

Arashi Vision (U.S.) LLC (d/b/a Insta360)

v.

GoPro, Inc.

IPR2024-01052

U.S. Patent No. 11,336,832

Patent Owner's Demonstratives

Hearing: October 7, 2025

Summary: Grounds

Ground	Claim(s) challenged
1. Thomason + Pacurariu	1, 2, 7-12, 17-20
2. Thomason + Pacurariu + Watanabe	3-6, 13-16
3. Voss + Derbanne	1, 2, 7-12, 17-20
4. Voss + Derbanne + Watanabe	3-6, 13-16

Pet. at 8

1. 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.

Undisputed That The Claims Require Frame-by-Frame Horizon Leveling

Trials@uspto.gov
571-272-7822

Paper 10
Entered: January 7, 2025

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.

IPR2024-01052
Patent 11,336,832 B1

Before WILLIAM V. SAINDON, NABEEL U. KHAN, and
BRIAN D. RANGE, *Administrative Patent Judges*.

RANGE, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

Based on the '832 patent's claim language and specification as we discuss above, we construe 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. We apply this claim construction when addressing the prior art grounds below.

The '832 patent explains that video frames may define visual content "viewable as a function of progress through the progress length of the video content." *Id.* at 5:16–26. Here, function of progress refers to different frames corresponding to different points in the video, consistent with Petitioner's position.

based on rotational positions correlating to different times. Thus, the language of claim 1 (and similar language of claim 11) is consistent with Petitioner's position that this language means determining a viewing window for different frames of the video where different frames correspond to recordings at different points in time.

Paper 10 (Institution Decision) at 13-21

'832 Patent Overview – Claim 7 (Determining Size Of The Viewing Window)

The size of the viewing window (punchout) may be determined (e.g., dynamically changed) based on the rotational positions of the image capture device. For example, rotation (e.g., tilt) of the visual content may be estimated based on readings from the position sensor of the image capture device. The rotational positions of the image capture device as the function of progress through the capture duration may be used to determine/estimate the offset of the visual content from horizon due to rotation of the image capture device. The size of the viewing window may be changed (e.g., increased, decreased) based on the amount of rotation. The size of the viewing window may be changed to take advantage of different amounts of the visual content that may be presented within a horizon-leveled of the visual content based on different amounts of rotation of the image capture device.

Ex. 1001 ('832 patent) at 10:52-67

7. The system of claim 1, wherein 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 based on the rotational positions of the image capture device as the function of progress through the capture duration.

Ex. 1001 ('832 patent) at Cl. 7

'832 Patent Overview – Claim 8 (Simulate Changes In Zoom)

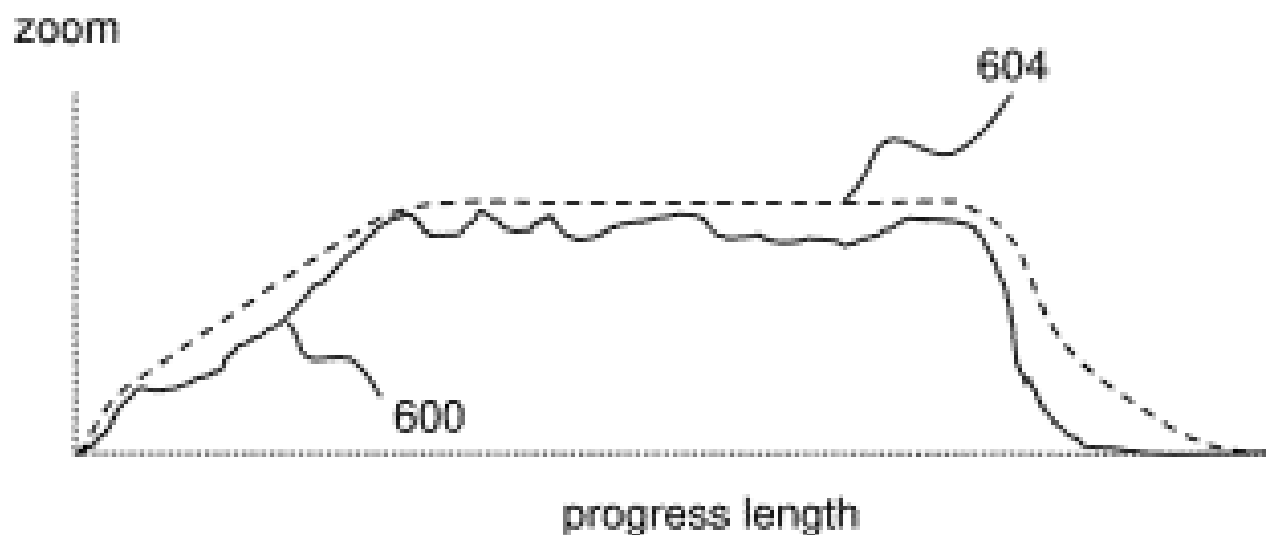
In some implementations, the changes in the maximum size of the viewing window (that may be used to horizon level visual content) based on rotation of the image capture device may be used to change the zoom level of the image capture device used to capture visual content. Use of buttons, switches, dials, and/or other features of the image capture device that needs to be engaged to change the zoom level of the image capture device may interfere with visual content capture. For example, a user engaging a button, a

content capture by the image capture device. The image capture device may monitor the rotational positions of the image capture device during capture to determine the zoom level of the visual content capture. When the image capture device is rotated away from being horizontally/vertically held towards being tilted by 45 degrees from horizon, the zoom level of the image capture device may be increased (e.g., larger than 1×) with the extent of the visual content that is captured including and/or being smaller than the maximum size of the viewing window allowed based on the image capture device rotation. When the image capture device is rotated away from being tilted by 45 degrees from horizon, the zoom level of the image capture device may be decreased (e.g., towards 1×) with the extent of the visual content that is captured including and/or being smaller than the maximum size of the viewing window allowed based on the image capture device rotation.

Ex. 1001 ('832 patent) at 11:56-64, 12:8-31

8. The system of claim 7, wherein 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 ('832 patent) at Cl. 8



Ex. 1001 ('832 patent) at Fig. 6C

'832 Patent Overview – Claim 10 (Determining Location Of The Viewing Window)

In some implementations, the location of the viewing window may be changed as a function of progress through the progress length to simulate panning in the horizon-leveled visual content. For example, the viewing window may be moved within the field of view of the visual content while not extending beyond the field of view of the visual content. Movement of the viewing window may simulate panning of the image capture device during visual content capture (e.g., panning up and down, side to side). For example, a video may include at different moment depiction of different things of interest in different spatial locations. The location of the viewing window may be changed to pan from one thing of interest to another thing of interest. Other changes in the placement of the viewing window are contemplated.

Ex. 1001 ('832 patent) at 20:51-65

10. The system of claim 1, 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, the location of the viewing window within the field of view of the visual content determining framing of the visual content.

Ex. 1001 ('832 patent) at Cl. 10

'832 Patent Overview – Claims 3-6 (Include Distortion To Hide An Off-Axis Horizon)

center of the image. Existence 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. With respect to the barrel distortion, an off-axis horizon may be bent towards the true horizon and reduce the impact of imperfect horizon leveling. Images 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 ('832 patent) at 22:15-25



Ex. 2021¶168

3. The system of claim 1, wherein the visual content includes a distortion such that a straight line within a scene depicted within the visual content appears as a curved line, the distortion of the visual content reducing impact of an off-axis horizon depicted within the horizon-leveled visual content.

4. The system of claim 3, wherein the distortion includes a barrel distortion or a pincushion distortion.

5. The system of claim 3, wherein the visual content includes the distortion based on capture of the visual content through a wide field of view optical element.

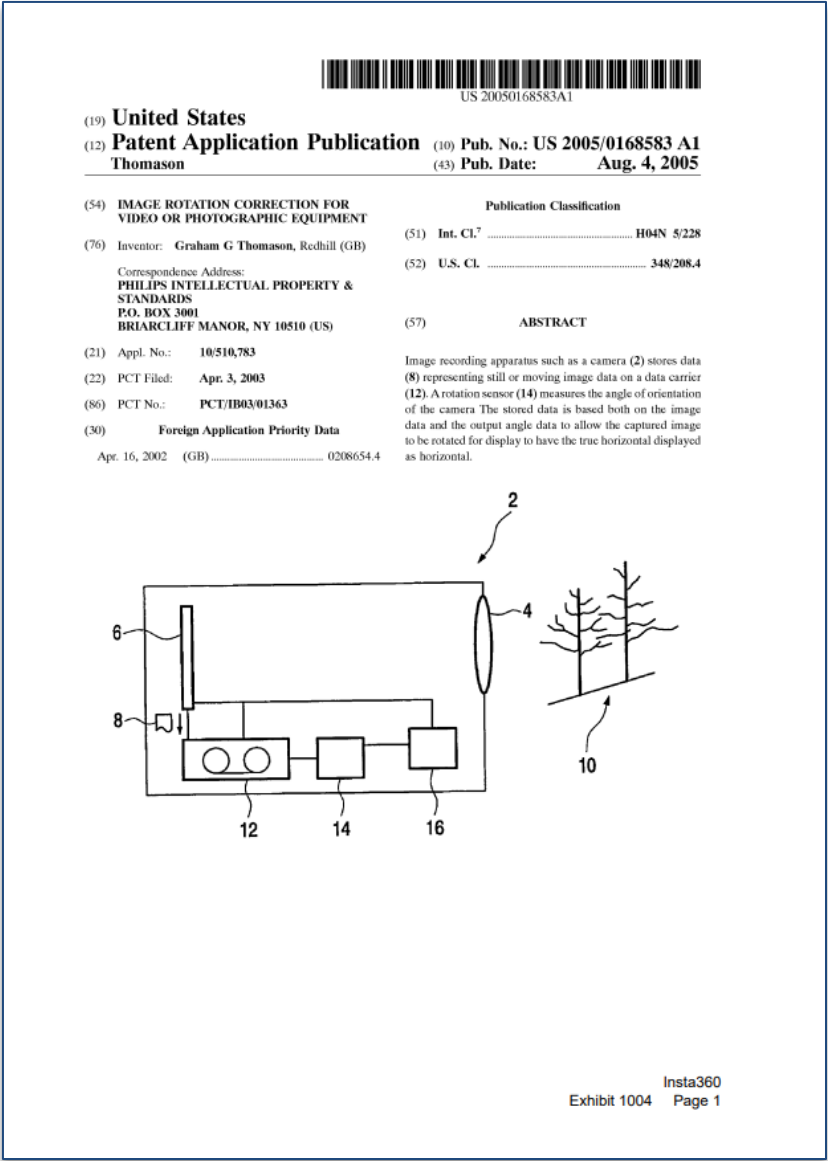
6. The system of claim 3, wherein the visual content includes the distortion based on application of the distortion to non-distorted visual content, the distortion applied to the non-distorted visual content based on the visual content including the non-distorted visual content.

Ex. 1001 ('832 patent) at Cls. 3-6

Ground 1 (Thomason + Pacurariu)

Claim 1

Petitioner Has Not Met Its Burden To Show Thomason Discloses Claim 1



Ex. 1004 (Thomason)

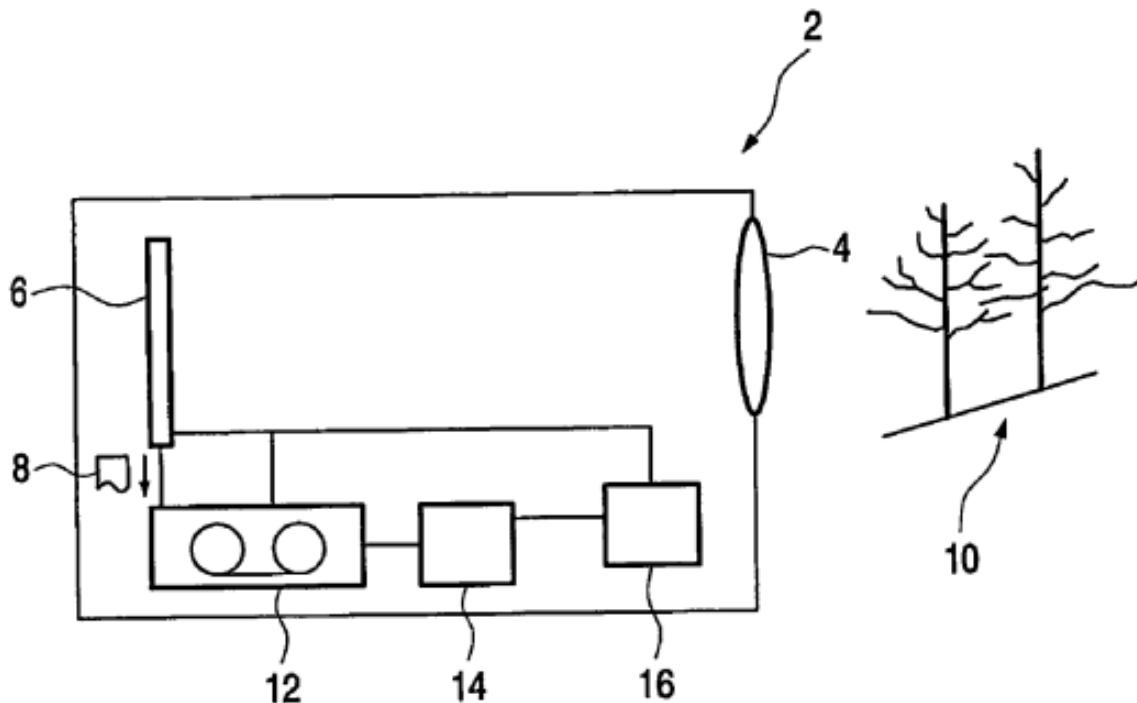
- **Thomason discloses a one-time orientation measurement and correction**
- **No express or inherent disclosure of frame-by-frame horizon leveling**

No Express Or Inherent Disclosure Of Frame-By-Frame Horizon Leveling

[0027] ... The camera **may record either still images or moving images**, in the latter case by capturing a sequence of items of image data **8** representing sequential frames of the moving image.

[0028] The camera **2** also **includes memory 12 for recording the image data 8**. The memory is in the example shown a tape, although the skilled person will be familiar with many other forms of memory suitable for storing still or video images and these may also be used.

[0029] A **rotation sensor 14** is provided that measures **the angle of the camera to the vertical** and outputs a corresponding measurement signal. **This angle is recorded** in the memory **12**.



Ex. 1004 (Thomason) at Fig. 1

No Express Or Inherent Disclosure of Frame-by-Frame Horizon Leveling

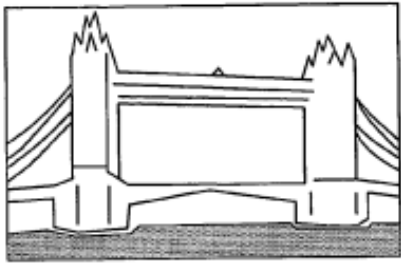


Fig.3a

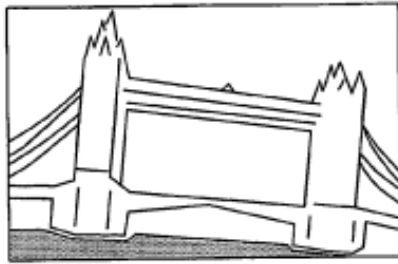


Fig.3b

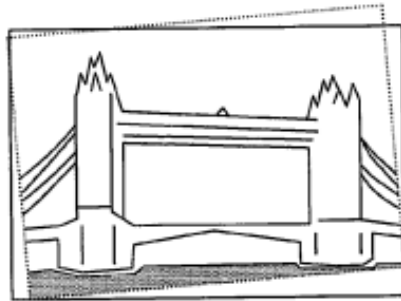


Fig.3c



Fig.3d



Fig.3e

[0017] In another aspect, the invention relates to a method of processing image information, including capturing image information in a camera; measuring the orientation of the camera with respect to vertical to an accuracy of better than 5°, and recording image data based on the image information and the measured orientation of the camera.

[0035] The image as shown in FIG. 3 b is recorded in the memory together with the data item that records the camera angle.

Thomason Discloses A One-Time Correction

- Thomason discloses that its rotation sensor is an “accurate accelerometer”:

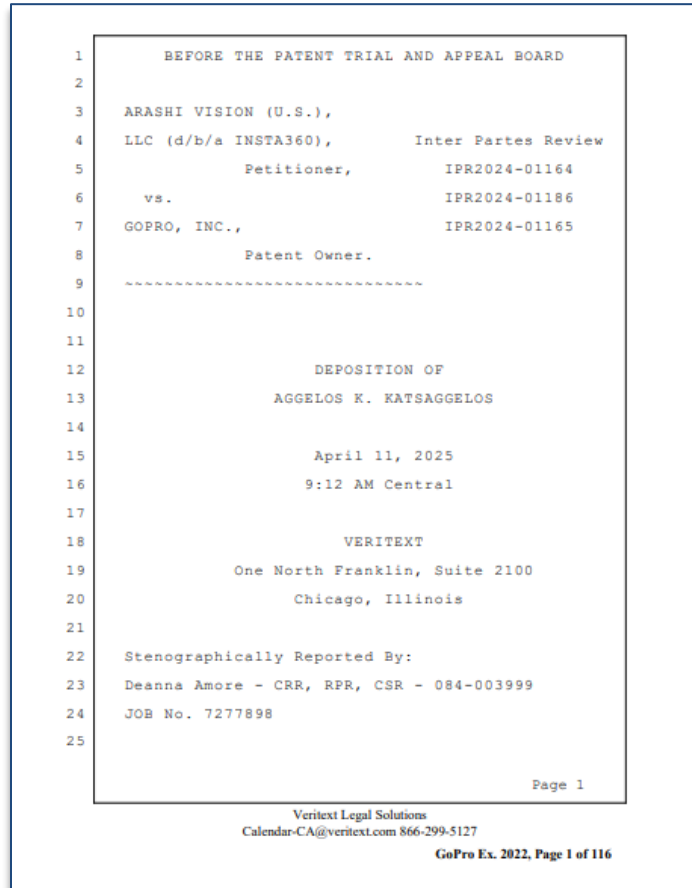
[0029] A rotation sensor 14 is provided that **measures the angle of the camera to the vertical** and outputs a corresponding measurement signal. This angle is recorded in the memory 12. **The rotation sensor is an accurate accelerometer.**

- Patent Owner’s expert explains that a POSITA would understand Thomason’s disclosure of an accelerometer to teach a one-time measurement and correction:

89. ... A POSITA would understand that a single **accelerometer is not suitable for capturing rotational information and determining viewing windows for multiple frames in a video**. This is because a single accelerometer is not suitable for obtaining rotational information from a moving camera. An **accelerometer can only measure rotation in one dimension**, whereas a moving camera may rotate in three dimensions.

Thomason Discloses A One-Time Correction

- Undisputed that a single accelerometer camera can only perform a one-time correction:



EX2022 (4-11-2025 Depo Tr. of Dr. Katsaggelos),
10:19-11:6; Sur-reply at 4

Q So if you have a video and you're trying to do horizon leveling frame by frame, did you consider whether you can do that just with a gyroscope alone?

A As I mentioned, this is not an analysis I performed for this declaration.

Q And the same is true as whether you can do it with an accelerometer alone?

A I did not consider this question in my analysis.

The Board Should Decline To Consider Petitioner's New Argument In Reply

- Petition relied upon Fig. 3 embodiment where Thomason discloses the rotation sensor is a single accelerometer for a one-time correction:

Thomason's system includes "[a] *rotation sensor 14* [] that measures the angle of the camera to the vertical and outputs a corresponding measurement signal." (EX1004, [0029]) (emphasis added.).

Paper 2 (Petition) at 19

- Reply attempts to rely upon a different embodiment where Thomason discloses a multiple angle rotation sensor for stitching together a panoramic image:

(POR, 31.) Thomason expressly teaches 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." (EX1004, [0015].) "The 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." (EX1004, [0041]; *see also id.*,

Paper 32 (Reply) at 11

The Board Should Decline To Consider Petitioner's New Argument In Reply

- Petition relied upon Fig. 3 embodiment where rotation sensor is a single accelerometer for a one-time correction:

[0029] A rotation sensor 14 is provided that **measures the angle of the camera to the vertical** and outputs a corresponding measurement signal. This angle is recorded in the memory 12. **The rotation sensor is an accurate accelerometer.**

Ex. 1004 (Thomason) at ¶29

- Reply relies upon a different embodiment where rotation sensor is a multiple angle rotation sensor for stitching together a panoramic image:

[0015] **A plurality of sensors may be provided to allow for image correction in a number of planes, for example corrections for rotation and tilt. The camera may be able to use the information from the sensors to record a panoramic image by stitching together a plurality of individual images.**

Ex. 1004 (Thomason) at ¶15

[0041] **The 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. The sensor may include a plurality of accelerometers. The stored information may then be used, for example, **to stitch together a high-quality image from several successive image to make up a panoramic images** using the orientation information to accurately align and stitch together the different still images.

Ex. 1004 (Thomason) at ¶41

Sur-Reply at 4-5

Petitioner's New Argument Also Fails On The Merits

- New embodiment involves the creation of a panoramic image – not horizon leveling frames of a video
- Petitioner has not provided any motivation to combine the two different embodiment in Thomason or show there would be a reasonable expectation of success

[0015] **A plurality of sensors may be provided to allow for image correction in a number of planes, for example corrections for rotation and tilt. The camera may be able to use the information from the sensors to record a panoramic image by stitching together a plurality of individual images.**

Ex. 1004 (Thomason) at ¶15

[0041] **The 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. The sensor may include a plurality of accelerometers. The stored information may then be used, for example, **to stitch together a high-quality image from several successive image to make up a panoramic images** using the orientation information to accurately align and stitch together the different still images.

Ex. 1004 (Thomason) at ¶41

At Best, Thomason's Disclosures Are Ambiguous Which Is Insufficient



Anticipation requires that a single reference “describe the claimed invention with sufficient precision and detail to establish that the subject matter existed in the prior art.” *Verve, LLC v. Crane Cams, Inc.*, 311 F.3d 1116, 1120 (Fed. Cir. 2002) (emphasis added). **For this reason, it has long been understood that ambiguous references do not, as a matter of law, anticipate a claim.** See, e.g., *W.L. Gore & Assocs., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1554 (Fed. Cir. 1983) (refusing to find claims anticipated when the prior art references were “unacceptably vague”); see also *In re Hughes*, 52 CCPA 1355, 345 F.2d 184, 188 (1965); *In re Turlay*, 49 CCPA 1288, 304 F.2d 893, 899 (1962) (“It is well established that an anticipation rejection cannot be predicated on an ambiguous reference.”).

Wasica Finance GmbH v. Continental Automotive Systems, Inc., 853 F.3d 1272, 1284 (Fed. Cir. 2017)

- The Petition included only conclusory motivations to combine that parrot the language from KSR



“[T]he conclusory assertions in [Petitioner’s expert] declaration do not provide substantial evidence for finding a motivation to combine”

Belden Inc. v. Berk-Tek LLC, 805 F.3d 1064, 1073 (Fed. Cir. 2015)

- Patent Owner’s expert provided detailed technical explanations of why a POSITA would not combine the two references (Ex. 2021, ¶¶116-119)

- **The Petition does not identify any drawback with Thomason's one-time tilt correction that would motivate a POSITA to modify Thomason**



“[B]oth of these references independently accomplish similar functions.... Because each device independently operates effectively, a person having ordinary skill in the art, who was merely seeking to create a better device... would have no reason to combine the features of both devices into a single device.”

Kinetic Concepts, Inc. v. Smith and Nephew, Inc., 688 F.3d 1342, 1369 (Fed. Cir. 2012)

Ground 1

Claim 7

'832 Patent, Claim 7



US011336832B1

(12) **United States Patent**
Stimm et al.

(10) **Patent No.:** US 11,336,832 B1
(45) **Date of Patent:** May 17, 2022

(54) SYSTEMS AND METHODS FOR HORIZON
LEVELING VIDEOS(56) **References Cited**

U.S. PATENT DOCUMENTS

(71) Applicant: **GoPro, Inc.**, San Mateo, CA (US)

(72) Inventors: **Daryl Stimm**, Encinitas, CA (US); **Kyler William Schwartz**, Valley Center, CA (US); **Jonathan Leland Thorn**, San Leandro, CA (US)

(73) Assignee: **GoPro, Inc.**, San Mateo, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 94 days.

(21) Appl. No.: 17/006,536

(22) Filed: **Aug. 28, 2020**

Related U.S. Application Data

(60) Provisional application No. 62/894,649, filed on Aug. 30, 2019.

(51) Int. Cl.	
<i>H04N 5/232</i>	(2006.01)
<i>H04N 5/225</i>	(2006.01)
<i>G06T 3/40</i>	(2006.01)
<i>G06T 5/00</i>	(2006.01)

(2006.01)
(2006.01)
(2006.01)
(2006.01)

(52) **U.S. Cl.**
CPC *H04N 5/23299* (2018.08); *G06T 3/40*
(2013.01); *G06T 5/006* (2013.01); *H04N*
5/22525 (2018.08); *H04N 5/232935* (2018.08);
H04N 5/232945 (2018.08)

S 5/23299 (20
; *G06T* 5/00
08); *H04N* 5/
H04N.

(58) **Field of Classification Search**
CPC .. G06T 7/30; G06T 3/40; G06T 5/006; H04N
5/23218; H04N 5/23254; H04N 5/2327;
H04N 5/23299; H04N 5/22525; H04N
5/232935; H04N 5/232945

on Search
G06T 3/40; G06T 3/42; H04N 5/23; H04N 5/23299; H04N 5/232999

See application file for complete search history.

20 Claims, 9 Drawing Sheets

METHOD 200

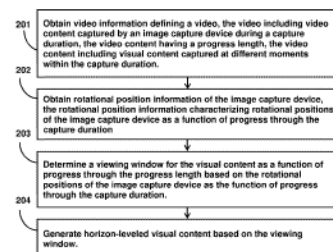
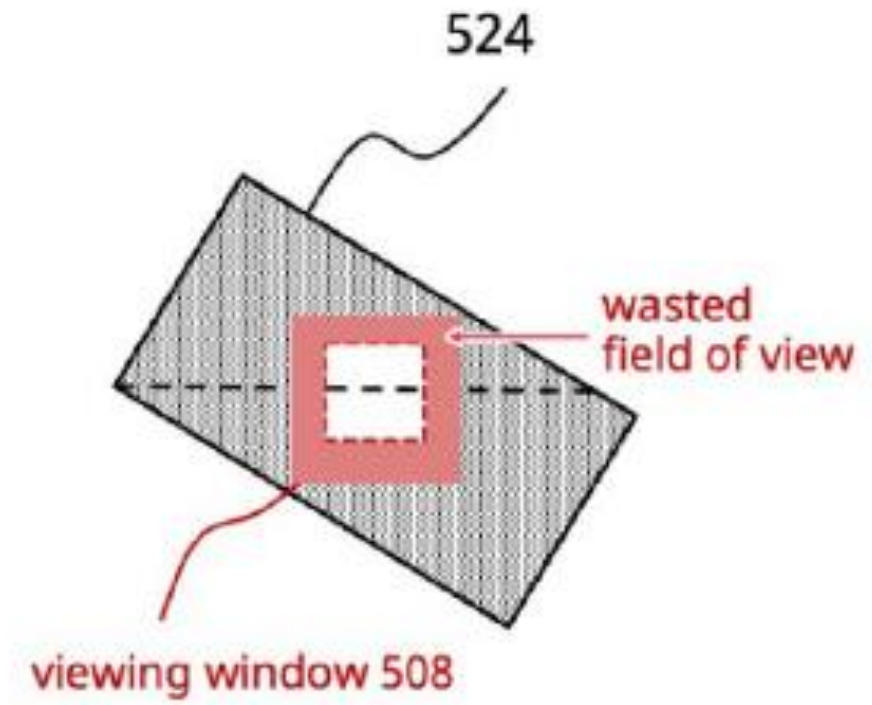
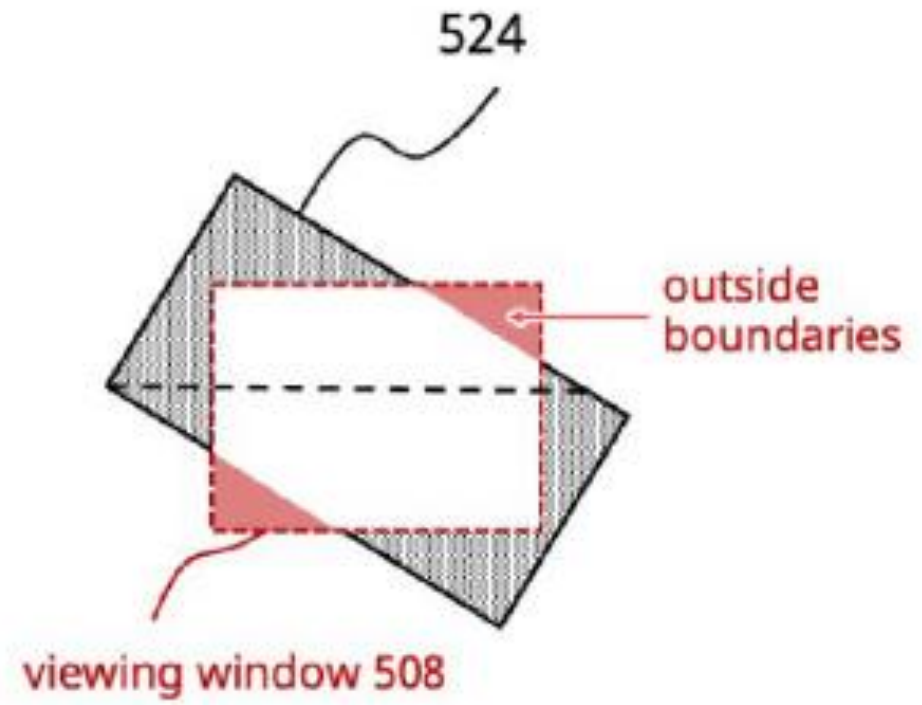


Exhibit 1001 Insta360 Page 1

7. The system of claim 1, wherein 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 based on the rotational positions of the image capture device as the function of progress through the capture duration.

Ex. 1001 ('832 patent) at Cl. 7

Problem Solved by the '832 Patent



'832 Patent Solution: Determination of the Size of the Viewing Window

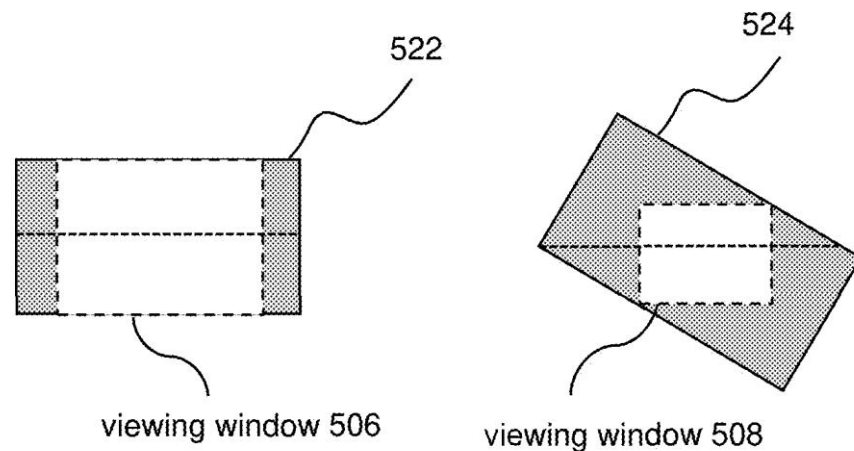


FIG. 5B

In some implementations, the determination of the viewing window may include determination of the size of the viewing window (viewing size). The size of the viewing window may be determined 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/or other information. The size of the viewing window may be determined for different moments within the progress length of the visual content. The size of the viewing window may be determined to take into account the maximum size of the viewing window allowed based on the image capture device rotation. The size of the viewing window may be determined to be the same or smaller than the maximum size of the viewing window allowed based on the image capture device rotation. In some

Ex. 1001 ('832 patent) at 17:51-65

Challenges With Resizing The Viewing Window

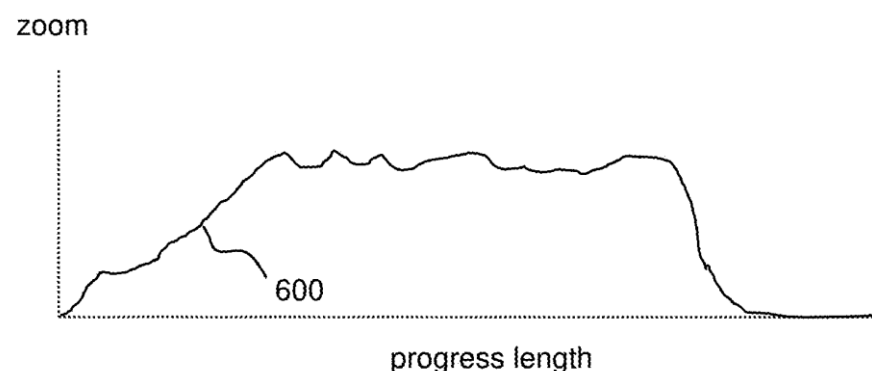


FIG. 6A

within the horizon-leveled visual content. The size of the viewing window may increase with decrease in zoom. The size of the viewing window may decrease with increase in zoom. Using the zoom values of the zoom curve may result in pronounced (e.g., rapid, jittery) changes in zoom/viewing window size within the horizon-leveled visual content. The zoom effect may be very pronounced within the horizon-leveled visual content if the visual content was captured by an image capture device undergoing jittery/rapid rotations.

Ex. 1001 ('832 patent) at 18:30-37

Challenges With Resizing The Viewing Window: “Pumping”



Petitioner Has Not Established That “Pumping” Problem Was A Recognized Problem

BY MR. SCHMIDT:

Q Are you able to say whether or not the pumping phenomena was a recognized problem in the field at the time the '832 patent was filed?

MS. LI: Same objection, form.

BY THE WITNESS:

A This is not a question I addressed in my declaration. It was not part of any of the claims that I analyzed in the '832 patent and I haven't expressed an opinion regarding that.

Ex. 2041 (Katsaggelos Dep.) at 40:4-12; Sur-Reply at 7-8

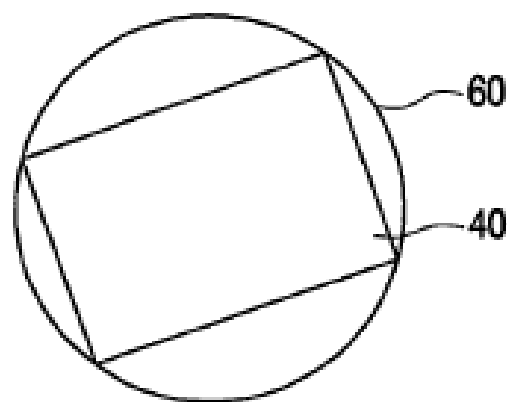


Fig.5

[0039] In a further modification, the sensor array may be circular to enable arbitrary rotation to take place without any loss at the edges. FIG. 5 illustrates such a circular sensor 60 with nominal image frame 40. Rotation to any angle is possible without size reduction. The individual pixels of circular sensor 60 may be arranged on a hexagonal grid.

Ex. 1004 (Thomason) at ¶39

Pacurariu: Fixed-Sixed Crop Region

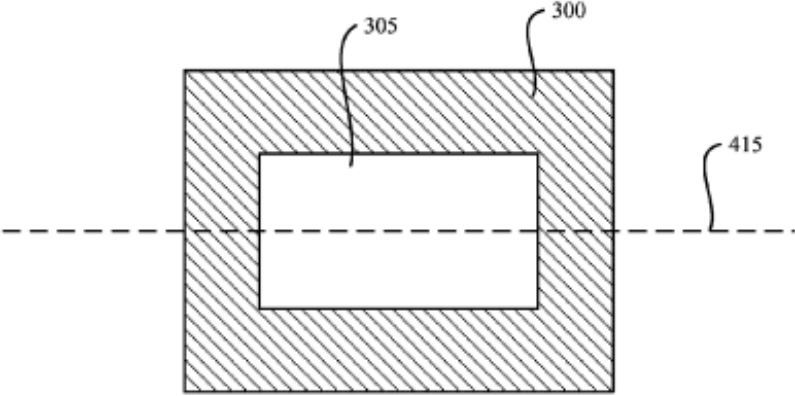


Figure 4A

[0042] FIG. 4A illustrates a graphical representation of the image sensor array 300 with the image area 305 having a smaller size than the image area shown in FIG. 3A according to some embodiments described herein. In this example, the **image area is reduced to compensate for future or potential rotations of the image area 305 relative to the image sensor array 300 or vice versa (see FIG. 5A).** As shown, the image area 305 and/or the image sensor array 300 are aligned with the horizon 415.

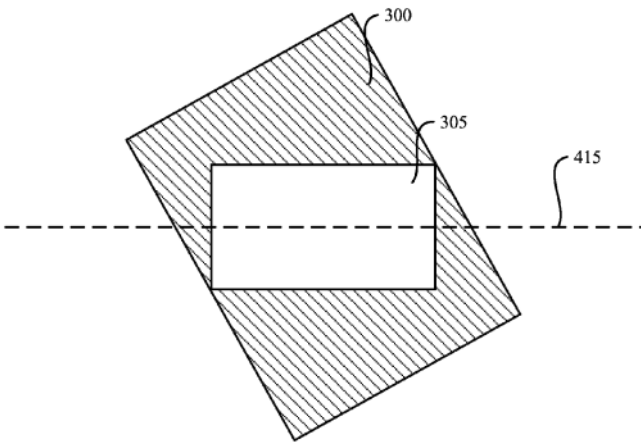


Figure 5A

[0044] FIG. 5A illustrates a graphical representation of the image sensor array **300** that is tilted relative to the gravitational vector **410** and relative to the horizon **415**. **A reduced area of the image area 305 may be used to compensate for any rotation.** In this example, the image sensor array **300** is tilted 60.8° relative to the gravitational field and 29.2° relative to the horizon **415**. The size of the image area may depend on the size of the image sensor and/or the desired aspect ratio of the image area.

Petitioner's CN Application Describes The State of the Art At The Time

2019


US011336832B1

(72) Inventors: **Daryl Stimm, Encinitas, CA (US);
Kyler William Schwartz, Valley
Center, CA (US); Jonathan Leland
Thorn, San Leandro, CA (US)**

(73) Assignee: **GoPro, Inc., San Mateo, CA (US)**

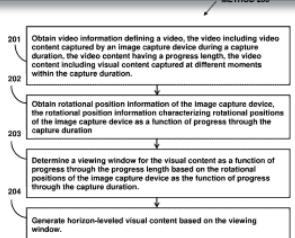
(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 94 days.

(21) Appl. No.: **17/006,536**

(22) Filed: **Aug. 28, 2020**

Related U.S. Application Data

(60) **Provisional application No. 62/894,649, filed on Aug. 30, 2019.**


201 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.
202 Obtain rotational position information of the image capture device, the rotational position information characterizing rotational positions of the image capture device as a function of progress through the capture duration.
203 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 a function of progress through the capture duration.
204 Generate horizon-leveted visual content based on the viewing window.

Ex. 1001 ('832 Patent)

2020

(19) State Intellectual Property Office
(12) Invention patent
[logo:]
(10) Authorization announcement number CN 112804444 B

[QR code]

(21) Application number 202011601388.2
(22) **Application date 12/30/2020**
(65) Published document number of the same application
Application publication number CN 112804444 A
(43) Application publication date 05/14/2021
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Bao'an District, Shenzhen City, Guangdong
Province 518000**
(72) **Inventor Men Zehua Chen Cong**

Reviewer Tian Qiushuo

corresponding original motion state to the target video frame under the viewing angle field limit corresponding to the target FOV value, so that the anti-shake processed video is as close as possible to the ideal motion smoothed video. At the same time, it maximizes the viewing angle field of the processed video image and improves the anti-shake effect of the video.

corresponding original motion state to the target video frame under the viewing angle field limit corresponding to the target FOV value, so that the anti-shake processed video is as close as possible to the ideal motion smoothed video. At the same time, it maximizes the viewing angle field of the processed video image and improves the anti-shake effect of the video.

GoPro Ex. 2004 Page 1 of 13

Ex. 2004 (Petitioner's CN Patent Application)

Petitioner CN Application: “Existing” Solutions Use “Fixed” Size Viewing Window

- Petitioner’s description of the state of the art (fixed viewing window)

Background technique

[0002] In the video electronic image stabilization process, the **existing technical solution** is generally to first establish a motion model of the camera, and estimate the original motion state of the camera at different moments in the video based on the camera gyroscope (or visual characteristics) and the established motion model. Then according to the ideal motion smooth motion state obtained by the smoothing algorithm at different times, each frame of the video is converted from the image corresponding to the original motion state to the image corresponding to the ideal motion smooth state. However, for cameras with field of view (FOV) restrictions, it is necessary to obtain a boundary-limited motion state that allows the converted image to be successfully indexed in the original video image based on the original motion state, the ideal motion smoothing state, and the camera's FOV. Then the image is converted from the original motion state to the image of the camera's observation position in the boundary-limited motion state to achieve the purpose of electronic image stabilization.

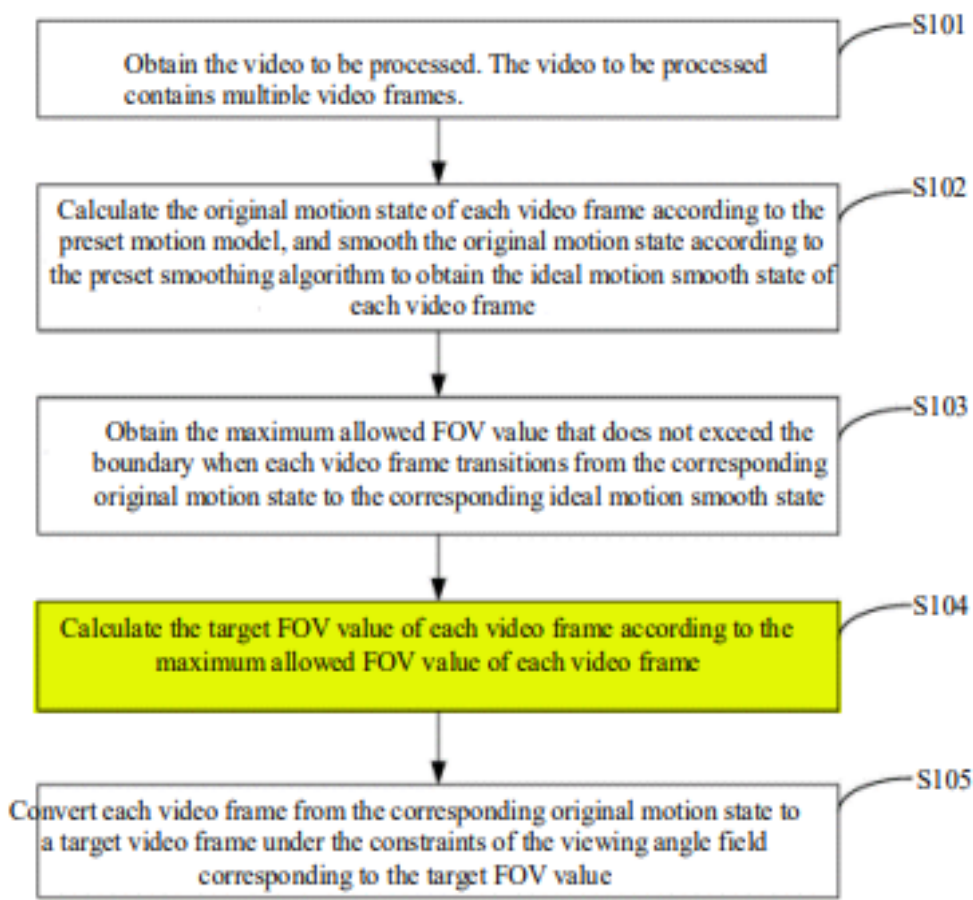
[0003] In boundary-constrained electronic image stabilization, there are inherent flaws in using a **fixed FOV** for the output video:

[0004] a. **If the output video uses a large fixed FOV**, when the degree of movement is relatively intense, since the boundary of the output anti-shake video image is relatively close to the boundary of the original image, the boundary-limited motion state at each moment is different from the ideal smooth motion state. The deviation is too large, resulting in **poor anti-shake effect**;

[0005] b. **If the output video adopts a small fixed FOV**, when the motion is relatively gentle, the anti-shake smoothing margin is too large (that is, the output video can adopt a larger FOV, which can make the motion state with boundary restrictions and the ideal motion smooth. state is closer or identical), resulting in a **waste of FOV**. Therefore, in reality, a compromise size FOV is often selected. However, when the movement is particularly intense, the above-mentioned problem a will occur, making the anti-shake effect less than optimal. When the movement is particularly gentle, the above-mentioned problem b will occur, so that the FOV utilization rate at this moment is not reached to the maximum.

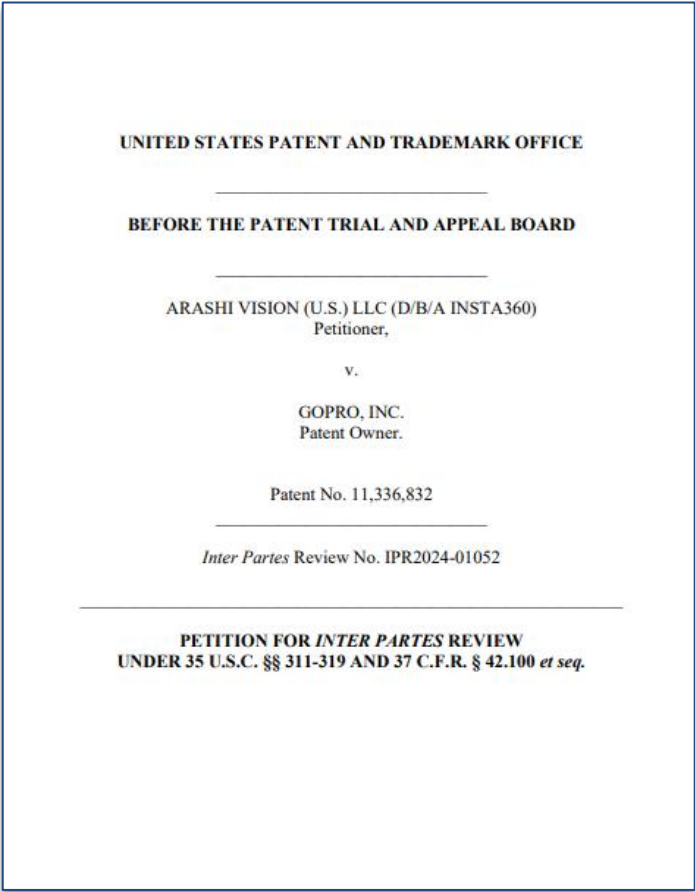
Ex 2004 (Petitioner’s CN Patent Application) ¶¶ 2-5

- Petitioner’s purported improvement (change viewing window size frame-by-frame)



Ex 2004 (Petitioner’s CN Patent Application) Fig. 1

Petitioner's Theory For Claim 7



Paper 2 (Petition) at 37-40

The Petition relies solely on actual disclosure by Thomason for determining the viewing window size



no argument that this feature is “inherent” in Thomason



no argument that it would be obvious to modify Thomason to add this feature

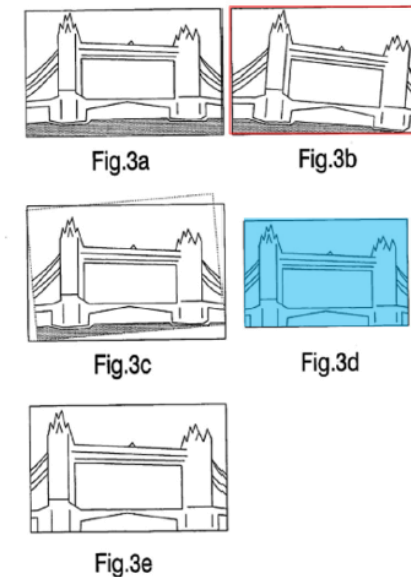


no reliance on Pacurariu for this limitation

The Petition Relies Solely on Figures 3b-d of Thomason for Claim 7

5. **Claim 7:** “The system of claim 1, wherein 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 based on the rotational positions of the image capture device as the function of progress through the capture duration.”

As shown in Figures 3b-d below, Thomason applies a “rotation correction” to Figure 3b “so that true horizontals appear as horizontal,” as shown in Figure 3c. (EX1004, [0036].) “[T]he image is cropped to eliminate blank space as illustrated in FIG. 3d.” (EX1004, [0036].) Thus, 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. (EX1002, ¶119.) For example, Figure 3b is taken with a camera angle at an angle of about 10° to the vertical, but if it is taken with a camera angle at an angle of about 20° to the vertical, more of the image may need to be cropped to obtain the viewing window showing horizon-leveled visual content, resulting in a viewing window having a smaller size. (EX1002, ¶119.)



Thus, in Thomason, the size of the viewing window may be dependent on the rotational position of the camera—a more tilted camera angle may result in a smaller viewing window because there is less visual content in the image that may be horizon-leveled. (EX1002, ¶¶120-121.) Thus, in Thomason, for each image in the video, the size of the viewing window is determined based on the corresponding rotational position of the camera. (*Id.*)

Petitioner's Expert Opinion Is Conclusory And Not Supported By Thomason

121. For each image in the video, the size of the viewing window is determined based on the corresponding rotational position of the camera. Thomason discloses “a rotation sensor for providing an output representing *the angle of the captured image* to the horizontal to an accuracy of 5° or better; and a data carrier for recording data based on *both image data representing the captured image and angle data representing the angle measured by the rotation sensor* so that a rotated image corrected to have the true horizontal in the captured image displayed as horizontal can be displayed from the data recorded on the data carrier.” (EX1004, [0004] (emphases added).) As a specific example, Thomason discloses that “[t]he image as shown in FIG. 3b is recorded in the memory *together with the data item that records the camera angle.*” (EX1004, [0035] (emphasis added).)

Ex. 1001
(Katsaggelos Decl.)
at ¶121

Thomason Teaches, at Most, a One-Time Correction to Video Data

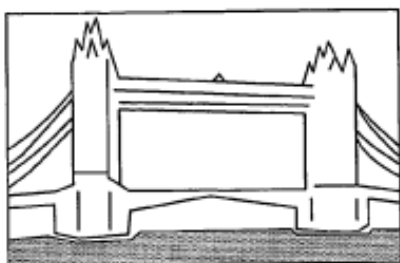


Fig.3a

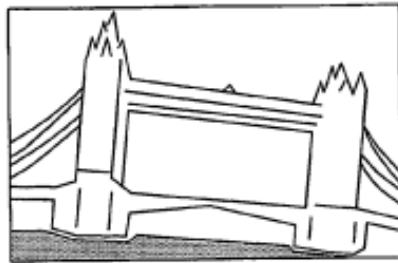


Fig.3b

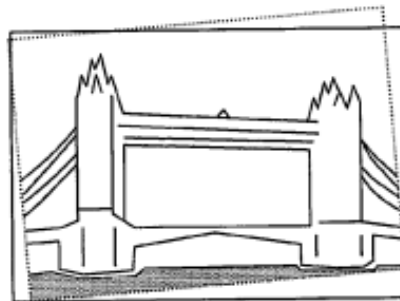


Fig.3c



Fig.3d



Fig.3e

[0017] In another aspect, the invention relates to a method of processing image information, including capturing image information in a camera; measuring the orientation of the camera with respect to vertical to an accuracy of better than 5°, and recording image data based on the image information and the measured orientation of the camera.

[0035] The image as shown in FIG. 3b is recorded in the memory together with the data item that records the camera angle.

[0036] On replay, the processor 22 calculates the image on display 24 as shown in FIG. 3c, with a rotation correction applied using the camera item data angle by replay processor 22 so that true horizontals appear as horizontal. Some of the image frame of the rotation corrected image is blank, as may be seen. Accordingly, the image is cropped to eliminate blank space as illustrated in FIG. 3d. Frame 40 represents the recorded image and frame 42 represents the image frame of the displayed image.

Ex. 1004 (Thomason) at ¶¶17, 35-36

Petitioner's Expert Admits Thomason Only Expressly Discloses a Correction To a Single Frame

BY MR. SCHMIDT:

Q I promise I'm going to ask you about that, that's going to be my next line of questions. I just want to establish one simple point. You agree that what's described in the first sentence of paragraph 32 of Thomason is a correction to a single frame. Fair?

MS. LI: Objection, form. Same objection.

BY THE WITNESS:

A I brought up 32. Our whole discussion started whether Thomason discloses storing image and motion data and whether we need Pacurariu or not for that and I pointed to this as just an example, there might be multiple other places where such a thing is disclosed, so the image data 8 is one frame of a video, that's how it's presented in Thomason, and therefore using the television set, for example, as is mentioned

later it's understood that the mention is for one frame but this one frame being part of the video, this is what happens for the whole video.

Ex. 2041 (Katsaggelos Dep.) at 78:11-79:3;
Sur-Reply at 3

Petitioner Cannot Rely Upon Obviousness to Modify Thomason



Like the petitioner in *Intelligent Bio-Systems*, **Yita waited until its reply to present what in substance is an argument that it would have been obvious to a relevant artisan to modify Rabbe to arrive at the one-eighth limitation. This argument was a “meaningfully distinct contention,”** *Ariosa Diagnostics*, 805 F.3d at 1367, from those made in Yita's petition, which focused (for the claim limitation at issue) only on what Rabbe discloses.

Yita LLC v. MacNeil IP LLC, 69 F.4th 1356, 1366-1367 (Fed. Cir. 2023)



To the extent the Board found the challenged claims to be unpatentable based on an obviousness ground that was not presented in the petition, this was error. See *Koninklijke Philips N.V. v. Google LLC*, 948 F.3d 1330, 1336–37 (Fed. Cir. 2020) (holding that the Board erred by instituting IPR based on a combination of references that the petitioner “did not advance in its petition.”). On remand, the Board must hold FFP to the obviousness theory articulated in ground one.

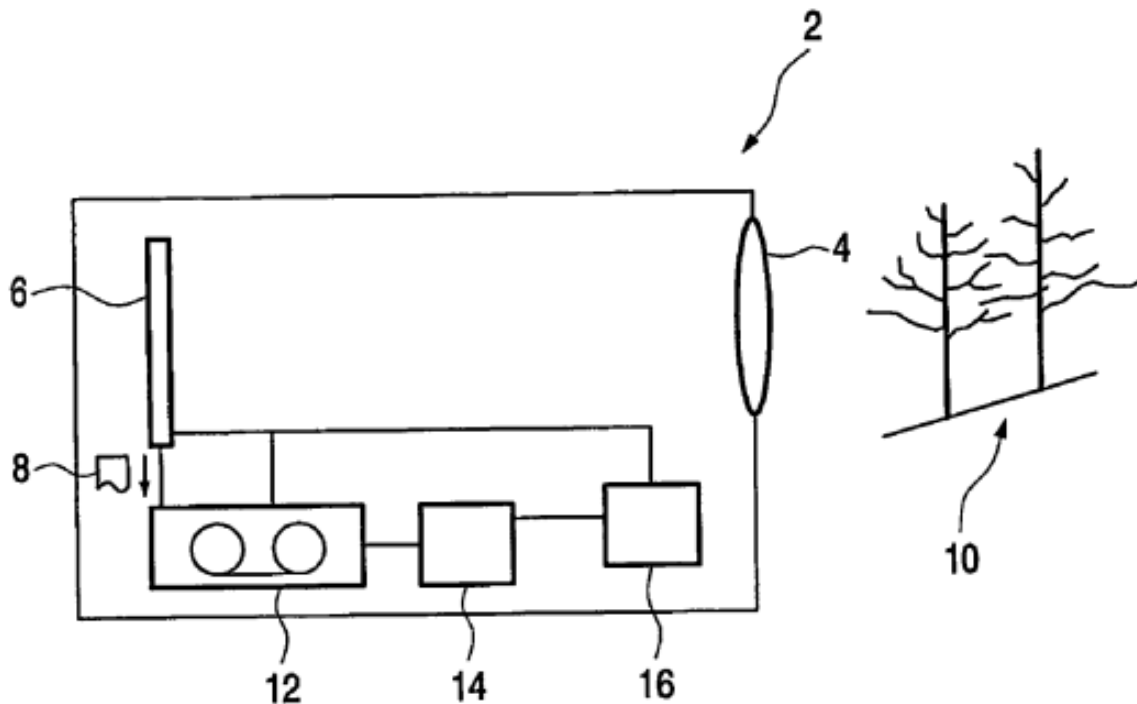
Kerry Group Services International Ltd. v. Florida Food Products, LLC, 2025 WL 582881, *4 (Fed. Cir. 2025)

Thomason Teaches, at Most, a One-Time Correction to Video Data

[0027] ... The camera **may record either still images or moving images**, in the latter case by capturing a sequence of items of image data 8 representing sequential frames of the moving image.

[0028] The camera 2 also **includes memory 12 for recording the image data 8**. The memory is in the example shown a tape, although the skilled person will be familiar with many other forms of memory suitable for storing still or video images and these may also be used.

[0029] A **rotation sensor 14 is provided that measures the angle of the camera to the vertical** and outputs a corresponding measurement signal. **This angle is recorded** in the memory 12.



Ex. 1004 (Thomason) at Fig. 1

Thomason Teaches, at Most, a One-Time Correction to Video Data

- Thomason discloses that its rotation sensor is an “accurate accelerometer”:

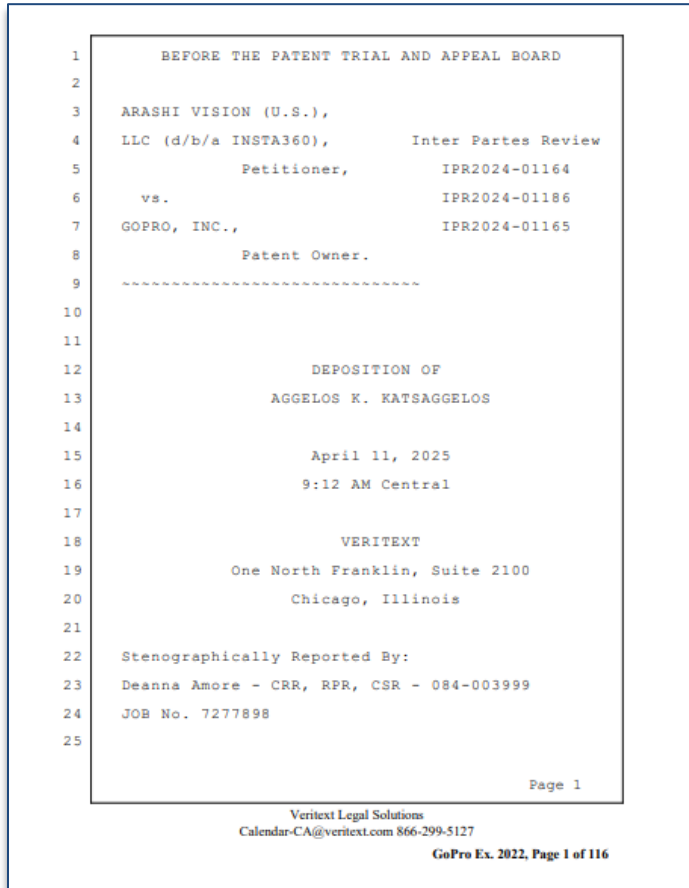
[0029] A rotation sensor 14 is provided that **measures the angle of the camera to the vertical** and outputs a corresponding measurement signal. This angle is recorded in the memory 12. **The rotation sensor is an accurate accelerometer.**

- Patent Owner’s expert explains that a POSITA would understand Thomason’s disclosure of an accelerometer to teach a one-time measurement and correction:

89. ... A POSITA would understand that a single **accelerometer is not suitable for capturing rotational information and determining viewing windows for multiple frames in a video**. This is because a single accelerometer is not suitable for obtaining rotational information from a moving camera. An accelerometer can only measure rotation in one dimension, whereas a moving camera may rotate in three dimensions.

Thomason Teaches, at Most, a One-Time Correction to Video Data

- Undisputed that a single accelerometer camera can only perform a one-time correction:



EX2022 (4-11-2025 Depo Tr. of Dr. Katsaggelos),
10:19-11:6; ; Sur-reply at 4

Q So if you have a video and you're trying to do horizon leveling frame by frame, did you consider whether you can do that just with a gyroscope alone?

A As I mentioned, this is not an analysis I performed for this declaration.

Q And the same is true as whether you can do it with an accelerometer alone?

A I did not consider this question in my analysis.

The Board Should Decline To Consider Petitioner's New Argument In Reply

- Petition relied upon Fig. 3 embodiment where Thomason discloses the rotation sensor is a single accelerometer for a one-time correction:

Thomason's system includes "[a] *rotation sensor 14* [] that measures the angle of the camera to the vertical and outputs a corresponding measurement signal." (EX1004, [0029]) (emphasis added.)

Paper 2 (Petition) at 19

- Reply attempts to rely upon a different embodiment where Thomason discloses a multiple angle rotation sensor for stitching together a panoramic image:

(POR, 31.) Thomason expressly teaches 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." (EX1004, [0015].) "The 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**." (EX1004, [0041]; *see also id.*,

Paper 32 (Reply) at 11

Petitioner's New Reply Argument Fails on the Merits

- Reply relies upon a different embodiment where rotation sensor is a multiple angle rotation sensor for stitching together a panoramic image:

[0015] **A plurality of sensors may be provided to allow for image correction in a number of planes, for example corrections for rotation and tilt. The camera may be able to use the information from the sensors to record a panoramic image by stitching together a plurality of individual images.**

[0041] **The 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. The sensor may include a plurality of accelerometers. The stored information may then be used, for example, **to stitch together a high-quality image from several successive image to make up a panoramic images** using the orientation information to accurately align and stitch together the different still images.

Ex. 1004 (Thomason) at ¶¶15, 41

At Best, Thomason's Disclosures Are Ambiguous Which Is Insufficient



Anticipation requires that a single reference “describe the claimed invention with sufficient precision and detail to establish that the subject matter existed in the prior art.” *Verve, LLC v. Crane Cams, Inc.*, 311 F.3d 1116, 1120 (Fed. Cir. 2002) (emphasis added). **For this reason, it has long been understood that ambiguous references do not, as a matter of law, anticipate a claim.** See, e.g., *W.L. Gore & Assocs., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1554 (Fed. Cir. 1983) (refusing to find claims anticipated when the prior art references were “unacceptably vague”); see also *In re Hughes*, 52 CCPA 1355, 345 F.2d 184, 188 (1965); *In re Turlay*, 49 CCPA 1288, 304 F.2d 893, 899 (1962) (“It is well established that an anticipation rejection cannot be predicated on an ambiguous reference.”).

Wasica Finance GmbH v. Continental Automotive Systems, Inc., 853 F.3d 1272, 1284 (Fed. Cir. 2017)

Erroneous reliance on expert's hindsight interpretation rather than actual disclosures from reference

duration.” Mr. Goodin pointed out that paragraph [0036] of Thomason discloses that a rotation correction is applied using the camera item data angle by a replay processor so that the true horizontals appear as horizontal and that the image is cropped to eliminate blank space as illustrated in Fig. 3d. Mr. Goodin explained that this disclosure in Thomason supports that Thomason determines the size of the viewing window. Mr. Goodin also explained that one of skill would understand that Thomason discloses determining the size of the viewing window as a function of progress through the progress length because based on the degree of rotation, “more or less image would be cropped as you proceed through the video to obtain the viewing window.” Goodin Tr. at 1322:2–1323:7 and RDX-0013C.298.

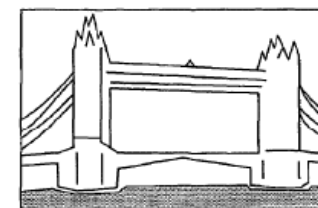


Fig.3a

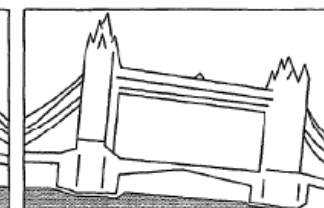


Fig.3b

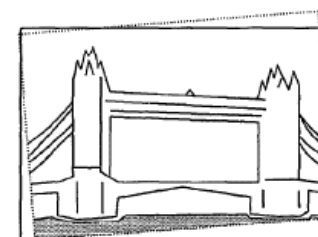


Fig.3c

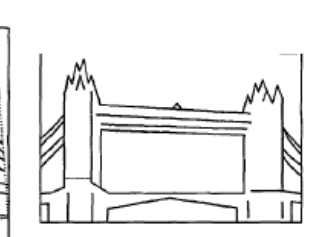


Fig.3d



Fig.3e

EX1027 (ITC Initial Determination) at 148

Ground 1

Claim 8

'832 Patent, Claim 8



US011336832B1

(12) **United States Patent**
Stimm et al.

(10) **Patent No.:** US 11,336,832 B1
(45) **Date of Patent:** May 17, 2022

(54) **SYSTEMS AND METHODS FOR HORIZON LEVELING VIDEOS**

(71) Applicant: **GoPro, Inc.**, San Mateo, CA (US)

(72) Inventors: **Daryl Stimm**, Encinitas, CA (US);
Kyler William Schwartz, Valley Center, CA (US); **Jonathan Leland Thorn**, San Leandro, CA (US)

(73) Assignee: **GoPro, Inc.**, San Mateo, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 94 days.

(21) Appl. No.: 17/006,536

(22) Filed: **Aug. 28, 2020**

Related U.S. Application Data

(60) Provisional application No. 62/894,649, filed on Aug. 30, 2019.

(51) **Int. Cl.**
H04N 5/232 (2006.01)
H04N 5/225 (2006.01)
G06T 3/40 (2006.01)
G06T 5/00 (2006.01)

(52) **U.S. Cl.**
CPC **H04N 5/23299** (2018.08); **G06T 3/40** (2013.01); **G06T 5/006** (2013.01); **H04N 5/22525** (2018.08); **H04N 5/232935** (2018.08); **H04N 5/232945** (2018.08)

(58) **Field of Classification Search**
CPC .. **G06T 7/30**; **G06T 3/40**; **G06T 5/006**; **H04N 5/23218**; **H04N 5/23254**; **H04N 5/2327**; **H04N 5/23299**; **H04N 5/22525**; **H04N 5/232935**; **H04N 5/232945**

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2004/0257384 A1* 12/2004 Park H04N 5/232045 345,646
2015/0215532 A1* 7/2015 Jafarideh H04N 5/232045 348,36
2015/0254871 A1* 9/2015 MacMillan G06T 3/0062 382,180
2016/0088287 A1* 3/2016 Sadi H04N 13/261 348,43
2016/0283097 A1* 9/2016 Voss G11B 27/031 3508
2017/0118458 A1* 4/2017 Gronholm G03B 35/08 5/23254
2017/0142337 A1* 5/2017 Kokaram H04N 5/23254 21,6543
2018/0160194 A1* 6/2018 Baylis H04N 5/23254 5/29201
2019/0189160 A1* 6/2019 Huang

OTHER PUBLICATIONS

Video Retrieval Methods Using Geographic Information in Windows Azure Cloud (Year: 2014)*

* cited by examiner

Primary Examiner—Nize N Sivji

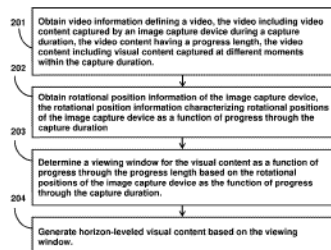
(74) **Attorney, Agent, or Firm**—Esplin & Associates, PC

(57) **ABSTRACT**

A video may be captured by an image capture device in motion. A horizon-leveled view of the video may be generated by providing a punchout of the video. The punchout of the video may compensate for rotation of the image capture device during capture of the video. The placement of the punchout of the video may be changed based on different rotational positions of to provide a view in which a horizon depicted within the video is leveled.

20 Claims, 9 Drawing Sheets

METHOD 200



Insta360

Exhibit 1001 Page 1

7. The system of claim 1, wherein 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 based on the rotational positions of the image capture device as the function of progress through the capture duration.

Ex. 1001 ('832 patent) at Cl. 7

8. The system of claim 7, wherein 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 ('832 patent) at Cl. 8

“Simulated Zoom”

For example, FIG. 6C illustrates an example smoothed zoom curve 604. The smoothed zoom curve 604 may smoother changes in zoom than the zoom curve 600. The value of the smoothed zoom curve 604 may be equal to and/or greater than the maximum value of the zoom curve 600. Using a smoothed zoom curve may allow for rapid changes in zoom to be replaced with smoothed zooms, creating a more cinematic feel to the horizon-leveled video than use of the zoom curve 600. Smoothing of the zoom curve 600 may include analysis of the changes in the sizes of the viewing window as defined by the zoom curve 600. Based on the analysis, the viewing window may be artificially made smaller and/or larger (e.g., artificially zoom-in and/or zoom-out) during moments that do not require the change in viewing window size to ramp-up and/or ramp-down to the needed viewing window size.

Ex. 1001 ('832 patent) at 19:27-42

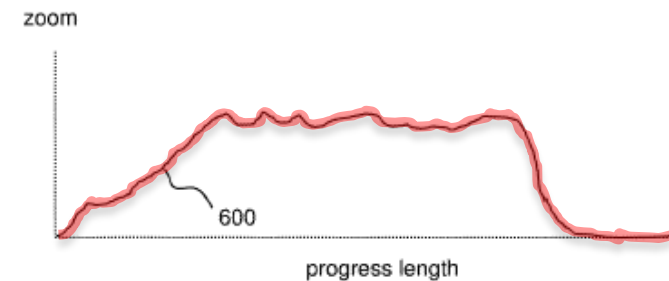


FIG. 6A

Zoom as a result of actual viewing window size changes (Claim 7)

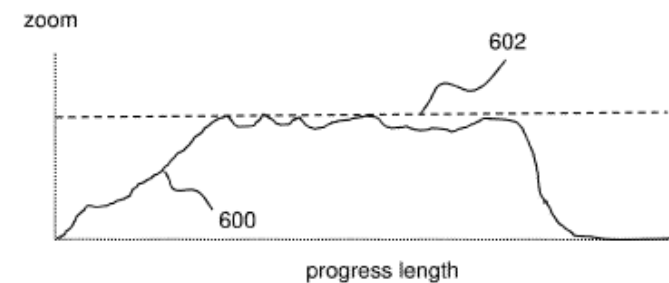


FIG. 6B

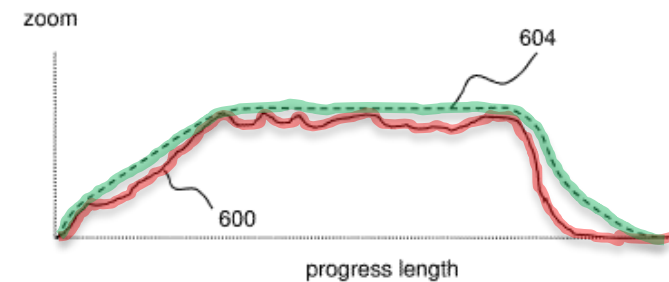


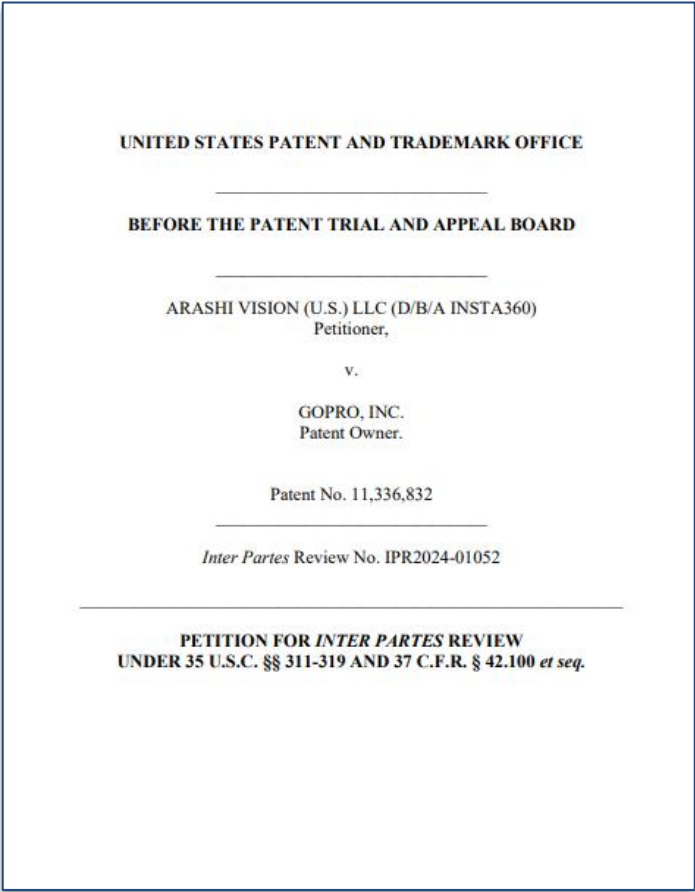
FIG. 6C

“Simulated Zoom” (Claim 8)

sizes. Rather than simulating a constant zoom or a zoom with pronounced (e.g., rapid. Jittery) changes, the smoothing of the changes in the maximum sizes may simulate smoothed/gradual changes in zoom.

Ex. 1001 ('832 patent) at 19:12-15

Petitioner's Theory For Claim 8



Paper 2 (Petition) at 37-40

The Petition relies solely on actual disclosure by Thomason for “simulating zoom”

 no argument that this feature is “inherent” in Thomason

 no argument that it would be obvious to modify Thomason to add this feature

 no reliance on Pacurariu for this limitation

Petitioner Agrees That Claim 8 Adds Further Requirements to Claim 7

Regardless, the Petition provided different mappings for different claims. It cites Thomason's *FIG. 3d* for claim 7 and *FIG. 3e* for claim 8. Regarding claim 8, the Petition explains that Figure 3d is 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; EX1019, ¶50.) The ALJ agreed. (ITC ID, 162-163.)

Paper 32 (Reply) at 13

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.)

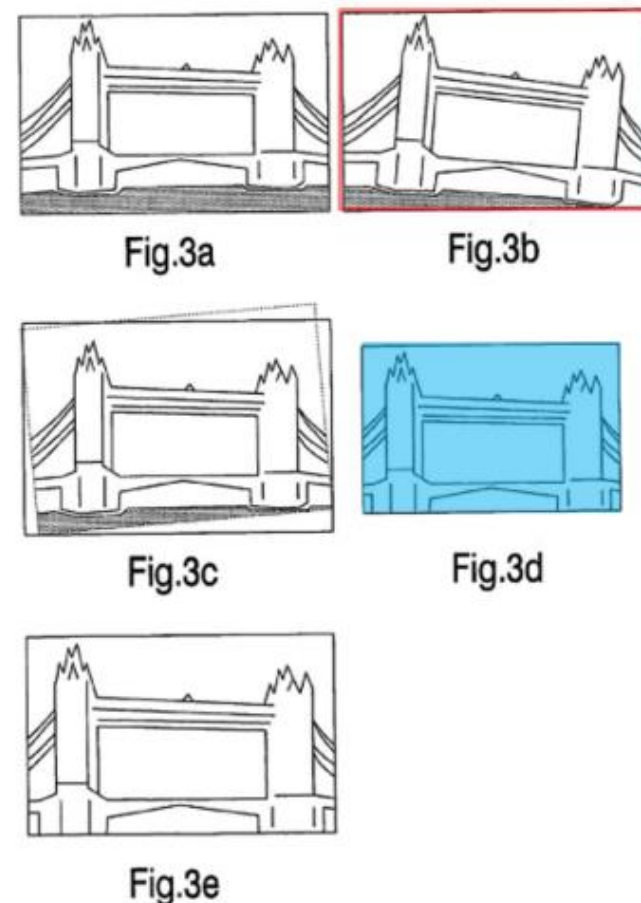
EX1019 (Katsaggelos Reply Decl.) ¶24

Petitioner Has Not Met Its Burden To Show Thomason Discloses Claim 8

The Petition relied upon Thomasson Figure 3d for claim 8

as original image frame 40.” (EX1004, [0037].) Comparing to Figure 3a (the original image, below), the scene in Figure 3e appears more zoomed-in because the objects appear larger. (EX1002, ¶124.) Thus, the changing size of the viewing window (Figure 3d) simulates changes in zoom for the visual content. (EX1002, ¶124.)

Paper 2 (Petition) at 39

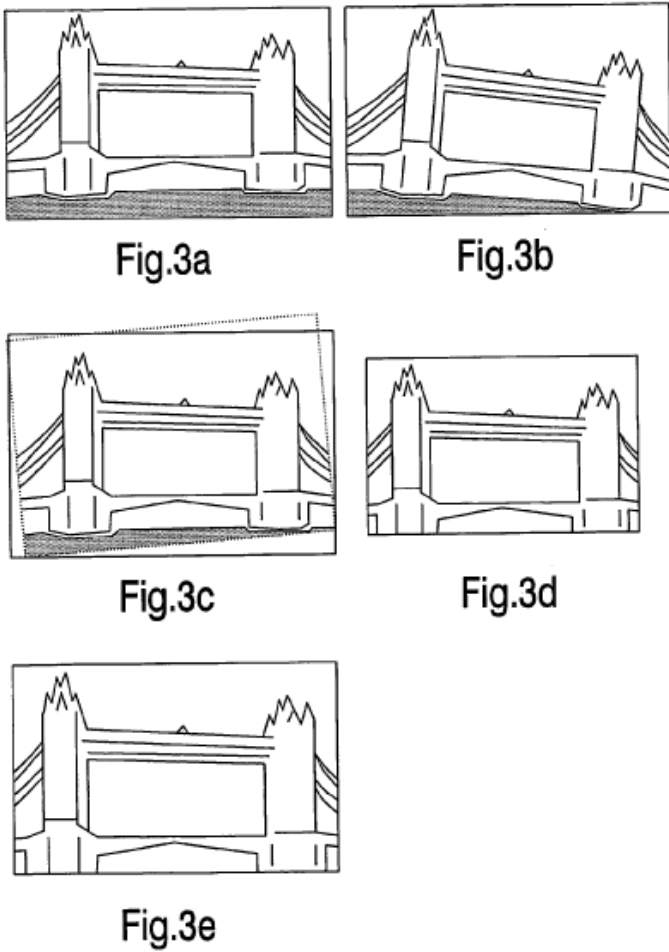


Ex. 1004 (Thomason) Fig. 3

On Reply, Petitioner changed its theory to rely on Thomasson Figure 3e

Regardless, the Petition provided different mappings for different claims. It cites Thomason's *FIG. 3d* for claim 7 and *FIG. 3e* for claim 8. Regarding claim 8, the Petition explains that Figure 3d is 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; EX1019, ¶50.) The ALJ agreed. (ITC ID, 162-163.)

Paper 32 (Reply) at 13



The Board Should Disregard Petitioner's New Argument Based on Pacurariu

meritless. (*Supra* § II.C.) Even adopting GoPro's position, Pacurariu discloses that "the tilt angle data may be filtered or *smoothed* . . . on a plurality of the tilt angle data." (EX1005, [0066]). Thus, Pacurariu discloses calculating smoothed rotation data, which would result in a smoothed/gradual change in the viewing window size and thus a "smoothed" zoom effect. (EX1019, ¶51.) Dr. Foroosh omitted this disclosure in his analysis. (EX1018, 209:5-12.)

Paper 32 (Reply) at 14

[0066] Moreover, 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.

EX1005 (Pacurariu) at [0066]

In Any Event, Pacurariu Does Not Disclose “Simulating Zoom”

BY MR. SCHMIDT:

Q But just reading paragraph 66 of Pacurariu you can't say why a person of ordinary skill in the art would want to implement that type of smoothing for the tilt angle data?

MS. LI: Objection, form.

BY THE WITNESS:

A In paragraph 66 I don't see a reason stated why this data may be filtered or smoothed, just yeah, I want to have a smoother signal, that's all, but why do we need to do that, we have to see the rest of the specification to figure it out.

Ex. 2041 (Katsaggelos Dep.) at 96:8-96:18

Ground 1

Claim 10

Petitioner Has Not Met Its Burden To Show Thomason Discloses Claim 10

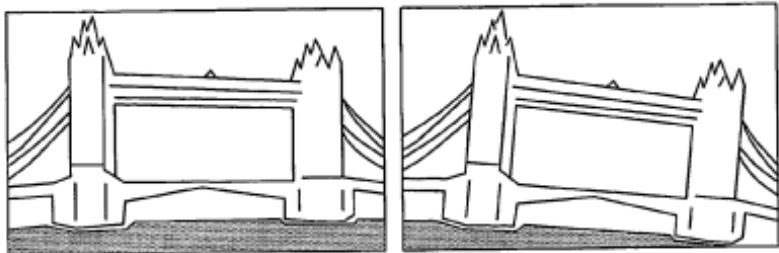


Fig.3a

Fig.3b

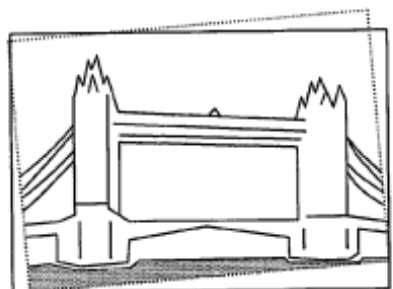


Fig.3c



Fig.3d



Fig.3e

Petitioner argues only disclosure by Thomason:

- ✗ no disclosure of viewing window location determination frame-by-frame**
- ✗ viewing window is fixed in the center**

Petitioner Has Not Met Its Burden To Show Pacurariu Render Claim 10 Obvious

- No disclosure of determining viewing window location (fixed viewing window in the center)

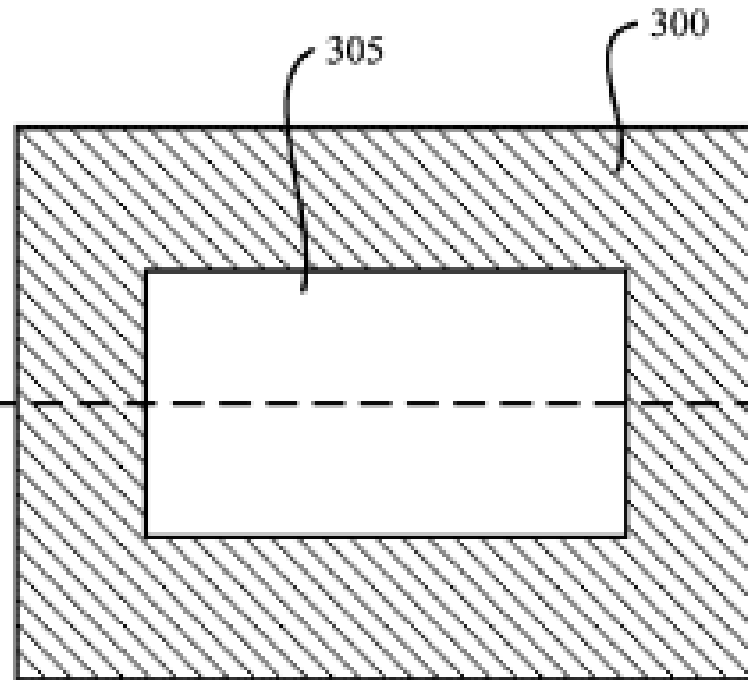


Figure 4A

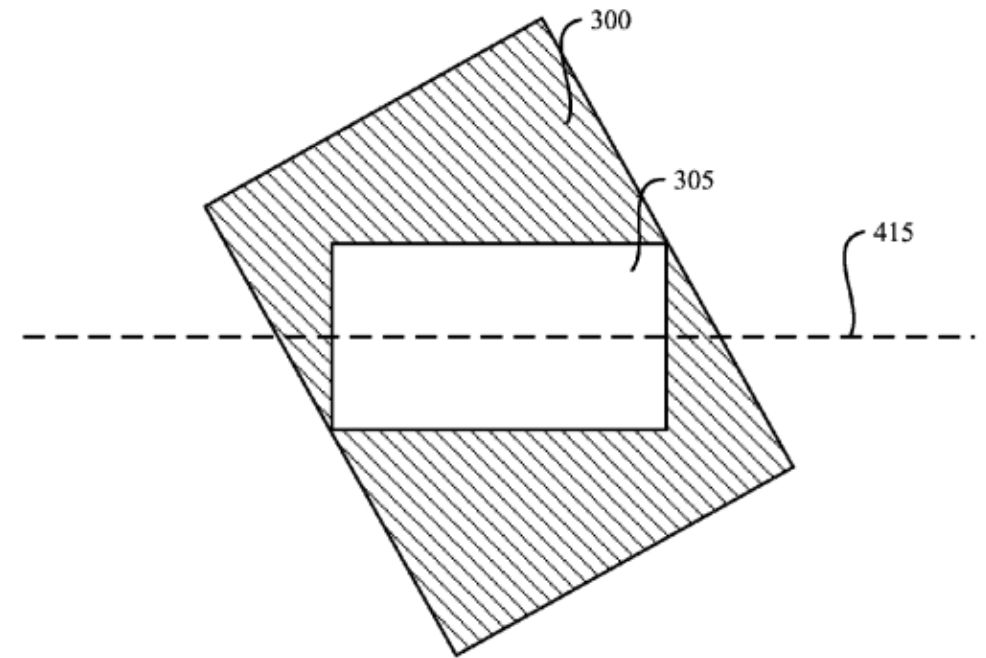


Figure 5A

“Thomason’s viewing window in FIG. 3d appears not perfectly centered with respect to the original image, thus meeting GoPro’s construction.”

Paper 32 (Reply) at 15



“[P]atent drawings do not define the precise proportions of the elements and may not be relied on to show particular sizes if the specification is completely silent on the issue.”

Hockerson-Halberstadt, Inc. v. Avia Group Int'l, 222 F.3d 951, 956 (Fed. Cir. 2000)

Sur-Reply at 10

Ground 3 (Voss + Derbanne) Claim 1

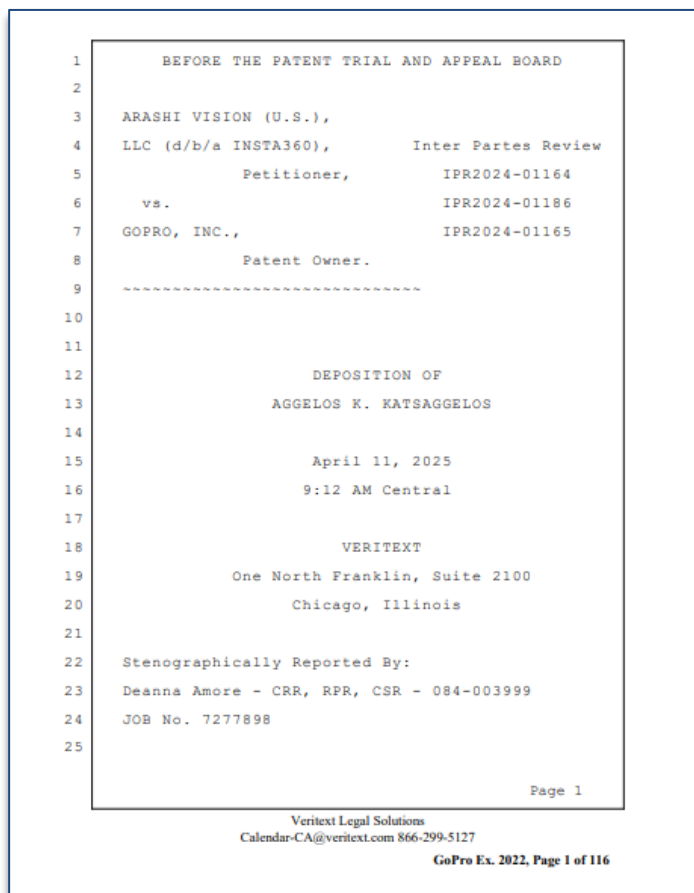
Petitioner Has Not Met Its Burden To Show Voss Discloses Claim 1

Voss's mobile phone is not configured to:

- “determine a viewing window... the viewing window *defining extents* of the visual content to be included with the horizon leveled visual content”; and
- “generate horizon-leveled visual content based on the viewing window, the horizon leveled visual content including a *punchout out of the extents of the visual content defined by the viewing window*”

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.

Undisputed That Claim 1 Requires Horizon-Levelling The Contents of the Viewing Window

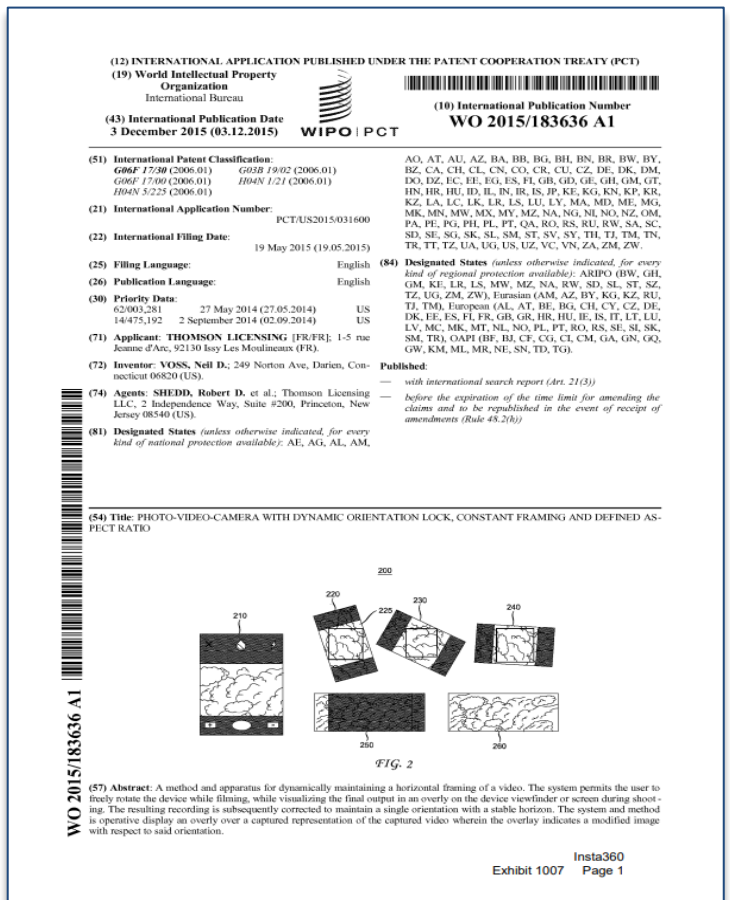


EX2041 (8-22-2025 Depo Tr. of Dr.
Katsaggelos), 13:2- 15:8, 15:10-16:7;
Sur-Reply at 18

- Q But you agree, Doctor, that whatever appears within the viewing window at a particular moment in time has to be horizon-leveled, right?
- A ... The limitation of viewing window to be included within horizon-leveled content **so the horizon-leveled visual content includes the viewing window. It can be larger but it cannot be smaller, it has to include it.**
- Q ... If you had a system that cropped visual content and did not include everything that was in the viewing window in the horizon-leveled visual content, then that system configuration would not meet the claim, right?
- A Yeah, I interpret the including, as I mentioned before, that again if A is included in B then A is found in B but B can be larger.

Voss Is Directed At Addressing Oscillations Between Portrait And Landscape

- Voss is directed at configuring a mobile phone to address the problem of users oscillating between portrait and landscape orientations when recording a video:



In many cases users shoot video without specific attention to horizontal orientation, especially when filming a social activity, live event or other subject matter where the user is engaged in the experience that takes their focus off the device they are recording with. Further, **most mobile phones are designed to be used in a vertical orientation. Thus, a user may start using the device in its intended orientation, only to realize later that video should be filmed in a horizontal orientation.** Thus, it is desirable to overcome these problems with current video cameras embedded in mobile electronic devices.

Ex. 1007 (Voss) at 2:17-21

Obviousness Theory Asserted by the Petition

- h. 1[d][i]: “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,”

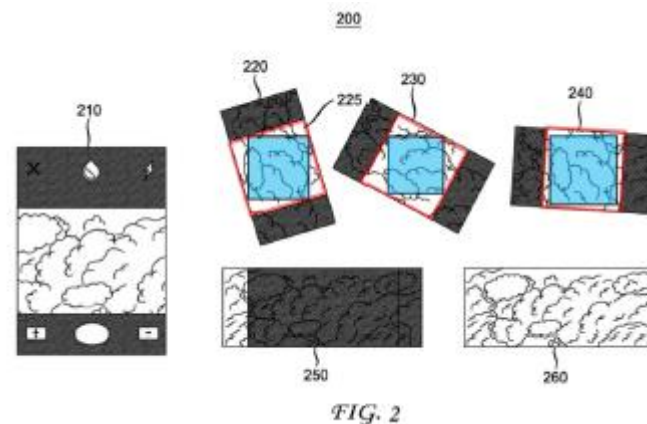
Voss discloses “determine a viewing window for the visual content . . . based on the rotational positions of the image capture device as the function of progress through the capture duration.” As shown in Figure 2 below, “[t]he *inset rectangle 225* is transformed to *compensate for rotation 220, 230, 240* by essentially rotating in the inverse of the device's own rotation, which is sampled from the device's integrated gyroscope.” (EX1007, 10:5-7 (emphases added).) Voss' inset rectangle is a “viewing window” determined based on rotational information of the image capture device. (EX1002, ¶194.)

Paper 2 (Petition) at 68

1. 1[e][ii]: “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.”

Voss discloses that its operations “effectuate[] horizon leveling of the visual content.” Voss states that “as the device is rotated, the controlling processor can continuously update the display and save the video or image in a way which has a *continuous consistent horizon*.” (EX1007, 12:10-12 (emphasis added).)

Paper 2 (Petition) at 74-75



EX1007 (Voss) Fig. 2 (annotated by Petitioner)

Support by the description

i) But the description only defines in page 10 lines 10, 11, line 15 "***an inset rectangle 225 is inscribed within the overall sensor that is best-fit to the maximum boundaries of the sensor given the desired optimal aspect ratio for the given (current) orientation***".

Fig. 4, page 14 lines 3-5 define "An inscribed rectangle 440, as described previously, may also be overlaid on the image to indicate an aspect ratio of the image or video to be captured". There is here no mention of an orientation, contrary to the wording of claim 1 and contrary to the description pages 16-17, thus leading to subject matter in claim 1 not supported by the description, Article 6 PCT, or even to an unclear description Article 5 PCT.

ii) Moreover, the expressions "*inset rectangle 225*", "*insert rectangle*", "*inscribed rectangle*" and "*a graphic representative of said aspect ratio **and** said orientation*" seem to refer to the same feature. However, the terminology and the signs must be consistent throughout the application. Rule 10.2 PCT.

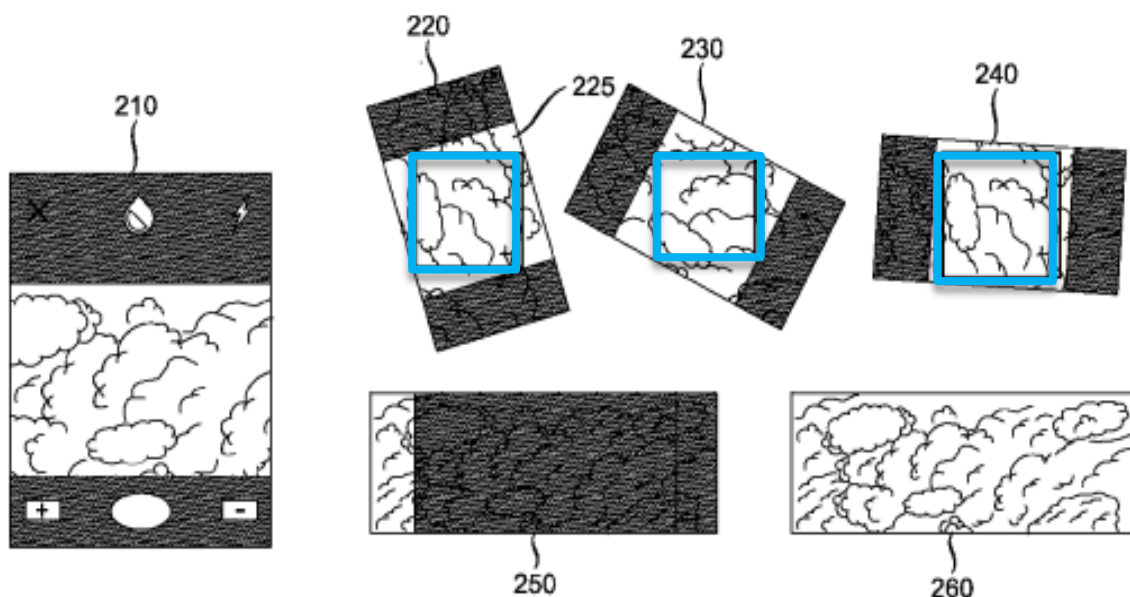
3.2

In addition, figure 2 defines an inscribed square 225, not any inscribed rectangle, leading to an unclear claim, Article 6 PCT.

For example, the "maximum boundaries of the sensor" is nowhere defined in the description and can therefore not be used as a basis for the definition of the "inscribed rectangle". Thus, because of the potential contradiction between description and figure 2, the description may be deemed unclear, Article 5 PCT.

Ex. 2030 (World Patent Office Report) ¶¶ 3.1, 3.2

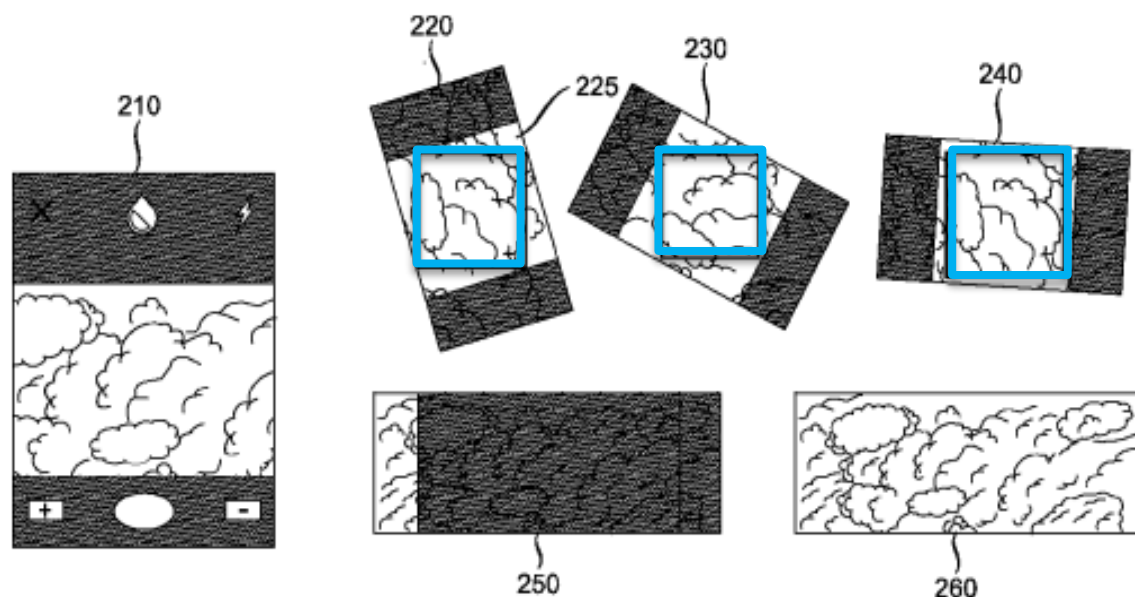
Voss "Inner Rectangle" (225)



aspect ratio is chosen. An inset rectangle 225 is inscribed within the overall sensor that is best-fit to the maximum boundaries of the sensor given the desired optimal aspect ratio for the given (current) orientation. The boundaries of the sensor are slightly padded in order to provide 'breathing room' for correction. The inset rectangle 225 is transformed to compensate for rotation 220, 230, 240 by essentially rotating in the inverse of the device's own rotation, which is sampled from the device's integrated gyroscope. The transformed inner rectangle 225 is inscribed optimally inside the maximum available bounds of the overall sensor minus the padding. Depending on the device's current most orientation, the dimensions of the transformed inner rectangle 225 are adjusted to interpolate between the two optimal aspect ratios, relative to the amount of rotation.

Ex. 1007 (Voss) at 10:2-11

Voss “Inner Rectangle” (225)

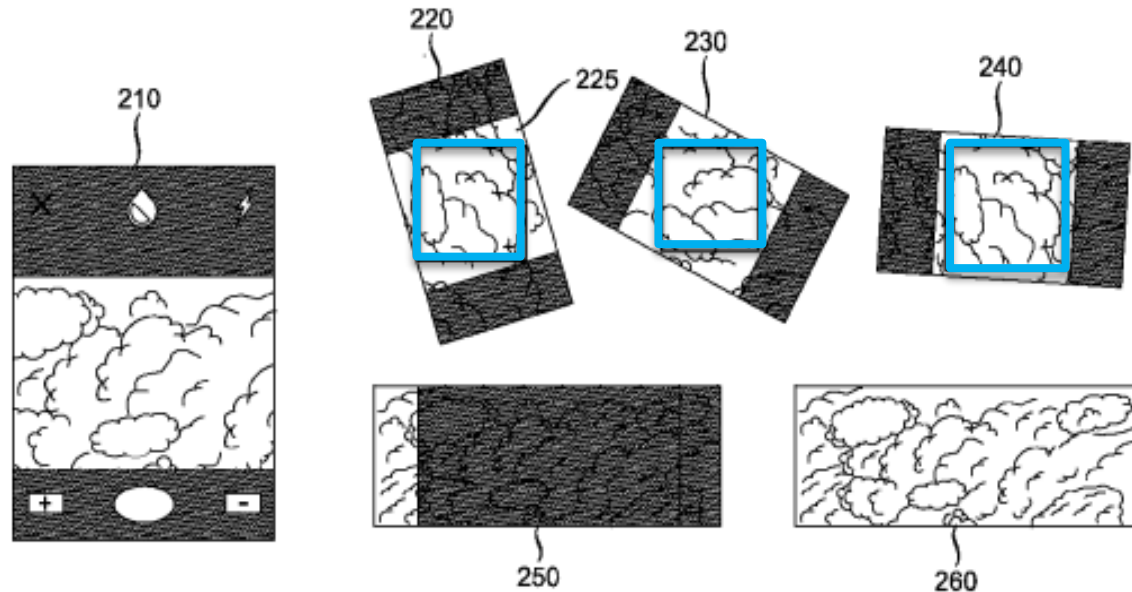


4. **Claim 2:** “The system of claim 1, wherein the viewing window has a one-by-one aspect ratio, the one-by-one aspect ratio reducing impact of an off-axis horizon depicted within the horizon-leveled visual content.”

Voss discloses that “[t]he user may optionally indicate a preferred final video or image ration, such as 1:1, 9:16, 16:9, or any other ratio selected by the user.” (EX1007, 12:22-23.) Voss also discloses “the sampled rectangle is 1:1.” (EX1007, 10:18.)

Paper 2 (Petition) at 75

Voss's Phone Transforms the Contents of Inset Rectangle to Output Rectangle

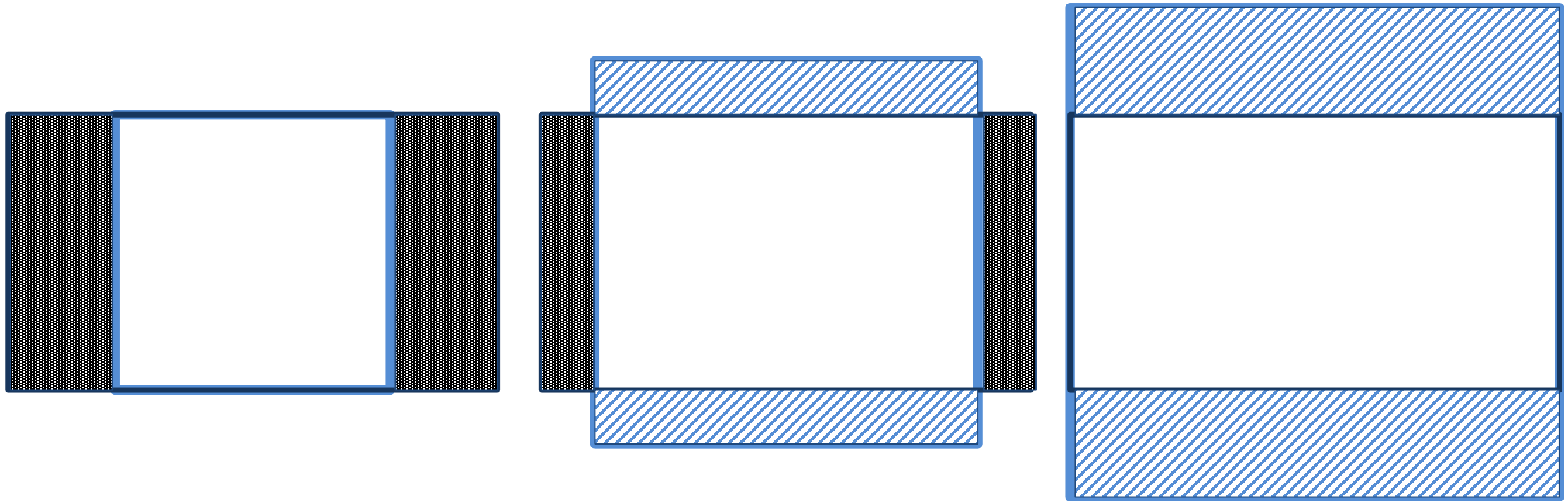


bounds of the overall sensor minus the padding. Depending on the device's current most orientation, the dimensions of the transformed inner rectangle 225 are adjusted to interpolate between the two optimal aspect ratios, relative to the amount of rotation.

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. The inscribed rectangle is sampled and then transformed to fit an optimal output dimension. For example, if the optimal output

Ex. 1007 (Voss) at 10:9-17

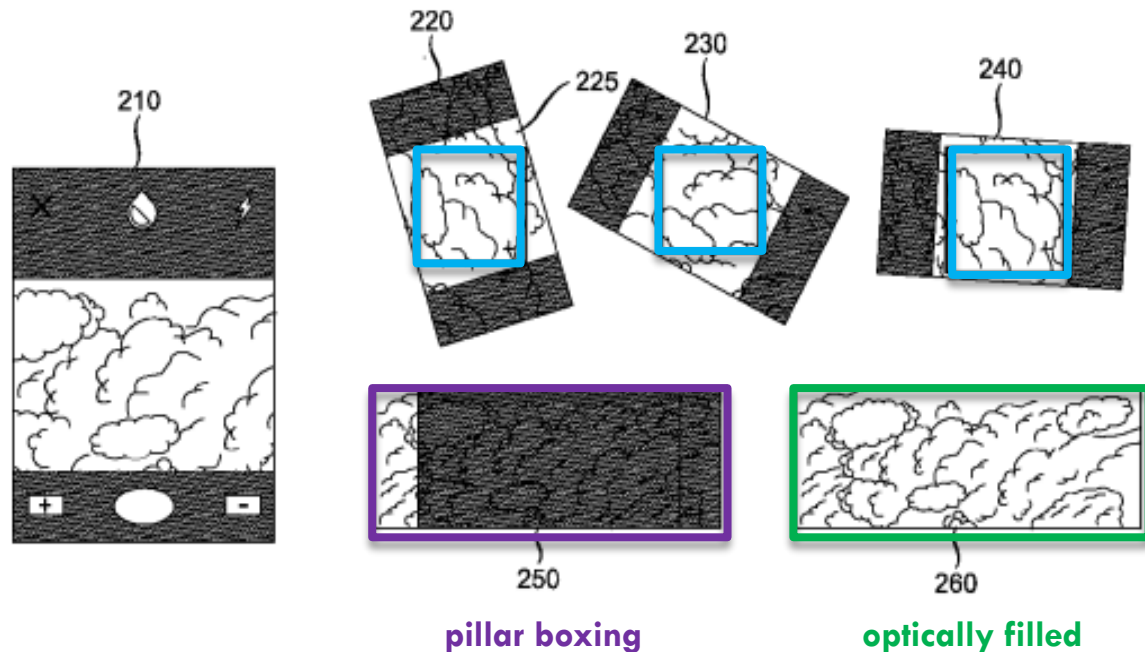
Voss's Inner Rectangle Does Not Define Extents of the Visual Content to be Included Within Horizon-Leveled Visual Content



POR at 51, 59-60

Voss's Phone Is Configured To Oscillate Between Filling And Pillar Boxing

- Voss's discloses that its mobile phone is configured to **oscillate** between filling (cropping) and pillar boxing (blacking out) the “**sampled rectangle**” (alleged viewing window)



For example, if 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').** In the end the result is a fixed aspect asset where the content framing adjusts based on the dynamically provided aspect ratio during correction. So for example a 16:9 video comprised of 1:1 to 16:9 content would **oscillate between being optically filled 260 (during 16:9 portions) and fit with pillar boxing 250 (during 1:1 portions).**

Petitioner Cannot Show Voss's Configuration Satisfies Claim 1

1. 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.

Petitioner Cannot Show Voss's Configuration Satisfies Claim 1



The sole question on appeal is whether Perrodin disclosed “a rule requiring the image elements to be contiguous... It did not. It is true that the example depicted in Figures 18 and 19 *happened* to result in contiguity. But that cannot represent a general rule that would demand contiguity for all images, as required by the claims here.”

In re Facebook, Inc., 2018 WL 3860547, *2 (Fed. Cir. 2018)

“Configure, as defined by dictionaries, means set up for operation especially in a particular way.”

Rex Med., L.P. v. Intuitive Surgical, Inc., 2020 WL 2128795, at *5 (D. Del. 2020)

Derbanne Does Not Cure The Deficiencies in Petitioner's Theory

Further, Derbanne discloses “[v]ideo content may define visual content viewable as a function of progress through a progress length of the video content.” (EX1008, 13:49-51 (emphasis added).) The Voss-Derbanne combination would process the video content in Derbanne’s format, which is “viewable as a function of progress through a progress length of the video content” as taught by Derbanne, to determine the viewing windows for different frames in the video content, thus determining a viewing window for the visual content “as a function of progress through the progress length.” (EX1002, ¶197.)

Paper 2 (Petition) at 69

- I. 1[e][ii]: “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.”

Voss discloses that its operations “effectuate[] horizon leveling of the visual content.” Voss states that “as the device is rotated, the controlling processor can continuously update the display and save the video or image in a way which has a *continuous consistent horizon*.” (EX1007, 12:10-12 (emphasis added).)

Paper 2 (Petition) at 74-75

The Petitions relies on Derbanne only for the “function of progress through a progress length” portion of the “determining a viewing window” limitation 1[d][i]

The Petition does not rely on Debranne for the “inclusion of extents” requirement of limitation 1[e][ii]

POR at 61; Sur-Reply at 20

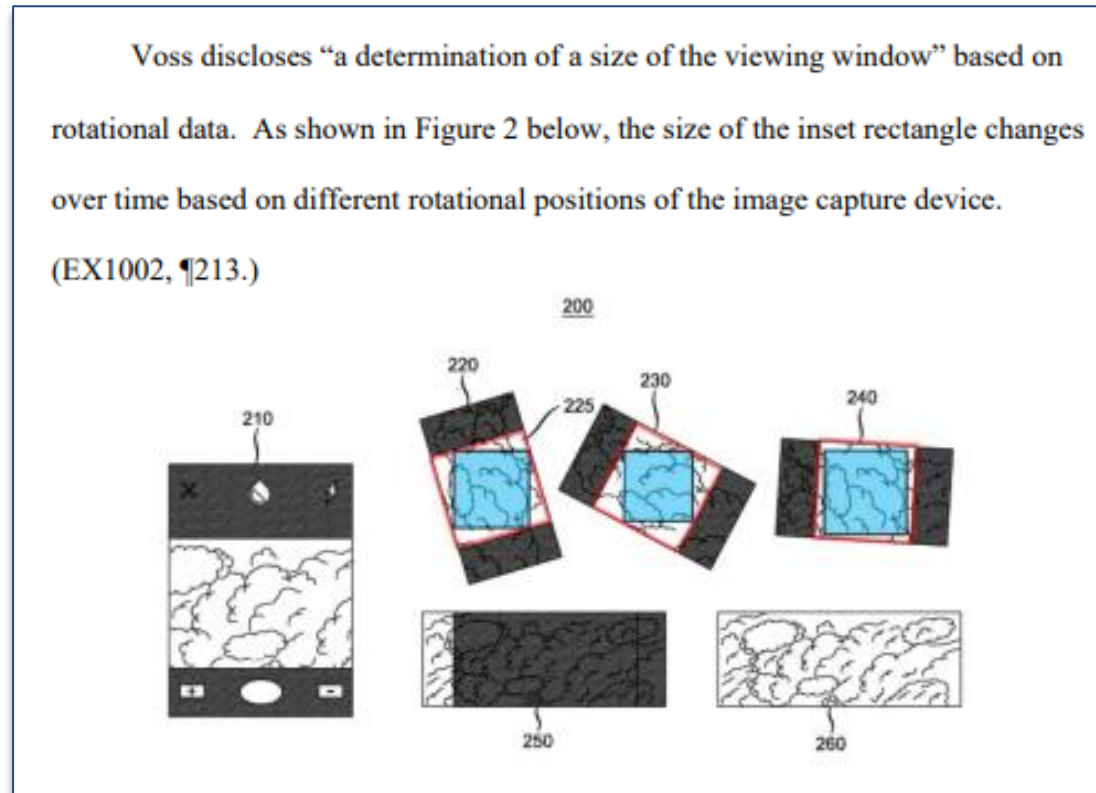
Ground 3

Claim 7

Petitioner Has Not Met Its Burden To Show Voss Discloses Claim 7

Voss does not disclose determining viewing window size frame-by-frame

The Petition's entire analysis for Claim 7 (reproduced below) relies upon Figure 2 and purported differences in the size of the blue box:



Paper 2 (Petition) at 75-76

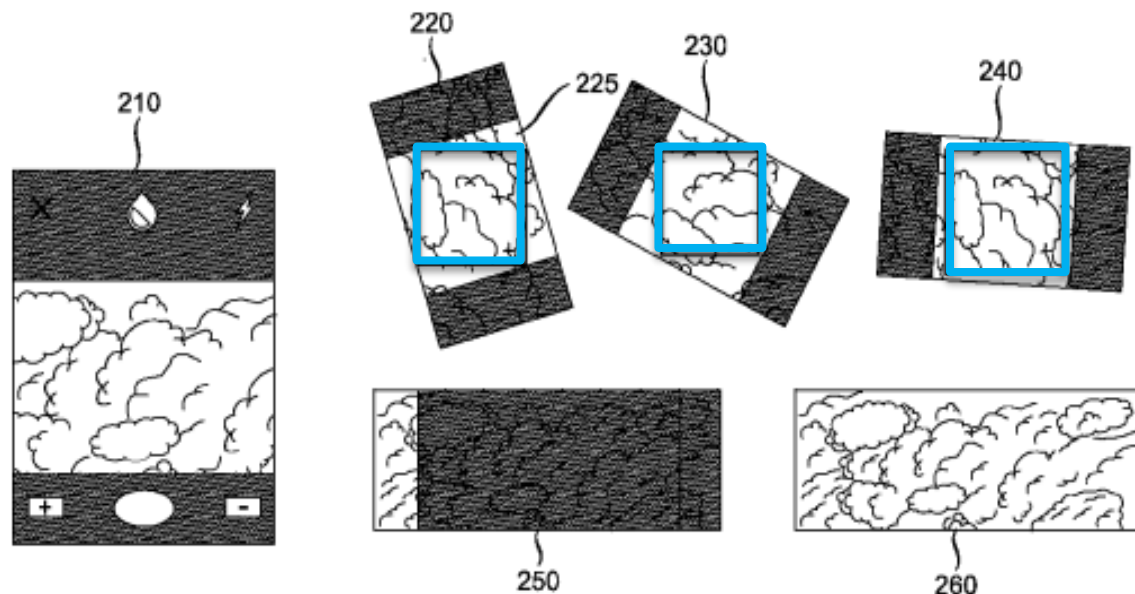


“[P]atent drawings do not define the precise proportions of the elements and may not be relied on to show particular sizes if the specification is completely silent on the issue.”

Hockerson-Halberstadt, Inc. v. Avia Group Int'l, 222 F.3d 951, 956 (Fed. Cir. 2000)

Voss states that “[t]he transformed inner rectangle 225 is *inscribed optimally* inside the maximum available bounds of the overall sensor minus the padding.” (EX1007, 10:7-9.) The inset rectangle can also change in aspect ratio. (*Id.*, 10:9-11; EX1019, ¶95.) Voss’s inset rectangle changes in size.

Petitioner's New Arguments Fail On The Merits



4. **Claim 2:** “The system of claim 1, wherein the viewing window has a one-by-one aspect ratio, the one-by-one aspect ratio reducing impact of an off-axis horizon depicted within the horizon-leveled visual content.”

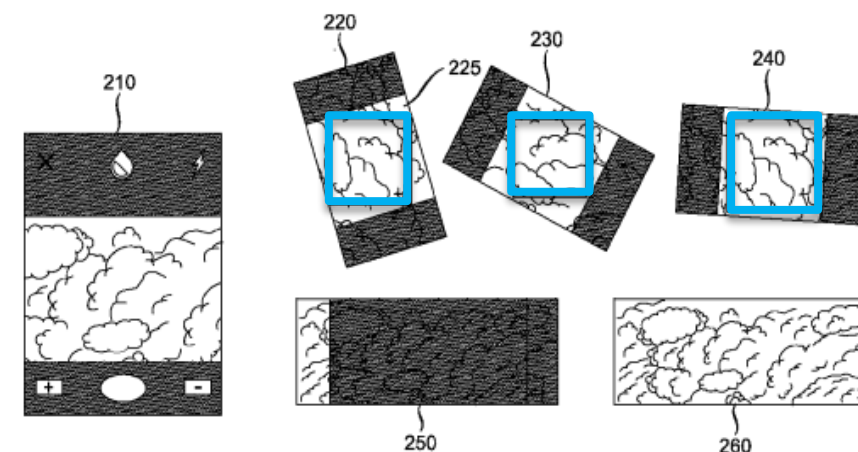
Voss discloses that “[t]he user may optionally indicate a preferred final video or image ration, such as 1:1, 9:16, 16:9, or any other ratio selected by the user.” (EX1007, 12:22-23.) Voss also discloses “the sampled rectangle is 1:1.” (EX1007, 10:18.)

Paper 2 (Petition) at 75

Petitioner's New Arguments Fail On The Merits

bounds of the overall sensor minus the padding. Depending on the device's current most orientation, the dimensions of the transformed inner rectangle 225 are adjusted to interpolate between the two optimal aspect ratios, relative to the amount of rotation.

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. The inscribed rectangle is sampled and then transformed to fit an optimal output dimension. For example, if the optimal output



Ex. 1007 (Voss) at 10:9-17

Ground 3

Claim 8

The Petition's entire analysis for Claim 8 is reproduced below:

As shown for claim 7, the viewing window may change its size. (*Supra* § V.C.5.) Further, Voss discloses “the framing of the image inside the output box is maintained regardless of the aspect ratio. Thus, no matter how the device is oriented, scene is zoomed in or out to keep consistent framing.” (EX1007, 13:10-12.) Voss further discloses “where maximum resolution is desired, the zooming in and out may change the size of the object of interest.” (EX1007, 13:14-15; EX1002, ¶216.)

Paper 2 (Petition) at 76-77

Voss is describing framing of the “output box,” not the inner rectangle (alleged viewing window):

In certain other embodiments, the framing of the image inside the output box is maintained regardless of the aspect ratio. Thus, no matter how the device is oriented, scene is zoomed in or out to keep consistent framing. In some such cases, the object of interest in the video would stay the same size regardless of orientation and aspect ratio. In other cases, where maximum resolution is desired, the zooming in and out may change the size of the object of interest. Alternately, the image may be cropped to maintain the size regardless of orientation and aspect ratio.

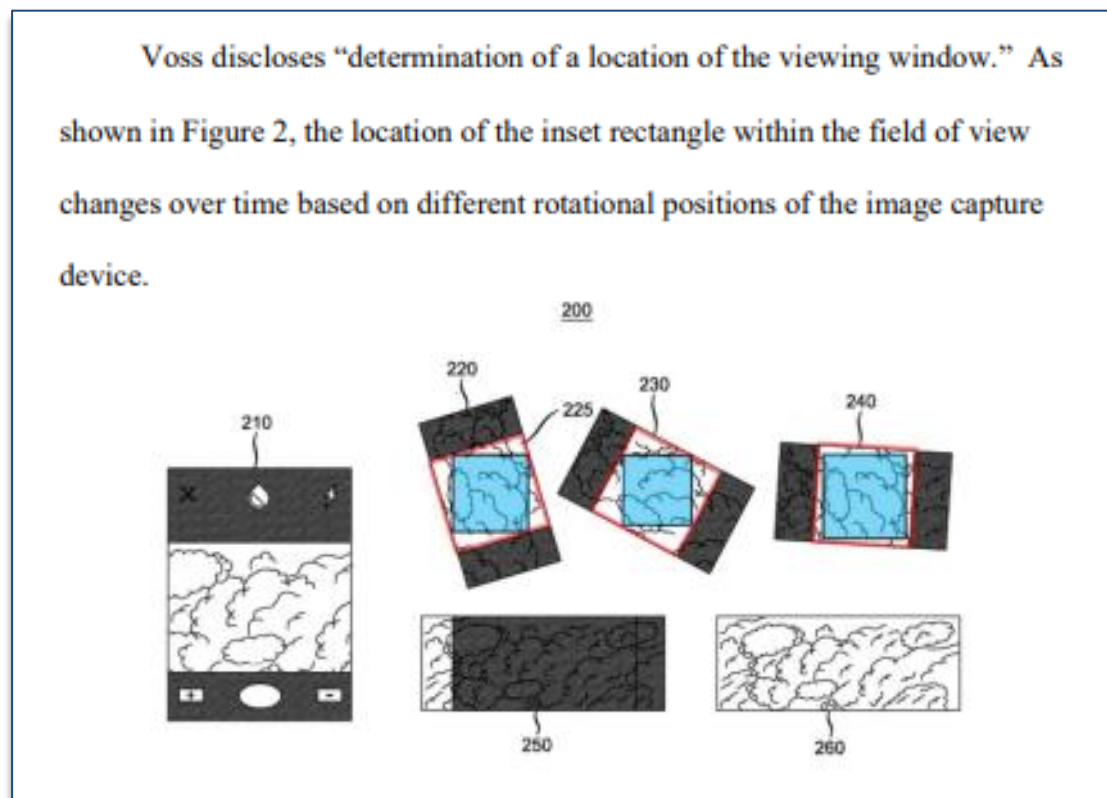
Ground 3

Claim 10

Petitioner Has Not Met Its Burden To Show Voss Discloses Claim 10

Voss does not disclose determining viewing window location frame-by-frame

The Petition's entire analysis for Claim 10 (reproduced below) relies upon Figure 2 which shows the location of the viewing window fixed in the center:



Paper 2 (Petition) at 77-78

Petitioner's Reply Introduces A New Argument That Fails On The Merits

much. (EX1018, 193:4-9; 208:2-7.) Voss discloses an uncentered viewing window 440 in FIG. 4. Derbanne provides a similar example. (EX1019, ¶102.)

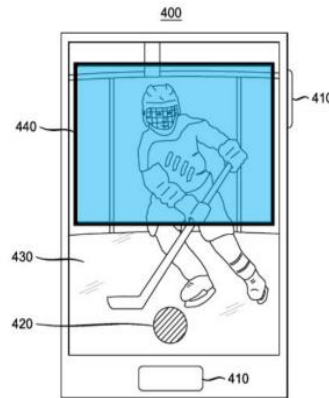


FIG. 4

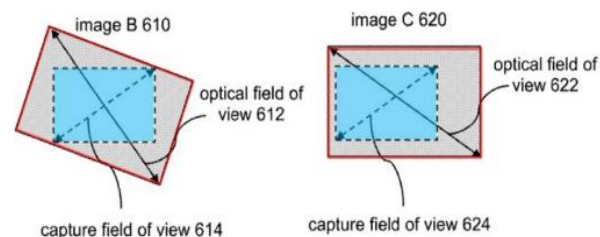


FIG. 6B

- Board should not consider Petitioner's new argument
- Voss
 - Fig. 4 does not disclose determining viewing window location
 - Viewing window remains fixed
- Derbanne
 - Derbanne does not disclose “viewing window” or “punchout” for horizon leveling
 - No motivation to modify Voss's fixed viewing window in view of Derbanne

Ground 2 (Thomason + Pacurariu + Watanabe)

Ground 4 (Voss + Derbanne + Watanabe)

'832 Patent, Claims 3 and 4



(12) **United States Patent**
Stimm et al.

(10) **Patent No.:** US 11,336,832 B1
(45) **Date of Patent:** May 17, 2022

(54) SYSTEMS AND METHODS FOR HORIZON
LEVELING VIDEOS

(71) Applicant: **GoPro, Inc.**, San Mateo, CA (US)

(72) Inventors: **Daryl Stimm**, Encinitas, CA (US); **Kyler William Schwartz**, Valley Center, CA (US); **Jonathan Leland Thorn**, San Leandro, CA (US)

(73) Assignee: **GoPro, Inc.**, San Mateo, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 94 days.

(21) Appl. No.: 17/006,536

(22) Filed: **Aug. 28, 2020**

Related U.S. Application Data

(60) Provisional application No. 62/894,649, filed on Aug. 30, 2019.

(51) **Int. Cl.**

H04N 5/232	(2006.01)
H04N 5/225	(2006.01)

G06T 3/40 (2006.01)
G06T 5/00 (2006.01)

(52) **U.S. CL**
CPC *H04N 5/23299* (2018.08); *G06T 3/40*
(2013.01); *G06T 5/006* (2013.01); *H04N*
5/22525 (2018.08); *H04N 5/232935* (2018.08);
H04N 5/232945 (2018.08)

(58) **Field of Classification Search**
CPC .. G06T 7/30; G06T 3/40; G06T 5/006; H04N
5/23218; H04N 5/23254; H04N 5/2327;
H04N 5/23299; H04N 5/22525; H04N
5/232935; H04N 5/232945

See application file for complete search history.

References Cited

U.S. PATENT DOCUMENTS

2004/0257384	A1*	12/2004	Park	H04N 5/232945	345/646
2015/0215532	A1*	7/2015	Jafarizadeh	H04N 5/232945	348/36
2015/0254871	A1*	9/2015	MacMillan	G06T 3/0062	382/180
2016/0088287	A1*	3/2016	Sadi	H04N 1/38	138/41
2016/0283097	A1*	9/2016	Voss	H1B 27/031	34/263
2017/0114843	A1*	4/2017	Gronholm	G03B 35/08	
2017/0214327	A1*	5/2017	Koraham	H04N 5/23254	
2018/0161961	A1*	6/2018	Bayliss	H04N 21/6501	
2019/0189194	A1*	6/2019	Huang	H04N 5/9243	

OTHER PUBLICATIONS

Video Retrieval Methods Using Geographic Information in Windows Azure Cloud (Year: 2014).*

* cited by examiner

Primary Examiner — Nizar N Sivji

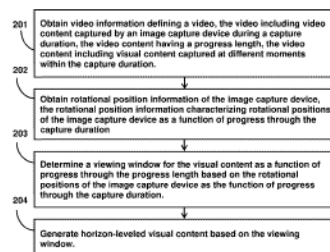
(74) *Attorney, Agent, or Firm* — Esplin & Associates, PC

ABSTRACT

A video may be captured by an image capture device in motion. A horizon-leveled view of the video may be generated by providing a punchout of the video. The punchout of the video may compensate for rotation of the image capture device during capture of the video. The placement of the punchout of the video may be changed based on different rotational positions of to provide a view in which a horizon depicted within the video is leveled.

20 Claims, 9 Drawing Sheets

METHOD 200



Insta360
Exhibit 1001 Page 1

3. The system of claim 1, wherein the visual content includes a distortion such that a straight line within a scene depicted within the visual content appears as a curved line, the distortion of the visual content reducing impact of an off-axis horizon depicted within the horizon-leveled visual content.

Ex. 1001 ('832 patent) at Cl. 3

4. The system of claim 3, wherein the distortion includes a barrel distortion or a pincushion distortion.

Ex. 1001 ('832 patent) at Cl. 4

Claim 3 Requires Processing Visual Content With Pre-Existing Distortion

“visual content” is the original, “obtained” content

1. 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;

* * *

“horizon-leveled visual content” is the processed output from the “visual content”

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.

3. The system of claim 1, wherein the visual content includes a distortion such that a straight line within a scene depicted within the visual content appears as a curved line, the distortion of the visual content reducing impact of an off-axis horizon depicted within the horizon-leveled visual content.

Ex. 1001 ('832 patent) at Cl. 1, 3

Claim 3 Requires Processing Visual Content With Pre-Existing Distortion

The distortion within the image may be changed to include a desired distortion that reduces the impact of an off-axis horizon depicted within the visual content (e.g., via a **direct transformation that changes the existing distortion to the desired distortion**; via an indirect transformation that removes the existing distortion and then applies the desired distortion).

EX1001, 22:66-23:1

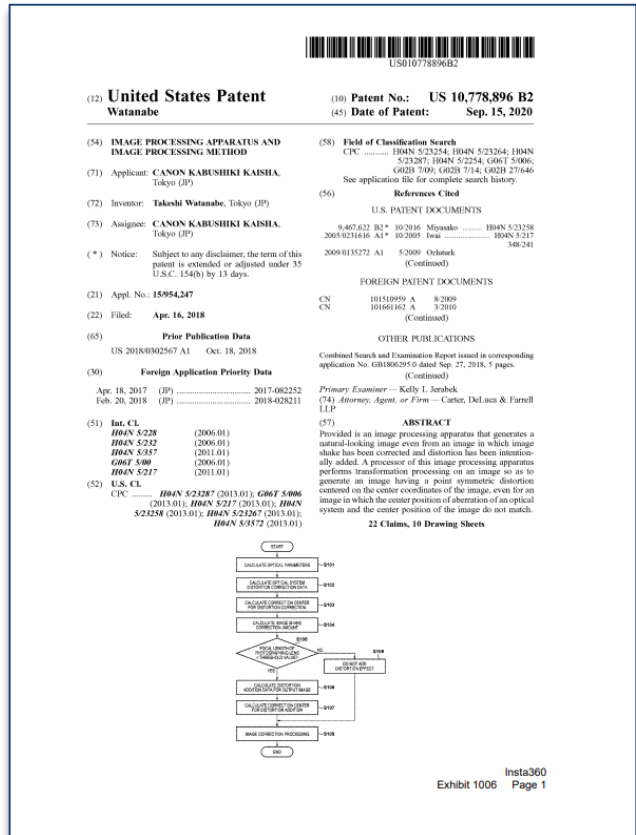


“The mere fact that there is an alternative embodiment disclosed in the asserted patent that is not encompassed by our claim construction does not outweigh the language of the claim, especially when the court's construction is supported by the intrinsic evidence.”

August Tech. Corp. v. Camtek, Ltd., 655 F.3d 1278, 1285 (Fed. Cir. 2011)

Watanabe Is NOT Directed At Horizon Leveling or Using Distortion to Reduce the Impact of an Off-Axis Horizon

Watanabe is directed at the problem of distortion from a fisheye lens being off-center after anti-shake correction which can be “un-natural”:



POR at 13-14

However, in the case of performing image shake correction on a moving image, the positional relationship between the optical axis of the imaging optical system and the center of each moving image frame changes over time due to image shake correction. Therefore, if barrel distortion effect is applied to moving image frames having undergone image shake correction by assuming that the optical axis is always orthogonal to the center of the image, the relationship between the image height and the degree of distortion changes over time

Ex. 1006 (Watanabe) at 1:27-40

Watanabe seeks to solve this problem by removing distorting in the captured image and reintroducing a new distortion that is centered

A processor of this image processing apparatus performs transformation processing on an image so as to generate an image having a point symmetric distortion centered on the center coordinates of the image, even for an image in which the center position of aberration of an optical system and the center position of the image do not match.

Ex. 1006 (Watanabe) at Abstract

Claims Are Not Obvious Where None Of The Prior Art Discloses The Limitation



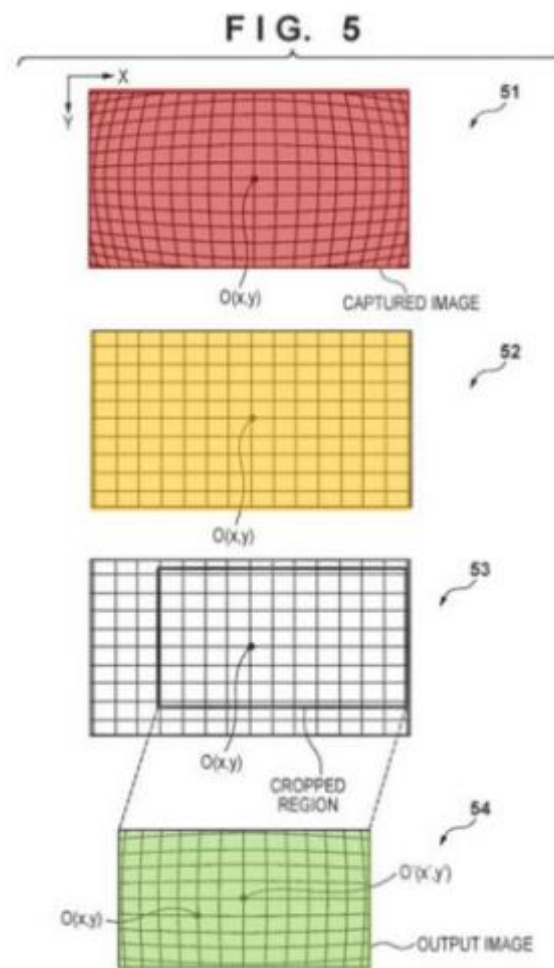
We next address the merits of the Board's obviousness determination. Asset Guard argues that **there is no disclosure, in any of the references, of a seam formed between substrates “to allow for moisture to pass between the first and second encapsulated substrates so that moisture is allowed to seep away from the bottom of the tank” through the seam, a limitation required by representative independent claim 1.** The Board rested its obviousness conclusion on its determination that “the broad teachings of Noble would allow for seams formed between encapsulated sections of the pad to allow moisture to pass,” as Noble “does not require the tape to be present after the spa is installed,” Board Decision, 2020 WL 6375849, at *7 (emphasis added). That reasoning, we conclude, is insufficient under the law of obviousness.

In re Assett Guard Products, Inc., 2022 WL 1097363, *5-*6 (Fed. Cir. 2022)



We begin by addressing the Board's erroneous finding that the prior art disclosed all claim limitations. Both parties appear to agree that most of the limitations found in claims 1 and 3 are disclosed by Ashkenazi or Nitzan; **the only dispute is whether these references teach inactivating one of the claimed Gram-positive bacteria without using a photosensitizer. The Board's finding that this was taught by the combination of Ashkenazi and Nitzan is not supported by substantial evidence... We see nothing in Ashkenazi that discloses or suggests inactivating *P. acnes*, or any other bacteria, without using a photosensitizer.**

Watanabe Performs Anti-Shake Correction on *Undistorted* Visual Content



Due to distortion correction performed by the distortion correction circuit 106, **image distortion shown in 51 of FIG. 5 is corrected (removed) (52, FIG. 5).**

...

The image shake correction circuit 107 outputs the image of the **determined cropping region** as an image subjected to image shake correction. Unless 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).**

...

The distortion addition circuit 108 **adds a distortion effect to the image subjected to image shake correction (54, FIG. 5)....**

Reply, 20 (citing EX1006, Fig. 5;
annotations added by Petitioner)

Ex. 1006 (Watanabe) at 11:15-54

POR at 13-14, 17-20

The ITC Erred In Finding That Thomasson + Watanabee Rendered Claims 3 and 4 Obvious

Erroneous reliance on an “obvious to try” theory not asserted here

GoPro argues that Thomason uses a lens without distortion and that it would not be obvious to add distortion per Watanabe. GoPro Br. at 142 and Schonfeld Tr. at 1503:13–1504:3. Watanabe discloses, however, that wide-angle lenses that introduce barrel distortion were known, RX-2003 at 9:33–44, and teaches that retaining that barrel distortion was desirable. *See* Insta360Br. at 215, *citing* RX-2003 at 11:7–9 and Insta360 Reply at 61). The evidence thus supports that obtaining video content with barrel distortion and ensuring that any outputted horizon-leveled video also included barrel distortion (claims 3 and 4) would have been, at the very least, obvious to try when implementing the techniques of Thomason in view of Watanabe. *KSR*, 550 U.S. at 421 (“Where there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp.”).

EX1027 (ITC Initial Determination) at 165

Improper reliance on GoPro’s prior-art wide-angle lens cameras that did not horizon level

That GoPro cameras were prevalent at the time of the invention of the ’832 patent and included fisheye lenses (*i.e.*, lenses that cause barrel distortion) supports this conclusion. GoPro Br. at 203, *citing* Lema Tr. at 360:17–361:10 (“capturing 80 to 85 percent of the consumer market historically). Mr. Goodin’s testimony that one of skill would have done this to “mak[e] the image appear natural” is persuasive in light of the explicit teachings of the art and despite testimony from GoPro founder Mr. Woodman that traditional camera companies tended to eliminate distortion. Goodin Tr. at 1331:5–17 and Woodman Tr. at 78:3–23. The evidence thus supports that there is a motivation to combine Thomason and Watanabe (to use a wide-angle lens) and that the combination would predicably result in an output image with barrel distortion. Clear and convincing evidence supports that claims 3 and 4 are obvious in view of the combination of Thomason and Watanabe. *See* Goodin Tr. at 1328:8–1331:21.

EX1027 (ITC Initial Determination) at 165-166

'832 Secondary Consideration

GoPro's Horizon Leveling Feature Practices and is Coextensive With The Challenged Claims

- GoPro's expert showed Horizon Leveling Feature practices claims 1, 3, 7 and 8 (EX2021, ¶¶ 164-169)
- ITC found Horizon Leveling feature practices claims 1, 3, 7 and 8 (EX1027, 140)
- Claims 11, 13, 17 and 18 are methods claims reciting the same limitations as claims 1, 3, 7 and 8

Horizon Leveling – Distortion



EX2021, ¶¶ 164-169; see also EX2008

POR at 70-73; Sur-Reply at 24-25



Pablo Lema
GoPro Head of Product

4. GoPro's HERO line of cameras is our flagship product line and has long represented the core of our camera business. Since at least 2016, the HERO line has accounted for an average of over 70% of our annual camera revenue. GoPro's HERO camera line has been the top-selling action camera in the United States for nine consecutive quarters, capturing between 80 to 85 percent of the consumer market.

EX2024, ¶ 4

HERO Commercial Success is Directly Tied to Practicing Horizon Levelling Feature



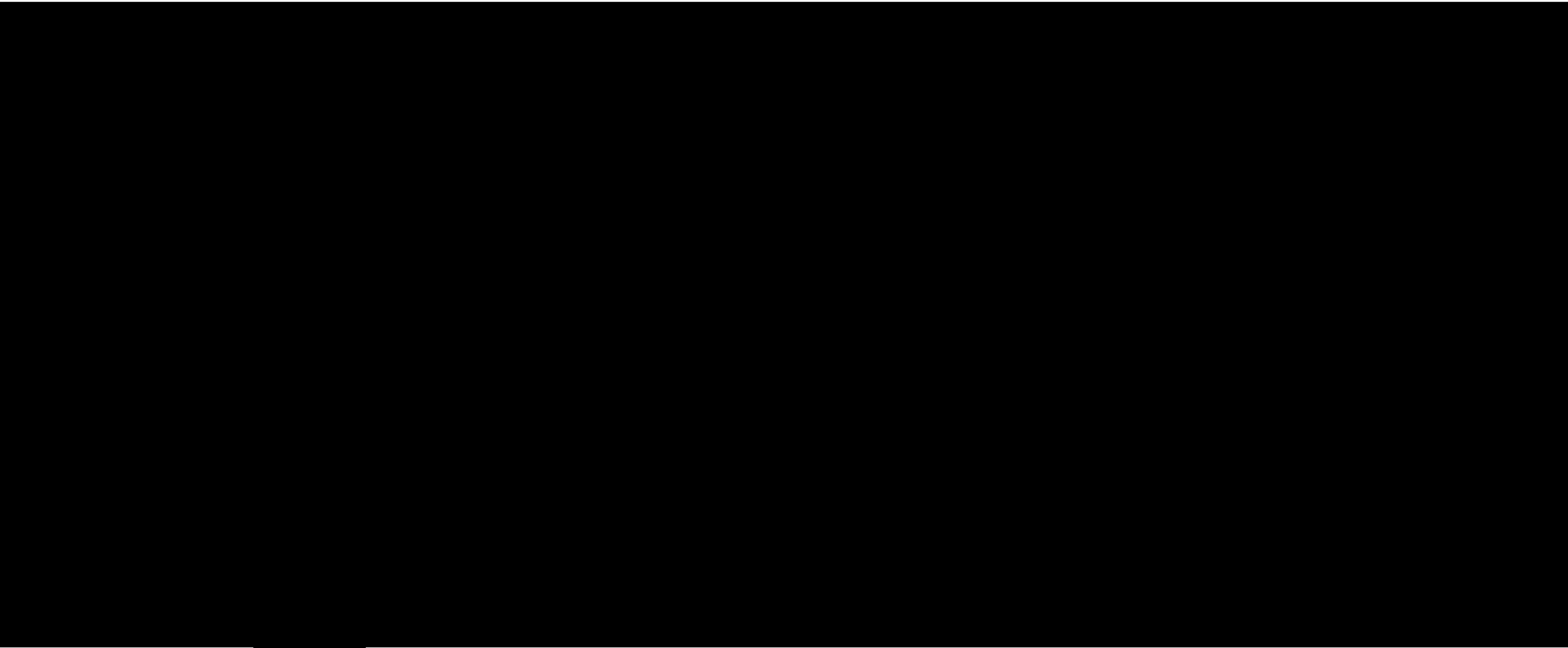
Pablo Lema
GoPro Head of Product

9. Horizon Leveling—a further enhancement to our digital image stabilization technology—was introduced as an in-camera feature for our HERO9 release in 2020. Horizon Leveling is a functionality that is implemented within HyperSmooth. In our earlier customer evaluation studies and surveys, the Horizon Leveling functionality was evaluated within the broader category of digital image stabilization technologies. Over time, however, we learned that the feature was so popular and impactful to customers that we began to isolate it and track it separately for purposes of marketing and analyzing customer demand.

EX2024, ¶ 9

POR at 73-75

Commercial Success is Directly Tied to Practicing Horizon Levelling Feature



EX2018, 28-29

EX2019, 14

POR at 75; Sur-Reply at 26

Commercial Success is Directly Tied to Practicing Horizon Levelling Feature



Pablo Lema
GoPro Head of Product

20. In a separate study conducted at the end of 2022, our consumer insights team surveyed actual purchasers of the HERO11 Black to identify which features drove their purchase decisions. A true and correct copy of this study was marked as “CX-649C” in the recent ITC hearing and is attached to this declaration as Exhibit B. This post-purchase study is summarized on page 14. According to the results, “Advanced video stabilization (HyperSmooth 5.0 with AutoBoost)” was the number one driver of purchase. “Horizon Lock and Leveling” ranked second, and “Digital Lenses (HyperView)” —which includes SuperView and immersive aspect-ratio functionality—ranked twelfth.

EX2024, ¶ 20

POR at 73-75

Objective Indicia of Non-Obviousness: Nexus

- GoPro's Horizon Leveling Feature Is The Claimed Invention:



“A patent owner is entitled to a **presumption of nexus when** it shows that the **asserted objective evidence is tied to a specific product that ‘embodies the claimed features, and is coextensive with them.’**”

Intex Recreation Corp. v. Team Worldwide Corp., No. 2020-1141, 2023 WL 6969790, at *4 (Fed. Cir. 2023)



“Although we **do not require the patentee to prove perfect correspondence to meet the co-extensiveness requirement**, what we do require is that the patentee demonstrate that the **product is essentially the claimed invention.**”

Fox Factory, Inc. v. SRAM, LLC, 944 F.3d 1366, 1373-74 (Fed. Cir. 2019)

Petitioner Fails To Rebut The Presumption Of Nexus

- **Petitioner:** Horizon Leveling was just one of a “myriad” of features in GoPro’s HERO camera (Reply, 33) and “unclaimed competing factors also contribute to the success of GoPro products”



“[W]e have never held that the existence of one or more unclaimed features, standing alone, means nexus may not be presumed. Indeed, there is rarely a perfect correspondence between the claimed invention and the product. As we explained, the **purpose of the coextensiveness requirement is to ensure that nexus is only presumed when the product tied to the evidence of secondary considerations ‘is the invention disclosed and claimed.’”**

Fox Factory, Inc. v. SRAM, LLC, 944 F.3d 1366, 1373-74 (Fed. Cir. 2019)

Objective Indicia of Non-Obviousness: Copying & Unmet Need

- Petitioner released “Horizon Lock” after GoPro released Horizon Leveling in 2020
- Petitioner reverse engineered GoPro’s Horizon Leveling technology

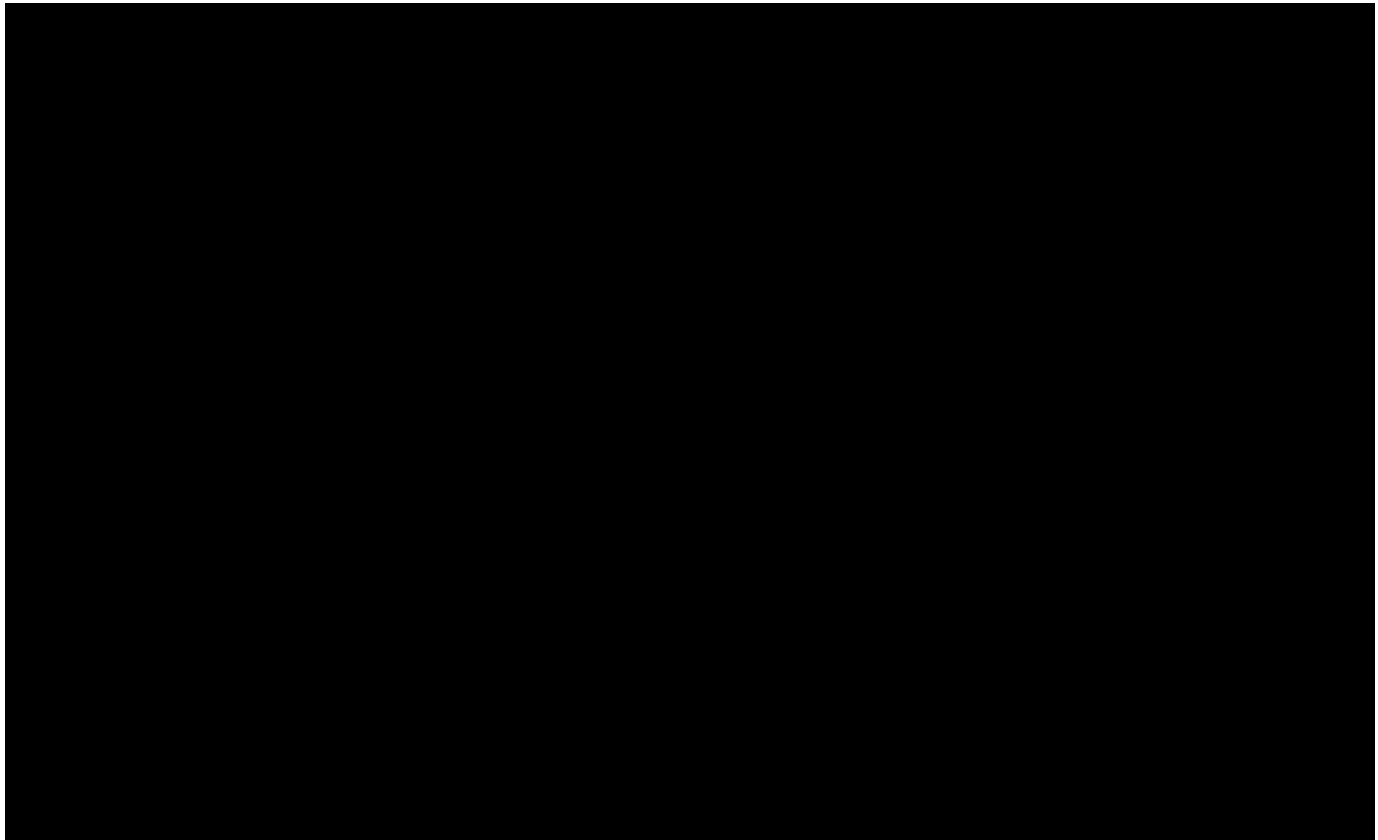
Horizon Lock

Horizon Lock is now available for the 4K Mod and 1-Inch Mod (camera firmware must be updated to at least version 1.2.64).

Particularly useful for action scenes or whenever it's difficult to hold the camera steady, Horizon Lock keeps footage upright and level when shooting in Pro video mode (FlowState Stabilization).



EX2031

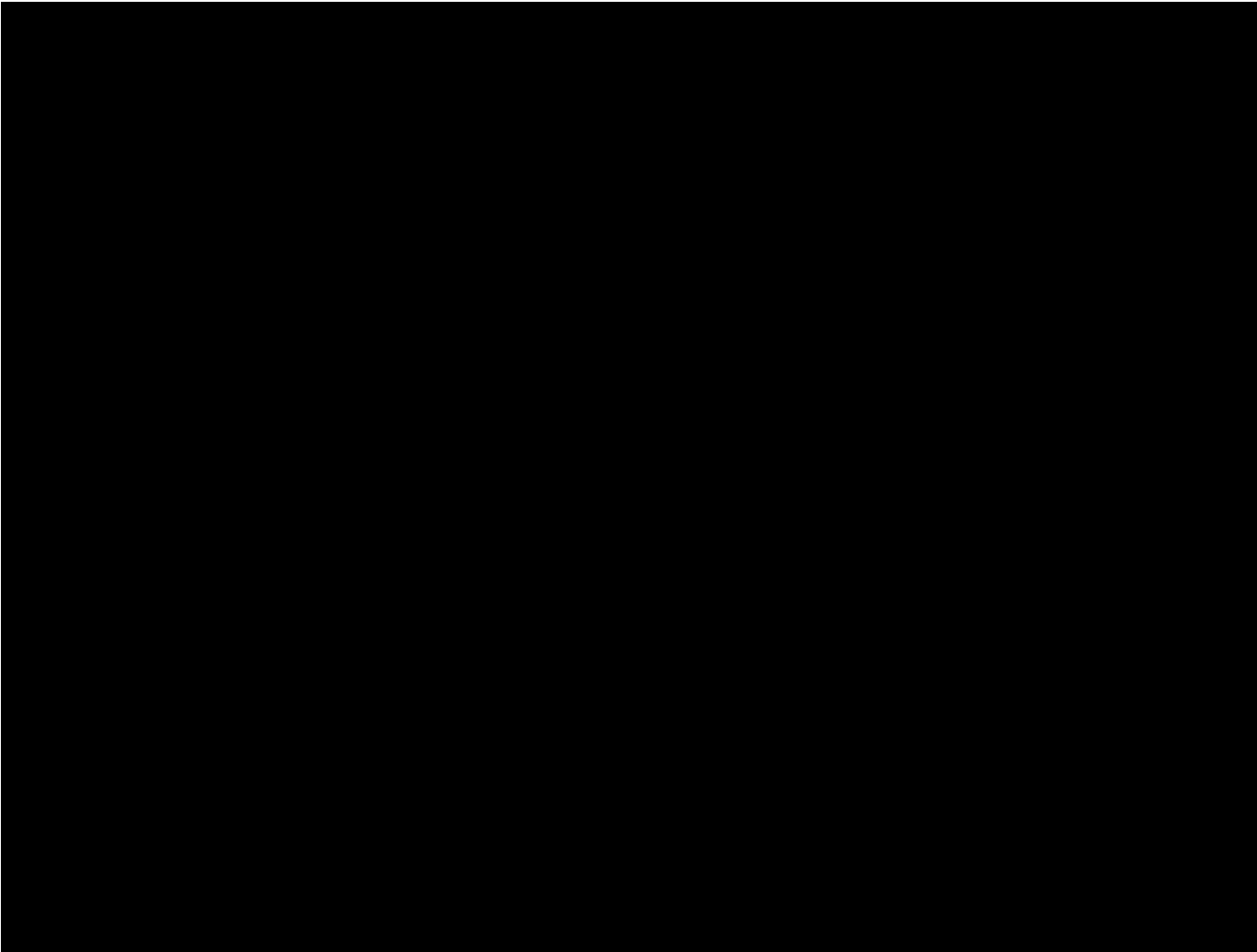


EX2032, 2

POR at 75; EX2021, ¶172

**December
2022
Development
Notes**

**February 2023
Development
Notes**



EX2033, 1

EX2033, 2

X2033, 5

Objective Indicia of Non-Obviousness: Copying & Unmet Need

12/30/2020

(19) State Intellectual Property Office
(12) Invention patent
[logo:]
(10) Authorization announcement number CN 11280444 A

(21) Application number 202011601388.2
(22) Application date 12/30/2020
(65) Published document number of the same application
Application publication number CN 11280444 A
(43) Application publication date 05/14/2021
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Bao'an District, Shenzhen City, Guangdong
Province 518000
(72) Inventor Men Zehua Chen Cong

Reviewer Tian Qiushuo

corresponding original motion state to the target video frame under the viewing angle field limit corresponding to the target FOV value, so that the anti-shake processed video is as close as possible to the ideal motion smoothed video. At the same time, it maximizes the viewing angle field of the processed video image and improves the anti-shake effect of the video.

GoPro Ex. 2004 Page 1 of 13

Ex. 2004 (Petitioner's CN Patent Application)

12/30/2020

CX-0892C

012--Research Institute R&D CenterComparative test and validation of anti-shake in high-frequency vibration scenes
Created by Chen Cong, last modified by Men Zehua on January 15, 2021
Comparative test and validation of anti-shake in high-frequency vibration scenes
Validated by: Men Zehua Time: 12/30/2020
1. Validation purposes and requirements
In order to test and compare the anti-shake effect of 2000hz_us firmware, 500hz_ms firmware and Gopro Hero9. Validation requirements Validation scenarios for relatively rigid connections between test machines include

CONFIDENTIAL BUSINESS INFORMATION
SUBJECT TO PROTECTIVE ORDER
CONFIDENTIAL BUSINESS INFORMATION - SUBJECT TO PROTECTIVE ORDER
CX-0892C.0001

INSTA360_1400-00053217
GP_INSTA360_1400-00053217_T1
GoPro Ex. 2035, Page 1 of 17

Ex. 2035 (Internal Engineering Document)

POR at 76-77; EX2021, ¶173; Sur-Reply at 27-28

Objective Indicia of Non-Obviousness: Copying & Unmet Need

- **Petitioner’s CN patent attempts to patent GoPro’s invention, claiming there is an unmet need for determining size of viewing window dynamically (frame-by-frame)**

Background technique

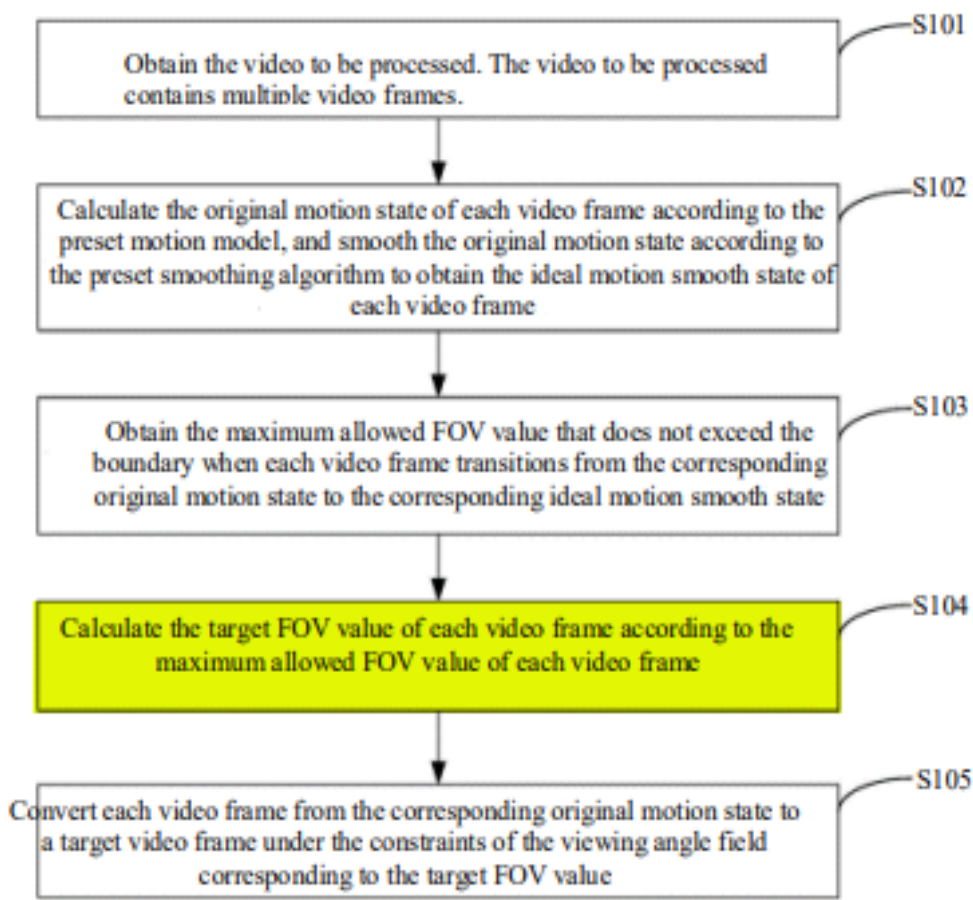
[0002] In the video electronic image stabilization process, the **existing technical solution** is generally to first establish a motion model of the camera, and estimate the original motion state of the camera at different moments in the video based on the camera gyroscope (or visual characteristics) and the established motion model. Then according to the ideal motion smooth motion state obtained by the smoothing algorithm at different times, each frame of the video is converted from the image corresponding to the original motion state to the image corresponding to the ideal motion smooth state. However, for cameras with field of view (FOV) restrictions, it is necessary to obtain a boundary-limited motion state that allows the converted image to be successfully indexed in the original video image based on the original motion state, the ideal motion smoothing state, and the camera's FOV. Then the image is converted from the original motion state to the image of the camera's observation position in the boundary-limited motion state to achieve the purpose of electronic image stabilization.

[0003] In boundary-constrained electronic image stabilization, there are inherent flaws in using a **fixed FOV** for the output video:

[0004] a. **If the output video uses a large fixed FOV**, when the degree of movement is relatively intense, since the boundary of the output anti-shake video image is relatively close to the boundary of the original image, the boundary-limited motion state at each moment is different from the ideal smooth motion state. The deviation is too large, resulting in **poor anti-shake effect**;

[0005] b. **If the output video adopts a small fixed FOV**, when the motion is relatively gentle, the anti-shake smoothing margin is too large (that is, the output video can adopt a larger FOV, which can make the motion state with boundary restrictions and the ideal motion smooth. state is closer or identical), resulting in a **waste of FOV**. Therefore, in reality, a compromise size FOV is often selected. However, when the movement is particularly intense, the above-mentioned problem a will occur, making the anti-shake effect less than optimal. When the movement is particularly gentle, the above-mentioned problem b will occur, so that the FOV utilization rate at this moment is not reached to the maximum.

Ex 2004 (Petitioner’s CN Patent Application) ¶¶ 2-5



Ex 2004 (Petitioner’s CN Patent Application) Fig. 1

The ITC Applied an Overly Stringent Standard of Nexus

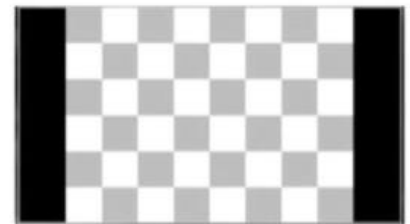
Consideration of indicia of non-obviousness does not change this outcome. *See* GoPro Br. at 144 and 199–211. Unlike the advent of Hypersmooth motion stabilization, GoPro does not present specific evidence linking the techniques of claims 7 and 8 with the commercial success and industry praise found persuasive above. And as Insta360 notes, GoPro's discussion is largely focused on its Hero3, Hero5, and Hero7 models, all of which precede the Hero9 in which horizon-leveling was first implemented. *See generally* GoPro Br. at 199–204. GoPro highlights a technical Emmy award from 2020–21 credited to Hypersmooth but given the difference between motion stabilization and horizon-leveling, this industry praise has at best, an attenuated connection to the window re-sizing techniques of claims 7 and 8 of the '832 patent. CX-0020 (award); CX-0636 (press release); *see* Insta360 Reply at 62, *citing* GoPro Br. at 136; CX-0649C.14 (Hypersmooth and Horizon features are different lines of customer inquiry). Similarly, while the evidence supports that the Hero line of cameras was, overall, successful commercially, and that surveys show "horizon-leveling" is important to consumers (Lema Tr. at 372:11–375:25 and CX-0649C.14), claims 7 and 8 are not directed to just horizon leveling. If survey or other evidence indicated that dynamic window-size horizon-leveling was an important driver of commercial success or industry praise, that could have been a different matter. But there is no such evidence.

EX1027 (ITC Initial Determination) at 151

'413 Secondary Consideration

GoPro's SuperView Feature Practices and is Coextensive With The Challenged Claims

- Undisputed: GoPro's HERO7 Black SuperView feature practices the '413 patent



Standard 4:3 Aspect Ratio image

- Footage is captured in a tall 4:3 aspect ratio to frame all the action but does not fill the screen when played back



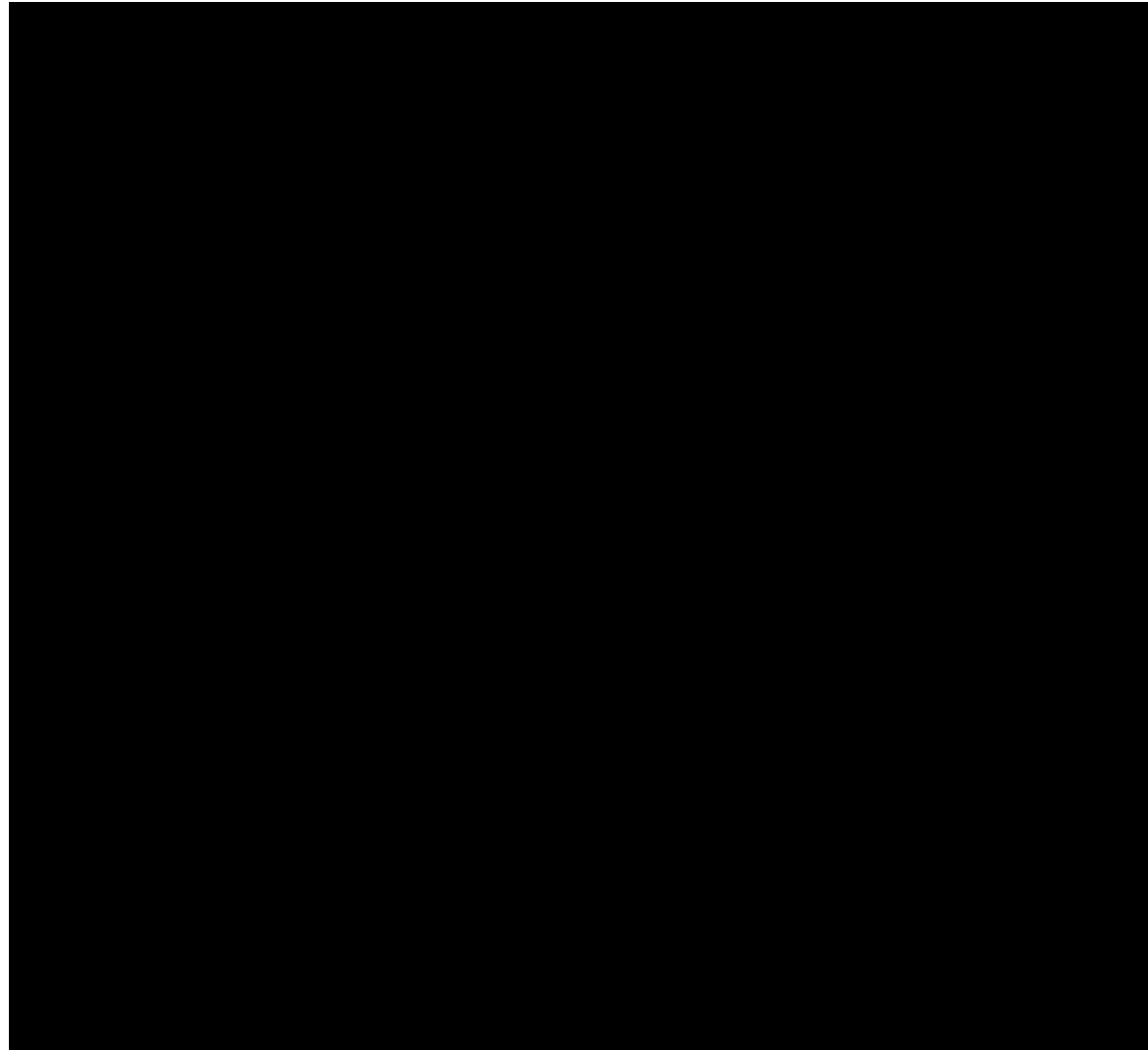
SuperView

- The camera dynamically stretches the footage to a wide 16:9 aspect ratio for full screen playback.

Ex. 2028 (Hero 7 Black Manual) at 47; POR 46



Ex. 2021 (SuperView YouTube video); POR 59



Ex. 2027 (Foroosh Decl.) at ¶144



Pablo Lema
GoPro Head of Product

4. GoPro's HERO line of cameras is our flagship product line and has long represented the core of our camera business. Since at least 2016, the HERO line has accounted for an average of over 70% of our annual camera revenue. GoPro's HERO camera line has been the top-selling action camera in the United States for nine consecutive quarters, capturing between 80 to 85 percent of the consumer market.

EX2024, ¶ 4

Commercial Success is Directly Tied to Practicing SuperView Feature



Pablo Lema
GoPro Head of Product

8. While SuperView was available before HERO7, its impact increased significantly when combined with HyperSmooth. Specifically, GoPro's approach of *embracing distortion*, rather than avoiding it, allowed us to achieve surprising results, enhancing the dynamic and immersive feel of videos.

EX2024, ¶ 8

SuperView: Objective Consumer Survey Data

14. In 2022, GoPro's consumer insights team conducted a hardware segmentation study, which I personally reviewed and used in product development discussions. A true and correct copy of this study was marked as "CX-590C" in the recent ITC hearing and is attached to this declaration as Exhibit A. This analysis segmented a global pool of more than 300 million potential camera customers into ten market subgroups based on product preferences and behaviors. These groups are depicted on page 6 of the study.

16. For each group, the study evaluated which features matter most to each segment by ranking their responses to a set of key product features. All of these features are listed and defined on page 5 of CX-590C. While the purpose of the study was to analyze the relative strength of the 33 product features listed on page 5, all of those product features are things that the GoPro product group considers key drivers of customer demand. A typical GoPro action camera, for example, has in excess of 100 separate product features—far more than just the 33 listed on page 5.

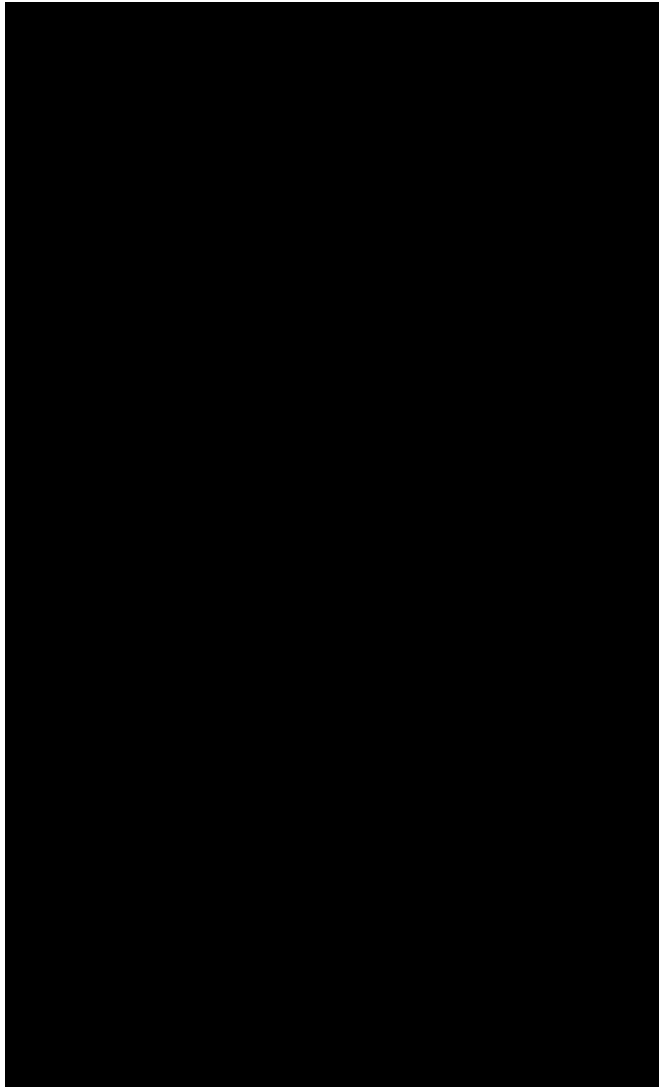
15. Of these ten market segments, GoPro's core historical customer base is most closely aligned with four segments: Core HEROes, Lightweighters, Overcapturers, and Easygoing HEROes. These are the groups we have traditionally targeted with our flagship HERO product line.

EX2024, ¶¶ 14-15

EX2024, ¶ 16

SuperView: Objective Consumer Survey Data

- Customer surveys confirm nexus



Ex. 2040 at 10; POR 50



Ex. 2019 at 14; POR 51

Commercial Success is Directly Tied to Practicing SuperView Feature



Pablo Lema
GoPro Head of Product

18. On page 10 of CX-590C, the Core HEROes segment ranked “Advanced video stabilization” as the number one most important feature, and “Wide variety of modes and settings,” which includes SuperView, as number seven. On page 12, the Lightweighters segment ranked “Advanced video stabilization” third and “Wide variety of modes and settings” twenty-first. On page 13, Easygoing HEROes ranked “Advanced video stabilization” third and “Wide variety of modes and settings” twelfth. And on page 14, Overcapturers also ranked “Advanced video stabilization” third and “Wide variety of modes and settings” eighth.

EX2024, ¶ 18

19. These rankings confirmed what we were seeing in customer feedback and sales data: HyperSmooth and immersive lens options were among the most important and valued features driving customer demand across our HERO customer base. Our product planning decisions—including resource allocation and feature prioritization—relied heavily on this data.

EX2024, ¶ 19

Objective Indicia of Non-Obviousness: Nexus

- **Petitioner:** SuperView was just one of many features in the HERO 7 so lacks nexus *Reply 29-30*



“It is not necessary ... that the patented invention be solely responsible for the commercial success, in order for this factor to be given weight appropriate to the evidence, along with other pertinent factors.”

Cont'l Can Co. USA, Inc. v. Monsanto Co., 948 F.2d 1264, 1273 (Fed. Cir. 1991); POR 55

Objective Indicia of Non-Obviousness: Industry Praise

- Undisputed: GoPro's HERO7 Black and SuperView significant industry praise



Ex. 2036; POR 51



Ex. 2038; POR 51



Ex. 2039; POR 51

Objective Indicia of Non-Obviousness: Industry Praise

- **Undisputed:** GoPro's HERO7 Black and SuperView significant industry praise

Superview is a clever GoPro video mode which is designed to capture a more immersive wide angle perspective. It does this by shooting at a 4:3 aspect ratio, using the full height of the camera's sensor, and then dynamically stretching the sides to produce a widescreen 16:9 aspect ratio.

Ex. 2013; POR 52-53

Hello, is there any chance on getting a Superview-like mode like the one in the Hero 7? Asking this because i bought the Q Action but since i'm a biker i think it's a very important feature and now i feel like i want to send the osmo back and buy a The superview should be a software feature, so do you think would it be possible to get it in next firmware updates? Mayt with an higher resolution than 1080p and with rocksteady on...

Ex. 2016; POR 52-53

Ex. 2015; POR 53-54

The GoPro camera that we were sent was the "Hero3+ Black Edition". *NB – here's the dull technical bit* It films up to 4K resolution (No.1 teen says that I need to tell you that "this is INSANE". So consider yourself told), and it films with GoPro's unique SuperView™ lens. Which means it has a ridiculously wide angle which allowed even a selfie taken from just arms reach to capture all six of our family!



LittleStuff family selfie (we LOVE this picture)

Objective Indicia of Non-Obviousness: Copying

- Petitioner's ActionView feature copied SuperView

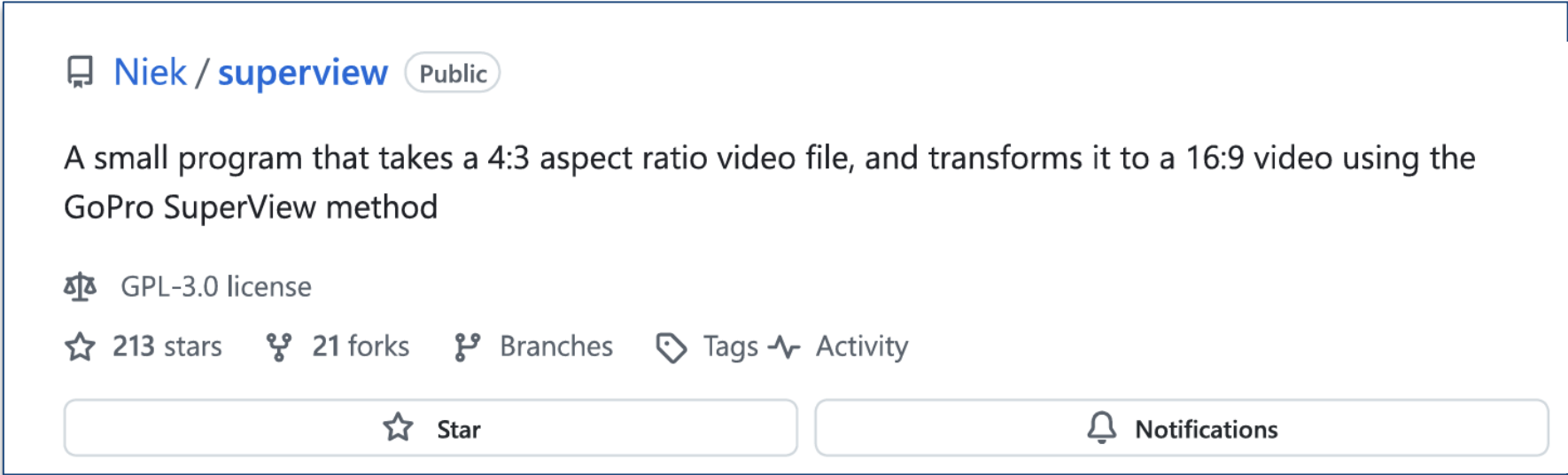


Ex. 2035 at 7; POR 52

Ex. 2033 at 1; POR 52

Objective Indicia of Non-Obviousness: Copying

- Others have copied SuperView



Ex. 2011; POR 52

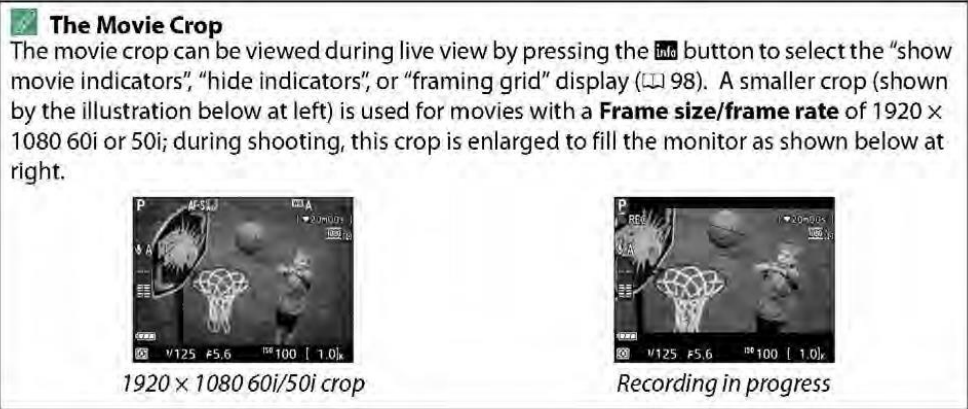
Objective Indicia of Non-Obviousness: Long-Felt Need / Unexpected Results

- Conventional wisdom was that introducing distortion was undesirable

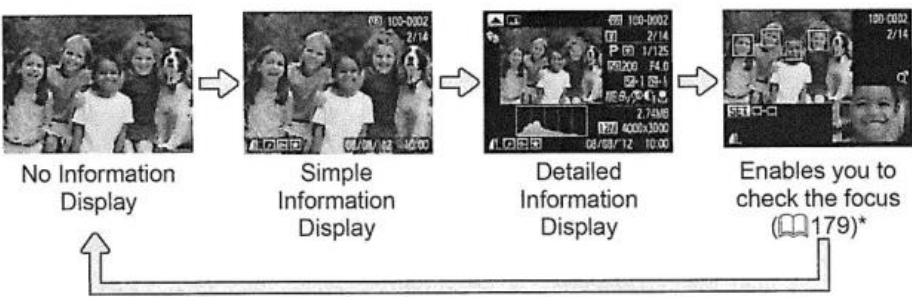
“At the time of the '413 patent, conventional wisdom was that introducing distortion into images was undesirable. For instance, distortion, particularly geometric distortion, can stretch or compress parts of the image in an uneven way, making faces or bodies look elongated, squished, or warped. This effect is especially undesirable in personal or group photos, where people expect to see a realistic representation of themselves. Because of these reasons, photographers and camera designers traditionally seek to avoid or minimize distortion to maintain the integrity, realism, and appeal of their photos.”

Ex. 2027 (Foroosh Decl.) at ¶169

- Traditional cameras avoided introducing distortion



Ex. 2020 (Nikon D5200 Manual) at 120; POR 57



Ex. 1028 (Canon PowerShot Manual) at 176; Surreply 29

Objective Indicia of Non-Obviousness: Long-Felt Need / Unexpected Results

“In particular, GoPro’s SuperView invention utilizes a sensor that captured an image in one aspect ratio (4:3) so that the image can be “taller,” and then allowed it to be displayed and previewed on the screen in aspect ratios that are more commonly used in video settings (e.g., 16:9). To do this, however, GoPro had to intentionally introduce distortion into the image. SuperView thus applies a warping function that distorts the edges while eliminating distortion in the center. GoPro’s unconventional approach arises from the fact that GoPro’s cameras are directed at action sports, not conventional photography. GoPro recognized that video for certain action sport scenes, like skiing, surfing and bicycling, result in persons being centered in the middle of the shot, with no persons on the edges. This means that the periphery can be distorted in an acceptable manner.”

Ex. 2027 (Foroosh Decl.) at ¶171

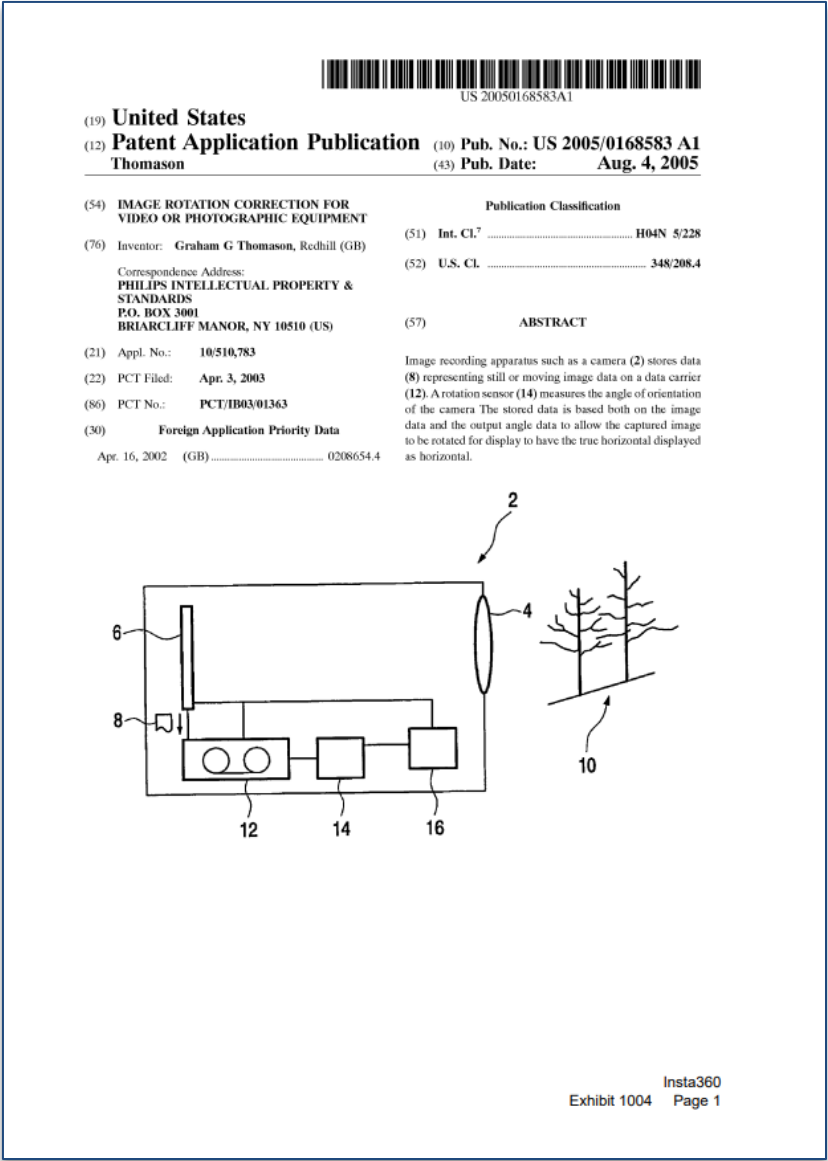
173. Thus, in my opinion, the SuperView functionality met the long-felt need of producing high-quality, wide-angle video for action cameras through the use of non-linear distortion, which was an unexpected result.

Ex. 2027 (Foroosh Decl.) at ¶173

Appendix

Appendix

Thomason



[0002] Cameras, such as video or still digital cameras, are frequently used by amateurs who may have difficulties in correctly orienting the camera. There is thus a need for a camera capable of reducing the effect of poor orientation.

Ex. 1004 (Thomason)

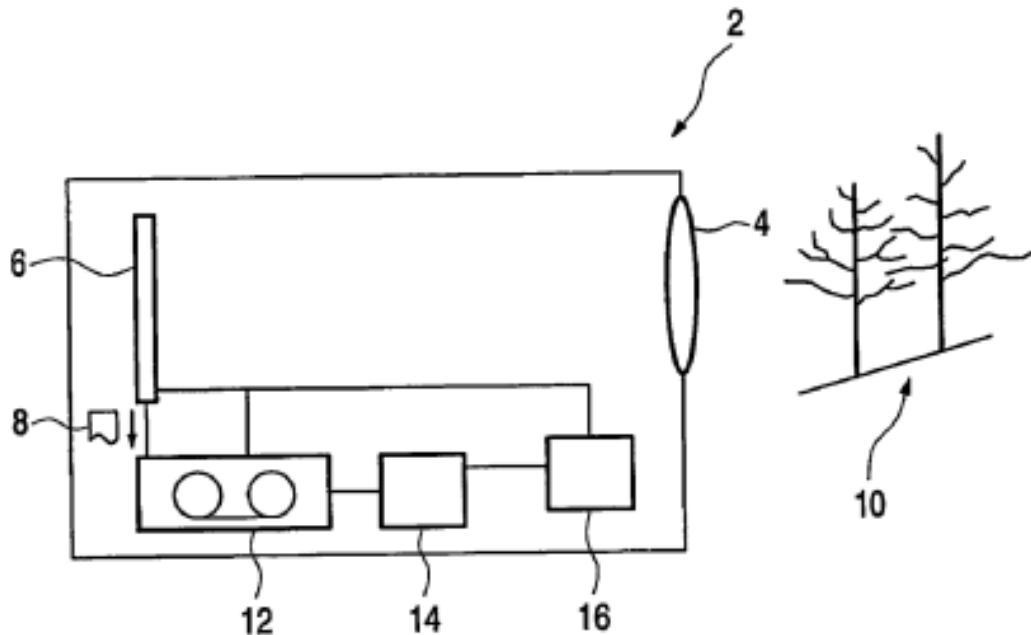


Fig.1

[0027] A camera 2 includes a lens 4 and a charge-coupled device (CCD) 6 which acts as a sensor to capture image data 8 representing a scene 10 in front of the camera. The camera may record either still images or moving images, in the latter case by capturing a sequence of items of image data 8 representing sequential frames of the moving image.

[0028] The camera 2 also includes memory 12 for recording the image data 8. The memory is in the example shown a tape, although the skilled person will be familiar with many other forms of memory suitable for storing still or video images and these may also be used. For example, the memory may be a solid state memory such as a flash memory, a removable memory card, a magnetic disc, an optically recordable disc or film.

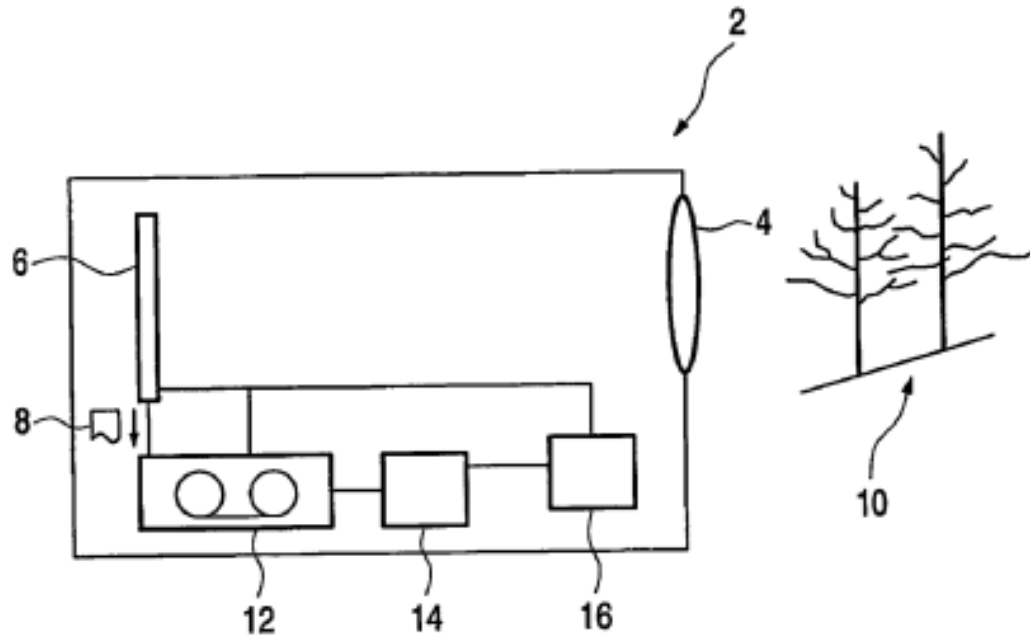


Fig.1

[0029] A rotation sensor 14 is provided that measures the angle of the camera to the vertical and outputs a corresponding measurement signal. This angle is recorded in the memory 12. The rotation sensor is an accurate accelerometer.

[0031] The camera 2 is under the control of camera processor 16. The camera processor 16 may be arranged to be switchable between a correction mode measuring and storing the angle information for correcting the image and a normal mode in which the rotation sensor is not used.

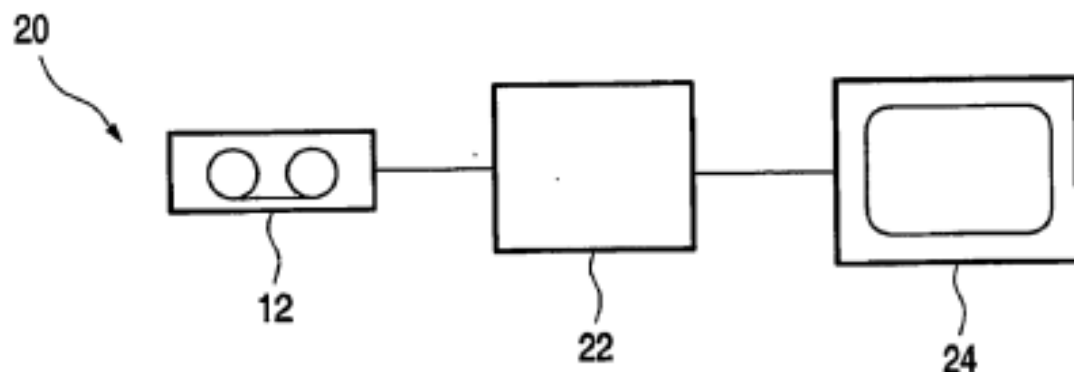


Fig.2

[0032] A playback device 20 is provided that can accept memory 12 and process the recorded image data 8 and rotation angle in replay processor 22. The processed image data is played back on display device 24, for example a television set. It will be appreciated by the skilled person that the replay processor 22 may be incorporated in camera 2 and may indeed be the same processor as camera processor 16.

[0033] The processor 22 can operate in a correction mode that corrects for inaccurate orientation of the camera with respect to the vertical. Thus, the processor 22 uses the recorded rotation angle information to cause an image to be displayed on display 24 that has the horizontal, even if the camera was slightly misaligned when the image was recorded.



Fig.3a



Fig.3b

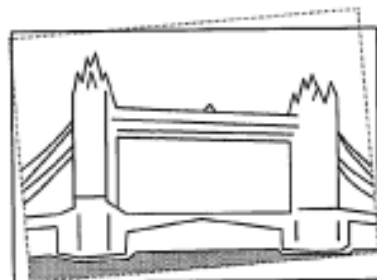


Fig.3c

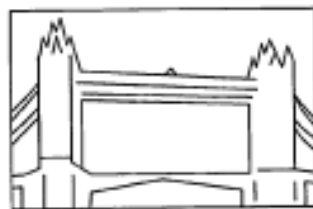


Fig.3d



Fig.3e

[0034] FIG. 3 illustrates the use of the system. FIG. 3 a shows the image that the user should have taken i.e. with the camera horizontally aligned. FIG. 3 b shows the image taken with a camera angle at an angle of about 10° to the vertical. The true horizontal in the image is thus also at an angle of 10° to the horizontal in the recorded image.

[0035] The image as shown in FIG. 3 b is recorded in the memory together with the data item that records the camera angle.

[0036] On replay, the processor 22 calculates the image on display 24 as shown in FIG. 3 c, with a rotation correction applied using the camera item data angle by replay processor 22 so that true horizontals appear as horizontal. Some of the image frame of the rotation corrected image is blank, as may be seen. Accordingly, the image is cropped to eliminate blank space as illustrated in FIG. 3 d. Frame 40 represents the recorded image and frame 42 represents the image frame of the displayed image.

[0037] As illustrated in FIG. 3 e, the corrected image 42 is resized so that the final image frame 44 is the same size as original image frame 40.

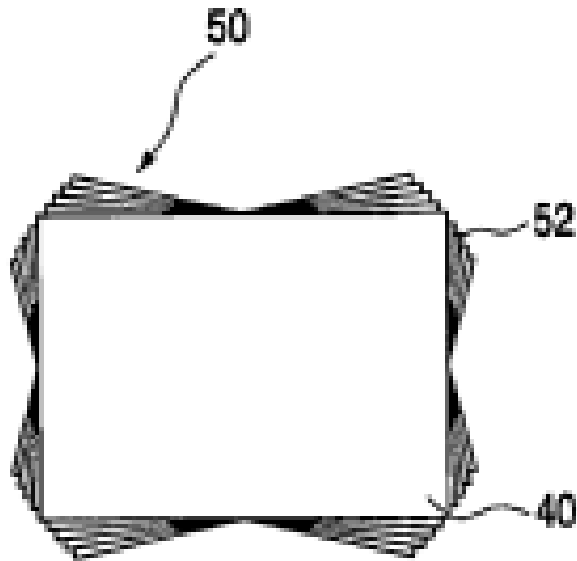


Fig.4

[0038] In a modification of the invention, illustrated in FIG. 4, the recorded image area 50 is greater than that of the nominal image frame 40 in order that the image may be rotated without resizing. Marginal pixels 52 outside the nominal frame 40 may be switched on only when required to avoid excessive power drain when the automatic alignment feature is not in use.

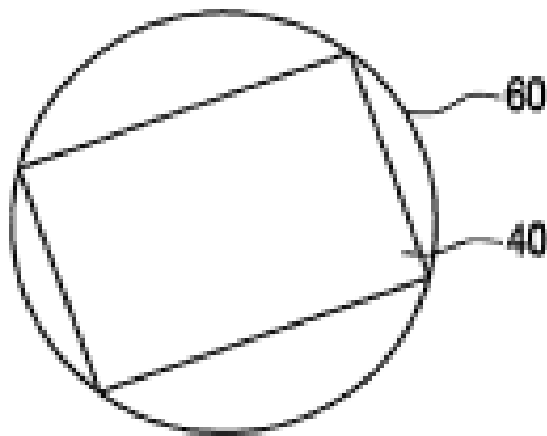
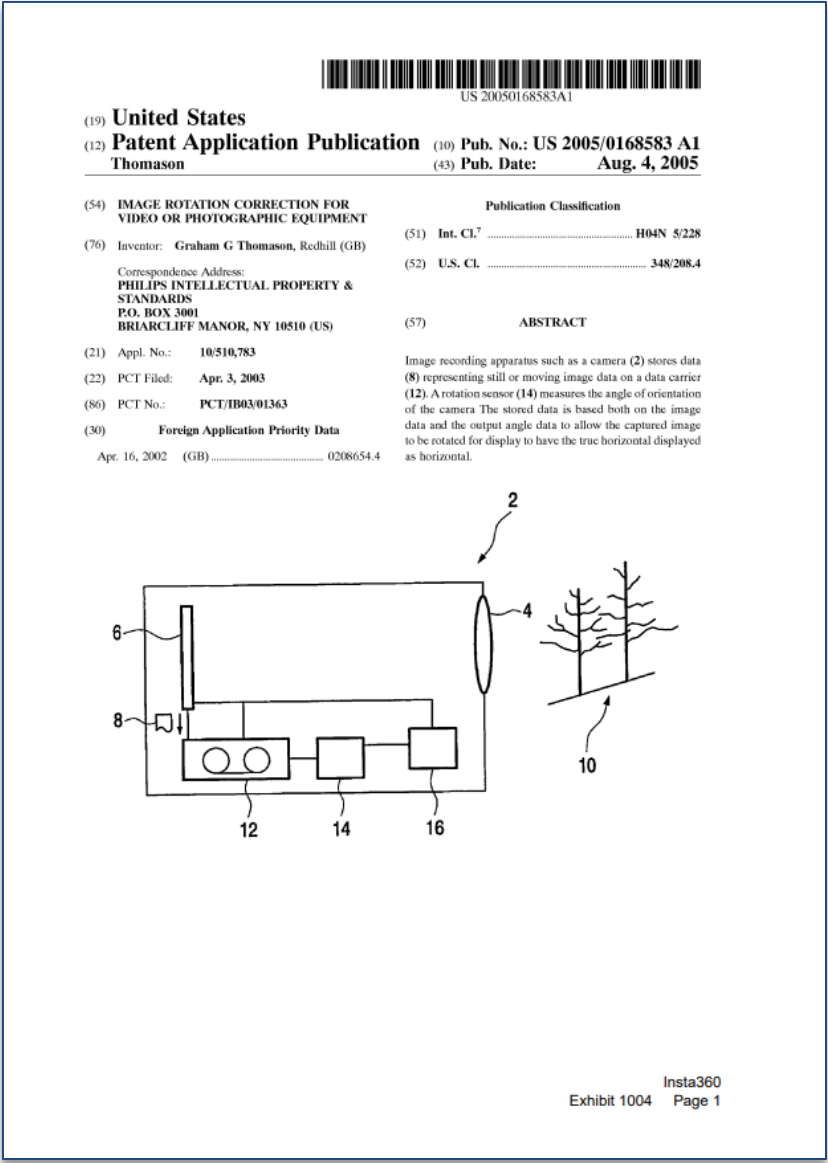


Fig.5

[0039] In a further modification, the sensor array may be circular to enable arbitrary rotation to take place without any loss at the edges. FIG. 5 illustrates such a circular sensor 60 with nominal image frame 40. Rotation to any angle is possible without size reduction. The individual pixels of circular sensor 60 may be arranged on a hexagonal grid.

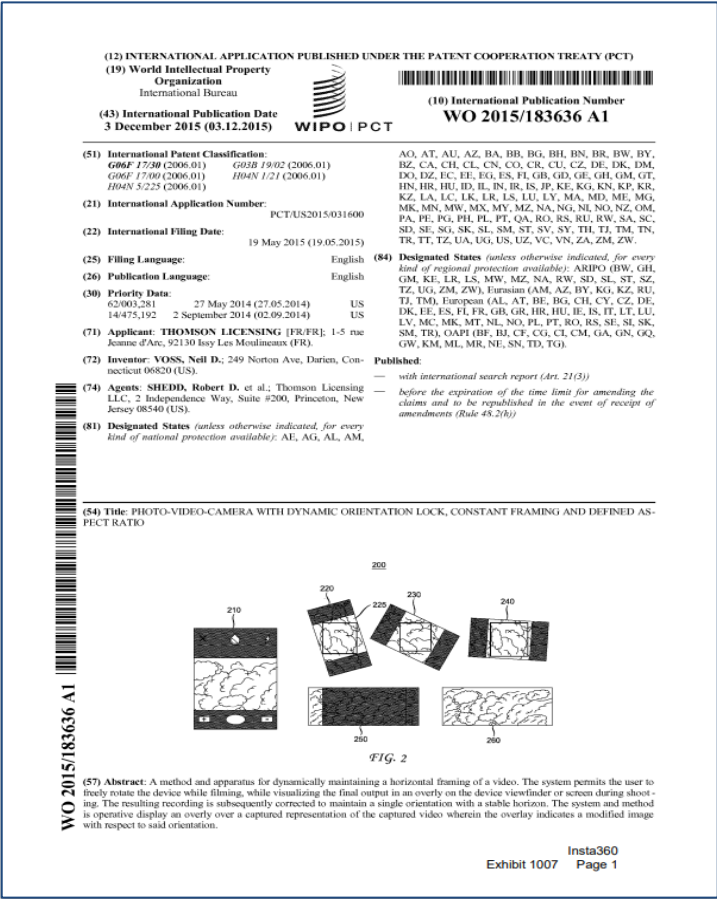


Ex. 1004 (Thomason)

[0015] A plurality of sensors may be provided to allow for image correction in a number of planes, for example corrections for rotation and tilt. The camera may be able to use the information from the sensors to record a panoramic image by stitching together a plurality of individual images.

[0041] The 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. The sensor may include a plurality of accelerometers. The stored information may then be used, for example, to stitch together a high quality image from several successive image to make up a panoramic images using the orientation information to accurately align and stitch together the different still images.

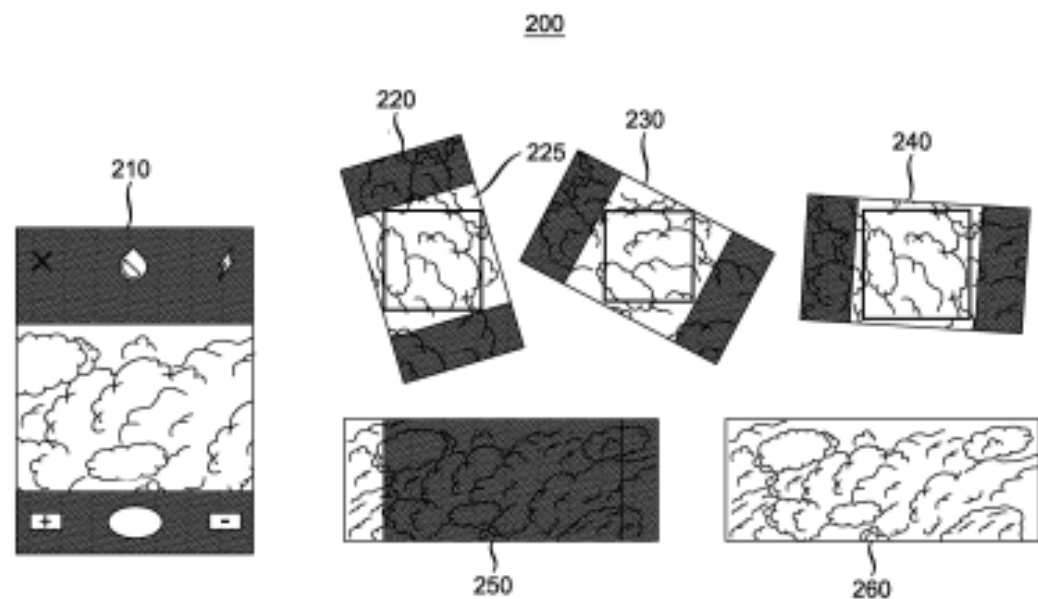
Voss



For example, many videos on mobile devices are recorded in a manner where the user may inadvertently rotate the mobile device, thereby tilting the video horizon the vertical orientation of the video for the viewer. In an extreme case, a user may start filming with the camera in a vertical orientation and change to a horizontal orientation. This would result in a video which starts out oriented properly, but ends up rotated 90 degrees when being displayed to a viewer. To correct this problem post processing is required, which is an undesirable option for a user wishing to directly share the video via a social network.

Additionally, recording a video with the mobile device in a vertical position often results in a video which is taller than it is wide. This end result is not optimal for consumption on most displays, such as television screens, which are typically wider than they are tall. In many cases users shoot video without specific attention to horizontal orientation, especially when filming a social activity, live event or other subject matter where the user is engaged in the experience that takes their focus off the device they are recording with. Further, most mobile phones are designed to be used in a vertical orientation. Thus, a user may start using the device in its intended orientation, only to realize later that video should be filmed in a horizontal orientation.

Ex. 1007 (Voss) 3



Turning now to FIG. 2, an exemplary mobile device display having an active display 200 according to the present invention is shown. The exemplary mobile device application is operative for allowing a user to record in any framing and freely rotate their device while shooting, visualizing the final output in an overlay on the device's viewfinder during shooting and ultimately correcting for their orientation in the final output.

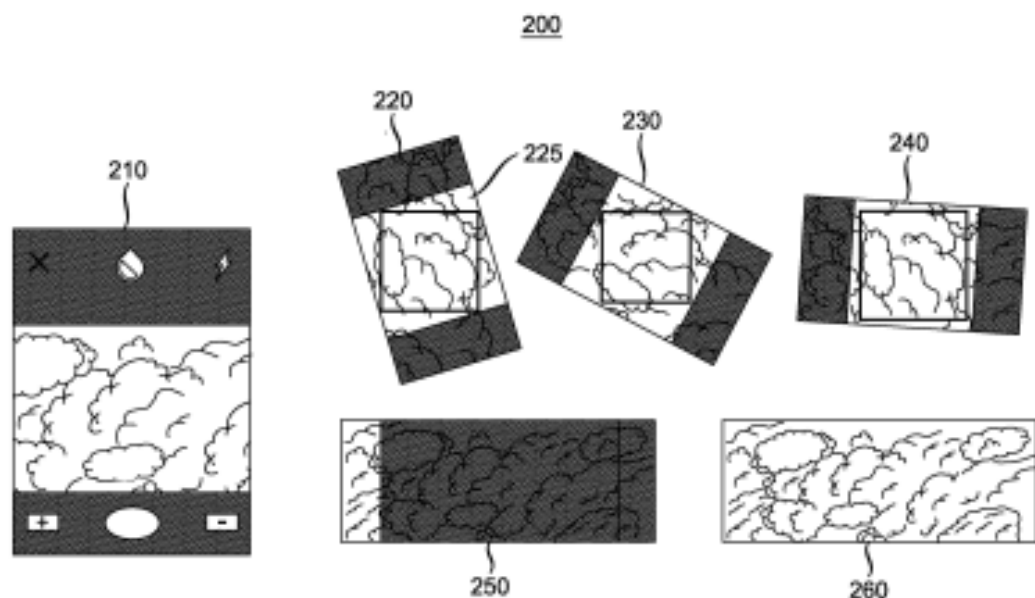


FIG. 2

According to the exemplary embodiment, when a user begins shooting the user's current orientation is taken into account and the vector of gravity based on the device's sensors is used to register a horizon. For each possible orientation, such as portrait 210, where the device's screen and related optical sensor is taller than wide, or landscape 250, where the device's screen and related optical sensor is wider than tall, an optimal target aspect ratio is chosen. An inset rectangle 225 is inscribed within the overall sensor that is best-fit to the maximum boundaries of the sensor given the desired optimal aspect ratio for the given (current) orientation. The boundaries of the sensor are slightly padded in order to provide 'breathing room' for correction. The inset rectangle 225 is transformed to compensate for rotation 220, 230, 240 by essentially rotating in the inverse of the device's own rotation, which is sampled from the device's integrated gyroscope. The transformed inner rectangle 225 is inscribed optimally inside the maximum available bounds of the overall sensor minus the padding. Depending on the device's current most orientation, the dimensions of the transformed inner rectangle 225 are adjusted to interpolate between the two optimal aspect ratios, relative to the amount of rotation.

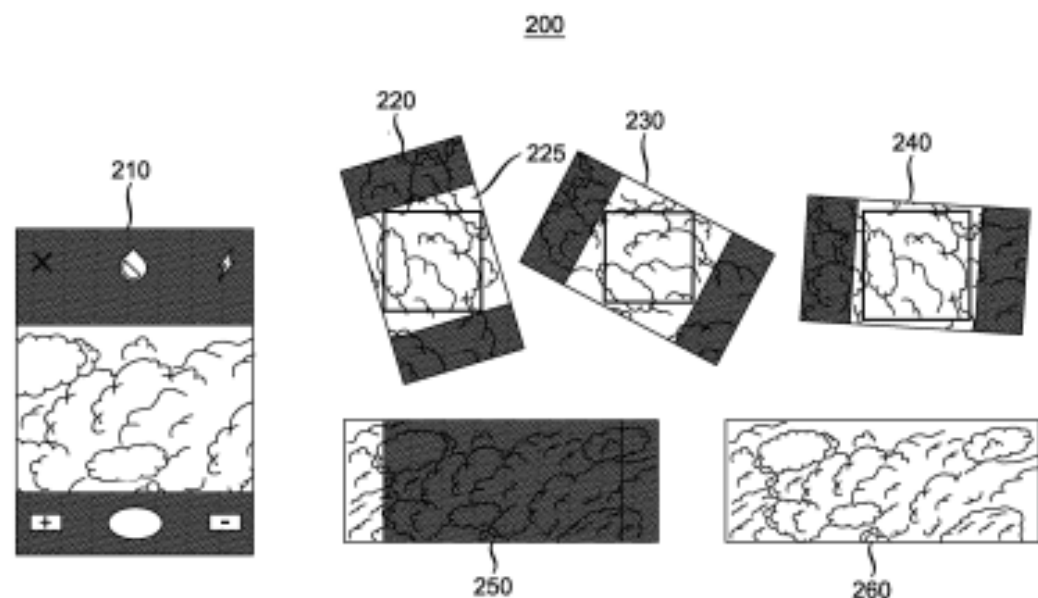


FIG. 2

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. The inscribed rectangle is sampled and then transformed to fit an optimal output dimension. For example, if 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'. In the end the result is a fixed aspect asset where the content framing adjusts based on the dynamically provided aspect ratio during correction. So for example a 16:9 video comprised of 1:1 to 16:9 content would oscillate between being optically filled 260 (during 16:9 portions) and fit with pillar boxing 250 (during 1:1 portions).

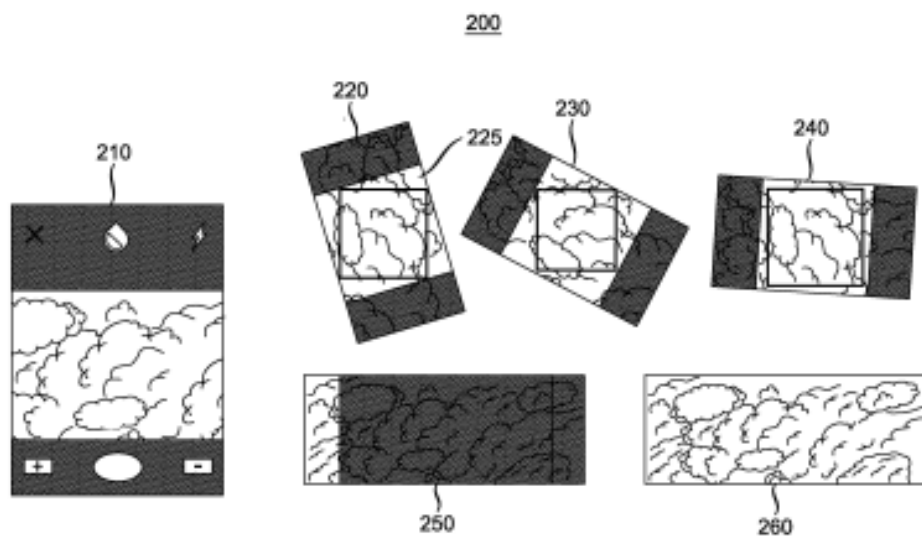
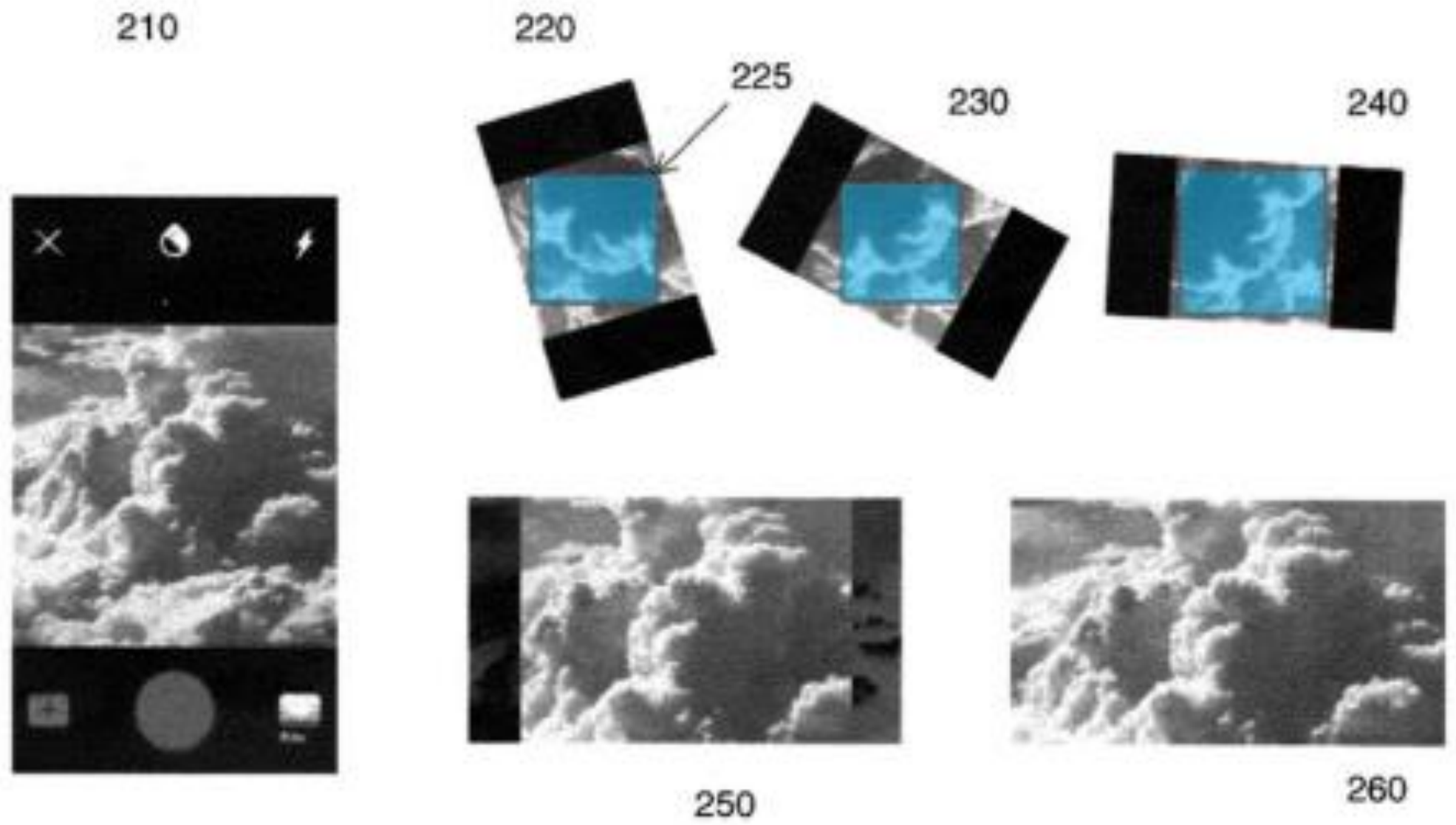


FIG. 2

Additional refinements whereby the total aggregate of all movement is considered and weighed into the selection of optimal output aspect ratio are in place. For example, if a user records a video that is 'mostly landscape' with a minority of portrait content, the output format will be a landscape aspect ratio (pillar boxing the portrait segments). If a user records a video that is mostly portrait the opposite applies (the video will be portrait and fill the output optically, cropping any landscape content that falls outside the bounds of the output rectangle).



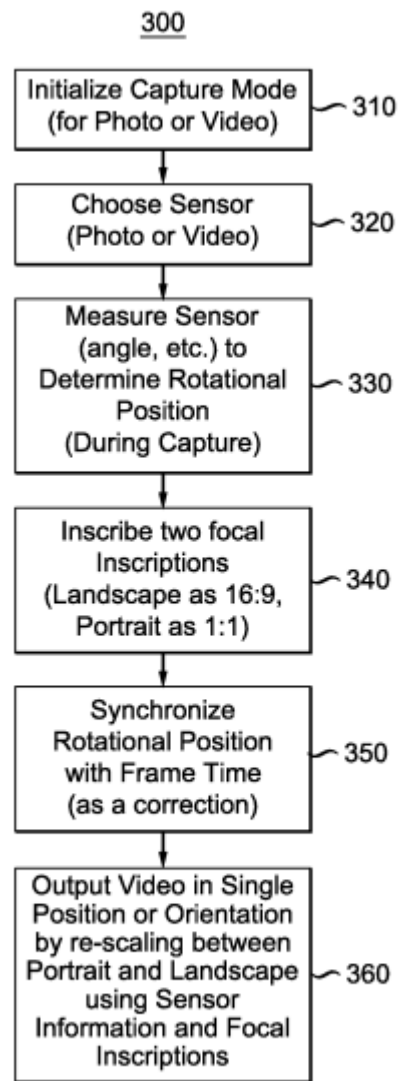
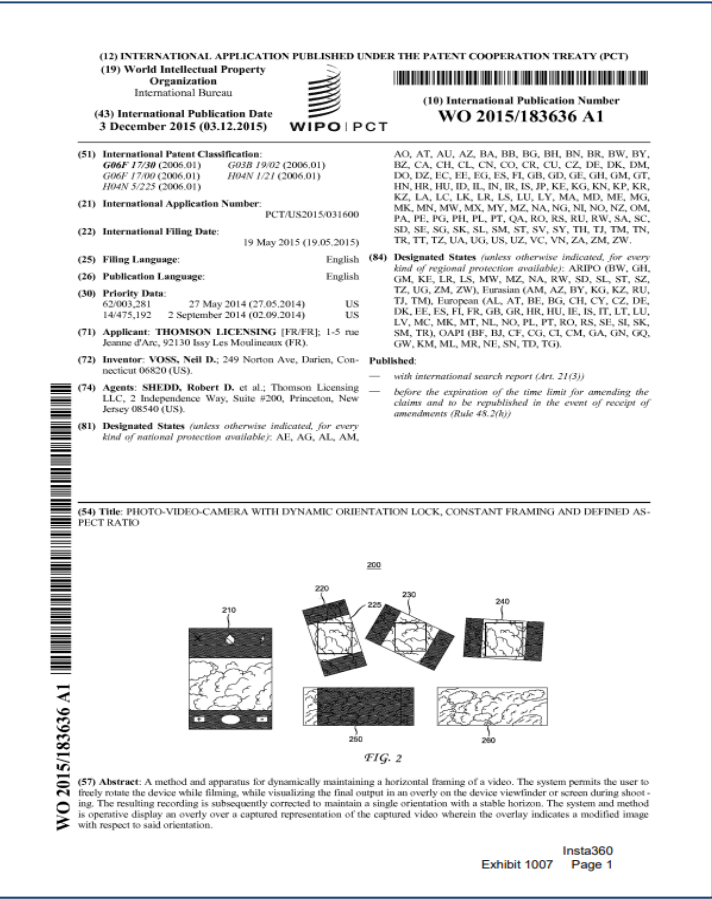


FIG. 3

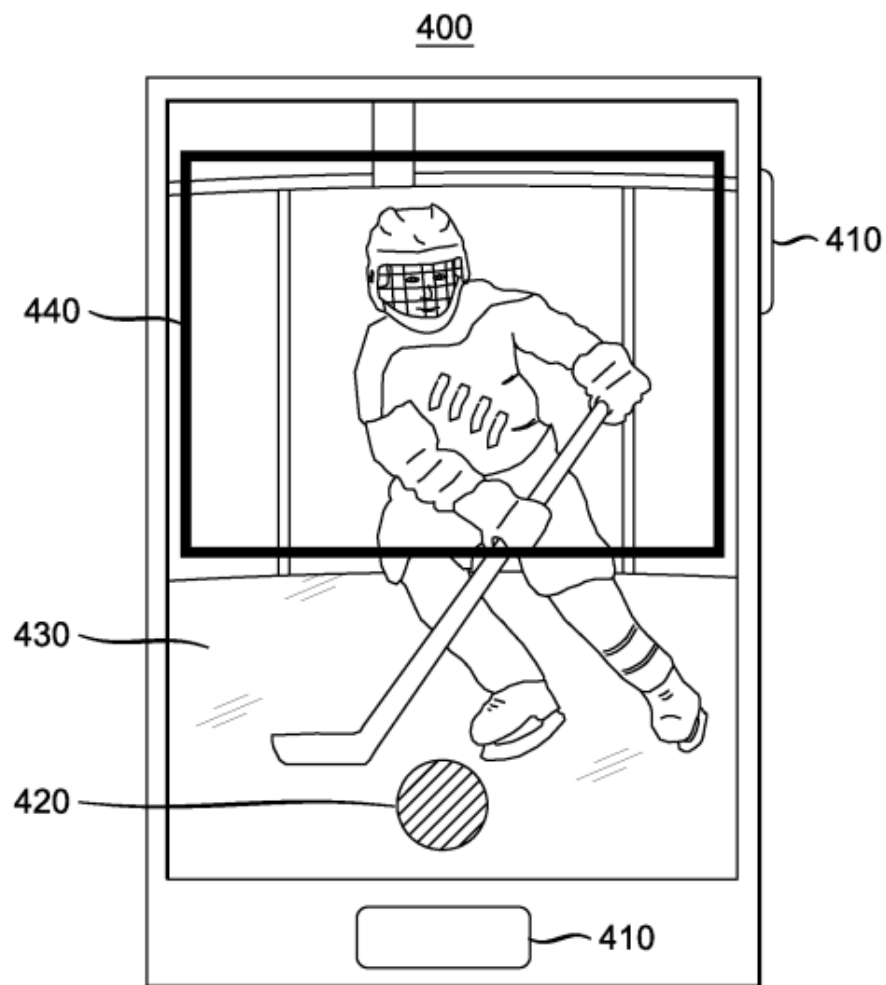
After the inertial sensor has returned an indication of the vertical and/or horizontal orientation of the mobile device, the mobile device depicts an inset rectangle on the display indicating the captured orientation of the video or image 340. As the mobile device is rotated, the system processor continuously synchronizes inset rectangle with the rotational measurement received from the inertial sensor 350. The representation of the orientation may be checked, further be refined, or improved by analyzing the image using techniques such as line recognition, facial recognition, or the like.

The user may optionally indicate a preferred final video or image ration, such as 1:1, 9:16, 16:9, or any other ratio selected by the user. The system may also store user selections for different ratios according to orientation of the mobile device. For example, the user may indicate a 1:1 ratio for video recorded in the vertical orientation, but a 16:9 ratio for video recorded in the horizontal orientation. In this instance, the system may continuously or incrementally rescale video 360 as the mobile device is rotated. Thus a video may start out with a 1:1 orientation, but could gradually be rescaled to end in a 16:9 orientation in response to a user rotating from a vertical to horizontal orientation while filming. Optionally, a user may indicate that the beginning or ending orientation determines the final ratio of the video.



Ex. 1007 (Voss) 13

In certain other embodiments, the framing of the image inside the output box is maintained regardless of the aspect ratio. Thus, no matter how the device is oriented, scene is zoomed in or out to keep consistent framing. In some such cases, the object of interest in the video would stay the same size regardless of orientation and aspect ratio. In other cases, where maximum resolution is desired, the zooming in and out may change the size of the object of interest. Alternately, the image may be cropped to maintain the size regardless of orientation and aspect ratio.

*FIG. 4*

Turning now to FIG. 4, an exemplary mobile device display having a capture initialization 400 is shown. An exemplary mobile device is shown depicting a touch tone display for capturing images or video. According to an aspect of the present invention, the capture mode of the exemplary device may be initiated in response to a number of actions. Any of hardware buttons 410 of the mobile device may be depressed to initiate the capture sequence. Alternatively, a software button 420 may be activated through the touch screen to initiate the capture sequence. The software button 420 may be overlaid on the image 430 displayed on the touch screen. The image 430 acts as a viewfinder indicating the current image being captured by the image sensor. An inscribed rectangle 440, as described previously, may also be overlaid on the image to indicate an aspect ratio of the image or video to be captured.

Pacurariu

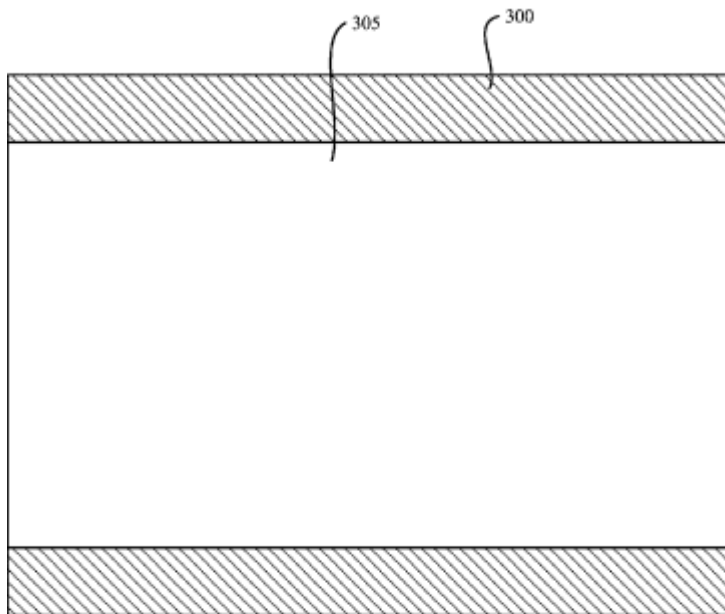


Figure 3

[0040] FIG. 3 illustrates a graphical representation of an image sensor array **300** and an image area **305** of the image sensor array **300** that defines a number of image sensor elements within the image sensor array according to some embodiments described herein. The image area **305**, for example, may represent the portion of the field of view that the user would like recorded as an image or a video frame. In this example, the image sensor array **300** may include a 4:3 aspect ratio such that the number of image sensor elements along the vertical axis is three-fourths the number of image sensor elements along the horizontal axis and produces an image with a corresponding aspect ratio of pixels.... In some embodiments, the image area **305** may be the area where an image is focused onto the image sensor array **300**. The image area **305** may capture a scene being recorded by the camera. The image area **305** may have a different aspect ratio than the image sensor array **300**. For example, the image area may have a 16:9 aspect ratio such that the number of image sensor elements along the vertical axis is nine-sixteenths the number of image sensor elements along the horizontal axis. Various other aspect ratios may be used. Moreover, the aspect ratio, size, position, and/or orientation of the image area **305** may be changed at any time. A image sensor array **300** of any size may be used that allows for image areas of any aspect ratio. Moreover, the aspect ratio may be changed in software or hardware. This change in aspect ratio, for example, may be dynamic.

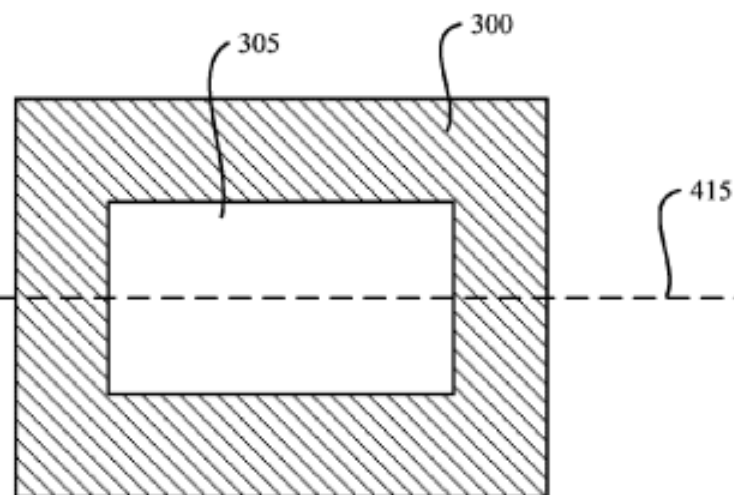


Figure 4A

[0042] FIG. 4A illustrates a graphical representation of the image sensor array 300 with the image area 305 having a smaller size than the image area shown in FIG. 3A according to some embodiments described herein. In this example, the image area is reduced to compensate for future or potential rotations of the image area 305 relative to the image sensor array 300 or vice versa (see FIG. 5A). As shown, the image area 305 and/or the image sensor array 300 are aligned with the horizon 415.

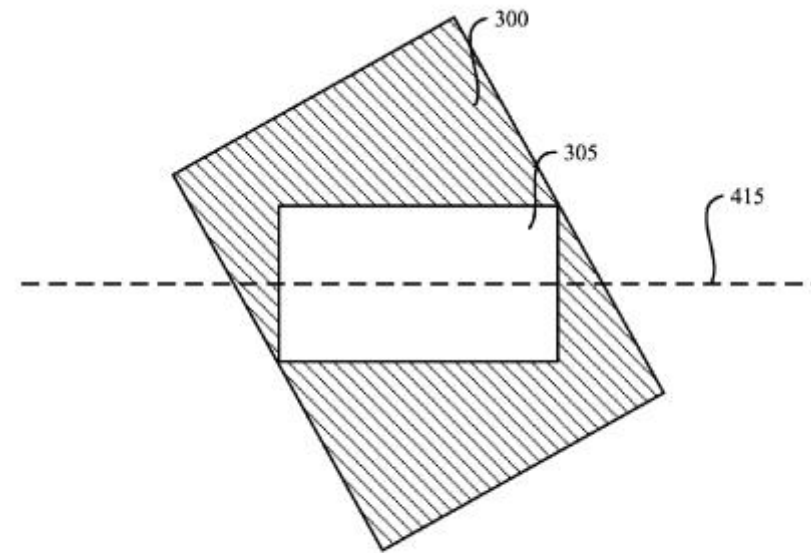
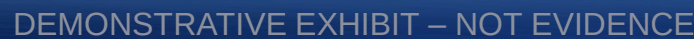


Figure 5A

[0044] FIG. 5A illustrates a graphical representation of the image sensor array **300** that is tilted relative to the gravitational vector **410** and relative to the horizon **415**. A reduced area of the image area **305** may be used to compensate for any rotation. In this example, the image sensor array **300** is tilted 60.8° relative to the gravitational field and 29.2° relative to the horizon **415**. The size of the image area may depend on the size of the image sensor and/or the desired aspect ratio of the image area.

Derbanne

Ex. 1008 (Derbannes)





Images with an optical field of view are captured by an image capture device. An observed trajectory of the image capture device reflects the positions of the image capture device at different moments may be determined. A capture trajectory of the image capture device reflects virtual positions of the image capture device from which video content may be generated. The capture trajectory is determined based on a subsequent portion of the observed trajectory such that a portion of the capture trajectory corresponding to a portion of the observed trajectory is determined based on a subsequent portion of the observed trajectory. Orientations of punch-outs for the images are determined based on the capture trajectory. Video content is generated based on visual content of the images within the punch-outs.

Derbanne – Ex. 1008

may be obtained by the processor 11. An observed trajectory of the image capture device during the capture duration may be determined based on the position information and/or other information. The observed trajectory may reflect the positions of the image capture device at different moments within the capture duration. The observed trajectory may include a first portion corresponding to a first moment within the capture duration and a second portion corresponding to a second moment subsequent to the first moment within the capture duration. A capture trajectory of the image capture device may be determined based on a subsequent portion of the observed trajectory and/or other information such that a portion of the capture trajectory corresponding to the first portion of the observed trajectory may be determined based on the second portion of the observed trajectory. The capture trajectory may have smoother changes in the positions of the image capture device than the observed trajectory. Orienta-

Ex. 1008 (Derbanne) at 3:50-65

In some implementations, the capture trajectory may be determined based on minimization of a rotational velocity of the image capture device/housing of the image capture device and a rotational acceleration of the image capture device/housing of the image capture device while respecting a set of constraints. For example, the capture trajectory may be determined by generating a smooth path that respects the set of constraints, rather than by modifying the observed trajectory. For instance, a smooth path defining yaw angle position, pitch angle position, and/or roll angle position may be generated by finding a path of the image capture device/housing of the image capture device that minimizes a combination of a time derivative, a second time derivative, and/or other time derivative(s) of the yaw angle position, pitch angle position, and/or roll angle position while respecting the set of constraints:

$$\min\left(\left\|\frac{d}{dt}\theta\right\|^2 + \left\|\frac{d^2}{dt^2}\theta\right\|^2 + \dots\right) \quad (54)$$

In some implementations, one or more of the portions of the minimization calculation may be changed. For example, one or more portions of the minimization calculation (e.g., the first time derivative) may be changed to have a greater affect or a lesser affect than other portion(s) of the minimization calculation (e.g., the second time derivative), and/or other factors may be introduced into the calculation.

Ex. 1008 (Derbanne) at 10:61-11:24

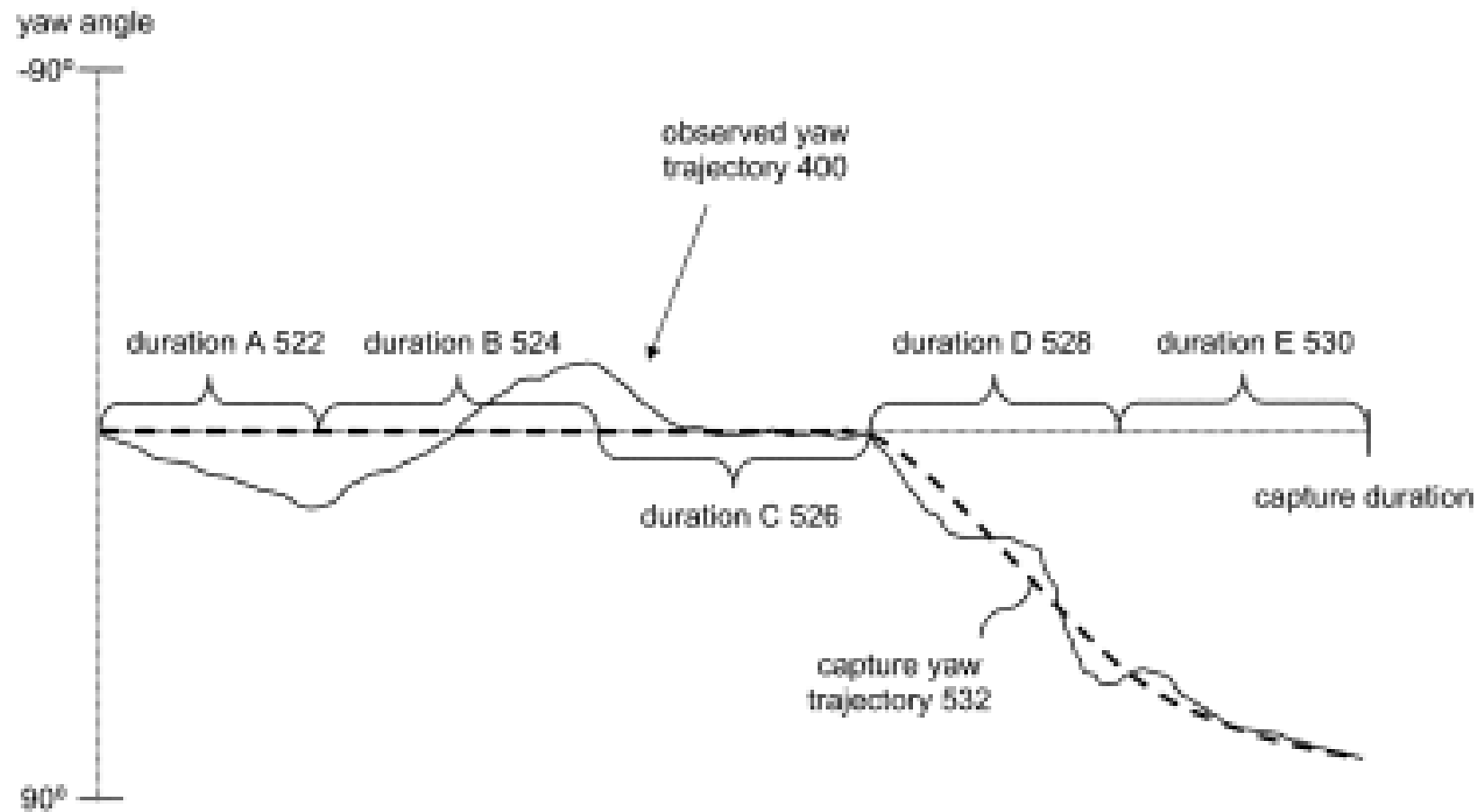


FIG. 5C

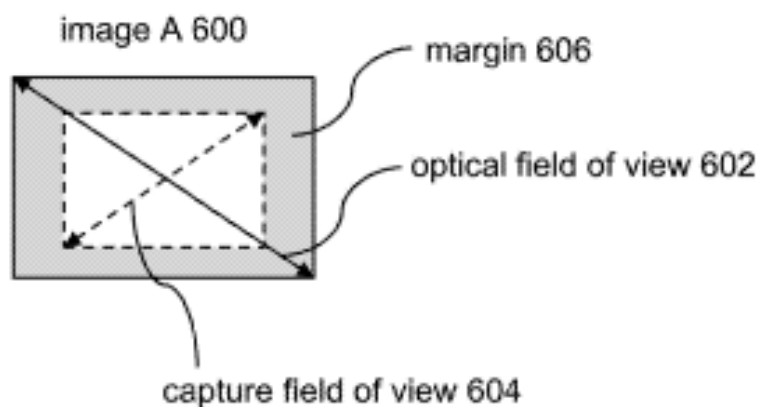


FIG. 6A

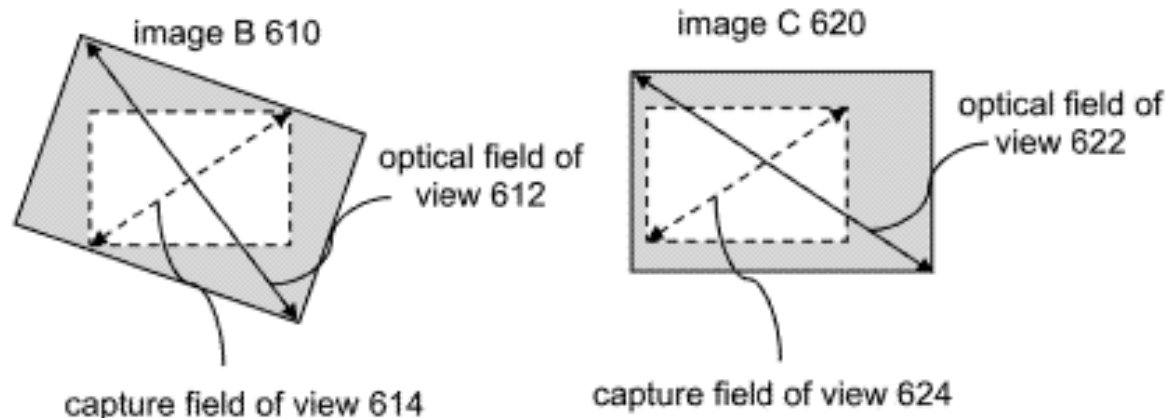


FIG. 6B

Watanabe

Watanabe – Ex. 1006

(12) United States Patent Watanabe	(10) Patent No.: US 10,778,996 B2 (45) Date of Patent: Oct. 15, 2020
(54) IMAGE PROCESSING APPARATUS AND IMAGE PROCESSING METHOD	(58) Field of Classification Search CPC H04N 5/2324; H04N 5/2328; H04N 5/2258 G06T 5/00; G02B 7/09; G02B 7/41; G02B 27/46 See application file for complete search history.
(71) Applicant: CANON KABUSHIKI KAISHA, Tokyo (JP)	(56) References Cited U.S. PATENT DOCUMENTS 9,467,622 B2 * 10/2014 Miyakawa H04N 5/2328 2003/0131614 A1 10/2003 H04N 5/217 2009/0135272 A1 5/2009 Ohtsuki 348,241 (Continued)
(72) Inventor: Takeshi Watanabe, Tokyo (JP)	FOREIGN PATENT DOCUMENTS 101510659 A 8/2009 CN 10166162 A 2/2010 (Continued)
(73) Assignee: CANON KABUSHIKI KAISHA, Tokyo (JP)	OTHER PUBLICATION DOCUMENTS Combined Search and Examination Report issued in corresponding application No. GB1802959.9 dated Sep. 27, 2018, 5 pages. (Continued)
(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 13 days.	PRIMARY EXAMINER Primary Examiner—Kelly L. Jersbach (74) Attorney, Agent, or Firm—Carter, DeLuca & Farrell LLP
(21) Appl. No. 15954,247	ABSTRACT (57) Provided is an image processing apparatus that generates a natural-looking image even from an image in which image shading has been corrected. Information is input to and output from a processor of the image processing apparatus performs transformation processing on an image so as to generate an image having little asymmetric distortion centered on the center coordinates of the image, even for an image in which the center position of aberration of an optical system and the center position of the image do not match.
(22) Filed: Apr. 16, 2018	22 Claims, 10 Drawing Sheets
(65) Prior Publication Data US 2018/0302567 A1 Oct. 18, 2018	
(30) Foreign Application Priority Data Apr. 18, 2017 (JP) 2017-082522 Feb. 20, 2018 (JP) 2018-0298211	
(51) Int. Cl. H04N 5/28 (2006.01) H04N 5/32 (2006.01) H04N 5/05 (2011.01) G06T 5/00 (2006.01) H04N 5/217 (2011.01)	
(52) CPC H04N 5/2328 (2013.01); G06T 5/00 (2013.01); H04N 5/217 (2013.01); H04N 5/2324 (2013.01); H04N 5/2267 (2013.01); H04N 5/05872 (2013.01)	

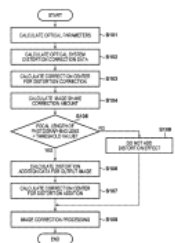


Exhibit 1006 Page 1

(57)

ABSTRACT

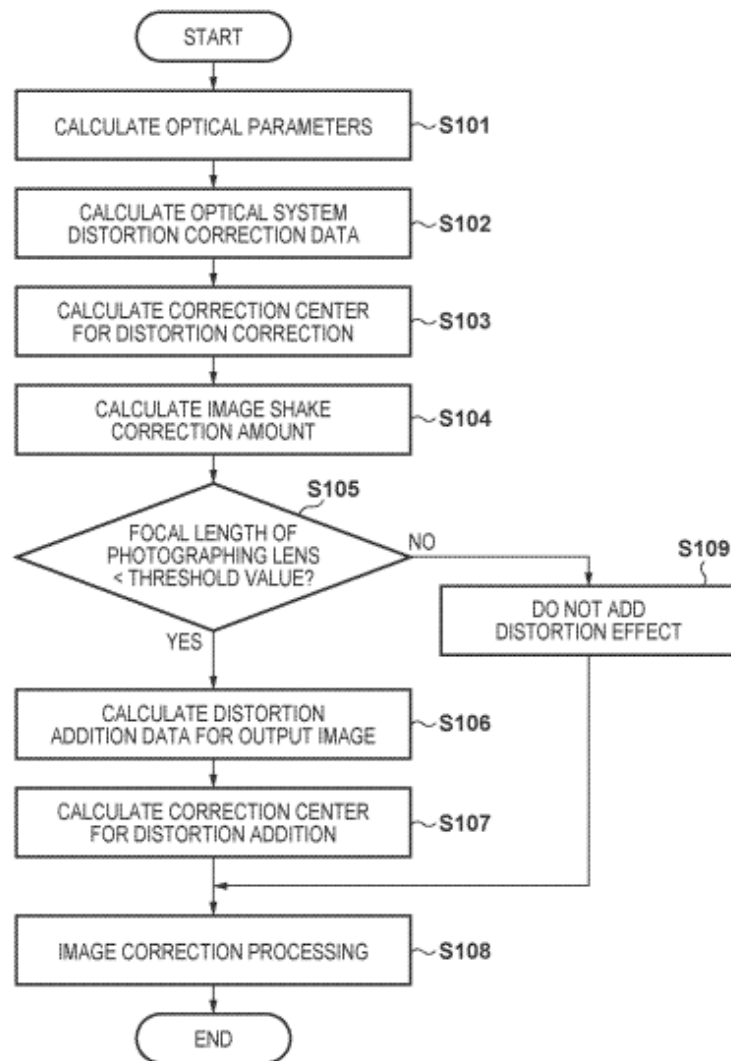
Provided is an image processing apparatus that generates a natural-looking image even from an image in which image shake has been corrected and distortion has been intentionally added. A processor of this image processing apparatus performs transformation processing on an image so as to generate an image having a point symmetric distortion centered on the center coordinates of the image, even for an image in which the center position of aberration of an optical system and the center position of the image do not match.

Ex. 1006 (Watanabe)

Thus, in this embodiment, if the focal length of the photographing lens **102** is smaller than the threshold value, the distortion addition circuit **108** adds a distortion effect, and if the focal length of the photographing lens **102** is larger than or equal to the threshold value, does not add a distortion effect. Here, the threshold value can be a visually desirable value if distortion that resembles aberration is added to an image.



FIG. 2



In step S106, the distortion correction amount calculation circuit 202 calculates the characteristics of a distortion effect used by the distortion addition circuit 108. In this embodiment, a distortion effect that is added by the distortion addition circuit 108 is calculated based on the distortion characteristics of a photographing lens (i.e., the photographing lens 102) used for shooting an image subjected to image shake correction. For example, if the maximum distortion rate of the photographing lens 102 is -10% as shown in 31 of FIG. 3, distortion addition data for adding distortion (barrel distortion) whose maximum distortion rate is about -3% is calculated. This distortion addition data can be calculated by multiplying distortion correction data shown in 32 of FIG. 3 by a magnification of $-3/10$. Note that, here, 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. Alternatively, in order to simplify the processing, default distortion addition data prepared in advance may be read out regardless of the photographing lens 102.

GoPro's Sur-Reply Did Not Raise New Arguments

GoPro Did Not Raise A New Claim Construction In Sur-Reply

- Petitioner argues that GoPro raised a new claim construction for “configured” in Sur-Reply

“including.” *Id.* But GoPro advances a new construction of claim 1’s “configured” language, arguing for the first time that the term “configured” excludes prior art that may oscillate between cropping and pillar-boxing. *Id.*

Paper 45 (Petitioner’s Mtn. to Strike), 1

- GoPro did not raise a new claim construction in Sur-Reply
- GoPro applied the plain meaning to respond to Petitioner’s new argument in Reply that Voss’s disclosure of pillar boxing satisfies the claims

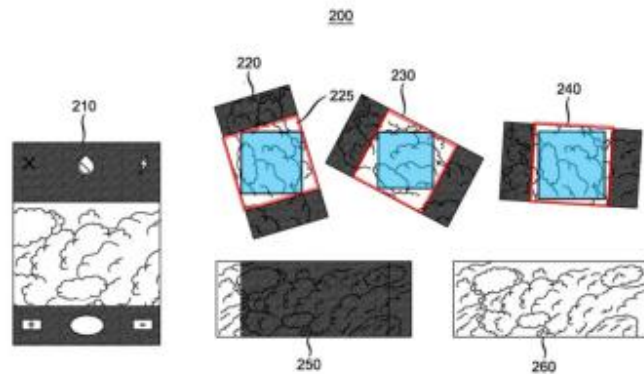
The Petition's Conclusory Analysis Did Not Mention "Pillar" or "Letter" Boxing

- The Petition did not mention "pillar boxing" or "letter boxing," and included only a conclusory opinion that Figure 2 shows Voss is configured to punch out the extents of the viewing window

- i. 1[d][ii]: "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,"

In Voss, "[t]he transformed inner rectangle 225 is inscribed optimally inside the maximum available bounds of the overall sensor minus the padding."

(EX1007, 10:7-9.) As shown in Figure 2 below, each of the inset rectangles (marked in blue) defines the extents of visual content. (EX1002, ¶200.)



Voss discloses "the horizon-leveled visual content including a punchout of the extents of the visual content defined by the viewing window." As shown in Figure 2 of Voss, the inset rectangle defines a portion of the visual content for presentation. (EX1002, ¶208.)

Petition, 74

Petition, 71

GoPro's POR Showed That The Petition's Conclusory Analysis Does Not Satisfy Claim 1

- The inset rectangle of Figure 2 (alleged viewing window) is cropped to fit an output rectangle, such that it does not define the extents of visual content to be included within horizon-leveled visual content

Finally, the inset rectangular of Voss does not define the extent of the visual content to be included within the horizon-levelled content. Ex. 2021, ¶128. Instead, after video capture is complete, Voss teaches that the “inscribed rectangle is sampled and then transformed to fit an optimal output dimension.” *Id.*, 10:16-17. This new output dimension may have a completely different aspect ratio from the aspect ratios selected for the inset rectangle during video capture and thus may require “cropping data as necessary.” *Id.* For example, “[i]f a user records a video that is mostly portrait ... the video will be portrait and fill the output optically, cropping any landscape content that falls outside of the *output rectangle*.”

POR, 51

Thus, the inset rectangle in Voss is not a “viewing window” as required by the '832 claims. Rather, Voss teaches the creation of a new “output rectangle” that may have a different size and shape, and may comprise a mere subset of the content that was defined within the extents of the inset rectangle during video capture.

POR, 51

Petitioner's Reply Raised An Improper New Argument Regarding Letter/Pillar Boxing

- Petitioner's Reply for the first time relied upon Voss's disclosure of oscillating between filling and letter boxing (also called pillar boxing):

GoPro's argument that the inset rectangle in Voss is not a "viewing window" because it does not "equate" the horizon-leveled visual content also fails. (EX1019, ¶90.) Contrary to GoPro's suggestion, the claims require that the horizon-leveled visual content only *include* the visual content defined by the viewing window. (*Supra* §II.A.) Voss discloses it. Specifically, "[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'.*" (EX1007, 10:17-21.) The output includes the rectangle. Dr. Foroosh testified that he omitted the second half of the sentence in his analysis. (EX1018, 196:5-12.)

Petition does not mention "letter" and "pillar" boxing

Petition does not cite to letter and pillar boxing

GoPro's Sur-Reply Responds To Petitioner's New Letter/Pillar Boxing Argument

- GoPro applied the plain meaning to respond to Petitioner's new argument in Reply that Voss's disclosure of pillar boxing satisfies the claims
- GoPro did not raise a new claim construction

Petitioner's Reply confirms that Voss is not configured as required by the claim. Voss's output rectangle is configured to "oscillate between" transforming the inset rectangle content through a process of "fill[ing]" ("*cropping data*" within the inset rectangle to create the output box) and "fit[ting]" ("black[ing] out any unused area with 'letter boxing' or 'pillar boxing.'"). *Id.*; EX1007, 10:17-11:2. Petitioner concedes that when the output box is created through filling (*i.e.*, cropping content), Claim 1 is not satisfied. Reply, 27. Indeed, Petitioner quotes Voss's disclosure of filling and fitting and then relies solely on the fitting. *Id.*

Because it is undisputed that filling does not generate horizon-leveling visual content that includes a punchout of the extents of the visual content defined by the viewing window, Voss's system is not configured as required by Claim 1. PO, 57-58. As GoPro previously explained, this speaks to the fundamental difference between the "inset" rectangle in Voss and the "viewing window" claimed by the '832 patent. The fact that Voss's differently configured system may in some instances result in an output rectangle that happens to include the entire inset rectangle with black bars filling the excess space, does not mean that Voss is configured to generate horizon-leveled visual content by punching out the extents of the viewing window, as required by Claim 1. *In re Facebook, Inc.*, 2018 WL 3860547, *2 (Fed. Cir. 2018) (prior art did not disclose "a rule requiring the elements to be contiguous" where system "happened to result in contiguity" in some instances); *Rex Med., L.P. v. Intuitive Surgical, Inc.*, 2020 WL 2128795, at *5 (D. Del. 2020) ("Configure, as defined by dictionaries, means set up for operation especially in a particular way.").

Sur-Reply, 19-20

GoPro Did Not Improperly Rely Upon EX2004

GoPro Did Not Improperly Rely Upon EX2004 In Its Sur-Reply

- **Petitioner argues that GoPro improperly relied upon EX2004 (Petitioner's CN Patent Application) in its Sur-Reply:**

In its Sur-Reply, GoPro relies on EX2004, a Chinese patent application by Insta360, when addressing the Thomason-Pacurariu combination and claims 7/17. (Paper 39, 5-6.) But EX2004 was only mentioned in discussing secondary considerations in GoPro's POR. (Paper 25, 77-78.) GoPro briefly mentioned EX2004 in its POPR, but only in connection with its failed attempt to limit "function of progress" to a smoothed zoom curve. (Paper 7, 16-18, 23.)

Paper 45 (Petitioner's Mtn. to Strike), 4

- **EX2004 is not new evidence**
- **GoPro's Sur-Reply argument is the same one it raised in its POR and POPR**
- **GoPro relies upon EX2004 in its Sur-Reply to address new opinions in a 65-page expert declaration Petitioner submitted with its Reply**

The POPR, POR, And Sur-Rely Rely Upon EX2004 For The Same Argument

- GoPro has consistently argued Petitioner's description of the states of the art in EX2004 contradicts its argument that the prior art discloses or renders obvious changing the size of the viewing window:

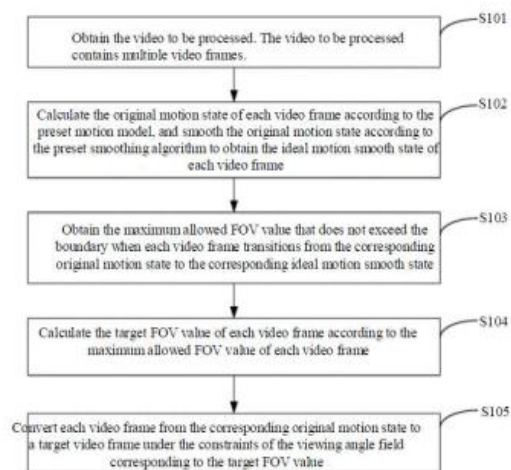
The novelty of determining a viewing window as a function of progress, and the lack of similar disclosure in Thomason, is confirmed by a Chinese patent application owned by Petitioner, CN 112804444 B ("444 application"). See Ex. 2003, 2004 (certified translation); Ex. 2001, ¶61. As

POPR, 17

In particular, the '444 application explains that a large fixed viewing window will have a poor horizon-leveled image if the "movement is relatively intense," because the boundaries of the new image are too close to the boundary of the original image, which prevents the new image from having an "ideal smooth motion state." Ex. 2004, ¶4. As Dr. Foroosh explains, when the viewing window is fixed to a large size, it can only be rotated by a certain amount before the window exceeds the boundaries of the original frame. Ex. 2001, ¶62. Thus, it is unable to provide the "ideal smooth motion state." *Id.* Yet as the '444 application further explains, if the fixed viewing window is too small, then much of the original image will not be captured, resulting in a "waste of FOV." Ex. 2004, ¶5. The '444 application thus explains that dynamically changing the size of the viewing window allows for maximum capture of the original image while providing a smooth leveling. Ex. 2001,

POPR, 18

In addition, '444 Chinese application describes what GoPro earlier claimed in the '832 patent and implemented in the Horizon Leveling functionality. Ex. 2021, ¶173. The '444 application describes obtaining video information, obtains rotational position information captured as a function of progress through a capture duration, and then, based on the rotational position information and boundary constraints, determining a dynamic FoV (i.e., a dynamically changing "viewing window" size) for each frame with a adequate stabilization margin.



Ex. 2004, ¶¶27-44.

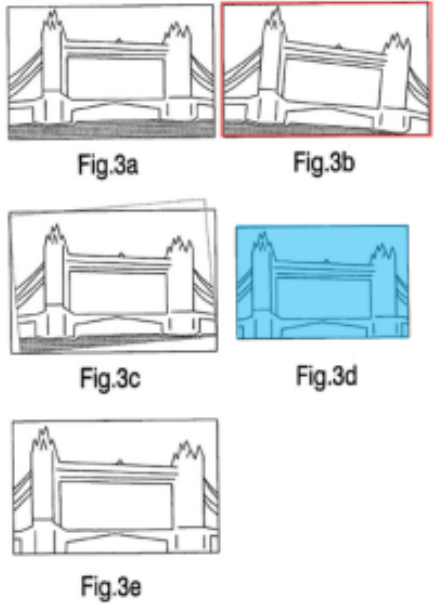
POR, 76-77

Fifth, Petitioner's claim that Thomason would be understood to teach determining the size of the viewing window frame-by-frame is contradicted by Petitioner's own later-in-time patent application that describes the state of the art. In that application, Petitioner described "existing technical solutions" as using one of two options. One option was to select a "large" viewing window size which allowed the camera to display more content during gentle motion or when there is minimal tilt, but that resulted in the viewing window exceeding the boundaries of the camera's image sensor during certain camera movements such that it could not horizon-level. EX2004, ¶¶3-5. The other option was to utilize a "small" viewing window size that could compensate for any rotation and movement, which required sacrificing the field-of-view ("FoV") displayed to the user. These options are shown below:

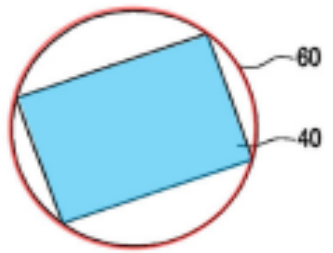
Sur-Reply, 5

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.)



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.

GoPro Has Not Taken Contrary Positions On “Location”

GoPro Has Not Taken Contrary Positions On “Location”

- Petitioner argues that GoPro has taken inconsistent position regarding “whether claims 10 and 20 require the location of the viewing window to change” (Paper 45, 4-5).
- GoPro’s has consistently argued that determining a location requires a process for calculating the location of a viewing window that is capable of change:

In addition, Petitioner’s expert Dr. Katsaggelo testified that “determination of the viewing window” requires some “process” by the camera “based on some logic,” where there is some potential for change Ex. 2022, 60:7-20; 61:1-6 (“It is just to be based on some *algorithmic* logic”); 61:8-16 (“[T]he placement could potentially change, yes.”). The Board also

POR, 35-36

Petitioner also incorrectly claims that PO is asking the Board to require a determination of an “x-y coordinate” that must “change” across frames. Reply, 15; *id.*, 5-6. The question is not whether determining location of the viewing window requires the viewing window to actually change. There may be circumstances where location is determined to be the same across frames. However, the claim requires a process that *allows* for change. POR, 35-36. Thomason (and Pacurariu) lack such a process. *Id.*, 37-39.

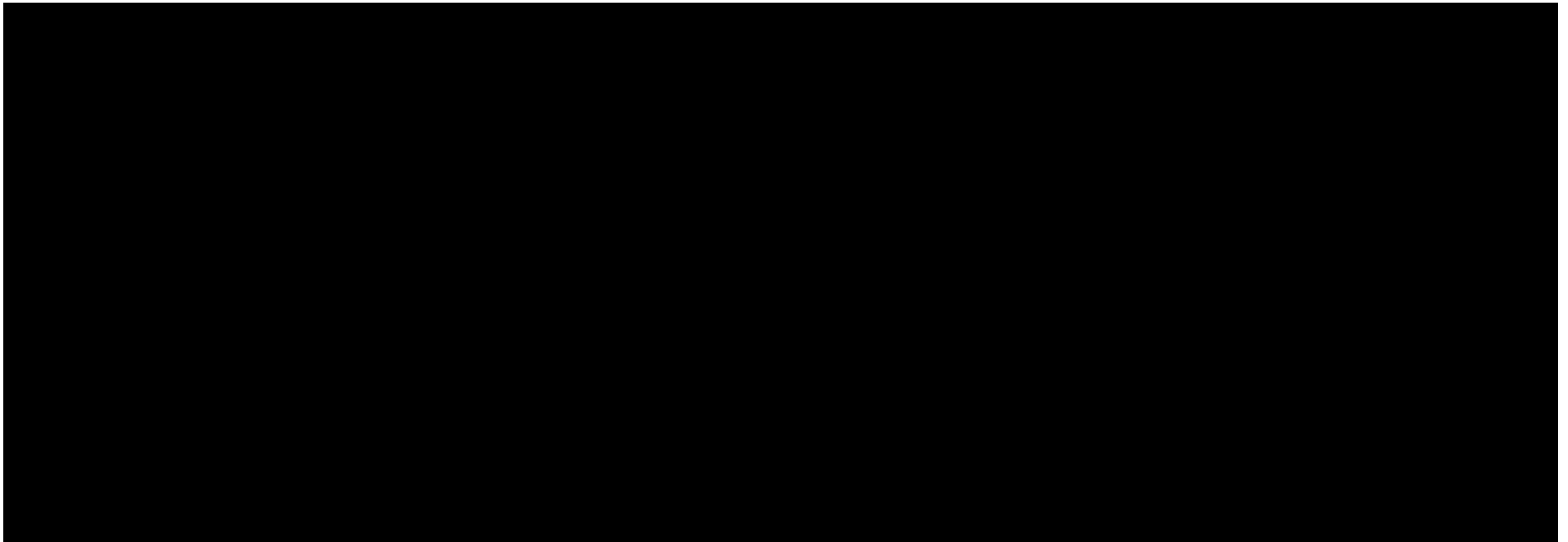
Sur-Reply, 10

- There is no location determined in Petitioner’s prior art; the viewing window is fixed in the center and incapable of change

GoPro's Nexus And Unmet Need Arguments Are Not Improper

GoPro's Nexus Argument Is Not Improper

- GoPro's POR argued that there was a “direct nexus,” identifying evidence of secondary considerations that was co-extensive with the Horizon Leveling Feature (POR, 73-74)
- For instance, GoPro presented surveys describing the success of the “Horizon Leveling” feature



EX2018, 28-29

EX2019, 14

GoPro's Nexus Argument Is Not Improper

- Petitioner argued in Reply that GoPro's evidence did not establish nexus or a presumption of nexus:

GoPro does not argue any presumption of nexus. Indeed, it makes no attempt to show how the purported practicing product HERO9, which includes a myriad of other features, are “coextensive with” the challenged claims. (ID, 52.)
Fox Factory, Inc. v. SRAM, LLC, 944 F.3d 1366, 1373 (Fed. Cir. 2019).

Reply, 33-34

- GoPro's Sur-Reply responded that its POR established a presumption of nexus:

Here, GoPro established a presumption of nexus by showing that the same Horizon-Leveling feature valued by customers is coextensive with the claimed invention. For instance, GoPro submitted consumer surveys that showed GoPro's “Horizon-Leveling” feature was one of the top reasons for the success of the GoPro devices. EX2021, ¶¶177-179; EX2018, 23; EX2019, 14. That is all that is required to show nexus. The law “do[es] not require the patentee to prove perfect correspondence to meet the coextensiveness requirement,” but merely that “the product is essentially the claimed invention.” *Fox Factory*, 944 F.3d at 1374.

Sur-Reply, 26

GoPro's Unmet Need Argument Is Not Improper

- GoPro's POR argued that Petitioner itself attempted to patent changing the size of the viewing window frame-by-frame

In addition, '444 Chinese application describes what GoPro earlier claimed in the '832 patent and implemented in the Horizon Leveling functionality. Ex. 2021, ¶173. The '444 application describes obtaining

POR, 76-77

- Petitioner argued in Reply that this evidence did not establish copying or unmet need

No copying. GoPro's alleged copying evidence based on Petitioner's '444 Chinese application has been rejected by both the Board and the ITC. (ID, 53; ITC ID, 151-152.) There is no evidence of replicating GoPro's technology. (EX1019,

No long-felt but unmet need. GoPro does not argue any unmet need. (EX1019, ¶124.) Its own witnesses are aware of none. (EX1022, 150:20-151:9; EX1026, 66:18-67:15.)

Reply, 35

- GoPro's Sur-Reply addresses Petitioner's argument by showing its evidence establishes copying and that Petitioner itself recognized a long-felt need:

¶11 (proposing determining viewing window size for each frame). This evidence shows copying and that Petitioner itself recognized a long felt need in the art.

Sur-Reply, 28

The ALJ Decision

ALJ Decision Addressed Different Invalidity Grounds

		Ground	Claim(s) Challenged
System Art		1. Anticipation Based on Insta360 Go System	1, 3-4
		2. Obviousness Based on Insta360 Go System and Thomason	7-8
		3. Anticipation Based on ReelSteady Go System	1, 3-4, 7-8
No Anticipation Ground		4. Anticipation Based on Thomason	1, 7-8
		5. Obviousness Based on Thomason and Watanabe	3-4

ALJ Decision –Thomason (Claim 1)

(1) Claim 1

Insta360 argues that Thomason discloses all elements of claim 1. *See* Insta360 Br. at 208–212. Of these, GoPro disputes elements 1[c] and 1[d]. GoPro Br. at 141 and GoPro Reply at 59. For those elements not in dispute, the evidence supports that they are disclosed in Thomason. *See* Insta360 Br. at 209–212 and Goodin Tr. at 1324:11–1325:13 and 1327:12–1328:1.

GoPro’s central disagreement as to elements 1[c] and 1[d] is that Thomason fails to “characteriz[e] rotational positions of the image capture device as a function of progress through the capture duration” because “Insta360 does not point to any disclosure teaching that these two ‘separate’ pieces of data are synchronized or aligned frame-to-frame, as a function of progress through the capture duration as required.” GoPro Br. at 141 and *see* GoPro Reply at 59. As discussed previously, the claim does not require the type of synchronization GoPro demands. A characterization of data “as a function of progress *through the capture duration*” is different than a characterization of data “as a function of progress *through the progress length*.” ’832 patent at claim 1 (emphasis added). Even then, Thomason discloses, “[t]he image . . . is recorded in the memory together with the data item that records the camera angle.” RX-1597 at [0035]. Naturally, image frames making up video content are recorded and stored in a sequence. The evidence supports that Thomason’s rotational position information is also stored in a sequence (*i.e.*, as a function of progress through the capture duration). Mr. Goodin credibly testified that Thomason discloses elements 1[c] and 1[d]. Goodin Tr. at 1325:15–1327:10.

EX1027 (ALJ Decision), 160-161

GoPro argues that Thomason uses a lens without distortion and that it would not be obvious to add distortion per Watanabe. GoPro Br. at 142 and Schonfeld Tr. at 1503:13–1504:3. Watanabe discloses, however, that wide-angle lenses that introduce barrel distortion were known, RX-2003 at 9:33–44, and teaches that retaining that barrel distortion was desirable. *See* Insta360Br. at 215, *citing* RX-2003 at 11:7–9 and Insta360 Reply at 61). The evidence thus supports that obtaining video content with barrel distortion and ensuring that any outputted horizon-leveled video also included barrel distortion (claims 3 and 4) would have been, at the very least, obvious to try when implementing the techniques of Thomason in view of Watanabe. *KSR*, 550 U.S. at 421 (“Where there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp.”).

ALJ Decision –Thomason (Claim 7)

The evidence supports that Thomason teaches the requirements of claim 7, namely, adjusting the size of a viewing window (*i.e.*, punchout) on a frame-by-frame basis based on the camera's rotation orientation on that same frame-by-frame basis:

The camera may record either still images or moving images, in the latter case by capturing a sequence of items of image data 8 representing sequential frames of the moving image.

....

FIG. 3 *a* shows the image that the user should have taken *i.e.* with the camera horizontally aligned. FIG. 3 *b* shows the image taken with a camera angle at an angle of about 10° to the vertical.

....

On replay, the processor 22 calculates the image on display 24 as shown in FIG. 3 *c*, with a rotation correction applied using the camera item data angle by replay processor 22 so that true horizontals appear as horizontal. Some of the image frame of the rotation corrected image is blank, as may be seen. Accordingly, the image is cropped to eliminate blank space as illustrated in FIG. 3 *d*. Frame 40 represents the recorded image and frame 42 represents the image frame of the displayed image.



Fig.3a



Fig.3b



Fig.3c



Fig.3d

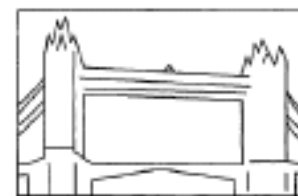


Fig.3e

EX1027 (ALJ Decision), 146-147