

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ARASHI VISION (U.S.) LLC (D/B/A INSTA360),
Petitioner,

v.

GOPRO, INC.,
Patent Owner.

Patent No. 11,336,832

Inter Partes Review No. IPR2024-01052

SECOND DECLARATION OF DR. AGGELOS KATSAGGELOS

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I, Aggelos Katsaggelos, make this declaration in connection with the proceeding identified above.¹

I. INTRODUCTION

1. I am a professor at Northwestern University, holder of the Joseph Cummings chair, in the Department of Electrical and Computer Engineering and by courtesy Computer Science and Radiology. I am also the Director of the AI in Multimedia Image and Video Processing Lab (AIM-IVPL) and the Deputy Director of the Computation Center for Computational Imaging and Signal Analytics in Medicine. I described my qualifications in detail in my opening declaration dated June 20, 2024, which I understand is Exhibit 1002 to this proceeding. A copy of my *curriculum vitae* was provided in the Exhibit 1002 as Appendix A. I have been retained by counsel for Arashi Vision (U.S.) LLC (d/b/a Insta360) (“Petitioner” or “Insta360”) as a technical expert in connection with the proceeding identified above. I described my qualifications in detail in my opening declaration dated June 20, 2024, which I understand is Exhibit 1002 to this proceeding. A copy of my *curriculum vitae* was provided in the Exhibit 1002 as Appendix A.

¹ Unless otherwise noted, emphases in bold are added.

2. I submit this supplemental declaration in support of Insta360's Petition for *Inter Partes* Review of United States Patent No. 11,336,832 ("the '832 patent") (Ex. 1001.) I have been asked to consider GoPro's Patent Owner Response (Paper 24) and the Declaration of Dr. Foroosh (Ex. 2021) and provide rebuttal opinions regarding the same. In performing my analysis in this proceeding, I have considered the '832 patent (Ex. 1001), its prosecution history, materials cited and discussed in GoPro's Patent Owner Response and the Declaration of Dr. Foroosh, and materials cited in this declaration. I also reviewed the transcript of the deposition of Dr. Foroosh on July 1, 2025.

3. I am being compensated for my time at my standard consulting rate. I am also being reimbursed for expenses that I incur during my work. My compensation does not depend on the results of my study and analysis, the substance of my opinions, or the outcome of any proceeding involving the Challenged Claims. I have no financial interest in the outcome of this matter or in any litigation involving the '832 patent.

4. I have personal knowledge of the facts and opinions set forth in this declaration and believe them to be true. If called upon to do so, I would testify competently thereto. I have been warned that willful false statements and the like are punishable by fine or imprisonment, or both.

5. Although I am not a lawyer and will not provide any legal opinions, I have been advised to apply certain legal standards in forming my opinions. I set forth my understanding of those legal standards in my opening declaration. (*See* Ex. 1002 (Jun. 20, 2024, Katsaggelos Decl.), ¶¶ 26-28.)

II. REBUTTAL OPINIONS

6. I understand that GoPro and Dr. Foroosh have argued that the prior art does not disclose certain limitations claimed in the '832 patent under their narrow interpretations of several claim elements. I offer the following opinions in response.

A. CLAIM CONSTRUCTION

7. I have reviewed the Board's discussion of claim construction in its Institution Decision (Paper 10 ("DI")). The Board construed claim 1's "determin[ing] a viewing window for the visual content as a function of progress through the progress length" as "requiring determining a viewing window for different times of the video." (ID, 21.) I agree with the Board's construction.

8. Dr. Foroosh interpreted many claim terms in a much narrower manner than their ordinary and customary meaning in light of the specification. I address each of these claim terms below.

1. “the horizon-leveled visual content including a punchout of the extents of the visual content defined by the viewing window” (claims 1, 11)

9. I understand that GoPro and Dr. Foroosh have argued that the word “including” in the limitation “the horizon-leveled visual content including a punchout of the extents of the visual content defined by the viewing window” means “*equating*.” (See Paper 24 (“POR”), 57-59.) GoPro states that “[t]he ‘extents’ of visual content defined by the viewing window must *equate* to the horizon-leveled visual content.” (POR, 58.)

10. I disagree that the word “include” means “equate” to a POSITA. If Item X and Item Y equate, they are identical. If Item X includes Item Y, Item Y only needs to be a part of Item X. I note that the claims consistently require that the horizon-leveled visual content *include* the visual content defined by the viewing window: “the viewing window defining extents of the visual content to be *included* within horizon-leveled visual content”; “the horizon-leveled visual content *including* a punchout of the extents of the visual content defined by the viewing window”; “*inclusion* of the extents of the visual content defined by the viewing window within the horizon-leveled visual content effectuates horizon leveling of the visual content.” (Ex. 1001, claims 1 and 11.)

11. I note that none of GoPro’s citations on page 58 of the Patent Owner Response mentions the concept of “equate.” GoPro points to the Petitioner’s claim

construction of “punchout” in the ITC proceeding (Ex. 2027, 8) that the term means “a cropped portion of the visual content defined by the viewing window.” (POR, 58-59.) But this construction does not mean that the “horizon-leveled visual content” exclusively contains the visual content defined by the viewing window. Even Dr. Foroosh’s definition of “viewing window” – a window for defining the extent of content that will ultimately be processed and available for viewing – does not preclude something else to also be available for viewing. (Ex. 2021, 142.)

2. “the visual content” (all claims)

12. I understand that GoPro and Dr. Foroosh have argued that “the visual content” means “the original visual content” that has not been horizon-leveled. (See POR, 17.) I also understand that GoPro and Dr. Foroosh have argued for a narrow construction in claim 3—i.e., a distortion must exist in the original visual content *and* “remain” the same in the image after horizon-leveling. (*Id.*)

13. A POSITA would understand that “the visual content” means what it says – that is, the graphical information. Dr. Foroosh offered a similarly broad interpretation of the term during his deposition: “viewable aspects that you see” and “what are viewable within an image.” (Ex. 1018, 101:20-102:10.) By itself, the term does not specify *when* the information is obtained and *where* it is stored; it must be understood in the context of the entire claim language. Dr. Foroosh

agreed that the claim term does not necessarily mean a specific file. (Ex. 1018, 103:15-104:4.)

14. A POSITA reading the claim language would understand that “the visual content” may be part of “the video content” or part of “the horizon-leveled visual content.” Claim 1 is reproduced below in its entirety:

15. A system for horizon leveling videos, the system comprising:
one or more physical processors configured by machine-readable
instructions to:

obtain video information defining a video, the video
including video content captured by an image capture device
during a capture duration, the video content having a progress
length, the *video content* including *visual content* captured at
different moments within the capture duration, the visual content
viewable as a function of progress through the progress length,
the visual content having a field of view;

obtain rotational position information for the video, the
rotational position information characterizing rotational
positions of the image capture device as a function of progress
through the capture duration;

determine a viewing window for the visual content as a function of progress through the progress length based on the rotational positions of the image capture device as the function of progress through the capture duration, the viewing window defining extents of *the visual content* to be **included** within *horizon-leveled visual content* as the function of progress through the progress length, wherein determination of the viewing window includes determination of a placement of the viewing window within the field of view of the visual content as the function of progress through the progress length based on the rotational positions of the image capture device as the function of progress through the capture duration; and

generate the horizon-leveled visual content based on the viewing window, the *horizon-leveled visual content* **including** a punchout of the extents of *the visual content* defined by the viewing window, wherein **inclusion** of the extents of *the visual content* defined by the viewing window within the *horizon-leveled visual content* effectuates horizon leveling of the visual content.

16. A POSITA would understand that the claim language shows that “the visual content” refers to the graphical information. It does not mean an original file before horizon-leveling. For example, the same pixels in the original video file also exist (albeit rotated) in the horizon-leveled video file.

17. Dr. Foroosh testified that the term “may not” be a file. (Ex. 1018, 104:3-4.) He agreed that “the horizon-leveled visual content includes some portion of the visual content”, stating that “the last step of Claim 1 [] connects the visual content [] to both viewing window and horizon-leveled visual content.” (Ex. 1018, 105:20-106:22.)

18. With the plain meaning of “the visual content,” a POSITA would understand that “the visual content includes a distortion” in claim 3 means either the “video content” or the “horizon-leveled visual content” includes a distortion. A POSITA also would understand that “the visual content includes the distortion based on application of the distortion to non-distorted visual content” in claim 6 means that either the “video content” or the “horizon-leveled visual content” includes application of the distortion to non-distorted visual content.

19. The ’832 specification is clear that a distortion can be added to “horizon-leveled content.” According to the specification, “[t]he horizon-leveled visual content may include an off-axis horizon based on imperfect horizon leveling of the visual content. For example, the amount of rotation performed on the visual

content may be inaccurate and/or imprecise, and *the horizon leveling of the visual content may be imperfect*. An *off-axis horizon may be less noticeable within visual content that includes a distortion* than within visual content that does not include the distortion.” (Ex. 1001, 21:54-62; *see also* 21:52-54; 22:49-23:3.)

The ’832 specification even teaches “an indirect transformation that *removes the existing distortion and then applies the desired distortion*.” (Ex. 1001, 23:1-3.)

Thus, a POSITA would understand that the “horizon-leveled visual content” includes application of the distortion to non-distorted visual content.

20. Importantly, to effectively perform horizon leveling, a POSITA would understand that it makes sense to first perform horizon-leveling and *then add distortion to fix any imperfect horizon leveling*. This ensures more accurate control of the effect of distortion (i.e., to reduce the impact of the off-axis horizon in the imperfectly horizon-leveled image). It makes no sense to correct imperfect horizon leveling before horizon leveling is even performed. Doing so may lead to under-correction or over-correction because the issue to be corrected has not even materialized.

3. “simulate changes in zoom” (claims 8, 18)

21. I understand that GoPro and Dr. Foroosh have argued that “simulate changes in zoom” means implement a “smoothed zoom curve.” (*See* POR, 34.) I understand the Board has previously rejected GoPro’s attempt to limit claim 1 to

the “smoothed zoom curve” embodiment. (DI, 19, 20.) I disagree that the word “simulate” means artificially zooming implemented using a “smoothed zoom curve.” (POR, 34.)

22. The claims do not restrict the changes in zoom to be “smoothed” or otherwise. They just recite “simulate changes in zoom.” (Ex. 1001, claims 8 and 18.)

23. The ’832 specification describes many types of zoom that may be simulated. For example, it describes “*simulating a constant zoom*” and “*simulating . . . a zoom with pronounced (e.g., rapid. Jittery) changes*”. (Ex. 1001, 19:12-15.) Thus, the term “simulate” is not limited to a “smoothed” zoom. For example, the ’832 patent specification also provides examples of zoom “simulation” in FIGs. 6A and 6B, which has to do with the changing size of the viewing window and nothing to do with a “smoothed zoom curve.” (Ex. 1001, FIGs. 6A-B.)

24. A POSITA would understand the plain meaning of “simulate.” The Cambridge Dictionary defines “simulate” as “to do or make something that looks real but is not real.” (Ex. 1020, 1.) In the ’832 specification, the word is used to refer to the concept that zoom is not achieved by receiving a user input (e.g., a “zoom button/switch/dial” to change the zoom level), but instead achieved automatically by rotation of the camera. (Ex. 1001, 12:2-31, 12:47-59.)

**4. “determination of a location of the viewing window”
(claims 10, 20)**

25. I understand that GoPro and Dr. Foroosh have argued that “determination of a location of the viewing window” to mean determination of an “x-y coordinate” that must “change” across frames. (*See* POR, 35-36.)

26. I disagree with this narrow interpretation. Construing “location” as a point is inconsistent with the rest of the claim, which recites that “the location of the viewing window within the field of view of the visual content determining *framing* of the visual content.” A POSITA would understand that a point, by itself, cannot determine “framing” of visual content. Only an *area* of the viewing window can determine the framing.

27. A POSITA reading the claims would understand that the claims require that the location of the viewing window to be *determined* but say nothing about whether it has to *change*. The claims also have no requirement that the location must change across frames.

28. The Board’s construction, namely that the “function of progress” language in claim 1 requires “determining a viewing window *for different times of the video*,” does not require the viewing window to change. The Board’s construction speaks to *when* the determination of the viewing window is made, not the *necessary result* of the determination.

29. Dr. Foroosh mischaracterizes the Board’s construction, alleging that “the Board also construed ‘determining a viewing window as a function of progress’ to *require some change*.” (Ex. 2021, 44.) But the Board never construed the claim term to require change. Dr. Foroosh points to my testimony that “[i]t is just to be based on some algorithmic logic where this window is placed.” (*Id.*) Again, algorithmic logic does not necessarily mean change. As an example, a system can algorithmically determine the location of the viewing window for each frame in a video at the same location (e.g., at the center of the frame) or different locations.

30. During the deposition, Dr. Foroosh acknowledged that the Board’s construction does not state or require “change.” He testified that “I don’t think the board expressed an opinion on that change either way” and that “I do not think board expressed any opinion on the change aspect one way or the other.” (Ex. 1018, 68:4-69:3.) For example, he testified:

. . . it doesn’t mean that either way -- it means both of them. So, the claim language is -- you know Claim 10, in a sense is broader.

It meets both cases. [[[W]hether it changes or not, it meets it.

[B]ut changing is there also. That’s what I’m saying.

(Ex. 1018, 78:15-79:2.)

31. Indeed, I note that FIG. 5C of the '832 patent confirms that the viewing window's center point does not change. Dr. Foroosh agreed that “[window 510] appears to be at the center of that Box 534.” (Ex. 1018, 58:20-25.) Even if “location” is construed to mean the x-y coordinates of the center point of the viewing window, the '832 specification does not disclose that it has to change.

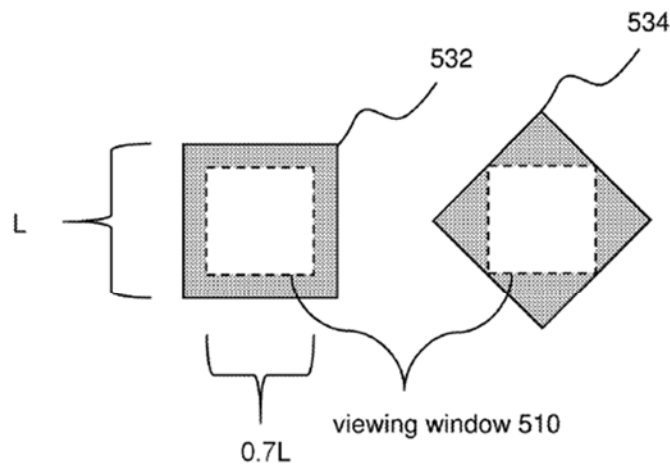


FIG. 5C

32. I also note that the “function of progress” language in claim 1 is not even in claims 10 and 20. A comparison between claim 10 and another dependent claim 7 shows that “as the function of progress” is deliberately omitted from claim 10.

- Claim 7: “the determination of the viewing window further includes *determination of a size of the viewing*

window as the function of progress through the progress length . . .”

- Claim 10: “wherein the determination of the placement of the viewing window within the field of view of the visual content includes *determination of a location of the viewing window* within the field of view of the visual content . . .”

33. Thus, the “function of progress” language is tied to the determination of the viewing window in claim 1, but not to the determination of the location specifically. Even under GoPro’s narrow construction, the claims would only require the viewing window change as a whole, but there is no requirement that *all attributes* of the viewing window, including the location, must change.

34. There are two briefly discussed embodiments in the ’832 patent relating to “simulating panning” and “content detection.” (Ex. 1001, 20:23-65.) Dr. Foroosh alleges that “framing refers to drawing the viewer’s attention to certain elements within the image.” (Ex. 2021, ¶ 99.) This definition goes well beyond the plain meaning of “framing” as understood by a POSITA. “Framing” can draw the viewer’s attention to the visual content that is in the frame, but it does not necessarily involve content detection/focusing. Limiting the meaning of the word “framing” to require content detection/focusing or panning is far-fetched.

Nothing in the claim language mentions or implies that the claim must be limited to these specific features in the '832 patent.

**B. GROUND 1: CLAIMS 1, 2, 7-12, 17-20 ARE OBVIOUS
OVER THOMASON AND PACURARIU**

**1. The Thomason-Pacurariu system teaches horizon-
leveling multiple frames in a video (all claims).**

35. I understand that GoPro and Dr. Foroosh have argued that Thomason does not teach that collecting rotational position information for “different frames of a video” or determining a viewing window for “multiple video frames.” (POR, 41.)

36. As an initial matter, this is already taught by the secondary reference Pacurariu, which is included in the Petitioner’s proposed combination. Pacurariu explicitly teaches – and GoPro does not dispute – that rotational position information is obtained “for each video frame.” (Ex. 1005, FIG. 6.) As shown in FIG. 7, Pacurariu is clear that each video frame is selected and horizon-leveled, until the end of the video is reached. The Petition articulates a Thomason-Pacurariu combination that “generate[s] a rotated image for *each video frame* in Thomason’s video content.” (Paper 2 (“Petition”), 23.)

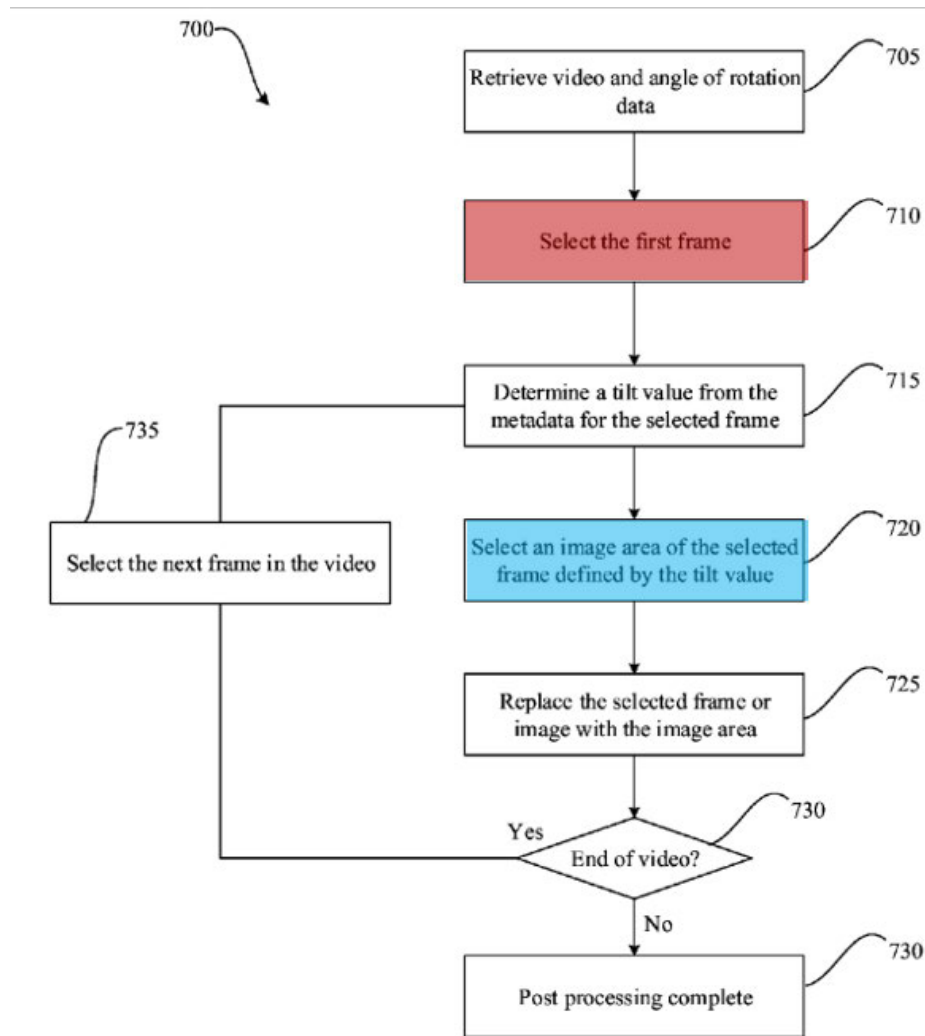
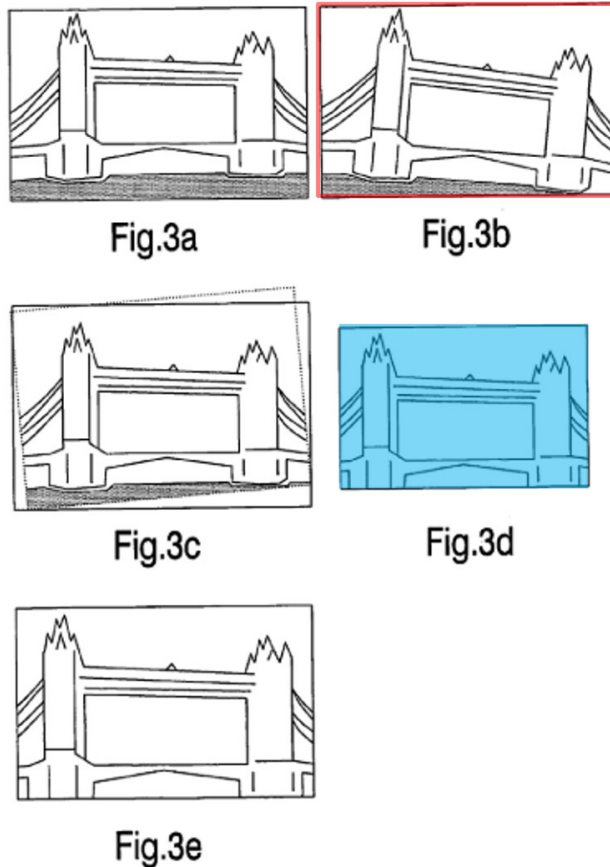


Figure 7

37. I disagree that Thomason performs an alleged “one-time tilt adjustment.” (POR, 45.) This interpretation defies a POSITA’s understanding of how video processing works. Thomason is clear that a video is “*a sequence of items of image data*” 8 representing sequential frames of the moving image.” (Ex. 1004, [0027].) Thomason then teaches that horizon-leveling is performed on a frame-specific basis in FIG. 3. In FIG. 3, an image is horizon-leveled based on

rotation amount *for that particular image*, not some other image. (See also Ex. 1004], [0004] and claim 10.) Dr. Foroosh agreed that “Figure 3 is describing horizon leveling of an image based on the rotational amount for that particular image.” (Ex. 1018, 143:11-14.)



38. A POSITA would understand that horizon-leveling a video involve horizon-leveling multiple frames in the video, that is, each frame in the “sequence of items of image 8” that form Thomason’s video. Otherwise, Thomason would be inoperable – horizon-leveling an image using another image’s rotation data would be ineffective.

39. I note that Dr. Foroosh *incorrectly altered* quotation of Thomason: “process[ing] the recorded image data 8 [i.e. the captured video] and rotation angle.” (Ex. 2021, 86.) But everything in the bracket is added by GoPro itself. The original quotation is “process the recorded image data 8 and rotation angle”—it only refers to “image data” and makes no mention of “video.” Here, Thomason teaches that recorded image data 8 is processed using its rotation angle. It follows that a video – which Thomason describes as “a sequence of items of image data 8” – is corrected using their respective frame-specific rotation information.

40. Dr. Foroosh confirmed during his deposition that “image data 8” refers to an image, not a video, stating that “image data could mean just the image itself, raw data or it could mean also including maybe additional metadata.” ([Ex. 1018, 136:3-18.]

41. I disagree with the series of mischaracterization made by GoPro.

42. First, GoPro and Dr. Foroosh are incorrect that “Thomason’s camera is not intended to be hand-held operated.” (POR, 9.) Thomason expressly states that “[t]he invention also relates to a camera as set out above incorporated into a further device including for example a *mobile telephone*, or computer.” (Ex. 1004, [0016].) GoPro also mischaracterizes Thomason as suitable for “still” digital cameras, ignoring Thomason’s title of “[i]mage rotation correction for *video* or photographic equipment” and related disclosure of “video” processing. (*Id.*, 1.)

43. GoPro alleges that Thomason involves a “fixed, yet slightly misaligned video camera” because Thomason states that cameras can be “frequently used by amateurs.” (POR, 29.) This leap of logic is incorrect. Nowhere does Thomason state that its system is limited to use by amateurs. During his deposition, Dr. Foroosh cannot provide an opinion on the meaning of “an amateur camera” and how it differs from a “professional camera” that can support this leap of logic. (Ex. 1018, 33:5-34:18.)

44. Regardless, an “amateur” who has “difficulties in correctly orienting the camera” would likely *greatly* misalign a camera at different degrees under different circumstances, not slightly or with a fixed amount. (POR, 29.) Indeed, Thomason teaches systems where “[r]otation *to any angle* is possible,” not just slight misalignment. (Ex. 1004, [0039].) GoPro misstates that Thomason only uses “a *single* accelerometer” and thus “can only infer rotation in *one* dimension.” (POR, 31.) Thomason broadly discloses that “[a] *plurality of sensors* may be provided to allow for image correction *in a number of planes*, for example corrections for rotation and tilt.” (Ex. 1004, [0015].) Further, “[t]he rotation sensor **14** may be a *multiple angle rotation sensor*, capable of *measuring orientation about more than 1 axis* and storing the result in memory 12.” (Ex. 1004, [0041]; *see also* [0004], [0007], [0017], [0041].) Thomason did not disclose or suggest an “accelerometer alone” system.

45. Dr. Foroosh’s testimony that this citation is not a part of the Petitioner’s combination is incorrect. (Ex. 1018, 118:4-11.) The “rotation sensor 14” was repeatedly referred to in the Petition and my original declaration. (Petition, 19-20; Ex. 1002, 59, 75, 91.) Dr. Foroosh’s testimony that the multi-angle rotation sensor 14 is only used to generate a panoramic image is unsupported by Thomason. (Ex. 1018, 122:7-13.) As a POSITA would understand, the fact that these sensors “may then be used” (Ex. 1004, [0041]) for another purpose does not preclude their use for measuring orientations for multiple axes to achieve horizon leveling. Ultimately, it makes no sense that Thomason teaches horizon-leveling by a system that is somehow not equipped to perform horizon-leveling.

46. Nor does Thomason limit the “sensors” to accelerometer only. And GoPro’s argument that Thomason’s exemplary sensor is not “accurate” flies in the face of Thomason. Thomason explicitly disclosed “correcting the image data so that the image is *accurately* horizontal.” (Ex. 1004, [0042].)

2. The Thomason-Pacurariu system teaches determining a “size” of the viewing window (claims 7, 17).

47. GoPro is incorrect that “Thomason never discloses that it determines a size of the viewing window for *multiple frames in a video*.” (Ex. 1002, 28.) As discussed above, Thomason discloses frame-by-frame horizon-leveling. (*Supra* § II.B.1.) In FIG. 3, the size of the viewing window FIG. 3d is based on *how much*

of FIG. 3c needs to be cropped, which depends on the amount of rotation in FIG.

3b. As I explained in my original declaration, “depending on the degree of rotation, more or less of the image would need to be cropped to obtain the viewing window showing horizon-leveled visual content.” (Ex. 1002, ¶119.)

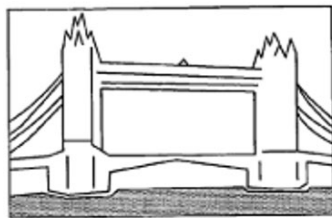


Fig.3a



Fig.3b

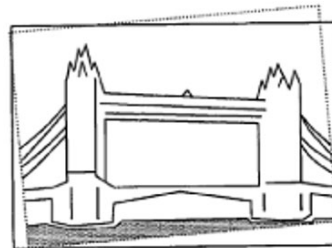


Fig.3c

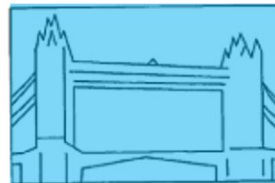


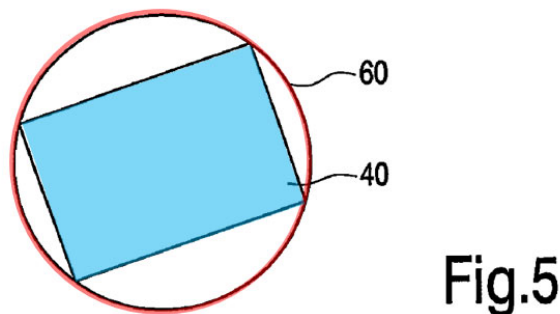
Fig.3d



Fig.3e

48. To contrast with the size-varying embodiment of FIG. 3, Thomason also provides FIG. 5 as an embodiment where the size of the viewing window remains constant. In the FIG. 5 embodiment, “the sensor array may be circular to enable arbitrary rotation to take place without any loss at the edges” and “[r]otation

to any angle is possible without size reduction.” (Ex. 1004, [0039].) A POSITA would understand the dichotomy between FIG. 3 and FIG. 5 – FIG. 3 enables arbitrary rotation with size reduction; FIG. 5 enables arbitrary rotation without size reduction (due to circular sensor).

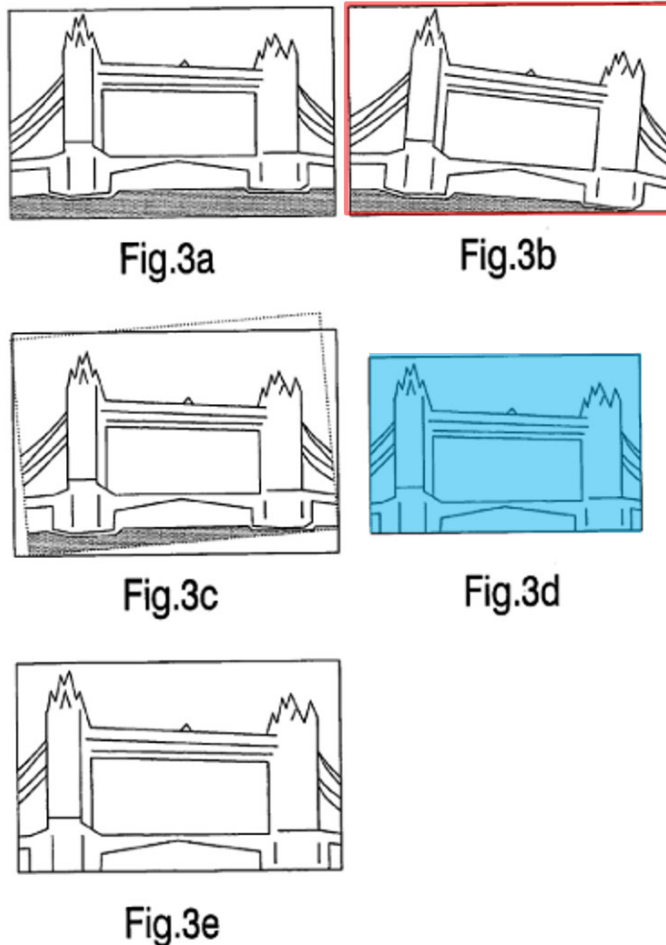


49. I note that Pacurariu also discloses this limitation. Pacurariu shows a larger window 305 in FIG. 3 and states that “aspect ratio, size, position, and/or orientation of the image area 305 may be changed at any time.” (Ex. 1005, [0040].) Regardless, Thomason teaches a frame-specific viewing window that changes in size.

3. The Thomason-Pacurariu system teaches “simulating changes in zoom” (claims 8 and 18).

50. GoPro mischaracterizes the Petition by arguing that “Petitioner suggests that this limitation [in claims 8 and 18] is met simply by changing the size of the viewing window.” (POR, 64.) GoPro has ignored the analyses for claims 7 and 8 in the Petition and my original Declaration. The Petition and my original

declaration point to Thomason's FIG. 3d for claim 7 and Thomason's FIG. 3e for claim 8. (Petition, 39; Ex. 1002, 124.) Fig. 3d shows that the size of the viewing window changes based on rotation, thus disclosing claim 7. With respect to claim 8, the Petition explained that Figure 3d is further resized to Figure 3e and that "[c]omparing to Figure 3a (the original image, below), the scene in Figure 3e appears more zoomed-in because the objects appear larger." (Petition, 39.) Thus, I disagree with GoPro's argument based on claim differentiation because the Petition and my Declaration provided different mapping for different claims.



51. I understand that GoPro and Dr. Foroosh have argued that the claims somehow refer a “smoothed zoom curve 604” depicted in FIG. 6C of the ’832 patent. (POR, 34.) That construction is meritless as I explained above. (*Supra* § II.A.3.) And even assuming that a “smoothed zoom curve” is somehow required, Pacurariu discloses that “the tilt angle data may be filtered or smoothed using a Savitzky-Golay filter, local regression smoothing, smoothing spline, a Kalman filter, etc. on a plurality of the tilt angle data. Various other filters or smoothing algorithms may be used without limitation.” (Ex. 1005, [0066].) In other words, Pacurariu discloses calculating smoothed rotation data, which would result in a smoothed/gradual change in the size of the viewing window and thus a “smoothed” zoom effect.

4. The Thomason-Pacurariu system teaches determining a “location” (claims 10 and 20).

52. I disagree with GoPro’s narrowing construction that claims 10 and 20 requires a determination of an x-y coordinate that must change across frames, as explained above. (*Supra* § II.A.4.)

53. The proposed combination of Thomason and Pacurariu discloses determining the area covered by the viewing window (e.g., as shown in FIG. 3 of Thomason) frame-by-frame. Even if the term “location” is construed to refer to a

point as GoPro contends, the Thomason-Pacurariu system determines where the viewing window is on a frame-by-frame basis.

54. I disagree with GoPro's argument that Thomason and Pacurariu do not change the location of the viewing window as it is always centered. The plain claim language does not require change. Even under GoPro's narrow construction, FIG. 3 of Thomason shows that its viewing window (FIG. 3d) is not perfectly centered with respect to the original image. Thus, a POSITA would understand that the x-y coordinate of the viewing window would change across frames.

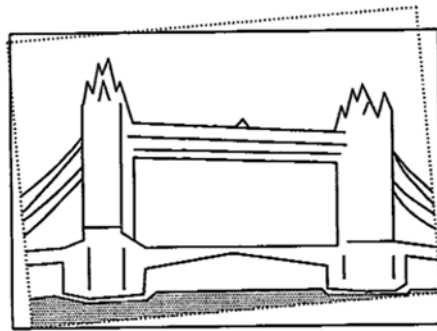


Fig.3c



Fig.3d

5. A POSITA would be motivated to combine Thomason and Pacurariu.

55. I agree with the Board, who noted “great similarity of the references’ technology” and stated that the two references are “in the same field of endeavor” and that “a person having ordinary skill in the art would have understood that Pecurariu’s teachings would have predictably improved Thomason.” (DI, 34-35.)

56. GoPro purportedly reproduced “the entirety of Petitioner’s analysis” in the Response, but significant portions of the Petitioner’s analysis were missing in GoPro’s alleged reproduction. For example, GoPro’s reproduction omitted an articulated combination provided on page 23 of the Petition, specifically that “[t]he Thomason-Pacurariu combination results in a system in which rotational position information, such as a tilt value as taught by Pacurariu, may be obtained for each video frame in Thomason’s video content, be saved as metadata or as part of each video frame as taught by Pacurariu, and be used to generate a rotated image for each video frame in Thomason’s video content.” (Petition, 23.)

57. In other words, to the extent that Thomason does not explicitly teach storing frame-specific rotation data as “metadata” and when to retrieve it in the frame-by-frame analysis, Pacurariu teaches that rotational data can be saved for each video frame as metadata and retrieved in an iterative, frame-by-frame analysis as shown in FIG. 7. As the Petition explained, “[c]ombining the teachings of Thomason and Pacurariu as such would yield predictable results of effectively and efficiently horizon-leveling video data.” (Petition, 23.) The combination is obvious to try because, for example, a POSITA would understand that there are a finite number of ways to store frame-specific rotation data: as metadata or in a separate database. For example, Pacurariu states that “[t]he tilt angle data may be saved as metadata within a separate file or as part of each video frame.” (Ex. 1005,

[0052].) A POSITA would understand that there are clearly design incentives for an efficient horizon-leveling algorithm.

58. The rest of GoPro’s arguments are based on an incorrect assumption that Thomason is an “accelerometer-only” system and is “mostly stationary.” (POR, 45-46.) These are plainly contradicted by Thomason, which states that the invention is applicable to “mobile telephone” and that “[a] plurality of sensors may be provided to allow for image correction in a number of planes, for example corrections for rotation and tilt.” (Ex. 1004, [0015].)

59. Similarly, GoPro’s argument that Thomason and Pacurariu are directed to devices “having entirely different movements” is incorrect. (POR, 46.) Both Thomason and Pacurariu are designed for mobile phones – Pacurariu states that “[*m*]obile phones with video cameras are one example of video cameras being more and accessible and usable,” and Thomason states that “[t]he invention also relates to a camera as set out above incorporated into a further device, including for example a *mobile telephone*, or computer.” (Ex. 1004, [0016]; Ex. 1005, [0002].) Furthermore, like Thomason, Pacurariu teaches a plurality of sensors, such as “an accelerometer, gyroscope, and/or magnetometer” such as a “a nine-axis accelerometer that includes a gyroscope and a magnetometer” in one embodiment. (Ex. 1005, [0026], claim 5.)

60. Thus, incorporating Pacurariu's techniques into Thomason would be straightforward to a POSITA. A POSITA would understand that modifying Thomason would simply involve storing frame-specific rotational data (e.g., as acquired by Thomason's and/or Pacurariu's sensors) as metadata and retrieving the metadata for horizon-leveling each video frame as taught by Pacurariu.

61. GoPro argues that the proposed combination cannot "overcom[e]" problems related to synchronization and alignment of the position and video data. (POR, 46.) But nowhere do the claims require "synchronization" as GoPro asserts. In any event, both references disclose synchronization. Thomason states, for example, that "[t]he image as shown in FIG. 3b is recorded in the memory *together with the data item that records the camera angle.*" (Ex. 1004, [0035].) Similarly, Pacurariu teaches, for instance, that "the tilt angle data may be saved with each video frame. The tilt angle data may be saved as metadata within a separate file or *as part of each video frame.*" (Ex. 1005, [0052].)

C. GROUND 2: CLAIMS 3-6, 13-16 ARE OBVIOUS OVER THOMASON, PACURARIU, AND WATANABE

1. The proposed combination teaches "the distortion of the visual content reducing impact of an off-axis horizon depicted within the horizon-leveled visual content" (claims 2 and 12).

62. The '832 specification shows that the reduced impact is a natural effect of the distortion. For example, the '832 patent states that "*[e]xistence of*

such distortion(s) within an image may create curves within the image, which may make an off-axis horizon less noticeable than in an image without distortion” and thus “[i]mages with distortion may increase the tolerance for an off axis-horizon, and the images may appear to be level enough with slight offset.” (Ex. 1001, 22:15-22.) Accordingly, “images with distortion may enable use of horizon leveling with less accuracy/precision to produce acceptable results.” (Ex. 1001, 22:23-25.) In other words, the ’832 patent teaches that if a distortion exists, the impact of an off-axis horizon would be reduced.

63. Dr. Foroosh testified that “I think it’s Claim 3 within the specs is basically described, in part at least, in this sentence” when pointed to the sentence “*[e]xistence* of such distortion(s) within an image may create curves within the image, which may make an off-axis horizon less noticeable than in an image without distortion.” (Ex. 1018, 109:19-110:16.) By “in part,” Dr. Foroosh clarified that he meant “[t]hat sentence is probably not the only sentence referring to that concept.” (Ex. 1018, 110:17-22.) Dr. Foroosh paraphrased the sentence to mean “if an image has distortion of off-axis horizon the impact [of an] off-axis horizon is less noticeable.” (*Id.*, 111:12-112:1.) Dr. Foroosh agreed that the sentence does not refer to anything other than the existence of distortion, stating that “[i]t just refers to, yes, the existence of distortion makes off axis horizon less noticeable.” (*Id.*, 111:20-112:1.)

64. To illustrate this effect of distortion, FIG. 7 shows a non-distorted image 702, an image 704 with barrel distortion, and an image with pincushion distortion. (Ex. 1001, 21:60-22:25.) The distorted images 704 and 706 are provided as examples of “such distortion(s) within an image” that “may make an off-axis horizon less noticeable than in an image without distortion.” (Ex. 1001, 22:15-18.) The ’832 patent discloses no additional processing beyond the mere existence of distortion in 704 and 706, which alone can achieve the effect of reducing the impact of an off-axis horizon. (Ex. 1001, 22:4-25.)

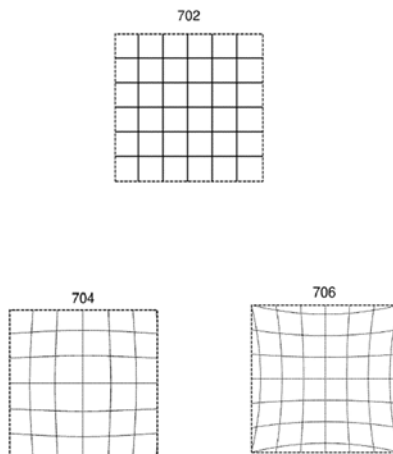
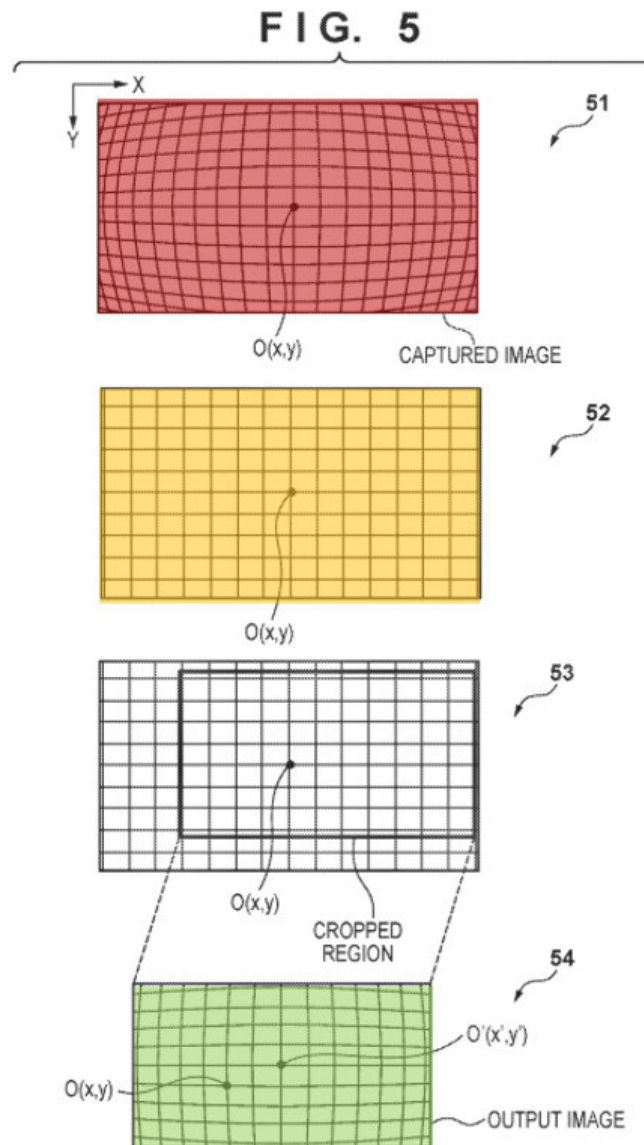


FIG. 7

65. The proposed combination discloses that “the distortion of the visual content reducing impact of an off-axis horizon depicted within the horizon-leveled visual content.” For example, image 54 of Watanabe is a distorted image, e.g., which has been horizon-leveled according to the teachings of Thomason and Pacurariu. As shown, image 54 contains distortion. A POSITA would understand

that the existence of distortion would reduce the impact of an off-axis horizon depicted in the image. In the same way the distorted images 704 and 706 of the '832 patent would bend an off-axis horizon and make it less noticeable, Watanabe's distorted image 54 would also achieve the same effect.



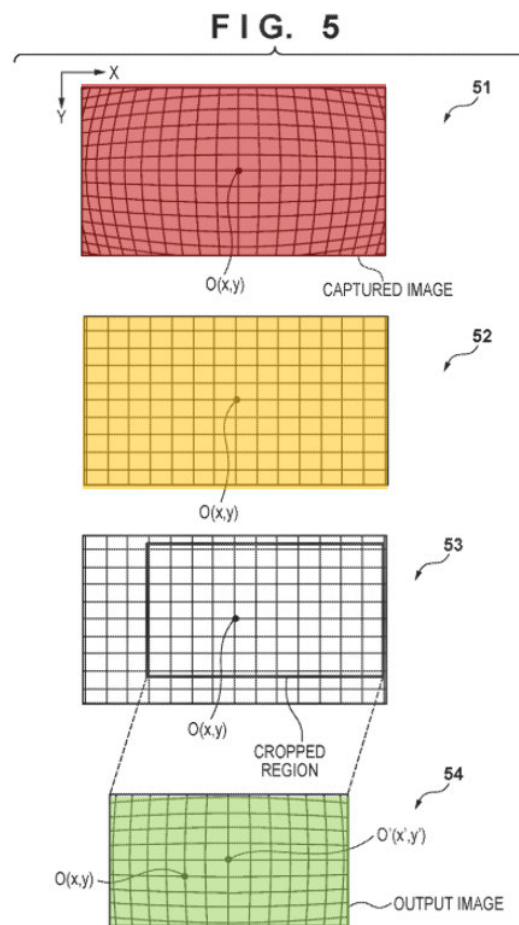
66. Contrary to GoPro's assertion that "Thomason and Pacurariu do not address the problem of an off-axis horizon," horizon-leveling is the very purpose

of both references, as highlighted in their abstracts. Thomason describes “allow[ing] the captured image to be rotated for display to have the true horizontal displayed as *horizontal*.” (Ex. 1004, Abstract.) Pacurariu describes using “the tilt of the image sensor relative to the Earth’s gravitational field or the *horizon*” to correct the image data. (Ex. 1005, Abstract.) Similarly, Watanabe is directed to “image shake correction.” (Ex. 1006, 1:13-16[.]) An off-axis horizon can result from image shake and thus can be corrected using Watanabe’s techniques. For example, Watanabe’s “image shake correction circuit 107 determines a cropping region so as to eliminate image shake resulting from shake of the video camera 100, based on an image shake correction amount calculated by the image shake correction amount calculation circuit 203.” (Ex.1006, 11:26-30.)

67. Both Thomason and Pacurariu disclose off-axis horizon. Thomason states that its rotation sensor may provide “an output representing the angle of the captured image to the horizontal to *an accuracy of 5° or better*.” (Ex. 1004, [0004].) Similarly, Pacurariu describes various types of rotation sensors and states “the tilt angle data may be filtered or smoothed.” (Ex. 1005, [0059], [0066].) A POSITA would understand that the horizon-leveling in Thomason and Pacurariu may not be perfect for a given video frame due to hardware and/or software reasons. Thus, Thomason and/or Pacurariu can result in an off-axis horizon.

2. The proposed combination teaches “the visual content includes a distortion” (claims 3, 13).

68. I disagree with GoPro’s narrow construction that the claims require that a distortion be part of the “original visual content” before horizon-leveling fails. (*Supra* § II.A.2.) Regardless, the proposed combination discloses a distortion present in the visual content before *and* after horizon-leveling. For example, as shown in FIG. 5 of Watanabe, both image 51 (i.e., a captured image) and image 54 (i.e., the horizon-leveled image) contain distortion.



69. I note that GoPro is wrong that Watanabe removes a distortion and reintroduces a “significantly different” distortion. (POR, 55-56.) A POSITA would understand that Watanabe teaches reintroducing the same distortion.

70. In Watanabe, the reintroduced distortion can be the same as the originally captured distortion. For example, Watanabe states that “[a] distortion addition circuit 108 reads out, from the image memory 105, an image in which distortion and image shake have been respectively corrected by the distortion correction circuit 106 and the image shake correction circuit 107, *adds the effect of distortion caused by the photographing lens 102 to this image*, and stores the image to the image memory 105.” (Ex. 1006, 5:36-42; *see also* FIG. 1.)

71. Watanabe teaches that the *amount* of distortion can be the same: “a distortion effect of about 30% of the degree of the distortion of the photographing lens 102 is assumed to be added, but the degree of a distortion effect that is added by the distortion addition circuit 108 can be appropriately determined in a range *not exceeding the intensity of distortion caused by aberration of the photographing lens 102.*” (Ex. 1006, 9:67-10:5.) A POSITA would understand that this means that the amount of distortion may be equal to or smaller than the original distortion. Dr. Foroosh testified that “not exceeding” means “not going beyond something.” (Ex. 1018, 179:21-25.)

72. Watanabe teaches that the *center* of the distortion can be the same, “[u]nless the image shake correction amount is 0, the image coordinates (x,y) and the center coordinates of the image subjected to image shake correction (cropping region) do not match (53, FIG. 5).” (Ex. 1006, 11:33-36.) A POSITA would understand that this means the center coordinates of the distortion match if the image shake correction amount is 0. For example, if the shake is even on all sides, the center would remain the same through shake correction.

73. Even Dr. Foroosh acknowledged that “the cropped portion of the image is *often* located off-center from the original image”, not always. (Ex. 2021, 22.) “Often” is not “always.” GoPro points to FIG. 5 as support that the centers of the original and added distortion do not match. (POR, 13-14.) But FIG. 5 is a specially crafted example to illustrate a scenario in which the image shake correction is not 0. Watanabe also discloses the possibility that the image shake correction amount is 0.

3. The proposed combination teaches “the visual content includes the distortion based on application of the distortion to non-distorted visual content” (claims 6, 16).

74. I note that GoPro’s argument again is improperly based on its narrow interpretation that “the visual content” refers to visual content before horizon leveling and that “the distortion must be applied before the image is processed into

the claimed ‘horizon-levelled visual content.’” (POR, 24-25.) I disagree with this narrow construction as discussed above. (*Supra* § II.A.2.) The proposed combination teaches that the horizon-leveled visual content includes the distortion based on application of the distortion to non-distorted visual content (e.g., 53).

4. A POSITA would be motivated to combine Watanabe with the Thomson-Pacurariu system.

75. The Thomason-Pacurariu system results in an efficient horizon-leveling system. This system can be used to horizon-level distorted images/videos and non-distorted images/videos alike. At the time of the claimed invention, distorted images were commonly produced by cameras. Nothing in Thomason or Pacurariu limits horizon leveling to non-distorted images and videos. A POSITA would understand that Thomason and Pacurariu’s horizon leveling can be used for distorted or non-distorted images and videos. The combination of Thomason and Pacurariu, when processing a distorted image, would disclose claims 3-5 and 13-15.

76. A POSITA would understand that an amateur camera such as an action camera uses wide angle lens and thus has distortions. This was confirmed by Dr. Foroosh during his deposition. Dr. Foroosh agreed that action cameras may have different types of lenses “depend[ing] on the manufacturer’s design.” (Ex. 1018, 40:8-16, 41:11-17.) Dr. Foroosh testified that “some [] can accept wide

angle.” (Ex. 1018, 40:8-16.) He also agreed that “wide angle camera would introduce some non-linear distortions in the output image. (Ex. 1018, 41:11-17.)

77. Even assuming that Thomason-Pacurariu system does not disclose processing distorted images or videos, it would have been obvious in light of Watanabe. A POSITA would understand that geometric translations of an image, such as image rotation, assume a Cartesian grid where every pixel has consistent spacing and the image content lies on a flat, regular plane. Lens distortions, such as barrel and pincushion distortions, can cause nonlinear stretching or compression of image content. Rotating such a distorted image can introduce compounded warping and interpolation errors. Linear and nonlinear operations do not commute. That is, for example, if we apply a barrel distortion (a nonlinear transformation) to an image first, followed by rotation (a linear transformation), we will not obtain the same result as if we apply the rotation first, followed by the barrel distortion to the same image.

78. Watanabe provides a solution for the problem, because it teaches removing distortion, performing image correction, and adding distortion back. Integrating Watanabe results in an improved image processing pipeline, in which distortion is removed to further enhance image correction (including horizon-leveling) and added back. The pipeline would allow for more efficient and

accurate horizon-leveling for distorted images. How Watanabe's image correction may sometimes crop an image off-center is irrelevant to the combination.

79. A POSITA would have been motivated to combine Thomason, Pacurariu, and Watanabe because they are all related to the same technical problem (i.e., correcting for camera motion) and the same general solution (i.e., the use of rotational data to correct for camera motion). A POSITA would understand that horizon leveling involves compensating for the tilt of the image/video. Watanabe states that “in this specification, movement of an image capturing apparatus is referred to as ‘shake’” and that “rotational components around the optical axis of shake are corrected by affine transformations, or *tilt components of shake* (keystone distortion of an image) are corrected by projection conversion.” (Ex. 1006, 3:56-60, 5:26-32.) Watanabe also teaches that its techniques “can be applied to any electronic device that can perform image shake correction” including “mobile phones.” (Ex. 1006, 3:61-4:3.)

80. Watanabe broadly discloses motion correction, including correcting tilting motions. This is similar to horizon leveling. As Dr. Foroosh testified, “[if] a camera is tilted, it would correct that so the horizon is leveled.” (Ex. 1018, 46:14-19.) Watanabe performs the same type of operation: “rotational components around the optical axis of shake are corrected by affine transformations, or *tilt components of shake* (keystone distortion of an image) are corrected by projection

conversion.” (Ex. 1006, 5:26-32.) I note that the ’832 patent on its face cites to U.S. Patent Pub. No. 2017/0142337, which is directed to “Stabilization based on accelerometer data.” (Ex. 1021, Title.) This shows that the patent examiner clearly thinks that stabilization is relevant to horizon leveling when considering patentability of the ’832 patent.

81. GoPro’s argument that the proposed combination lacks motivation because it is “undesirable to add barrel distortion to an image that did not already have it” misses the point. (POR, 23.) The proposed combination, as explained in the Petition and my original Declaration, would receive a distorted image to horizon-level rather than a non-distorted image. As discussed above, a POSITA would understand that the Thomason-Pacurariu system can be used to process non-distorted images and distorted images, which are commonly produced by cameras (and also taught by Watanabe). The addition of Watanabe improves the system’s capability of horizon-leveling distorted images.

82. GoPro and Dr. Foroosh drew an illogical conclusion from my testimony about Watanabe, particularly that “[a]ll of these are specific algorithmic steps that are important.” (Ex. 2021, 31-32.) The fact that a reference has “important” steps does not mean that a POSITA would be less motivated to use it. To the contrary, Watanabe’s steps of removing distortion and then adding it back,

which are useful steps for handling image distortions in processing an image, would motivate a POSITA to apply them to other image processing pipelines.

83. I note that the combination of Thomason and Pacurariu alone, when processing a distorted image, would disclose claims 3-5 and 13-15. The combination of Thomason, Pacurariu, and Watanabe discloses claims 3-6 and 13-16.

D. GROUND 3: CLAIMS 1, 2, 7-12, 17-20 ARE OBVIOUS OVER VOSS AND DERBANNE

1. The Voss-Derbanne system discloses determining a “viewing window” (all claims).

84. I note that GoPro made several mischaracterizations of Voss. First, GoPro argued that it is not clear whether the Petition is relying on the blue shaded box or the red outlined box as the “inset rectangle” described in Voss. (POR, 48-49.) But the Petition cannot be clearer, having color-coded “inset rectangle” in the same shade of blue throughout, thus mapping the blue box to the “inset rectangle.”

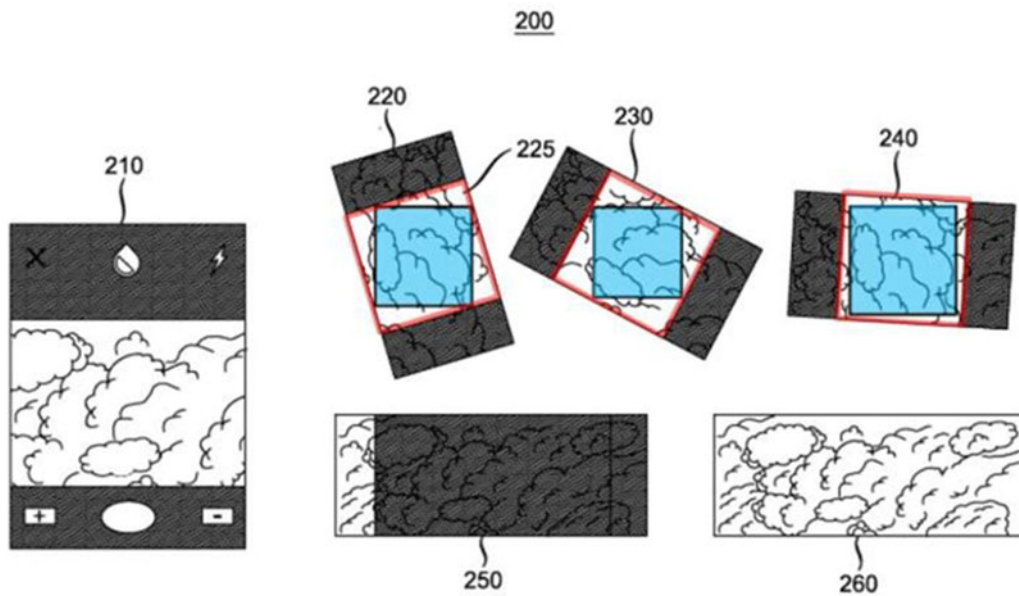


FIG. 2

85. The description in Voss is also clear, stating that “[t]he inset rectangle 225 is transformed to compensate for rotation 220, 230, 240 by essentially rotating in the inverse of the device’s own rotation.” (Ex. 1007, 10:5-7.) This language clearly refers to the blue box rather than, for example, the red box. When asked about the relationship between the blue box and the device, Dr. Foroosh agreed “there is relative rotation between them.” (Ex. 1018, 190:4-191:8.)

86. GoPro argues that the blue-shaded box is not the inset rectangle because it does not change aspect ratios. (POR, 49-50.) This is incorrect. Voss does not require the inset rectangle to change aspect ratios. Voss’ discussion of aspect ratios is also not with reference to the inset rectangle in FIG. 2. Instead, it is provided in a separate paragraph and belongs to a separate example (the paragraph starts with “For example, if”). (Ex. 1007, 10:13.)

87. GoPro's argument that the clouds depicted in FIG. 2 appear to rotate with the device had already been addressed by the Petition and my original Declaration. The Petition provided a better rendering of FIG. 2 from a related application of Voss. (Ex. 1002, ¶171.) The related application International Publication No. WO 2015/038180 shows what appears to be the original photographic version of Figure 2, reproduced below, in which the clouds in the inset rectangle 225 have substantially the same orientation despite rotation of the device. (Ex. 1013, FIG. 2; Ex. 1002, ¶171.) As I explained, the slight variations in the orientation across the three images may be due to movement of the clouds over time while the video was taken. (Ex. 1002, ¶171.)

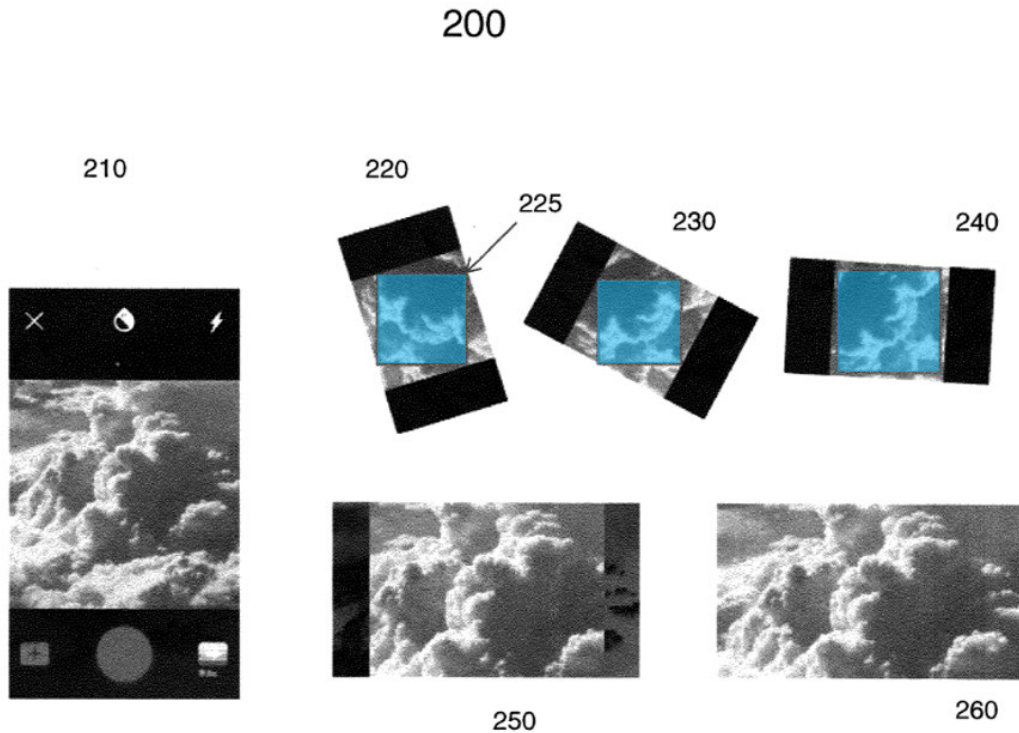


FIG. 2

88. GoPro also mischaracterizes statements in the Written Opinion. The issues raised in the Written Opinion are at most semantic in nature. In paragraph 3.2, the Office states “figure 2 defines an inscribed *square* 225, not any inscribed *rectangle*, leading to an unclear claim, Article 6 PCT.” (Ex. 2030, 5.) In other words, the Office merely points that the insect rectangle in FIG. 2 appears to be a square. The Office never expressed confusion as to what is the inset rectangle. In any event, a POSITA would also understand that a square is a type of rectangle. Similarly, in paragraph 4, the Office took issue with the claim language, not Voss’

description. In fact, the conclusion in the same paragraph is that Voss' description "provides the basis for clearer claims." (Ex. 2030, 7.)

89. GoPro's allegation that Voss is based on "simply distinguishing between a vertical and horizon orientation" is wrong. (POR, 48.) Voss' technique is more granular than this alleged binary processing. Based on FIG. 2, a POSITA would understand that compensatory rotation of the inset rectangle 225 cannot be performed if the rotation measurement is binary (i.e., vertical and horizontal). Further, Voss states "[t]he inertial sensor is for determining *rotational values*," not just vertical and horizontal orientations. (Ex. 1007, 3:22-23.) In fact, a substantial part of Voss is dedicated to describing various techniques to synchronize measurements from its inertial sensor and the video frames by performing interpolation or increasing the frequency of rotational measurements "to provide more accurate positional information in time with the video." (Ex. 1007, 15:20-17:2; *see also* FIGS. 6-7.)

90. I further disagree with GoPro's argument that the inset rectangle is not a "viewing window" because it does not define the extents of the visual content to be included within the horizon-leveled visual content. Contrary to GoPro's suggestion, the claims require that the horizon-leveled visual content only *include* the visual content defined by the viewing window. (Ex. 1001, claims 1 and 11.) Voss discloses that the horizon-leveled visual content *includes* the visual content

defined by the viewing window (i.e., the inset rectangle). Specifically, Voss describes that, if the optimal output dimension is different from the inset rectangle, one of two approaches can be used: cropping or letter/pillar boxing. Pillar boxing involves keeping the entirety of the inset rectangle in the output. “[I]f the optimal output dimension is 4:3 and the sampled rectangle is 1:1, the sampled rectangle would either be aspect filled (fully filling the 1:1 area optically, cropping data as necessary) or aspect fit (fully fitting inside the 1:1 area optically, ***blacking out any unused area with ‘letter boxing’ or ‘pillar boxing’.***” (Ex. 1007, 10:17-21.)

91. A POSITA would understand that, by using letter/pillar boxing, Voss’s output box would include the entire inset rectangle because letter/pillar boxing does not involve cropping. Further, a POSITA would understand that, if the aspect ratios of the optimal output dimension and the inset rectangle are the same, then the output box would equate to the inset rectangle (i.e., no pillar boxing is needed). Thus, Voss teaches that the final output would include the entirety of the inset rectangle, potentially plus some letter/pillar boxing.

92. In addition, GoPro concedes that Derbanne teaches “punch-outs” and that “Derbanne does disclose the determination of a window based on rotation of an image capture device.” (POR, 54.) In fact, FIG. 6B of Derbanne illustrates punch-outs 614 and 624 and Derbanne teaches that “[v]ideo content is generated based on visual content of the images within the punch-outs.” (Ex. 1008,

Abstract.) GoPro argues that Derbanne is directed to video stabilization. (P0R, 52-56, 62.) But the Petition never proposed incorporating Derbanne's video stabilization into Voss. Rather, the proposed combination draws from Derbanne's disclosure on how a viewing window is used to generate content. (Petition, 61-62.) Specifically, the proposed combination involves punching out (as taught by Derbanne) the visual content defined by Voss' inset rectangle and generating video content accordingly. Because Voss and Derbanne are both related to rotating visual content in video data to compensate for motion of the image capture device, a POSITA would be motivated to look to Derbanne to incorporate teachings related to the mechanism of punchout and content generation for generating horizon-leveled content in Voss.

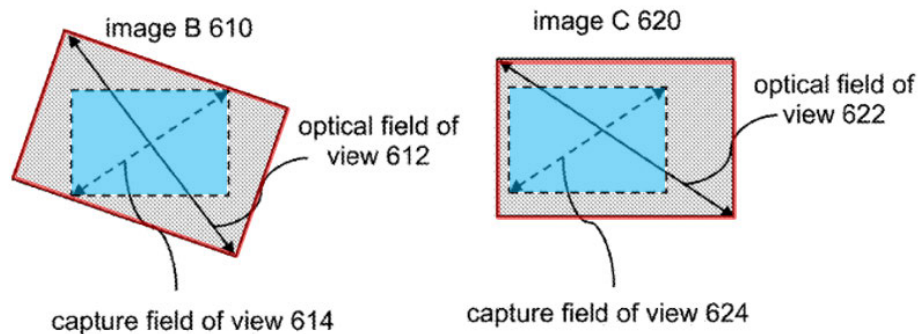


FIG. 6B

2. The Voss-Derbanne system discloses determining a “size of the viewing window” (claims 7, 17).

93. It is clear to a POSITA that the blue box in FIG. 2 changes in size. “With the naked eye,” Dr. Foroosh testified that the rightmost blue box “appears larger than the other two” and that the middle one “looks smaller.” (Ex. 1018, 191:21-192:8.) I note that Dr. Foroosh’s testimony contradicts his own declaration, which states that blue-shaded box does not appear to “meaningfully change in size or aspect ratio.” (Ex. 2021, 56.)

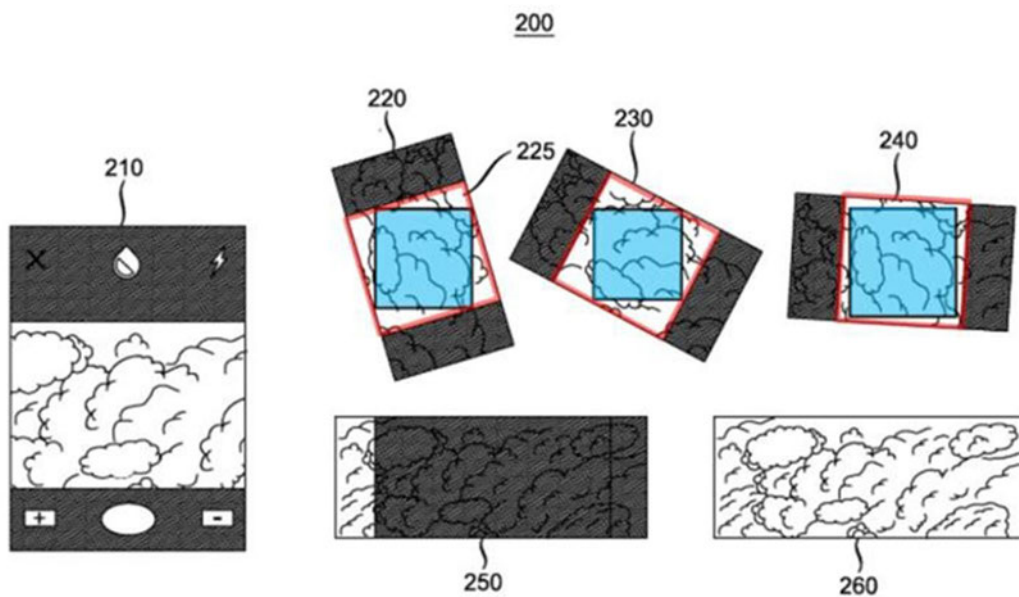


FIG. 2

94. Consistent with FIG. 2, Voss states that “[t]he transformed inner rectangle 225 is inscribed optimally inside the maximum available bounds of the overall sensor minus the padding.” (Ex. 1007, 10:7-9.) In other words, the size of

Voss' inset rectangle is optimized and dynamically changing over time given the rotation and the visual content available.

95. Voss also describes an embodiment in which the inset rectangle changes in aspect ratio. Voss states: “For example, if the optimal aspect ratio selected for portrait orientation was square (1:1) and the optimal aspect ratio selected for landscape orientation was wide (16:9), the inscribed rectangle would interpolate optimally between 1:1 and 16:9 as it is rotated from one orientation to another.” (Ex. 1007, 10:13-16.) In other words, if the device is rotated from portrait orientation to landscape orientation, the inscribed rectangle would rotate and change in aspect ratio. In this embodiment, the size of the rectangle also changes from frame to frame.

3. The Voss-Derbanne system discloses “simulate changes in zoom” (claims 8, 18).

96. Voss provides a robust description of zoom simulation. For example, Voss states that “no matter how the device is oriented, scene is zoomed in or out to keep consistent framing” and “where maximum resolution is desired, the zooming in and out may change the size of the object of interest.” (Ex. 1007, 13:11-15.) In other words, as the device rotates, the size of the inset rectangle changes as shown in FIG. 2, thereby simulating changes in zoom as the scene is zoomed in or out (to keep consistent framing).

97. The '832 patent describes the same concept that rotation of the device causes zooming, stating that “the zoom level of the image capture device may be changed based on rotation of the image capture device.” (Ex. 1001, 12:9-12.)

98. GoPro’s argument that there is a difference between “output box” and “inset rectangle” again misses the point. (POR, 63-64.) As discussed above, this is a difference without distinction. Voss’ output box contains the inset rectangle in its entirety (plus some letter/pillar boxing if the aspect ratios are different). Thus, the cited descriptions of Voss apply to the “output box” and “inset rectangle” equally.

99. Regarding GoPro’s claim differentiation argument, GoPro again overlooked the entirely different analyses for claims 7 and 8 in the Petition. The Petition did not suggest that this limitation is met simply by changing the size of the viewing window. For claim 8, the Petition points to additional disclosures of Voss that explicitly teach the zooming concept. (Petition, 76-77.)

100. I disagree that the claim requires modifying the size of the viewing window “for the purpose of simulating changes in zoom.” (POR, 65.) The claim does not recite “for the purpose of”; instead, it merely recites “the size of the viewing window changes as the function of progress through the progress length to simulate changes in zoom for the visual content.” (Ex. 1001, 30:45-48.) Nothing in the claim requires a subjective purpose. And even assuming that it does, a

POSITA would understand that, in Voss, rotating the device would cause the inset rectangle to change size (as shown in FIG. 2) and can be done for the purpose of simulating changes in zoom.

4. The Voss-Derbanne system discloses determining a “location” of the viewing window (claims 10, 20).

101. Regardless of whether “location” is a point or an area, the Voss-Derbanne system determines where the viewing window is on a frame-by-frame basis. In both illustrated and original versions of FIG. 2, the blue box covers different areas of the scene. Dr. Foroosh agreed that the blue boxes “cover different portions of the clouds.” (Ex. 1018, 192:17-20.)

102. Even if the claim is construed to require that a “point” of a viewing window not always be “centered” as GoPro alleges, Voss provides an example of uncentered “inscribed rectangle 440” in FIG. 4. Derbanne provides a similar example. Dr. Foroosh testified that he agreed that the these viewing windows are not centered. (Ex. 1018, 193:4-9; 208:2-7.)

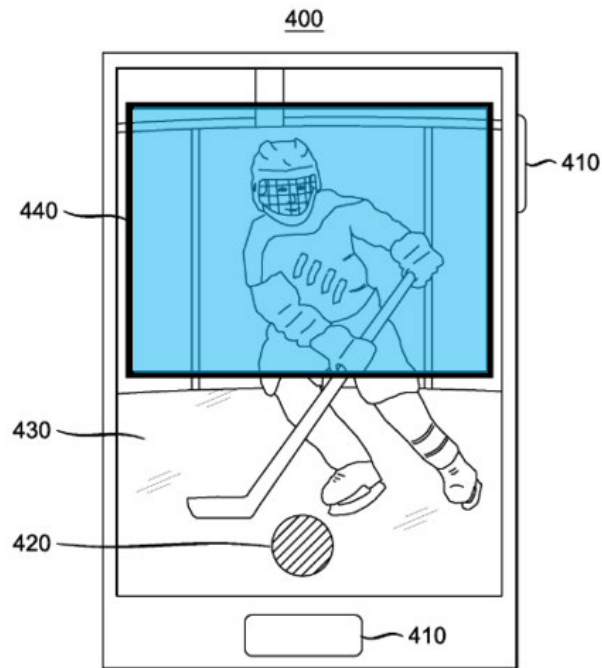


FIG. 4

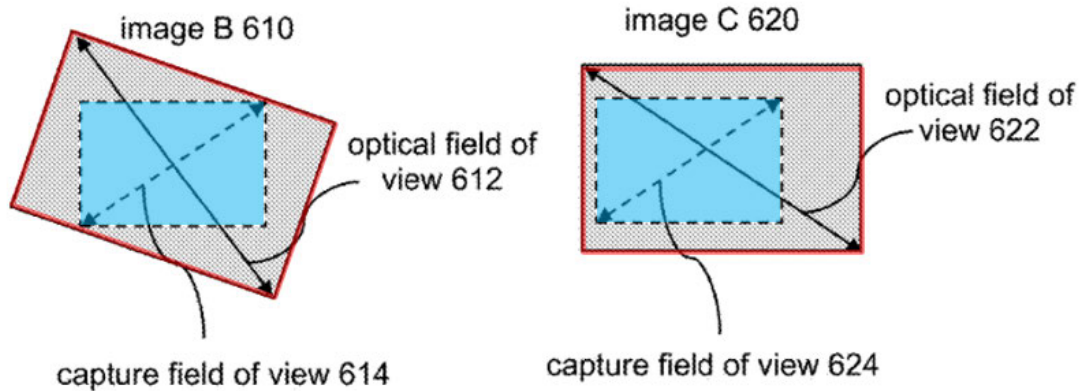


FIG. 6B

5. A POSITA would be motivated to combine Voss and Derbanne (all claims).

103. The Board noted that “Voss and Derbanne are in the same field of endeavor” and “a person having ordinary skill in the art would have known that

Derbanne’s techniques could be used to improve Voss.” (DI, 46.) I agree with the Board.

104. GoPro’s argument that Derbanne cannot be combined with Voss because it is directed to image stabilization and teaches the use of a “capture trajectory” to determine a viewing window misses the point. (POR, 52-55.) A POSITA would understand that both Derbanne and Voss involve motion correction. Derbanne also discloses correcting motion in three axes, including in the roll direction. A POSITA would understand that horizon leveling—such as disclosed in Voss—compensates motion in the roll direction.

105. The Petition relied on Derbanne’s disclosure for limitations related to format of the video content and rotational position information, as well as the “punchout” for visualizing the processed data. (Petition, 61-62.) As explained in the Petition, “[t]he Voss-Derbanne combination would process the video content in Derbanne’s format.” (Petition, 69.) The Voss-Derbanne combination is obvious because it “results in a system in which data (captured video data, rotational position information) is captured, stored, and maintained in accordance with the teachings of Derbanne, and a punchout may be generated, yielding the predictable result of improving the video management and processing capabilities of Voss.” (Petition, 62.)

106. Like Voss, Derbanne is directed to rotating visual content in video data to compensate for motion of the image capture device. (Ex, 1008, 1:18-57.) During his deposition, Dr. Foroosh agreed with this point, stating with reference to Derbanne that “we are compensating translation and rotations. We are doing the same things.” (Ex. 1018, 205:1-7.) GoPro suggests that Derbanne does not correct “deliberate” tilt and thus does not disclose horizon leveling (POR, 54-55), the ’832 patent does not require horizon level to be performed on “intentional” rotations only. A POISTA would understand that horizon level can be applied to “intentional or not intentional” rotations.

107. The Voss-Derbanne combination is obvious to try because there are a finite number of solutions for obtaining and storing video data and corresponding rotational data. For example, video data may be stored as a series of images or in a compressed format, and the associated rotational data can be stored in different formats accordingly. Voss teaches, for example, “[t]he position output signal may convey position information that characterizes positions of the housing 312 at different moments (points in time, time durations) within the capture duration.” (Ex. 1008, 5:49-52.) Thus, the teachings of Derbanne related to formatting of video data and rotational data can help a POSITA implement Voss’ horizon-leveling algorithm.

**E. GROUND 4: CLAIMS 3-6, 13-16 ARE OBVIOUS OVER
VOSS, DERBANNE, AND WATANABE**

108. GoPro’s arguments fail for the same reasons discussed for Ground 2.

In particular, a POSITA would be motivated to combine Voss-Derbanne with Watanabe. Integrating Watanabe results in a similarly improved image processing pipeline, in which distortion is removed to allow for accurate image correction (including horizon-leveling) and then added back. The pipeline would allow for efficient and accurate horizon-leveling for distorted images. I note that the combination of Thomason and Pacurariu alone, when processing a distorted image, would disclose claims 3-5 and 13-15. The combination of Thomason, Pacurariu, and Watanabe discloses claims 3-6 and 13-16.

**F. THE OBJECTIVE EVIDENCE DOES NOT SUPPORT
NON-OBVIOUSNESS**

109. I understand that one of the factual inquiries when determining the obviousness of a patent is to consider objective evidence related to the issue of obviousness, sometimes called “secondary considerations of non-obviousness” or “objective indicia of non-obviousness.”

110. I understand objective indicia include: (i) commercial success of a product due to the merits of the claimed invention; (ii) long-felt need for the solution provided by the claimed invention; (iii) unsuccessful attempts by others to find the solution provided by the claimed invention; (iv) copying of the claimed

invention by others; (v) unexpected and superior results from the claimed invention; (vi) praise of the claimed invention by others in the art; (vii) independent invention of the claimed invention by others before or at about the same time as it was conceived by the named inventors; (viii) whether others expressed surprise or disbelief regarding the invention; (ix) whether others sought or obtained rights to the claimed invention from the patentee; and (x) whether the inventor proceeded contrary to accepted wisdom in the art.

111. I understand that objective indicia are only relevant to the obviousness inquiry if there is a nexus between the claimed invention and the objective indicia of non-obviousness. I also understand that a rebuttable presumption of nexus applies only when a patent owner shows that the purported objective indicia evidence is tied to a specific product and that product embodies the claimed invention, and is coextensive with the claims. On the other hand, a patent owner is not entitled to a presumption of nexus if the patented invention is only a component of a commercially successful machine or process. I further understand that to show nexus, any purported objective indicia must be the direct result of the unique characteristics of the claimed invention.

112. I understand that the Board previously found that GoPro failed to show objective indicia of non-obviousness. Based on what GoPro has submitted in

its Patent Owner Response and Dr. Foroosh's declarations, I agree with the Board's conclusion.

1. GoPro fails to show it practices the '832 patent

113. As a threshold matter, GoPro and Dr. Foroosh fail to show GoPro practices the challenged claims. GoPro alleges that its HERO9 is the practicing product. To show HERO9 practices a claim of the '832 patent, I understand that GoPro has to provide evidence to show that HERO9 practices each and every limitation in that claim. GoPro and Dr. Foroosh have failed to do so.

114. Claims 3-4. GoPro and Dr. Foroosh have failed to show how HERO9 or other GoPro products practice claims 3 and 4. GoPro is silent on how "the distortion of the visual content reducing impact of an off-axis horizon" in HERO9 or other GoPro products (POR, 72-73) despite accusing Petitioner of relying on "conclusory assertion of its expert." (*id.*, 16.)

115. Claims 7-8. GoPro and Dr. Foroosh have failed to show how HERO9 or other GoPro products practice claims 7 and 8. GoPro does not explain how HERO9 or other GoPro products "simulate[] changes in zoom" (*id.*, 73) despite arguing that this limitation "includes a requirement that the resizing accomplish a controlled zooming effect." (*id.*, 33.)

116. Claims 2, 5-6, 9-20. GoPro does not argue HERO9 or other GoPro products practice these claims.

2. There is no nexus.

117. GoPro does not argue any presumption of nexus. I understand that a patent owner is not entitled to a presumption of nexus between the evidence and the claimed invention if the patented invention is only a component of a commercially successful product. Mr. Lema admits that horizon leveling is only a component, or one feature, of HERO9, the allegedly practicing product. (Ex. 2024, ¶¶ 10 (“HERO7 Black was the first GoPro product to bring the combined HyperSmooth, SuperView, and digital lens package of features for customers (Horizon Leveling was released 2 years later with HERO9 Black).”))

118. GoPro makes no attempt to show how the purported practicing product are coextensive with the challenged claims. I understand that the coextensive requirement requires the patent owner to show the product is essentially the claimed invention, but perfect overlap is not necessary. GoPro, however, has failed to do this. There are features in HERO9 other than horizon leveling, and GoPro has failed to explain the significance of those features and how they impact HERO9. For example, Mr. Lema admits that [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] Thus, I agree with the Board's finding that

the surveys GoPro cites show that GoPro's products have meaningful unclaimed features. (ID, 52; Ex. 2018, 23; *see also* Ex. 2019, 14.)

119. GoPro also does not show that any purported objective indicia is the direct result of the unique characteristics of the claimed invention. GoPro fails to identify any secondary consideration attributable to horizon leveling, let alone the claimed invention of the '832 patent. For example, to distinguish from prior art, GoPro contends that the '832 invention requires obtaining "rotational position information . . . as a function of progress through the capture duration," "determine[ing] a viewing window . . . as a function of progress through the progress length," "a viewing window that is dynamic in size," and "introducing distortion to the image that is horizon leveled." (POR, 4-6.) GoPro, however, identifies no objective indicia that is tied to any such purported novelty.

120. GoPro's own cited evidence shows lack of nexus. For example, the cited consumer surveys show [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

(Ex. 2018, 23.) And GoPro's witness Mr. Lema concedes that [REDACTED]

[REDACTED]

[REDACTED] (Ex. 2024 ¶ 16; *see also* Ex. 2040, 5.)

3. No objective indicia of non-obviousness

121. **No commercial success / industry praise.** GoPro's own exhibits show that the purported commercial success is attributed to many factors unrelated to horizon leveling. [REDACTED]

[REDACTED]

[REDACTED] GoPro points to no industry praise. Nor do I see any such evidence.

122. **No copying.** I understand that GoPro's alleged copying evidence based on Petitioner's '444 Chinese application has been rejected by the Board. (ID, 53.) I agree. The '444 Chinese application does not even mention horizon leveling. Rather, it involves anti-shake techniques. Even assuming the '444 Chinese application contains similar technology as the '832 patent, GoPro identifies no evidence showing that the Petitioner had access to GoPro's technology and replicated it. (Ex. 1022, 159:14-160:3 [REDACTED]
[REDACTED]
[REDACTED].)

To the contrary, the evidence shows that Petitioner independently developed horizon leveling. (Ex. 1023, 257:11-259:2, 259:11-17, 261:4-5, 261:12-22 (Insta360 engineer Wenjie Jiang testifying Insta360 never copied GoPro and instead developed Insta360's own horizon leveling; Ex. 1024, 244:3-12, 245:2-14 (Insta360 engineer Biao Sang testifying Insta360 never copied GoPro).)

123. Nor does GoPro's purported "reverse engineering" evidence show copying. The cited "engineering documents" merely show that the Petitioner conducted benchmarking and compared its products' performance with GoPro's. Benchmarking is a standard practice in the industry and is not copying, as GoPro's witness Mr. Lema concedes. (Ex. 1025, 386:9-14 ("Q. So benchmarking and overtly copying are different? A. In my opinion, benchmarking something to

understand the benefits is very different than reverse-engineering and trying to do exactly what someone else did.”).) Indeed, GoPro’s witness confirmed that GoPro regularly performs teardowns of Insta360 products. (*Id.*, 388:24-389:2 (“Q. GoPro also does teardowns of Insta360 products; right? A. I think some people at our company do teardowns of the products that we purchase.”), 390:3-391:24 [REDACTED]

[REDACTED]

[REDACTED].)

124. **No long-felt but unmet need.** GoPro does not argue any unmet need. Its own witnesses are aware of none. (Ex. 1022, 150:20-151:9 [REDACTED]

[REDACTED]

[REDACTED] 1026, 66:18-67:15 ([REDACTED]).)

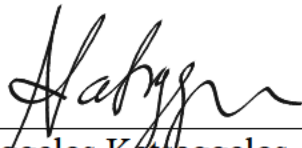
125. **No unexpected results/failure of others.** GoPro does not argue the claimed inventions had unexpected results. [REDACTED]

[REDACTED]. (Ex. 1026, 66:18-67:3 ([REDACTED])).)

* * *

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and that these statements were made with 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.

Dated: July 14, 2025



Aggelos Katsaggelos