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(54) ELECTRONIC CAMERA

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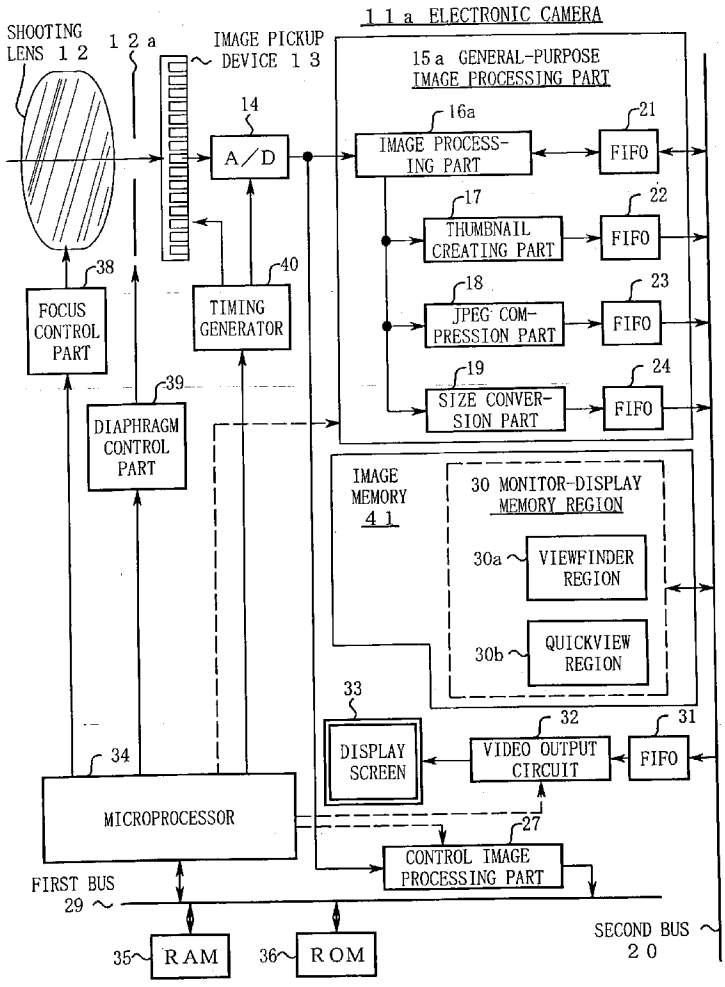
(57) **ABSTRACT**

An electronic camera of the present invention includes an image pickup part performing "still image pickup generating a still image signal" and "control image pickup successively generating control image signals having higher frame rate" in time division; a still image processing part applying predetermined still image signal processing to the still image signal; a control image processing part applying predetermined control signal processing to the control image signals to extract control data; and a control part performing at least one control operation out of exposure control, focus control, and white balance control, based on the control data output from the control image processing part. Particularly, in the present invention, the control image processing part and the still image processing part are configured to operate independently. The control image processing part performs the signal processing on the control image signals successively generated, even when the still image signal is being signal-processed.



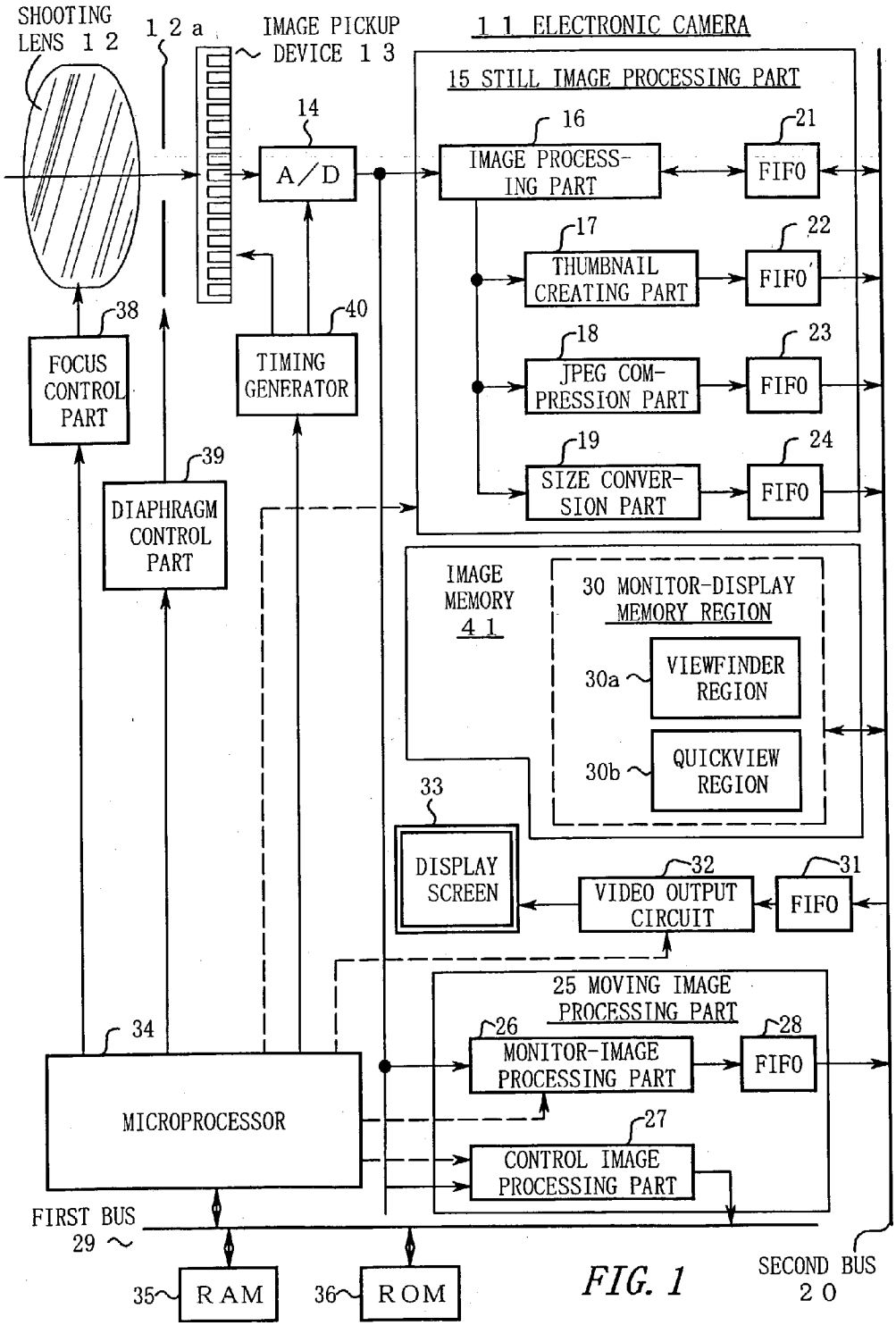

SHOOTING LENS 12
12a
IMAGE PICKUP DEVICE 13
11 ELECTRONIC CAMERA
15 STILL IMAGE PROCESSING PART
14
A/D
16
IMAGE PROCESSING PART
21
FIFO
17
THUMBNAIL CREATING PART
22
FIFO
18
JPEG COMPRESSION PART
23
FIFO
19
SIZE CONVERSION PART
24
FIFO
38
FOCUS CONTROL PART
40
TIMING GENERATOR
39
DIAPHRAGM CONTROL PART
IMAGE MEMORY 41
30 MONITOR-DISPLAY MEMORY REGION
30a
VIEWFINDER REGION
30b
QUICKVIEW REGION
33
DISPLAY SCREEN
32
VIDEO OUTPUT CIRCUIT
31
FIFO
25 MOVING IMAGE PROCESSING PART
26
MONITOR-IMAGE PROCESSING PART
28
FIFO
27
CONTROL IMAGE PROCESSING PART
34
MICROPROCESSOR
FIRST BUS 29
35
RAM
36
ROM
SECOND BUS 20

FIG. 1

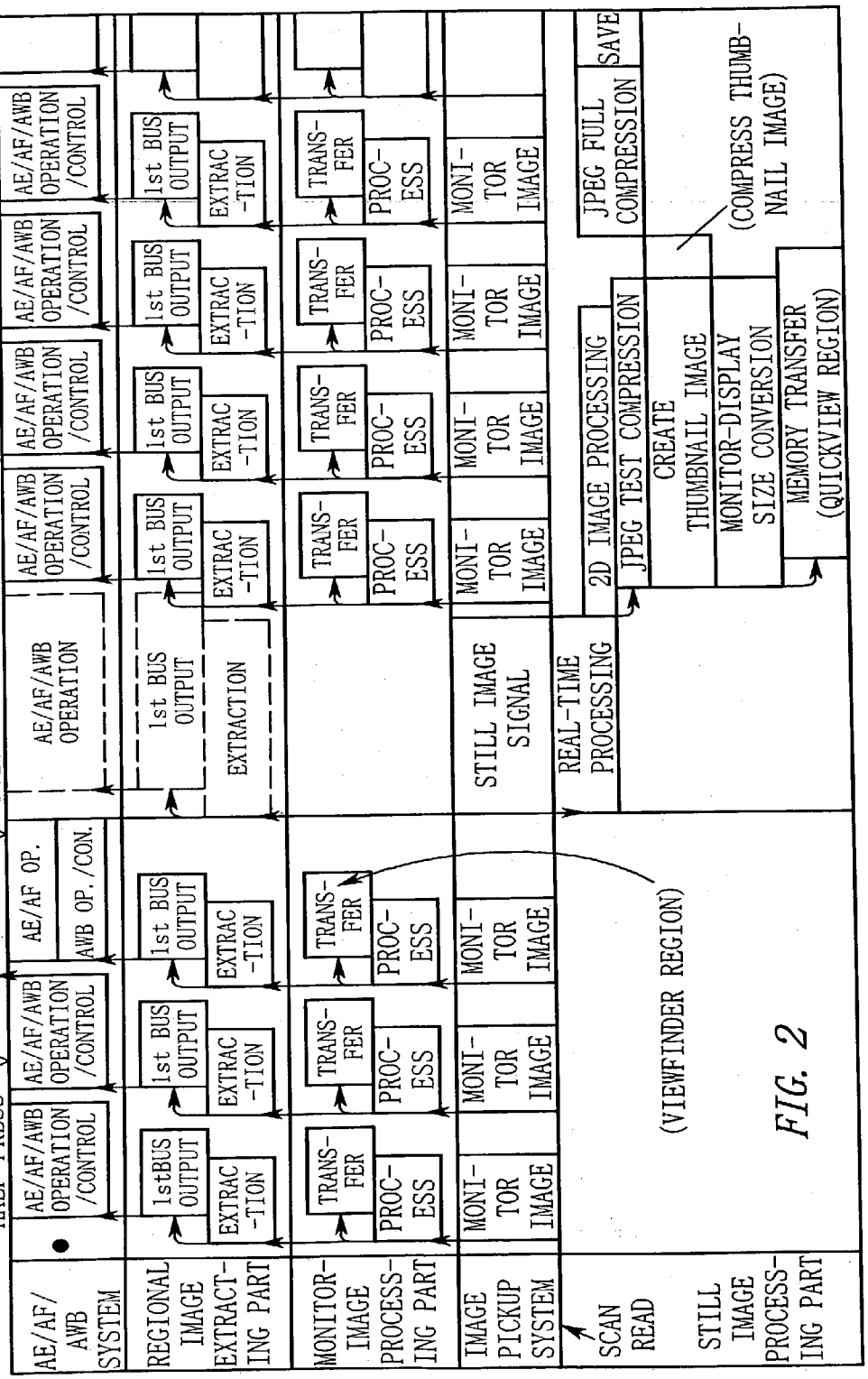

HALF PRESS
AE/AF LOCK
FULL PRESS
AE/AF/ AWB SYSTEM
REGIONAL IMAGE EXTRACTING PART
MONITOR-IMAGE PROCESSING PART
IMAGE PICKUP SYSTEM
SCAN READ
STILL IMAGE PROCESSING PART
AE/AF/AWB OPERATION /CONTROL
AE/AF OP.
AWB OP./CON.
AE/AF/AWB OPERATION
1st BUS OUTPUT
EXTRACTION
EXTRAC-TION
TRANS-FER
PROC-ESS
MONI-TOR IMAGE
STILL IMAGE SIGNAL
REAL-TIME PROCESSING
2D IMAGE PROCESSING
JPEG TEST COMPRESSION
CREATE THUMBNAIL IMAGE
MONITOR-DISPLAY SIZE CONVERSION
MEMORY TRANSFER (QUICKVIEW REGION)
JPEG FULL COMPRESSION
SAVE
(COMPRESS THUMB-NAIL IMAGE)
(VIEWFINDER REGION)

FIG. 2

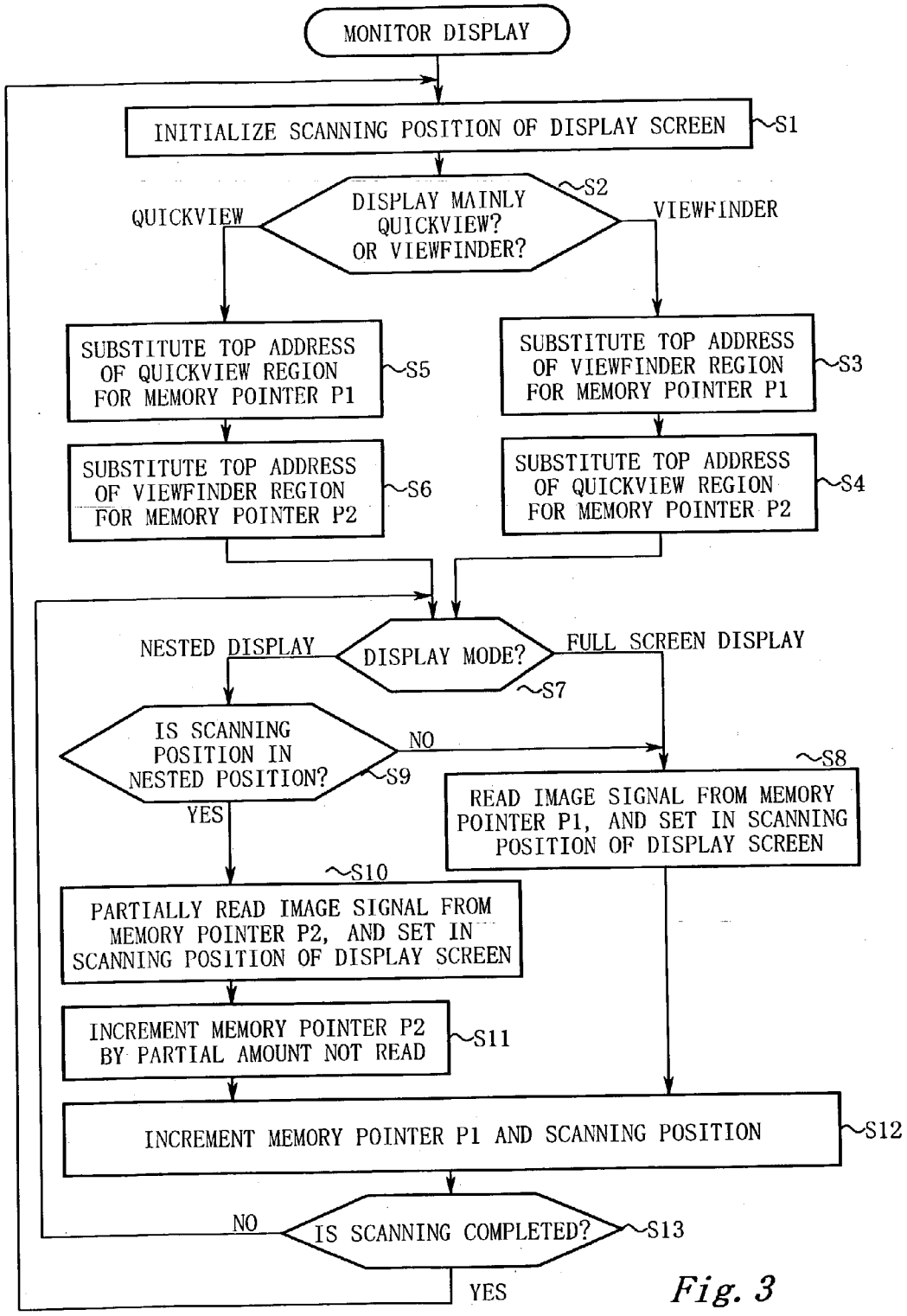

MONITOR DISPLAY
INITIALIZE SCANNING POSITION OF DISPLAY SCREEN
S1
DISPLAY MAINLY QUICKVIEW? OR VIEWFINDER?
S2
QUICKVIEW
VIEWFINDER
SUBSTITUTE TOP ADDRESS OF QUICKVIEW REGION FOR MEMORY POINTER P1
S5
SUBSTITUTE TOP ADDRESS OF VIEWFINDER REGION FOR MEMORY POINTER P1
S3
SUBSTITUTE TOP ADDRESS OF VIEWFINDER REGION FOR MEMORY POINTER P2
S6
SUBSTITUTE TOP ADDRESS OF QUICKVIEW REGION FOR MEMORY POINTER P2
S4
NESTED DISPLAY
DISPLAY MODE?
FULL SCREEN DISPLAY
S7
IS SCANNING POSITION IN NESTED POSITION?
S9
NO
YES
S8
READ IMAGE SIGNAL FROM MEMORY POINTER P1, AND SET IN SCANNING POSITION OF DISPLAY SCREEN
S10
PARTIALLY READ IMAGE SIGNAL FROM MEMORY POINTER P2, AND SET IN SCANNING POSITION OF DISPLAY SCREEN
INCREMENT MEMORY POINTER P2 BY PARTIAL AMOUNT NOT READ
S11
INCREMENT MEMORY POINTER P1 AND SCANNING POSITION
S12
NO
IS SCANNING COMPLETED?
S13
YES

Fig. 3

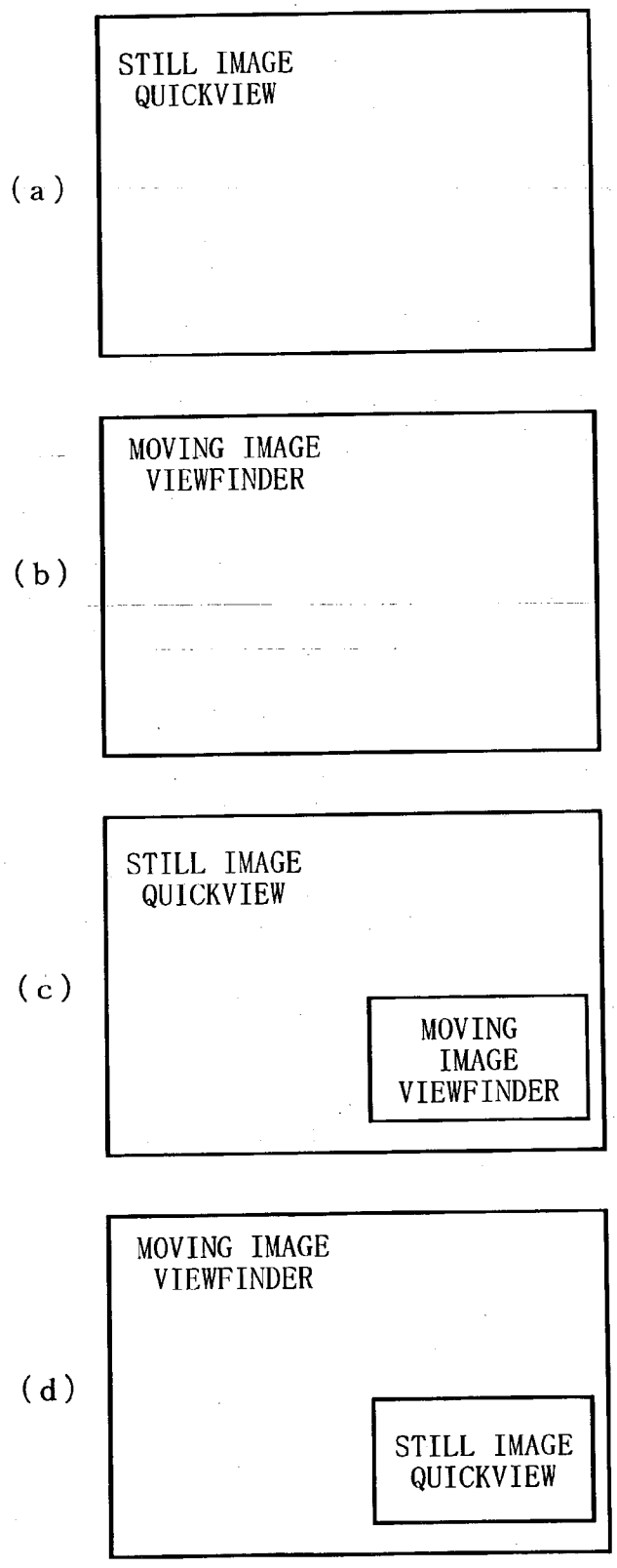

(a)
STILL IMAGE
QUICKVIEW
(b)
MOVING IMAGE
VIEWFINDER
(c)
STILL IMAGE
QUICKVIEW
MOVING
IMAGE
VIEWFINDER
(d)
MOVING IMAGE
VIEWFINDER
STILL IMAGE
QUICKVIEW

Fig. 4

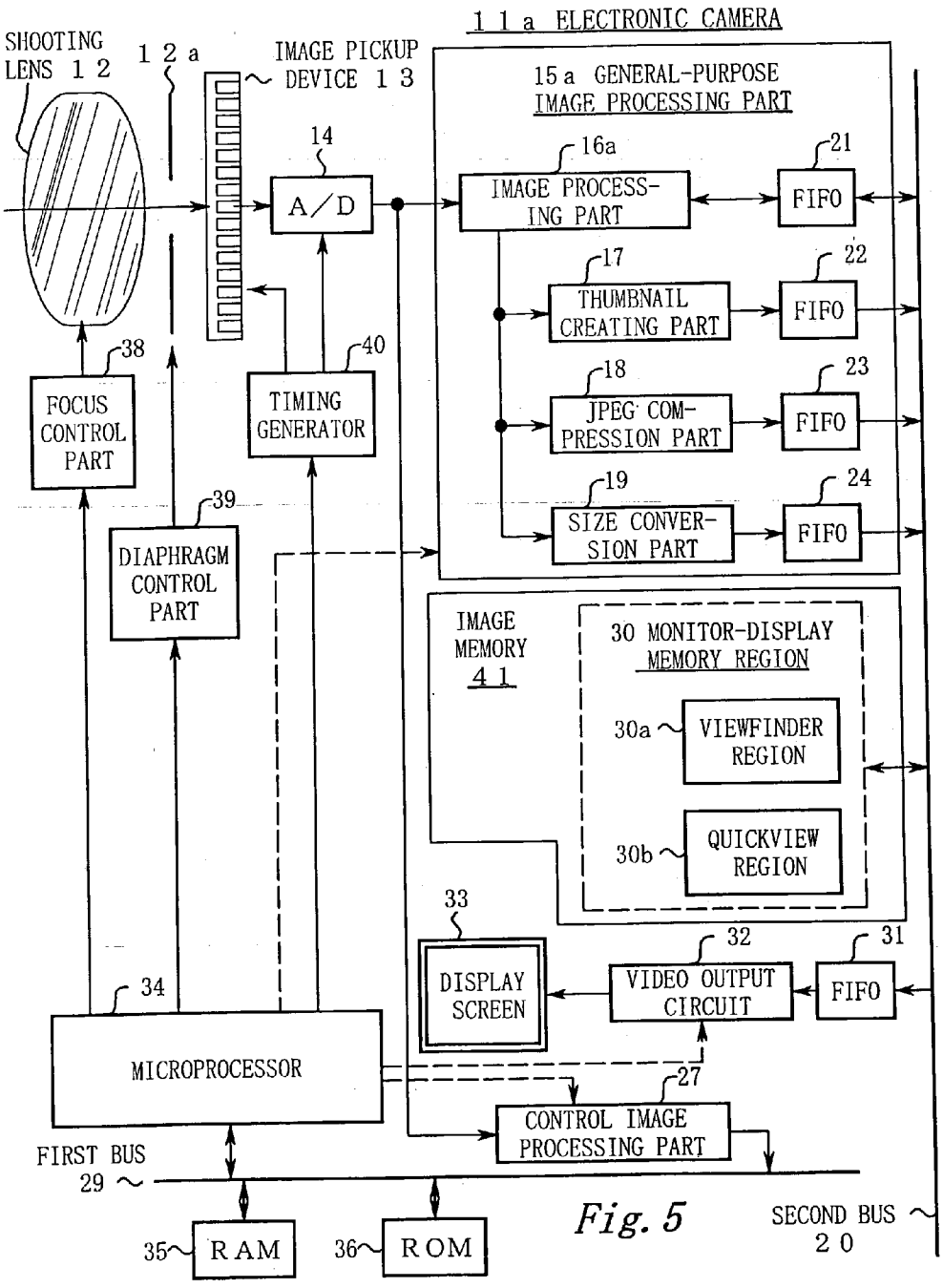

11a ELECTRONIC CAMERA
SHOOTING LENS 12
12a
IMAGE PICKUP DEVICE 13
14
A/D
15a GENERAL-PURPOSE IMAGE PROCESSING PART
16a
IMAGE PROCESSING PART
21
FIFO
17
THUMBNAIL CREATING PART
22
FIFO
18
JPEG COMPRESSION PART
23
FIFO
19
SIZE CONVERSION PART
24
FIFO
38
FOCUS CONTROL PART
40
TIMING GENERATOR
39
DIAPHRAGM CONTROL PART
IMAGE MEMORY 41
30 MONITOR-DISPLAY MEMORY REGION
30a
VIEWFINDER REGION
30b
QUICKVIEW REGION
33
DISPLAY SCREEN
32
VIDEO OUTPUT CIRCUIT
31
FIFO
34
MICROPROCESSOR
27
CONTROL IMAGE PROCESSING PART
FIRST BUS 29
35
RAM
36
ROM
SECOND BUS 20

Fig. 5

ELECTRONIC CAMERA

FIELD OF THE INVENTION

[0001] The present invention relates to an electronic camera which performs still image pickup and monitor image pickup (or control image pickup) of high frame rate in time division.

DESCRIPTION OF THE BACKGROUND ART

[0002] Conventionally, there have been known electronic cameras that pick up monitor images at high frame rate and, in response to a release operation by a photographer, perform still image pickup at high resolution.

[0003] By the way, electronic cameras of this kind typically perform signal processing on a still image (such as tone conversion, color interpolation, and image compression) with priority, immediately after a still image is picked up.

[0004] When still image processing is thus performed by priority, the time before checking the monitor of the still image signal can be reduced as much as possible. In addition, image compression is started quickly to ease the memory size of the image data, so that there is an advantageous effect that there can be increase in the number of possible exposures when continuously shooting.

[0005] While performing such still image processing, however, it was a necessity to stop picking up the monitor image or stop processing the monitor signal. Because of that, there have been problems of the monitor display being interrupted, or control operations of electronic cameras that use monitor images (such as focus control) being interrupted.

[0006] Such interruptions have caused a time lag such that the focus control of the electronic camera is exercised again, producing the adverse effect of delaying the next monitor display and still image pickup. Recently in particular, the foregoing adverse effect has had a propensity to grow in influence because the processing time of still images is on the increase due to electronic cameras having higher resolutions.

DISCLOSURE OF THE INVENTION

[0007] In view of the foregoing problem, it is thus an object of the present invention to provide an electronic camera which performs signal processing on image signals of high frame rate picked up in succession, even when a still image is being signal-processed.

[0008] Hereinafter, the contents of claims of the present invention will be described item by item.

[0009] (1) An electronic camera of the present invention comprises an image pickup part, a still image processing part, a control image processing part, and a control part.

[0010] This image pickup part performs "still image pickup for shooting a subject image to generate a still image signal" and "control image pickup for successively generating control image signals having a frame rate higher than that of the still image signal" in time division.

[0011] Moreover, the still image processing part accepts the still image signal generated by the image pickup part and applies predetermined still image signal processing to this still image signal.

[0012] Furthermore, the control image processing part accepts the control image signals generated by the image pickup part and applies predetermined control signal processing to these control image signals to extract control data.

[0013] Besides, the control part accepts the control data output from the control image processing part and performs at least one control operation out of exposure control, focus control, and white balance control, based on this control data.

[0014] In particular, the present invention is characterized in that the control image processing part and the still image processing part mentioned above are configured to operate independently, and the control image processing part performs the signal processing on the control image signals successively generated, even when the still image signal is being signal-processed.

[0015] In such a configuration, the control image processing part can process the control image signals picked up in succession by the image pickup part so that the control data is extracted smoothly even when the still image signal is being processed.

[0016] As a result, the continuous extracting of the control data will not be needlessly interrupted, even in the course of processing the still image signal. Therefore, it becomes possible to obtain control data as continuously as possible, and the adverse effect, that control operations may be delayed because they follow discontinuous change in the control data, can be mended.

[0017] (2) Moreover, another electronic camera of the present invention comprises an image pickup part, a still image processing part, and a monitor-image processing part.

[0018] This image pickup part performs "still image pickup for shooting a subject image to generate a still image signal" and "monitor-image pickup for successively generating monitor-image signals having a frame rate higher than that of the still image signal" in time division.

[0019] Besides, the still image processing part accepts the still image signal generated by this image pickup part and applies predetermined still image signal processing to this still image signal.

[0020] Furthermore, the monitor-image processing part accepts the monitor-image signals generated by the image pickup part and applies predetermined monitor signal processing to these monitor-image signals.

[0021] In particular, the present invention is characterized in that the monitor-image processing part and the still image processing part are configured to operate independently, and the monitor-image processing part performs the signal processing on the monitor-image signals successively generated, even when the still image signal is being signal-processed.

[0022] In such a configuration, the monitor-image processing part can smoothly process the monitor-image signals picked up in succession by the image pickup part, even when the still image signal is being processed.

[0023] As a result, monitor images are displayed without uselessly being interrupted even in the course of processing the still image signal. The monitor images can thus be displayed as continuously as possible.

[0024] (3) Furthermore, another electronic camera of the present invention is the electronic camera as set forth in the foregoing section (2), comprising a control image processing part and a control part.

[0025] This control image processing part accepts the monitor-image signals generated by the image pickup part and applies predetermined control signal processing to these monitor-image signals to extract control data.

[0026] Besides, the control part accepts the control data output from the control image processing part and performs at least one control operation out of exposure control, focus control, and white balance control, based on this control data.

[0027] In particular, the present invention is characterized in that the control image processing part and the still image processing part are configured to operate independently, and the control image processing part performs the signal processing on the monitor-image signals successively generated, even when the still image signal is being signal-processed.

[0028] In such a configuration, "the extraction of the control data" and "the monitor signal processing" will not be needlessly interrupted, even in the course of processing the still image signal. Therefore, the adverse effect that subsequent monitor displays and control operations are delayed can be mended.

[0029] (4) Furthermore, another electronic camera of the present invention comprises an image pickup part, an image processing part, a control image processing part, and a control part.

[0030] This image pickup part performs "still image pickup for shooting a subject image to generate a still image signal" and "monitor-image pickup for successively generating monitor-image signals having a frame rate higher than that of the still image signal" in time division.

[0031] Moreover, the image processing part applies predetermined still image signal processing to the still image signal generated by the image pickup part and applies predetermined monitor signal processing to the monitor-image signals generated by the image pickup part.

[0032] Furthermore, the control image processing part applies predetermined control signal processing to the monitor-image signals generated by the image pickup part to extract control data.

[0033] Besides, the control part performs at least one control operation out of exposure control, focus control, and white balance control, based on the control data output from the control image processing part.

[0034] In particular, the present invention is characterized in that the control image processing part and the image processing part are configured to operate independently, and the control image processing part performs the signal processing on the control image signals successively generated, even when the still image signal is being signal-processed.

[0035] In such a configuration, the signal processing of the still image signal and the monitor-image signals is performed by the image processing part, which is a single unit. Therefore, it becomes possible to reduce the circuit scale of the apparatus as compared to the case where the still image processing part and the monitor-image processing part are provided independently. As a result, power consumption can easily be reduced, resulting in extending the battery life of the electronic camera.

[0036] Incidentally, in the foregoing configuration, the signal processing of the still image signal and that of the monitor-image signal cannot be perfectly synchronized. On that account, when the still image signal is processed with priority, updating the monitor display while the still image signal is being signal-processed becomes difficult. Nevertheless, even under these circumstances, the control image processing part can extract the control data from the monitor-image signals. Thus, although the monitor display cannot be updated, the continuity of the control data will not be needlessly interrupted and the control data can be obtained as continuously as possible. Consequently, it becomes possible to mend the adverse effect that control operations may be delayed because they follow discontinuous change in control data.

[0037] (5) Another electronic camera of the present invention is the electronic camera as set forth in the foregoing section (2) or the foregoing section (4), comprising a display part for displaying the still image signal and the monitor-image signals in a juxtaposed fashion, in a nested fashion, or in a selective fashion.

[0038] When images are displayed in a juxtaposed fashion, it becomes possible to determine the next composition based on the moving image display by the monitor-image signals and to check the monitor by the still image signal at the same time.

[0039] Moreover, when images are displayed in a nested fashion, the images displayed concurrently are more in a subordinate-superior relationship than in when they are displayed in a juxtaposed fashion. It is thus easier to recognize intuitively which image is which.

[0040] Furthermore, when images are displayed selectively, it becomes possible to check the desired image signal alone on the monitor.

[0041] (6) Another electronic camera of the present invention is the electronic camera as set forth in the foregoing section (5), wherein the display part has a first memory region for storing the still image signal for monitor display use and a second memory region for storing the monitor-image signals, the first and second memory regions being independent from each other, and switches the memory region to be displayed on a monitor to replace display on the monitor.

[0042] In such a configuration, the two memory regions are independent from each other. This makes it possible to replace the display on the monitor quickly by switching the memory region to be displayed on the monitor. This allows such operations as instantaneously replacing the positions of images to be displayed in a juxtaposed fashion and instantaneously switching a still image display with a monitor image.

[0043] Incidentally, the foregoing object and other objects of the present invention can be seen easily from the following description and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0044] **FIG. 1** is a diagram showing the configuration of an electronic camera **11** according to the first embodiment;

[0045] **FIG. 2** is a timing chart for explaining the operation of the electronic camera **11**;

[0046] **FIG. 3** is a flowchart for explaining the operation of a video output circuit **32**;

[0047] **FIG. 4** is a diagram showing display examples of a display screen **33**; and

[0048] **FIG. 5** is a diagram showing the configuration of an electronic camera **11***a* according to the second embodiment.

BEST MODE FOR CARRYING OUT THE INVENTION

[0049] Hereinafter, embodiments of the present invention will be described with reference to the drawings.

[0050] <<First Embodiment>>

[0051] A first embodiment is one corresponding to the inventions of claims 1-5.

[0052] (Configuration of First Embodiment)

[0053] **FIG. 1** is a diagram showing the configuration of an electronic camera **11**.

[0054] **FIG. 2** is a timing chart for explaining the operation of the electronic camera **11**.

[0055] In **FIG. 1, a** shooting lens **12** is mounted on the electronic camera **11**. The image pickup surface of an image pickup device **13** is situated on the optical axis of this shooting lens **12** via a diaphragm **12***a*. Incidentally, for the sake of avoiding smear in reading a still image signal after release, a mechanical shutter may be arranged in front of the image pickup surface of the image pickup device **13**.

[0056] An image signal output from this image pickup device **13** is supplied to a still image processing part **15** and a moving image processing part **25** through an A/D conversion part **14**.

[0057] This still image processing part **15** is composed of an image processing part **16** for performing a 2D image process, a thumbnail creating part **17** for creating thumbnails, a JPEG compression part **18** for performing JPEG compression, and a size conversion part **18** for converting image sizes for use in monitor display of still images. These processing parts **16-19** are connected to a second bus **20** which is used chiefly for image processing, through FIFO (First-In First-Out memories) **21-24**, respectively.

[0058] Here, the image processing part **16** performs imperfect pixel correction, black level clamp, gain adjustment, white balance adjustment, tone conversion, color interpolation, color coordinate conversion, filtering, etc. Of these, a series of processes capable of real-time processing such as imperfect pixel correction, black level clamp, and gain adjustment is processed in real time as a first step. Here, white balance adjustment is executed as part of the real-time processing if white balance adjustment values are obtained in advance from monitor-image signals or the like. Tone conversion can also be executed as part of the real-time processing if it can be processed before color interpolation.

[0059] On the other hand, color interpolation and filtering are difficult to execute as part of the real-time processing since they are 2D image processes. Then, these 2D image processes are executed as a second step while data is exchanged with an image memory **41** to be described later.

[0060] Meanwhile, the moving image processing part **25** is composed of a monitor-image processing part **26** for performing signal processing on a monitor-image signal and a control image processing part **27** for extracting control data from predetermined regions of a monitor image. The output of this monitor-image processing part **26** is connected to the second bus **20** through a FIFO **28**. Moreover, the output of the control image processing part **27** is connected to a first bus **29** which is used chiefly for system control.

[0061] The image memory **41** is also connected to the second bus **20**. A monitor-display memory region **30** in the image memory **41** is provided with two memory regions (viewfinder region **30***a*, quickview region **30***b*) which are capable of independent accesses. Incidentally, this image memory **41** is also used as a work memory in performing signal processing.

[0062] Moreover, the second bus **20** is connected with a video output circuit **32** through a FIFO **31**. This video output circuit **32** drives a display screen **33** to exercise image display.

[0063] Now, the first bus **29** is connected with a microprocessor **34** for performing system control, a RAM **35**, a ROM **36**, and so on. This microprocessor **34** is connected with the still image processing part **15**, the monitor-image processing part **26**, the control image processing part **27**, the video output circuit **32**, a focus control part **38** for performing a focus control on the shooting lens **12**, a diaphragm control part **39** for controlling the diaphragm **12***a*, a timing generator **40** for controlling the image pickup device **13** and the A/D conversion part **14**, and so on, in order that control signals for system control are transmitted thereto, respectively.

[0064] Incidentally, these control signals may be transmitted to the respective units through the first bus **29**. Incidentally, when a mechanical shutter is provided, a control signal of the microprocessor **34** is also transmitted to a control unit of the mechanical shutter.

[0065] (Correspondence Between the Foregoing Configuration and the Present Invention)

[0066] Hereinafter, description will be given of the correspondence between the first embodiment and the present invention.

[0067] The image pickup part as set forth in claims corresponds to the image pickup device **13** and the timing generator **40**.

[0068] The still image processing part as set forth in claims corresponds to the still image processing part **15**.

[0069] The control image processing part as set forth in claims corresponds to the control image processing part **27**.

[0070] The control part as set forth in claims corresponds to the microprocessor **34**, the focus control part **38**, the diaphragm control part **39**, the timing generator **40**, the monitor-image processing part **26** (a white balance adjustment function thereof), etc.

[0071] The control image signal as set forth in claims corresponds to the monitor-image signal.

[0072] The monitor-image processing part as set forth in claims corresponds to the monitor-image processing part **26**.

[0073] The display part as set forth in claims corresponds to the monitor-display memory region **30** for and the video output circuit **32**.

[0074] The first memory region as set forth in claims corresponds to the quickview region **30***b*.

[0075] The second memory region as set forth in claims corresponds to the viewfinder region **30***a*.

[0076] Next, characteristic operations of the first embodiment will be described individually.

[0077] (Monitor-Image Signals Processing Operation)

[0078] Initially, description will be given of the operation for processing monitor-image signals.

[0079] The timing generator **40** drives the image pickup device **13** to generate monitor-image signals in succession. These monitor-image signals are image signals of high frame rate, being generated by partially reading data that is generated pixel by pixel in the image pickup device **13**. Incidentally, when the image pickup device **13** is a CCD, the monitor-image signals are often signals whose lines are partially skipped being read.

[0080] The monitor-image signals thus successively generated are digitized by the A/D conversion part **14** before supplied to both the monitor-image processing part **26** and the control image processing part **27**.

[0081] The monitor-image processing part **26** performs signal processing for monitor display (such as color interpolation and tone conversion) on the monitor-image signals. Concurrently with this signal processing, the monitor-image processing part **26** transfers and records the processed monitor-image signals onto the viewfinder region **30***a* in the monitor-display memory region **30** arranged in the image memory **41** through the second bus **20**. The video output circuit **32** reads the monitor-image signals from this viewfinder region **30***a* periodically, and displays the monitor-image signals on the display screen **33** as moving images.

[0082] Meanwhile, the control image processing part **27** extracts a regional image of a focus detection area, a regional image of a photometric area, and a regional image of a white balance area individually from the monitor-image signals. Incidentally, these areas can be changed freely by a control signal from the microprocessor **34**. Moreover, unless there is a specific problem, these areas may be united to omit redundancy in the processing for extracting the regional images.

[0083] The control image processing part **27** performs operations on these regional images to extract control data (here, a contrast value, a photometric value, and a white balance value).

[0084] Concurrently with this extracting operation, the control image processing part **27** successively outputs the extracted control data to the microprocessor **34** through the first bus **29**.

[0085] Here, the microprocessor **34** performs operations based on the control data of the contrast value to drive the focus control part **38**, thereby exercising a focus control of contrast hill-climbing method.

[0086] The microprocessor **34** also performs an exposure operation based on the control data of the photometric value, thereby exercising an exposure control through the diaphragm control part **39** and the timing generator **40** (electronic shutter). Incidentally, at the time of the control image pickup (monitor-image pickup), the depth of focus of the shooting lens **12** is better rendered shallower to increase the detection sensitivity to focus errors (peaks in contrast value). Thus, the diaphragm **12***a* is preferably fixed to near release.

[0087] Moreover, the microprocessor **34** transmits the control data of the white balance adjustment value to the monitor-image processing part (or still image processing part) for the sake of a white balance adjustment.

[0088] The focus control and exposure control described above are locked after the release is half pressed. During this control lock, the shooting lens **12** is fixed to the focus position and the exposure control value is held by the microprocessor **34** in preparation for still image pickup by a full press of the release. Incidentally, as shown in **FIG. 2**, the image pickup operation of the monitor-image signals, the extraction processing of the control data, the white balance adjustment, the operation for a focus control, the operation for an exposure control, and the like continue being performed even after the half press.

[0089] By the sequential processing of the monitor-image signals described above, the control operation of the electronic camera **11** and the moving image display of the monitor-image signals continue being effected as shown in **FIG. 2**.

[0090] (Still Image Signal Processing Operation)

[0091] Next, description will be given of the operation for processing a still image signal.

[0092] When the release button of the electronic camera **11** is full pressed during the operation for processing monitor-image signals as described above, the microprocessor **34** controls the timing generator **40** to perform still image pickup (exposure) based on the exposure control value held at the time of the control lock (control of the diaphragm **12***a* and the electronic shutter), and then reads a still image signal from the image pickup device **13**. This still image signal is an image signal of high resolution, being read from the image pickup device **13** with no partial reading.

[0093] The still image signal generated thus is digitized by the A/D conversion part **14** before supplied to the image processing part **16**. The image processing part **16** performs, as described above, the real-time processing of the first step and the 2D image process of the second step on this still image signal.

[0094] Here, if a white balance adjustment is to be made to the still image signal by using the white balance adjustment value obtained in the immediately preceding control image pickup (monitor-image pickup), the microprocessor **34** sets this adjustment value to the image processing part **16** before the read of the still image signal so that the white balance adjustment is made in the process of the real-time processing.

[0095] The image processing part **16**, each time it completes the 2D image process for a minimum unit of processing, supplies the still image signal past the 2D image process (YCbCr, RGB, or such an image signal) to the thumbnail

creating part **17**, the JPEG compression part **18**, and the size conversion part **19** as needed.

[**0096**] The thumbnail creating part **17** creates a thumbnail image based on the still image signal supplied thus.

[**0097**] The JPEG compression part **18** performs JPEG test compression and JPEG full compression based on the still image signal (typically a YCbCr image signal) supplied thus, compressing the still image signal to a target code volume.

[**0098**] Incidentally, the JPEG compression part **18** also performs image compression of the thumbnail image during such JPEG compression.

[**0099**] The compressed image data and thumbnail compressed data processed thus are integrated into JPEG files and stored into a memory card (not shown).

[**0100**] Meanwhile, the size conversion part **19** performs size conversion for quickview (monitor check of the result of the image pickup) based on the still image signal supplied thus. Concurrently with such size conversion, the size conversion part **19** transfers and records the size-converted still image signal onto the quickview region **30***b* through the second bus **20**. The video output circuit **32** reads the still image signal from this quickview region **30***b*, and makes a quickview display on the display screen **33**.

[**0101**] Incidentally, when the output signal of the video output circuit **32** is a video signal of NTSC format, PAL format, or SECAM format, the size conversion part **19** is supplied with a YCbCr image signal.

[**0102**] By the processing of the still image signal described above, the still image signal is stored and a quickview display is effected as shown in **FIG. 2**.

[**0103**] (Concerning Processing of Monitor-Image Signals during Signal Processing of Still Image Signal)

[**0104**] Next, description will be given of the processing of monitor-image signals during the signal processing of a still image signal described above.

[**0105**] Initially, as shown in **FIG. 2**, the timing generator **40** restarts the successive generation of monitor-image signals immediately after the completion of read of the still image signal. Here, the still image processing part **15** has started the signal processing on the still image signal.

[**0106**] The control image processing part **27** restarts the operation of extracting control data from monitor-image signals immediately without hampering the operation of this still image processing part **15** at all.

[**0107**] In addition, the monitor-image processing part **26** restarts the monitor signal processing immediately without hampering the operation of this still image processing part **15** at all.

[**0108**] (Concerning Monitor Display Replacing Operation)

[**0109**] **FIG. 3** is a flowchart for explaining the operation of the video output circuit **32**.

[**0110**] Hereinafter, the operation for replacing monitor display will be described with reference to the step numbers shown in **FIG. 3**.

[**0111**] Step S1: Initially, the video output circuit **32** sets the scanning position of the display screen **33** to an initial position (such as the upper left of the screen).

[**0112**] Step S2: The video output circuit **32** determines which screen to display mainly (hereinafter, referred to as "main screen") in accordance with internal flag information. Here, when the viewfinder is the main screen, the video output circuit **32** moves to step S3 in operation. On the other hand, when the quickview is the main screen, the video output circuit **32** moves to step S5 in operation. Incidentally, the microprocessor **34** can rewrite the flag information in this video output circuit **32** to change the screen to display mainly as needed.

[**0113**] Step S3: Here, the viewfinder is selected as the main screen. Then, the video output circuit **32** substitutes the top address of the viewfinder region **30***a*, the main screen, for a memory pointer P1.

[**0114**] Step S4: Moreover, the video output circuit **32** substitutes the top address of the quickview region **30***b* for another memory pointer P2. After the completion of such pointer setting, the video output circuit **32** moves to step S7 in operation.

[**0115**] Step S5: Here, the quickview is selected as the main screen. Then, the video output circuit **32** substitutes the top address of the quickview region **30***b*, the main screen, for the memory pointer P1.

[**0116**] Step S6: Moreover, the video output circuit **32** substitutes the top address of the viewfinder region **30***a* for the other memory pointer P2. After the completion of such pointer setting, the video output circuit **32** moves to step S7 in operation.

[**0117**] Step S7: The video output circuit **32** selects the display mode of the screen in accordance with internal flag information. Here, when a full screen display is selected as the display mode, the video output circuit **32** moves to step S8 in operation. On the other hand, when a nested display is selected, the video output circuit **32** moves to step S9 in operation. Incidentally, the microprocessor **34** can rewrite the flag information in this video output circuit **32** to change the display mode as needed.

[**0118**] Step S8: The video output circuit **32** reads an image signal from the memory pointer P1 and sets the signal value in the scanning position of the display screen **33**. After such setting, the video output circuit **32** moves to step S12 in operation.

[**0119**] Step S9: Since the nested display is selected here, the video output circuit **32** determines whether or not the current scanning position corresponds to the nested screen.

[**0120**] When the current scanning position does not correspond to the nested screen, the video output circuit **32** moves to step S8 in operation to perform the same operation as with full screen display.

[**0121**] On the other hand, when the current scanning position corresponds to the nested screen, the video output circuit **32** moves to step S10 in operation to perform the processing of the nested screen.

[0122] Step S10: To perform the processing of the nested screen here, the video output circuit **32** partially reads an image signal from the memory pointer P2, and sets the signal value in the scanning position of the display screen **33**.

[0123] Step S11: The video output circuit **32** increments the memory pointer P2 by the partial amount not read, in preparation for the next pointer reference.

[0124] Step S12: The video output circuit **32** increments the memory pointer P1 and the scanning position in preparation for the next pointer reference.

[0125] Step S13: Here, the video output circuit **32** determines whether the scanning is completed or not. If the scanning is not completed, the video output circuit **32** returns to step S7 in operation to continue scanning the display screen **33**. On the other hand, if the scanning is completed, the video output circuit **32** returns to step S1 in operation to repeat the scanning of the display screen **33** from the initial position.

[0126] (Effects, Etc. of the First Embodiment)

[0127] As described above, in the first embodiment, the generation of a monitor-image signal is restarted immediately after the generation of a still image signal as shown in **FIG. 2**. In response to this monitor-image signal, the control image processing part **27** restarts the operation for extracting control data immediately. Consequently, the control data has high continuity, which can effectively preclude the problem that a discontinuous change in the control data causes a delay in subsequent control operations.

[0128] Besides, in the first embodiment, the monitor-image processing part **26** performs the processing of monitor-image signals even while a still image signal is processed. It is therefore possible to display the monitor-image signals even during the still image signal processing.

[0129] Moreover, in the first embodiment, the operation of the video output circuit **32** described above makes it possible to display four types of screens shown in FIGS. **4**(*a*)-(*d*) on the display screen **33**. In this case, the microprocessor **34** can rewrite the flag information in the video output circuit **32** to switch these four types of screens instantaneously.

[0130] In particular, the first embodiment comprises the second bus **20** for exchanging still image signals and the first bus **29** for exchanging control data, the buses being independent of each other. This precludes the still image signals and the control data from conflicting on an identical bus, and makes it possible to perform the still image processing and the control operations smoothly in parallel.

[0131] Furthermore, in the first embodiment, the image pickup operation of the monitor-image signals, the extraction processing of the control data, the white balance adjustment to the monitor images, the operation for a focus control, and the operation for an exposure control are continued even after the release is half pressed. The control data and the operations can thus be maintained at high continuity even after the half press. Consequently, it becomes possible to effectively preclude such adverse effects that the control operations delay restarting after the half-pressed state is cleared.

[0132] Now, description will be given of another embodiment.

[0133] <<Second Embodiment>>

[0134] A second embodiment is one corresponding to the inventions of claims 1 and 6-8.

[0135] **FIG. 5** is a diagram showing the configuration of an electronic camera **11***a* according to the second embodiment.

[0136] The configuration of the second embodiment is characterized in that the still image processing part **15**, the monitor-image processing part **26**, and the FIFO **28** are omitted from the electronic camera **11** described above (**FIG. 1**), and a general-purpose image processing part **15***a* is arranged instead.

[0137] This general-purpose image processing part **15***a* contains an image processing part **16***a*. This image processing part **16***a* performs still image signal processing or signal processing for a monitor image selectively depending on the type of the image signal (still image signal, monitor-image signal) designated by the microprocessor **34**.

[0138] Incidentally, since the components and operations are otherwise the same as in the first embodiment, description thereof will be omitted here.

[0139] As above, according to the second embodiment, the signal processing circuits dedicated to monitor-image signals become unnecessary. This makes it possible to reduce the circuit scale of the entire electronic camera. As a result, the power consumption of the electronic camera can be lowered to extend the battery life of the electronic camera.

[0140] Moreover, since the control image processing part **27** extracts control data even during the signal processing of still image signals, the control data can be obtained as continuously as possible. This can improve the problem that a discontinuous change in the control data causes a delay in control operations.

[0141] Furthermore, in the second embodiment, the image processing part **16***a* for performing image processing for general purpose use and the JPEG compression part **18** and the like for performing signal processing dedicated to still image signals are configured capable of independent operations. The image processing part **16***a* can thus enter the signal processing of monitor-image signals quickly after the signal processing of a still image signal shifts to the JPEG compression part **18** and the like. As a result, it becomes possible to shorten the interruption of monitor display.

[0142] (Supplemental Remarks on Embodiments)

[0143] Incidentally, in the embodiments described above, regional images are cut out of the monitor-image signals, and control data (such as a contrast value, a photometric value, and a white balance value) is calculated from these regional images. However, the control data is not limited thereto. For example, the control image processing part **27** may cut regional images out of the monitor-image signals and transmit these regional images to the microprocessor **34** as the control data. In this case, the microprocessor **34** performs operations for a contrast value, a photometric value, a white balance value, etc. based on the regional images.

[0144] Moreover, in the foregoing embodiments, the control data is not extracted from the still image signal. However, this is not restrictive. For example, the control image

processing part **27** may extract control data from the still image signal (see dotted portions shown in **FIG. 2**). In this case, the continuity of the control data can be enhanced further, allowing an additional improvement to the adverse effect that subsequent monitor display and still image pickup might get delayed due to a discontinuous change in the control data.

[**0145**] Incidentally, the foregoing embodiments have dealt with the cases where the video output circuit **32** makes a full screen display and a nested display. However, this is not restrictive. For example, the video output circuit **32** may arrange two screens on the display screen **33** for juxtaposed display.

[**0146**] Moreover, in the foregoing embodiments, the video output circuit **32** switches the memory pointers P1 and P2 in accordance with the scanning position of the screen. However, this is not restrictive. For example, image signals may be read from the two memory regions **30***a* and **30***b* in parallel (as concerns a nested screen, partial read shall be performed) so that the video output circuit **32** selects which image signal to display in accordance with the scanning position.

[**0147**] By the way, in the present invention, the control data has high continuity even during the signal processing of the still image signal. This improves the continuity of the focus control and the like. Consequently, the next release operation can be accepted easily even during the signal processing of the still image signal. In such a case, it is preferable to perform either of the following operations:

[**0148**] 1) The still image processing part **15** continues the signal processing of the still image signal (2D image process in particular) and captures the released still image signal (at least temporarily records the same on the image memory) concurrently. Incidentally, the capture is preferably accompanied with the real-time processing.

[**0149**] 2) The still image processing part **15** suspends the signal processing of the still image signal, captures the released still image signal (at least temporarily records the same on the image memory) as an interrupt, and restarts the suspended signal processing after the completion of the capture. Incidentally, the capture is preferably accompanied with the real-time processing.

[**0150**] These operations can reduce the possibility of missing the right moment for a valuable shot.

[**0151**] The invention may be embodied in other specific forms without departing from the spirit and essential characteristics thereof. The foregoing embodiments are therefore to be considered in all aspects as illustrative and not restrictive. The scope of the invention is indicated by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

1. An electronic camera comprising:

an image pickup part for performing "still image pickup for shooting a subject image to generate a still image signal", and "control image pickup for successively generating control image signals having a frame rate higher than that of said still image signal" in time division;

a still image processing part for accepting said still image signal generated by said image pickup part and applying predetermined still image signal processing thereto;

a control image processing part for accepting said control image signals generated by said image pickup part and applying predetermined control signal processing thereto to extract control data; and

a control part for accepting said control data output from said control image processing part and performing at least one control operation out of exposure control, focus control, and white balance control, based on said control data, wherein

said control image processing part and said still image processing part are configured to operate independently, and

said control image processing part performs the signal processing on said control image signals successively generated, even when said still image signal is being signal-processed.

2. An electronic camera comprising:

an image pickup part for performing "still image pickup for shooting a subject image to generate a still image signal" and "monitor-image pickup for successively generating monitor-image signals having a frame rate higher than that of said still image signal" in time division;

a still image processing part for accepting said still image signal generated by said image pickup part and applying predetermined still image signal processing thereto; and

a monitor-image processing part for accepting said monitor-image signals generated by said image pickup part and applying predetermined monitor signal processing thereto, wherein

said monitor-image processing part and said still image processing part are configured to operate independently, and

said monitor-image processing part performs the signal processing on said monitor-image signals successively generated, even when said still image signal is being signal-processed.

3. The electronic camera according to claim 2, comprising

a display part for displaying said still image signal and said monitor-image signals in one of a juxtaposed fashion, a nested fashion, and a selective fashion.

4. The electronic camera according to claim 3, wherein said display part

has a first memory region for storing said still image signal for monitor display use and a second memory region for storing said monitor-image signals, said first and second memory regions being independent from each other, and

switches the memory region to be displayed on a monitor to replace display on the monitor.

5. The electronic camera according to claim 2, comprising

a control image processing part for accepting said monitor-image signals generated by said image pickup part

and applying predetermined control signal processing thereto to extract control data; and

a control part for accepting said control data output from said control image processing part and performing at least one control operation out of exposure control, focus control, and white balance control, based on said control data, wherein

said control image processing part and said still image processing part are configured to operate independently, and

said control image processing part performs the signal processing on said control image signals successively generated, even when said still image signal is being signal-processed.

6. An electronic camera comprising:

an image pickup part for performing "still image pickup for shooting a subject image to generate a still image signal" and "monitor-image pickup for successively generating monitor-image signals having a frame rate higher than that of said still image signal" in time division;

an image processing part for applying predetermined still image signal processing to said still image signal generated by said image pickup part and for applying predetermined monitor signal processing to said monitor-image signals generated by said image pickup part;

a control image processing part for accepting said monitor-image signals generated by said image pickup part and applying predetermined control signal processing thereto to extract control data; and

a control part for accepting said control data output from said control image processing part and performing at least one control operation out of exposure control, focus control, and white balance control, based on said control data, wherein

said control image processing part and said image processing part are configured to operate independently, and

said control image processing part performs the signal processing on said control image signals successively generated, even when said still image signal is being signal-processed.

7. The electronic camera according to claim 6, comprising

a display part for displaying said still image signal and said monitor-image signals in one of a juxtaposed fashion, a nested fashion, and a selective fashion.

8. The electronic camera according to claim 7, wherein said display part

has a first memory region for storing said still image signal for monitor display use and a second memory region for storing said monitor-image signals, said first and second memory regions being independent from each other, and

switches the memory region to be displayed on a monitor to replace display on the monitor.

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