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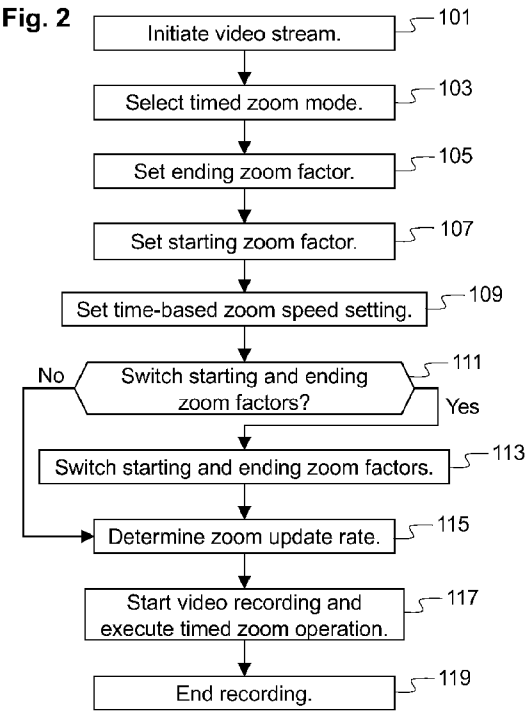
Fig. 2



(57) Abstract: The present invention relates a method of controlling a zoom on a camera apparatus. The method comprises the steps of: selecting (103) a zoom mode; setting (105) an ending zoom factor for a zoom operation; setting (107) a starting zoom factor for the zoom operation, the difference between the ending zoom factor and the starting zoom factor defines a zoom range for the zoom operation; setting (109) a zoom speed setting value indicating directly or indirectly a zoom speed of the zoom operation; and starting (117) the zoom operation according to the selected zoom mode while recording a video by using the starting zoom factor as an initial zoom setting, and applying the set zoom speed setting value to the zoom operation while the zoom operation progresses.

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ALGORITHMIC CAMERA ZOOM CONTROLLER METHOD

TECHNICAL FIELD

The present invention relates to a method of precisely controlling a continuous, repeatable, and configurable zoom using one or more camera lenses on a camera apparatus, such as a handheld device, which may be a mobile phone. The present invention also relates to a camera apparatus configured to carry out the proposed method.

BACKGROUND OF THE INVENTION

Software camera control techniques on camera apparatuses, such as on mobile phones, include for example camera zoom control techniques, which are typically currently based on multi-touch input (i.e., sometimes informally known as “pinch to zoom”). The zoom speed is not controlled by a precise algorithmic setting, but instead, the method requires reading an input on a multi-touch display. This method is imprecise because of the variations caused by the input reading. In the same zoom therefore, some of the zoom could be controlled based on one multi-touch input at one speed whereas immediately following this speed, the multi-touch input can have variations impacting the speed causing it to slow down, speed up, jerk forward, skip backward, etc. in an imprecise way. Not only are there variations with the reading of the input, but the input itself is also dependent on the dimension of the multi-touch display where a smaller display will allow for an overall smaller zoom range while in addition the dexterity of the multi-touch input itself can cause variations between different multi-touches. In all cases, the current method does not make the ability to create, preview and record a seamless, precise, and repeatable zoom – regardless of the display size or dexterity of the multi-touch – from the maximum focal length to the minimum focal length, as well as any other starting or ending focal lengths, in any given multi-touch display. There is also an overall speed limitation at the extremes (i.e., it is not possible for the input to create, preview and record a full zoom across one or more camera lenses, at the fastest end, for example in half a second, or at the slowest end, for example in 60 seconds or greater). Pinch to zoom is imprecise and depends on the multi-gesture input. This means that it is not possible to precisely reproduce the behavior because of the display and multi-touch factors. The current method also requires a multi-touch input to be read, so that it is not possible to achieve a precise zoom.

SUMMARY OF THE INVENTION

It is an object of the present invention to overcome at least some of the problems identified above related to camera zoom operations, which may be carried out with handheld camera apparatuses, such as with mobile phones.

According to a first aspect of the invention, there is provided a method of controlling a zoom on a camera apparatus as recited in claim 1.

The advantages of the proposed method are multi-faceted. The key advantages include: 1) precision; 2) repeatability; 3) adaptability; 4) fingerless control; and 5) simplicity.

In the case of precision, the proposed algorithm allows for “clocked” zoom speed settings that are user selectable. A user is given the possibility to choose a precise speed the zoom should travel from a choice of zoom speed settings (for example 0.5 s, 30 s, 60 s when the zoom speed is expressed in seconds) from a starting zoom factor to an ending zoom factor. The different speeds can be labeled with icons on a display of the camera apparatus. The zoom speed value may be any value from a given zoom speed range. A suitable range may be for instance 0.5 s to 100 s, or more specifically 0.5 s to 60 s.

In the case of repeatability, the user can take any desired number of shots with the exact same zoom speed. Therefore, if the user wants to take different takes of a subject, which is quite common in semi-professional and professional settings, the user has confidence that each take will have the same zoom speed applied regardless of finger movement.

The invention proposes two different zoom modes, namely a first zoom mode, referred to as a timed zoom mode, and which is characterized by a first zoom speed setting, which may be expressed as a first time interval or period, and a second zoom mode, referred to as a servo zoom mode, and which is characterized by a second zoom speed setting, which may be expressed as a second, different time interval or period. The zoom speed setting indicates directly or indirectly a zoom speed of the zoom operation. In the case of adaptability, the servo zoom setting can be changed while shooting while at the same time having user interface input controls available for the user. Furthermore, in the case of the servo zoom mode, the user can start a shot with one servo zoom speed setting and then either increase/decrease the speed in the

same shot. The user is also able to switch between either the timed zoom mode or the servo zoom mode in the same recording.

In the case of fingerless control, the user is able to set an exact starting zoom factor (starting focal length) and a corresponding ending zoom factor (ending focal length). It is to be noted that by a zoom factor is understood in the present description the zoom level of the lens that is used in the zoom operation. In other words, the zoom factor expresses the current level of magnification of the original image. For example, a real-world object (for instance a tree) projected on an image surface that is 2000 px × 1000 px, where the zoom factor of the tree is 1x, which corresponds to a width of 100 px, the same object of the tree with a 2x zoom factor applied will now be 200 px wide whereas the image surface dimensions remain 2000 px × 1000 px. The zoom factor may thus be understood to be synonymous with focal length, or to have a linear relationship with focal length. A fingerless zoom is available in the timed zoom mode. More specifically, after having started the zoom operation by for example tapping an icon on the display of the camera apparatus, the zoom starts to travel between a start zoom factor and an end zoom factor without the user having to enter any further inputs. This allows the user to keep both hands on the phone for increased stability thereby solving one of the problems that mobile phone camera users are confronted with, namely shaky shots.

Finally, in the case of simplicity, the user interface may provide the user with a control ring module, which allows the user to experience effortless control over the zoom features as well as other video and audio controls. In the same shot, the user can easily change control between the servo zoom mode, the timed zoom mode, as well as exposure value, audio settings, and/or additional features.

According to a second aspect of the invention, there is provided a computer program product comprising instructions for implementing the steps of the method according to the first aspect of the present invention when loaded and run on the computing means of a camera apparatus.

According to a third aspect of the invention, there is provided a camera apparatus configured to carry out the method according to the first aspect of the invention.

Other aspects of the invention are recited in the dependent claims attached hereto.

BRIEF DESCRIPTION OF THE DRAWINGS

Other features and advantages of the invention will become apparent from the following description of a non-limiting exemplary embodiment, with reference to the appended drawings, in which:

- Figure 1 shows a simplified block diagram of a camera apparatus, which is arranged to carry out the proposed zoom controller method;
- Figure 2 shows a flow chart of an example timed zoom mode method according to the present invention;
- Figures 3 to 6 are different views of a graphical user interface of the timed zoom mode;
- Figure 7 shows a flow chart of an example servo zoom mode method according to the present invention;
- Figures 8 and 9 are different views of a graphical user interface of the servo zoom mode; and
- Figures 10a and 10b show the timed zoom and servo zoom mode methods in one flow chart.

DETAILED DESCRIPTION OF AN EMBODIMENT OF THE INVENTION

An embodiment of the present invention will now be described in detail with reference to the attached figures. This embodiment is described in the context of a precision-algorithmic-based automatic speed zoom controller method running on a camera device, which in the example below is a mobile or smart phone. Identical or corresponding functional and structural elements which appear in the different drawings are assigned the same reference numerals. When the words first and second are used to refer to different zoom modes or other operations, it is to be understood that this does not necessarily imply or mean that the first and second modes of operations need to be carried out in any particular order unless explicitly or implicitly stated. The word speed is to be understood in a broad sense to mean the rate at which something (e.g., the zoom) moves or travels or is able to move or travel, but which is not necessarily given in a traditional unit of speed, such as in m/s. In the embodiment explained below, the unit of speed is given in seconds, but any other appropriate unit may equally be used.

Figure 1 illustrates a simplified block diagram of a camera apparatus or device, which in this example is a mobile phone 1, which is configured to carry out the proposed zoom controller method. Only the functional elements of the device 1 that are useful for understanding the teachings of the present invention are shown in Figure 1. The device comprises a user interface unit 3, also referred to as a user interface, through which a user can control the operation of a camera application module or unit 5 of the device. The camera application module is understood to comprise necessary hardware components, and software for operating a camera application according to the teachings of the present invention. The hardware components comprise for instance a single-lens or multi-lens arrangement for recording videos. In this case, the user interface comprises a graphical user interface comprising a touch screen display. The graphical user interface allows the user to interact with the device through graphical icons, elements or symbols. The user interface may instead or in addition optionally comprise one or more individual physical buttons and/or voice control means for receiving voice commands. The user interface allows the user to input commands, also referred to as user inputs, to control the operation of the camera application and other functionalities of the device. A processing unit 7 is provided to retrieve or read and execute instructions. The processing unit is for instance configured to interpret and/or read user inputs received through the user interface 3 and to send instructions to the camera application.

The present invention proposes a precision-algorithmic-based automatic speed zoom controller method, which may be run on the device 1 of Figure 1. The method can selectively be operated in a first operational or zoom mode, referred to as a timed zoom mode, and in a second operational or zoom mode, referred to as a servo zoom mode. The method can be controlled automatically via the timed zoom mode based on a first zoom speed setting or parameter or a first zoom-speed-related setting, which is a configured time setting allowing for zooming between two zoom factors based on a time-based speed setting. Alternatively, the method can be controlled variably via the servo zoom mode based on a second zoom speed setting or parameter or a second zoom-speed-related setting.

The proposed method removes all ambiguity of the traditional “pinch to zoom” method through the addition of an algorithm which allows for a precise, repeatable, and configurable speed between any two zoom factors at any configured zoom speed. This can be achieved in both a variable zoom range when in the servo zoom mode (the starting zoom factor is when the reading occurs, whereas the ending

zoom factor is obtained when the user input is no longer being read, where the zoom speed between the two zoom factors is based on the selected speed setting, which may be given in seconds), and a fixed zoom range when in the timed zoom mode (the starting and ending zoom factors are pre-selected, and starting the recording controls the zoom range based on the selected time-based zoom speed setting).

In the servo zoom mode, a selected zoom speed setting value precisely controls the variable zoom range. In this mode, the zoom operation commences with a single input, where the input reading itself does not control the speed of the zoom as the algorithm controls the zoom speed independently of the input reading, eliminating the imprecision based on a “pinch to zoom” method. In the servo zoom mode, the zoom speed setting defines a time duration or period (expressed for instance in seconds) required for the zoom to reach a given zoom multiplier. The zoom multiplier may for instance be a 5x zoom multiplier, or any other suitable zoom multiplier, such as 2x, 3x, 4x, 6x, 7x, etc. In this case, the zoom speed setting would define a time duration for the zoom to travel from a 1x zoom to a 6x zoom, or vice versa, where Yx zoom means that the camera lens can enlarge an object projected on an image surface Y times. Therefore, if the speed setting is selected for a finite amount of time (e.g., five seconds for a 5x zoom multiplication difference as in the above example), a repeatable and reproducible zoom is possible creating an exact copy of the zoom factor independent of input reading. By configuring the zoom behavior, the speed of the zoom is now controlled in a predictable way. It is possible to replicate this zoom behavior an endless number of times with an extremely high predictability. In addition, this invention allows for reproducibility as well as granularity in that any speed setting is possible based on the algorithm, which can precisely control the increase/decrease of the starting and ending zoom factors based on a predetermined speed setting. In addition, the servo zoom mode allows the speed setting to be continuously changed so that it is possible to have a recording with an unlimited number of different zoom speeds within the same recording.

In the case of the timed zoom mode, an algorithm is provided that processes a time-based speed setting (expressed for example in seconds) that is then applied to the camera application to seamlessly zoom between a selected starting zoom factor and an ending zoom factor. No input reading is required (apart from an input reading launching the zoom operation), and based on the chosen time-based zoom speed setting value, the zoom automatically starts at the starting zoom factor and ends at the ending zoom factor once the recording, or more specifically the zoom

operation is started. In both modes, the same algorithm is used, either in a time-based zoom speed setting between fixed starting and ending zoom factors in the timed zoom mode, or in a speed setting between a starting zoom factor and a variable ending zoom factor based on the reading of an input in the servo zoom mode. Therefore, based on either the fixed zoom range (timed zoom mode) or variable zoom range (servo zoom mode), the algorithm calculates the average velocity required in the zoom range thereby controlling the camera lens.

The present invention is next described with reference to the flow charts of Figures 2, 7, 10a, and 10b. The flow chart of Figure 2 illustrates an example operation of the timed zoom mode. In step 101, a video stream is initiated. More specifically, the camera application is set to a video preview mode. In this mode, the camera application is open and ready to record a video, but no recording takes place yet. In step 103, the timed zoom mode is selected or set. In this example, the selection is made by the user, and this selection is then read by the processing unit 7. This also means that the user interface is configured to receive user inputs specific to this mode of operation. More specifically, in this example, the user interface shows on the display of the device some icons and/or symbols specific to this mode of operation. Figure 3 shows an example view of the graphical user interface when the timed zoom mode has been selected. In step 105, a first zoom factor, which in this example is an ending zoom factor, is set or selected. In this example, the ending zoom factor is selected by the user by using the user interface. This selection is then read and/or interpreted by the processing unit, and the camera application is then informed accordingly. The ending zoom factor may be set to be the current zoom factor of the camera application, or any other suitable value selected by the user. Figure 4 shows an example view of the graphical user interface when the ending zoom factor has been selected (in this example 13 mm). The zoom operation to be carried out in this example is a zoom-out operation. As can be seen, in this example, a control ring element 9 is shown on the display to allow the user to select the ending zoom factor by rotating the control ring element.

In step 107, a second zoom factor, which in this example is the starting zoom factor, is set or selected. In this example, the starting zoom factor is selected by the user by using the user interface. This selection is then read and/or interpreted by the processing unit 7, and the camera application is then informed accordingly. Figure 5 shows an example view of the graphical user interface when the starting zoom factor has been selected. The control ring element 9 is again used by the user to

make the selection. In this particular case, the starting zoom factor was set to 82 mm. In step 109, the zoom speed setting value of the timed zoom mode is set or selected. This selection is again made by the user through the user interface. In the example of Figures 4 to 6, the zoom speed setting value was set to 35 seconds. The speed setting in the timed zoom mode is a time-based setting. More specifically, the zoom speed setting value in the present case indicates the time required for the zoom to travel from the starting zoom factor to the ending zoom factor. In other words, once the recording is started, the zoom range from the starting zoom factor (in this example 82 mm) to the ending zoom factor (in this example 13 mm) will take place in 35 seconds. Figure 6 shows the focal length of the lens (i.e., 56 mm) 9 seconds after the timed zoom started. If no zoom speed setting value is set by the user, then the camera application uses a default zoom speed setting value, or a previous zoom speed setting value, which are pre-defined time durations. In all the scenarios, the speed setting value is read by the processing unit 7, which forwards the read zoom speed setting value to the camera application module 5. In other words, the zoom speed setting value is set in the camera application in response to a detected input from the user (or using a previous or default value).

In step 111, it is determined whether or not the starting and ending zoom factors should be switched. For example, the user may want to switch the zoom factors so that the ending zoom factor becomes the starting zoom factor, while the starting zoom factor becomes the ending zoom factor. In this case, the user enters the corresponding input(s) through the user interface 3 which is/are again read and/or interpreted by the processing unit 7, which then informs the camera application module 5 accordingly. Thus, if it is determined that the starting and ending zoom factors should be switched, then in step 113, the switching takes place. If on the other hand no switching is necessary, then the process continues in step 115. In this step, the zoom update rate is determined. In this example, the zoom is updated so that the transition between zoom levels (zoom factors) is exponential, leading to a visually linear zoom transition between the zoom levels. The zoom update rate is obtained from the zoom speed setting value, the starting zoom factor, and the ending zoom factor. In this case, the rate of change is defined as powers of two per second (which is the exponential part of the change), which means that it would take one second to double the current zoom level (when the starting zoom level is lower than the final zoom level according to a “zoom in” operation) or halve it (“zoom out” operation) for the rate of 1. Mathematically speaking, the rate is in this example defined as:

$$zoom\ update\ rate = \frac{log_2 \frac{\max\ (starting\ zoom\ factor, ending\ zoom\ factor)}{\min\ (starting\ zoom\ factor, ending\ zoom\ factor}}{zoom\ speed\ setting\ value}.$$

In step 117, the video recording is started, and the timed zoom operation is executed. This step is illustrated in Figure 6. The commands are again received through the user interface 3 and read by the processing unit 7. In step 119, the recording is terminated, and the camera application module 5 outputs the recording file, which can then be saved to disk. In this example, the termination command is given by the user through the user interface. It is to be noted that the zoom operation may end before the recording is terminated. In other words, the zoom operation and the video recording do not have to end simultaneously. Furthermore, in the flow chart of Figure 2, the order of the steps may be changed. For example, steps 105 to 109 may be carried out in any order.

The flow chart of Figure 7 illustrates an example operation of the servo zoom mode. In step 201, a video stream is initiated. More specifically, the camera application is set to a video preview mode. In this mode, the camera application is open and ready to record a video, but no recording takes place yet. In step 203, the recording is started. In step 205, the zoom speed setting value is set or selected. In this case, the speed setting value is selected by the user through the user interface 3, and the processing unit 7 reads and/or interprets the user input. Different zoom speed setting values can be labeled with different icons 11 shown on the display of the camera apparatus 1 as shown in Figure 8. The icons 11 may optionally show the respective zoom speed setting value. If the user does not select any zoom speed setting value, then a default zoom speed setting value or a previously selected zoom speed setting value may be used. Thus, the zoom speed setting value is set in the camera application in response to a detected input from the user (or using a previous or default value). It is to be noted that in the servo zoom mode, the different zoom speed setting values have their specific pre-calculated zoom update rate associated with the given zoom speed setting value. In step 207, the servo zoom mode is selected or set. In this example, the selection is made by the user, and the selection is read by the processing unit 7. This also means that the user interface is configured to receive user inputs specific to this mode of operation. More specifically, in this example, the user interface shows on the display of the device some icons and/or symbols specific to this mode of operation.

In step 209, the user enters zoom commands through the user interface. The commands are then read by the processing unit 7. In particular, the user either enters manual commands to zoom in or out, for example by long pressing (i.e., by touching and holding) on a zoom-in button or icon 13, or a zoom-out button or icon 15 according to the desired zoom operation as shown in Figure 9. While the user gives zoom commands (in this case by touching and holding a zoom-in or zoom-out icon on the display), the camera application module 5 executes the servo zoom operation. This also means that the zoom factor is updated based on the detected user input(s). In other words, the ending zoom factor during the zoom operation is obtained as follows: $ending\ zoom\ factor = starting\ zoom\ factor \pm zoom\ speed\ setting\ value \times user\ input\ duration$. In this example, the user input duration is thus the duration of a long press operation of a display icon or button.

In the servo zoom mode, the ending zoom factor is not known in advance, (i.e., before the zoom operation ends), but the zoom factor is incrementally increased/decreased while user input (read long press input of the user) is active. This may in reality be implemented so that a batch of small sequential zoom updates yields to the effect from the above equation. Nonetheless, for both interpretations (small batch updates vs final servo zoom change) the equations are the same, the only difference being the duration, which is very short for the batch update. According to a concrete example, we can think of going from 1x (the starting zoom factor) to 5x (the ending zoom factor) by long pressing a button icon for 4 seconds and increasing zoom by 0.1x every 0.1 seconds. That rate means the change of 1x during a time period of 1 second. After 4 seconds, the operation will end up with a 5x zoom. In step 211, the recording is terminated, and the camera application module 5 outputs the video recording file, which can then be saved to disk. It is to be noted that also in the servo zoom mode, the order of the above steps may be changed. For example, steps 203, 205, and 207 may be carried out in any order.

As in the timed zoom operation, also in the servo zoom operation, the zoom operation may end before the recording is terminated. In other words, the zoom operation and the video recording do not have to end simultaneously. Furthermore, step 209 may be repeated a plurality of times. These different zoom operations may optionally use different zoom speed settings. Moreover, some of the zoom operations may be zoom-in operations, and some of them may be zoom-out operations.

The flow chart of Figures 10a and 10b illustrates an example combined operation of the servo zoom and timed zoom modes. In step 301, a video stream is initiated. In step 303, video recording is started without necessarily applying any zoom yet. In step 305, a servo zoom speed setting is set and read by the processing unit 7. This setting may be selected by the user, but if no user selection takes place, then a default servo zoom speed setting value or a previous servo zoom speed setting value may be used instead. In step 307, it is determined whether or not the servo zoom mode is selected. In the affirmative, the process continues in step 309, where the user enters zoom commands through the user interface 3, which are read by the processing unit 7. In this manner, the servo zoom mode operation is executed. As explained above, in this mode, the user manually gives zoom commands repeatedly or continuously through the user interface by long pressing an element of the user interface 3.

The process then continues in step 311, where it is determined whether or not the timed zoom mode is selected. The process also continues in this step if no servo zoom mode was selected in step 307. If the timed zoom mode is now selected, then in step 313, the ending zoom factor is set. In this example, the ending zoom factor is selected by the user by using the user interface. This selection is then read by the processing unit 7, which informs the camera application module 5 accordingly. The ending zoom factor may be set to be the current zoom factor of the camera application. In step 315, the starting zoom factor is set or selected. In this example, the starting zoom factor is selected by the user by using the user interface. This selection is then read by the processing unit 7, and the camera application is then informed accordingly. In step 317, the zoom speed setting value of the timed zoom mode is set or selected. This selection again made by the user through the user interface. If no zoom speed setting value is set by the user, then the camera application uses a default zoom speed setting value, which is a pre-defined time duration.

In step 319, it is determined whether or not the starting and ending zoom factors should be switched? For example, the user may want to switch the zoom factors so that the ending zoom factor becomes the starting zoom factor, while the starting zoom factor becomes the ending zoom factor. In this case, the user enters the corresponding inputs through the user interface 3 which are again read by the processing unit 7, which then informs the camera application module 5 accordingly. Thus, if it is determined that the starting and ending zoom factors should be switched,

then in step 321, the switching takes place. If on the other hand, no switching is necessary, then the process continues in step 323. In this step, the zoom update rate is determined. In step 325, the timed zoom operation is executed, i.e., in this example, the user starts the zoom operation according to the timed zoom operation. More specifically, the zoom operation starts from the starting zoom factor and ends as soon as the zoom has reached the ending zoom factor. The zoom operation takes place in the time duration defined by the timed zoom speed setting value. The user simply needs to start the zoom operation, but no further input is necessary from the user to reach the ending zoom factor. The video recording is then terminated in step 327. It is to be noted that if in step 311 no timed zoom mode was selected, then the process would also continue in step 327.

In the flow chart of Figures 10a and 10b, the servo zoom operation was explained to take place first, and the timed zoom operation was carried out after the servo zoom operation. However, it is equally possible to implement the timed zoom operation before the servo zoom operation. For example, the zoom operation may start by using the timed zoom operation, which may then be interrupted or stopped by implementing the servo zoom operation. It is also possible for instance to change the settings for the servo zoom operation while recording, and the user is able to switch between the timed zoom operation or the servo zoom operation in the same recording. In the case of the servo zoom operation, the user can start a recording with one servo zoom speed setting and then either increase/decrease the speed in the same recording. Finally, the user interface may implement a control ring shown on the display of the camera apparatus 1, which allows the user to experience effortless control over the zoom features as well as other video and audio controls. In the same recording, the user can easily change control between the servo zoom mode, the timed zoom mode as well as exposure value, audio settings and/or additional features.

As explained above, the present invention concerns a computer-implemented method of precisely controlling a continuous, repeatable, and configurable zoom using a camera apparatus featuring a single-lens camera or a multi-lens camera. The proposed method allows users to set different zoom speed programs to precisely control the zoom speed across the single/dual/triple/(eventually unlimited) camera configurations of camera apparatuses. By using software algorithms, the proposed method recreates the servo zoom feature of physical lenses as well as the mechanical nature of zoom controllers. The method comprises the step

of setting a zoom mode, which in the present example is either the timed zoom mode or the servo zoom mode. The method further comprises the step of choosing a zoom speed setting, which may define a first fixed time interval in the case of the timed zoom mode, which results in a corresponding zoomed recording duration, where the recording can continue after the timed zoom recording portion is executed and where the mode can be switched to the servo zoom mode in the same recording. In the case of the servo zoom mode, the zoom speed setting may define a second fixed time interval, which may be understood as a pre-defined zoom speed setting (for example 0.5 s for a 5x zoom factor multiplier). The zoom in this mode is controlled by reading a user input, and where the speed setting can be limitlessly changed in the course of a recording. The method additionally comprises the step of selecting a zoom range by choosing a starting zoom factor and an ending zoom factor, which in the case of the timed zoom mode is a fixed pre-defined zoom range in (for example the starting zoom factor is set to 13 mm and the ending zoom factor is set to 77 mm), or in the case of the servo zoom mode it is a variable zoom range based on the reading of the user input (i.e., the starting zoom factor is the focal length when an input is detected and read, whereas the ending zoom factor corresponds to the focal length when the input is released). An algorithm is provided that calculates the difference between the starting and ending zoom factors for the selected zoom speed setting. In the case of the timed zoom mode, the camera application automatically creates a recording of the chosen combination of a zoom range and the speed setting and saves it to disk while the recording can continue after the completion of the timed zoom operation. The user can switch to the servo zoom mode, and in the case of the servo zoom mode, the user can create a live preview and record a video of any length dependent on the phone hardware while switching the speed setting throughout the preview and/or recording. The recording is saved in a data file and saved to disk.

The above-described method steps may be carried out by suitable circuits or circuitry. The terms “circuits” and “circuitry” refer to physical electronic components or modules (e.g. hardware), and any software and/or firmware (“code”) that may configure the hardware, be executed by the hardware, and or otherwise be associated with the hardware. The circuits may thus be operable to carry out or they comprise means for carrying out the required method steps as described above.

While the invention has been illustrated and described in detail in the drawings and foregoing description, such illustration and description are to be considered illustrative or exemplary and not restrictive, the invention being not limited

to the disclosed embodiment. Other embodiments and variants are understood, and can be achieved by those skilled in the art when carrying out the claimed invention, based on a study of the drawings, the disclosure and the appended claims. For example, it is possible to combine any of the above teachings to obtain further variants.

In the claims, the word “comprising” does not exclude other elements or steps, and the indefinite article “a” or “an” does not exclude a plurality. The mere fact that different features are recited in mutually different dependent claims does not indicate that a combination of these features cannot be advantageously used. Any reference signs in the claims should not be construed as limiting the scope of the invention.

CLAIMS

1. A method of controlling a zoom on a camera apparatus (1), the method comprising the steps of:

selecting (103, 207) a zoom mode;

setting (105, 209) an ending zoom factor for a zoom operation;

setting (107, 211) a starting zoom factor for the zoom operation, the difference between the ending zoom factor and the starting zoom factor defines a zoom range for the zoom operation;

setting (109, 205) a zoom speed setting value indicating directly or indirectly a zoom speed of the zoom operation; and

starting (117, 209) the zoom operation according to the selected zoom mode while recording a video by using the starting zoom factor as an initial zoom setting, and applying the set zoom speed setting value to the zoom operation while the zoom operation progresses.

2. The method according to claim 1, wherein the zoom speed setting value for a first zoom mode indicates a time duration for the zoom operation to transition from the starting zoom factor to the ending zoom factor during the zoom operation, and the zoom speed setting value for a second zoom mode indicates a time duration for the zoom operation to perform a given zoom multiplication operation.

3. The method according to claim 1 or 2, wherein the method further comprises determining (115, 205) a zoom update rate prior to starting the zoom operation.

4. The method according to claim 3, wherein the zoom is updated so that the transition between zoom factors is exponential, leading to a visually linear zoom transition between the zoom factors.

5. The method according to claim 3 or 4, wherein the zoom update rate is based on the zoom speed setting value, the starting zoom factor, and the ending zoom factor.

6. The method according to any one of claims 3 to 5, wherein the zoom update rate is obtained as follows:

$$zoom\ update\ rate = \frac{log_2 \frac{\max\ (starting\ zoom\ factor, ending\ zoom\ factor)}{\min\ (starting\ zoom\ factor, ending\ zoom\ factor)}}{zoom\ speed\ setting\ value}.$$

7. The method according to any one of claims 3 to 5, wherein the zoom update rate is determined such that it leads to the ending zoom factor during the zoom operation as follows:

$$ending\ zoom\ factor =$$
$$starting\ zoom\ factor \pm zoom\ speed\ setting\ value\ \times user\ input\ duration.$$

8. The method according to any one of the preceding claims, wherein the method further comprises switching (113) the starting zoom factor and the ending zoom factor so that the starting zoom factor becomes the ending zoom factor, while the ending zoom factor becomes the starting zoom factor.

9. The method according to any one of the preceding claims, wherein the zoom operation is started as soon as a user input launching the zoom operation is detected, and the method further comprises ending (117) the zoom operation as soon as the ending zoom factor has been reached without reading any further user inputs relating to the zoom operation.

10. The method according to any one of claims 1 to 8, wherein the zoom operation is started as soon as a user input launching the zoom operation is detected, and the method further comprises ending (209) the zoom operation as soon as a release of the user input launching the zoom operation is detected.

11. The method according to claim 10, wherein the ending zoom factor corresponds to a zoom factor upon detecting the release of the user input launching the zoom operation.

12. The method according to any one of the preceding claims, wherein the zoom mode comprises a first zoom mode characterized by a pre-set zoom range, which is set prior to starting the zoom operation, and a second zoom mode characterized by a variable zoom range, the length of which being defined by a continuous user input duration.

13. The method according to claim 12, wherein the video recording comprises a first zoom operation according to the first zoom mode or the second zoom mode, followed by a second zoom operation according to the other one of the first and second zoom modes.

14. The method according to any one of the preceding claims, wherein the method further comprises starting (117) the video recording once the zoom speed setting value has been set.

15. The method according to any one of claims 1 to 13, wherein the method further comprises starting (203) the video recording prior to setting the zoom speed setting value.

16. The method according to any one of preceding claims, wherein the method further comprises showing a control ring as a graphical user interface element on a display of the camera apparatus (1) to allow a user to select the ending zoom factor and/or the starting zoom factor by rotating the control ring.

17. The method according to any one of preceding claims, wherein the method further comprises changing the zoom speed setting value in the same video recording.

18. A non-transitory computer program product comprising instructions for implementing the steps of the method according to any one of the preceding claims when loaded and run on computing means of a camera apparatus (1).

19. A camera apparatus (1) for controlling a zoom, the camera apparatus comprising means for:

selecting a zoom mode;

setting an ending zoom factor for a zoom operation;

setting a starting zoom factor for the zoom operation, the difference between the ending zoom factor and the starting zoom factor defines a zoom range for the zoom operation;

setting a zoom speed setting value indicating directly or indirectly a zoom speed of the zoom operation; and

starting the zoom operation according to the selected zoom mode while recording a video by using the starting zoom factor as an initial zoom setting, and applying the set zoom speed setting value to the zoom operation while the zoom operation progresses.

5

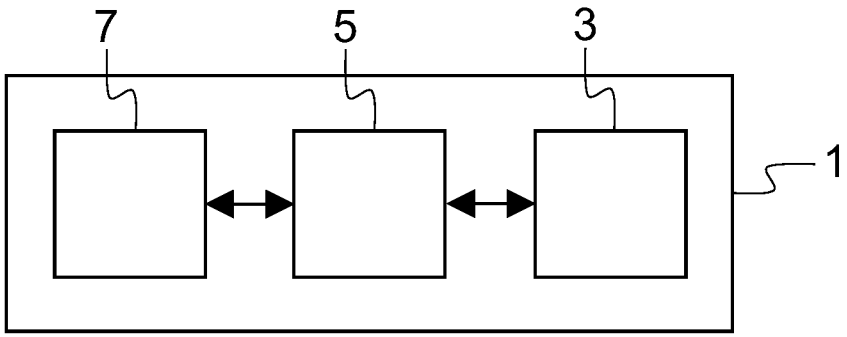

Fig. 1

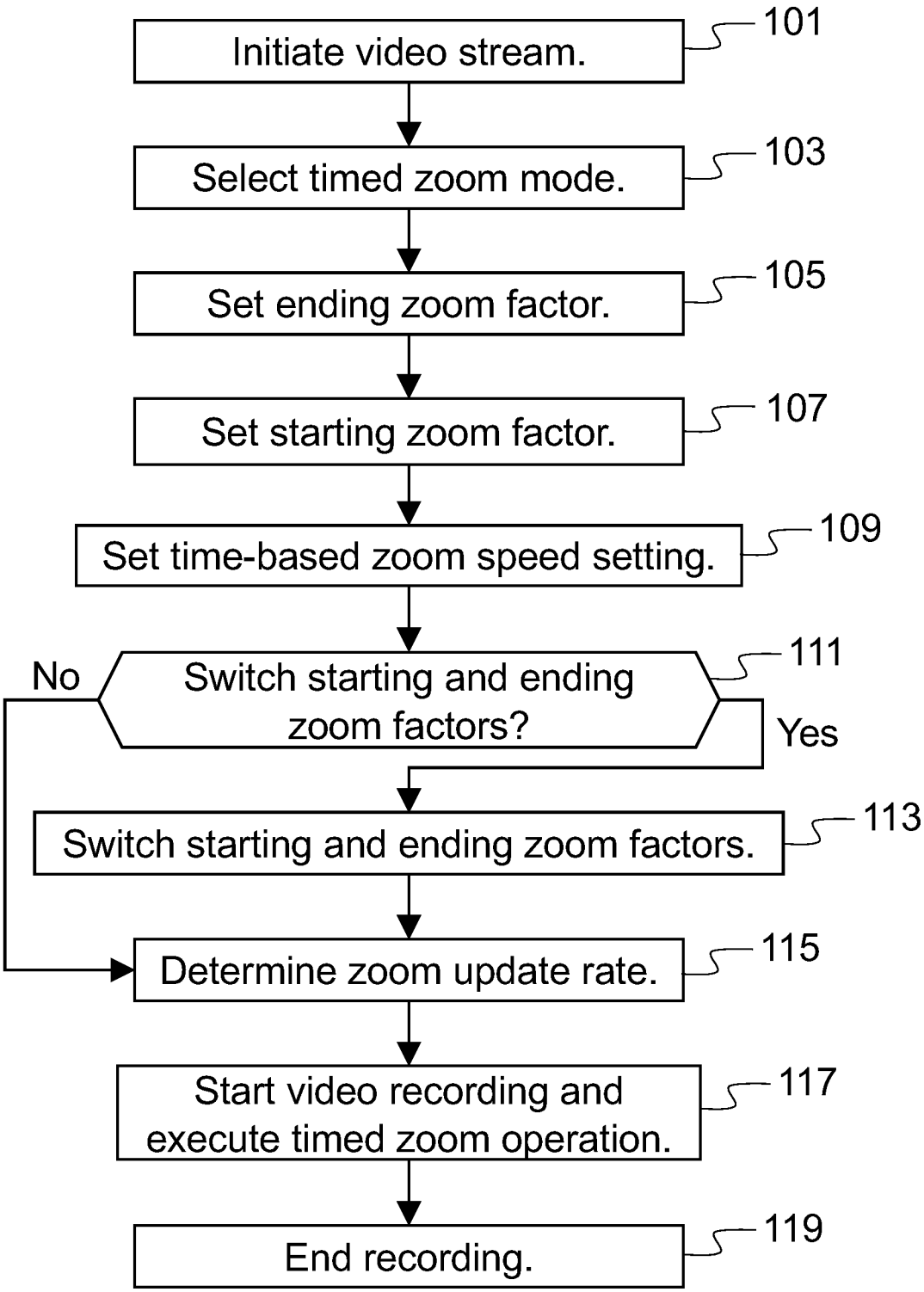
Initiate video stream.
101
Select timed zoom mode.
103
Set ending zoom factor.
105
Set starting zoom factor.
107
Set time-based zoom speed setting.
109
No
Switch starting and ending zoom factors?
111
Yes
Switch starting and ending zoom factors.
113
Determine zoom update rate.
115
Start video recording and execute timed zoom operation.
117
End recording.
119

Fig. 2

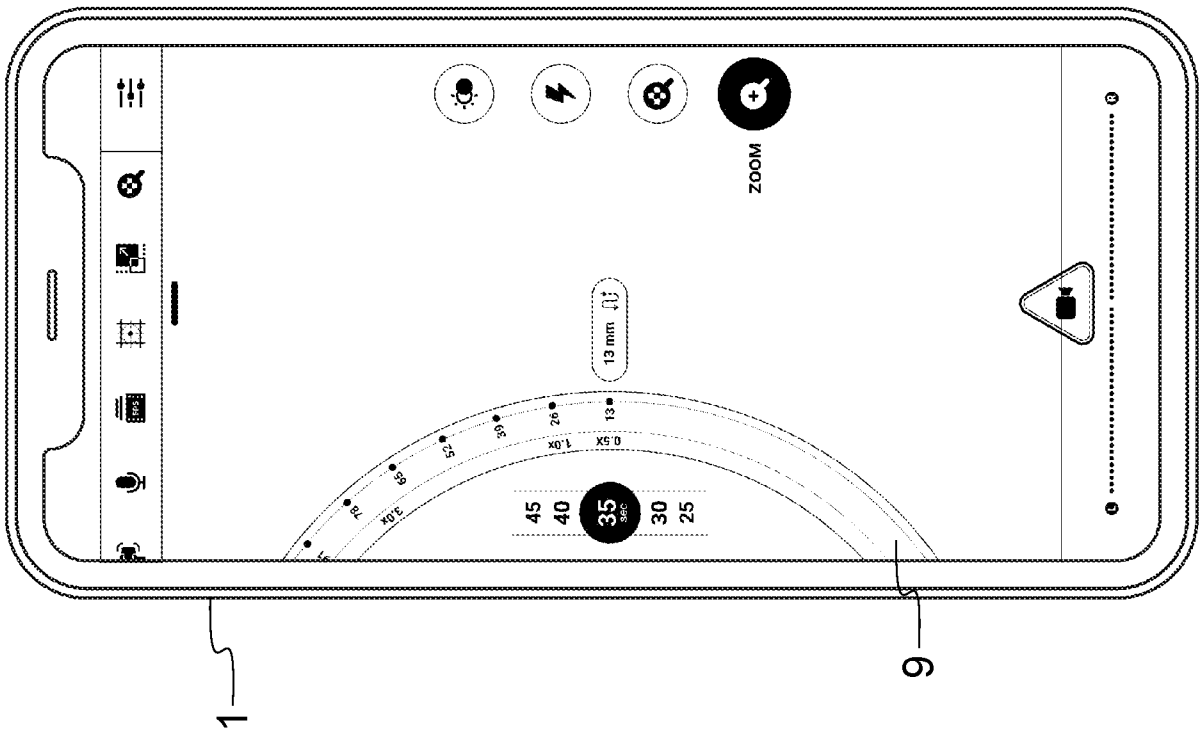

Fig. 4

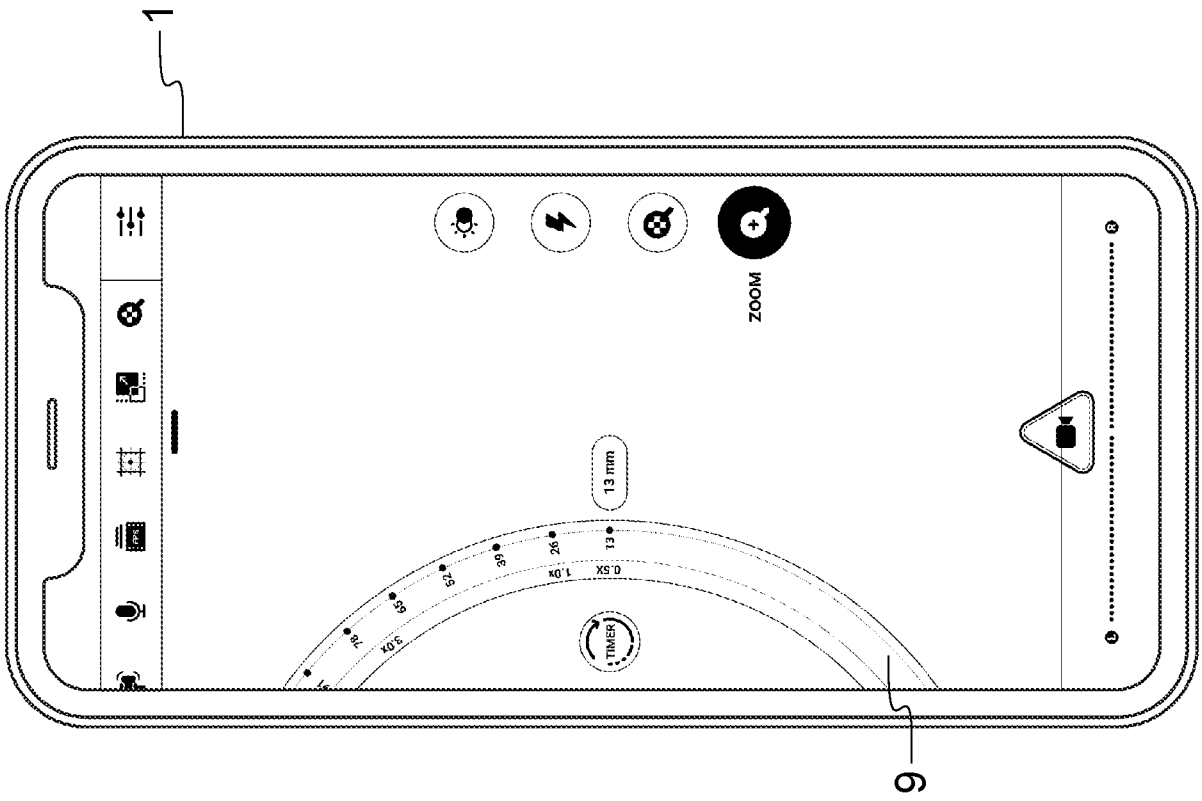

Fig. 3

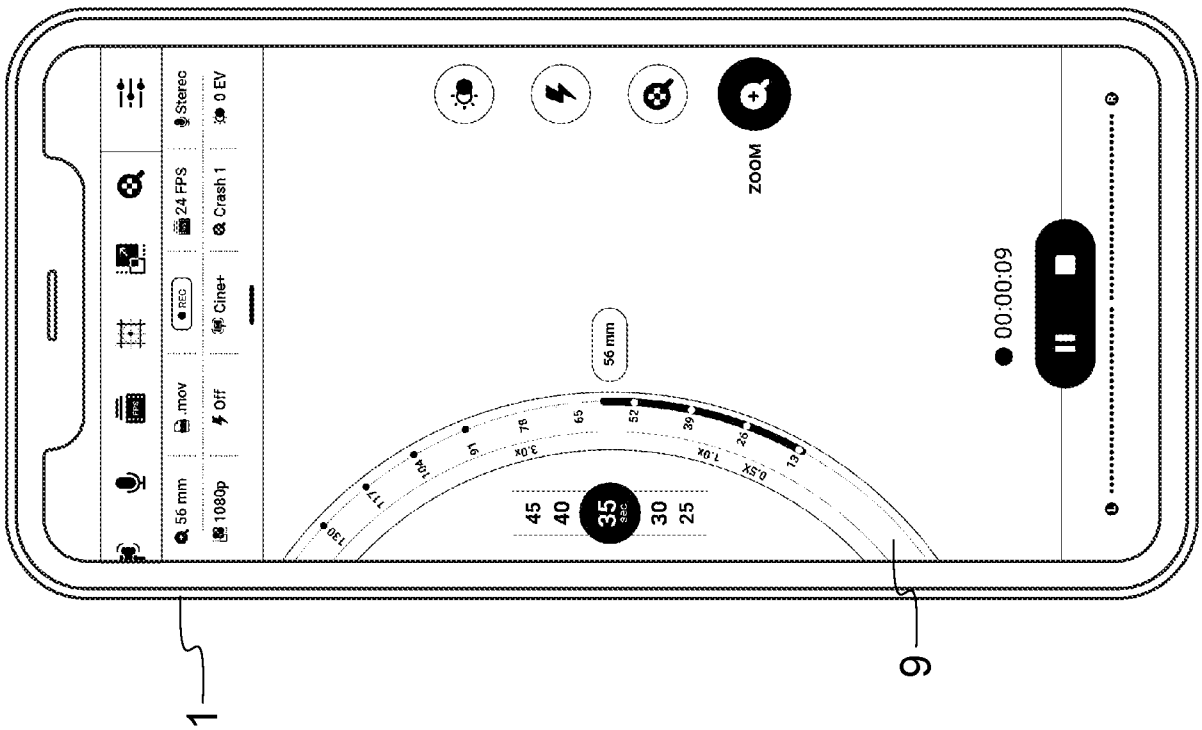
1
9
ZOOM
56 mm
1080p
.mov
Off
REC
Cine+
24 FPS
Crash 1
Stereo
0 EV
00:00:09
45 40 35 30 25
0.5X 1.0X 3.0X

Fig. 6

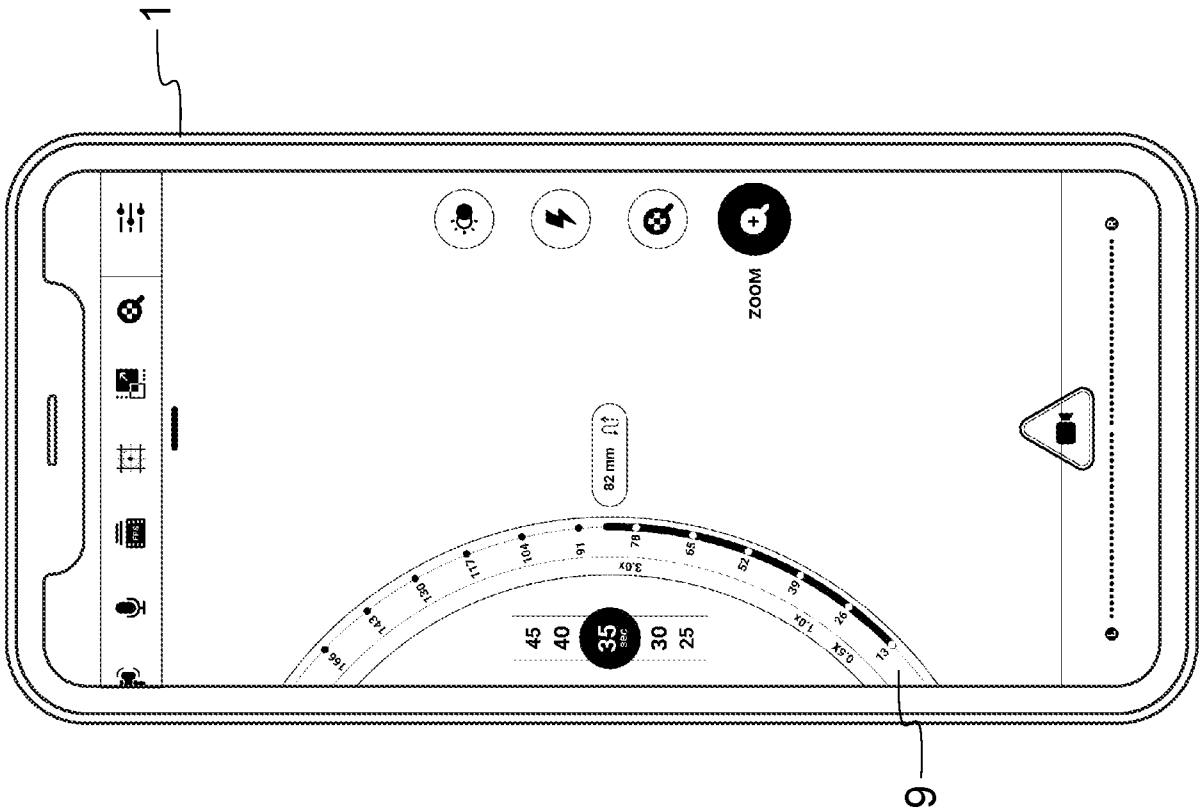
1
9
ZOOM
82 mm
45 40 35 30 25
0.5X 1.0X 3.0X

Fig. 5

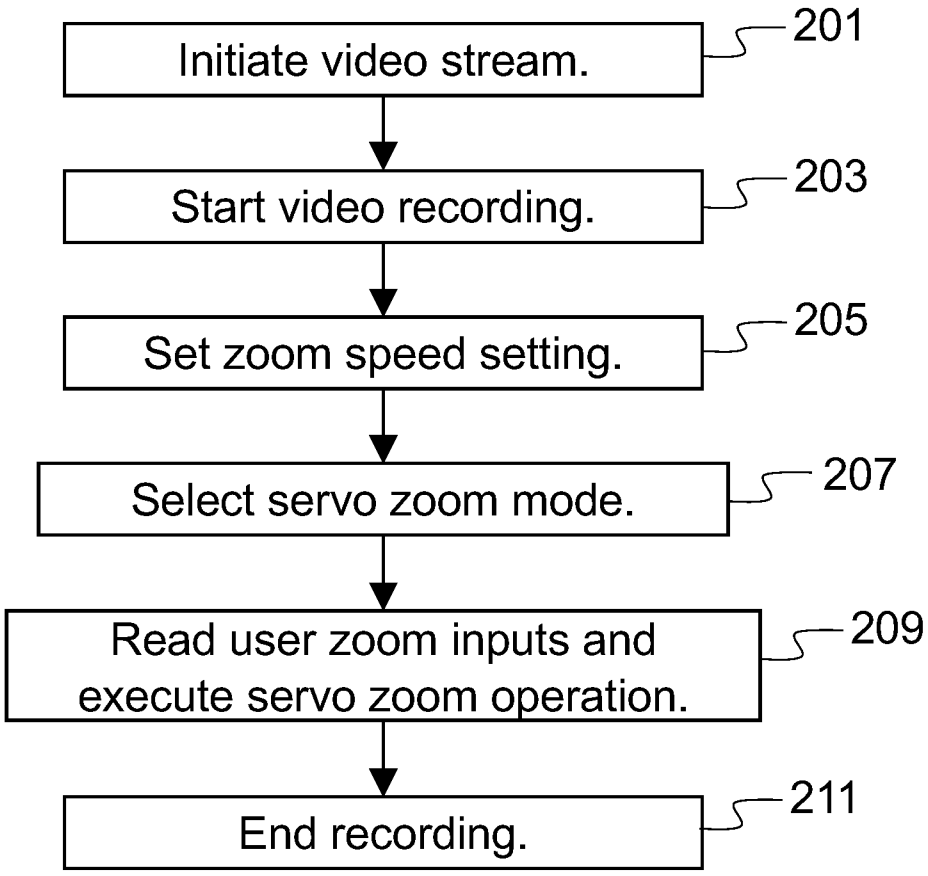
Initiate video stream.
201
Start video recording.
203
Set zoom speed setting.
205
Select servo zoom mode.
207
Read user zoom inputs and execute servo zoom operation.
209
End recording.
211

Fig. 7

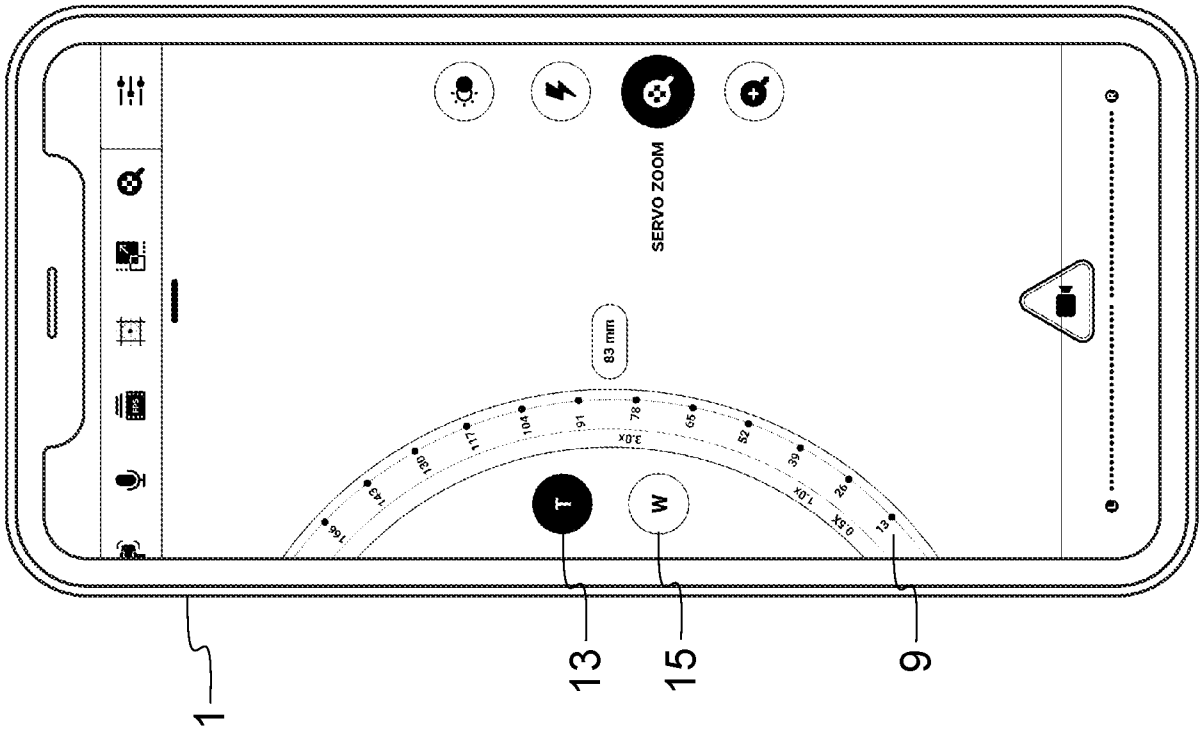
SERVO ZOOM
83 mm
T
W
1
13
15
9

Fig. 9

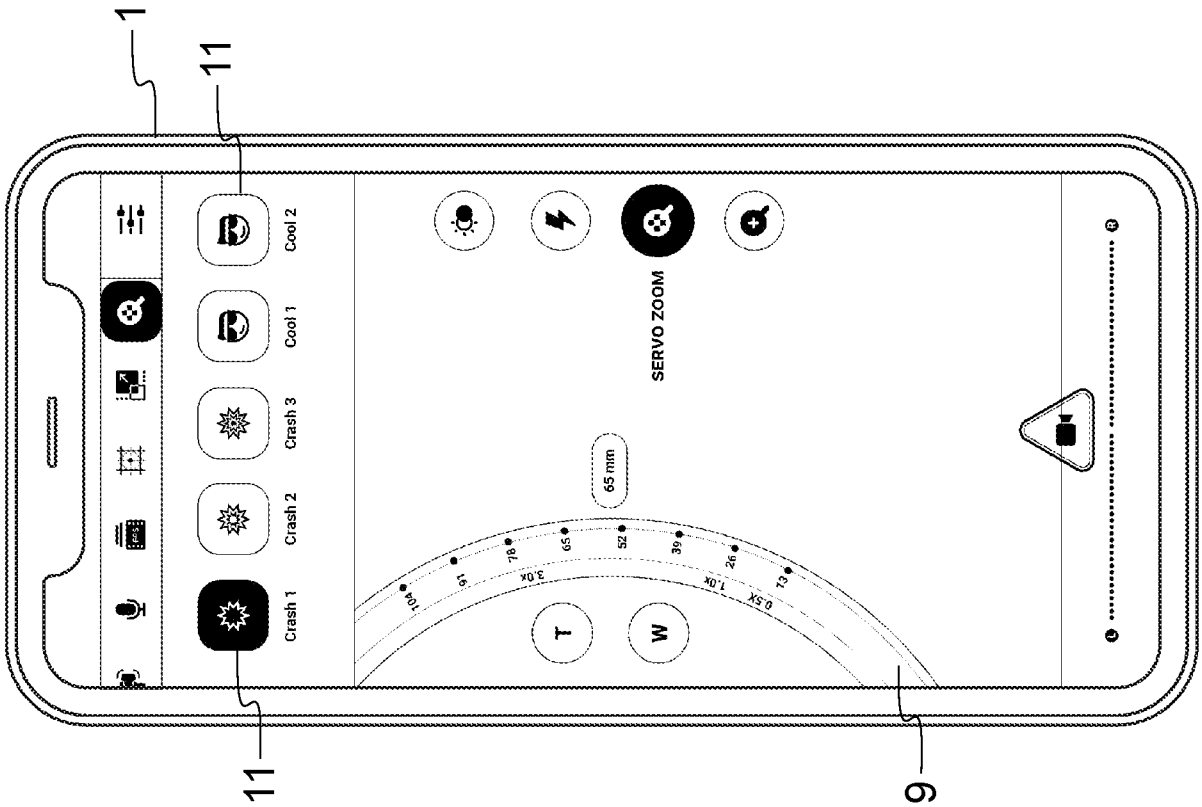
Cool 2
Cool 1
Crash 3
Crash 2
Crash 1
SERVO ZOOM
65 mm
T
W
1
11
11
9

Fig. 8

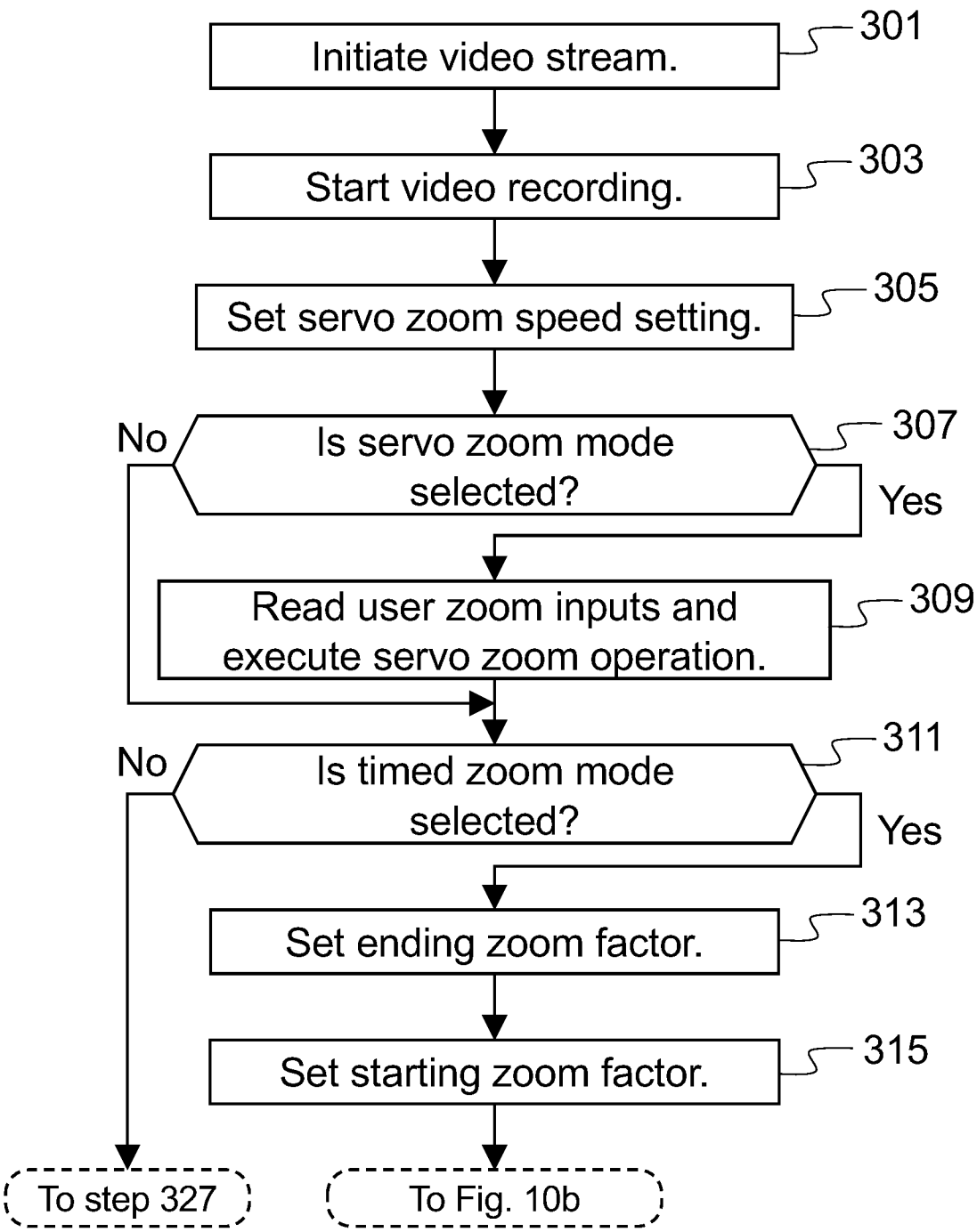
Initiate video stream.
301
Start video recording.
303
Set servo zoom speed setting.
305
No
Is servo zoom mode selected?
307
Yes
Read user zoom inputs and execute servo zoom operation.
309
No
Is timed zoom mode selected?
311
Yes
Set ending zoom factor.
313
Set starting zoom factor.
315
To step 327
To Fig. 10b

Fig. 10a

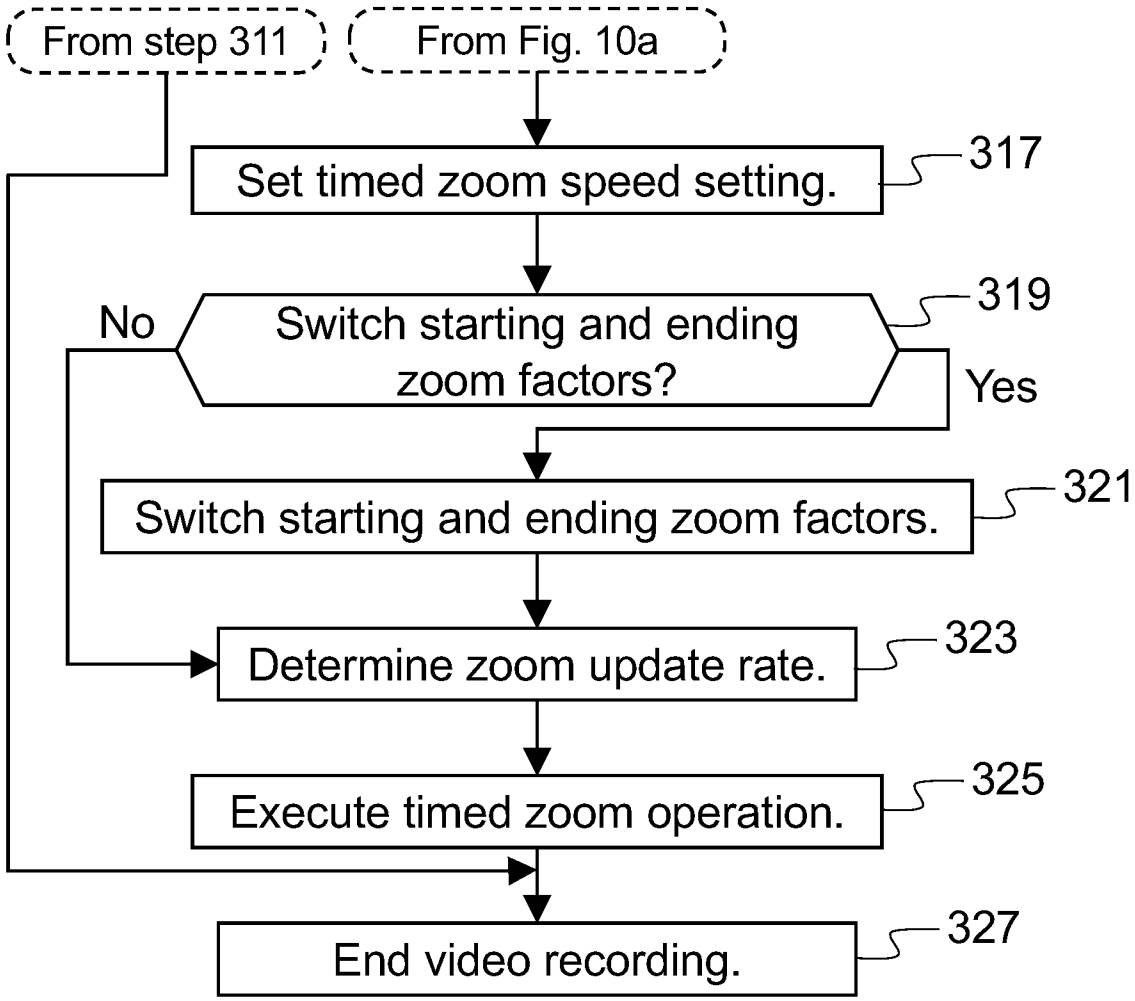
From step 311
From Fig. 10a
Set timed zoom speed setting.
317
Switch starting and ending zoom factors?
319
No
Yes
Switch starting and ending zoom factors.
321
Determine zoom update rate.
323
Execute timed zoom operation.
325
End video recording.
327

Fig. 10b

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2023/050490

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04N23/69 H04N23/63
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2021/289140 A1 (DOLGIN YURI [IL] ET AL) 16 September 2021 (2021-09-16)	1,3,5, 8-13, 17-19
Y	abstract	4,7,16
A	paragraph [0006] - paragraph [0013] paragraph [0038] paragraph [0061] - paragraph [0077] paragraph [0091] paragraph [0105] - paragraph [0135] figures 1-6	2,6,14, 15

-/--

[x] Further documents are listed in the continuation of Box C.

[x] See patent family annex.

* Special categories of cited documents :

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"E" earlier application or patent but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance;; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 March 2023	21/03/2023

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Schreib, Franz

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Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2023/050490

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 11 190 689 B1 (WANG YOUYOU [US] ET AL) 30 November 2021 (2021-11-30)	1,3,14, 15,18,19
Y	column 1, line 24 - line 28	2,4,6,7,
	column 4, line 60 - column 5, line 2	16
A	column 20, line 16 - line 19	5,8-13,
	column 20, line 53 - line 66	17
	column 21, line 58 - column 22, line 9	
	figures 1A-5C	

Y	WO 2015/061769 A1 (LIGHTCO INC [US]) 30 April 2015 (2015-04-30)	2,4,6
A	abstract	1,3,5,
	paragraph [0259] - paragraph [0261]	7-15
	paragraph [0285]	
	paragraph [0298]	
	figures 1A-28	

Y	US 2021/195093 A1 (MANZARI BEHKISH J [US] ET AL) 24 June 2021 (2021-06-24)	16
A	abstract	1-15,
	paragraph [0334]	17-19
	paragraph [0355]	
	paragraph [0370]	
	paragraph [0379] - paragraph [0383]	
	figures 1A-26	

1

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International application No
PCT/IB2023/050490

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Information on patent family members

International application No
PCT/IB2023/050490

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