

IPR2024-01052 (U.S. Patent No. 11,336,832)

Arashi Vision (U.S.) LLC (D/B/A Insta360) (Petitioner)

v.

GoPro, Inc. (Patent Owner)

October 7, 2025

Roadmap

- 1. '832 Patent**
- 2. Claim Construction**
- 3. Grounds 1-4**
- 4. Secondary Considerations**
- 5. ITC's Invalidity Findings**

'832 Patent

'832 Patent

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); **Kyle 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. 62/894,549, filed on Aug. 30, 2019.

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

(52) U.S. Cl. (2006.01)
CPC **H04N 5/23299** (2013.08); **G06T 3/40** (2013.01); **G06T 5/006** (2013.01); **H04N 5/22525** (2013.08); **H04N 5/232935** (2013.08); **H04N 5/232945** (2013.08)

(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 Jafarzadeh H04N 5/232945 346,36
2015/0254873 A1* 9/2015 MacMillan G06T 3/0062 382,189
2016/0088287 A1* 3/2016 Sadi H04N 13/261 346,43
2016/0283697 A1* 9/2016 Voss G11B 27/031 346,43
2017/0118458 A1* 4/2017 Granholm G03D 15/08 346,43
2017/042237 A1* 5/2017 Kokarun H04N 5/23254 346,43
2018/0160194 A1* 6/2018 Bayless H04N 21/6543 346,43
2019/0189169 A1* 6/2019 Huang H04N 5/2321 346,43

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** — Explis & Associates, PC

ABSTRACT
(57) 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 the image capture device to provide a view in which a horizon depicted within the video is leveled.

20 Claims, 9 Drawing Sheets

METHOD 200

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.

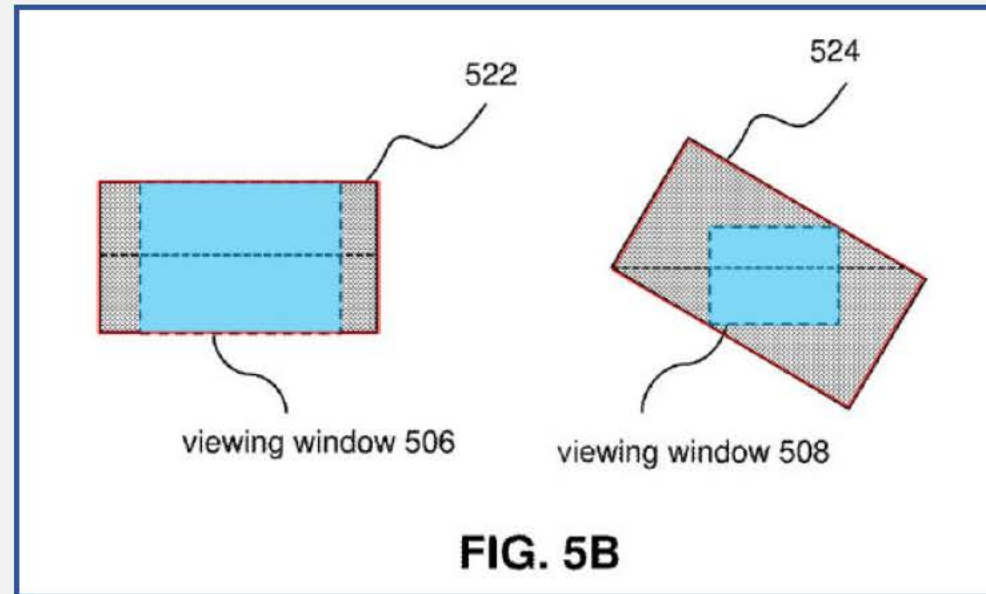
203 Determine a viewing window for the visual content as a function of progress through the progress length based on the rotational positions of the image capture device as a function of progress through the capture duration.

204 Generate horizon-leveled visual content based on the viewing window.

'832 Patent (Ex. 1001)

The visual content of the image 524 may include a tilted depiction of a scene. A viewing window 508 may be placed within the field of view of the visual content of the image 524 to provide a leveled view of the scene.

'832 Patent (Ex. 1001), 11:29-31



'832 Patent (Ex. 1001)

Claim Construction

Claim 1

Claim Term	Board’s Preliminary Construction
Determine a viewing window for the visual content as a function of progress through the progress length	Determine a viewing window <u>for different times of the video</u>

'832 Patent (Ex. 1001), Claim 1

Decision on Institution (Paper 10), 19-20

Claim 1

window as a function of progress. Ex. 2001, ¶58. One of the novel aspects of the invention of the '832 patent stems from choosing a viewing window for each frame based on properties of nearby frames or the entire video to achieve smoother transitions from frame to frame as they are horizon-leveled. For example, the '832 patent describes the use of a “zoom curve 604” which

...

Figure 6C depicts the different zoom curves, which shows how determination of the viewing window is a *function of progress*. As can be seen, zoom curve 604 (which determines the viewing window as a function of progress) is significantly smoother than zoom curve 600 (which only determines the viewing window using rotation data). Ex. 2001, ¶59.

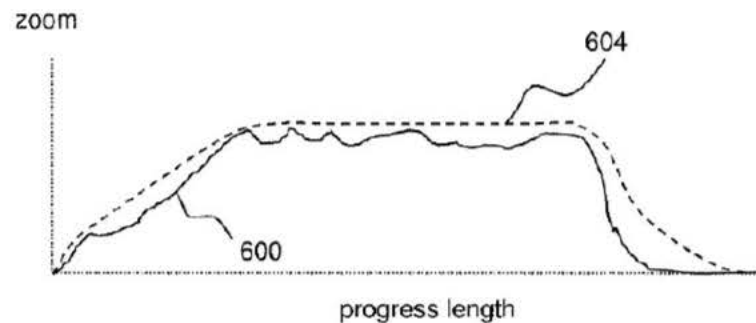


FIG. 6C

The Board rejected GoPro's narrow construction

Moreover, the specific examples do not persuasively support Patent Owner's implied claim construction. Patent Owner argues that ““zoom curve 604” which allows for rapid changes in horizon leveling to be smoothed from frame to frame” must be distinguished from “zoom curve 600 that is based only on rotation data.” Prelim. Resp. 15–16 (citing, for example, Ex. 1001, Figure 6C). Patent Owner does not, however, explain why claim 1's scope must be limited to this embodiment. Rather, as we note above, the

Decision on Institution (Paper 10), 19-20

POPR (Paper 7), 15-16

Instituted Grounds

Ground 1: Thomason and Pacurariu

Ground	35 U.S.C. §	Claims	Prior Art Reference(s)
1	103	1, 2, 7-12, 17-20	Thomason, Pacurariu
2	103	3-6, 13-16	Thomason, Pacurariu, Watanabe
3	103	1, 2, 7-12, 17-20	Voss, Derbanne
4	103	3-6, 13-16	Voss, Derbanne, Watanabe

Petition (Paper 2), 8



Thomason

Thomason Discloses Frame-by-Frame Horizon-Leveling

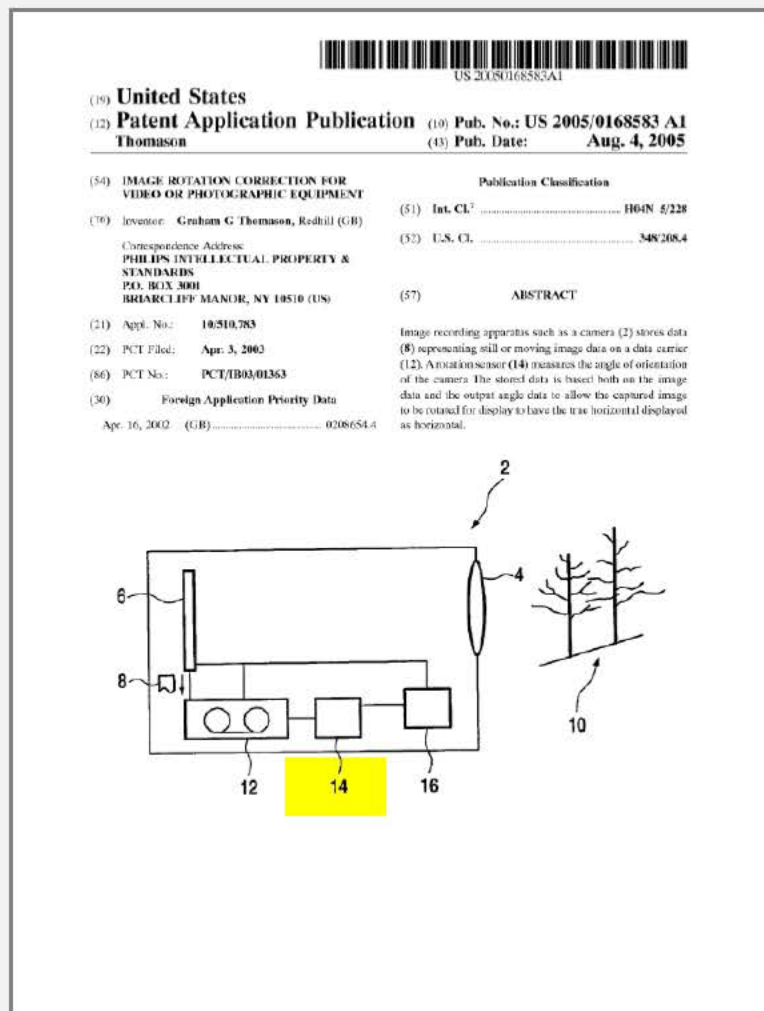


IMAGE ROTATION CORRECTION FOR VIDEO OR PHOTOGRAPHIC EQUIPMENT

[0001] The invention relates to the processing of image information, particularly in video or photographic equipment, and to apparatus for recording images such as video or photographic images.

[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.

Thomason (Ex. 1004), Title, [0001]-[0002]

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.

Thomason (Ex. 1004), [0027]

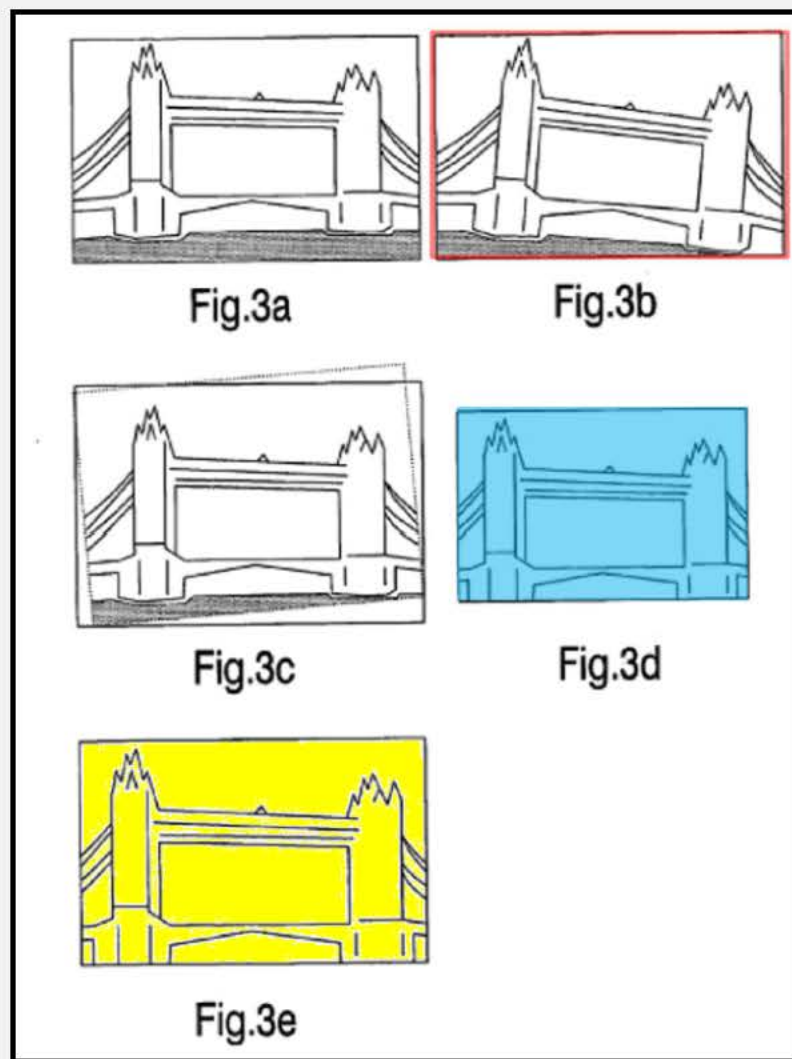
Thomason Discloses Frame-by-Frame Horizon-Leveling

[0034] FIG. 3 illustrates the use of the system. FIG. 3a shows the image that the user should have taken i.e. with the camera horizontally aligned. FIG. 3b 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. 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.

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



Thomason (Ex. 1004)

Petition (Paper 2), 24-25;

Katsaggelos Dec. (Ex. 1002), ¶¶ 49-50 12

Thomason Discloses Frame-by-Frame Horizon-Leveling

POR's Mischaracterization

time orientation measurement and correction. Ex. 2021, ¶86. Indeed, Thomason describes “process[ing] the recorded image data 8 [i.e. the captured video] and *rotation angle*,” (note, singular), Ex. 1004, ¶32, indicating that the rotation angle is only captured once for the video, not multiple times across the video.

POR (Paper 25), 29-30

video = “a sequence of items of” image data



[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

Thomason (Ex. 1004)

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.

Thomason (Ex. 1004), [0027]

Thomason Discloses Hand-Held Devices and Multiple Accelerometers

POR's Mischaracterization

accelerometer. Ex. 1004, ¶29. Notably, an accelerometer can, at best, crudely infer rotation about just a single axis. Ex. 2021, ¶46. It is therefore apparent that Thomason's camera is not intended to be hand-held operated. Thomason

POR (Paper 25), 9

POR's Mischaracterization

Finally, Thomason only discloses the use of a single accelerometer for collecting rotational information. Ex. 1004, ¶29. A POSITA would

POR (Paper 25), 31

[0016] The invention also relates to a camera as set out above incorporated into a further device, including for example a mobile telephone, or computer.

Thomason (Ex. 1004)

[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.



Pacurariu

Pacurariu

Ground	35 U.S.C. §	Claims	Prior Art Reference(s)
1	103	1, 2, 7-12, 17-20	Thomason, Pacurariu
2	103	3-6, 13-16	Thomason, Pacurariu, Watanabe

Pacurariu

(19) **United States**
 (12) **Patent Application Publication** (10) Pub. No.: US 2015/0181123A1
 Pacurariu et al. (43) Pub. Date: Jun. 25, 2015

(54) **IMAGE ORIENTATION ADJUSTMENT BASED ON CAMERA ORIENTATION**
 (71) Applicant: LYVE MINDS, INC., CUPERTINO, CA (US)
 (72) Inventors: Mihnea Calin Pacurariu, Cupertino, CA (US); David Hoenig, Cupertino, CA (US); Andreas von Sneider, Cupertino, CA (US)
 (73) Assignee: LYVE MINDS, INC., CUPERTINO, CA (US)
 (21) Appl. No.: 14/135,568
 (22) Filed: Dec. 19, 2013

Publication Classification
 (51) Int. Cl. H04N 5/232 (2006.01); H04N 5/14 (2006.01)

(52) U.S. CL. CPC H04N 5/23264 (2013.01); H04N 5/14 (2006.01)

(57) **ABSTRACT**
 Systems and methods are disclosed to rotate an image recorded by an image sensor to compensate for angular rotation or tilt of the image sensor. For example, a camera can include an image sensor having a plurality of pixels arranged in an array, an accelerometer, a memory, and a processing unit. The processing unit can be configured to read a first plurality of pixels corresponding to an imaging area of the image sensor. The processing unit can also be configured to receive an acceleration value from the accelerometer, and determine a tilt angle value from the acceleration value that represents at least in part the tilt of the image sensor relative to the Earth's gravitational field or the horizon. The processing unit may also be configured to rotate at least a subset of the first plurality of image pixels of the image sensor based on the tilt angle value.

Systems and methods are disclosed to rotate an image recorded by an image sensor to compensate for angular rotation or tilt of the image sensor. For example, a camera can

Pacurariu (Ex. 1005), Abstract

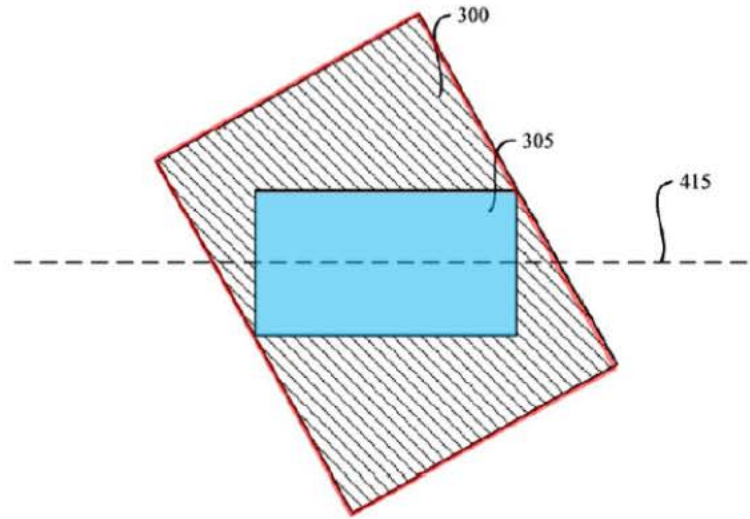
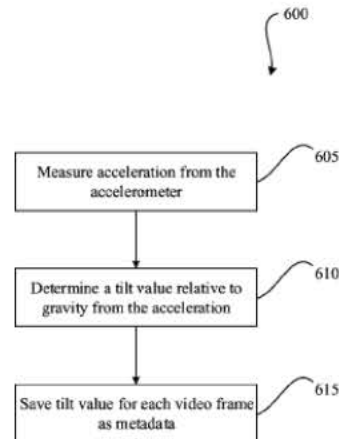


Figure 5A

Pacurariu (Ex. 1005)

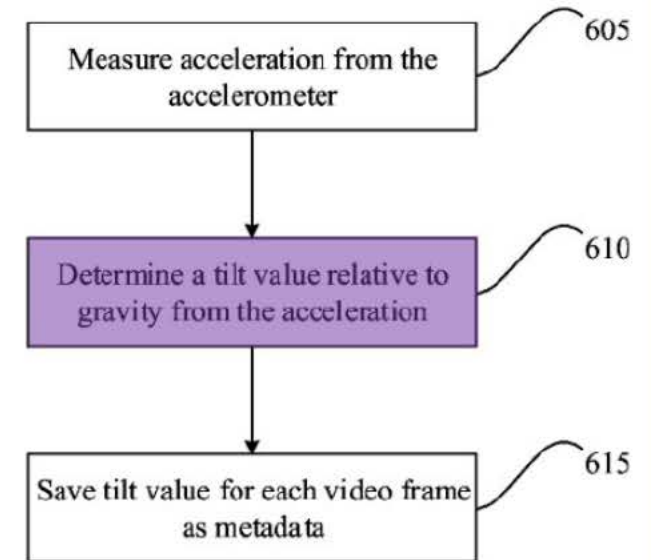
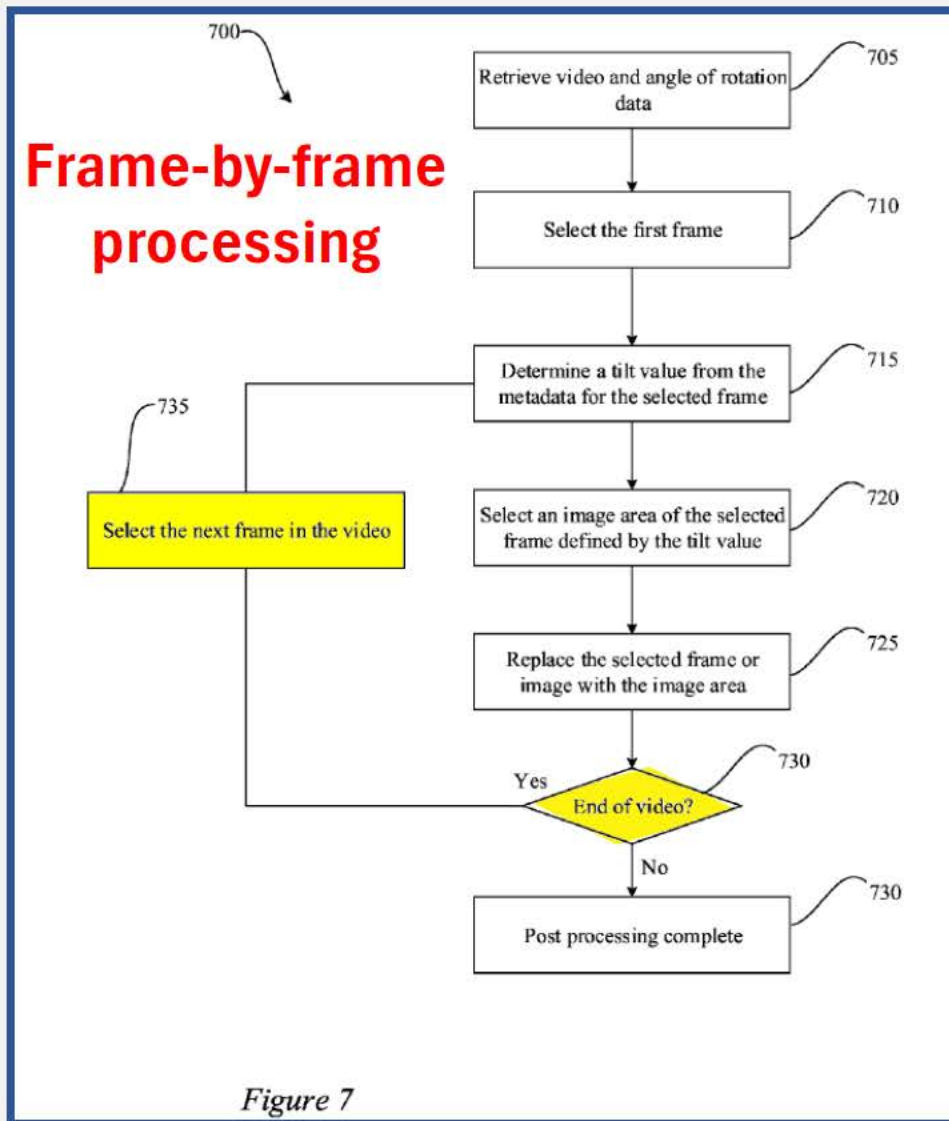


FIG. 6

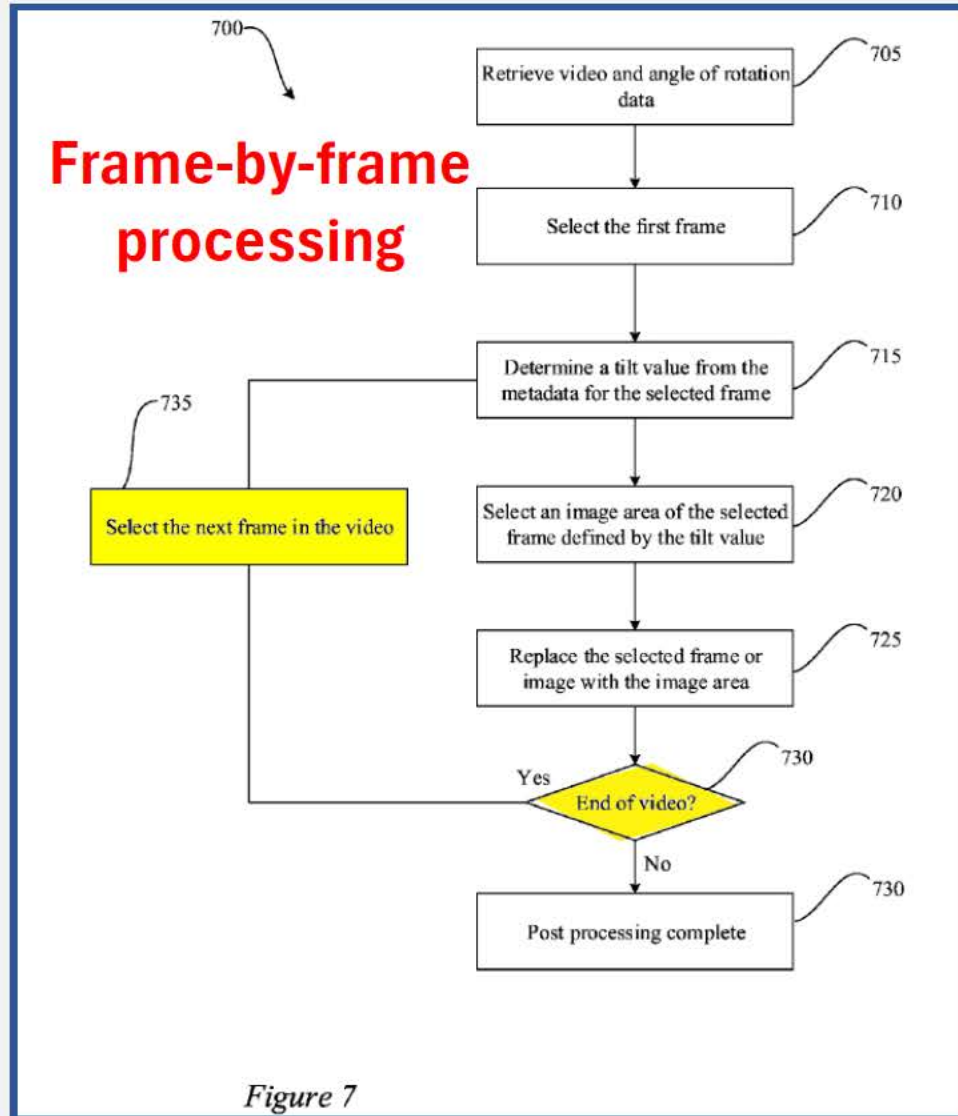
Pacurariu (Ex. 1005)

Pacurariu



Pacurariu (Ex. 1005)

Pacurariu



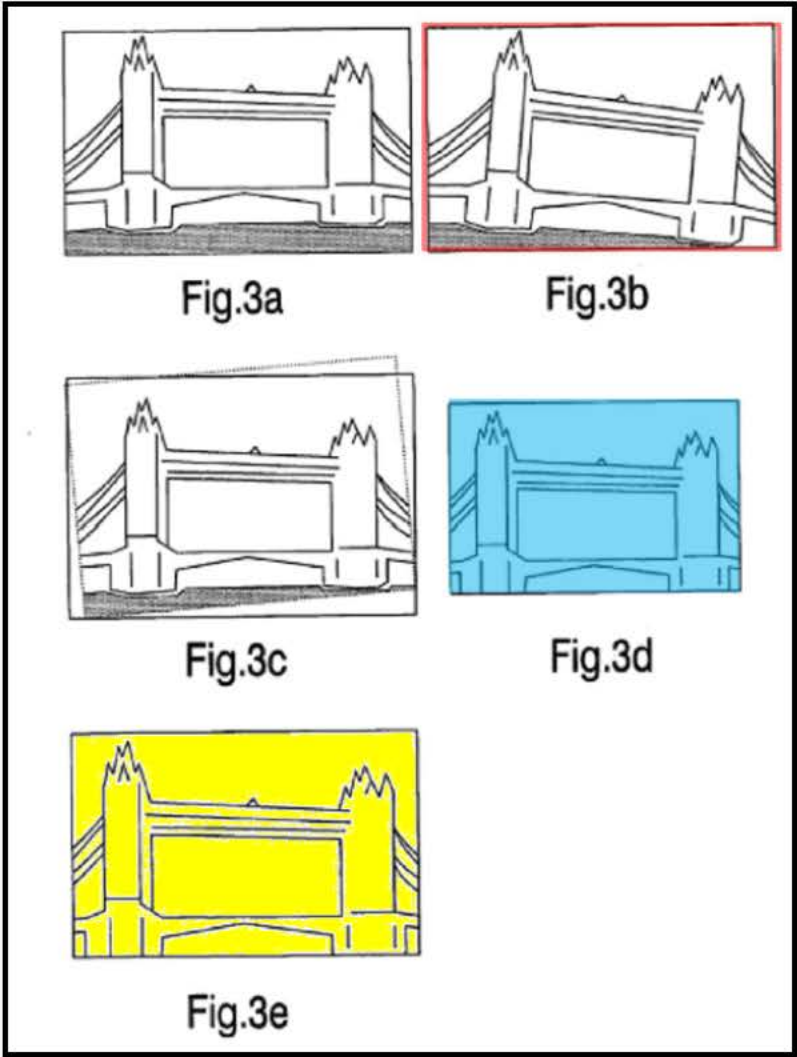
Thomason-Pacurariu Combination

The Thomason-Pacurariu combination results in a system in which rotational position information, such as a tilt value as taught by Pacurariu, may be obtained for each video frame in Thomason's video content, be saved as metadata or as part of each video frame as taught by Pacurariu, and be used to generate a rotated image for each video frame in Thomason's video content. (EX1005, [0052], [0055]-[0057], FIGS. 6-7; EX1002, ¶81.) Further, the Thomason-Pacurariu system

Petition (Paper 2), 23

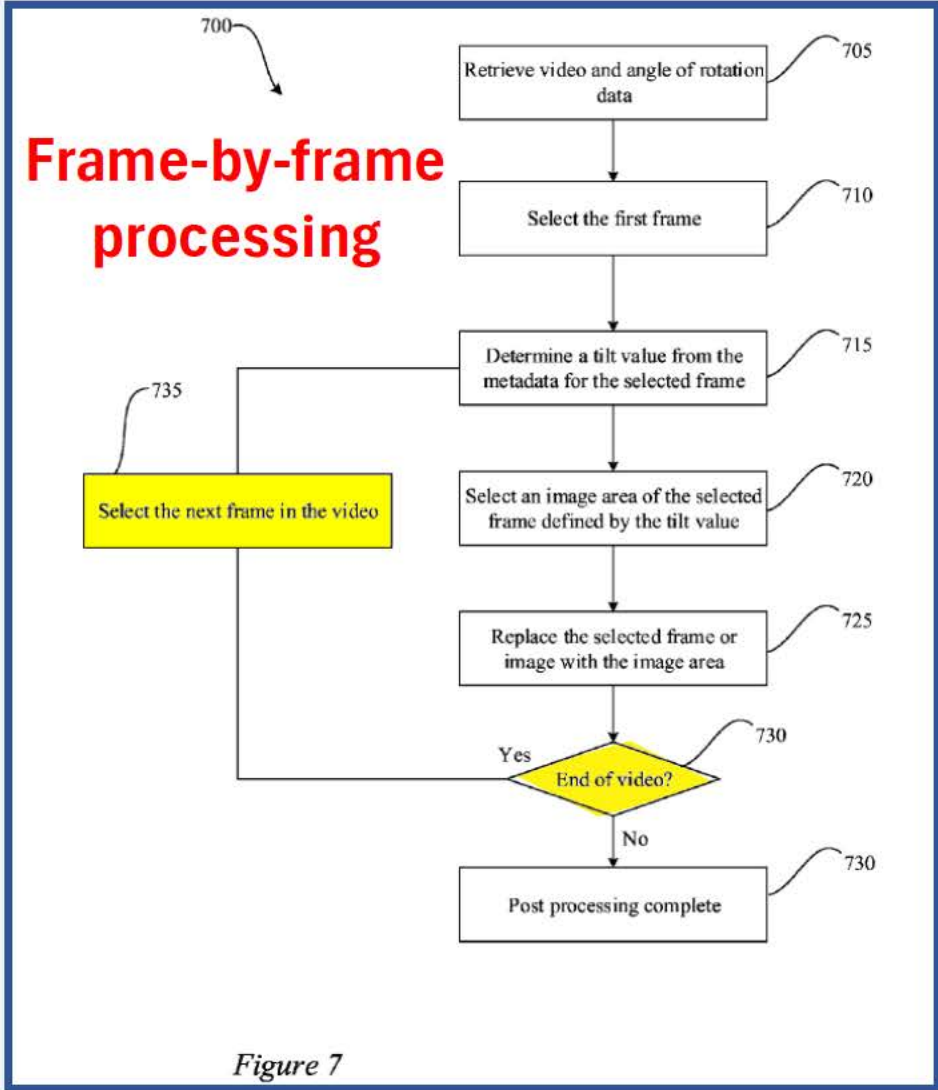
Pacurariu (Ex. 1005)

Claim 1



Thomason (Ex. 1004), FIG. 3

+



Pacurariu (Ex. 1005), FIG. 7

Claim 1

Rationale to Combine

29, 35; Ex. 1005 ¶¶ 26, 41, 46, 51–52, 55–57, Figs. 6–7. Pecurariu and Thomason are in the same field of endeavor, and we agree with Petitioner on this record, that a person having ordinary skill in the art would have understood that Pecurariu’s teachings would have predictably improved Thomason.

Decision on Institution (Paper 10), 34

POR’s Mischaracterization

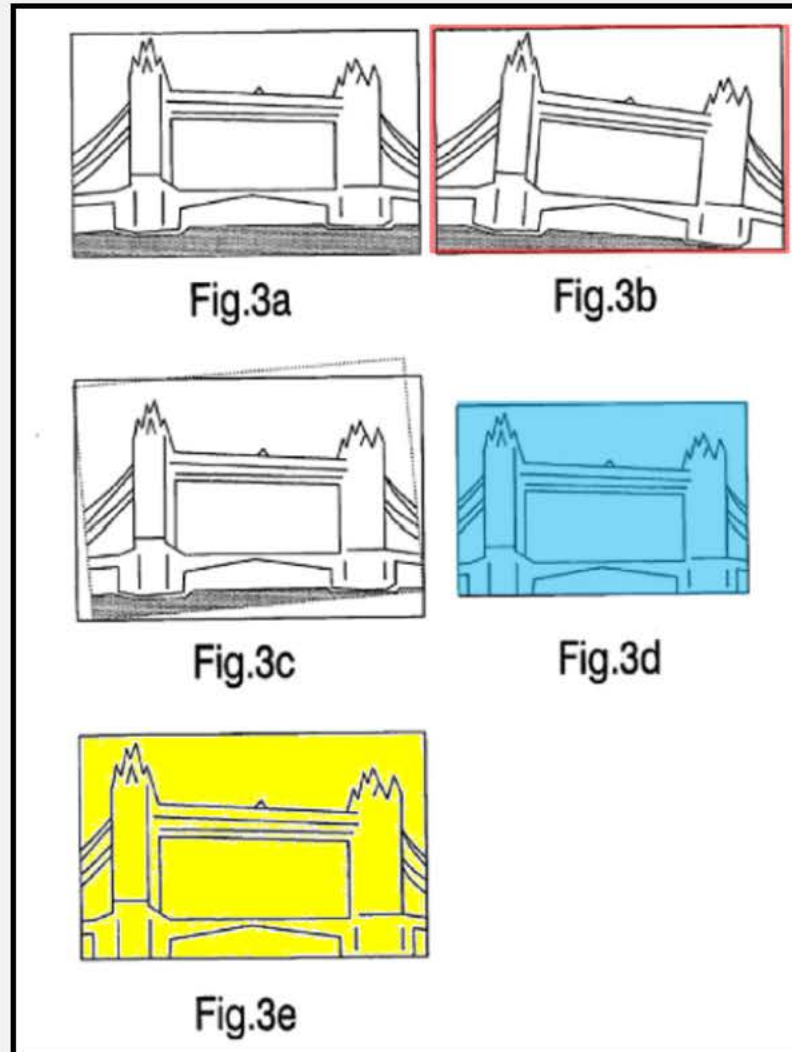
Yet Thomason’s accelerometer-only camera is simply not capable of generating a rotated image for each video frame. Ex. 2021, ¶116. In

POR (Paper 25), 44

[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 infor-

Claims 7/17: “Determination of a Size”



Thomason (Ex. 1004), FIG. 3

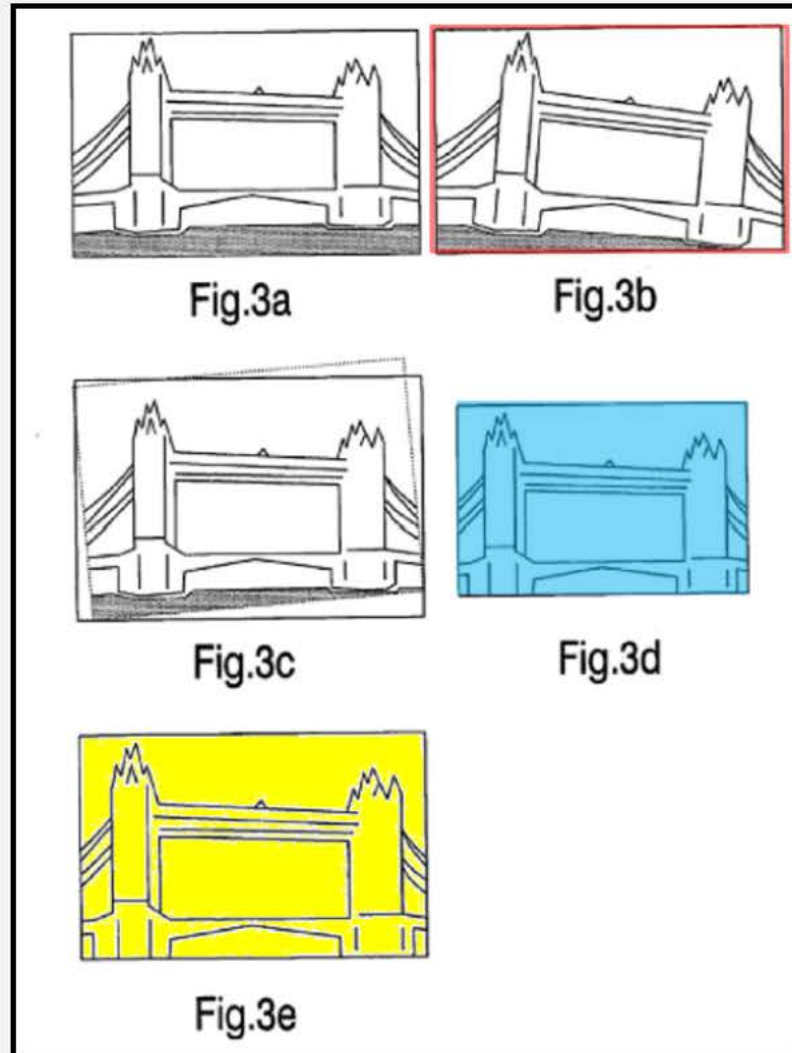
[0034] FIG. 3 illustrates the use of the system. FIG. 3a shows the image that the user should have taken i.e. with the camera horizontally aligned. FIG. 3b shows the image taken with a camera angle at an angle of about 10° to the vertical. The true horizontal in the image is thus also at an angle of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

[0035] The image as shown in FIG. 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.

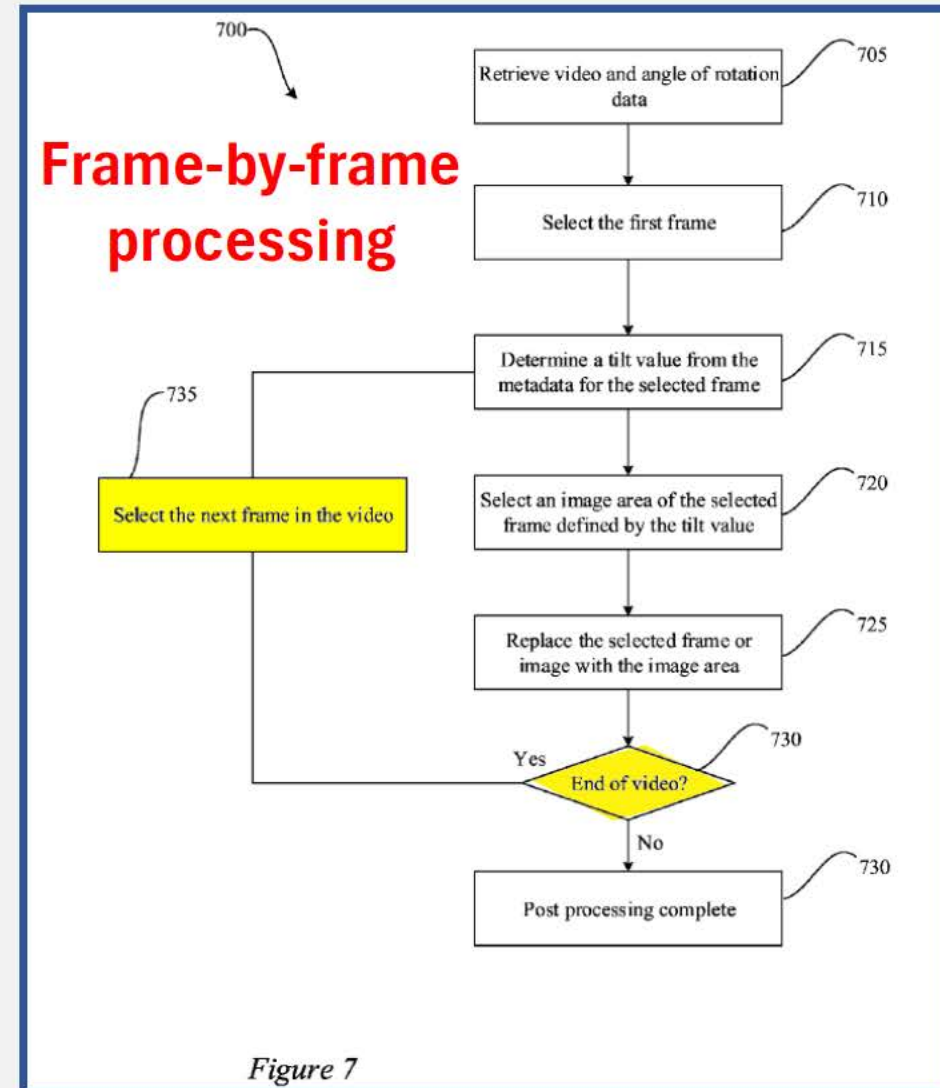
[0037] As illustrated in FIG. 3e, the corrected image 42 is resized so that the final image frame 44 is the same size as original image frame 40.

Claims 7/17: “Determination of a Size”



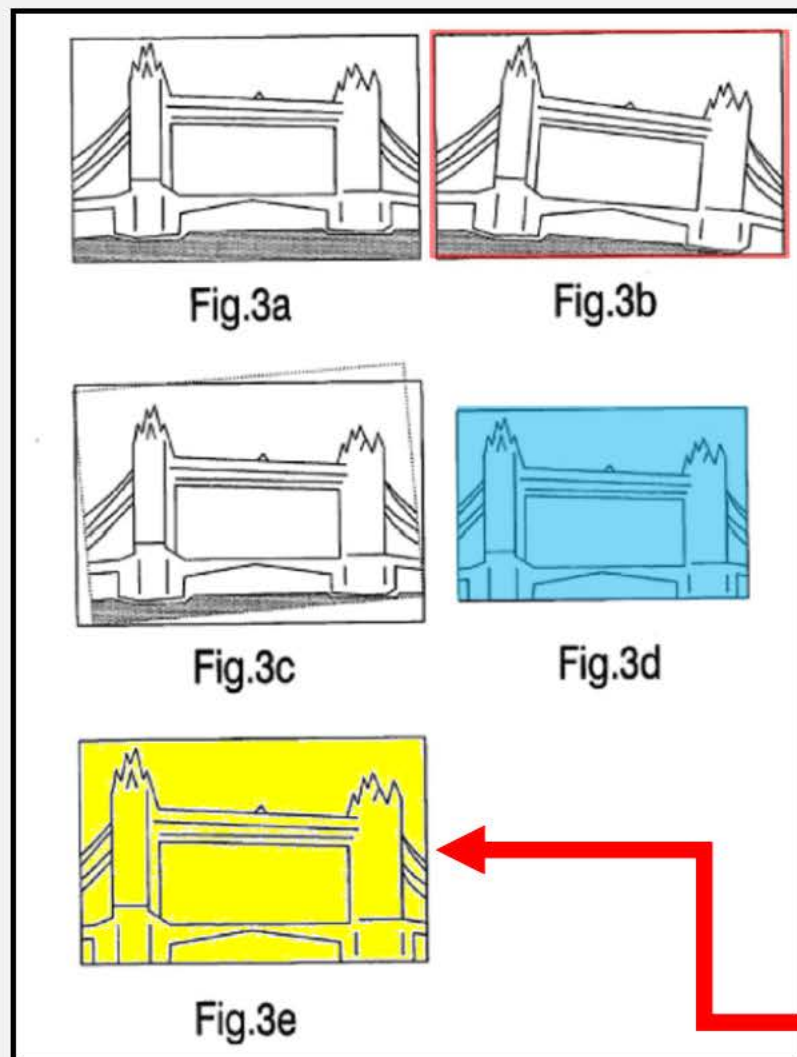
Thomason (Ex. 1004), FIG. 3

+



Pacurariu (Ex. 1005), FIG. 7

Claims 8/18: “the Size of the Viewing Window Changes . . . to Simulate Changes in Zoom”



Thomason (Ex. 1004)

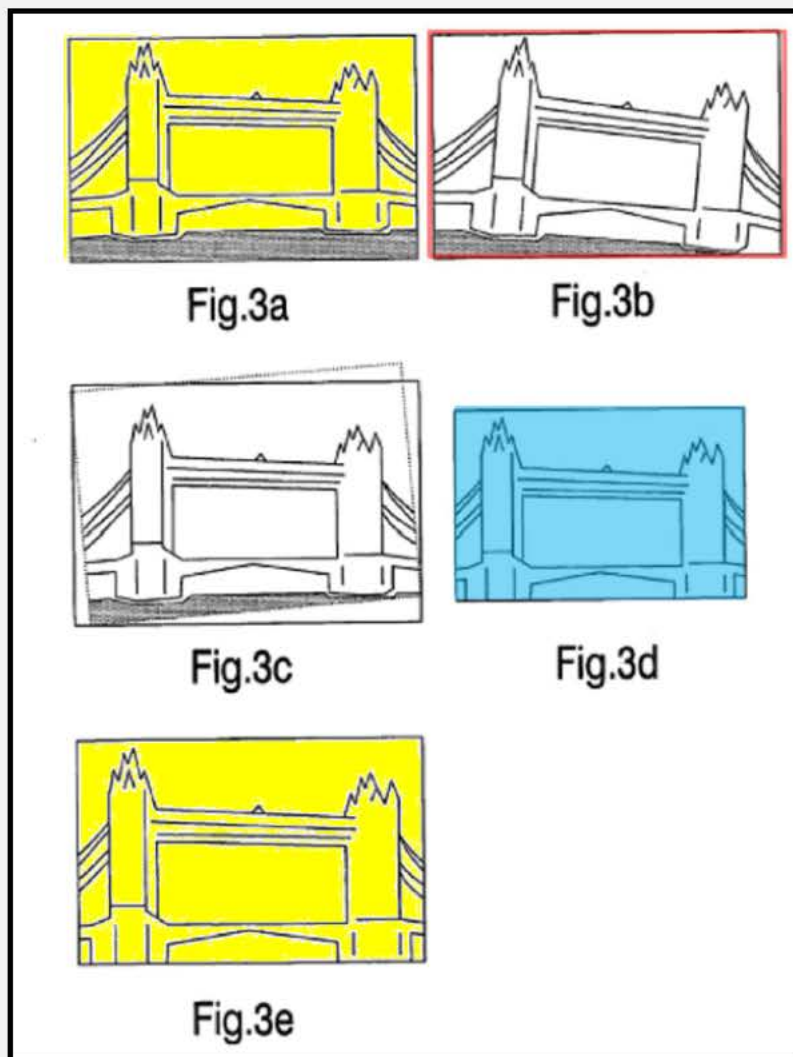
[0034] FIG. 3 illustrates the use of the system. FIG. 3a shows the image that the user should have taken i.e. with the camera horizontally aligned. FIG. 3b shows the image taken with a camera angle at an angle of about 10° to the vertical. The true horizontal in the image is thus also at an angle of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

[0035] The image as shown in FIG. 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.

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

Claims 8/18: “the Size of the Viewing Window Changes . . . to Simulate Changes in Zoom”



Thomason (Ex. 1004), FIG. 3

Declaration by Dr. Katsaggelos

as original image frame 40.” (EX1004, [0037].) Comparing to FIG. 3a (“the image that the user should have taken i.e., [.] with the camera horizontally aligned”), the scene in FIG. 3e appears more zoomed-in because the objects appear larger. (EX1004, [0034].) In other words, if the camera is tilted, the scene in the viewing window (e.g., FIGS. 3d and 3e) would appear to be more zoomed-in than if the camera is not tilted (e.g., FIG. 3a). Thus, the changing size of the viewing window (i.e., FIG. 3d) can simulate changes in zoom for the visual content.

Katsaggelos Dec. (Ex. 1002), ¶124

GoPro's Improper Interpretation of "Simulate"

POR's Narrow Interpretation

This understanding is supported by the '832 patent specification, which teaches that merely resizing the viewing window without regard to zoom "may result in pronounced (e.g., rapid, jittery) changes in zoom/viewing window size within the horizon-leveled visual content." Ex. 1001, 18:32-37; *see also id.* Fig. 6A. To alleviate this problem, the '832 patent explains that "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." *Id.*, 19:38-42. The artificial (*i.e. simulated*) zooming can be implemented using a "smoothed zoom curve 604," such as depicted in Figure 6C, which "allow[s] for rapid changes in zoom to be replaced with

'832 Patent's Broad Disclosure

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.

'832 Patent (Ex. 1001), 19:12-15

POR (Paper 25), 33-34

GoPro's Improper Interpretation of "Simulate"

POR's Narrow Interpretation

This understanding is supported by the '832 patent specification, which teaches that merely resizing the viewing window without regard to zoom "may result in pronounced (e.g., rapid, jittery) changes in zoom/viewing window size within the horizon-leveled visual content." Ex. 1001, 18:32-37; *see also id.* Fig. 6A. To alleviate this problem, the '832 patent explains that "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." *Id.*, 19:38-42. The artificial (*i.e. simulated*) zooming can be implemented using a "smoothed zoom curve 604," such as depicted in Figure 6C, which "allow[s] for rapid changes in zoom to be replaced with

Sur-Reply's Shifting Position

Petitioner argues that GoPro seeks to limit the claims to "implementing a 'smoothed zoom curve.'" Reply, 14. Not so. Although "[t]he artificial (*i.e.*, simulated) zooming can be implemented using a 'smoothed zoom curve 604'" (POR, 34), PO is not asserting that the claims are limited to the specific smoothed zoom curve embodiment. Any one of the various "artificial" zoom effects described by the Patent would satisfy claim 8.⁴ EX1001, 19:55-20:7

Sur-Reply (Paper 39), 8

POR (Paper 25), 33-34

GoPro's Improper Interpretation of "Simulate"

'832 Patent – Only Instances of “Artificial”

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);
Kyle 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. 62/894,549, filed on Aug. 30, 2019.

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

(52) U.S. Cl. (2006.01)
CPC **H04N 5/23299** (2013.08); **G06T 3/40** (2013.01); **G06T 5/006** (2013.01); **H04N 5/23255** (2018.08); **H04N 5/23295** (2018.08); **H04N 5/23295** (2018.08)

(58) **Field of Classification Search**
CPC **G06T 3/40**; **G06T 3/40**; **G06T 5/006**; **H04N 5/23218**; **H04N 5/23254**; **H04N 5/2327**; **H04N 5/23299**; **H04N 5/23295**; **H04N 5/23295**; **H04N 5/23295**

See application file for complete search history.

20 Claims, 9 Drawing Sheets

METHOD 200

```

graph TD
    201[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[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.]
    202 --> 203[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 the function of progress through the capture duration.]
    203 --> 204[204 Generate horizon-leveled visual content based on the viewing window.]
  
```

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.

'832 Patent (Ex. 1001), 19:27-42

POR (Paper 25), 33-34; Reply (Paper 32), 4; Katsaggelos Reply Dec. (Ex. 1019), ¶¶ 21-24

DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

“Simulate” Does Not Require a Zoom Curve

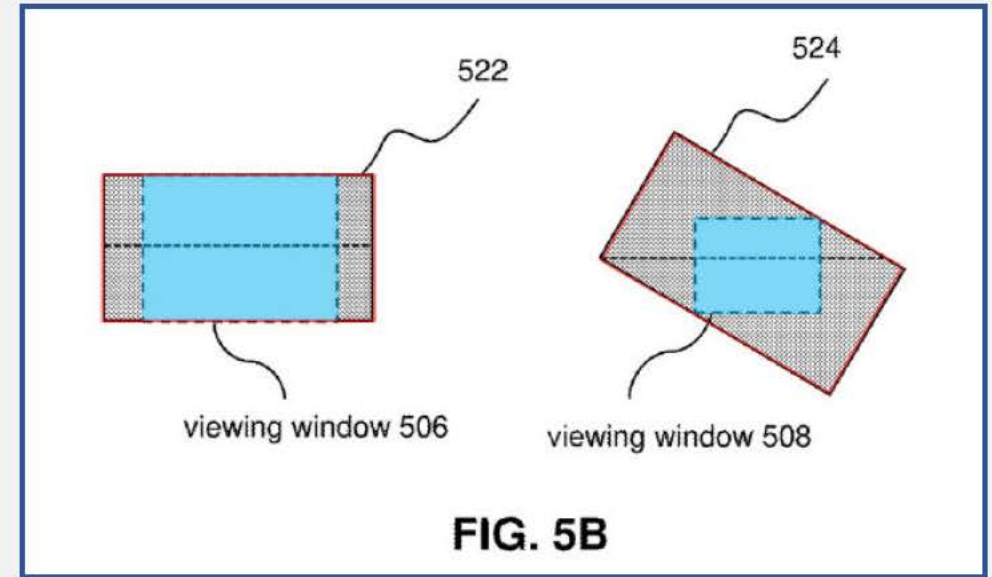
'832 Patent

image capture device may take time. For example, when a user wishes to zoom-in and/or zoom-out, the user may need to locate the corresponding zoom button/switch/dial and engage the zoom button/switch/dial to change the zoom level.

Rather than requiring such interaction by the user with the image capture device, the zoom level of the image capture device may be changed based on rotation of the image capture device. For example, the zoom-level of the image capture device. ...

video frames). The capture of the video may start with the image capture device leveled to capture the image 522 (initial video frame). During the capture of the video, the image capture device may be rotated to capture the image 524 (subsequent video frame). The rotation of the image capture device from being leveled to being tilted may cause the zoom level of the image capture device to be increased

'832 Patent (Ex. 1001), 12:3-11, 12:34-40



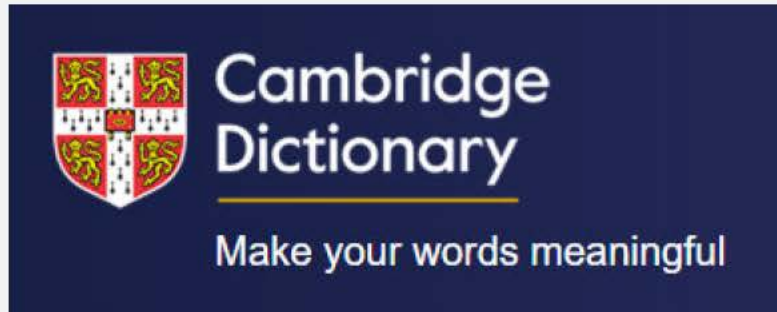
'832 Patent (Ex. 1001), FIG. 5B

content. The viewing size may be increased to simulate decrease in zoom of the visual content. The viewing size may be decreased to simulate increase in zoom of the visual content.

'832 Patent (Ex. 1001), 15:45-48

Reply (Paper 32), 4; Katsaggelos Reply Dec. (Ex. 1019), ¶¶ 21-24

“Simulate” Does Not Require a Zoom Curve



simulate

verb [T]

UK ☐ /'sim.jə.leɪt/ US ☐ /'sim.jə.leɪt/

Add to word list ☐

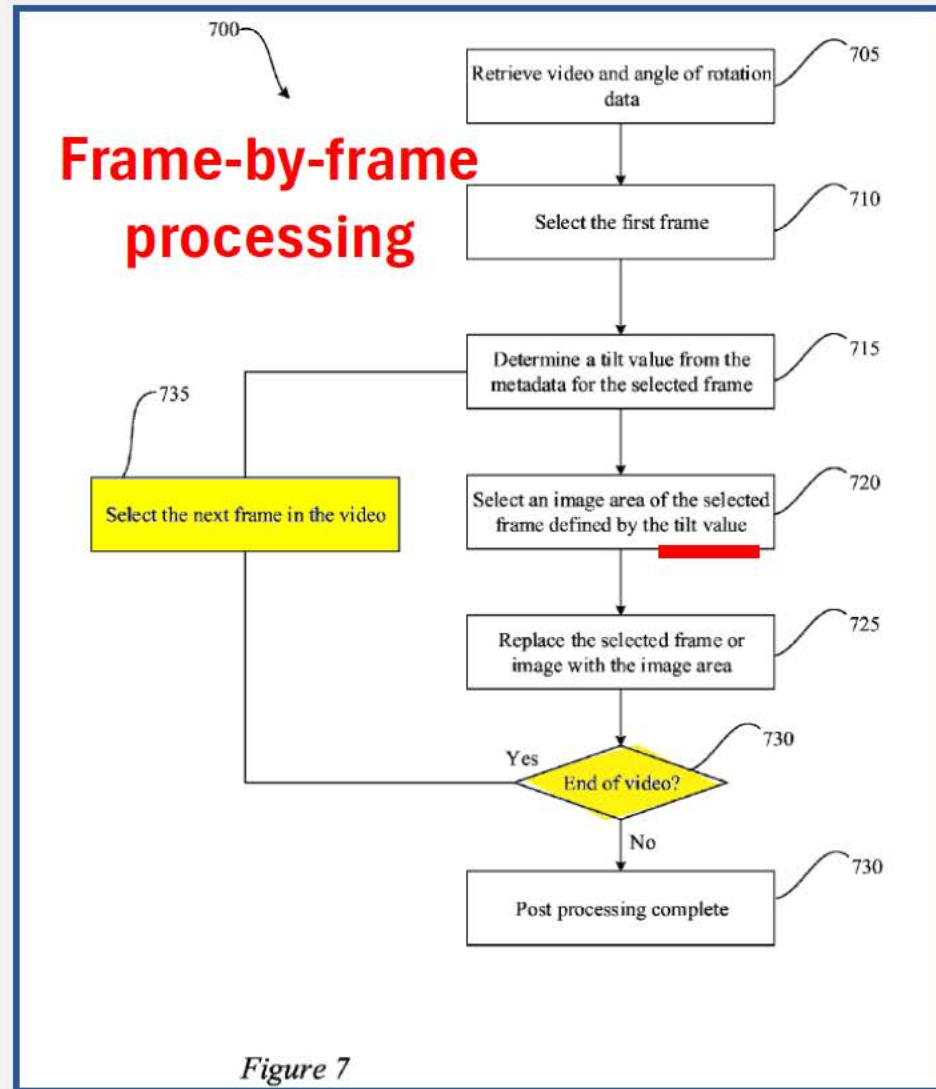
to do or make something that **looks real** but is not **real**:

- In **cheap furniture**, **plastic** is often used to **simulate wood**.

Cambridge Dictionary (Ex. 1020); Reply (Paper 32), 4

Reply (Paper 32), 4; Katsaggelos Reply Dec. (Ex. 1019), ¶¶ 21-24

Claims 8/18: “the Size of the Viewing Window Changes . . . to Simulate Changes in Zoom”



angle data of all the frames for the video. 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.

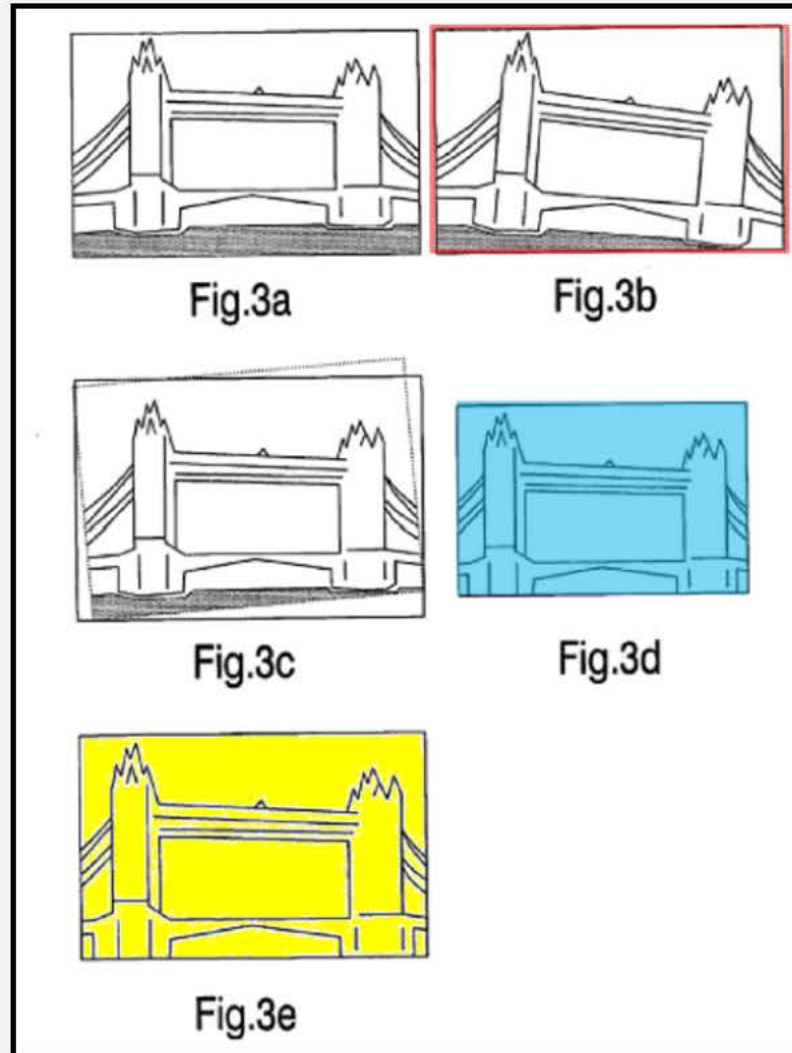
Pacurariu (Ex. 1005), [0059]

Pacurariu (Ex. 1005), FIG. 7

Claims 10 and 20: “Determination of a Location”

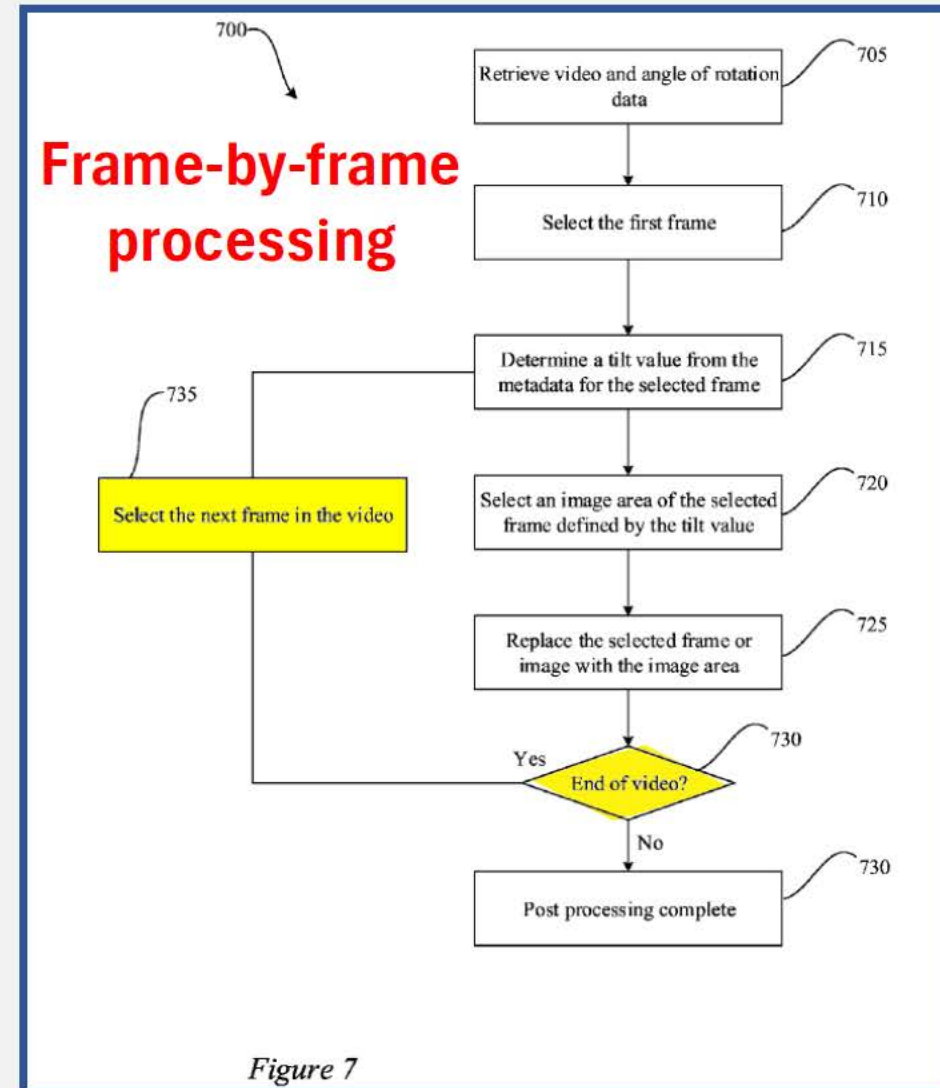
10. The system of claim 1, wherein the determination of the placement of the viewing window within the field of view of the visual content includes determination of a location of the viewing window within the field of view of the visual content, the **location of the viewing window** within the field of view of the visual content determining framing of the visual content.

Claims 10 and 20: “Determination of a Location”



Thomason (Ex. 1004), FIG. 3

+



Pacurariu (Ex. 1005), FIG. 7

Claims 10 and 20: “Determination of a Location”

Claim Term	Patent Owner’s Narrow Interpretation
“Determination of a location”	The plain meaning of the “location of the viewing window” refers to the x-y coordinate at which the viewing window is placed. Ex. 2021, ¶98. + window to frame a certain element within the image, the center of the viewing window must correspond with the center of the element of interest, as the + However, the claim requires a process that allows for change. POR, 35-36.

Reply (Paper 32), 5-7

*POR (Paper 25), 36-37
Sur-Reply (Paper 39), 10*

“Location of the Viewing Window” Is Not Limited to a Point

(12) United States Patent
Stimm et al.

(10) Patent
(45) Date

(54) SYSTEMS AND METHODS FOR HORIZON
LEVELING VIDEOS

(56)

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

2004/0257384

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

2015/0215532

2015/0254871

2016/0080287

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

2016/0280977

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

2017/0116458

2017/0142237

2018/0160194

2019/0189160

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

(22) Filed: Aug. 28, 2020

Related U.S. Application Data

(60) Provisional application No. 62/894,549, filed on Aug.
30, 2019.

Video Retrieval
from Azure Cloud (Year: 2019)

* cited by examiner

(51) Int. Cl.

H04N 5/232

H04N 5/225

G06T 3/40

G06T 5/00

(52) U.S. Cl.

CPC

H04N 5/23299 (2013.08); G06T 3/40

(2013.01); G06T 5/006 (2013.01); H04N

5/22525 (2013.08); H04N 5/22905 (2013.08);

H04N 5/23295 (2013.08)

(58) Field of Classification Search

CPC

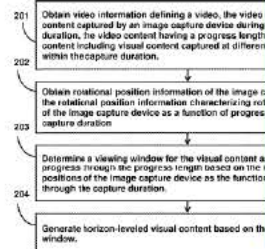
G06T 7/30; G06T 3/40; G06T 5/006; H04N

5/23218; H04N 5/23254; H04N 5/2327;

H04N 5/23299; H04N 5/22525; H04N

5/23295; H04N 5/23295

See application file for complete search history.



visual content. The extent of the visual content defined by the viewing window may define how the portion of the visual content within the viewing window is framed for inclusion in the horizon-leveled visual content.

'832 Patent (Ex. 1001), 20:19-22

in horizon-leveled visual content) and/or to modify use of the image capture device to capture visual content by using the viewing window representation as a guide (e.g., using the outline of the viewing window overlaid over preview of the visual content being captured to frame horizon-leveled visual content).

'832 Patent (Ex. 1001), 24:53-58

“Location of the Viewing Window” Is Not Limited to “Content Detection” or “Panning”

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. 62/894,549**, 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 5/2525 (2018.08); H04N 5/2295 (2018.08); H04N 5/23295 (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 5/23295; H04N 5/23295

See application file for complete search history.

20 Claims, 9 Drawing Sheets

METHOD 200

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-leveled visual content based on the viewing window.

For example, one or more of location, shape, size, and/or other characteristics of the viewing window may be determined based on content detection and/or other information. Content detection may include detection of one or more things (e.g., persons, faces, objects, environment, emotion, activity, action) depicted within the visual content. One or more of location, shape, size, and/or other characteristics of the viewing window may be determined based on the content detection so that the horizon-leveled visual content includes portions of the visual content framed based on one or more things depicted within the visual content. For

...

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

'832 Patent (Ex. 1001), 20:23-54

GoPro's Inconsistent Positions

POR

of the location. Ex. 2021, ¶97. The viewing window cannot have the same location throughout the video.

POR (Paper 25), 36



Sur-reply

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.

Sur-Reply (Paper 39), 10

“Location of the Viewing Window” Needs Not Change

Dr. Foroosh conceded claims do not require change of location

1 UNITED STATES PATENT AND TRADEMARK OFFICE
2 -----
3 BEFORE THE PATENT TRIAL AND APPEAL BOARD
4 -----
5 ARASHI VISION (U.S.) LLC (D/B/A INSTA360)
6 Petitioner,
7 vs.
8 GOPRO, INC.,
9 Patent Owner.
10 Patent No. 11,336,832
11 -----
12 Inter Partes Review No. IPR2024-01052
13 -----
14 LOCATION: Veritext Orlando
15 800 North Magnolia Avenue
16 Suite 400
17 Orlando, Florida 32803
18 DATE: July 1, 2025
19 TIME: 10:00 a.m. - 3:45 p.m.
20
21 DEPOSITION OF DR. HASSAN FOROOSH
22
23 Taken before Julie Giordano, Florida
24 Professional Reporter, Notary Public in and for the
25 State of Florida at Large, pursuant to Notice of
Taking Deposition filed in the above case.

Page 1

Veritext Legal Solutions
Calendar-CA@veritext.com 866-299-5127

Q. So if the location of the viewing window does not change over time, it does not meet the claim language, correct?

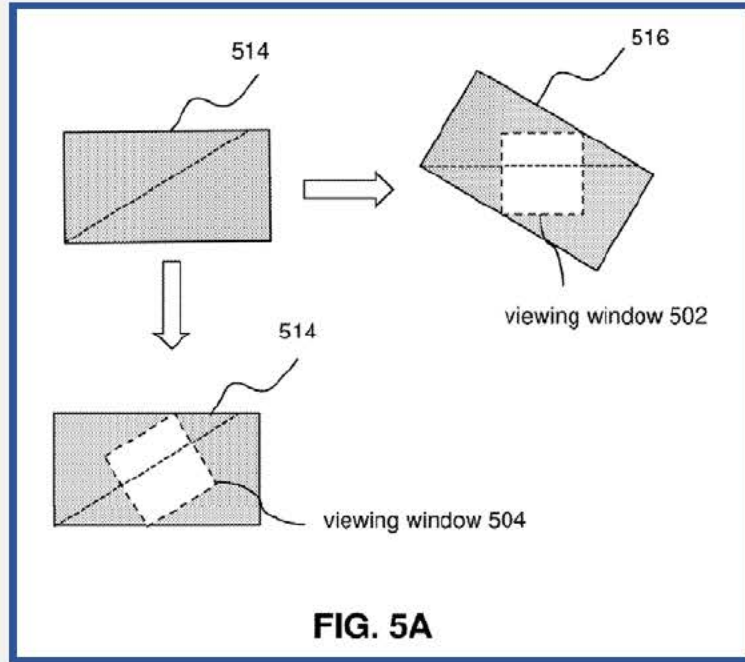
A. No. I disagree with that also because it doesn't mean that either way -- it meets both of them. So, the claim language is -- you know, **Claim 10, in a sense, is broader. It meets both cases. You know, whether it changes or not, it meets it.**

Foroosh Depo Trans. (Ex. 1018), 78:15-79:1

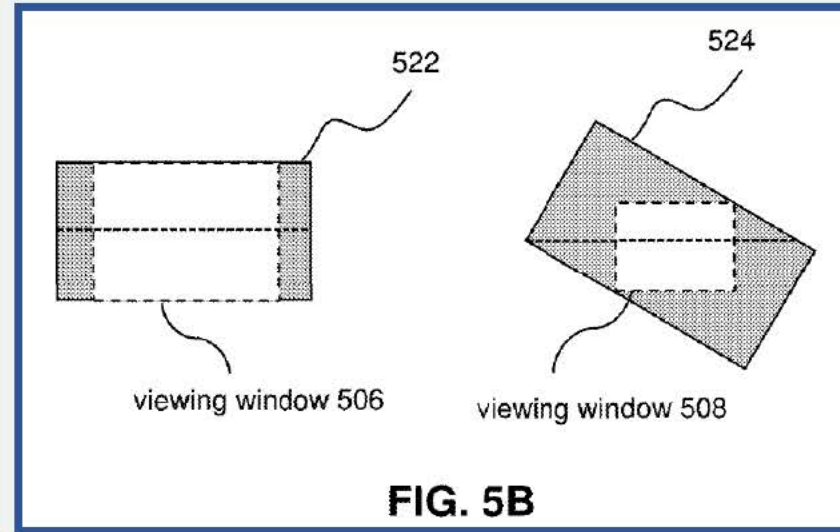
The '832 Patent Discloses “Viewing Windows” with Centered Locations

view of the visual content. The placement of the viewing window may be determined by one or more of rotation, location, shape, size, and/or other characteristics of the viewing window. For example, the placement of the viewing window may be determined as described above with respect to FIGS. 5A-5C.

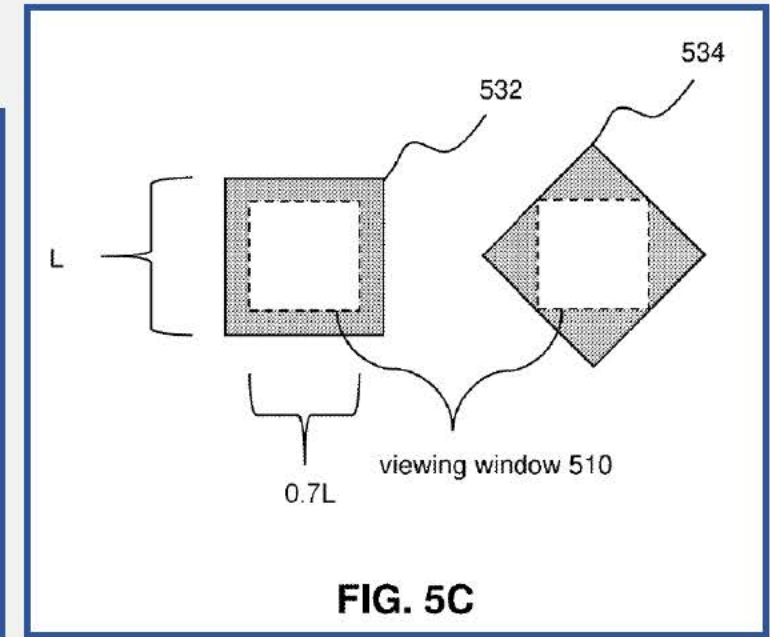
'832 Patent (Ex. 1001), 16:37-42



'832 Patent (Ex. 1001), FIG. 5A



'832 Patent (Ex. 1001), FIG. 5B



'832 Patent (Ex. 1001), FIG. 5C
Petition (Paper 2), 5; Reply (Paper 32), 5-6;
Katsaggelos Reply Dec. (Ex. 1019), ¶31 39

Ground 2: Thomason, Pacurariu, and Watanabe

Ground	35 U.S.C. §	Claims	Prior Art Reference(s)
1	103	1, 2, 7-12, 17-20	Thomason, Pacurariu
2	103	3-6, 13-16	Thomason, Pacurariu, Watanabe
3	103	1, 2, 7-12, 17-20	Voss, Derbanne
4	103	3-6, 13-16	Voss, Derbanne, Watanabe

Petition (Paper 2), 8



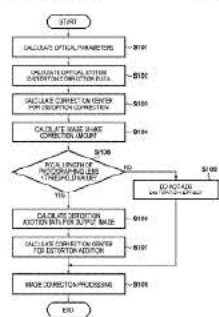
Watanabe

Watanabe



US01077889CB2

(12) United States Patent Watanabe (54) IMAGE PROCESSING APPARATUS AND IMAGE PROCESSING METHOD (71) Applicant: CANON KABUSHIKI KAISHA, Tokyo (JP) (72) Inventor: Takeshi Watanabe, Tokyo (JP) (73) Assignee: CANON KABUSHIKI KAISHA, Tokyo (JP) (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 15 days. (21) Appl. No.: 15954,247 (22) Filed: Apr. 16, 2018 (65) Prior Publication Data US 2018/0502567 A1 Oct. 18, 2018 (30) Foreign Application Priority Data Apr. 18, 2017 (JP) 2017-082252 Feb. 20, 2018 (JP) 2018-028211 (51) Int. Cl. H04N 5/228 (2006.01) H04N 5/232 (2006.01) H04N 5/357 (2011.01) G06T 5/60 (2006.01) H04N 5/217 (2011.01) (52) U.S. Cl. CPC H04N 5/23287 (2013.01); G06T 5/606 (2013.01); H04N 5/217 (2013.01); H04N 5/23258 (2013.01); H04N 5/23267 (2013.01); H04N 5/3572 (2013.01)	(10) Patent No.: US 10,778,896 B2 (45) Date of Patent: Sep. 15, 2020 (58) Field of Classification Search CPC H04N 5/23254; H04N 5/23264; H04N 5/23287; H04N 5/2254; G06T 5/606; G02B 7/09; G02B 7/14; G02B 27/646 See application file for complete search history. (56) References Cited U.S. PATENT DOCUMENTS 9,467,632 B2* 10/2016 Miyazaki H04N 5/23258 2005/0231616 A1* 10/2005 Iwai H04N 5/217 2009/0135732 A1 5/2009 Ohtsuka (Continued) FOREIGN PATENT DOCUMENTS CN 10110959 A 8/2009 CN 101461162 A 3/2010 (Continued) OTHER PUBLICATIONS Combined Search and Examination Report issued in corresponding application No. GB1906205.0 dated Sep. 27, 2018, 5 pages. (Continued) Primary Examiner — Kelly L. Janabek (74) Attorney, Agent, or Firm — Carter, DeLuca & Farrell LLP (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. 22 Claims, 10 Drawing Sheets
--	--



Description of the Related Art

It is known to perform accurate image shake correction on an image whose distortion is caused by aberration of an imaging optical system (Japanese Patent Laid-Open No. 2006-33759). In addition, it is known that image distortion caused by aberration can be classified into barrel distortion and pincushion distortion, and that barrel distortion appears more natural. Therefore, in Japanese Patent Laid-Open No. 2006-33759, barrel distortion is intentionally added to an image to which image shake correction has been applied.

Watanabe (Ex. 1006), 1:13-21

Petition (Paper 2), 52; Katsaggelos Dec. (Ex. 1002), ¶ 158

Watanabe

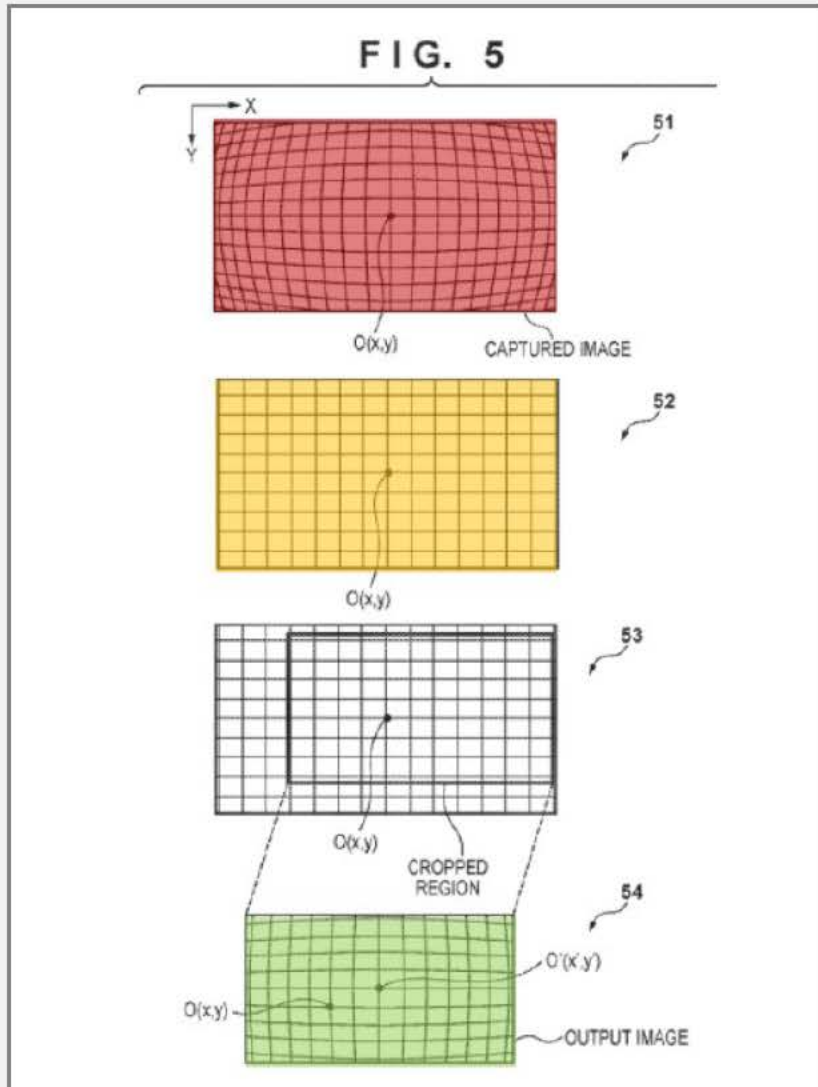
Watanabe (Ex. 1006), 11:7-9; 11:21-23; 24-27, 11:37-39

In FIG. 5, **51** schematically shows distortion of an image captured by the image sensor **103** and stored in the image memory **105**. Here, barrel distortion that is centered on

tion circuit **106**. 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** performs image shake correction on the image in **52** of FIG. 5 in which distortion has been corrected. The image shake correction circuit **107** determines a cropping region so as to eliminate image shake resulting from shake of the video camera **100**,

The distortion addition circuit **108** adds a distortion effect to the image subjected to image shake correction (**54**, FIG. 5). The image coordinates (x,y) corresponding to the inter-

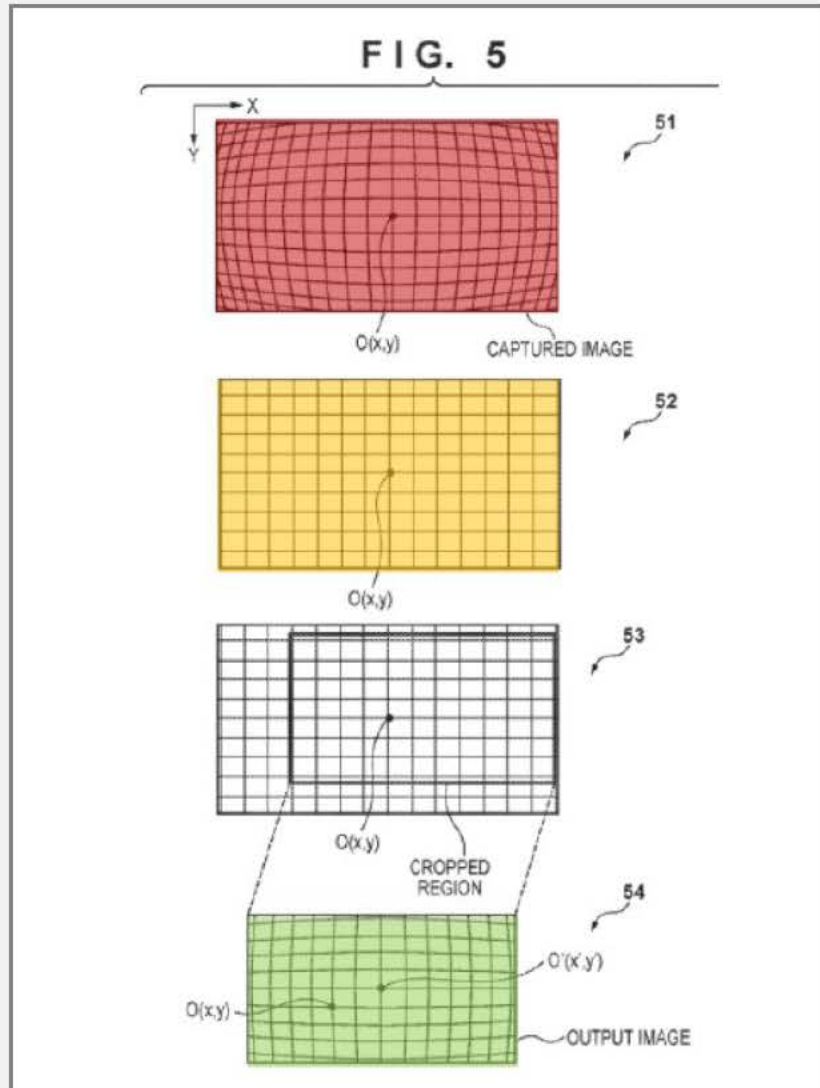


Watanabe (Ex. 1006)

Petition (Paper 2), 46-53

DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

Thomason-Pacurariu-Watanabe System



'832 Patent

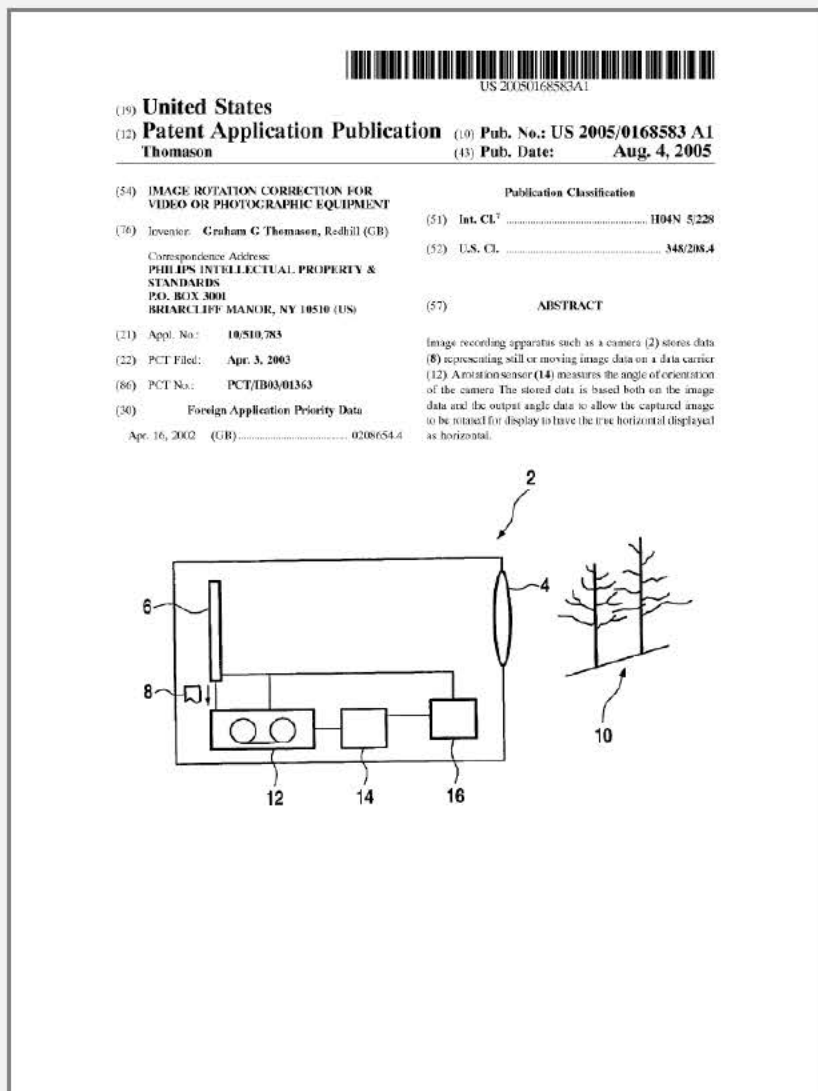
- ✓ 3. The system of claim 1, wherein the visual content includes a distortion such that a straight line within a scene depicted within the visual content appears as a curved line, the distortion of the visual content reducing impact of an off-axis horizon depicted within the horizon-leveled visual content.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

Thomason-Pacurariu Discloses Off-axis Horizon

Thomason

[0004] According to the invention, there is provided an image recording apparatus comprising: a lens; a means for capturing an image projected by the lens; 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.

Thomason (Ex. 1004), [0004]



Thomason-Pacurariu Discloses Off-axis Horizon

US 20150181123A1

(19) United States
(12) Patent Application Publication (10) Pub. No.: US 2015/0181123 A1
(43) Pub. Date: Jun. 25, 2015

(54) IMAGE ORIENTATION ADJUSTMENT BASED ON CAMERA ORIENTATION (52) U.S. CL. CPC: H04N 5/23264 (2013.01); H04N 5/14 (2013.01)

(71) Applicant: LYVE MINDS, INC., CUPERTINO, CA (US)

(72) Inventors: Mihnea Calin Pacurariu, Cupertino, CA (US); David Hoenig, Cupertino, CA (US); Andreas von Sneider, Cupertino, CA (US)

(73) Assignee: LYVE MINDS, INC., CUPERTINO, CA (US)

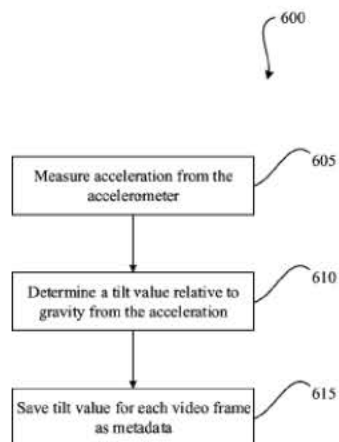
(21) Appl. No.: 14/135,568
(22) Filed: Dec. 19, 2013

Publication Classification

(51) Int. Cl. H04N 5/232 (2006.01); H04N 5/14 (2006.01)

(57) ABSTRACT

Systems and methods are disclosed to rotate an image recorded by an image sensor to compensate for angular rotation or tilt of the image sensor. For example, a camera can include an image sensor having a plurality of pixels arranged in an array, an accelerometer, a memory, and a processing unit. The processing unit can be configured to read a first plurality of pixels corresponding to an imaging area of the image sensor. The processing unit can also be configured to receive an acceleration value from the accelerometer, and determine an tilt angle value from the acceleration value that represents at least in part the tilt of the image sensor relative to the Earth's gravitational field or the horizon. The processing unit may also be configured to rotate at least a subset of the first plurality of image pixels of the image sensor based on the tilt angle value.

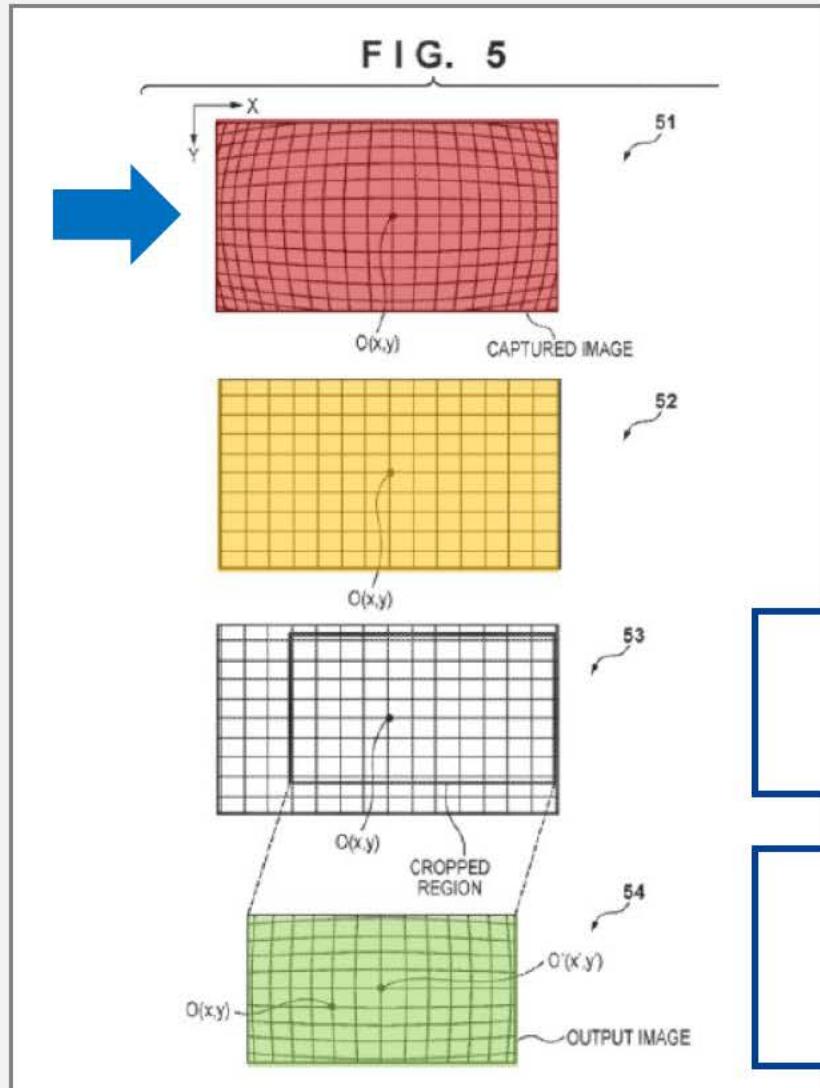


Pacurariu

angle data of all the frames for the video. 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.

Pacurariu (Ex. 1005), [0059]

The Thomason-Pacurariu-Watanabe Combo – “First Example”



Watanabe (Ex. 1006)

Petition (Paper 2), 48-52

Petition

Figure 5 (below) of Watanabe discloses two examples of visual content including distortions. First, “**51 schematically shows distortion** of an image captured by the image sensor 103 and stored in the image memory 105.”

(EX1006, 11:7-9 (emphasis added).) Further, Figure 5 depicts a process in which

Petition (Paper 2), 48

Typically, an image shot using a (super) wide-angle lens such as a **fisheye lens** is recognized to have distortion caused by aberration as one feature. In addition, when a large

lens). A wide conversion lens enables **wider angle** shooting than the photographing lens 102, but causes more intense barrel distortion. In the example of 1001 of FIG. 10, the

Watanabe (Ex. 1006), 9:33-35, 16:20-22

The Thomason-Pacurariu-Watanabe Combo – “First Example”

Dr. Foroosh conceded wide-angle lenses would introduce distortions

1 UNITED STATES PATENT AND TRADEMARK OFFICE
2 -----
3 BEFORE THE PATENT TRIAL AND APPEAL BOARD
4 -----
5 ARASHI VISION (U.S.) LLC (D/B/A INSTA360)
6 Petitioner,
7 vs.
8 GOPRO, INC.,
9 Patent Owner.
10 -----
11 Inter Partes Review No. IPR2024-01052
12 -----
13 LOCATION: Veritext Orlando
14 800 North Magnolia Avenue
15 Suite 400
16 Orlando, Florida 32803
17 DATE: July 1, 2025
18 TIME: 10:00 a.m. - 3:45 p.m.
19
20 DEPOSITION OF DR. HASSAN FOROOSH
21
22 Taken before Julie Giordano, Florida
23 Professional Reporter, Notary Public in and for the
24 State of Florida at Large, pursuant to Notice of
25 Taking Deposition filed in the above case.

Page 1

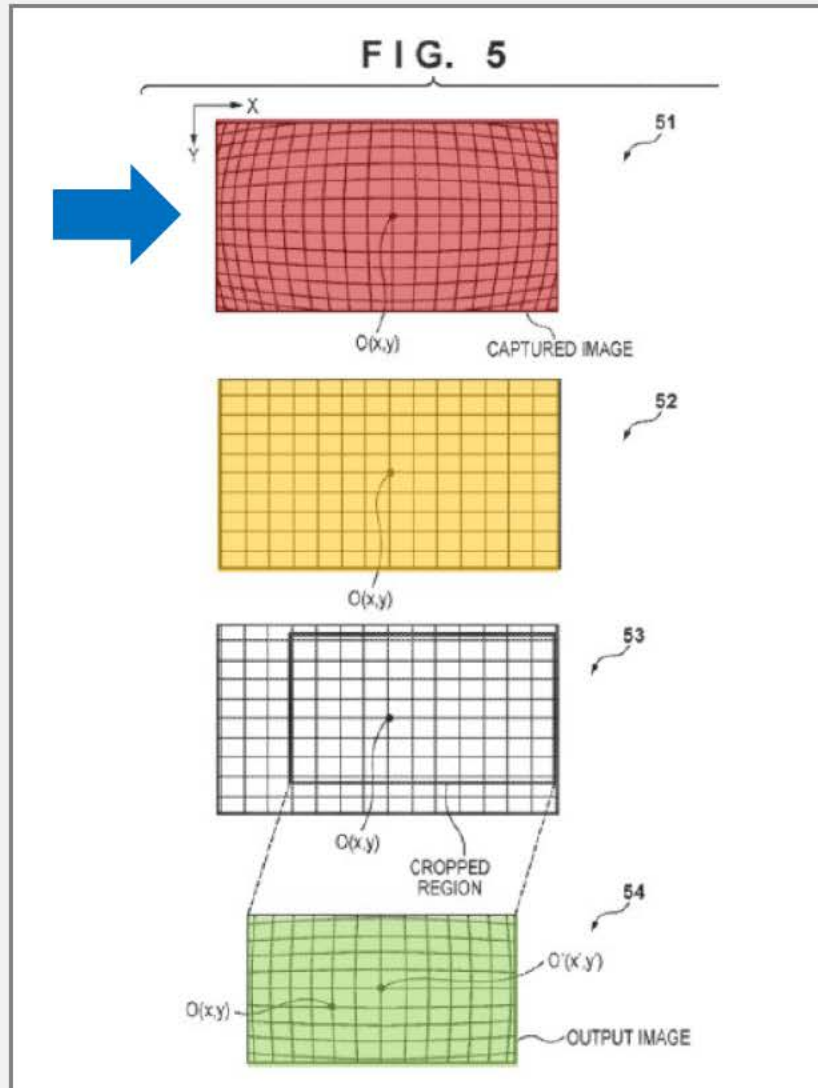
Veritext Legal Solutions
Calendar-CA@veritext.com 866-299-5127

Q. A wide angle lens would produce a distorted image or video, correct?

A. That's a general question. Yes, a wide angle camera would introduce some non-linear distortions in the output image.

Foroosh Depo Trans. (Ex. 1018), 41:11-17

Thomason-Pacurariu-Watanabe Combo – “First Example”



Watanabe (Ex. 1006)

Petition (Paper 2), 46-53

Petition

Figure 5 (below) of Watanabe discloses two examples of visual content including distortions. First, “**51 schematically shows distortion** of an image captured by the image sensor 103 and stored in the image memory 105.”

(EX1006, 11:7-9 (emphasis added).) Further, Figure 5 depicts a process in which

Petition (Paper 2), 48

’832 Patent



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.

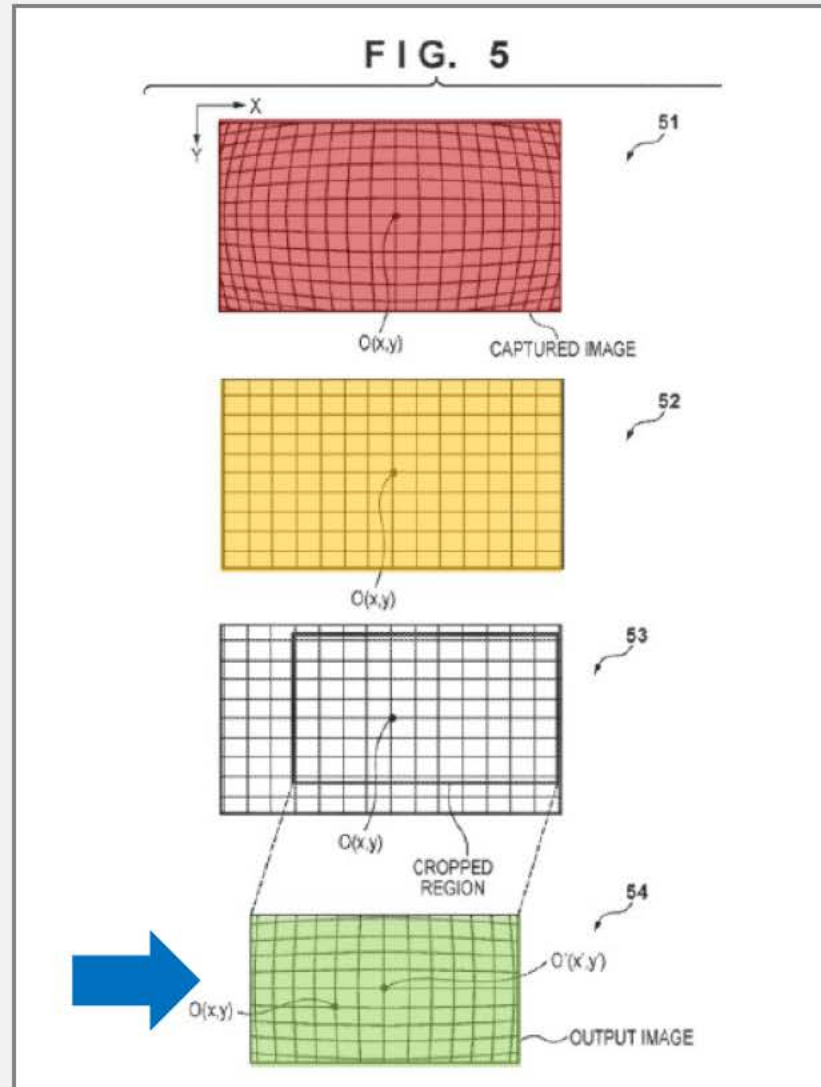


4. The system of claim 3, wherein the distortion includes a barrel distortion or a pincushion distortion.



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.

Thomason-Pacurariu-Watanabe Combo – “Second Example”

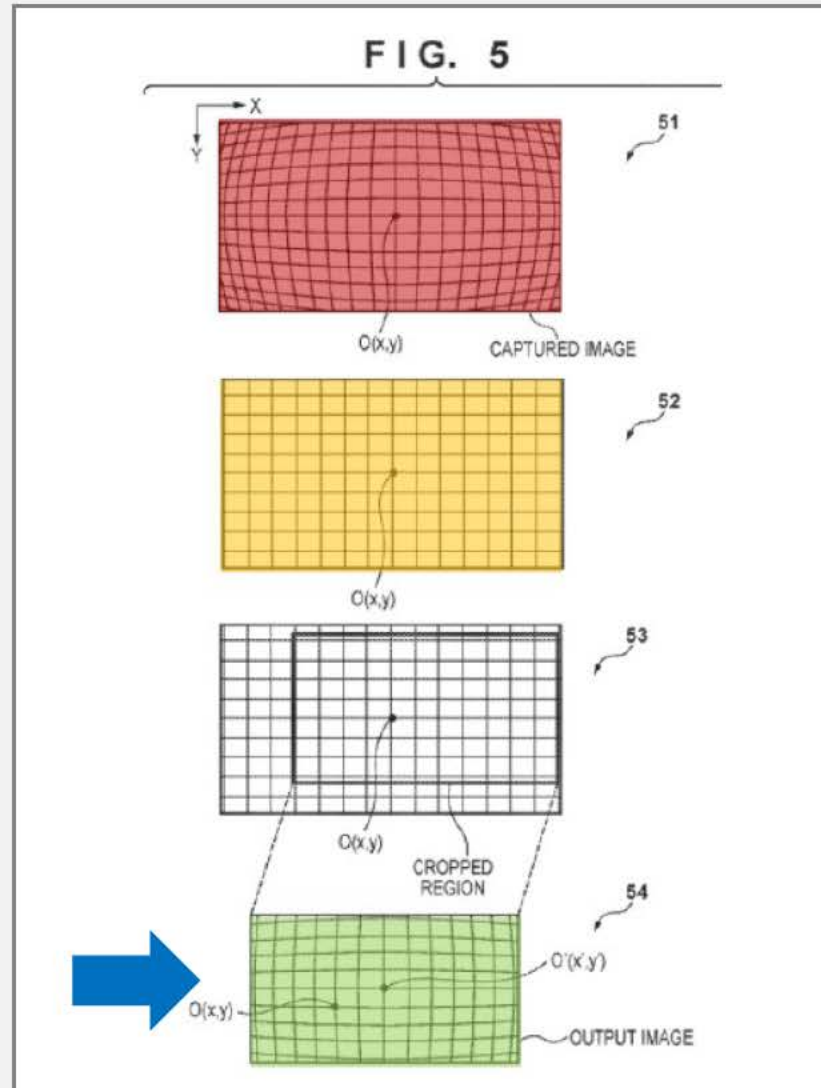


Watanabe (Ex. 1006)

Petition

Figure 5 (below) of Watanabe discloses two examples of visual content including distortions. First, “*51 schematically shows distortion* of an image captured by the image sensor 103 and stored in the image memory 105.” (EX1006, 11:7-9 (emphasis added).) Further, Figure 5 depicts a process in which “image *distortion shown in 51 of FIG. 5 is corrected* (removed) (52, FIG. 5),” “[t]he image shake correction circuit 107 performs image shake correction on the image in 52,” and “*[t]he distortion addition circuit 108 adds a distortion* effect to the image subjected to image shake correction (54, FIG. 5).” (EX1006, 11:22-25, 37-39 (emphases added).) Thus, both images 51 and 54 include distortions. (EX1002, ¶152.) As shown below, various straight lines within a scene appear as

Thomason-Pacurariu-Watanabe Combo – “Second Example”



Watanabe (Ex. 1006)

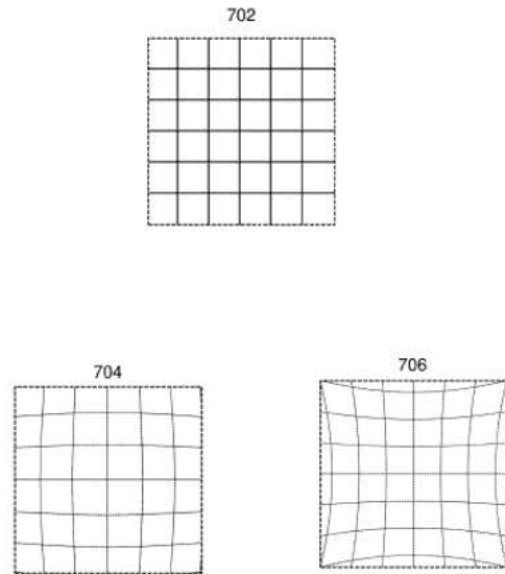
Petition

¶155.) For example, the Thomason-Pacurariu-Watanabe combination may remove image distortions from a captured image (e.g., caused by characteristics of the image sensor) as taught by Watanabe, obtain horizon-leveled visual content as taught by Thomason and Pacurariu, and intentionally add certain distortions such that the resulting image appear more natural looking as taught by Watanabe.

Petition (Paper 2), 50

The '832 Patent Discloses Removing and Reapplying Distortion

U.S. Patent May 17, 2022 Sheet 8 of 9 US 11,336,832 B1



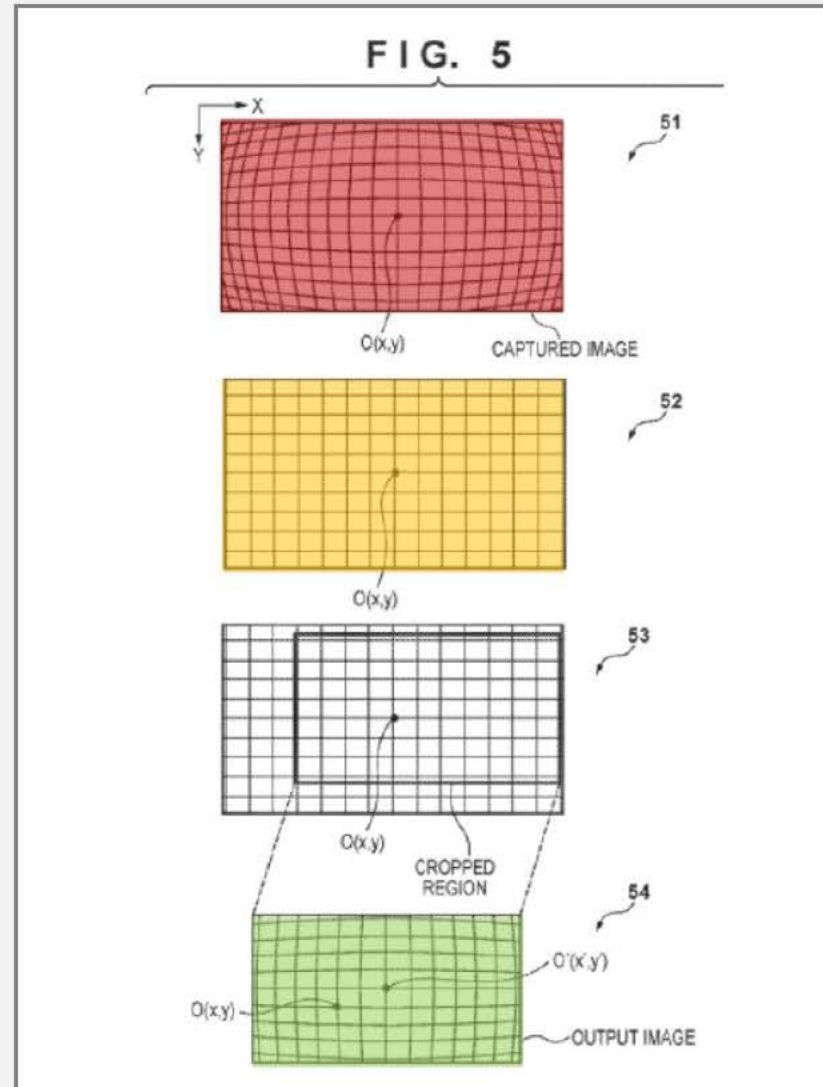
An off-axis horizon may refer to a horizon depicted within the horizon-leveled visual content that deviates from a true horizon (e.g., a straight horizontal line) within the image. The

'832 Patent (Ex. 1001), 21:52-54

image. As another example, the image and/or the metadata for the image may be analyzed to determine that the distortion within the image does not reduce the impact of an off-axis horizon depicted within the visual content. 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).

'832 Patent (Ex. 1001), 22:60-23:3

Thomason-Pacurariu-Watanabe System – “Second Example”



Watanabe (Ex. 1006)

'832 Patent

- ✓ 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.

GoPro's Improper Interpretation of "Visual Content"

Claim 3	GoPro's Position
3. The system of claim 1, wherein the <u>visual content</u> 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.	<i>original</i> visual content upon which horizon leveling is performed

POR (Paper 25), 17

The “Visual Content” Can Be Part of the “Video Content” or “Horizon-Leveled Visual 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;

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.

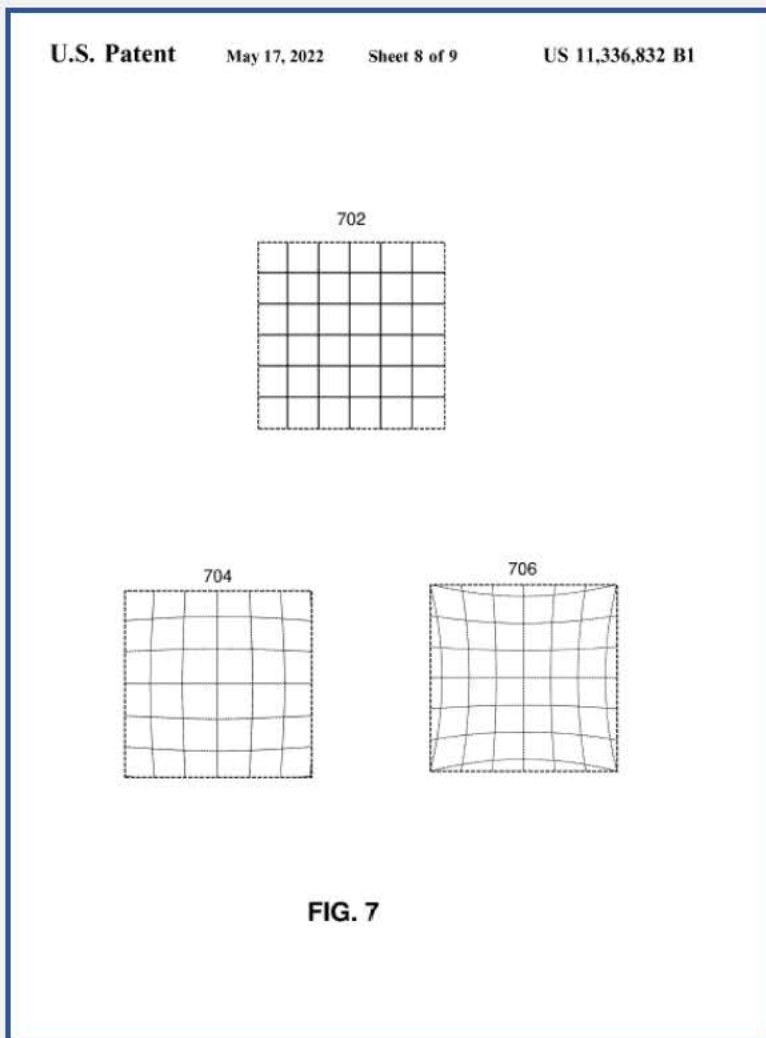
The “Visual Content” Can Be Part of the “Horizon-Leveled Visual Content”

’832 Patent

An off-axis horizon may refer to a horizon depicted within the horizon-leveled visual content that deviates from a true horizon (e.g., a straight horizontal line) within the image. The horizon-leveled visual content may include an off-axis horizon based on imperfect horizon leveling of the visual content. For example, the amount of rotation performed on the visual content may be inaccurate and/or imprecise, and the horizon leveling of the visual content may be imperfect.

An off-axis horizon may be less noticeable within visual content that includes a distortion than within visual content that does not include the distortion. FIG. 7 illustrates example non-distorted image 702 and distorted images 704, 706. The non-distorted image 702 may include the visual

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



The “Visual Content” Can Be Part of the “Horizon-Leveled Visual Content”

’832 Patent

An off-axis horizon may refer to a horizon depicted within the horizon-leveled visual content that deviates from a true horizon (e.g., a straight horizontal line) within the image. The

’832 Patent (Ex. 1001), 21:52-54

image. As another example, the image and/or the metadata for the image may be analyzed to determine that the distortion within the image does not reduce the impact of an off-axis horizon depicted within the visual content. 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).

’832 Patent (Ex. 1001), 22:60-23:3

U.S. Patent May 17, 2022 Sheet 8 of 9 US 11,336,832 B1

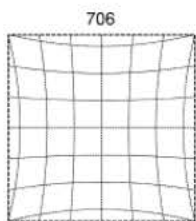
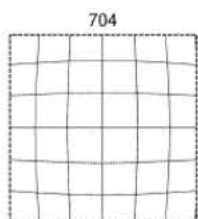
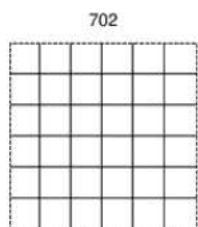


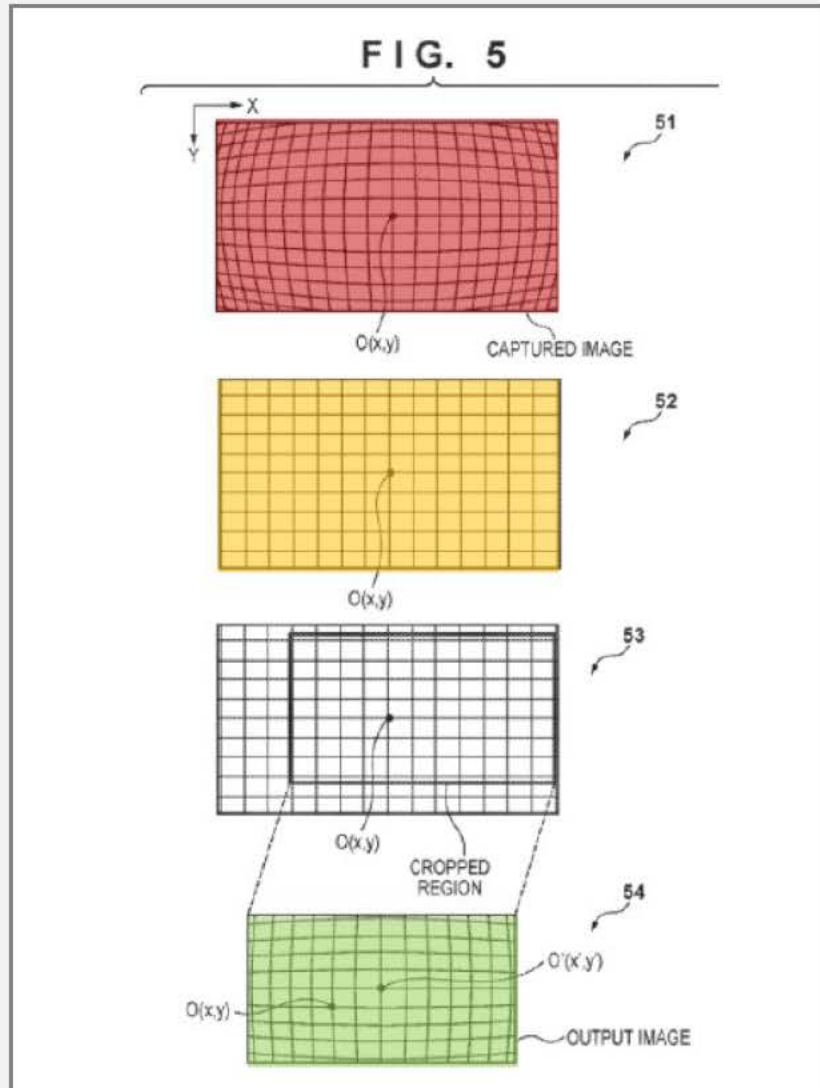
FIG. 7

Thomason-Pacurariu-Watanabe Combination

Watanabe teaches adding back the same distortion

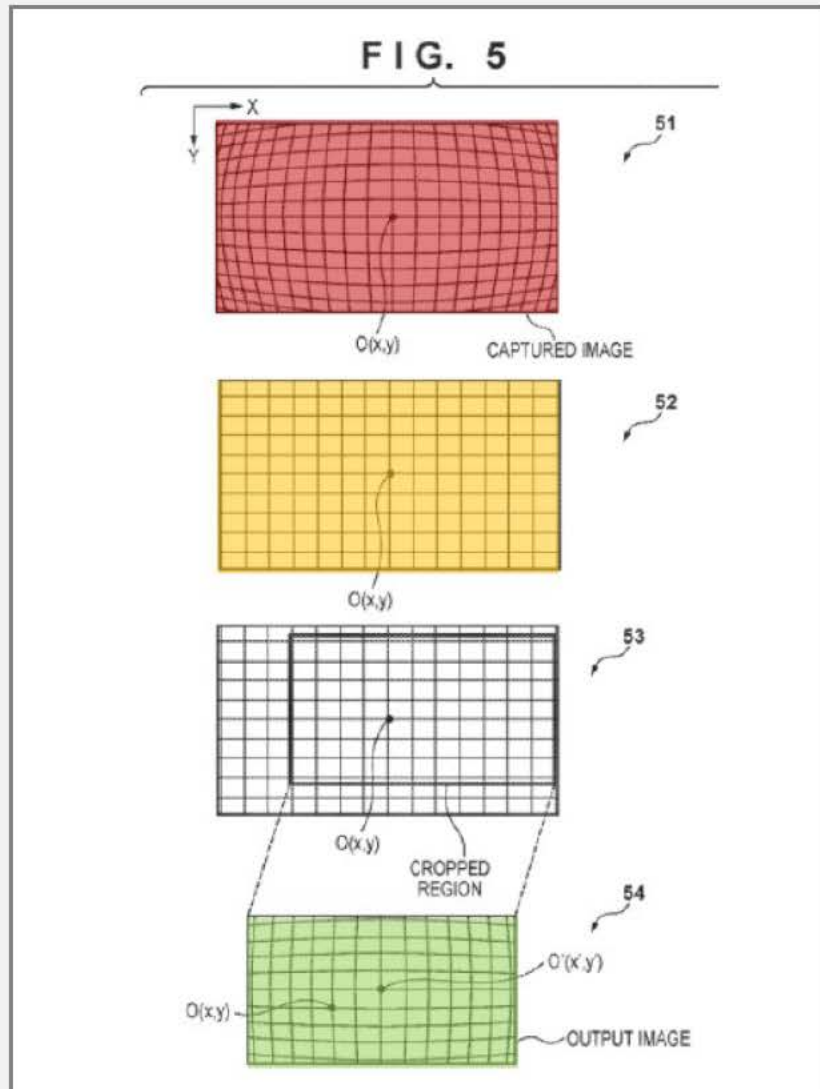
in 32 of FIG. 3 by a magnification of $-3/10$. Note that, here, a distortion effect of about 30% of the degree of the distortion of the photographing lens 102 is assumed to be added, but the degree of a distortion effect that is added by the distortion addition circuit 108 can be appropriately determined in a range not exceeding the intensity of distortion caused by aberration of the photographing lens 102.

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).



Thomason-Pacurariu-Watanabe Combination

Watanabe teaches adding back the same distortion

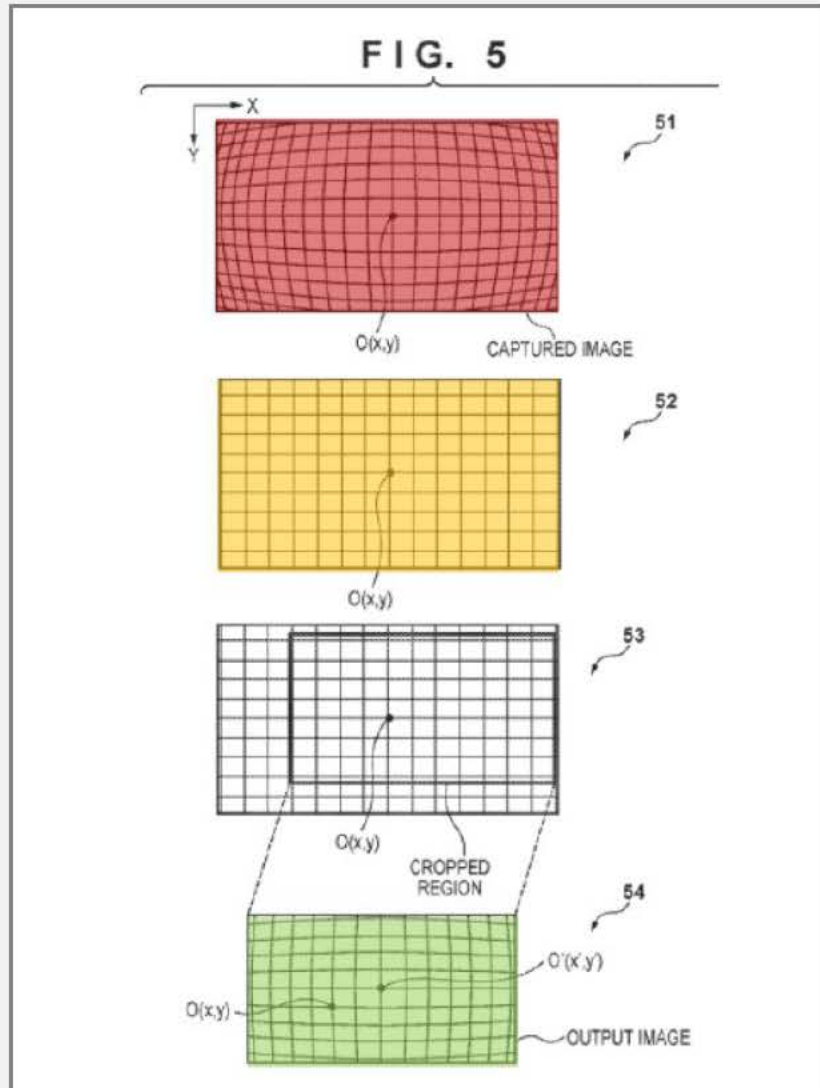


Watanabe (Ex. 1006)

A distortion addition circuit **108** reads out, from the image memory **105**, an image in which distortion and image shake have been respectively corrected by the distortion correction circuit **106** and the image shake correction circuit **107**, adds the effect of distortion caused by the photographing lens **102** to this image, and stores the image to the image memory **105**. The distortion addition circuit **108** can add a distortion

Watanabe (Ex. 1006), 5:36-42

Thomason-Pacurariu-Watanabe Combination



Rationale to Combine

A POSITA would have been motivated to combine Thomason, Pacurariu, and Watanabe because they are all related to the same technical problem (correcting for camera motion) and the same general solution (using rotational data to correct for camera motion). (EX1019, ¶¶79-82.) A POSITA would understand that horizon leveling involves compensating for the tilt of the image/video. (*Id.*; EX1001, 6:37-41, 9:37-39, 9:15-19.) Watanabe teaches that its techniques can be applied to “mobile phones.” (EX1006, 3:61-4:3.) It further discloses correction of “*tilt* components of shake[.]” (*Id.*, 5:26-32.) And Dr. Foroosh concedes that both horizon-leveling and Watanabe involved correcting for tilt. (EX1018, 46:14-19; 113:11-15; 148:5-10.)

Watanabe (Ex. 1006)

Reply (Paper 32), 23-24

Ground 3: Voss and Derbanne

Ground	35 U.S.C. §	Claims	Prior Art Reference(s)
1	103	1, 2, 7-12, 17-20	Thomason, Pacurariu
2	103	3-6, 13-16	Thomason, Pacurariu, Watanabe
3	103	1, 2, 7-12, 17-20	Voss, Derbanne
4	103	3-6, 13-16	Voss, Derbanne, Watanabe

Petition (Paper 2), 8

Voss

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(41) International Publication Date
3 December 2015 (03.12.2015)

(10) International Publication Number
WO 2015/18363 A1

(51) International Patent Classification:
G06F 17/30 (2006.01) G06B 15/02 (2006.01)
G06F 17/00 (2006.01) H04N 1/21 (2006.01)
H04N 5/225 (2006.01)

(21) International Application Number:
PCT/US2015/031600

(22) International Filing Date:
19 May 2015 (19.05.2015)

(25) Filing Language:
English

(26) Publication Language:
English

(30) Priority Data:
62/003,281 27 May 2014 (27.05.2014) US
14/475,192 2 September 2014 (02.09.2014) US

(71) Applicant: THOMSON LICENSING [FR/FR]; 1-5 rue
Jeanne d'Arc, 92130 Issy Les Moulineaux (FR)

(72) Inventor: VOSS, Neil D.; 249 Norton Ave, Doris, Con-
necticut 06820 (US)

(74) Agents: SHELDON, Robert D. et al.; Thomson Licensing
LLC, 2 Independence Way, Suite 4200, Princeton, New
Jersey 08540 (US)

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GI,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ,
TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, EG, GZ, HU,
IL, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,
DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CI, CG, CL, CM, GA, GN, GQ,
GW, KM, ML, MR, NE, SN, TD, TG).

Published
— with international search report (Art. 21(3))
— before the expiration of the time limit for amending the
claims and/or to be republished in the event of receipt of
amendments (Rule 48.2(b))

(54) Title: PHOTO-VIDEO-CAMERA WITH DYNAMIC ORIENTATION LOCK, CONSTANT FRAMING AND DEFINED AS-
PECT RATIO

FIG. 2

(57) Abstract: A method and apparatus for dynamically maintaining a horizontal framing of a video. The system permits the user to
freely rotate the device while filming, while visualizing the final output in an overlay on the device viewfinder or screen during
shooting. The resulting recording is subsequently corrected to maintain a single orientation with a stable horizon. The system and method
is operative display an overlay over a captured representation of the captured video wherein the overlay indicates a modified image
with respect to said orientation.

SUMMARY OF THE INVENTION

A method and apparatus for dynamically maintaining a horizontal framing of a video. The system permits the user to freely rotate the device while filming, while visualizing the final output in an overlay on the device viewfinder or screen during shooting. The resulting recording is subsequently corrected to maintain a single orientation with a stable horizon. The system and method is operative display an overlay over a captured representation of the captured video wherein the overlay indicates a modified image with respect to said orientation.

Voss (Ex. 1007), 3:5-11

Voss (Ex. 1007)

Voss

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)
 (19) World Intellectual Property Organization
 International Bureau
 (41) International Publication Date
 3 December 2015 (03.12.2015) WIPO | PCT

(10) International Publication Number
 WO 2015/18363 A1

(51) International Patent Classification:
 G06F 17/30 (2006.01) G06B 15/02 (2006.01)
 G06F 17/00 (2006.01) H04N 1/21 (2006.01)
 H04N 5/225 (2006.01)

(21) International Application Number:
 PCT/US2015/031600

(22) International Filing Date:
 19 May 2015 (19.05.2015)

(25) Filing Language: English
 (26) Publication Language: English

(30) Priority Data:
 62/003,281 27 May 2014 (27.05.2014) US
 14/475,192 2 September 2014 (02.09.2014) US

(71) Applicant: THOMSON LICENSING [FR/FR]; 1-5 rue
 Jeanne d'Arc, 92130 Issy Les Moulineaux (FR)

(72) Inventor: VOSS, Neil D.; 249 Norton Ave, Doris, Con-
 necticut 06820 (US)

(74) Agents: SHEDD, Robert D. et al.; Thomson Licensing
 LLC, 2 Independence Way, Suite 4200, Princeton, New
 Jersey 08540 (US)

(81) Designated States (unless otherwise indicated, for every
 kind of national protection available): AE, AG, AL, AM,

(84) Designated States (unless otherwise indicated, for every
 kind of regional protection available): ARIPO (BW, GI,
 GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ,
 TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, EG, GE, HU,
 TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,
 DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
 LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
 SM, TR), OAPI (BF, BJ, CI, CG, CL, CM, GA, GN, GQ,
 GW, KM, ML, MR, NE, SN, TD, TG).

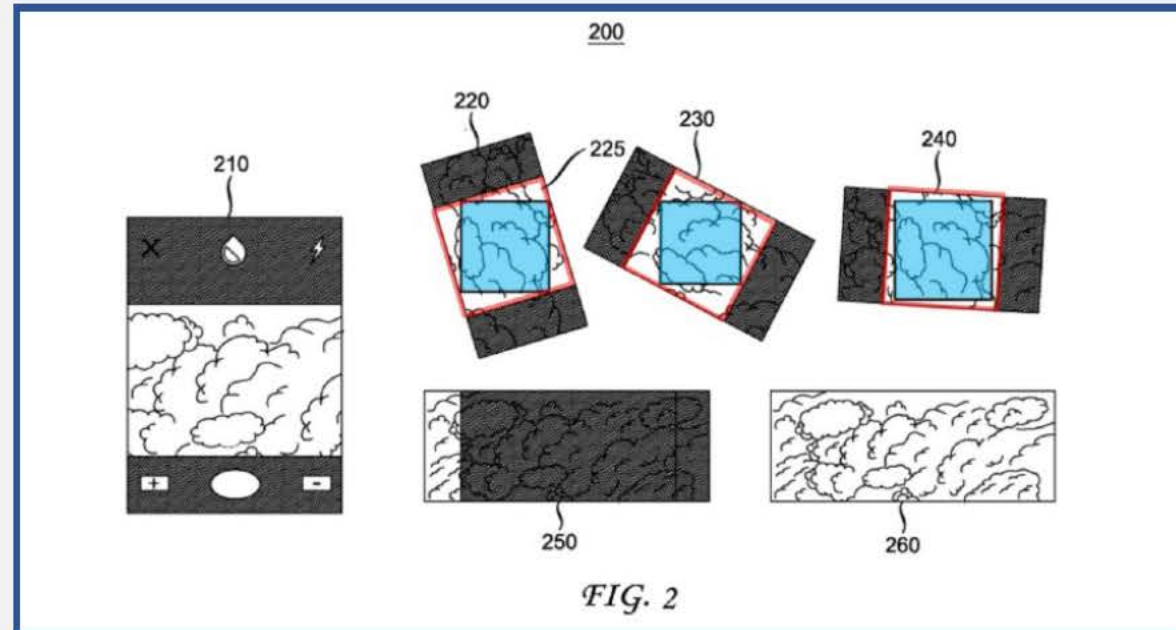
Published:
 — with international search report (Art. 21(3))
 — before the expiration of the time limit for amending the
 claims and for presenting observations on the invention (Rule 48.2(b))

(54) Title: PHOTO-VIDEO-CAMERA WITH DYNAMIC ORIENTATION LOCK, CONSTANT FRAMING AND DEFINED AS-
 PECTRATIO

FIG. 2

(57) Abstract: A method and apparatus for dynamically maintaining a horizontal framing of a video. The system permits the user to
 freely rotate the device while filming, while visualizing the final output in an overlay on the device viewfinder or screen during shoot-
 ing. The resulting recording is subsequently corrected to maintain a single orientation with a stable horizon. The system and method
 is operative display an overlay over a captured representation of the captured video wherein the overlay indicates a modified image
 with respect to said orientation.

Voss (Ex. 1007)



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

Voss (Ex. 1007), 10:5-9



Derbanne

Derbanne

US010341564B1

United States Patent
Derbanne et al.

(10) Patent No.: US 10,341,564 B1
(45) Date of Patent: *Jul. 2, 2019

(54) SYSTEMS AND METHODS FOR STABILIZING VIDEOS

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

(72) Inventors: **Thomas Derbanne**, Paris (FR); **Cesar Douady**, Les Moutiers (FR); **Masim Karpushin**, Paris (FR)

(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(h) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **16/156,066**

(22) Filed: **Oct. 2, 2018**

Related U.S. Application Data

(63) Continuation of application No. 15/987,786, filed on May 23, 2018.

(60) Provisional application No. 62/673,388, filed on May 18, 2018.

(51) **Int. Cl.**
H04N 5/22 (2006.01)
H04N 5/225 (2006.01)

(52) **U.S. CL.**
CPC — **H04N 5/2258** (2013.01); **H04N 5/2267** (2013.01); **H04N 5/2257** (2013.01)

(58) **Field of Classification Search**
CPC — **H04N 5/2267**
See application file for complete search history.

(56) References Cited

U.S. PATENT DOCUMENTS

6,654,019 B2 9/12/03 Gibert
6,027,946 P2 9/24/11 Cardew

8,237,787 B2 * 8/2012 Bollinger — H04N 5/225 3:40-1:51
9,148,714 B2 * 9/2015 Bollinger — H04N 5/225 2:27-9:93
9,279,993 B1 * 3/2016 Davis — G02B 27/01 9:36A, 5:69-10
6,2016 Van Hoff
(Continued)

FOREIGN PATENT DOCUMENTS

WO 2004/077272 A1 4/2004
WO 2016/060277 A1 6/2014

OTHER PUBLICATIONS

Kopf et al., "Earperson Hyper-Lapse Video" ACM Transactions on Graphics (Proceedings of SIGGRAPH 2014), 33(4), Article No. 78, 2014 (10 pages)

(Continued)

Primary Examiner — Cynthia Segura

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

(57)

ABSTRACT

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 punctures for the images are determined based on the capture trajectory. Video content is generated based on visual content of the images within the punctures.

20 Claims, 8 Drawing Sheets

The graph shows a yaw angle on the vertical axis, ranging from 90° at the top to 0° at the bottom. A solid line represents the 'observed yaw trajectory 410'. A dashed line represents the 'capture trajectory'. The capture trajectory is composed of several segments labeled 'duration A 522', 'duration B 524', 'duration C 526', 'duration D 528', and 'duration E 530'. The capture trajectory is shown as a series of punctures (dots) along the observed yaw trajectory. The punctures are labeled 'capture yaw trajectory 512'.

Derbanne (Ex. 1008)

SYSTEMS AND METHODS FOR STABILIZING VIDEOS

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),
Title, Abstract*

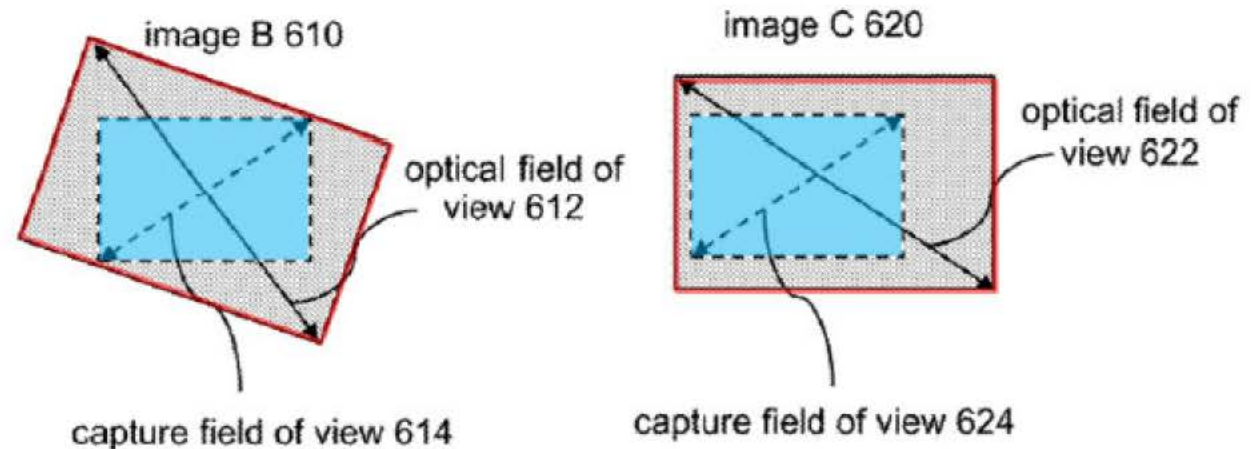


FIG. 6B

Derbanne Discloses Identical Claim Terms

Claim 1

Video content may define visual content viewable as a function of progress through a progress length of the video content. Video content may include video frames that define

durations) within the capture duration. The position information may characterize positions of the housing 312 based on specific translational and/or rotational positions of the housing 312 and/or based on changes in translational and/or rotational positions of the housing 312 as a function of progress through the capture duration. That is, the position

obtain video information defining a video, the video including video content captured by an image capture device during a capture duration, the video content including 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; and determine the viewing window for the visual content to be included within horizon-leveled 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

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.

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.

Voss-Derbanne Combination

Petition

10:5-7; EX1008, 13:2-8; EX1002, ¶183.) The Voss-Derbanne combination results in a system in which data (captured video data, rotational position information) is captured, stored, and maintained in accordance with the teachings of Derbanne, and a punchout may be generated, yielding the predictable result of improving the video management and processing capabilities of Voss. (EX1002, ¶184.) A

Petition (Paper 2), 62

Voss Discloses “Generate the Horizon-Leveled Visual Content Based on the Viewing Window” in Claim 1

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)
 (19) World Intellectual Property Organization
 International Bureau
 (41) International Publication Date
 3 December 2015 (03.12.2015) WIPO | PCT
 (10) International Publication Number
 WO 2015/18363 A1

(51) International Patent Classification:
 G06F 17/30 (2006.01) G06F 15/02 (2006.01)
 G06F 17/00 (2006.01) H04N 1/21 (2006.01)
 H04N 5/225 (2006.01)

(21) International Application Number:
 PCT/US2015/031600

(22) International Filing Date:
 19 May 2015 (19.05.2015)

(25) Filing Language:
 English

(26) Publication Language:
 English

(30) Priority Data:
 62/003,281 27 May 2014 (27.05.2014) US
 14/475,192 2 September 2014 (02.09.2014) US

(71) Applicant: THOMSON LICENSING [FR/FR]; 1-5 rue
 Jeanne d'Arc, 92130 Issy Les Moulineaux (FR)

(72) Inventor: VOSS, Neil D.; 249 Norton Ave, Doris, Con-
 necticut 06820 (US)

(74) Agents: SHELDON, Robert D. et al.; Thomson Licensing
 LLC, 2 Independence Way, Suite 4200, Princeton, New
 Jersey 08540 (US)

(81) Designated States (unless otherwise indicated, for every
 kind of national protection available): AE, AG, AL, AM,
 AO, AT, AU, AZ, BA, BB, BG, BE, BN, BR, BW, BY,
 BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,
 DO, DZ, EC, EG, ES, FI, GB, GD, GE, GH, GM, GT,
 HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,
 KZ, LA, LC, LK, LI, LS, LU, LV, MA, MD, ME, MG,
 MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM,
 PA, PE, PG, PH, PL, PT, QA, RO, RU, RW, SA, SC,
 SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,
 TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

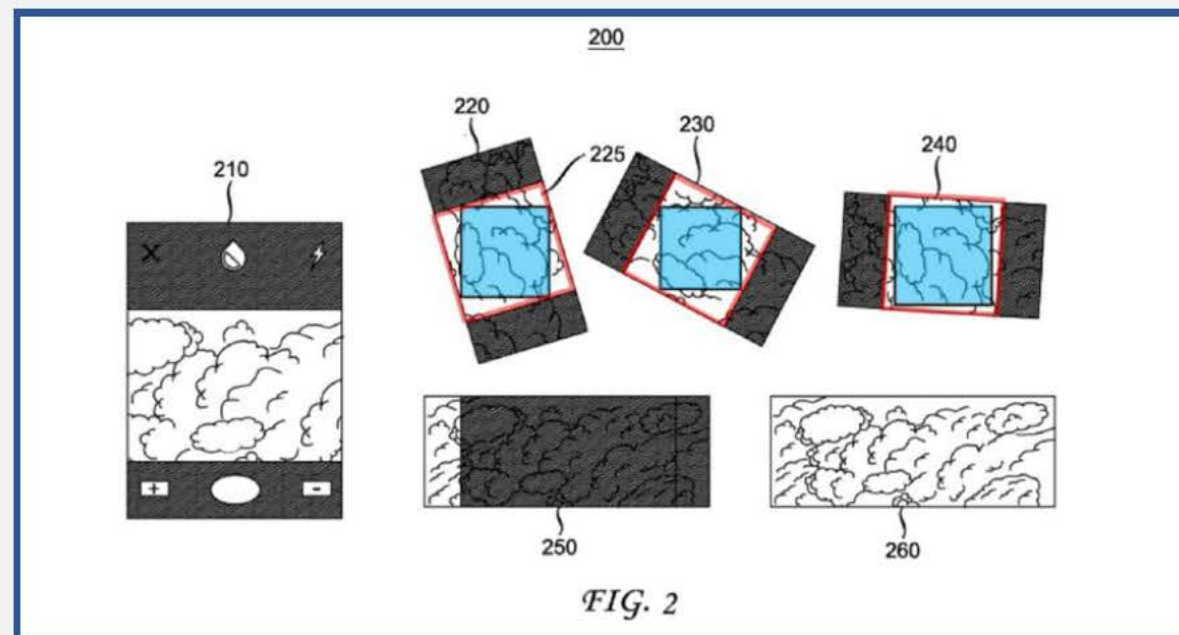
(84) Designated States (unless otherwise indicated, for every
 kind of regional protection available): ARIPO (BW, GI,
 GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ,
 TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, EG, GE, HU,
 TJ, TM, UZ, UA), European (AL, AT, BE, BG, CH, CY, CZ, DE,
 DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
 LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
 SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
 GW, KM, ML, MR, NE, SN, TD, TG).

Published
 with international search report (Art. 21(3))
 before the expiration of the time limit for amending the
 claims and/or to be republished in the event of receipt of
 amendments (Rule 48.2(b))

(54) Title: PHOTO-VIDEO-CAMERA WITH DYNAMIC ORIENTATION LOCK, CONSTANT FRAMING AND DEFINED ASPECT RATIO

(57) Abstract: A method and apparatus for dynamically maintaining a horizontal framing of a video. The system permits the user to freely rotate the device while filming, while visualizing the final output in an overlay on the device's viewfinder or screen during shooting. The resulting recording is subsequently corrected to maintain a single orientation with a stable horizon. The system and method is operative display an overlay over a captured representation of the captured video wherein the overlay indicates a modified image with respect to said orientation.

Voss (Ex. 1007)



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.

Voss (Ex. 1007), 9:14-19

GoPro's Shifting Positions on Voss

'832 Patent

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.

11. A method for horizon leveling videos, the method performed by a computing system including one or more processors, the method comprising:

obtaining, by the computing system, 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;

obtaining, by the computing system, 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;

determining, by the computing system, 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 determining the viewing window includes determining 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

generating, by the computing system, 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.

GoPro's Shifting Positions on Voss

No mentioning of
“oscillat[ing]” or
“configured”

POR

to fit an optimal output dimension.” Ex. 1007, 10:16-17. In fact, Voss teaches that the “optimal output dimension” may be completely different from the aspect ratios of the inset rectangle during capture, requiring “*cropping data as necessary.*” *Id.*, 10:17-21.

POR (Paper 25), 59

Sur-reply

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]” (“blacking out any unused area with ‘letter boxing’ or ‘pillar boxing.’”). *Id.*; EX1007, 10:17-11:2. Petitioner concedes that when the

Sur-Reply (Paper 39), 18-19

Reply (Paper 32), 27;

Petitioner Motion to Strike (Paper 45), 1-4.

Hewlett-Packard Co. v. Mustek Sys., Inc. (Fed. Cir. 2003)

“Prior art product that sometimes, but not always, embodies claimed method nonetheless teaches that aspect of invention.”

Hewlett-Packard Co. v. Mustek Sys., Inc., 340 F.3d 1314 (Fed. Cir. 2003)

Voss Discloses Examples That Do Not “Oscillate”

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).

Voss (Ex. 1007), 10:17-11:2

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.

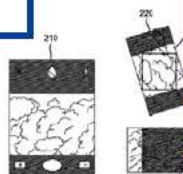
Additional refinements whereby the total aggregate of all movement is considered and weighed into the selection of optimal output aspect ratio are in place. For example, if a user records a video that is 'mostly landscape' with a minority of portrait content, the output format will be a landscape aspect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

filming. Optionally, a user may indicate that the beginning or ending orientation determines the final ratio of the video.

APPLICATION PUBLISHED
Property
Date
12/2015
WIPO
Publication No.
PCT/US2015/031600
19 May 2015 (19.05.2015)
2014 (27.05.2014)
2014 (02.09.2014)
Licensing (FRFR) 1-5
Les Moulins (FR)
249 Norton Ave, Daries, Con-
D. D. et al., Thomson Licensing
ay, Suite #200, Princeton, New
otherwise indicated, for every
availability: AE, AG, A, AM,
CAMERA WITH DYNAMIC ORIE

WO 2015/18363 A1

(57) Abstract: A method and apparatus for dynamically maintaining a video recording of a scene while the device is freely rotated. The resulting recording is subsequently corrected to maintain a fixed aspect ratio. The device is operative to display an overlay over a captured representation of the scene with respect to said orientation.

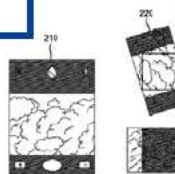


Voss Discloses Examples That Do Not “Oscillate”

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).

Voss (Ex. 1007), 10:17-11:2

APPLICATION PUBLISHED
Property
Publication Date
3.12.2015
WIPO
Classification:
G03B 1/02 (2006.01)
H04N 1/21 (2006.01)
Publication Number:
PCT/US2015/031600
19 May 2015 (19.05.2015)
2014 (27.05.2014)
2014 (02.09.2014)
Licensing (FRFR): 1-5
Lex Moulins (FR)
249 Norton Ave, Daries, Con
D. D. et al., Thomson Licensing
ay, Suite #200, Princeton, New
otherwise indicated, for every
availability: AE, AG, A, AM
CAMERA WITH DYNAMIC OR



WO 2015/183636 A1

(57) Abstract: A method and apparatus for dynamically rotating a video stream while filming, while visualizing the final image. The resulting recording is subsequently corrected to maintain an operative display an overly over a captured representation of with respect to said orientation.

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. An example of this can be seen in FIG. 8.

FIG. 8 depicts a flow diagram 800 of an exemplary methodology for processing a video stream wherein rotation occurs during capture. At the most basic level, the methodology involves six steps. The first step is initiating capture of a video stream (step 610). The next step is receiving data representing a video stream (step 820). A representation of the video stream can then be displayed (step 830). The fourth step is receiving data representing an aspect ratio (step 840). The fifth step is receiving data representing rotational position (step 850). The last step of the basic method is overlaying a graphic representative of said aspect ratio and said orientation over said representation of said video stream wherein the framing of the original video is maintained in the overly (step 860).

Voss (Ex. 1007)

Voss (Ex. 1007), 17:4-17

Derbanne Discloses “Generate the Horizon-Leveled Visual Content Based on the Viewing Window” in Claim 1

SYSTEMS AND METHODS FOR STABILIZING VIDEOS

tion. The orientations of the capture field of view for the images with respect to the optical field of view of the images may determine which portions of the visual content of the images (punch-outs) may be used to generate a video. That

Derbanne (Ex. 1008), 12:66-13:5

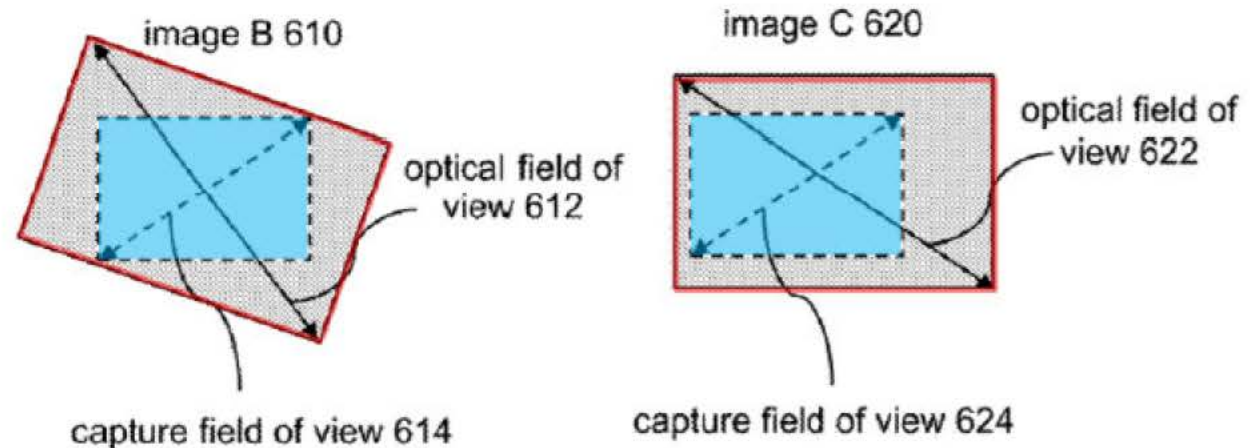


FIG. 6B

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

(10) **Patent No.:** US 10,341,564 B1
(45) **Date of Patent:** *Jul. 2, 2019

(54) **SYSTEMS AND METHODS FOR STABILIZING VIDEOS**

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

(72) Inventors: **Thomas Derbanne**, Paris (FR); **Cesar Douady**, Les Molières (FR); **Muslin Karpovich**, Paris (FR)

(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 0 days.
This patent is subject to a terminal disclaimer.

(21) Appl. No. 16/150,066

(22) Filed: **Oct. 2, 2018**

Related U.S. Application Data

(65) Continuation of application No. 15/987,786, filed on May 23, 2018.

(60) Provisional application No. 62/673,388, filed on May 18, 2018.

(51) Int. Cl. **H04N 5/22** (2006.01)
H04N 5/225 (2006.01)

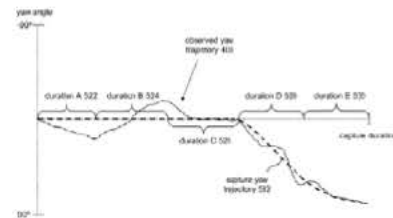
(52) U.S. Cl. **H04N 5/2258** (2013.01); **H04N 5/2267** (2013.01); **H04N 5/2252** (2013.01)

(58) Field of Classification Search CPC **H04N 5/2252** (2013.01)
See application file for complete search history.

References Cited

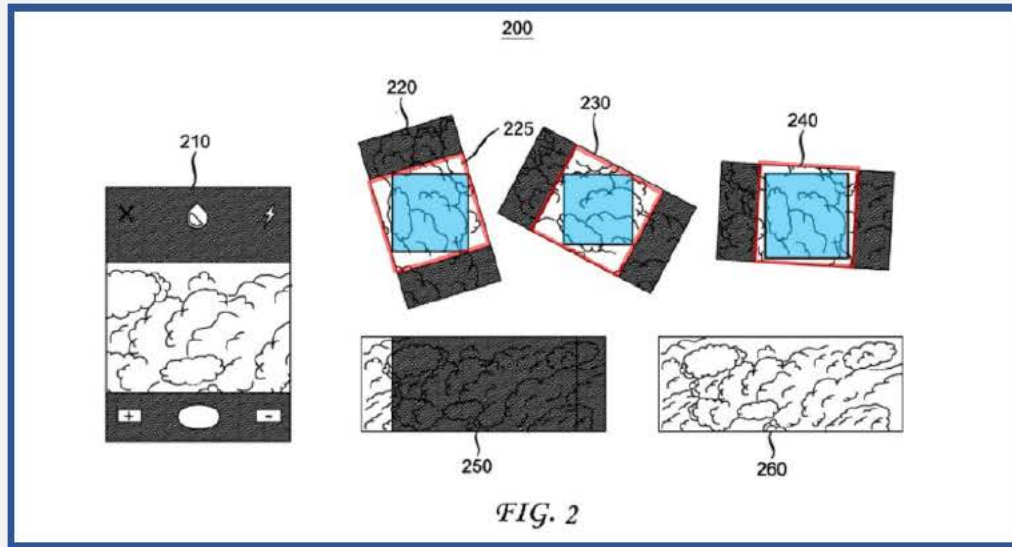
U.S. PATENT DOCUMENTS

6,654,019 B2 11/2003 Gilbert
6,022,948 B2 9/2001 Githens

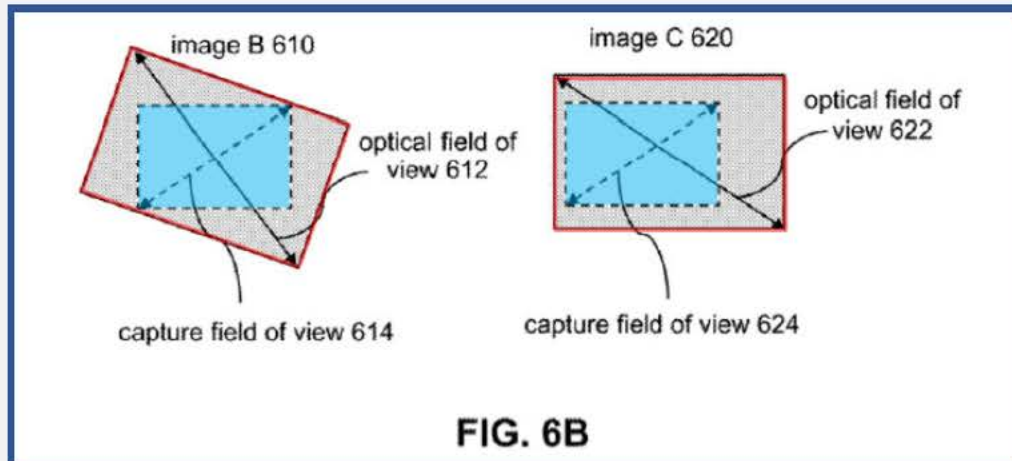


Derbanne (Ex. 1008)

Derbanne Discloses “Generate the Horizon-Leveled Visual Content Based on the Viewing Window” in Claim 1



Voss (Ex. 1007)



Derbanne (Ex. 1008)

it concerns stabilization is unavailing. Both Derbanne and Voss involve motion correction. Derbanne also discloses correcting motion in three axes, including in the roll direction. A POSITA would understand that horizon leveling—such as disclosed in Voss—compensates motion in the roll direction. (EX1019, ¶¶103-104.)

The Petition relies on Derbanne’s disclosure for limitations related to format of the video content and rotational position information, as well as the “punchout” for visualizing the processed data. (Petition, 61-62.) The Voss-Derbanne combination is obvious to try because there are a finite number of solutions for obtaining and storing video data and corresponding rotational data. (EX1019, ¶¶105-107.) For example, video data may be stored as a series of images or in a compressed format, and the associated rotational data can be stored in different formats accordingly. (*Id.*, ¶107.) The teachings of Derbanne related to formatting of video data and rotational data can help a POSITA implement Voss’ horizon-leveling algorithm. (*Id.*) Dr. Foroosh agreed with this point, stating with reference to Derbanne that “[w]e’re compensating translation and rotations. We are doing the same things.” (EX1018, 205:1-14.)

Claims 7 and 17 – “Determination of a Size”

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)
 (19) World Intellectual Property Organization
 International Bureau
 (41) International Publication Date
 3 December 2015 (03.12.2015) WIPO PCT

(10) International Publication Number
 WO 2015/18363 A1

(51) International Patent Classification:
 G06F 17/30 (2006.01) G06B 17/02 (2006.01)
 G06F 17/00 (2006.01) H04N 1/21 (2006.01)
 H04N 5/225 (2006.01)

(21) International Application Number:
 PCT/US2015/031600

(22) International Filing Date:
 19 May 2015 (19.05.2015)

(25) Filing Language:
 English

(26) Publication Language:
 English

(30) Priority Data:
 62/003,281 27 May 2014 (27.05.2014) US
 14/475,192 2 September 2014 (02.09.2014) US

(71) Applicant: THOMSON LICENSING [FR/FR]; 1-5 rue
 Jeanne d'Arc, 92130 Issy Les Moulineaux (FR)

(72) Inventor: VOSS, Neil D.; 249 Norton Ave, Doris, Con-
 nection 06820 (US)

(74) Agents: SHELDON, Robert D. et al.; Thomson Licensing
 LLC, 2 Independence Way, Suite 4200, Princeton, New
 Jersey 08540 (US)

(81) Designated States (unless otherwise indicated, for every
 kind of national protection available): AE, AG, AL, AM,
 AO, AT, AU, AZ, BA, BB, BG, BE, BN, BR, BW, BY,
 BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,
 DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
 HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,
 KZ, LA, LC, LK, LI, LS, LU, LV, MA, MD, ME, MG,
 MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM,
 PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC,
 SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,
 TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
 kind of regional protection available): ARIPO (BW, GI,
 GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ,
 TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, EG, GE, HU,
 TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,
 DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
 LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
 SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
 GW, KM, ML, MR, NE, SN, TD, TG).

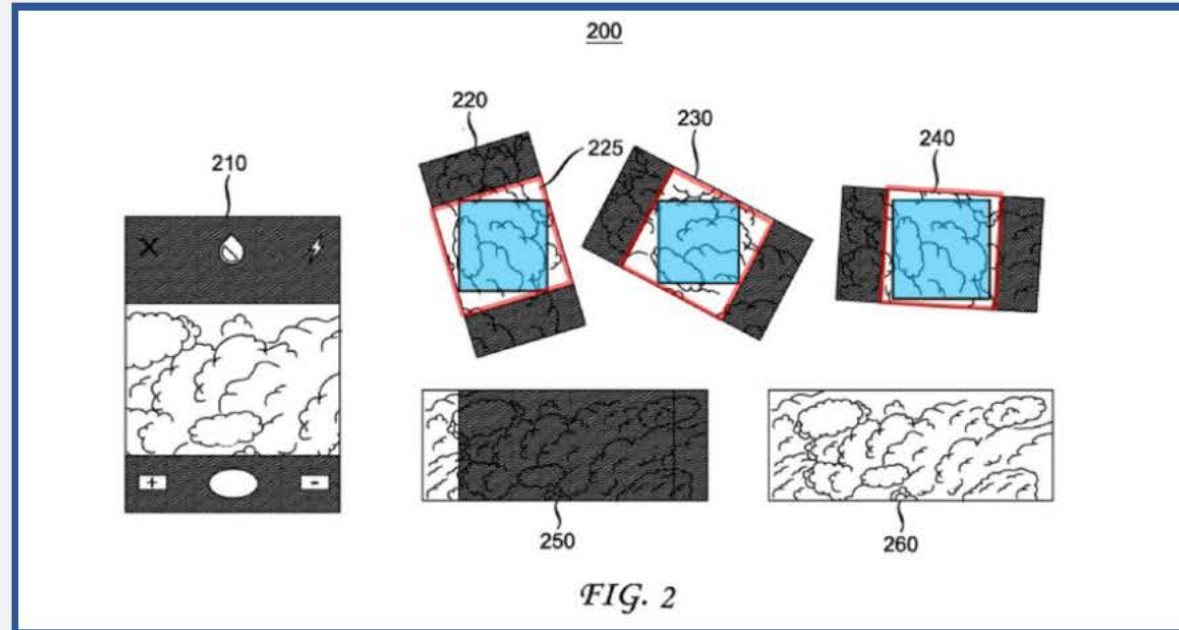
Published:
 — with international search report (Art. 21(3))
 — before the expiration of the time limit for amending the
 claims and/or to be republished in the event of receipt of
 amendments (Rule 48.2(b))

(54) Title: PHOTO-VIDEO CAMERA WITH DYNAMIC ORIENTATION LOCK, CONSTANT FRAMING AND DEFINED AS-
 PECTRATIO

FIG. 2

(57) Abstract: A method and apparatus for dynamically maintaining a horizontal framing of a video. The system permits the user to
 freely rotate the device while filming, while visualizing the final output in an overlay on the device viewfinder or screen during shoot-
 ing. The resulting recording is subsequently corrected to maintain a single orientation with a stable horizon. The system and method
 is operative display an overlay over a captured representation of the captured video wherein the overlay indicates a modified image
 with respect to said orientation.

Voss (Ex. 1007)



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

Voss (Ex. 1007), 10:5-9

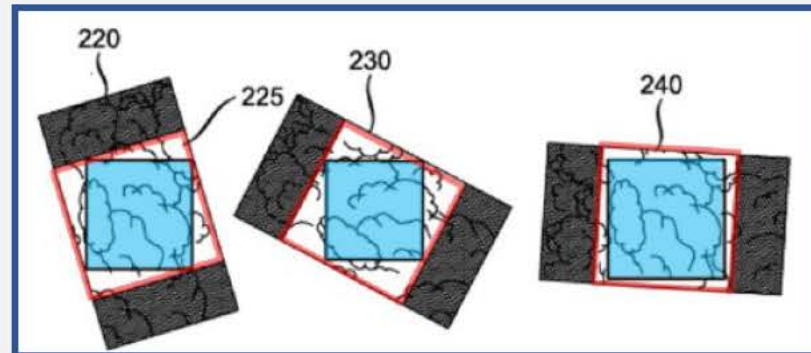
Claims 7 and 17 – “Determination of a Size”

Dr. Foroosh conceded Voss’s viewing windows change size

Q. And then that blue box from Figure 2 is the largest compared to, you know -- among the three blue boxes as shown in Figure 2, right?

A. Okay. One could just by the naked eye say yes, it appears larger than the other two.

Foroosh Depo Trans. (Ex. 1018), 191:21-25



Voss (Ex. 1007), FIG. 2

1 UNITED STATES PATENT AND TRADEMARK OFFICE
2 -----
3 BEFORE THE PATENT TRIAL AND APPEAL BOARD
4 -----
5 ARASHI VISION (U.S.) LLC (D/B/A INSTA360)
6 Petitioner,
7 vs.
8 GOPRO, INC.,
9 Patent Owner.
10 -----
11 Inter Partes Review No. IPR2024-01052
12 -----
13 LOCATION: Veritext Orlando
14 800 North Magnolia Avenue
15 Suite 400
16 Orlando, Florida 32803
17 DATE: July 1, 2025
18 TIME: 10:00 a.m. - 3:45 p.m.
19
20 DEPOSITION OF DR. HASSAN FOROOSH
21 Taken before Julie Giordano, Florida
22 Professional Reporter, Notary Public in and for the
23 State of Florida at Large, pursuant to Notice of
24 Taking Deposition filed in the above case.
25
Page 1
Veritext Legal Solutions
Calendar-CA@veritext.com 866-299-5127

Claims 8/18: “the Size of the Viewing Window Changes . . . to Simulate Changes in Zoom”

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)
(19) World Intellectual Property Organization
International Bureau
(41) International Publication Date
3 December 2015 (03.12.2015)
WIPO | PCT
(10) International Publication Number
WO 2015/18363 A1

(51) International Patent Classification:
G06F 17/30 (2006.01) G06F 15/02 (2006.01)
G06F 17/00 (2006.01) H04N 1/21 (2006.01)
H04N 5/225 (2006.01)

(21) International Application Number:
PCT/US2015/031600

(22) International Filing Date:
19 May 2015 (19.05.2015)

(25) Filing Language:
English

(26) Publication Language:
English

(30) Priority Data:
62/003,281 27 May 2014 (27.05.2014) US
14/475,192 2 September 2014 (02.09.2014) US

(71) Applicant: THOMSON LICENSING [FR/FR]; 1-5 rue
Jeanne d'Arc, 92130 Issy Les Moulineaux (FR)

(72) Inventor: VOSS, Neil D.; 249 Norton Ave, Doris, Con-
necticut 06820 (US)

(74) Agents: SHELDON, Robert D. et al.; Thomson Licensing
LLC, 2 Independence Way, Suite 4200, Princeton, New
Jersey 08540 (US)

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BE, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,
KZ, LA, LC, LK, LI, LS, LU, LV, MA, MD, ME, MG,
MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM,
PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC,
SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GI,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ,
TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, EG, GZ, IL,
IJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,
DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CI, CG, CL, CM, GA, GN, GQ,
GW, KM, ML, MR, NE, SN, TD, TG).

Published:
— with international search report (Art. 21(3)).
— before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
amendments (Rule 48.2(b)).

(54) Title: PHOTO-VIDEO-CAMERA WITH DYNAMIC ORIENTATION LOCK, CONSTANT FRAMING AND DEFINED AS-
PECT RATIO

FIG. 2

(57) Abstract: A method and apparatus for dynamically maintaining a horizontal framing of a video. The system permits the user to
truly rotate the device while filming, while visualizing the final output in an overlay on the device viewfinder or screen during shoot-
ing. The resulting recording is subsequently corrected to maintain a single orientation with a stable horizon. The system and method
is operative display an overlay over a captured representation of the captured video wherein the overlay indicates a modified image
with respect to said orientation.

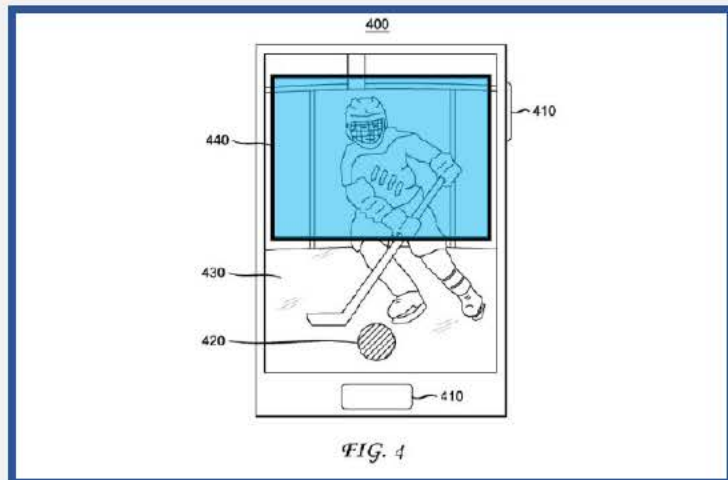
In certain other embodiments, the framing of the image inside the output box is maintained regardless of the aspect ratio. Thus, no matter how the device is oriented, scene is zoomed in or out to keep consistent framing. In some such cases, the object of interest in the video would stay the same size 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.

Voss (Ex. 1007), 13:10-16

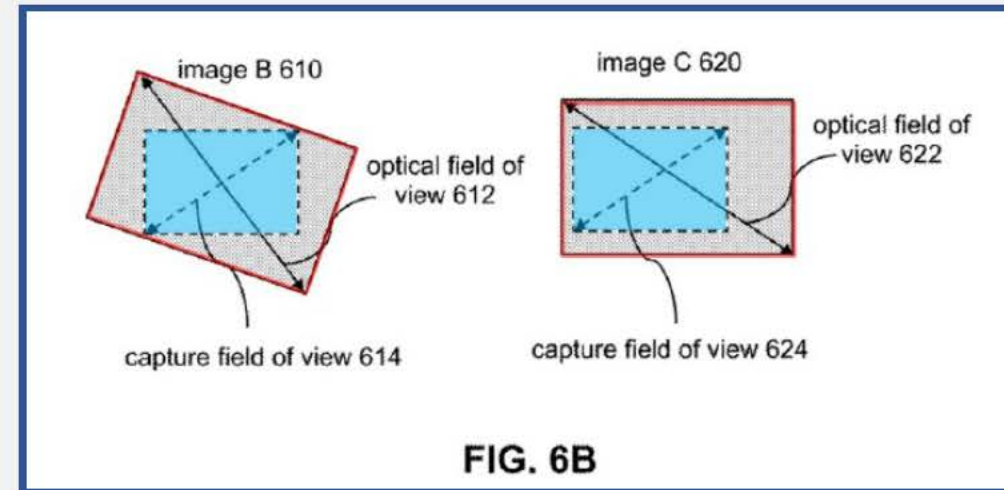
Voss (Ex. 1007)

Claims 10 and 20: “Determination of a Location”

Both Voss and Derbanne disclose off-centered locations



Voss (Ex. 1007), FIG. 4



Derbanne (Ex. 1008), FIG. 6B

WIPO Did Not Express “Serious Confusion”

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

WIPO Written Opinion (Ex. 2030), 5

4 Contradiction
The expression “the framing ... is maintained by zooming ...” in claims 7, 15, 27, 37, 42, 50 represents a contradiction in the claims because the expression “framing is maintained” means for instance close-up is maintained, but “zooming” means on the contrary that the framing will vary for instance from close-up to panorama. Therefore, the requirements of Article 6 PCT are not fulfilled.

The description page 13 lines 10-16 defines “no matter how the device is oriented, scene is zoomed in or out to keep consistent framing ... the object of interest would stay the same size ...” provides the basis for clear claims.

WIPO Written Opinion (Ex. 2030), 7

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA220

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY (PCT Rule 43bis.1)

Date of mailing (day/month/year) see form PCT/ISA210 (second sheet)

Applicant's or agent's file reference see form PCT/ISA220

FOR FURTHER ACTION See paragraph 2 below

International application No. PCT/US2015/031600

International filing date (day/month/year) 19.05.2015

Priority date (day/month/year) 27.05.2014

International Patent Classification (IPC) or both national classification and IPC INV. G06F17/30 ADD. G06F17/00 H04N5/225 G03B19/02 H04N1/21

Applicant THOMSON LICENSING

1. This opinion contains indications relating to the following items:

☒ Box No. I Basis of the opinion

☐ Box No. II Priority

☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

☐ Box No. IV Lack of unity of invention

☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step and industrial applicability, citations and explanations supporting such statement

☒ Box No. VI Certain documents cited

☒ Box No. VII Certain defects in the international application

☒ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 65.1(bis) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA220.

Name and mailing address of the ISA: European Patent Office D-60520 Munich Tel. +49 89 2399-0 Fax +49 89 2399-4465

Date of completion of this opinion see form PCT/ISA210

Authorized Officer Glasser, Jean-Marc Telephone No. +49 89 2399-6

Form PCT/ISA220 (Cover Sheet) (January 2015)

WIPO Written Opinion (Ex. 2030)

POR (Paper 25), 50-51;

Reply (Paper 32), 26

DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

Photographic Version of FIG. 2

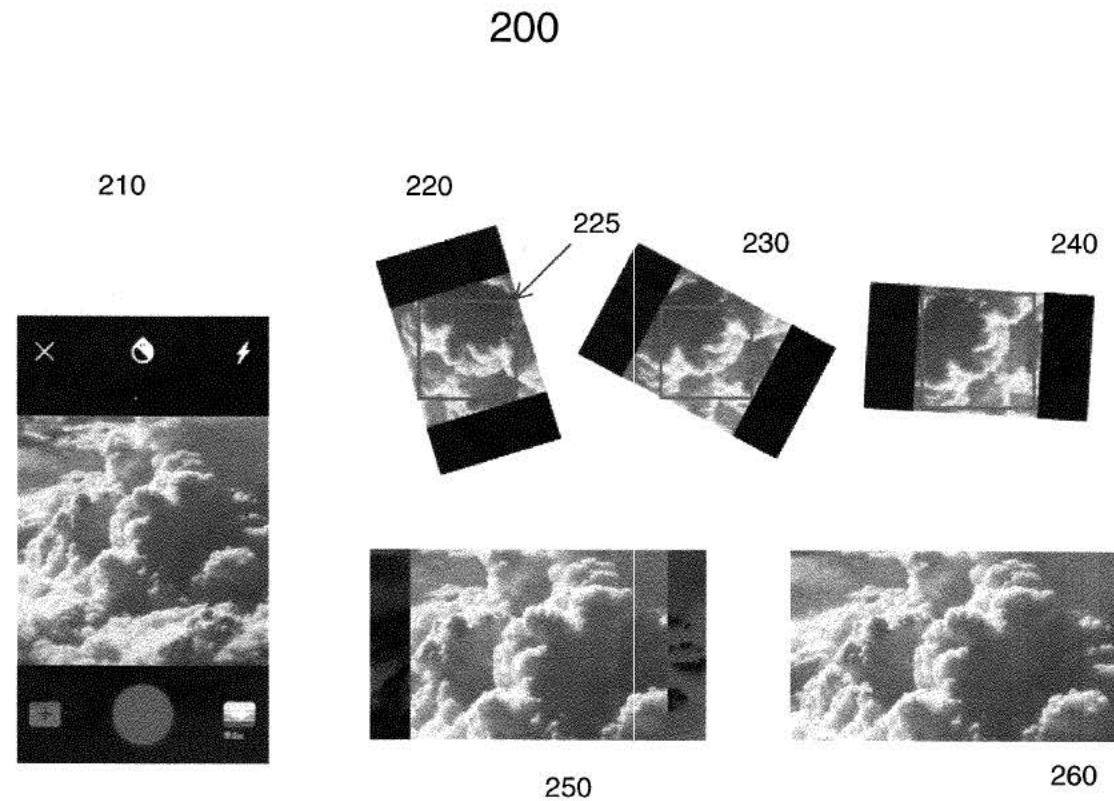


FIG. 2

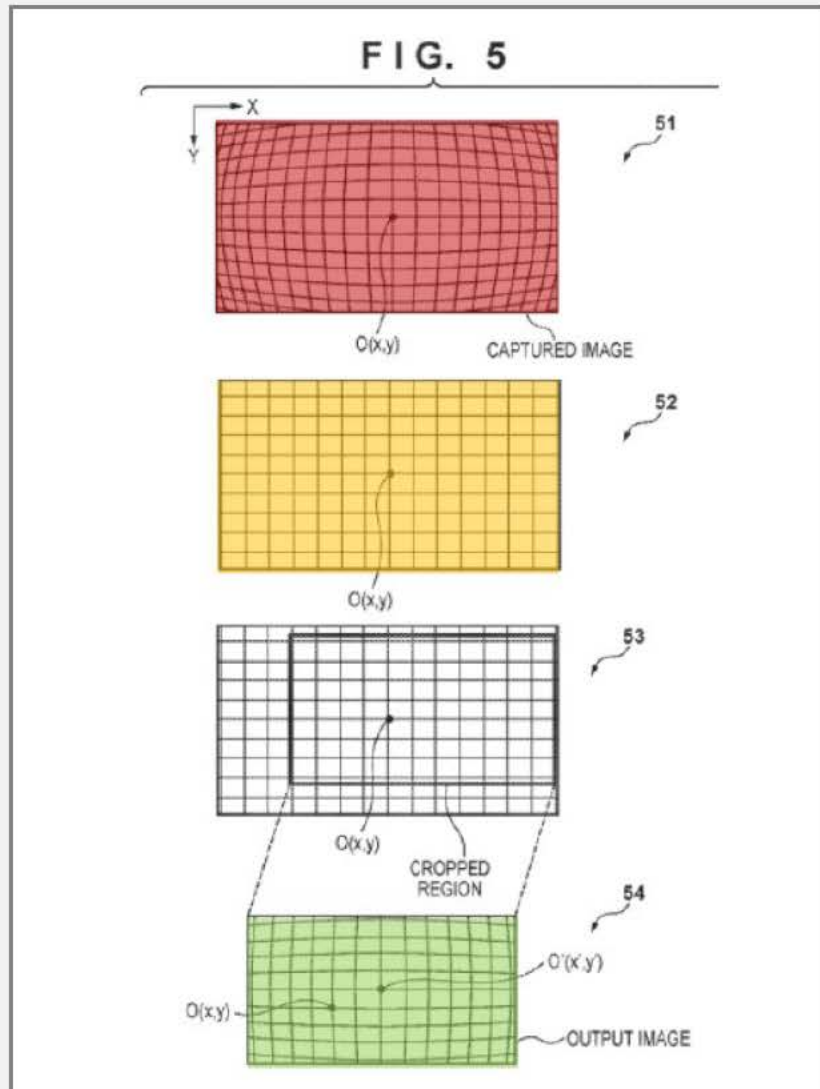
Voss (Ex. 1013)

Ground 4: Voss, Derbanne, and Watanabe

Ground	35 U.S.C. §	Claims	Prior Art Reference(s)
1	103	1, 2, 7-12, 17-20	Thomason, Pacurariu
2	103	3-6, 13-16	Thomason, Pacurariu, Watanabe
3	103	1, 2, 7-12, 17-20	Voss, Derbanne
4	103	3-6, 13-16	Voss, Derbanne, Watanabe

Petition (Paper 2), 8

Voss-Derbanne-Watanabe Combination



Watanabe (Ex. 1006)

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

Integrating Watanabe results in an improved image processing pipeline, in which distortion is removed to allow for accurate image correction (including horizon-leveling) and then added back. (EX1019, ¶108.)

Reply (Paper 32), 32-33

ITC's Invalidity Findings

ITC's Invalidity Findings

CONTAINS CONFIDENTIAL BUSINESS INFORMATION
SUBJECT TO PROTECTIVE ORDER

UNITED STATES INTERNATIONAL TRADE COMMISSION

Washington, D.C.

In the Matter of

CERTAIN CAMERAS, CAMERA
SYSTEMS, AND ACCESSORIES USED
THEREWITH

Inv. No. 337-TA-1400

INITIAL DETERMINATION ON VIOLATION OF SECTION 337 AND
RECOMMENDED DETERMINATION ON REMEDY AND BOND

Administrative Law Judge Doris Johnson Hines

(July 10, 2025)

Appearances:

For Complainant GoPro, Inc.:

S. Alex Lasher of Quinn Emanuel Urquhart & Sullivan, LLP, Washington, D.C., Sean S. Pak of Quinn Emanuel Urquhart & Sullivan, LLP, San Francisco, California, Patrick T. Schmidt of Quinn Emanuel Urquhart & Sullivan, LLP, Los Angeles, California, Nathan Hamstra of Quinn Emanuel Urquhart & Sullivan, LLP, Chicago, Illinois, and Jason C. Williams of Quinn Emanuel Urquhart & Sullivan, LLP, New York, New York.

For Respondents Arashi Vision Inc. d/b/a Insta360 and Arashi Vision (U.S.) LLC d/b/a Insta360.:

Mark L. Whitaker, Mary Prendergast, Jenna H. Seleznick, Maryrose F. McLaughlin of Morrison & Foerster LLP, Washington, D.C., Lily Li, Stella Mao, Evelyn Li-Jin Chang of Morrison & Foerster LLP, Palo Alto, California, Alex S. Yap, Ryan Malloy of Morrison & Foerster LLP, Los Angeles, California, Richard S. J. Hung of Morrison & Foerster LLP, San Francisco, California, and Nishi Tavernier of Morrison & Foerster LLP, New York, New York.

Clear and convincing evidence:

1. Claim 1 is anticipated by Thomason.
2. Claim 7 is anticipated by Thomason.
3. Claim 8 is anticipated by Thomason.
4. Claims 3 and 4 are obvious over Thomason and Watanabe.

EX1027, 21-28

The Commission Declined to Review ALJ's Initial Determination of Invalidity

Petitioner's Motion to Strike

Petitioner's Motion To Strike Sur-Reply

1. Improper New Claim Construction Argument on Voss

- a. POR mischaracterized that Voss always “crops” its inset rectangle and ignored Voss’ disclosure of “letter boxing” and “pillar boxing.” (EX1007, 10:20-21; POR (Paper 32), 27.)
- b. Sur-Reply changes course on Voss and focuses, for the first time, on Voss’ example involving “oscillat[ing].” (Sur-Reply (*Paper 39*), 17-21.) Sur-Reply also 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.*
- c. POR rests on one theory (based on Voss’ disclosure of “cropping”) while the Sur-Reply advances another (relying on a sentence on “oscillat[ing]”).
- d. The term “configured” does not carry the restrictive construction GoPro proposes. See, e.g., *Nevro Corp. v. Boston Scientific Corp.*, 955 F.3d 35, 41-42 (Fed. Cir. 2020).
- e. Voss’ example involving “oscillat[ing]” discloses the claim. Voss also discloses several “pillar boxing” examples without “oscillat[ing]” or “cropping.” (See, e.g., EX1007, 11:5-7, Abstract.)

Petitioner's Motion To Strike Sur-Reply

2. Improper New Reliance on EX2004

- a. EX2004 was only mentioned in discussing secondary considerations in GoPro's POR. (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. (POPR (*Paper 6*), 16-18, 23.) Regardless, GoPro has waived its argument based on EX2004 in the Sur-Reply. See *In re NuVasive, Inc.*, 842 F.3d 1376, 1380-81 (Fed. Cir. 2016).
- b. New reliance on EX2004 is not responsive to a new argument. Petition made clear that the Thomason-Pacurariu combination discloses frame-by-frame size determination. (Petition (*Paper 2*), 19-31, 37-40.) GoPro had the opportunity to address these arguments in its POR but chose not to.

Petitioner's Motion To Strike Sur-Reply

3. Improper New Position on “location”

- a. GoPro has taken directly contradictory positions on whether claims 10 and 20 require the location of the viewing window to change. (POR (*Paper 25*), 36 (“[t]he viewing window cannot have the same location throughout the video”); Sur-Reply (*Paper 39*), 10 (“[t]here may be circumstances where location is determined to be the same across frames”).)

4. Patent Owner's Shift to Arguing Presumption of Nexus and Unmet Need

- a. POR argued “there is a **direct** nexus between GoPro's Horizon Leveling and the objective evidence.” (POR (*Paper 25*), 73 (emphasis added).)
- b. Sur-Reply argued “a **presumption** of nexus.” (Sur-Reply (*Paper 39*), 26 (emphasis added).)
- c. For the first time, GoPro raises “unmet need” as a secondary consideration. (Sur-Reply (*Paper 39*), 27-28.)

PO's Motion to Strike

Petitioner's Opposition to Patent Owner's Motion To Strike

1. Original Thomason + Pacurariu + Watanabe Combination

- a. Petition mapped both “51” (“an image captured by the image sensor” as described in Watanabe) and “54” (an image with added distortion) to “the visual content” in claim 3. (Petition (*Paper 2*), 48-49.)
- b. GoPro's POPR did not mention Watanabe, let alone disputing the mappings above. (POPR (*Paper 7*), 6.) Nor did it propose any construction for “visual content.” *Id.*
- c. Reply pointed to an existing mapping in the Petition that would still meet GoPro's new construction. (Reply (*Paper 32*), 22-24.)
- d. GoPro's own POR and expert testimony underscore the obviousness: using the Thomason-Pacurariu horizon-leveling system for amateur cameras yields distortions in the original visual content. (POR (*Paper 25*), 29; EX1018, 40:8-16, 41:11-17.)

Petitioner's Opposition to Patent Owner's Motion To Strike

2. Obvious-to-Try Rationale for Voss-Derbanne

- a. Reply elaborated on Petition's obvious-to-try rationale. (Petition (Paper 2), 62.)
- b. Directly responsive to GoPro's argument regarding "finite number of solutions", Insta360 and its expert offered well-known predictable solutions in one sentence in the Reply. (Reply (*Paper 32*), 32.)
- c. GoPro incorrectly labeled that one-sentence elaboration as a "new theory" and a "new ground" to which it "is unable to fully respond." (PO Motion to Strike (*Paper 37*), 4-5.) GoPro's attempt to undermine the Voss-Derbanne combination on the premise that it is "limited in the length of its sur-reply" is improper.
- d. Petition also presented multiple rationales to combine Voss and Derbanne, which the Board preliminarily agreed with. (Petition (Paper 2), 62; DI (Paper 10), 46.)

Certificate of Service (37 C.F.R. § 42.6(e)(4))

I hereby certify that the attached PETITIONER'S DEMONSTRATIVES
was served as of the below date via e-mail (by agreement) to the following counsel
of record for Patent Owner:

James M. Glass, Registration No. 46,729
John T. McKee, Registration No. 65,926
Quincy Lu, Registration No. 76,954
Patrick Schmidt (*pro hac vice*)
Nima Hefazi, Registration No. 63,658
Quinn Emanuel Urquhart & Sullivan LLP
Email: jimglass@quinnemanuel.com
Email: johnmckee@quinnemanuel.com
Email: quincylu@quinnemanuel.com
Email: patrickschmidt@quinnemanuel.com
Email: nimahefazi@quinnemanuel.com

Dated: October 3, 2025

By: /s/ Yunan Yuan
Yunan Yuan