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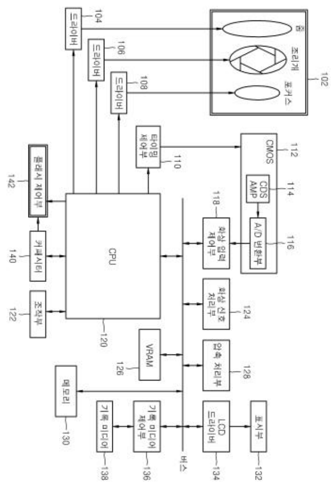
Imaging device

about 57 yo

An object of the present invention is to provide an imaging device capable of varying the time difference between preliminary light emission and main light emission and detecting an appropriate exposure amount during preliminary light emission. To achieve this object, the present invention provides: Photoelectric conversion elements arranged in a matrix form and storing stored charges according to exposure; stored charge reading means for reading the stored charges at a time difference according to the position of a row or column of the photoelectric conversion elements; resetting means for simultaneously resetting the stored charge of all the photoelectric conversion elements, and reset timing varying means for changing the timing for resetting the stored charge with respect to a synchronizing pulse corresponding to the reading time of the stored charge. Including an imaging device.

representation - Figure 1



Scope of Patent Claims

claim 1

a photoelectric conversion element disposed in a matrix form and accumulating electric charge according to exposure;

stored charge reading means for reading the stored charge with a time difference according to the position of the row or column of the photoelectric conversion element;

resetting means for simultaneously resetting the stored charge of all the photoelectric conversion elements before main exposure; and

and reset timing varying means capable of changing a timing for resetting the stored charge with respect to a synchronizing pulse corresponding to a readout time of the stored charge.

claim 2

According to claim 1,

main light emitting means for emitting light toward the subject during the main exposure;

a pre-light emitting means for emitting preliminary light toward a subject before the main exposure;

first preliminary exposure means for performing a first preliminary exposure under a first preliminary exposure condition before the main exposure;

second preliminary exposure means for performing a second preliminary exposure under a second preliminary exposure condition obtained by adding the preliminary light emission to the first preliminary exposure condition; and

further comprising main exposure condition determining means for comparing the first preliminary exposure and the second preliminary exposure to determine the amount of light emitted at the time of the main light emission;

wherein the reset means simultaneously resets stored charges in all of the photoelectric conversion elements before the main exposure and before the preliminary exposure.

claim 3

According to claim 2,

The imaging device performs preliminary exposure only on some rows or columns of the photoelectric conversion elements during the first preliminary exposure and the second preliminary exposure.

claim 4

According to claim 1,

wherein the reset timing variable means changes the timing according to an operation of an external operating member.

claim 5

According to claim 1,

wherein the reset timing variable means changes the timing according to photographing conditions.

claim 6

According to claim 1,

wherein the reset timing variable means sets the reset timing of the stored charge immediately prior to the synchronizing pulse.

claim 7

According to claim 1,

The photoelectric conversion element does not have a memory section for storing the stored charge.

claim 8

According to claim 1,

an imaging device further comprising a shutter disposed closer to the subject than the photoelectric conversion element, brought into an open state at the time of the main exposure, and brought into a closed state after a lapse of a predetermined time after the reset of the stored charge is performed before the main exposure; .

claim 9

According to claim 1,

and diaphragm driving means for driving a diaphragm for adjusting an amount of exposure to the photoelectric conversion element before the main exposure.

claim 10

According to claim 1,

An imaging device further comprising additional charging means for performing additional charging for the main light emission before the main exposure.

Specification

DETAILED DESCRIPTION OF THE INVENTION

purpose of invention

the technology to which the invention belongs, and that prior art in the field

<25> The present invention relates to an imaging device, and more particularly, to an imaging device capable of varying the time difference between preliminary light emission and main light emission.

<26> An imaging device equipped with an imaging element such as a photoelectric conversion element is provided with a lens, a diaphragm, a shutter, or the like, and reads electric charge generated in response to light impinging on the imaging surface of the imaging element as an electrical signal to record an image. am.

<27> When shooting with an imaging device under environmental conditions such as at night or indoors, the amount of light required to obtain an appropriate image is insufficient. In the case of the case, a photograph is taken after increasing the amount of light by emitting a flash provided in the imaging device.

<28> By the way, in order to reduce the manufacturing cost of the image pickup device or to reduce the size of the image pickup device, when the sensor for light control is not installed in the image capture device, the focus and exposure are measured while measuring the amount of light emitted by the flash for the first time during the actual shooting in which the subject is actually recorded on the recording medium. It is impossible to adjust at the same time as the actual shooting.

<29> Therefore, before the main light emission of the flash at the time of the main shooting, the pre-light emission of the flash is performed in advance to measure the necessary light emission amount. Then, before the main shooting, the focus or exposure adjustment is finished, and then the main shooting is performed. In this regard, Japanese Patent Laid-Open No. 2000-196951 discloses that an exposure amount is detected during preliminary light emission before main light emission, and an optimal exposure, white balance, and lens focus position can be set by the main light emission at the time of main shooting. A technology is disclosed.

<30> On the other hand, when the pre-flashes are performed before the main flashes, if the time difference between the pre-flashes and the main flashes is long, the person in the subject may mistake the pre-flashes for the main flashes. There was a problem that an appropriate image could not be obtained because the image was wound up.

<31> In addition, in order to accurately detect the exposure amount during pre-light emission before the main photograph, the exposure amount measured during pre-light emission should not be saturated, and the exposure period during pre-light emission measurement or the light emission period during light emission should be appropriately controlled. However, in spite of the adjustment of the exposure period during the pre-flashes, such as when shooting in a bright room using a flash, the measured exposure amount during the pre-flashes is saturated and the appropriate exposure amount cannot be detected often. Therefore, in those cases, there was a problem that the required amount of light emission at the time of main light emission could not be obtained.

The technical task to be achieved by the invention

<32> The main object of the present invention is to make the time difference between preliminary light emission and main light emission variable, and appropriate exposure at the time of preliminary light emission. It is to provide an imaging device capable of detecting a quantity.

Composition and operation of the invention

<33> The present invention provides photoelectric conversion elements arranged in a matrix form and accumulating stored charges according to exposure, and stored charge reading that reads the stored charges with a time difference according to the position of a row or column of the photoelectric conversion elements. means, resetting means for simultaneously resetting the stored charge of all the photoelectric conversion elements prior to main exposure, and timing for performing the resetting of the stored charge may be changed with respect to a synchronizing pulse corresponding to a reading time of the stored charge. Disclosed is an imaging device including a variable reset timing unit.

<34> Here, the reset timing variable unit may be controlled by a CPU.

<35> Here, the image pickup device comprises a main light emitting means for emitting light toward a subject during the main exposure, a preliminary light emitting means for emitting preliminary light toward the subject before the main exposure, and a first preliminary exposure condition before the main exposure. a first preliminary exposure means for performing a first preliminary exposure with the first preliminary exposure, and a second preliminary exposure means for performing a second preliminary exposure under a second preliminary exposure condition obtained by adding the preliminary light emission to the first preliminary exposure condition; further comprising final exposure condition determining means for comparing the first preliminary exposure with the second preliminary exposure to determine the amount of light emitted at the time of the main light emission, wherein the resetting means performs all of the photoelectric conversion before the main exposure and before the preliminary exposure. The reset of the stored charge of the elements can be performed simultaneously.

<36> Here, the exposure condition determining unit and the resetting unit may be controlled by a CPU.

<37> Here, during the first preliminary exposure and the second preliminary exposure, preliminary exposure may be performed only on some rows or columns of the photoelectric conversion elements.

<38> Here, the reset timing variable means may change the timing according to manipulation of an external operating member. Here, the external operation member includes, for example, a member for remote operation, a member installed on the outer surface of the main body of the imaging device, and the like. With the above configuration, the timing of resetting can be varied by manipulating an external operating member.

<39> Here, the reset timing variable unit may change the timing according to photographing conditions. Here, the photographing conditions include, for example, photographing environment conditions, setting conditions of the imaging device such as exposure conditions or sensitivity conditions, driving conditions of the imaging device such as diaphragm driving or additional charging.

<40> Here, the reset timing variable unit may set the reset timing of the stored charge immediately before the synchronization pulse.

<41> Here, the photoelectric conversion element may not have a memory unit for storing the stored charge.

<42> Here, the imaging device includes a shutter that is disposed closer to the subject than the photoelectric conversion element, is opened during the main exposure, and is closed after a predetermined time elapses after resetting the stored charge before the main exposure. can be further provided.

<43> Here, the imaging device may further include a diaphragm driving means for driving a diaphragm for adjusting an amount of exposure to the photoelectric conversion element before the main exposure.

<44> Here, the imaging device may further include additional charging means for additional charging for the main light emission before the main exposure.

<45> Hereinafter, the present invention will be described in detail with reference to embodiments shown in the accompanying drawings. In this specification and drawings, the same reference numerals are given to components having substantially the same functional configuration, thereby omitting redundant description.

<46> First, with reference to FIG. 1, the configuration of an imaging device according to an embodiment of the present invention will be described.

1 is a block diagram showing the configuration of an imaging device according to an embodiment of the present invention.

As shown in FIG. 1, the imaging device according to this embodiment includes an optical system 102 that passes light from the outside, and drivers 104 and 106 that control the operation of the optical system 102.), 108, a timing controller 110, a complementary metal oxide semiconductor (CMOS) 112, a CDS/AMP (correlated double sampling/amplifier) 114, A/D conversion unit 116, image input control unit 118, central processing unit (CPU) 120, operation unit 122, image signal processing unit 124, video random access memory (VRAM) 126, a compression processing unit 128, a memory 130, a display unit 132, a liquid crystal display (LCD) driver 134, a recording medium control unit 136, and a recording medium 138 and a capacitor, a condenser 140, and a flash controller 142.

<49> The optical system 102 has a lens, a zoom mechanism, an diaphragm mechanism, and a focus mechanism. The optical system 102 forms an image of a subject on the CMOS 112 through a lens. The driver 104 drives the zoom mechanism of the optical system 102, and the driver 106 drives the optical system 10

The diaphragm mechanism of 2) is driven, and the driver 108 drives the focus mechanism of the optical system 102.

<50> The timing controller 110 controls the exposure period of each pixel constituting the CMOS 112 and controls the reading of charge. The CMOS 112 is composed of elements capable of photoelectric conversion, and each element generates an electrical signal in response to light received.

<51> The CDS/AMP 114 removes low-frequency noise included in the electrical signal obtained from the CMOS 112 and amplifies the electrical signal to an arbitrary level. The A/D conversion unit 116 converts an analog electrical signal into a digital signal.

<52> The image input controller 118 receives an operation command from the CPU 120 and controls the operations of the CMOS 112, the CDS/AMP 114 and the A/D converter 116 related to image input. .

<53> The control unit 122 is composed of a power switch, a mode changer, and a shutter button, and is used by the user to set the shutter speed or ISO sensitivity.

<54> The VRAM 126 is a memory for displaying images, and is composed of a memory having a plurality of channels so that display images can be written and displayed on the display unit 132 at the same time.

<55> The compression processing unit 128 converts the input image data into compressed data in a compression format such as a JPEG compression format or an LZW compression format.

<56> The memory 130 is composed of, for example, a semiconductor storage element such as SDRAM (synchronous DRAM), and stores high-speed shutter images taken in time-division photography. Also, the operation program of the CPU 120 is stored in the memory 130 .

The image signal processing unit 124 synthesizes images, and the synthesized image is stored in the memory 130.

<58> The display section 132 is composed of display means such as an LCD, and images read from the VRAM 126 are displayed. The LCD driver 134 controls the output of the display unit 132 by driving the display unit 132 .

The recording medium control unit 136 writes image data into the recording medium 138 or images recorded in the recording medium 138. Control reading of data, setting information, etc.

The recording medium 138 is composed of, for example, an optical recording medium, a magneto-optical disk, a magnetic disk, a semiconductor storage medium, or the like. and record the captured image data. The recording medium 138 may be configured to be detachable from the imaging device.

<61> The capacitor 140 temporarily stores power to secure power capacity required for flash light emission.

<62> The flash control unit 142 controls the light emission of the flash, and in particular, simultaneously resets the imaging device or opens and closes the mechanical shutter. Controls the light-emitting operation linked to .

Next, with reference to FIG . 2, the operational flow of the imaging device involving preliminary light emission and main light emission will be described. 2 is a flowchart showing an imaging process according to the present embodiment.

In the imaging device according to the present embodiment, the imaging process starts when the shutter release is pressed (step S100).

<65> First of all, it is determined whether or not the flash light emission is required at the time of the main shooting (step S102).

<66> When flash photography is unnecessary, main photography is performed as it is. That is, exposure is started without flash emission, and image signal input is started. At this time, the imaging device accompanies driving of the mechanical shutter (step S160).

<67> On the other hand, if flash photography is required, a shutter speed for pre-light emission is determined according to a photographing environment (step S104).

<68> Then, the determined shutter speed for pre-emission is instructed to the imaging device (step S106). Next, only the normal light component is exposed at the shutter speed for pre-emission, and the exposed image signal is input (step S108).

<69> After that, exposure and image signals accompanying preliminary light emission are input at the shutter speed for preliminary light emission (step S110). Then, the amount of reflected light obtained by pre-emission is calculated based on the data obtained from the two exposure/injection patterns of only the normal light component and the data including the pre-emission flash component (step S112).

<70& gt; Next, from the calculated amount of reflected light, the actual light emission amount at the time of the main photographing is determined (step S114). Also, the shutter at the time of main emission The speed is determined (step S116). Then, the determined shutter speed for light emission is instructed to the imaging device (step S118).

<71> Then, the main shooting accompanied by light emission of the flash is performed. That is, exposure is performed accompanying the actual light emission of the flash, and an image signal is input. At this time, the imaging device accompanies driving of the mechanical shutter (step S120).

<72> Image processing is performed on the image signal read after steps S120 and step S160, and image data is written to storage (step S140).

<73> A series of imaging processes are ended, and the imaging device returns to the next imaging standby state (step S160).

<74> Next, referring to FIG. 3, an exposure control method using a general imaging device will be described. Fig. 3 is an explanatory diagram showing the exposure timing of the rolling shutter when a high-speed shutter is selected. The vertical axis represents the position of each line in the vertical direction of the imaging device, and the horizontal axis represents the elapsed time. Figure 3 also shows both the vertical transmission period and the flashing period.

<75> In the rolling shutter, exposure of each line of the imaging device starts from the uppermost line (TOP row) of each line (TS) and sequentially starts to the lowermost line (LAST row) (LS). Then, after a certain exposure period has elapsed from the start of exposure, the electric charge accumulated in each pixel of the imaging device is read out as an image signal. Reading of the image signal is started from the top line (TOP row) (TE) and sequentially from the bottom line (LAST row) (LE). The exposure period of each line is the time difference between the exposure start time and the read start time.

In FIG. 3, the range enclosed by a parallelogram having TS, TE, LE, and LS as vertices represents the exposure operation of the imaging device, and the point where the line parallel to the time axis (horizontal axis) and the sides of the parallelogram cross each other indicates the exposure start time or end time. For example, the exposure of the TOP row is from the TS point to the TE point, and the exposure of the LAST row is from the LS point to the LE point.

The vertical transmission period (VD) is the time indicated between vertical synchronizing pulses. In this specification, the period from one vertical synchronizing pulse to the next vertical synchronizing pulse is expressed as 1VD. The flash emission period is, for example, 1 millisecond, which is considerably shorter than that of 1VD. And, as shown in FIG. 3, an imaging device capable of receiving the reflected light of a subject under the influence of the flash can accumulate charge including a flash component in a portion where the exposure period and the flash emission period overlap. That is, the image pickup device exposed to light at the overlapping portion can accumulate charge including a flash component.

Since the exposure period of the rolling shutter when the high-speed shutter is selected is short, the line affected by the flash is, for example, only the central portion of the screen, as shown in FIG . At this time, the exposure period of the TOP row or LAST row is excluded from the flash emission period. Therefore, the flash component is not included in the image signal read from the TOP line or the LAST line. Therefore, it is necessary to lengthen the exposure period in order to expose the flash-irradiated subject in all lines of the imaging device and to include the flash component in all lines.

Next, a rolling shutter when a slow shutter is selected will be described with reference to FIG. 4 . Fig. 4 is an explanatory diagram showing the exposure timing of the rolling shutter when a slow shutter is selected. As shown in FIG. 3, the vertical axis represents the position of each line in the vertical direction of the imaging device, and the horizontal axis represents the elapsed time. In addition, FIG. 4 shows both the vertical transmission period and the flash emission period.

In FIG. 4, the exposure period is longer than that in FIG. 3 because a slow shutter speed is selected. As shown in FIG. 4, the flash emission period and the exposure period of each line of the imaging device overlap in all lines. Accordingly, it is possible to expose a subject irradiated with the flash in all lines of the imaging device. However, when a slow shutter speed is selected and the exposure period is lengthened, it is easily affected by hand shake and the like, and blur occurs in the image, making it impossible to obtain a clear image. In addition, in an environmental condition with strong light such as outside light, the imaging device is saturated and proper images cannot be obtained.

<81> Furthermore, if the calculation area for dimming is limited to the center of the screen, the selection of shutter speeds can be expanded even in the case of performing a rolling shutter. However, since the computational domain cannot be extremely narrowed, the shutter speed that can be selected in the high-speed direction is limited.

Next, with reference to FIG . 5, the exposure timing using a mechanical shutter, in which exposure is started by simultaneous resetting, will be described. Fig. 5 is an explanatory diagram showing exposure timing when exposure is started after reset and a mechanical shutter is used in combination.

As shown in FIG. 5, the charge reset of all lines from the TOP row to the LAST row of the imaging device is performed with the vertical sync pulse . are performed simultaneously Then, exposure of each line of the imaging device is simultaneously started simultaneously with resetting.

Next , after the lapse of a predetermined exposure period, image signal reading is started from the TOP row of the imaging device simultaneously with the vertical synchronizing pulse immediately after the start of exposure, and reading is started sequentially up to the LAST row. The exposure period of each line of the image pickup device is from the reset time of the electric charge of the image pickup device to the start time of reading the image signal. Therefore, each line of the image pickup device in the vertical direction

A difference arises in the exposure period. That is, as shown in FIG. 5, the exposure period of the TOP row is, for example, 1VD, and the exposure period of the LAST row is, for example, 2VD, and an exposure difference of 1VD occurs between the TOP row and the LAST row. Accordingly, the exposure amount of each line increases as one goes from the TOP row to the LAST row. Furthermore, the reset timing of the charge of all lines of the imaging device may be controlled by the timing control unit 110 or may be controlled by providing a timing generator function to the inside of the CMOS 112.

The mechanical shutter can forcibly block incident light to each line of the imaging device simultaneously by changing from an open state to a closed state. Exposure is terminated when the mechanical shutter is blocked. Therefore, when exposure is started by simultaneous resetting, the exposure period of all lines of the imaging device can be made the same by using a mechanical shutter together. As a result, the flash speed can be increased while including the flash component in all lines, and the selectable shutter speed range can be widened in the high-speed direction to a range not shorter than the flash emission period. In addition, in this embodiment, the so-called global shutter, which is composed of a photodiode unit for receiving light and a memory unit for accumulating light reception within one screen, and electronically opens the shutters simultaneously across all pixels constituting one screen, is not adopted. don't Therefore, since there is no need to make a memory unit for accumulating electric charge due to light reception, the area of the light receiving unit can be increased.

Next, with reference to FIG. 6, exposure timings for preliminary light emission and main light emission will be described.

Fig. 6 is an explanatory diagram showing exposure timing during preliminary light emission and during main shooting. The vertical axis represents the position of each line in the vertical direction of the imaging device, and the horizontal axis represents the elapsed time. 6 shows all of the vertical synchronizing pulse, the charge reset of the imaging device, and the flash emission period.

Exposure (12), (14), (16) and (18) shown in Fig. 6 represent the exposure operation of the imaging device . As in FIG. 5, the charge reset of all lines from the TOP row to the LAST row of the image pickup device is performed simultaneously with the vertical synchronizing pulse, and in each exposure (12), (14), (16), and (18) of the image pickup device Simultaneously with charge resetting, exposure is simultaneously started for each line. Next, after a predetermined exposure period has elapsed, reading of image signals is started from the TOP row of the imaging device simultaneously with the vertical synchronizing pulse immediately after the start of exposure, and reading is started sequentially from each line up to the LAST row. The exposure period of each line of the imaging element is from the reset timing of the electric charge of the imaging element to the start timing of image signal reading.

<89> Exposure 12 is an exposure at the time of capturing an image without a flash operation, and an exposure amount obtained in exposure 12 is an exposure amount of a normal light component that does not include a flash component.

<90> As shown in FIG. 6, the exposure 14 is an exposure during image capture accompanied by a flash operation as a pre-light emission during the pre-light emission period. The exposure amount obtained in the exposure 14 is included in a state in which the normal light component and the pre-emission flash component are mixed and added.

<91> In exposure 16, the same exposure operation without flash as in exposure 12 is performed.

<92> Exposure 18, as shown in FIG. 6, is exposure at the time of main shooting accompanied by a flash operation as main light emission during the main light emission period.

<93> Exposure 14 in which preliminary light emission is performed does not involve a mechanical shutter. Accordingly, the exposure amount is different for each line of the image element. For example, an exposure difference of a period equivalent to 1VD occurs between the TOP row and the LAST row. However, since the difference between the exposure amount obtained in exposure 14 and the exposure amount obtained in exposure 12 is used to calculate the pre-emission flash component, the difference in exposure amount for each line is negligible. there is.

<94> In addition, the sound of a mechanical shutter may be annoying because the operation sound of a shutter is generated. In addition, since the next exposure cannot be started from the closed state of the mechanical shutter until it is completely opened, there is a problem in that a time lag occurs in the operation of the imaging device. Therefore, if a mechanical shutter is used during pre-flashes, there is a risk that the shutter sound may be confused with the shutter sound for main shooting, and the image pickup device cannot promptly enter the main shooting mode after pre-flashes. Therefore, the mechanical shutter is not used in the case of pre-emission during image capture before the main shooting.

The actual light emission amount of the flash at the time of the main photographing is calculated based on the exposure amounts obtained in exposure (12) and exposure (14). The pre-flash flash component differs, for each corresponding pixel, the data value of the image signal read by the exposure 12 without flash operation from the data value of the image signal read by the exposure 14 at the time of the pre-flashes. (ÿÿ) is obtained by. This light emission amount is calculated from the difference between the evaluation value of the preliminary flash image and the target level. This calculation of the light emission amount and setting of control values such as the setting of this exposure amount based on the amount of light emission are performed during the period of exposure 16, for example, about 2VD, as shown in FIG.

<96> In addition, exposure 18 with a mechanical shutter is performed during this photographing. Therefore, the exposure period at the time of this shooting is

This is the period from when the charge of the device is reset all at once until the mechanical shutter is closed. In the pre-light emission and main photographing operations shown in FIG. 12, a light emission time lag A occurs between the pre-light emission period and the main light emission period, and the light emission time lag A is, for example, about 4VD.

Next, with reference to FIG . 7, a case in which the preliminary light emission timing is delayed compared to the case of FIG. 6 will be described. Fig. 7 is an explanatory diagram showing exposure timing during preliminary light emission and during main shooting. Since FIG. 7 is the same as FIG. 6 except for the pre-emission period, a detailed description thereof is omitted.

In the exposure timing of FIG . 6 described above, preliminary light emission is performed in the first half of the vertical transfer period VD immediately after the start of the exposure 14. On the other hand, in the exposure timing shown in Fig. 7, preliminary light emission is performed at the end of the vertical transfer period VD. As a result, the light emission time lag B occurring between the preliminary light emission period and the main light emission period is, for example, about 3VD. In the case of performing the preliminary light emission shown in FIG. 7, the time lag can be shortened by about 1VD compared to the light emission time lag (A) of FIG.

<99> Incidentally, in the exposure 14 with preliminary light emission shown in Figs. 6 and 7, the exposure period in the TOP row is 1VD, and the exposure period in the LAST row is 2VD. In a low-luminance scene such as a dark room or at night, it is common for the shutter speed to be longer than 1VD to obtain an appropriate amount of exposure. Therefore, the exposure 14 performed during the exposure period is not saturated in a low luminance scene. On the other hand, when pre-emission is performed under environmental conditions such as a bright room, the exposure 14 may be saturated because the pre-emission flash component is added to the normal light component. Therefore, there is a need for a technique in which the exposure 14 is not saturated even when pre-emission is performed under higher luminance environmental conditions other than a low luminance scene.

<100> Next, referring to FIG. 8, when the charge reset timing of the imaging device is moved to the end of the vertical transfer period (VD) explain about Fig. 8 is an explanatory diagram showing exposure timing at the time of preliminary light emission and at the time of main photographing.

<101> Exposures 22, 24, and 26 shown in FIG. 8 perform the exposure operation of the imaging device like the exposures 12, 14, and 16 shown in FIGS. 6 and 7. indicate The charge reset of all lines from the TOP row to the LAST row of the imaging device is performed simultaneously with the vertical synchronizing pulse. As in the case of FIG. 7 , reset is performed at the end of the vertical transmission period (VD). As in Figs. 6 and 7, exposures 22, 24, and 26 of the imaging device are simultaneously started in each line at the same time as the reset. Next, after the lapse of a predetermined exposure period, image signal reading is started from the TOP row of the imaging device simultaneously with the vertical synchronizing pulse immediately after the start of exposure, and reading is started sequentially from each line up to the LAST row. The exposure period of each line of the imaging element is from the reset timing of the electric charge of the imaging element to the start timing of image signal reading.

<102> In the cases of FIG. 7 and FIG. 8, the emission time lag B between the preliminary emission period and the main emission period is the same. In addition, the point that exposure of each line of an imaging element is started simultaneously with resetting of electric charge is the same. On the other hand, in the case shown in Fig. 8, the charge reset timing is shifted to the end timing of the vertical transfer period (VD), and the exposure period of each line of the imaging device in exposures (22), (24) and (26) is shorter than the exposure period of exposures 12, 14, and 16 shown in FIG. By shifting the reset timing of the charge of the imaging device in this way, the exposure start timing of the exposure 24 can be delayed, and the exposure period of each line can be shortened. As a result, even when preliminary light emission is performed under environmental conditions such as a bright room, the exposure amount in the exposure 24 is not saturated, and an appropriate exposure amount can be obtained while performing preliminary light emission.

Further, in the foregoing, an example in which the charge reset timing of the imaging element is set to the end of the vertical transfer period (1VD) has been shown. The reset time is a time when a pre-emission period can be sufficiently secured so that all lines of the imaging device can include a flash component due to pre-emission, and is a time before the next vertical synchronizing pulse. Furthermore, the reset timing is not limited to the above example, and the setting can be changed to a timing at which the exposure 24 is not saturated.

<104> Next, with reference to FIG. 9, exposure in the case of preliminary light emission in the high-speed reading mode will be described. Fig. 9 is an explanatory diagram showing exposure during preliminary light emission in high-speed reading mode and standard reading mode.

In the standard reading mode shown below in FIG. 9, the length of the vertical transfer period (VD) is 1VD, and the exposure 24 is the same as the case shown in FIG. 8 described above. Exposure 24 resets the charge on the imaging device at the end of the vertical transfer period. 8, the length of the vertical transfer period (VD) is 1VD, and the reading start time, end time, and period length of each line of the image pickup device are the same. . Reading of the image signal is 1 VD from the TOP line to the LAST line.

<106> On the other hand, the high-speed reading mode shown above in Fig. 9 is a mode in which the period required for reading is shortened by reducing the amount of data read from the imaging device.

<107> In the high-speed read mode, the vertical transmission period from one vertical sync pulse to the next vertical sync pulse is

Compared to VD, it is shortened to, for example, 1/3, and is called 1/3VD. Then, the number of lines for reading image signals is reduced to 1/3 of the lines compared to the standard reading mode, instead of all lines from the TOP line to the LAST line of the picture element. Also, in this mode, the reset timing of the charge of the imaging device is moved to the end of the vertical synchronizing pulse, not immediately after the vertical synchronizing pulse, as in the case shown in FIG. 8 . As a result, as shown in FIG. 9, the exposure operation in the high-speed reading mode becomes as shown in the exposure 34.

By shifting the reset timing of the charge of the imaging device in this way, the exposure start timing of the exposure 34 can be delayed, and the exposure period of each line can be shortened. In addition, the exposure amount of the imaging device can be reduced by shortening the vertical transfer period in the high-speed reading mode and reducing the amount of reading image signals. Therefore, in the case of photographing in the synchro mode during the daytime accompanied by a flash operation in a high-luminance outdoors, the exposure 34 is not saturated even if pre-light emission is performed, and an appropriate exposure amount can be obtained.

Next, referring to FIG. 10, an exposure mode in which exposure is started by simultaneous reset (hereinafter referred to as simultaneous reset mode) and an exposure mode using a rolling shutter (hereinafter referred to as rolling shutter mode) are compared . 10 is an explanatory diagram showing exposure timings in simultaneous reset mode and rolling shutter mode, and a screen of an imaging device for capturing a subject.

<110> The simultaneous reset mode shown in FIG. 10 shows a case in which the charge of the imaging device is reset at the end of the vertical transfer period and pre-emission is performed just before the vertical synchronizing pulse. Also, the rolling shutter mode represents a case in which pre-light emission is performed at the same time as the simultaneous reset mode. The screen 50 indicates the entire screen on which the imaging device captures a subject, and the evaluation target area 52 indicates an area for evaluating reflected light from the subject during preliminary light emission.

<111> The main light emission amount of the flash at the time of main shooting is determined by evaluating reflected light from the subject at the time of preliminary flashing. In this algorithm for determining the light emission amount, the periphery of the screen lowers the weight of the evaluation. Accordingly, the region to be evaluated 52 is located in the center of the screen 50, and the vertical and horizontal length of the region to be evaluated 52 is 1/2 of the vertical and horizontal length of the screen. As shown in FIG. 10, the exposure of each line of the image pickup device corresponding to the evaluation target region 52 of the screen 50 is between two upper and lower dotted lines of the simultaneous reset mode exposure and the rolling shutter mode exposure, respectively. is represented by the area in When comparing the exposure of the portion corresponding to the evaluation target region 52 between the simultaneous reset mode and the rolling shutter mode, it can be seen that the exposure amount is smaller in the simultaneous reset mode. Therefore, compared to the rolling shutter mode, the simultaneous reset mode is less likely to saturate exposure during pre-emission, and can be applied under various shooting conditions.

<112> As described above, in the simultaneous reset mode, the exposure period of each line of the image element can be shortened by moving the reset timing of the charge of the image pickup device to the end of the vertical transfer period instead of being the same as the vertical synchronizing pulse. can That is, by allowing the reset timing to be arbitrarily determined in the simultaneous reset mode, it is possible to reduce the possibility of exposure saturation compared to the rolling shutter mode, thereby contributing to improving the accuracy of dimming by pre-emission.

<113> Next, the exposure timing at the time of this photographing will be described with reference to FIGS. 11A and 11B. 11A and 11B are explanatory diagrams showing exposure timing at the time of main shooting with a mechanical shutter. FIG. 11A shows a case in which the reset timing of the charge of the imaging device is moved to the latter half of the vertical transfer period, and FIG. 11B shows a case in which the reset timing coincides with the vertical transfer period.

<114> As shown in FIG. 11B, in this shooting, the charge of the imaging device is reset simultaneously with or immediately after the vertical synchronizing pulse, and at the same time as the reset, exposure 18 is started on each line of the imaging device. . By setting the reset timing at the same time as or immediately after the vertical synchronizing pulse, the shutter time lag from when the photographer presses the shutter button until exposure actually starts can be shortened. However, even when the mechanical shutter is closed and light is blocked, dark noise is added to the image signal on the imaging device until the image signal of the imaging device is read. Therefore, the shorter the period from when the mechanical shutter is closed to the start of reading, the better.

<115> Therefore, by making the reset timing of the charge of the imaging device variable, as shown in Fig. 11A, if the reset timing is moved to the latter half of the vertical transfer period, the period from when the mechanical shutter is closed to reading the image signal can be shortened Therefore, it is possible to reduce the dark noise added to the image signal of the imaging device and improve the quality of the obtained image. Although the shutter time lag is lengthened by moving the reset timing to the latter part of the vertical transfer period, since a high-quality image can be obtained, it can be used when the imaging device is set to a high sensitivity setting.

<116> Next, with reference to FIGS. 12A and 12B, the exposure timing in the case of performing the main image after the diaphragm driving operation will be described. 12A and 12B are explanatory diagrams showing exposure timing during main imaging. FIG. 12A shows a case where the charge reset timing of the imaging device is moved to the latter half of the vertical transfer period, and FIG. 12B shows the reset timing equal to the vertical synchronization pulse.

represents a case of poetry.

As shown in FIG. 12B, in the main shooting, there is an operation of shifting from the live view mode in which the imaging device holds the subject before exposure to the main shooting mode in which the subject is actually exposed . At this time, since the aperture position set in the live view mode may need to be set to the aperture position required for the shooting mode, a period of driving the aperture operation is required. Then, exposure is started after the diaphragm drive operation is completed.

<118> In the case of the example shown in FIG. 12B, in this shooting, the charge reset of the image pickup device is performed simultaneously with or immediately after the vertical synchronizing pulse, and at the same time as the reset, exposure 18 is performed on each line of the image pickup device. is initiated Therefore, exposure 18 is started after waiting for the vertical synchronizing pulse after completion of the diaphragm driving operation. Therefore, completion of the diaphragm driving operation and reset cannot be performed within the same vertical transmission period. In addition, there is a problem that a release time lag occurs when the period from the completion of the diaphragm driving operation to the start of exposure is long.

<119> Therefore, by making the reset timing of the charge of the imaging device variable, the reset timing is shifted to the latter half of the vertical transfer period as shown in FIG. 12A. And, in the case of FIG. 12A, the exposure 38 can be started without waiting for the vertical synchronizing pulse after the diaphragm driving operation is completed. Therefore, when the diaphragm driving operation is completed in the first half of the vertical transfer period, the period until exposure starts can be shortened compared to the case of FIG. 12B in which the vertical synchronizing pulse and the reset timing are performed simultaneously.

<120> As described above, by making the reset timing of the charge of the image element variable and freely setting the reset timing under the control of the imaging device, the completion of the aperture driving operation and resetting can be performed within the same vertical transfer period, resulting in a release time lag can be shortened.

<121> Next, with reference to FIGS. 13A and 13B, the exposure timing of the main photographing in the case where additional charging for the main emission is required after preliminary emission is described. 13A and 13B are explanatory diagrams showing exposure timing during main imaging. Fig. 13A shows a case where the charge reset timing of the imaging device is moved to the latter half of the vertical transfer period, and Fig. 13B shows a case where the reset timing is set simultaneously with the vertical synchronizing pulse.

As shown in FIG. 13B, there are cases in which additional charging is required for main light emission, such as when the voltage suddenly drops after preliminary light emission in main shooting . At this time, an additional charging period is required until the charge required for main light emission is accumulated in the capacitor.

<123> Then, exposure is started after the additional charging is completed in this shooting. In the case of the example shown in FIG. 13B, in this shooting, charge reset of the image pickup device is performed simultaneously with or immediately after the vertical synchronizing pulse, and exposure 18 is started on each line of the image pickup device at the same time as the reset. Thus, exposure 18 is initiated after waiting for the vertical synchronizing pulse after completion of the additional charge. Therefore, additional charge completion and reset cannot be performed within the same vertical transmission period. In addition, if the period from the completion of additional charge to the start of exposure is long, there is a problem that a release time lag occurs.

Therefore, by making the reset timing of the charge of the imaging device variable, the reset timing is shifted to the latter half of the vertical transfer period as shown in FIG. 13A. And, in the case of FIG. 13A , the exposure 48 may be started without waiting for the vertical synchronizing pulse after the additional charge is completed. Therefore, when the additional charge is completed in the first half of the vertical transfer period, the period until the start of exposure can be shortened compared to the case of FIG. 13B in which the vertical synchronizing pulse and the reset timing are performed simultaneously.

<125> As described above, by making the reset timing of the charge of the image element variable and setting the reset timing freely under the control of the imaging device, additional charge completion and resetting can be performed within the same vertical transfer period, thereby reducing the release time lag. can be shortened

Effects of the Invention

<126> According to the present invention, the time difference between pre-emission and main emission can be made variable, so that an appropriate amount of exposure can be determined during pre-emission. It has a detectable effect.

<127> Although the present invention has been described with reference to the embodiments shown in the drawings, this is only exemplary, and those skilled in the art will understand that various modifications and equivalent other embodiments are possible therefrom. will be. Therefore, the true technical protection scope of the present invention should be determined by the technical spirit of the appended claims.

Brief description of the drawing

<1> Fig. 1 is a block diagram showing the configuration of an imaging device according to an embodiment of the present invention.

<2> Fig. 2 is a flowchart showing an imaging process according to the present embodiment.

<3> Fig. 3 is an explanatory diagram showing the exposure timing of the rolling shutter when a high-speed shutter is selected.

<4> Fig. 4 is an explanatory diagram showing the exposure timing of the rolling shutter when a slow shutter is selected.

<5> Fig. 5 is an explanatory diagram showing exposure timing when exposure is started after reset and a mechanical shutter is used in combination.

<6> Fig. 6, Fig. 7 and Fig. 8 are explanatory diagrams showing exposure timing at the time of preliminary light emission and at the time of main photographing.

<7> Fig. 9 is an explanatory view showing exposure during pre-emission in high-speed reading mode and standard reading mode.

<8> Fig. 10 is an explanatory diagram showing exposure timings in simultaneous reset mode and rolling shutter mode and a screen of an imaging device for capturing a subject; all.

<9> Figs. 11A and 11B are diagrams showing exposure timing during main shooting with a mechanical shutter.

<10> Figs. 12A and 12B are diagrams showing exposure timing at the time of main shooting after the diaphragm driving operation.

<11> FIGS. 13A and 13B show exposure timing during main shooting when additional charging for main emission is required after preliminary emission. It is a drawn drawing.

<12> * Brief explanation of the symbols for the main parts of the drawing *

<13> 12,14,16,18,22,24,26,28,34,38,48: Exposure

<14> 50: screen 52: evaluation target area

<15> 102: optical system 104, 106, 108: driver

<16> 110: timing controller 112: CMOS

<17> 114: CDS/AMP 116: A/D conversion unit

<18> 118: image input control unit 120: CPU

<19> 122 operation unit 124 image signal processing unit

<20> 126: VRAM 128: compression processing unit

<21> 130: memory 132: display unit

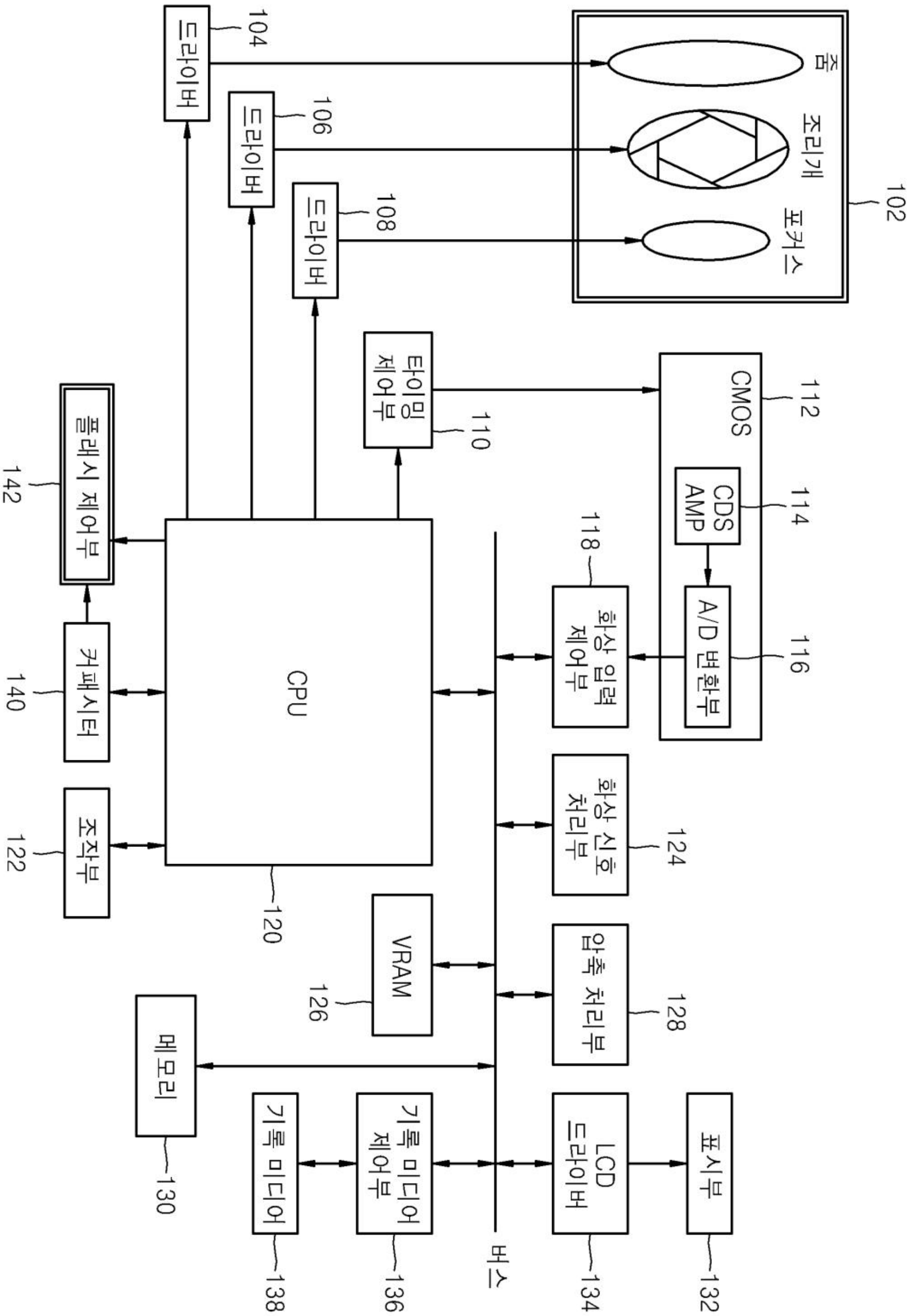
<22> 134: LCD driver 136: recording media control unit

<23> 138: recording medium 140: capacitor

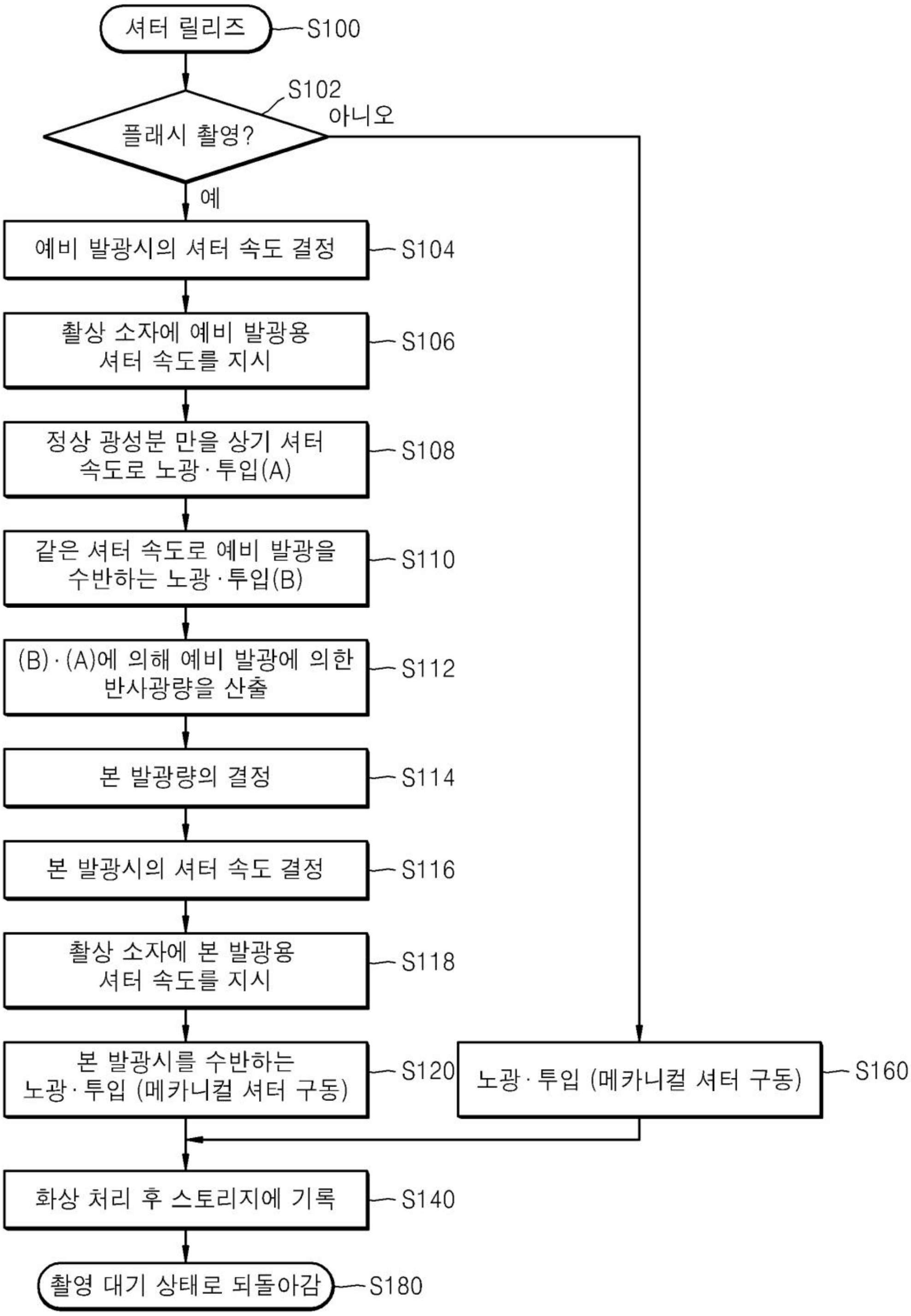
<24> 142: flash control

floor plan

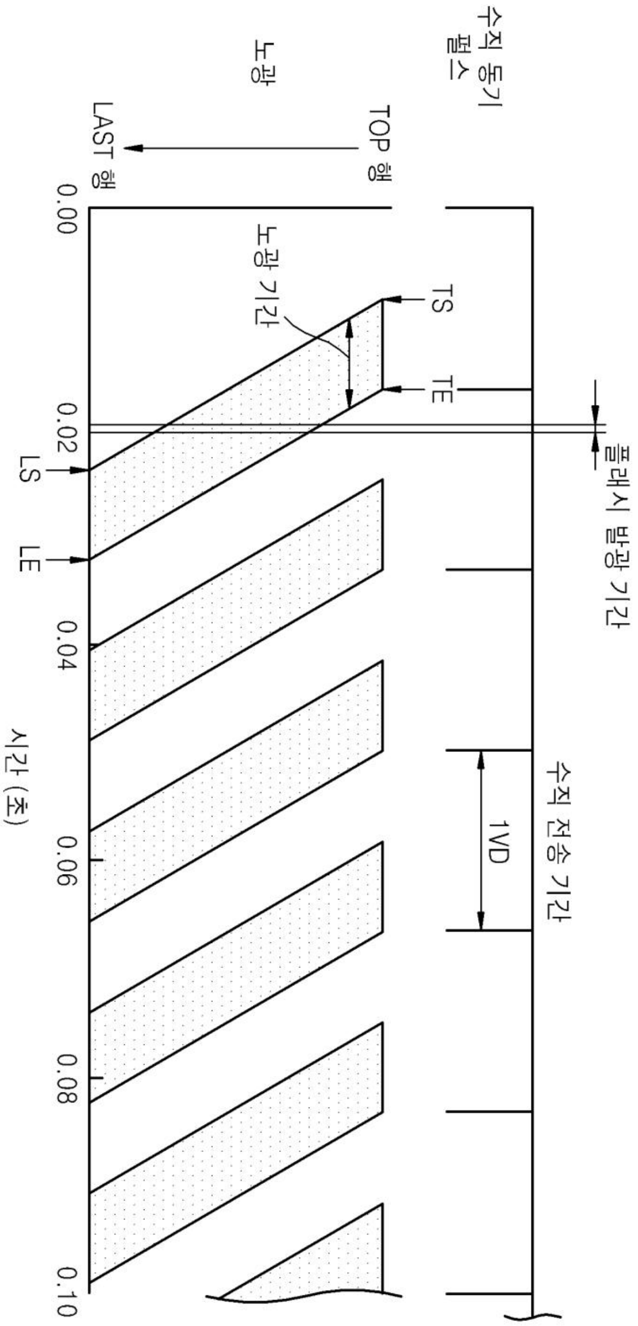
drawing 1



drawing 2


셔터 릴리즈
S100
S102
플래시 촬영?
아니오
예
예비 발광시의 셔터 속도 결정
S104
촬상 소자에 예비 발광용 셔터 속도를 지시
S106
정상 광성분 만을 상기 셔터 속도로 노광·투입(A)
S108
같은 셔터 속도로 예비 발광을 수반하는 노광·투입(B)
S110
(B)·(A)에 의해 예비 발광에 의한 반사광량을 산출
S112
본 발광량의 결정
S114
본 발광시의 셔터 속도 결정
S116
촬상 소자에 본 발광용 셔터 속도를 지시
S118
본 발광시를 수반하는 노광·투입 (메카니컬 셔터 구동)
S120
노광·투입 (메카니컬 셔터 구동)
S160
화상 처리 후 스토리지에 기록
S140
촬영 대기 상태로 되돌아감
S180

drawing 3


수직 동기 펄스
노광
TOP 행
LAST 행
노광 기간
TS
TE
플래시 발광 기간
LS
LE
수직 전송 기간
1VD
시간 (초)
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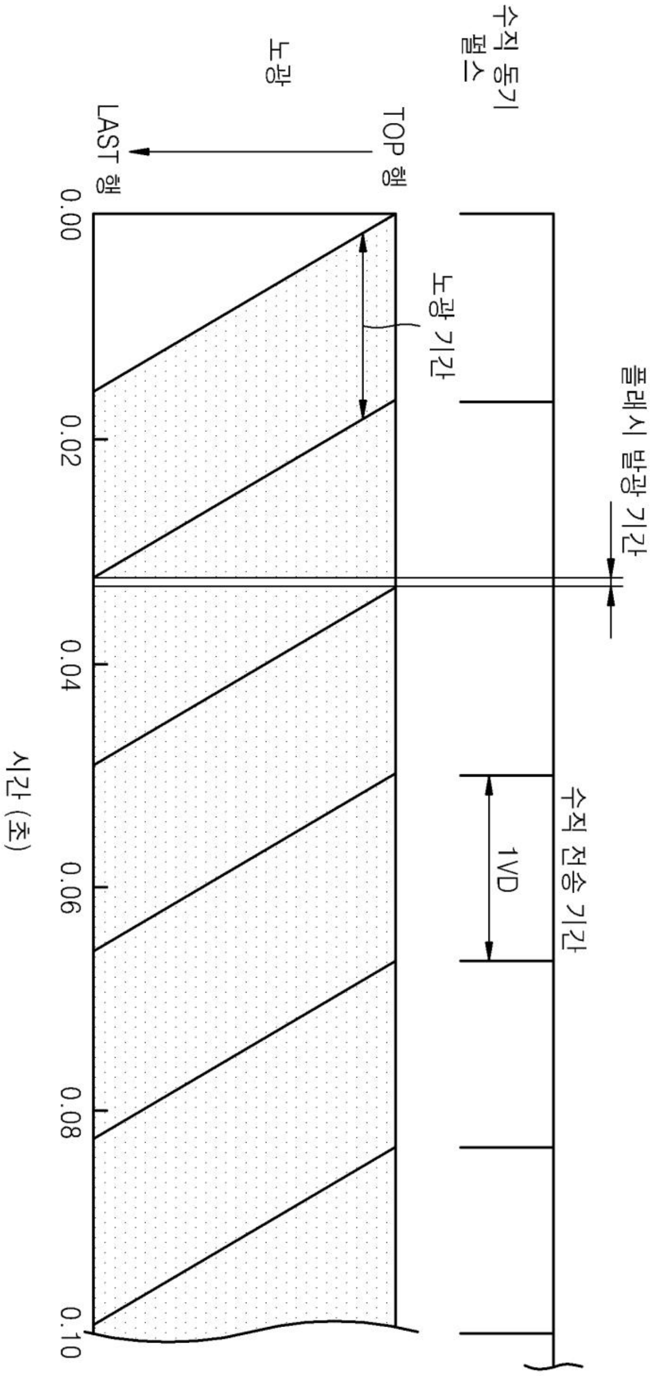
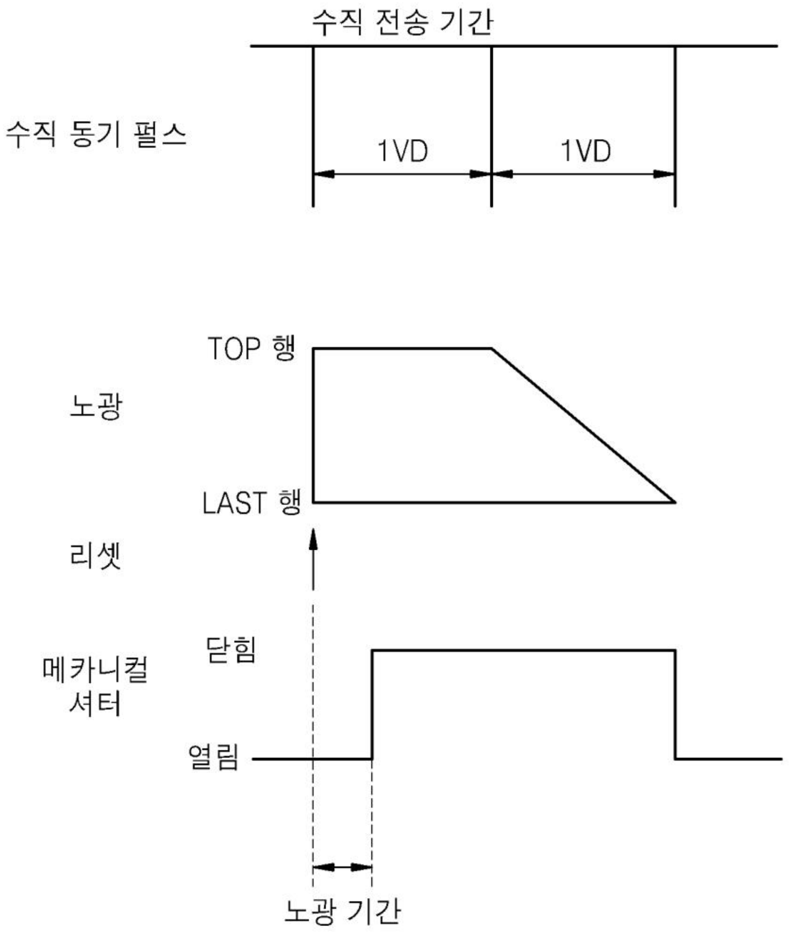
0.02
0.04
0.06
0.08
0.10

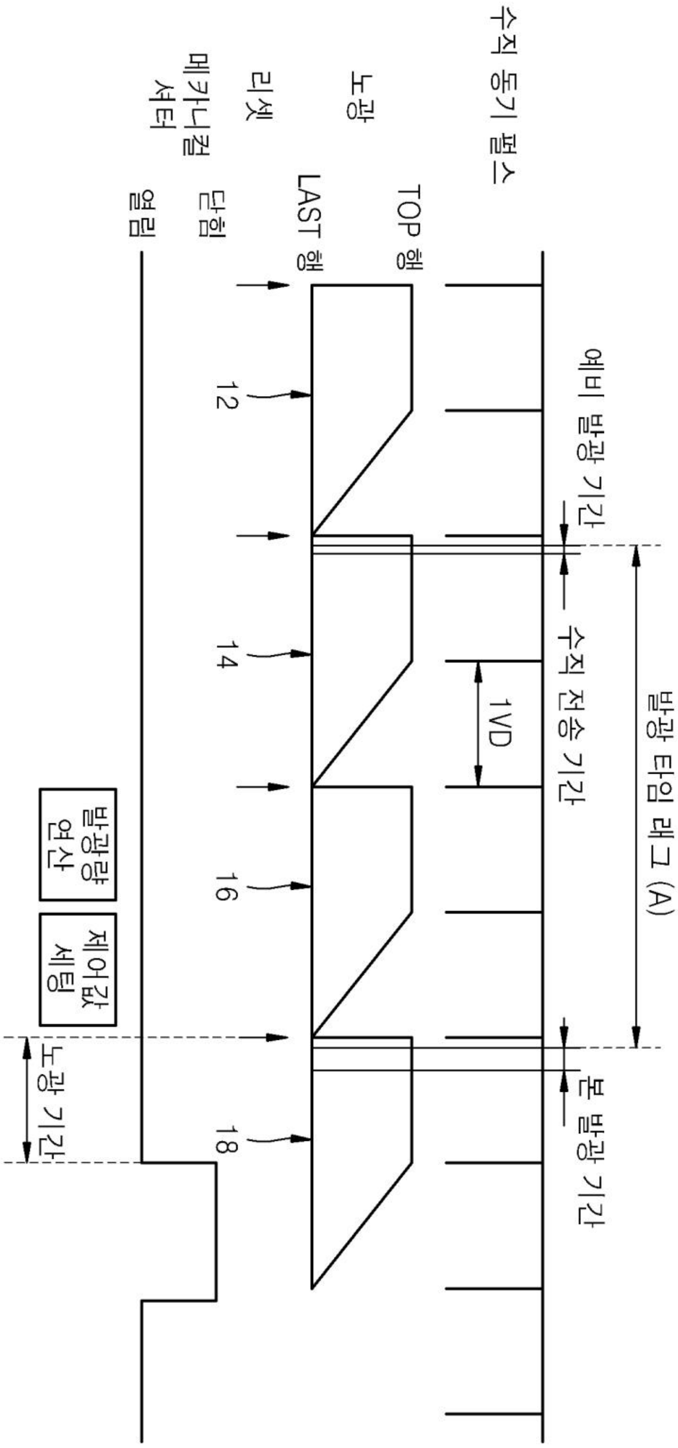
drawing 4


수직 동기 펄스
노광
TOP 행
LAST 행
노광 기간
플래시 발광 기간
수직 전송 기간
1VD
시간 (초)
0.00
0.02
0.04
0.06
0.08
0.10

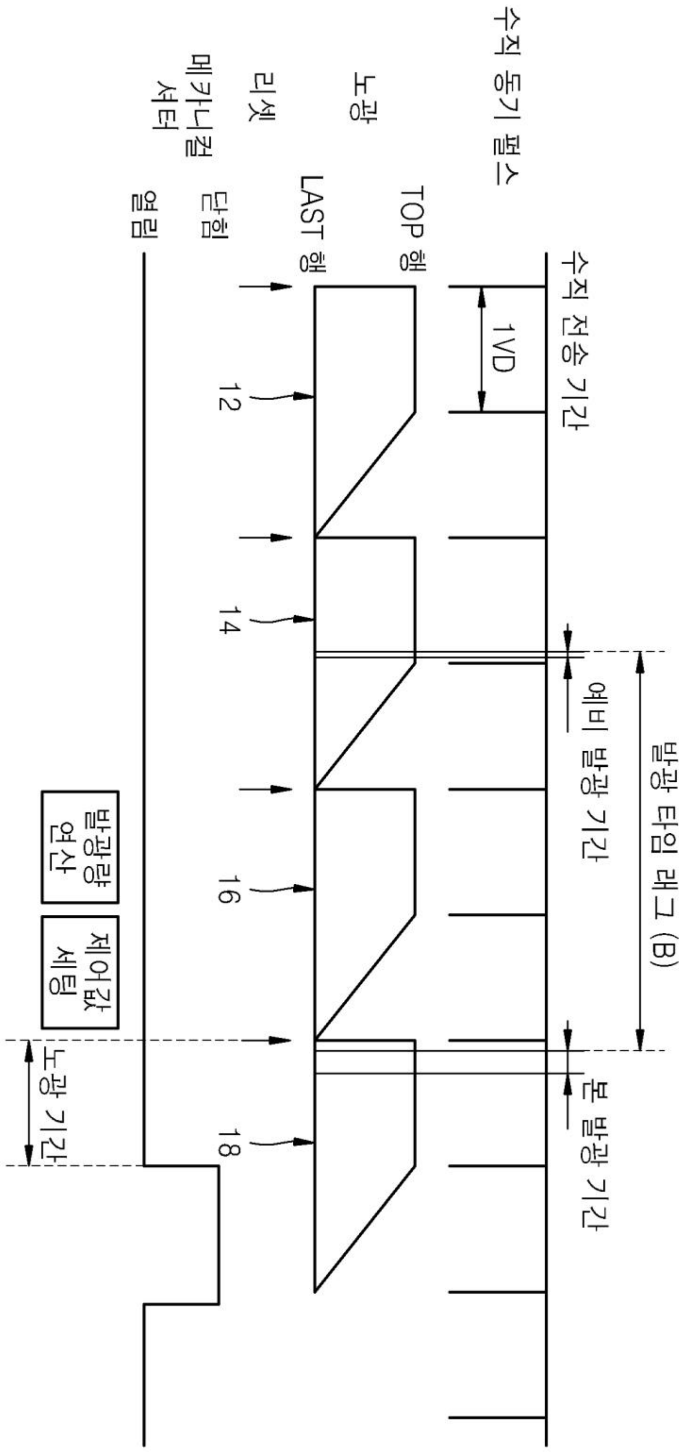
drawing 5



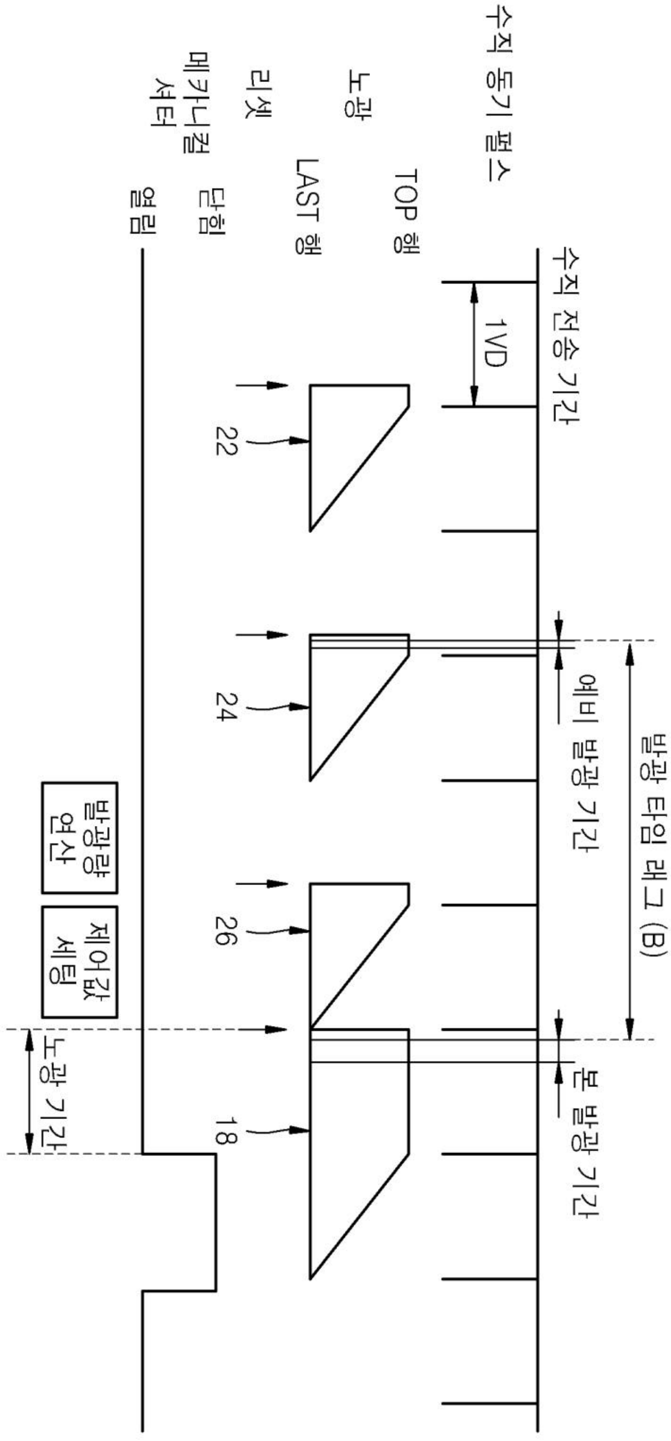
drawing 6


수직 동기 펄스
노광
리셋
메카니컬 셔터
TOP 행
LAST 행
닫힘
열림
12
14
16
18
예비 발광 기간
수직 전송 기간
1VD
발광 타임 래그 (A)
본 발광 기간
발광량 연산
제어값 세팅
노광 기간

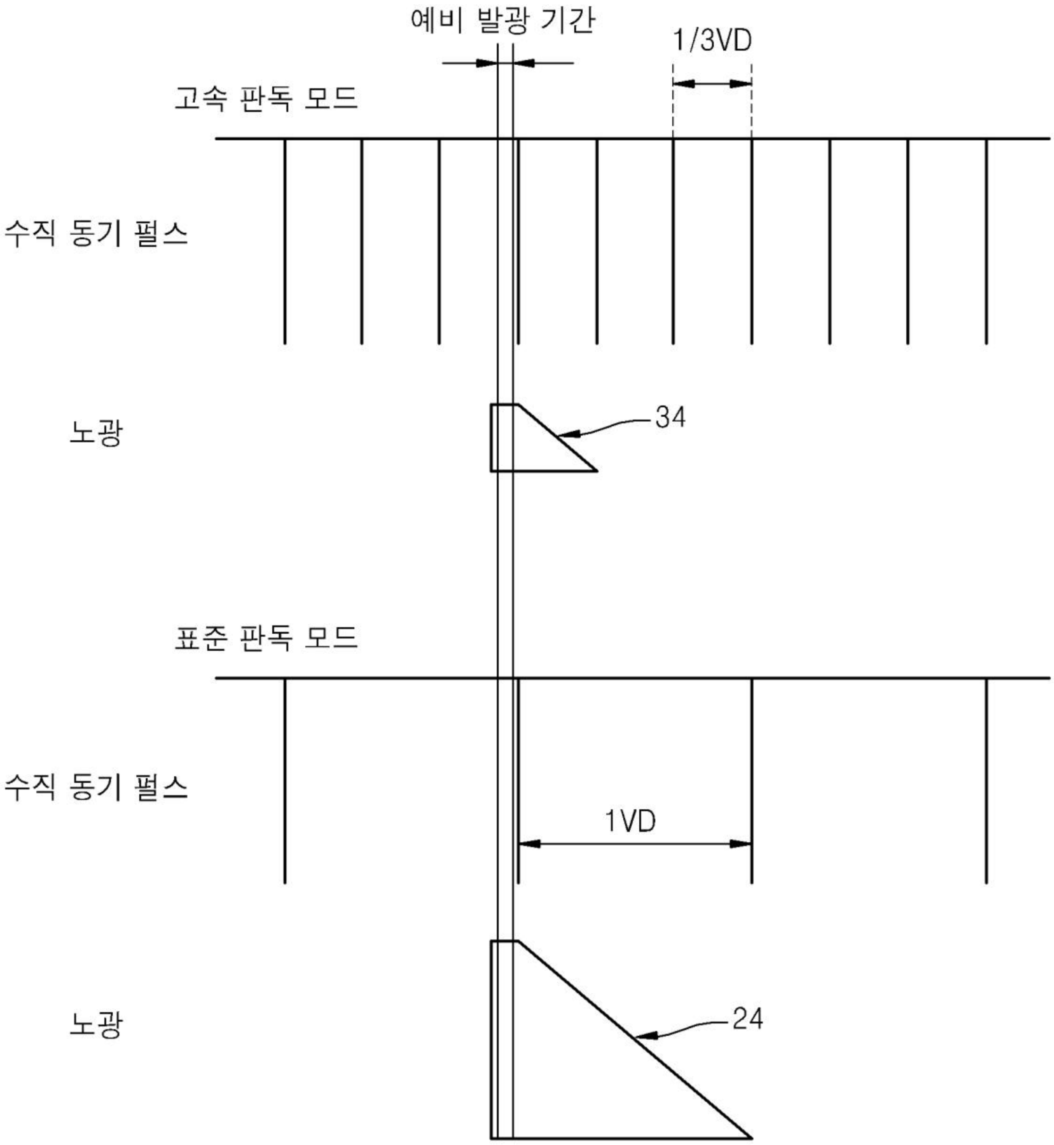
drawing 7


수직 동기 펄스
노광
TOP 행
LAST 행
리셋
메카니컬 셔터
닫힘
열림
수직 전송 기간
1VD
12
14
16
18
예비 발광 기간
발광 타임 래그 (B)
본 발광 기간
발광량 연산
제어값 세팅
노광 기간

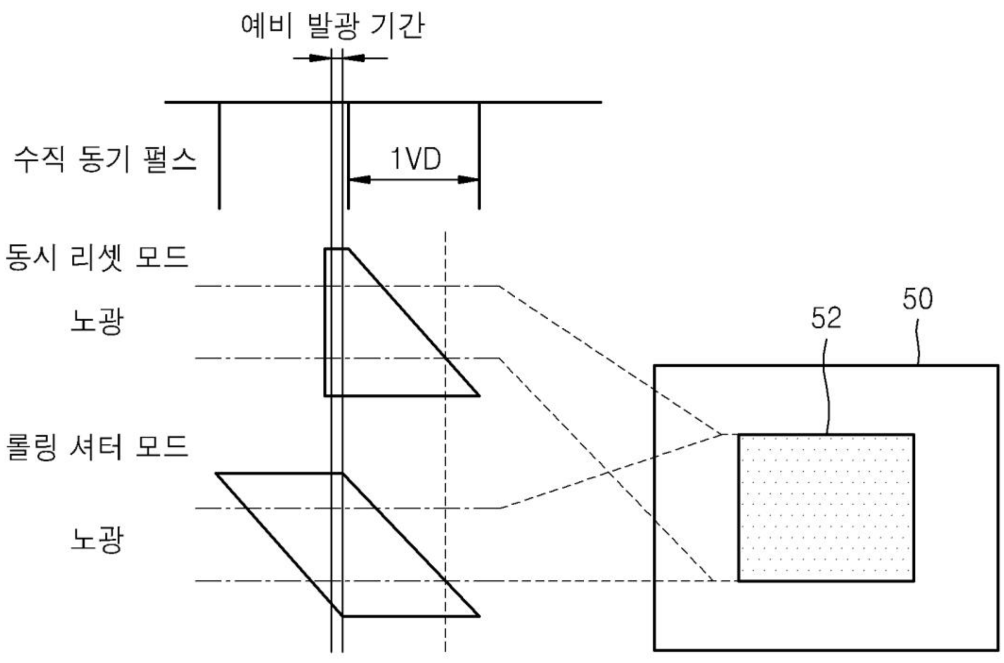
drawing 8


수직 동기 펄스
노광
TOP 행
LAST 행
리셋
메카니컬 셔터
닫힘
열림
수직 전송 기간
1VD
22
24
26
18
예비 발광 기간
발광 타임 래그 (B)
본 발광 기간
발광량 연산
제어값 세팅
노광 기간

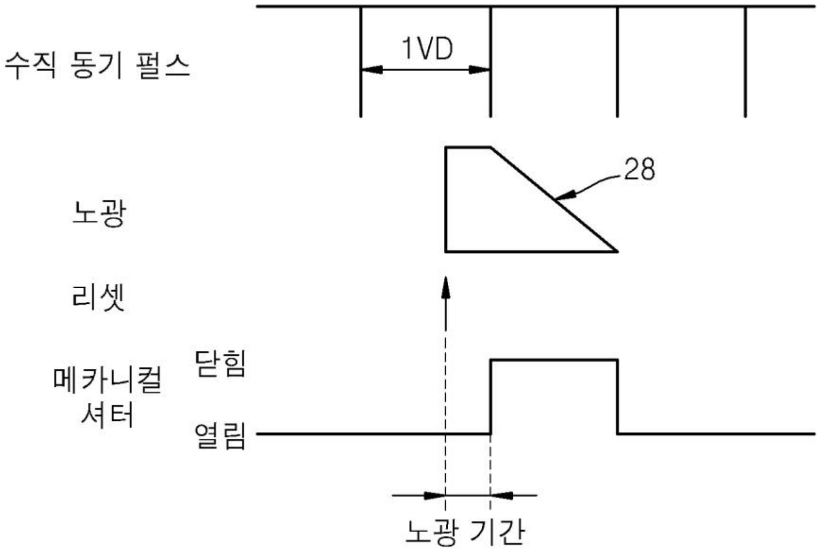
drawing 9



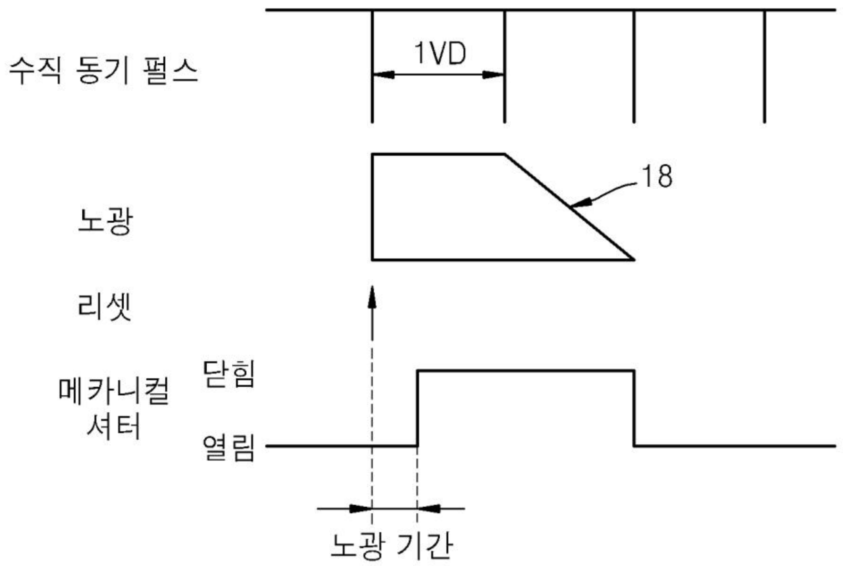
drawing 10



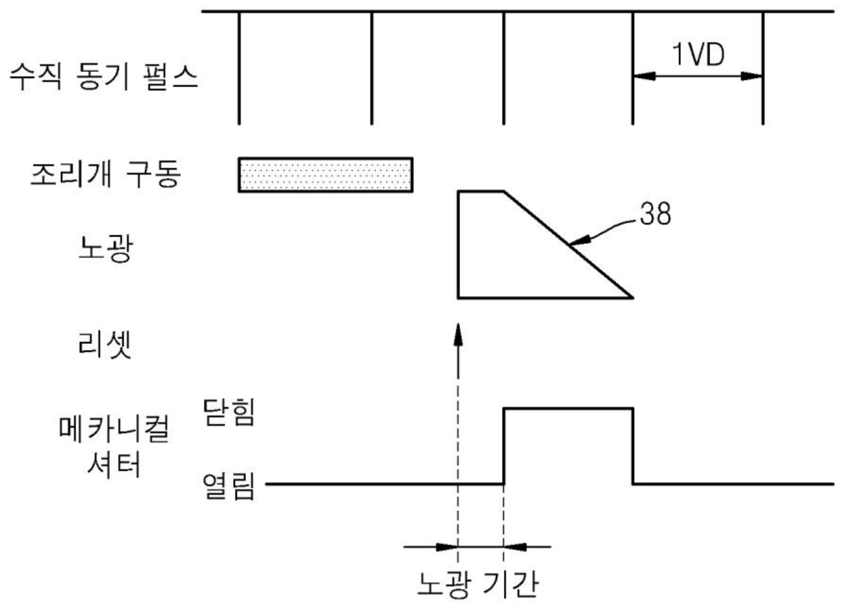
drawing 11a



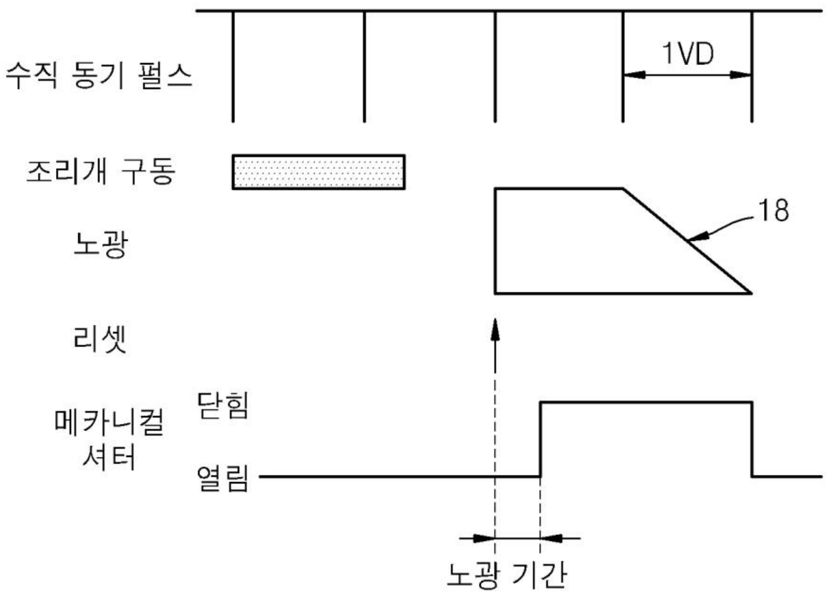
drawing 11b



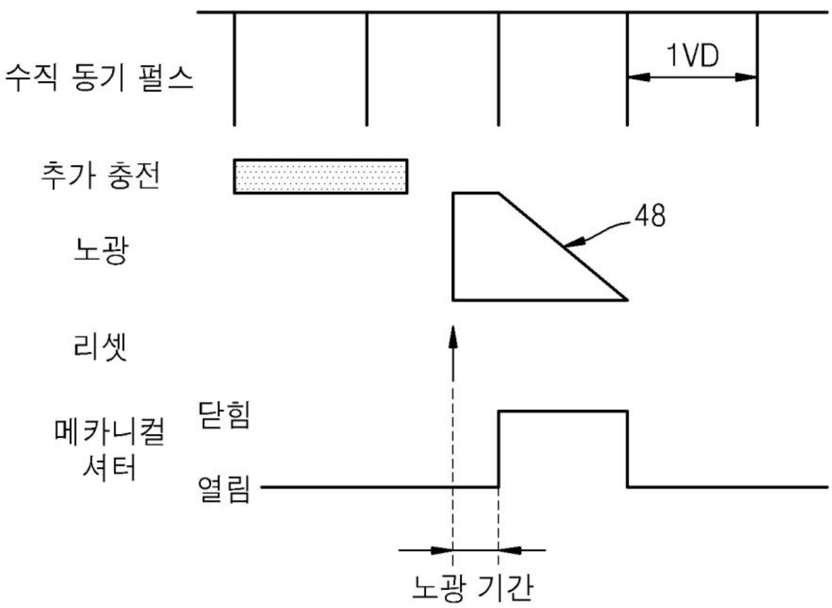
drawing 12a



drawing 12b



drawing 13a



drawing 13b