P1” such that “the subject image D is superimposed on the background image P1” and “the subject image D is alpha blended with [the] predetermined background.” Hoshino, [0021], [0035], [0037], [0039], [0040], [0118], Figs. 2, 4.

41. In my opinion, Hoshino is analogous art to the ’638 patent because it is directed to the same field of endeavor such as creating a composite image from

multiple captured images. Hoshino also seeks to solve at least one of the same problems as the '638 patent: creating an enhanced image by combining multiple images to create a composite image. *Compare* Ex. 1001, 1:47-50, *with* Hoshino, [0005]-[0007], Fig. 4.

X. Grounds of Unpatentability

42. Based on my review of the materials set forth above, including my application of the knowledge of a person of ordinary skill in the art, it is my opinion that substitute claims 7, 8, and 10-12 of the '638 patent would have been obvious to one of ordinary skill in the art.[3]

43. In particular, it is my opinion that substitute claims 7, 8, and 10-12 of the '638 patent would have been obvious to a POSITA based on the following grounds:

Ground	Claims	Basis	Prior Art
1	7, 8, 10-12	§ 103	Parulski and Safonov
2	7, 8, 10-12	§ 103	Parulski and Johnson
3	7, 8, 10-12	§ 103	Parulski, Safonov, and Johnson
4	7, 8, 10-12	§ 103	Parulski and Hoshino

[3] I have not been asked to offer my opinions as to substitute claim 9. I therefore have no opinion on the patentability of substitute claim 9.

XI. Ground 1: Parulski and Safonov Render Obvious Claims 7, 8, and 10-12.

A. Independent Claim 7

44. Parulski in combination with Safonov renders obvious substitute claim 7. Claim elements [7Preamble]-[7d], [7f], and [7g] are identical to issued claims [1Preamble]-[1d], [1f], and [1g]. My analysis of these limitations is substantively identical to my previous declaration. That analysis is reiterated below for convenience.

1. [7Preamble] "A digital camera having a focusing function and a focal length varying function of a main lens, the digital camera comprising:"

45. Substitute claim element [7Preamble] is substantively identical to original claim element [1Preamble]; thus, my analysis of claim [7Preamble] is substantively identical to my original analysis of claim [1Preamble]. Ex. 1003, ¶¶67-68. That analysis is reiterated below for convenience.

46. If the preamble is limiting,[4] in my opinion, Parulski discloses "[a] digital camera having a focusing function and a focal length varying function of a main lens."

47. Parulski discloses a digital camera having auto-focus ("focusing function") and optical zoom range ("focal length varying function") for a main lens. For example, Parulski discloses a digital camera with "multiple image capture stages, each composed of a lens and an image sensor, wherein the lenses of the multiple image capture stages have different focal lengths to provide an extended optical zoom range." Parulski, [0064]. Parulski also discloses that "one image capture stage may be used to capture digital still images or video images while another image capture stage is simultaneously being used for another purpose, such as enhanced autofocus, generation of a secondary image, production of a range map, and the like." Parulski, [0065]. Parulski's "one image capture stage," also referred to as the "first imaging stage," includes a main lens to capture a digital still image having both an "autofocus" focusing function and an "optical zoom range" focal length varying function. Parulski, [0064]-[0065]. Parulski explains

[4] I have no opinion whether the preambles of the claims are limiting. But if they are, it is my opinion that they are disclosed or rendered obvious for the reasons discussed herein.

that the system includes structures and software that carry out the recited functions in claims 1, 2, and 4-6[5] of the '638 patent, which are described below. Parulski, [0063].

2. [7a] "a main imaging unit configured to generate a main image by performing a photoelectric conversion from a subject obtained via the main lens;"

48. Substitute claim element [7a] is substantively identical to original claim element [1a]; thus, my analysis of claim [7a] is substantively identical to my original analysis of claim [1a]. Ex. 1003, ¶¶69-71. That analysis is reiterated below for convenience.

49. In my opinion, Parulski discloses "a main imaging unit configured to generate a main image by performing a photoelectric conversion from a subject obtained via the main lens."

50. Parulski explains that, in the prior art, two lenses capture an image of an object 151, such as shown in Figure 27. Parulski, [0007], Fig. 27. Parulski improves on this prior art by, for example, using an image capture assembly 10A having a "first imaging stage [("main imaging unit")], including a first zoom lens and a first image sensor." Parulski, [0072]; *see also* Parulski, [0074]-[0075]. Parulski's "first image sensor[] is used to capture a first (i.e., primary) still image at a first (i.e., primary) focus distance" from the first zoom lens ("main lens").

[5] The same is substitute claims 7, 8, and 10-12.

Parulski, [0072]. Parulski further discloses that the first image sensor for the first imaging stage can be either a CCD ("charged-coupled device") or CMOS ("complementary metal oxide semiconductor") image sensor. Parulski, [0078]. In my opinion, a POSITA would have understood that CCD and CMOS image sensors perform a photoelectric conversion from a subject obtained via the first zoom lens ("main lens") to generate an electronic image of the subject. *See* Parulski, [0007]; *see also* Ex. 1001, 2:63-65, 3:25-33.

51. Thus, in my opinion, Parulski discloses a first imaging unit having a CCD or CMOS image sensor configured to generate a main image by performing a photoelectric conversion from the object of the photo being taken obtained via the main lens.

3. [7b] "a sub-imaging unit configured to generate a sub-image by performing a photoelectric conversion from the subject obtained via a sub-lens;"

52. Substitute claim element [7b] is substantively identical to original claim element [1b]; thus, my analysis of claim [7b] is substantively identical to my original analysis of claim [1b]. Ex. 1003, ¶¶72-75. That analysis is reiterated below for convenience.

53. In my opinion, Parulski discloses "a sub-imaging unit configured to generate a sub-image by performing a photoelectric conversion from the subject obtained via a sub-lens."

54. As discussed above, Parulski improves on the prior art multi-image capture by, for example, using an image capture assembly 10A having a "second imaging stage" ("sub-imaging unit") that includes a second image lens, such as a "second zoom lens" ("sub-lens") and a "second image sensor" having a CCD image sensor. Parulski, [0072], [0078]; *see also* Parulski, [0074]-[0075]. Parulski further discloses that its "second image sensor[] is used to simultaneously capture a second (i.e., secondary or sub) still image at a second (i.e., secondary) focus distance." Parulski, [0072]. As explained for [7a], in my opinion, a POSITA would have understood that a CCD image sensor performs a photoelectric conversion of the incoming light of the object of the image being taken through the second image lens ("sub-lens"). *See* Parulski, [0007]; Ex. 1001, 2:63-65, 3:25-33.

55. Parulski's second image lens describes a sub-lens because, like the '638 patent, the image can be used to replace a portion of the main lens and/or a portion of the images taken by this lens can be used to create the modified, combined image. *See* Parulski, [0031], [0072], [0097], [0118], [0138]-[0140], [0145]; *see also* Ex. 1001, 11:13-16. For example, Parulski discloses that "the secondary still image is used to provide an enhancement signal that may, e.g., sharpen portions of the primary still image that are positioned near the secondary focus distance or may modify the dynamic range of the primary still image." Parulski, [0072]. The second image can be cropped and upsampled to correspond

to portions of the primary image. *See* Parulski, [0093], [0104], Fig. 4. "A modified image is then created by replacing portions of the primary image with portions of the secondary image." Parulski, [0145].

56. Thus, in my opinion, Parulski discloses a CCD image sensor that generates a sub-image by performing a photoelectric conversion obtained from the subject via a sub-lens. That sub-image is then used to create the modified image, as explained below in [7e].

4. [7c] "a focal length acquiring unit configured to acquire the focal length of the main lens;"

57. Substitute claim element [7c] is substantively identical to original claim element [1c]; thus, my analysis of claim [7c] is substantively identical to my original analysis of claim [1c]. Ex. 1003, ¶¶76-79. That analysis is reiterated below for convenience.

58. In my opinion, Parulski discloses "a focal length acquiring unit configured to acquire the focal length of the main lens."

59. For example, Parulski discloses that the "lenses of the multiple image capture stages have different focal lengths to provide an extended optical zoom range for the image capture assembly." Parulski, [0064]. Parulski provides this extended zoom range using control processor 40 that supplies electric signals and controls the zoom motor of the first zoom lens of the first imaging unit ("main lens"). *See* Parulski, [0079]. Parulski discloses that the control processor 40

"controls the zoom and focus motors." Parulski, [0079]. The user selects a focal length by adjusting the zoom position for the main lens ("first imaging stage 1") using a zoom control 42c of the user controls 42. Parulski, [0075], [0087], [0092], [0094]. Parulski discloses that "the user determines the zoom position by adjusting the zoom control 42c on the camera." Parulski, [0092]. An image of the scene in the first imaging lens is then captured by a corresponding image sensor 14 of the first imaging unit (main imaging unit) and "provides an image to a first image sensor 12." Parulski, [0075]. The image processor 50 "selects the sensor output 12e" from "the first imaging stage 1" as the main lens to "produce[] [a] focus detection signal[] that drive[s] the first … focus adjuster[]" using the second imaging stage's autofocus function. Parulski, [0080], [0082]. Parulski adjusts the position of the lens elements to focus light correctly onto the image sensor. The specific position of the lenses depends on the subject's distance and lens' focal lengths. A POSITA would have understood that the lens movement required to achieve the correct focus varies with focal length; longer focal lengths generally require more precise adjustment than shorter focal lengths. Autofocus systems, like those in Parulski, use various algorithms to determine when an image is in focus (e.g., contrast measure or phase difference measurements). Regardless of the algorithm used, autofocus systems, such as in Parulski, use the detected focus signal and the information acquired about the focal length to determine the amount

of lens adjustment that would be needed to bring the system into focus. In my opinion, a POSITA reading Parulski's disclosure would have understood that, to properly focus the main lens, the image processor 50 would have acquired the focal length of the main lens to optimize the composite image, as discussed in more detail below for elements [7d] and [7e]. "The control processor and timing generator 40, in combination with the image processor 50, … selects the sensor output 14e from the second imaging stage 2 as the captured image signal and uses the sensor output 12e from the first imaging stage 1 to generate the focus detection signal for the selected imaging stage 2." Parulski, [0082].

60. Additionally, Parulski discloses that "[i]n block 500 of FIG. 14, the zoom position is set to a default position when the camera is powered on. In block 502, the zoom position setting is compared to a value X at which the image capture function switches from the first image capture stage to the second image capture stage." Parulski, [0118]. In my opinion, a POSITA would have understood that the focal length would have been acquired to be able to compare it to the value X.

61. Thus, in my opinion, Parulski discloses "a focal length acquiring unit configured to acquire the focal length of the main lens."

5. [7d] "a magnification setting unit configured to set a level of magnification on the basis of the focal length;"

62. Substitute claim element [7d] is substantively identical to original claim element [1d]; thus, my analysis of claim [7d] is substantively identical to my

original analysis of claim [1d]. Ex. 1003, ¶¶80-88. That analysis is reiterated below for convenience.

63. In my opinion, Parulski discloses "a magnification setting unit configured to set a level of magnification on the basis of the focal length."

64. A POSITA would have understood that focal length is one of the fundamental characteristics of an optical system. It is expressed in millimeters (mm) and typically ranges from a couple of millimeters to 1000 mm for an optical system in common handheld cameras. The focal length determines the angle of view for the lens, or how much of the scene the lens can capture. A shorter focal length means a wider angle of view, while a longer focal length results in a narrower angle of view. For example, in a scene with a person standing in front of a house, one can use a short focal length lens to capture an image of the entire house or, without moving, they can choose a longer focal length lens to capture just an image of the person's face. A zoom lens is an optical system in which we can adjust the focal length of the system usually by mechanically adjusting the relationship between several lens that make up the system. When one "zooms in" you are adjusting the optical system to have a longer focal length. In the example, when going from an image of the entire house using a relatively short focal length optical system, by increasing the focal length of the system one can "zoom in" to an image of the face of the person in front of the house.

65. A POSITA would have likewise understood that magnification is the ratio of the size of the image formed by the lens to the size of the object being imaged. In a camera an optical system forms an image on an image sensor to capture an image. As the focal length of the optical system increases the image formed on the sensor is increased in size and results in a higher magnification. Alternatively, as one zooms in the magnification of the object being captured is increased.

66. As discussed above, Parulski discloses a main lens and sub-lens for generating images and acquiring a focal length of the main lens. Parulski modifies the level of magnification of the image obtained from the sub-lens on the bases of the focal length of the main lens so that the images are the same size and can be used to create a composite image where a portion of the sub-image replaces a portion of the main image. Parulski, [0031], [0066], [0075], [0093], [0097], [0101], [0104], [0138]-[0140], [0145], Figs. 4, 6, 9, 11.

67. Parulski also discloses that the sub-lens, which is part of the second imaging stage 2, can have a second focal length corresponding to the second imaging stage 2. *See* Parulski, [0075]. Parulski discloses that "[t]he image capture assembly 10A includes two imaging stages 1 and 2, both with zoom lenses 3 and 4.… The second zoom lens 4 is controlled by a second lens focus adjuster, e.g., zoom and focus motors 5b, and provides an image to a second image sensor 14."

Parulski, [0075]. Parulski discloses that "[b]ecause the two lenses have different focal lengths, they have different magnifications." Parulski, [0066].

68. Parulski also discloses creating a composite image using the main image and sub-image by replacing portions of the main image from the first imaging lens with "corresponding portions" of the sub-image from the second imaging lens to obtain a modified image with relatively low noise and good sharpness. Parulski, [0031], [0138]-[0140], [0145]. For example, Parulski discloses "replac[ing] portions of the primary image (areas of lower noise but with some motion blur) with corresponding portions of the secondary image (areas of higher noise but little or no motion blur) to obtain a modified image with relatively low noise and good sharpness." Parulski, [0031].

69. Because Parulski's lenses "have different focal lengths," and therefore "different magnifications," the system modifies the sub-image by changing the magnification (e.g., upsampling to change the size of the sub-image) to make the images the same scale ("magnification") to replace portions of the main image with corresponding portions of the sub-image. Parulski, [0066]. Parulski discloses that "[w]hen the user adjusts the zoom position on the image capture assembly to a second optical zoom range, the camera automatically switches to use the second imaging stage (containing, e.g., a second zoom lens) to capture the images, and begins using the first imaging stage for autofocus of the second imaging stage.

Because the two lenses have different focal lengths, they have different magnifications. Therefore, the digital filters used to determine the autofocus may be adjusted, as a function of this difference in magnification, in order to compensate for the differences in magnification." Parulski, [0066]. The magnification of the sub-image is modified so that the size of the desired replacement portion is the same in both images. Parulski, [0066] ("[T]he digital filters used to determine the autofocus may be adjusted, as a function of this difference in magnification, in order to compensate for the differences in magnification.").

70. Parulski discloses that, because the two image capture devices or image capture stages "have different focal lengths, at least one of the images must be modified to make the two or more images comparable to enable the pixel offsets to be determined." Parulski, [0104]. Parulski discloses a magnification scaling of the second image by "upsampl[ing]" the second image "so that corresponding features in the two autofocus images span the same numbers of pixels." Parulski, [0104]. A POSITA would have understood that, when two lenses have different focal lengths, they produce images with different magnifications, meaning that objects in each image have different sizes in pixel dimensions, even if the objects themselves are physically the same size. To compare these images accurately, especially for autofocus and other feature detection tasks, a POSITA would have

understood that it is essential to scale the images so that their features align correctly in terms of size and position. The determination of the scaling that is needed is straightforward and would have been well understood by a POSITA. Each lens has a magnification factor, which is the ratio of the sensor size to the focal length of the lens. If the same size sensor is used in both cases, the relative magnification between the two images is just the ratio of one focal length to the other. For example, if f1 is the focal length of first lens and f2 is the focal length of the second, the relative magnification between the two images captured with the same size sensor would just be f1/f2. Thus, when the first autofocus image is captured by the first imaging lens with the lower focal length (higher magnification), the second autofocus image from the second imaging lens can then be adjusted to the same magnification. In my opinion, magnification scaling calculation was well understood by POSITAs because it is a simple proportion or ratio calculation. A POSITA would have recognized that upsampling corresponds to setting a level of magnification on the basis of focal length to scale the images using a ratio so they can be combined. A POSITA would have known that upsampling, also known as interpolation or resampling, was a well known technique used to increase the resolution of a digital image. Upsampling involves creating new pixels from existing pixels, thereby increasing the total number of pixels in the image. A POSITA would have understood that upsampling is a

technique that is commonly used when enlargement of an image is desired or required or to make the features of an image compatible with another image for compositing multiple images or matching two images' resolutions for analysis or combining. A POSITA would have understood that there were a number of well-known algorithms for upsampling, including nearest neighbor interpolation, bilinear interpolation, and bicubic interpolation. For example, in Figure 4 below, box 262 (yellow) states that "[t]he autofocus image from the image stage in the lower zoom position is cropped and upsampled so that corresponding features in the two autofocus images span the same number of pixels." Parulski, Fig. 4 (annotated); *see also* Parulski, [0093], [0097], [0101], [0104], Figs. 3, 6, 9, 11. As explained above, this corresponds to setting a level of magnification of the upsampled image to correspond to the focal length of the primary image.

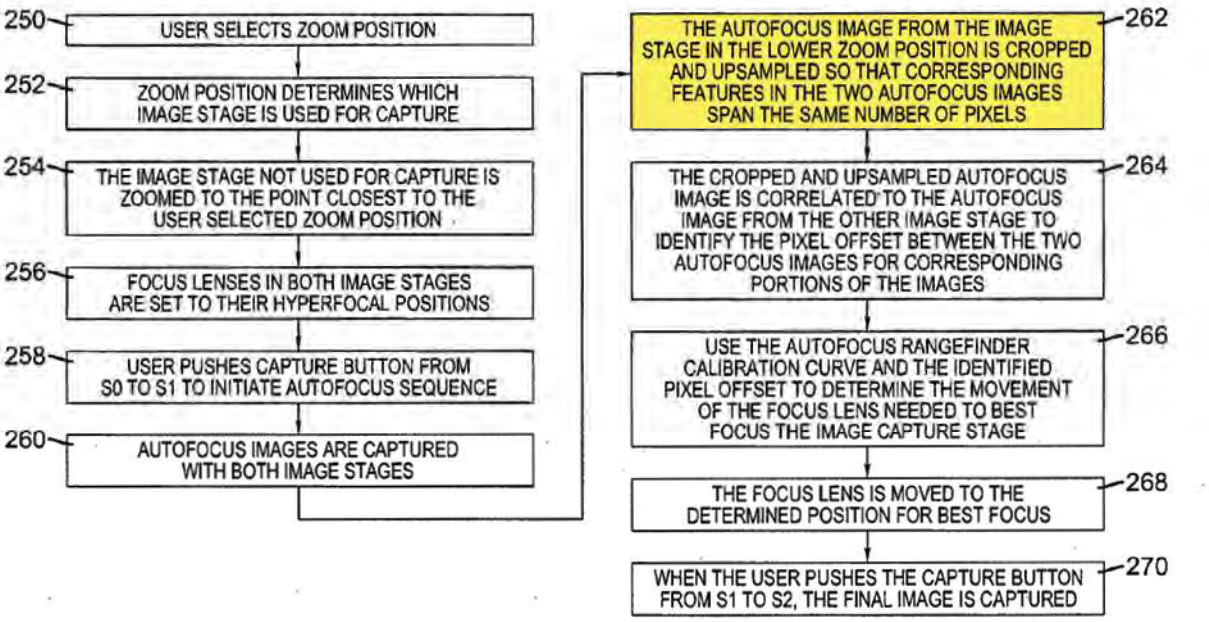


FIG. 4

Parulski, Fig. 4 (annotated).

71. Thus, in my opinion, Parulski discloses "a magnification setting unit configured to set a level of magnification on the basis of the focal length."

6. [7e] [7e(i)] "a composite image generating unit configured to [1] determine a cutout region in the sub-image, [2] cut out a partial image from the cutout region, [3] magnify at the level of magnification at least one of the main image and the sub-image, and [4] generate a composite image by superimposing the partial image on the main image,

[7e(ii)] wherein the generation of the composite image occurs after at least one of the main image and the sub-image is magnified at the level of magnification;"

72. I understand that claim element [7e] incorporates certain limitations from original claim elements [1e] and [4b].

73. I maintain that Parulski discloses or suggests at least a composite image generating unit configured to [1] determine a cutout region in the sub-image, [2] cut out a partial image from the cutout region, [3] magnify at the level of magnification at least one of the main image and the sub-image, and [4] generate a composite image by [replacing] the partial image on the main image, wherein the generation of the composite image occurs after at least one of the main image and the sub-image is magnified at the level of magnification for each of the reasons set forth in my original declaration, as I explain in elements [1e] and [4b] of my previous declaration. Ex. 1003, ¶¶89-103, 146-149. Regarding cutting, a POSITA would have understood, at a minimum, that Parulski's use of "corresponding portions of the secondary image" to replace portions of the primary image corresponds to cutting out a partial image selected from a determined cutout region.

74. It remains my opinion that Safonov renders obvious generating a composite image by superimposing the partial image on the main image, for the same reasons Safonov renders obvious combining images using alpha blending, as set forth in my original declaration (Ex. 1003, ¶¶166-179), and reiterated below.

75. Safonov discloses "a method of digital image enhancement and comprises a step of converting from an RGB color space to the luminance channel of an image, a step of filtering the luminance channel of the image by a bilateral

filter, a step of correcting shadow to increase local contrast and luminance, respectively, and correcting highlight[ing] to increase local contrast and decrease luminance at the luminance channel of the image, and a step of converting the corrected image into an RGB color space." Safonov, Abstract. Safonov achieves this by performing alpha blending on two images to obtain a single, higher-quality composite image. *See* Safonov, Abstract, 7. For example, Safonov discloses taking a "'detail image' D_s with high local contrast in shadows, and [a] 'digital image' D_h with high local contrast in the highlight area, i.e.[,] images that can identify digital correspondingly well in shadows and highlights. It is then possible to increase the local contrast and luminance of the source image I using the … alpha blending formula of I and D_s" and "also reduce luminance using the following alpha blending formula of I and D_h" shown in Safonov's formula (3). Safonov, 7.

76. In my opinion, a POSITA would have found it obvious to use Safonov's alpha blending as part of generating the composite image when combining the main image and sub-image. For example, a POSITA would have understood that the combined image should be created in a way that minimizes or hides the edges where the main image and sub-image meet, and would have recognized that blending the images would have smoothed the transition to prevent the user from seeing where the second image was used to replace part of the main image. In my opinion, a POSITA would have found it obvious to use alpha

blending on some (e.g., edges) or all of the sub-image portion added to the main image, such as where the sub-image has been superimposed over the main image, to blend away any differences in resolution, color variation, or gain settings, thereby cohesively integrating the sub-image into the main image.

a. Motivation to Combine Parulski and Safonov

77. In my opinion, a POSITA would have been motivated to use Safonov's alpha blending as part of Parulski's composite image generating unit to combine the main image and the sub-image when creating the composite, augmented, or enhanced image.

78. As discussed above, both Parulski and Safonov relate to cameras that combine multiple images into a single enhanced image. In my opinion, a POSITA would have known that the alpha blending disclosed in Safonov was a common, conventional technique used when combining images because it permits one image to be overlaid on the other, and the alpha channel or transparency can be used to smooth away differences in the images. *See* Safonov, 7 ("[I]t is possible to increase the local contrast of the source image *I* and also reduce luminance using the following alpha blending formula …."); Yadav, [0003] ("In computer graphics, alpha blending, or alpha channel blending, refers to the use of an alpha channel with other channels in an image in order to show translucency."); *see also* Yadav, [0007]. Indeed, one known purpose of alpha blending was to smooth the

combination of two different images or layers. Yadav, [0003], [0007]; *see also* Ex. 1001, 7:21-35.

79. In my opinion, a POSITA would have further been motivated to use the well-known alpha-blending technique in Safonov with Parulski's composite image generating unit when creating the composite image because the alpha-blending translucency would have helped smooth over the altered region, allowing the added sub-image to be more seamlessly integrated into the main image. *See* Yadav, [0003].

80. A POSITA would have understood that alpha blending is commonly used in graphic design, digital arts, web design, user interface development, video and film production, photography, electronic games, augmented and virtual reality, and scientific visualization. Alpha blending's widespread use is due to its effectiveness in blending multiple layers of images seamlessly, which is commonly needed in all these applications.

81. A POSITA also would have been motivated to incorporate Safonov's alpha blending into creating the composite image because it was a well-known technique used in image editing, image processing, and image combination software to combine multiple images into a single composite image, and thus represents a known technique in the art that would have yielded predictable results. Yadav, [0003].

82. Similarly, because alpha blending was a conventional technique in the prior art for combining two images, in my opinion, a POSITA would have recognized that it was a known, predictable solution that would have had a reasonable expectation of success to combine Parulski's main image and sub-image into a composite image and, therefore, would have been obvious to try as a method of combining the main image and the sub-image.

83. Incorporating alpha blending into a composite image generating unit provides significant advantages that would have been readily apparent to a POSITA. This is particularly useful when creating images that integrate different layers, each possibly containing different levels of detail, such as the system described in Parulski. A POSITA would have known that alpha blending enables the seamless combination of multiple images or layers by using a transparency (the alpha channel), which dictates how each pixel of the composite image is created by using the pixels from the images being combined. A POSITA would have understood that alpha blending allows for smooth transition between layers without harsh edges or visible seams, which is crucial for creating natural-looking composite images.

84. A POSITA also would have been motivated to incorporate Safonov's alpha blending into Parulski's creation of a modified image to further enhance the quality of the modified image to achieve Parulski's goal of the modified image

having "relatively low noise and good sharpness." Parulski, [0031]. For example, Safonov discloses that the alpha blending can enhance the modified image by increasing contrast and modifying the luminance, which is one known way of achieving Parulski's desired improvements. Safonov, 7.

b. Expected Success in Combining Parulski and Safonov

85. In my opinion, a POSITA would have had a reasonable expectation of success in using Safonov's alpha blending to enhance Parulski's modified image because it would have merely involved incorporating a known image-blending technique that was known to be used with digital camera images and was well within the POSITA's skill to incorporate.

86. A POSITA would have recognized that incorporating Safonov's alpha blending into Parulski's composite image generating unit would have required only the application of known, conventional software and image-processing techniques for alpha blending, and then applying the alpha blending to portions of the second image (sub-image) over a "corresponding portion[]" of the first image (main image) to obtain the enhanced or modified image with "relatively low noise and good sharpness," improved focus depth, increased local contrast, and reduced luminance. Parulski, [0031], [0138]-[0140], [0145]. Using alpha blending to combine the main image and the sub-image would have been merely the straightforward application of known, conventional techniques applied to

Parulski's already-disclosed combination of the main image and the sub-image, used according to their known functions to yield predictable results (creating a composite image using the processes disclosed in Parulski).

87. Thus, in my opinion, Parulski in combination with Safonov renders obvious "a composite image generating unit configured to [1] determine a cutout region in the sub-image, [2] cut out a partial image from the cutout region, [3] magnify at the level of magnification at least one of the main image and the sub-image, and [4] generate a composite image by superimposing the partial image on the main image, [7e(ii)] wherein the generation of the composite image occurs after at least one of the main image and the sub-image is magnified at the level of magnification."

7. [7f] "an image display unit configured to display the composite image; and"

88. Substitute claim element [7f] is substantively identical to original claim element [1f]; thus, my analysis of claim [7f] is substantively identical to my original analysis of claim [1f]. Ex. 1003, ¶¶104-115. That analysis is reiterated below for convenience.

89. In my opinion, Parulski discloses or renders obvious "an image display unit configured to display the composite image."

90. For example, Parulski discloses that the image capture assembly has a color liquid crystal display ("LCD") for displaying the images generated using

Parulski's multiple image stages. *See* Parulski, [0076], [0087]-[0090]. For example, Figure 2B of Parulski, annotated below, shows "a color LCD image display 70" (yellow) that displays the captured composite image preview created using the first and second image stages. Parulski [0076].

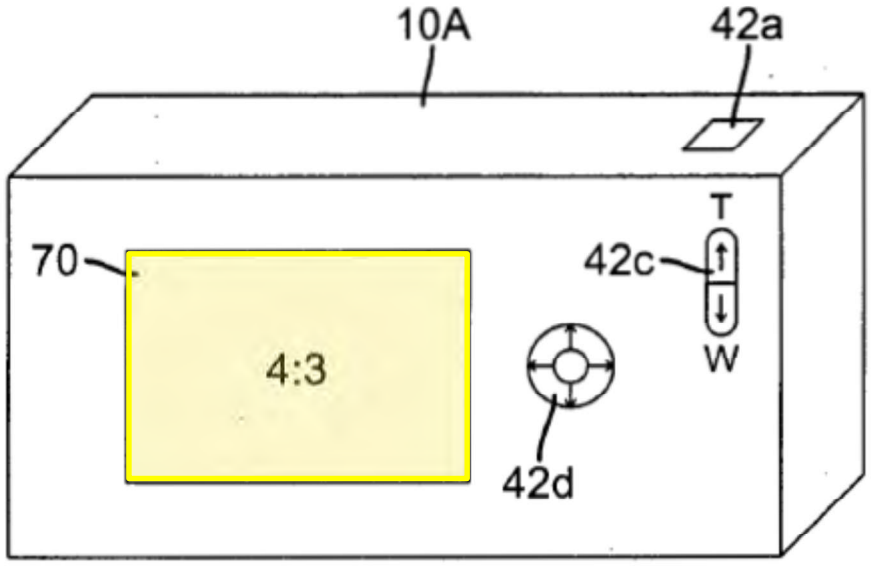


FIG. 2B

Parulski, Fig. 2B (annotated).

91. Because the LCD image display 70 is the only display in Parulski, in my opinion, a POSITA would have understood that Parulski's LCD image display 70 would be used to display the modified composite image so that the user can see the image that will be saved or reproduced later.

92. If the Patent Owner argues that Parulski does not disclose using LCD image display 70 to display the composite image, then, in my opinion, a POSITA would have found it obvious to modify Parulski so the LCD image display 70 displays the modified image so that the user can view the final image from the camera and determine whether it is acceptable. Parulski, [0031], [0076], [0087]-[0090].

a. Motivation to Modify Parulski

93. In my opinion, a POSITA would have been motivated to display the composite, augmented, modified, or enhanced image on Parulski's LCD image display 70 as a way to provide immediate feedback about how the final captured image will look. A POSITA would have recognized that this would allow photographers to see the final image and adjust the artistic decisions made in capturing in real-time or near real-time. For example, decisions that the photographers made about composition, lighting condition, lens setting, and exposure setting can all be quickly and easily verified by viewing the composite image on the LCD display. Displaying the composite image on LCD image display 70 would not only give the camera user confidence in the execution of the capture, but also allow him or her to make quick decisions if different or additional images need to be captured because the original composite image was unsatisfactory in some manner.

94. A POSITA would have known that an LCD was a common, conventional device used to display a captured image on a digital camera. *See* Parulski, [0076], [0087]-[0090]. Indeed, one of the purposes of LCD display 70 is to display images or videos, which provides an advantage over traditional film cameras because the user can immediately see the image that is being saved to the camera's memory and determine whether it is acceptable or should be retaken. Parulski, [0076], [0087]-[0090]. Indeed, Parulski's LCD already had the capability to display the two images from the two image capture stages in several ways including "one within the other." Parulski, [0131]; *see also* Parulski, Fig. 19.

95. In my opinion, a POSITA would have further been motivated to display the composite image on the LCD screen because it would allow the user to ensure that the captured image was satisfactory, including having "relatively low noise and good sharpness." Parulski, [0031]. By displaying the composite image, the digital camera could also free up memory because it needs only to store the composite image, rather than holding both the main image and the sub-image in memory for later combination. For digital cameras, this could have a significant effect on the number of images that a user can take and store because the single composite image requires less storage than the two separate images. By displaying the composite image on the LCD screen, Parulski's digital camera can show the user the actual image being stored for subsequent display, thereby facilitating the

user's review and approval or rejection of the image. If the composite image is deemed satisfactory, the user can proceed to take other photographs. If it is deemed unsatisfactory, the user will be able to delete it and retake the image. In my opinion, a POSITA would have been motivated to display this composite image viewing to the user because it would also mitigate the user needing to take multiple photographs of the same subject that might appear different in composite images.

96. A POSITA also would have been motivated to use Parulski's LCD screen to display the composite image because it was a well-known technique used in digital cameras to display a captured image or video and thus represents a known technique in the art that would have yielded predictable results. Parulski, [0076], [0087]-[0090].

97. Similarly, because LCD screens were a conventional technique in the prior art for displaying images or videos, in my opinion, a POSITA would have recognized that it was a known, predictable solution that would have had a reasonable expectation of success and, therefore, been obvious to try as a method for displaying the composite image.

b. Expectation of Success

98. In my opinion, a POSITA would have had a reasonable expectation of success in displaying the composite image using Parulski's existing LCD screen because it would have merely involved incorporating a known technique for

displaying images and videos that was known to be used with digital cameras and was well within the POSITA's skill to incorporate. Indeed, Parulski discloses that its LCD screen had the capability to display the two images "one within the other," and thus displaying the composite image would have been well within the POSITA's skill to display because it involves only a single image display. Parulski, [0131].

99. A POSITA would have recognized that displaying the composite image using Parulski's LCD screen would have required only the application of known, conventional software and processing techniques for displaying an image in a screen. Parulski, [0076], [0087]-[0090], [0131]. Using an LCD screen to display the composite image would have been merely the straightforward application of known, conventional techniques applied to Parulski's already-disclosed display of an image, such as the main image and the sub-image, used according to their known functions to yield predictable results (displaying a composite image on an LCD display).

100. Thus, Parulski discloses or renders obvious "an image display unit configured to display the composite image."

8. [7g] "wherein the magnification setting unit is configured to set the level of the magnification in order to match substantially a size of the main image and a size of the sub-image."

101. Substitute claim element [7g] is substantively identical to original claim element [1g]; thus, my analysis of claim [7g] is substantively identical to my original analysis of claim [1g]. Ex. 1003, ¶¶116-118. That analysis is reiterated below for convenience.

102. In my opinion, Parulski discloses or renders obvious "wherein the magnification setting unit is configured to set the level of the magnification in order to match substantially a size of the main image and a size of the sub-image."

103. As discussed above, Parulski discloses or renders obvious replacing a portion of the main image with a corresponding portion of the sub-image that has been upsampled to create a modified composite image because this describes setting the level of magnification so that the size of the main image and sub-image are substantially the same size or scale. Parulski, [0031], [0066], [0075], [0093], [0097], [0101], [0104] [0138]-[0140], [0145], Figs. 4, 6, 9, 11.

104. Thus, in my opinion, Parulski renders obvious the magnification setting unit is configured to set the level of the magnification in order to match substantially a size of the main image and a size of the sub-image.

B. [Claim 8] "The digital camera according to claim 7, wherein the sub-lens is a pan-focus lens."

105. In my opinion, Parulski renders obvious the additional limitation of claim 8, "wherein the sub-lens is a pan-focus lens." Substitute claim 8 is substantively identical to original claim 2; thus, my analysis of claim 8 is substantively identical to my original analysis of claim 2. Ex. 1003, ¶¶119-129. That analysis is reiterated below for convenience.

106. Parulski discloses that the second imaging stage 2 includes a fixed focal length lens that "generates an ultra-wide angle field of view" so "objects from 4 feet to infinity are in focus." Parulski, [0115]-[0116]. In my opinion, a POSITA would have understood that this disclosure describes a pan-focus lens, which is a lens that maintains all objects, from a certain distance to infinity, in focus. *See, e.g.*, Ex. 1010, Onozawa, 4:60-5:2.

107. If the Patent Owner argues that Parulski does not disclose that the sub-lens is a pan-focus lens, then, in my opinion, a POSITA would have found it obvious to use a pan-focus lens as the sub-lens because a larger portion of the captured image would be in focus and, thus, the subject being used to replace a portion of the main image would be in focus, regardless of its relative position to the in-focus object of the main lens.

1. Motivation to Modify Parulski

108. A POSITA would have understood that there are numerous advantages to using a pan-focus lens. Due to pan-focus lenses having a very deep depth-of-field, they are simple to use and provide instant focus of a scene. This eliminates the time needed for focusing and provides a consistent sharpness across a broad depth-of-field in every shot captured. A POSITA would have understood that, in a dual-lens system, a pan-focus lens serves as a complement to the functionality of a more specialized lens and offers a reliable all-purpose alternative that ensures an in-focus image is captured in even challenging situations. In my opinion, a POSITA would be motivated to modify Parulski's second imaging stage 2 to include a pan-focus lens to allow for greater depth of field to be achieved across a larger portion of the sub-image. A POSITA would have understood that by incorporating a pan-focus lens into a dual-lens camera system, it provides a balance between simplicity and functionality, making it ideal for users who want to acquire images in many different situations. A POSITA would have recognized that this configuration would provide broad versatility in capturing a wide range of scenes and subjects effectively and would have been readily motivated to use it for its combination of simplicity and versatility.

109. Further, a POSITA would have known that a pan-focus lens was a common, conventional technique to provide for greater depth of field across a

larger portion of the sub-image. *See, e.g.*, Ex. 1010, Onozawa, 4:60-5:2. For example, in my opinion, a POSITA would have been motivated to incorporate a pan-focus lens into the second imaging stage 2 to permit greater flexibility when replacing a portion of the main image because a greater portion of the sub-image would be in focus and therefore able to be used to create the composite image. A POSITA would have further been motivated to incorporate the well-known pan-focus lens in Parulski's second imaging stage 2 to permit a larger portion of the sub-image to be combined with the main image without having to worry about whether the replacement portion of the composite image is in focus because the pan-focus lens puts all objects in its field of view in focus. *See, e.g.*, Ex. 1010, Onozawa, 4:60-5:2.

110. In my opinion, a POSITA also would have been motivated to use a pan-focus lens in Parulski's second imaging stage 2 because it was a well-known technique used in cameras and optical systems to achieve a greater depth of field across a larger portion of an image. Ex. 1010, Onozawa, 4:60-5:2.

111. A POSITA also would have been motivated to incorporate a pan-focus lens into Parulski's second imaging stage 2 because a pan-focus lens is less complex and less expensive than a zoom lens. Because a pan-focus lens does not have a modifiable focal length, it requires fewer mechanisms to operate. Because a pan-focus lens is not capable of zooming in and out, the lens is less complex

because the pan-focus lens does not need to coordinate and align the multiple lenses at varying relationships to one another when zooming or include a zooming mechanism to achieve a precise focal length. This also means that less computer processing is required to determine a relationship between the two lenses. All these factors would have resulted in a less expensive camera, which could thereby reduce the consumer's purchasing cost, making it desirable to a POSITA.

112. Similarly, because pan-focus lenses were a conventional technique in the prior art, including for digital cameras, in my opinion, a POSITA would have recognized that it was a known, predictable solution that would have had a reasonable expectation of success and, therefore, been obvious to try as a method for achieving a greater depth of field across a larger portion of the image captured by Parulski's second imaging stage 2.

2. Expectation of Success

113. In my opinion, a POSITA would have had a reasonable expectation of success in modifying Parulski's second imaging stage lens to be a pan-focus lens because it would have been a simple swap of one lens type already known to a POSITA for another and that was known to work in the digital camera. Parulski discloses that a pan-focus lens could be used in the first imaging stage and also that whether the first or second imaging stage acts as the main imaging unit or the secondary imaging unit can switch depending on the focal length of the zoom lens.

Parulski, [0047], [0118]-[0120], Fig. 14. Additionally, at least one embodiment of Parulski includes three image capture stages, where the second stage has an ultra-wide focus lens, which as described above is equivalent to a pan-focus lens, which shows a POSITA would have understood how to modify the second stage lens to be a pan-focus lens. *See* Parulski, [0117].

114. A POSITA would have recognized that modifying Parulski's second imaging stage lens to be a pan-focus lens would have needed to apply only conventional manufacturing and image processing techniques to install the pan-focus lens and then extract the sub-image from the image captured by the pan-focus lens in the same way as Parulski describes extracting the sub-image from the second imaging stage. Parulski, [0093], [0104]. Using Parulski's already-disclosed pan-focus lens as the lens for the second imaging stage would have been a straightforward application of known, conventional manufacturing (installing a known pan-focus lens in Parulski's system) and applying Parulski's already-disclosed sub-image extraction and processing techniques to create a composite image, used according to their known functions to yield predictable results (creating a composite image using the processes disclosed in Parulski).

115. Thus, in my opinion, Parulski renders obvious claim 8.

C. Claim 10

116. In my opinion, Parulski renders obvious claim 10. Substitute claim 10 is substantively identical to original claim elements [4Preamble], [4a], and [4c]; thus, my analysis of claim 10 is substantively identical to my original analysis of claim elements [4Preamble], [4a], and [4c]. Ex. 1003, ¶¶130-145, 150-156. That analysis is reiterated below for convenience.

1. [10Preamble] "The digital camera according to claim 7, further comprising"

117. As discussed above, claim 7 is rendered obvious by Parulski and Safonov.

2. [10i] "[a] focusing amount acquiring unit configured to acquire amount [sic] of the focusing, wherein"

118. In my opinion, Parulski discloses or renders obvious "[a] focusing amount acquiring unit configured to acquire amount [sic] of the focusing."

119. As one example, Parulski discloses acquiring a focus amount by acquiring the focal length of the main lens, as explained in [7c].

120. As another example, Parulski discloses increasing an image's depth of field by allowing the system to take an out-of-focus portion of the main image and replace that same portion with an in-focus portion of the sub-image. Parulski, [0031]. For example, Figure 14, annotated below, "depicts a flow diagram showing a method for enhancing the depth of field of an image by using images from both

image capture stages according to an embodiment of the invention." Parulski, [0047]; *see also* Parulski, [0118]-[0120].

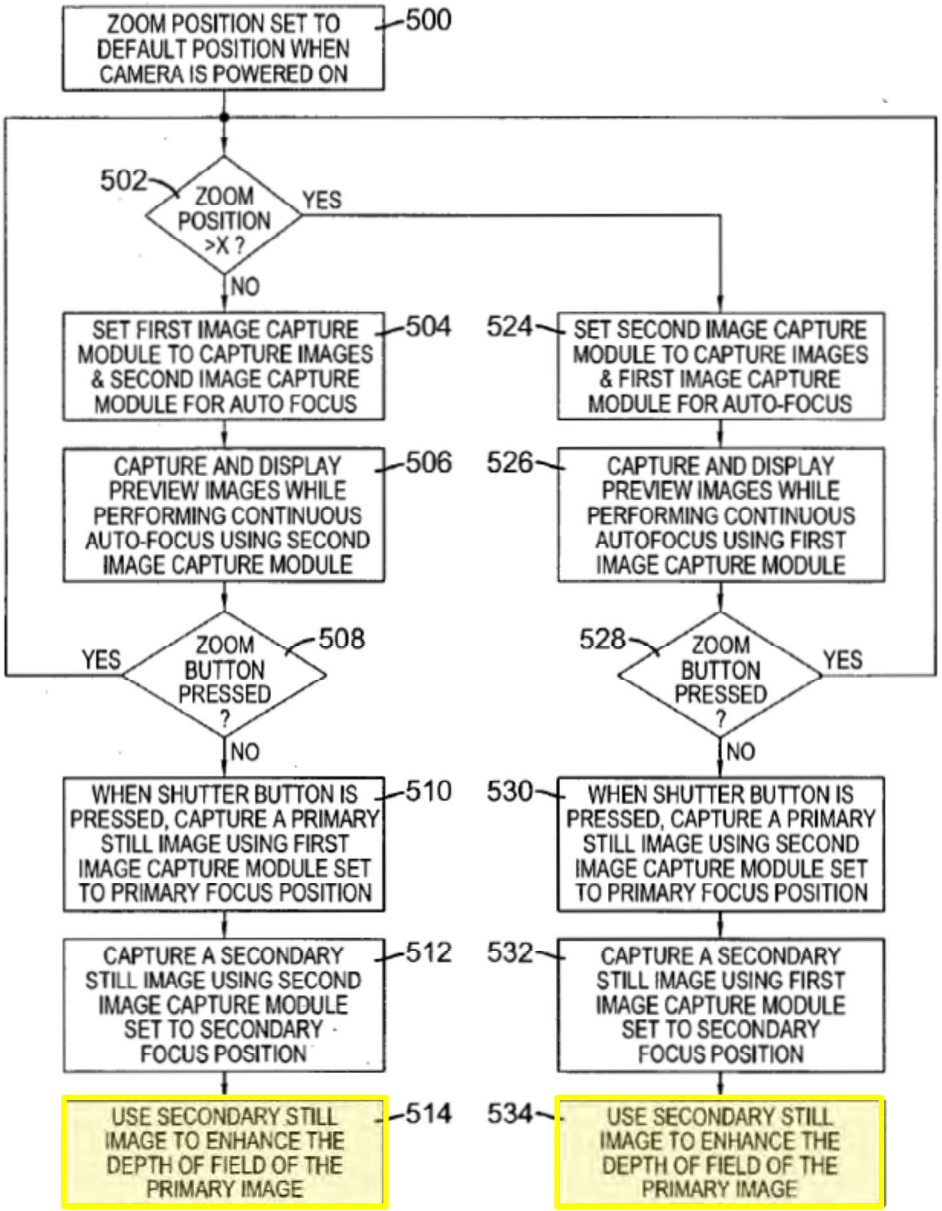


FIG. 14

Parulski, Fig. 14 (annotated).

121. "In block 500 of FIG. 14, the zoom position is set to a default position when the camera is powered on. In block 502, the zoom position setting is compared to a value X at which the image capture function switches from the first image capture stage to the second image capture stage." Parulski, [0118]. The value of X determines which imaging stage serves as the primary still image using a set focus position and which imaging stage will be the secondary still image that performs autofocus. Parulski, [0118]-[0120]. As discussed above in [1c], the autofocus (second imaging stage 2 in [7c]) is then used to set the best focus for the primary image. The image captured by the second imaging stage is then used to enhance the depth of field of the primary still image captured by the main lens. Parulski, [0118]-[0120]. In my opinion, a POSITA would have understood that Parulski's system acquires the autofocus amount to properly adjust the focus amount of the primary image. A POSITA would also have understood that to adjust the focus of the primary image to the desired value, Parulski's system acquires the current amount of focusing (e.g., when comparing the focal length to X) to know how much to modify to achieve the desired value determined by the autofocus.

122. I have also been asked to consider the situation in which element [7a] is interpreted to require using a roller and roller position sensor in the lens assembly, *see* Ex. 1001, 2:66-3:24, and, in my opinion, a POSITA would have

found it obvious to include a roller and a roller position sensor in Parulski's lens assembly so the lens can be displaced in the forward and backward directions and the amount of displacement can be detected, for example, to compare the focal length to X, as taught by Parulski. Parulski, [0118], Fig. 14. The use of a roller and roller position sensor would have been obvious to a POSITA because their use was well known in the art and conventional in zoom lens assemblies. *See* Ex. 1012, Ito, 7:16-35, Fig. 2; Ex. 1013, Takahara, 7:39-10:42, Figs. 11-19.

a. Motivation to Modify Parulski

123. In my opinion, a POSITA would have been motivated to include a roller and a roller position sensor in Parulski's lens assembly to control the lens displacement in the forward and backward directions to adjust the zoom and to detect that displacement to acquire the focal length of the lens during zooming, for example, to compare the focal length to X or to determine the offset between the main lens and the sub-lens. Parulski, [0118], Fig. 14.

124. A POSITA would have known that a roller and roller position sensor were common, conventional mechanisms and techniques to adjust and detect the position of a lens assembly and would immediately have envisioned this technique when reading Parulski because they were well known in the art. *See* Ex. 1012, Ito, 7:16-35, Fig. 2; Ex. 1013, Takahara, 7:39-10:42, Figs. 11-19.

125. In my opinion, a POSITA would have further been motivated to incorporate the well-known roller and roller position sensor into Parulski's camera assembly to adjust the main lens's position to accomplish mechanically zooming in and out and to detect the lens's zoom position (and focal length) to perform the composite image creation processes disclosed in Parulski. A POSITA would have understood that the lens position is critical to both the autofocusing and the image compositing operations described in Parulski.

126. A POSITA would have understood that, in Parulski's system, as the zoom position changes, internal lens elements move to adjust the focal length.[6] The position of these elements influences where the focus should be adjusted and as a result, the autofocus mechanism needs to know the zoom position to determine how to move these elements to achieve correct focus. Knowing the zoom position correlates to the amount of focusing of the lens. This is particularly true in Parulski because Parulski explains in paragraph [0003] that its system can also capture video, which requires accurate real-time autofocus. *See* Parulski [0003].

[6] Unless otherwise stated, the focal length refers to the focal length of the lens system. A POSITA would have understood that it was conventional in the art to treat a system as having one focal length.

127. A POSITA would have further understood that acquiring the lens position is also critical when compositing images because it is needed to maintain consistent scale and proportions across the images being combined. Knowing the zoom position for the lenses used to capture each image ensures that the elements from different photos match when composited, preventing unrealistic or jarring results where objects appear larger or smaller than expected relative to each other in the combined image. A POSITA would have also recognized that differing zoom positions can also change the apparent perspective and depth cues in images, and that for effective compositing, it would have been important that these perspectives are matched to avoid visual inconsistencies.

128. A POSITA also would have been motivated to incorporate a roller and roller position sensor into Parulski's camera assembly because they were well-known techniques used in cameras to mechanically move a zoom lens assembly to zoom in and out and to detect the position of the lens's assembly, thereby acquiring the zoom or focal length, and thus represents a known technique in the art and would have yielded predictable results. Ex. 1012, Ito, 7:16-35, Fig. 2; Ex. 1013, Takahara, 7:39-10:42, Figs. 11-19.

129. Similarly, because a roller and roller position sensor were conventional techniques in the prior art to mechanically adjust the zoom position of a lens assembly, in my opinion, a POSITA would have recognized that these

were known, predictable solutions that would have had a reasonable expectation of success and, therefore, been obvious to try as a method to mechanically adjust the zoom lens and detect the amount of zoom and focal length of the lens.

b. Expectation of Success

130. In my opinion, a POSITA would have reasonably expected success in incorporating a roller and roller position sensor into Parulski's camera assembly because it would have merely involved incorporating a known mechanism for moving the lens assembly to adjust the zoom lens and to determine the position of the assembly to determine the focal length of the lens that was known to work for digital cameras and was well within the POSITA's skill to incorporate.

131. A POSITA would have recognized that incorporating a roller and roller position sensor into Parulski's camera assembly would have required only the application of known, conventional software and mechanical techniques for zoom functions and then applying the roller and sensor to set and detect a zoom position for improved focus depth. Parulski, [0031], [0047], [0118]-[0120]. Using a roller and roller position sensor to adjust the focal length and zoom of the main lens and to detect that adjustment would have been merely the straightforward application of known, conventional techniques applied to Parulski's already-disclosed camera used according to their known functions to yield predictable results (adjusting the zoom and detecting the zoom amount).

132. Thus, in my opinion, Parulski renders obvious "[a] focusing amount acquiring unit configured to acquire amount of the focusing."

3. [10ii] "misalignment of the composite image decreases as the composite image is in focus with the subject on the basis of the amount and a predetermined cutout rule."

133. In my opinion, Parulski discloses that "misalignment of the composite image decreases as the composite image is in focus with the subject on the basis of the amount and a predetermined cutout rule." Ex. 1001, 14:38-40.

134. Parulski discloses a cutout rule that uses a range map and pixel offset to determine which position to cut out from the sub-image to replace the main image. This is determined from the sets of calibration curves. *See, e.g.*, Parulski, [0071], [0093], [0097], [0101], Fig. 4 at 266, Fig. 9 at 444-446.

135. For example, Parulski discloses an autofocus function that determines a "zoom position" of a "zoom … motor" to determine the focusing amount of the main lens. Parulski, [0065], [0092], [0093]. This position is associated with a "range map" to determine a pixel offset of the object's position between the main image captured by the first lens and the sub-image captured by the second lens, which corresponds to the distance to the object, or focusing amount. *See* Parulski, [0005], [0008], [0065], [0093], Figs. 17A, 17B. Figures 17A and 17B, below, show "a representation of a cropped and upsampled autofocus image 352 [Fig. 17B] from the image stage in the lower zoom position" ("sub-image") and "show the

offset between the two images that is used to determine the distance to portions of the scene." Parulski, [0093]; *see also* Parulski, [0050] ("FIG. 17A and FIG. 17B are representations of images captured with two image capture stages showing the offset between the two images that is used to determine the distance to portions of the scene.").

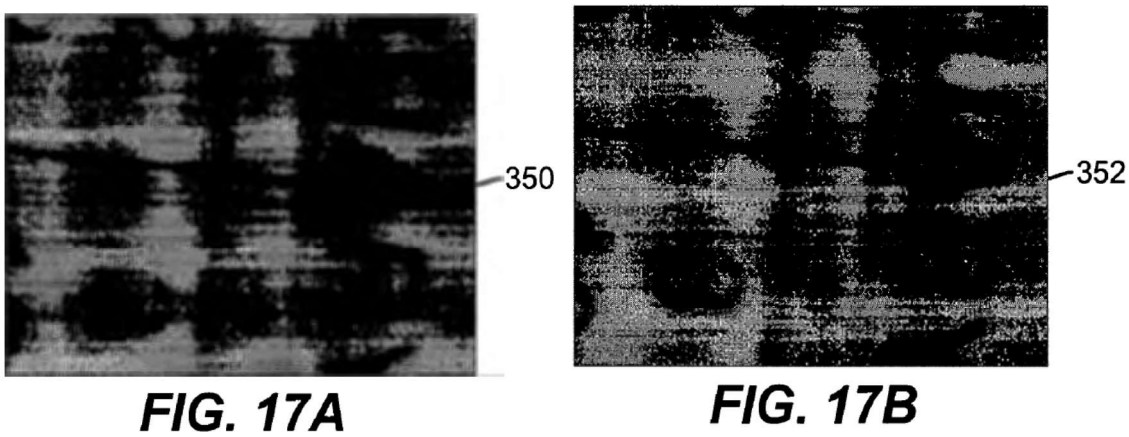


FIG. 17A FIG. 17B

Parulski, Figs. 17A, 17B.

136. Parulski further discloses that "a calibration factor is then applied to the focus detection signal to determine the distance that the focus lens must be moved to produce a best focus condition for the image capture." Parulski, [0093].

137. For example, Parulski discloses calibration curves used to "determine the movement of the focus lens needed in the capture stage [e.g., main lens] to produce [the] best focus." Parulski, [0097]. Parulski, discussing Figure 6, further discloses that "a series of image sets are captured with objects at known distances, using the shorter focal length first image capture stage and the longer focal length

second image capture stage at a series of focus lens positions," and then "the autofocus image from the lower focal length first image stage is cropped and upsampled so that corresponding features in the two autofocus images span the same number of pixels." Parulski, [0097], Fig. 6; *see also* Parulski, Fig. 4. "[T]he images from the second image capture stage are correlated to corresponding portions of the images from the cropped and upsampled image from the first image capture stage to determine the pixel offset between the images in each image set," and then "the data of pixel offset between images in each image set versus known distance to objects is stored as the autofocus rangefinder calibration curve." Parulski, [0097]. These steps are shown below in Figure 6 in boxes 300-306.

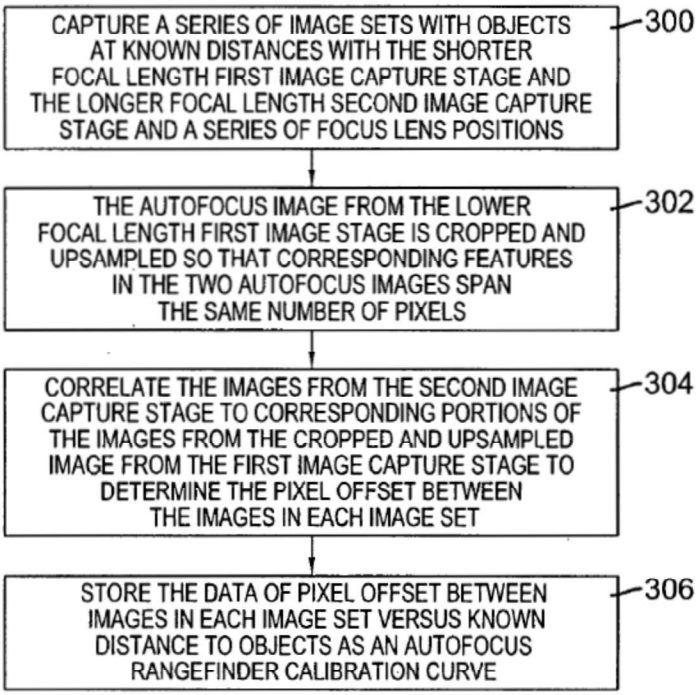


FIG. 6

Parulski, Fig. 6.

138. In my opinion, a POSITA would have recognized that this disclosure shows that Parulski uses a predetermined cutout rule, based on the pixel offset between the images and the known distance to objects in the calibration curve. *See* Parulski, [0093], Fig. 4 at 266; *see also* Parulski at [0097], [0101], Fig. 9 at 444-446. The calibration curve is then used to modify the focus of the primary image to "guide the positioning of an adjustable focus lens to produce the best image

quality." *See* Parulski, [0008]; *see also* Parulski, [0093], [0097], [0101], Fig. 4 at 266, Fig. 9 at 444-446.

139. Thus, in my opinion, Parulski discloses that "misalignment of the composite image decreases as the composite image is in focus with the subject on the basis of the amount and a predetermined cutout rule."

D. [Claim 11] "The digital camera according to claim 10, wherein the predetermined cutout rule is based on a principle of triangulation based on an interval between the main lens and the sub-lens, and distance from the digital camera to the subject on the basis of the amount."

140. Substitute claim 11 is substantively identical to original claim 5; thus, my analysis of claim 11 is substantively identical to my analysis of claim 5. Ex. 1003, ¶¶157-160. That analysis is reiterated below for convenience.

141. In my opinion, Parulski discloses or renders obvious the additional limitations of claim 11, "wherein the predetermined cutout rule is based on a principle of triangulation based on an interval between the main lens and the sub-lens, and distance from the digital camera to the subject on the basis of the amount."

142. Parulski's calibration curve for the predetermined cutout rule, discussed above for element [10ii], is based on well-known triangulation calculations described in the "Background of the Invention" section in Parulski. Parulski, [0008]. Parulski discloses that "the offset information x is used along

with the lens separation distance b and the focal length f to calculate the distance[] to the scene by triangulation." Parulski, [0008]. The interval between Parulski's main lens and the sub-lens corresponds to the separation distance b, *see* Parulski, [0007]-[0008], which is also discussed as the "[s]eparation [distance] between lenses" in Table 1. Parulski, [0105] (Table 1). Similarly, Parulski's triangulation calculation uses the distance d from the camera to the object, as explained in Parulski's equation $d=s \cdot f/(p \cdot m)$ and the "[d]istance" shown in Table 1. Parulski, [0105] & Table 1; *see also* Parulski, [0007]-[0008] (describing triangulating distance to an object using the "lens separation distance b" and the "distance d to the scene").

143. "The calculated distance d to the scene is used to guide the positioning of an adjustable focus lens to produce the best image quality." Parulski, [0008]; *see also* Parulski, [0105]. This triangulated distance calculation is used to prepare the "autofocus rangefinder calibration curve," for example, in block 266 (**yellow**) of Figure 4 with respect to a "rangefinder module" or a "rangefinder-based autofocus system[]." *See* Parulski, [0008]-[0009], [0097].

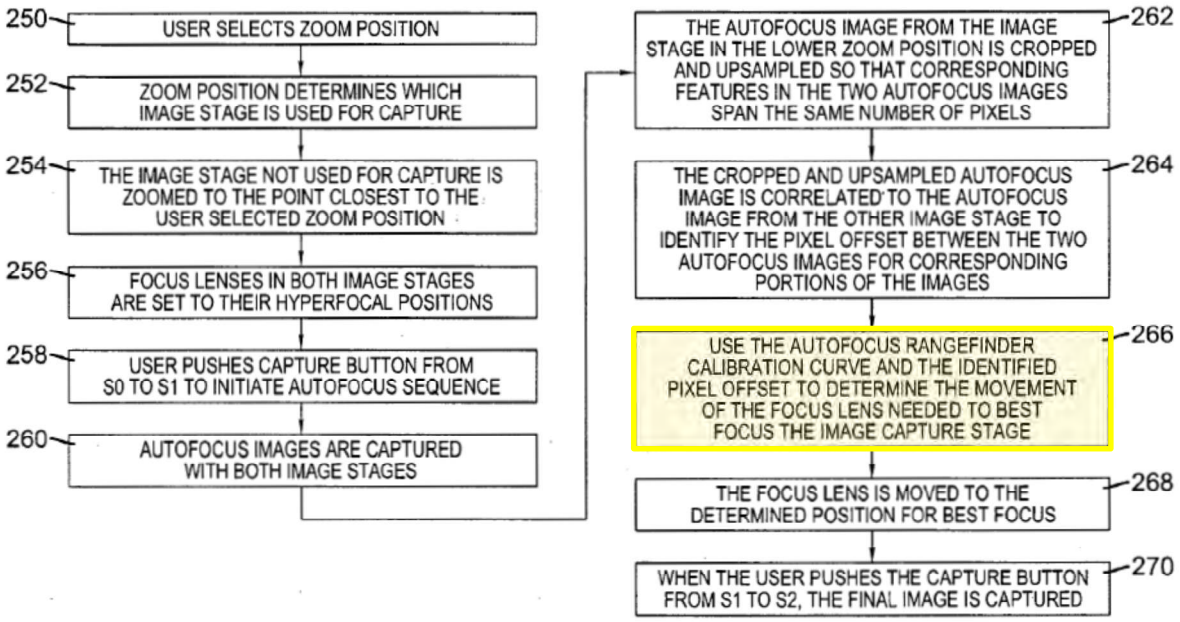


FIG. 4

Parulski, Fig. 4 (annotated).

144. Thus, in my opinion, Parulski discloses that "the predetermined cutout rule is based on a principle of triangulation based on an interval between the main lens and the sub-lens, and distance from the digital camera to the subject on the basis of the amount."

E. [Claim 12] "The digital camera according to claim 7, wherein the main image of the object is captured from a different angle from the sub-image of the subject."

145. Substitute claim 12 is substantively identical to original claim 6; thus, my analysis of claim 12 is substantively identical to my analysis of claim 6. Ex. 1003, ¶¶161-165. That analysis is reiterated below for convenience.

146. In my opinion, Parulski discloses the additional limitations of claim 12, "wherein the main image of the object is captured from a different angle from the sub-image of the subject."

147. For example, Parulski explains that "the two lenses" of the first image system (main lens) capturing the main image and the second image system (sub-lens) capturing the sub-image "have different focal lengths" and "different magnifications," which, in my opinion, a POSITA would have understood describes different fields of view. Parulski, [0066]. These different fields of view represent different angles being captured by each lens because field of view is related to the focal length and magnification of the lens. Parulski, [0066].[7]

148. Parulski confirms this, explaining that the first image lens 3 and the second image lens 4 "typically" have "different fields of view." Parulski, [0077]. Because the field of view describes the viewing angle of the lens, in my opinion, a POSITA would have known that two lenses with different fields of view would have different viewing angles for the main image (taken by the first image lens) and the sub-image (taken by the second image lens). For example, Parulski explains that an image lens may be a "wide angle" lens having a fixed field of view

[7] The '638 patent recognizes this basic principle of optical systems, stating that "the angle of view changes when the focal length … changes." Ex. 1001, 6:31-37.

angle or a zoom lens where the user can "set a desired field of view" (angle) for the lens, which describes the main lens and sub-lens capturing the object of the image from different angles. Parulski, [0087]; *see also* Ex. 1001, 5:20-34, 6:9-13.

149. I have also been asked to consider the situation in which the "different angle" means a different viewing angle from each lens to the object being captured, and, in my opinion, Parulski discloses this interpretation. Parulski teaches that the first image lens and the second image lens are separated by a "separation distance b," which, along with the difference in focal length, leads to an offset between the main image and the sub-image that permits triangulation to be used to determine the distance to the object. Parulski, [0008], [0105]; *see also* Parulski, [0067] (discussing using "a larger separation distance between the two lenses" to determine the distance to the object being photographed). This offset corresponds to each of the lenses having a slightly different angle between the lens and the object being captured.

150. Thus, in my opinion, Parulski discloses claim 12.

XII. Ground 2: Parulski and Johnson Render Obvious Substitute Claims 7, 8, and 10-12.

A. Independent Claim 7

151. As discussed above in Ground 1, it remains my opinion that Parulski discloses or renders obvious substitute claim elements [7Preamble]-[7d], [7e(i)[3]], [7e(ii)], and [7f]-[7g].

152. I have also been asked to consider whether Johnson discloses and renders obvious a composite image generating unit configured to determine a cutout region in the sub-image, cut out a partial image from the cutout region, and generate a composite image by superimposing the partial image on the main image, as recited in substitute claim elements [7e(i)[1]], [7e(i)[2]], and [7e(i)[4]]. In my opinion, Johnson does.

153. Johnson discloses a "digital camera" including an "image processing unit" (e.g., composite image generating unit) for "identif[ying] regions of difference between … two images," for example, "that eyes are partially or fully closed in one of the two images," and "creat[ing] a single composite image from the two original images" that "blend[s] the two images together to create a third preferred image as the final image." Johnson, Abstract, 1:51-61, 3:26-34, 4:19-22, Figs. 3-4. Johnson's image processing unit utilizes an "algorithm" to determine a "preferred region[]" (cutout region) in a "source" image (sub-image), such as a first image 24, and cuts out a partial image from the cutout region that is then "blended into" another image to create single, composite image. Johnson, 3:15-18, 3:26-50, Figs. 3-4. Figure 3 shows these "image processing steps," including generating a composite image by blending a preferred region from source image 1 into main image 2.

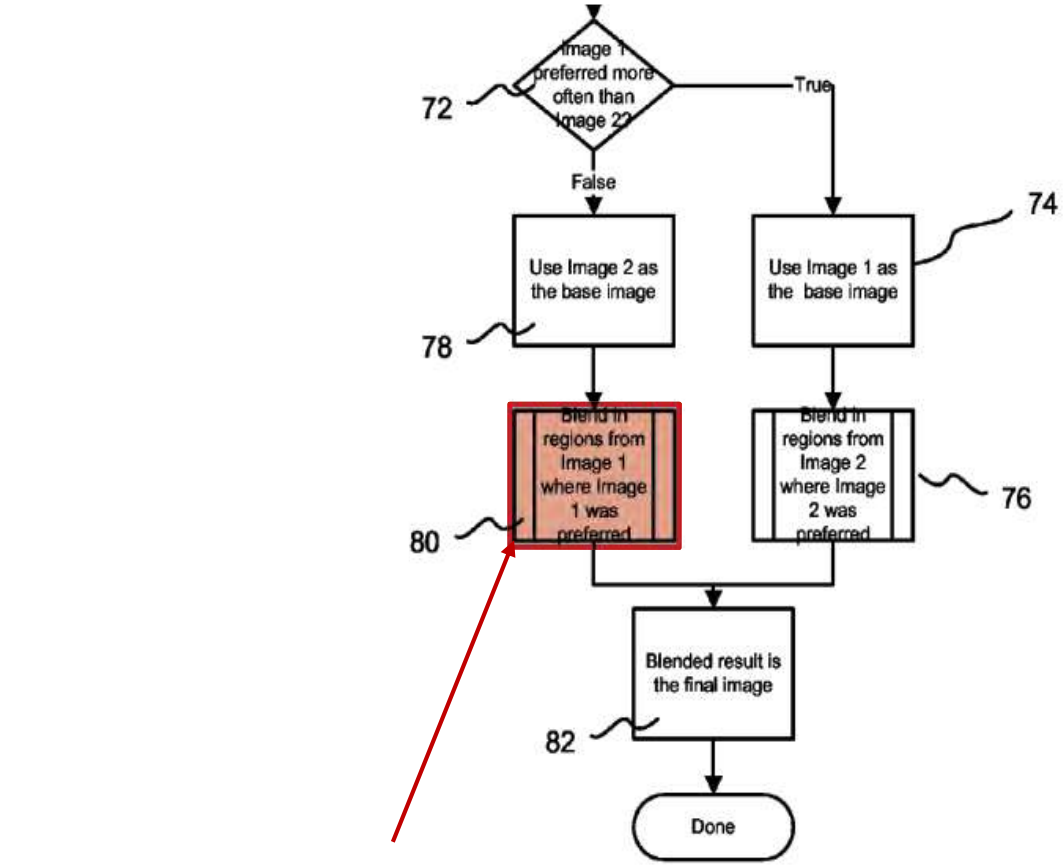


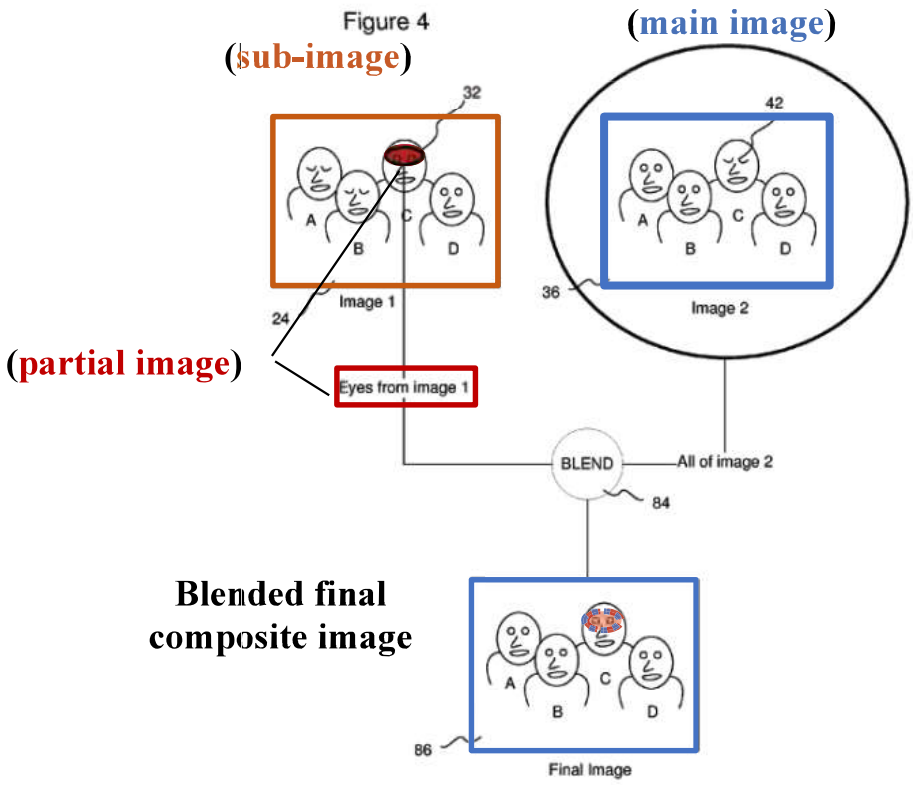
Figure 3

Johnson, Fig. 3 (annotated, excerpted),

154. In one example, the algorithm "identif[ies] regions of significant difference between the first image 24 and the second image 36" based on a "correlation" operation (e.g., "face and/or eye recognition processing") to determine that a person/subject 32's eyes are open in the first image 24, but closed in the second image 36. Johnson, 1:51-53, 3:26-34, 3:46-50, 4:19-22, Figs. 3-4. Because open eyes are preferable to closed eyes, Johnson's algorithm "chooses the

first image as the source for the … two regions (two eyes of Subject C 32)" to be incorporated in the second image ("base image"). Johnson, 3:37-45, Figs. 3-4. That is, Johnson's algorithm determines a cutout region in the "preferred image" (sub-image) and cuts out a partial image (e.g., subject 32's eyes) from the image cutout region, to incorporate and "blend[]" the partial image into the "base image" (main image). Johnson, 3:37-45.

155. Johnson's algorithm also generates a composite image by superimposing because it "blend[s] into the base image to create the blended [composite] final image 82." Johnson, 3:40-50 ("The region of each eye from Subject C 32 is blended 84 into the content of the second image 36, which effectively replaces the closed eyes of Subject C 42, creating a single final image 86 where all subjects have open eyes."). Figure 4 illustrates "blend[ing]" (superimposing) an eye region (partial image) of "image 1" (sub-image) with the corresponding eye region in "image 2" (main image) to generate a "final image" (composite image) having "elements of both images" (characteristics of both images). Johnson, 1:59-61, 3:46-50, Fig. 4.



Johnson, Fig. 4 (annotated).

1. Motivation to Combine Parulski and Johnson

156. In my opinion, a POSITA would have been motivated to implement Johnson's portion correlation, cutting, and blending techniques in Parulski's composite image generating unit.

157. Johnson explains that "blend[ing]" (superimposing) a desired region (cut partial image) of image 1 (sub-image) into image 2 (main image) "provide[s] an optimal result." Johnson, 3:46-53, 5:27-57 (enumerating various advantages of the disclosed processing algorithm). A POSITA would have been motivated to implement Johnson's portion correlation, cutting, and blending techniques because

a POSITA would have recognized that Johnson's solution to blend a preferred cut out portion of a sub-image into a correlated portion of the main image aligns with Parulski's goal of replacing the non-preferred blurred or washed out/obscured portions of a main image with the preferred sharp image or detail-visible portions of a sub-image, and would have understood that modifying Parulski to implement Johnson's cutout and blending processes would have furthered Parulski's to obtain an enhanced image to provide an "optimal result." Parulski, [0031], [0071], [0107]-[0109], [0140], [0145]; Johnson, 3:51-53.

158. Further, a POSITA would have known that the portion correlation, cutting, and blending disclosed in Johnson were common, conventional techniques used when combining images. *See, e.g.*, Cazier, [0045], [0059], [0060] (describing a "selection module" for "identify[ing] a portion of an image to be manipulated via a swap function or other editing function"). Thus, a POSITA would have also been motivated to implement Johnson's teachings, as described above, because they were well-known techniques used in image editing, image processing, and composite image generation, and thus represents a known technique in the art that would have yielded predictable results. Cazier, [0045], [0059], [0060].

159. Similarly, because blending was a conventional technique in the prior art for combining two images, in my opinion, a POSITA would have recognized that it was a known, predictable solution that would have had a reasonable

expectation of success to combine Parulski's main image and sub-image into a composite image and, therefore, would have been obvious to try as a method of combining the main image and the partial image.

2. Expected Success in Combining Johnson and Parulski

160. In my opinion, a POSITA would have had a reasonable expectation of success in using Johnson's portion correlation, cutting, and blending techniques to combine Parulski's partial and main images because it would have merely involved incorporating a known image blending technique that was known to be used with digital camera images and was well within the POSITA's skill to incorporate.

161. Johnson, like Parulski, generates composite images using elements of both a primary and secondary image. *Compare* Johnson, Abstract, Fig. 4, *with* Parulski, [0031], [0140], [0145], claims 11, 40; *see also* Ex. 1001, 1:47-50. And Johnson's image processing, like Parulski, is implemented using software (e.g., algorithm), which would have required only routine skill to integrate. *Compare* Johnson, 1:13-15, 1:51-61, 3:14-34, Fig. 3, *with* Parulski, [0063]; *see also* Szczuka [0099] ("algorithms may … be employed to merge or *superimpose*[] the images onto each other … such that the superimposed images together enhance the contrast of the image" (emphasis added)).

162. Thus, it is my opinion that a POSITA would have found combining Parulski and Johnson to generate a composite image by superimposing a selected

cutout region from a sub-image onto a main image to be a straightforward application of known, conventional software operations used according to their known functions to yield predictable results. *See* Parulski, [0063] (software implementation was "conventional and within the ordinary skill in such arts"); Szczuka, [0106] (using computer program software for superimposition).

163. Thus, in my opinion, Parulski in combination with Johnson renders obvious a composite image generating unit configured to determine a cutout region in the sub-image, cut out a partial image from the cutout region, and generate a composite image by superimposing the partial image on the main image, as recited in substitute claim elements [7e(i)[1]], [7e(i)[2]], and [7e(i)[4]].

B. Claims 8 and 10-12

164. As discussed above for Ground 1, Parulski discloses or renders obvious the additional limitations of claims 8 and 10-12. Incorporating Johnson does not alter my analysis or opinion.

XIII. Ground 3: Parulski, Johnson, and Safonov Render Obvious Substitute Claims 7, 8, and 10-12.

A. Independent Claim 7

165. As discussed above in Ground 1, it remains my opinion that Parulski discloses or renders obvious substitute claim elements [7Preamble]-[7d], [7e(i)[3]], [7e(ii)], and [7f]-[7g].

166. I have also been asked to consider whether Safonov renders obvious substitute claim element [7e(i)[4]] ("generate a composite image by superimposing the partial image on the main image") if it is interpreted to require alpha blending per se, and Johnson is found not to render this element obvious. In my opinion, Safonov renders obvious generating a composite image by superimposing the partial image on the main image using alpha blending per se, for each of the reasons I provide in Ground 1.

167. A POSITA would have, in my opinion, found it obvious to combine Parulski, Johnson, and Safonov, as explained in Grounds 1 and 2 and further explained below.

1. Motivation to Combine Parulski, Johnson, and Safonov

168. In my opinion, a POSITA would have been motivated to use Safonov's well-known alpha-blending technique as the "blend[ing]" for combining image portions in the Parulski-Johnson combination because alpha blending would have allowed the partial image (in the Parulski-Johnson combination) to be more seamlessly integrated into the main image and minimized or mitigated the visual transition between the superimposed portion and the main image. *See* Yadav, [0003]; *see supra* Grounds 1, 2. A POSITA also would have been motivated to utilize alpha blending because it was a well-known technique used to edit, process,

and combine images, and thus represents a known technique in the art that would have yielded predictable results. Yadav, [0003]; *see supra* Grounds 1, 2.

2. Expected Success in Combining Parulski, Johnson, and Safonov

169. In my opinion, a POSITA would have had a reasonable expectation of success in using Safonov's alpha blending as the "blend[ing]" in the Parulski-Johnson combination because it would have merely involved incorporating a known image blending technique used when combining multiple digital camera images, and was well within the POSITA's skill to incorporate, as I explain in Grounds 1 and 2.

170. Thus, in my opinion, Parulski in combination with Johnson and Safonov renders obvious a composite image generating unit configured to determine a cutout region in the sub-image, cut out a partial image from the cutout region, and generate a composite image by superimposing the partial image on the main image, as recited in substitute claim elements [7e(i)[1]], [7e(i)[2]], and [7e(i)[4]].

B. Claims 8 and 10-12

171. As discussed above for Ground 1, Parulski discloses or renders obvious the additional limitations of claims 8 and 10-12. Incorporating Johnson and Safonov does not alter my analysis or opinion.

XIV. Ground 4: Parulski and Hoshino Render Obvious Substitute Claims 7, 8, and 10-12.

A. Independent Claim 7

172. As discussed above in Ground 1, it remains my opinion that Parulski discloses or renders obvious substitute claim elements [7Preamble]-[7d], [7e(i)[3]], [7e(ii)], and [7f]-[7g].

173. I have also been asked to consider whether Hoshino discloses and renders obvious a composite image generating unit configured to determine a cutout region in the sub-image, cut out a partial image from the cutout region, and generate a composite image by superimposing the partial image on the main image, as recited in substitute claim elements [7e(i)[1]], [7e(i)[2]], and [7e(i)[4]], particularly if substitute claim element [7e(i)[4]] is interpreted to require alpha blending per se. In my opinion, Hoshino does.

174. Hoshino discloses a "camera device" including an "image processing subunit" (composite image generating unit) that "extracts [a] subject image D [(cut out a partial image)] from [a] subject-background picture E1 based on the difference information" and "combines the subject image D" with a "background image P1" (main image). Hoshino, [0021], [0035], [0037], [0039], [0040], [0118], Figs. 2, 4. When combining, "the subject image D is superimposed on the background image P1" and "the subject image D is alpha blended with [the] predetermined background." Hoshino, [0035], [0037], [0039], [0040], [0118],

Figs. 2, 4. Figure 2 illustrates a "process for extracting" ("cutting out a subject image from a subject-background image") (determining a cut out region in the sub-image), for example, by "generat[ing] difference information between each pair of corresponding pixels of the coordinated subject-background image E1 and background-only image E2." Hoshino, [0011], [0061], [0037], [0068]-[0076] (describing the difference information determination), Fig. 2. Figures 6A and 7C below illustrate the determined and extracted cutout region, "subject image D." Hoshino, [0026]-[0027], Figs. 6A, 7C.

FIG.6A

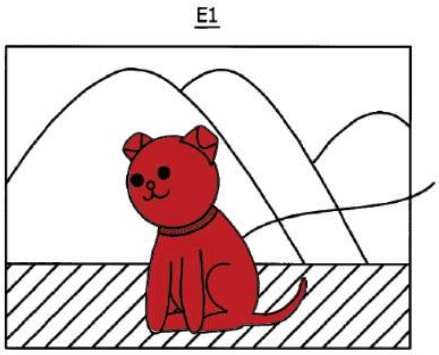
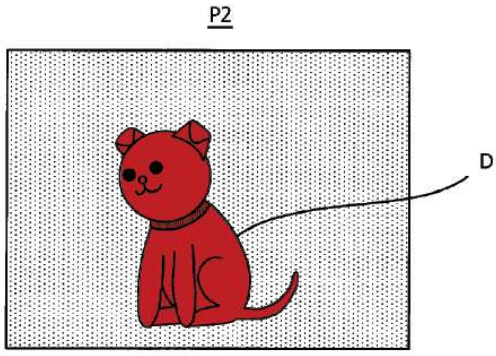


FIG.7C

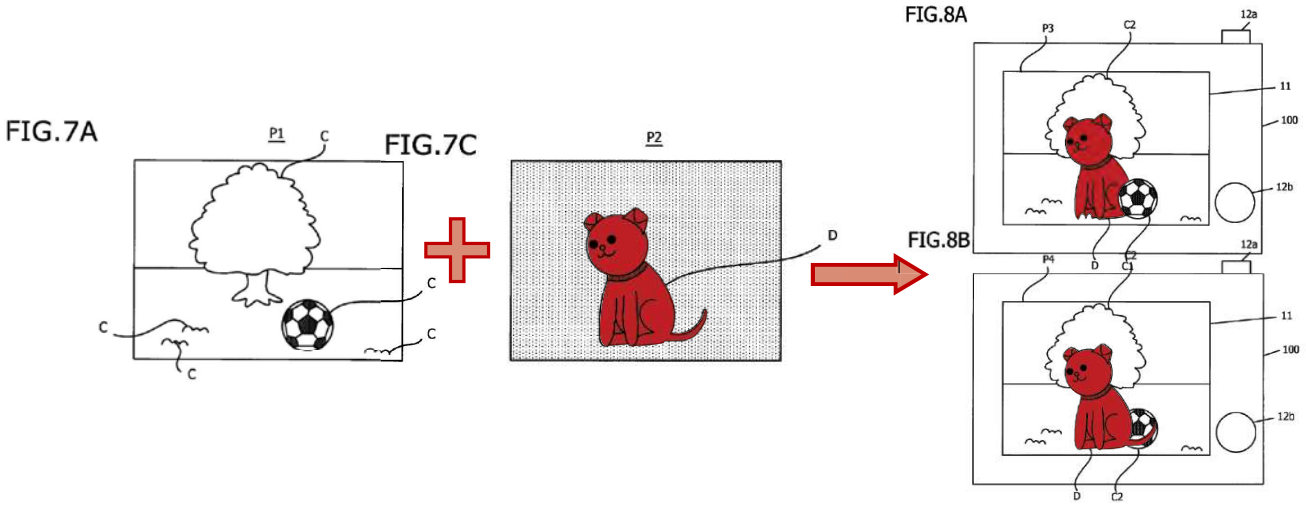


Hoshino, Figs. 6A, 7C (annotated).

175. Hoshino then generates "combined image[s] P3" and "P4"[8] by "superimpos[ing]" the extracted subject image D (cutout partial image) on a "background image P1" (main image). Hoshino, [0011], [0016]-[0017], [0100],

[8] Superimposing and alpha blending subject image D with the background to create either of combined images P3 and P4 is sufficient to render claim 7 obvious.

[0118], Figs. 7A-8B; *see also* Hoshino, Fig. 4 (describing combined image producing process). Specifically, subject image D is "alpha blend[ed]" and superimposed on the background image. *See, e.g.*, Hoshino, [0048]-[0052], [0086]-[0104], [0115]-[0118], Figs. 4, 7A-8B; *see also* Hoshino, [0038].



Hoshino, Figs. 7A, 7C, 8A-8B (annotated).

176. Thus, it is also my opinion that Hoshino discloses a composite image generating unit configured to determine a cutout region in the sub-image, cut out a partial image from the cutout region, and generate a composite image by superimposing the partial image on the main image, as recited in substitute claim elements [7e(i)[1]], [7e(i)[2]], and [7e(i)[4]], even if superimposition is interpreted to require alpha blending per se.

1. Motivation to Combine Parulski and Hoshino

177. In my opinion, a POSITA would have been motivated to implement Hoshino's correlating, extracting (cutting), and alpha blending techniques. Hoshino

explains that the "mere combin[ing] of the subject image and the background image might produce an unnatural image," and discloses techniques to produce better combined images. Hoshino, [0005]-[0006], [0103]-[0104]. A POSITA would have been motivated and found it obvious to use Hoshino's correlation, cutting, and superimposition (e.g., alpha blending) processes as part of Parulski's replacing a portion of the main image with the extracted sub-image portion for the same reasons I articulate in Grounds 2 and 3, and to produce a more natural looking combined image. Hoshino, [0005]-[0006], [0103]-[0104], Figs. 2, 4.

2. Expected Success in Combining Parulski and Hoshino

178. In my opinion, a POSITA would have also had a reasonable expectation of success in executing Hoshino's correlation, cutting, and superimposition in Parulski because Hoshino, like Parulski, is directed to generating composite images using elements of a primary and secondary image. *Compare* Hoshino [0005]-[0007], Fig. 4, *with* Parulski, [0063]; *see also* Ex. 1001, 1:47-50. Hoshino, like Parulski, implements its image processing using a computer program, which would have required only routine skill to integrate. *Compare* Parulski, [0063], *with* Hoshino, [0008]; *see also* Szczuka, [0099], [0106]. Thus, generating a composite image by superimposing a selected cutout region from a sub-image onto a main image would have been a straightforward application of

known, conventional software operations used according to their known functions to yield predictable results. Parulski, [0063].

179. Accordingly, it is my opinion that Parulski in combination with Hoshino also renders obvious a composite image generating unit configured to determine a cutout region in the sub-image, cut out a partial image from the cutout region, and generate a composite image by superimposing the partial image on the main image, as recited in substitute claim elements [7e(i)[1]], [7e(i)[2]], and [7e(i)[4]].

B. Claims 8 and 10-12

180. As discussed above for Ground 1, Parulski discloses or renders obvious the additional limitations of claims 8 and 10-12. Incorporating Hoshino does not alter my analysis or opinion.

XV. Conclusion

181. For the reasons set forth in Sections XI-XIV, it is my opinion that one skilled in the art would have found claims 7, 8, and 10-12 of the '638 patent obvious.

182. In signing this declaration, I understand that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I acknowledge that I may be subject to cross-examination in this case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

183. I declare that all statements made herein of my knowledge are true, and that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Date: June 15, 2025

Respectfully submitted,



Robert Stevenson, Ph.D.