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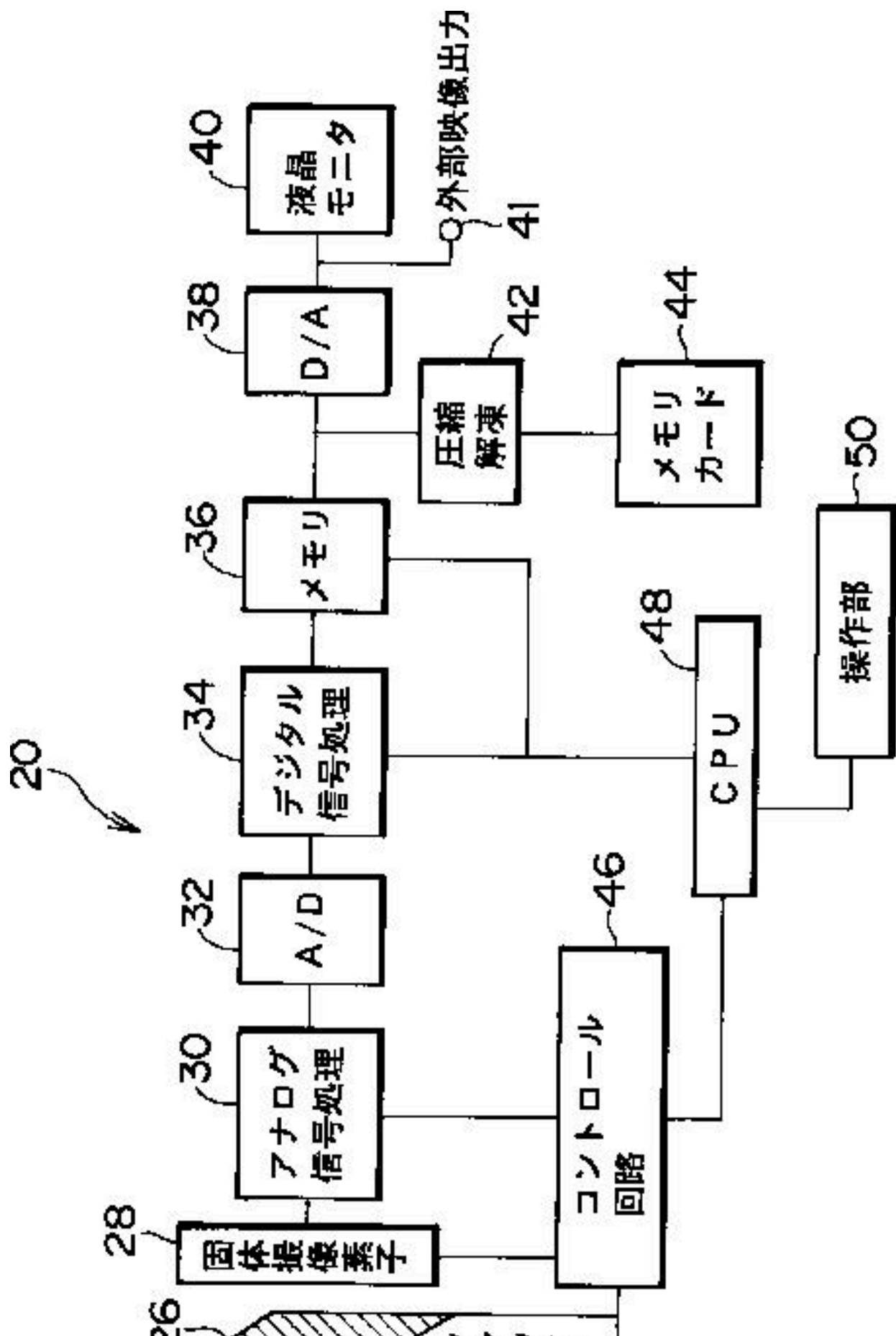
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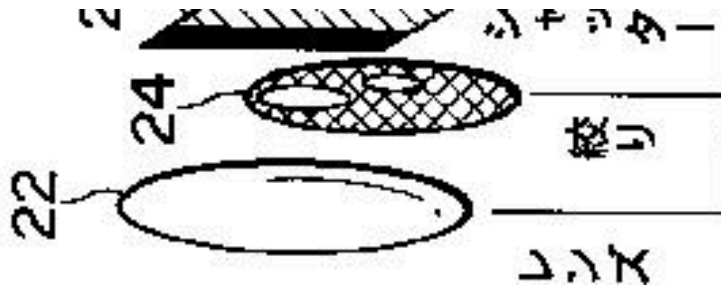
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(57) [Overview]

PROBLEM TO BE SOLVED: To provide a method for driving an image pickup device and an electronic camera capable of raising the refresh rate of images at the time of normal photographing and at the time of AE and AF and obtaining the image of high picture elements at the time of a macro photographing mode and at the time of output to an external monitor.

SOLUTION: At the time of the normal photographing mode and at the time of the AE and AF, the vertical direction of a solid-state image pickup element 28 is thinned to 1/4 or 1/8 and drive is performed. In this case, though the images becomes slightly coarse, the refresh rate is high and power consumption is little. Also, at the time of switching to the macro photographing mode and at the time of externally outputting and confirming image signals (at the time of external output connection), the drive is automatically performed by 1/2 thinning or without thinning. Thus, the image of the high picture elements is fetched, further strict focus confirmation is made possible at the time of macro confirmation and high definition images are viewed on an external large screen monitor.





Scope of Claims

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[Patent Claims]

[Claim 1] An imaging device driving method for reading out a signal from an imaging device incorporated in an imaging apparatus, the method comprising:

In a normal shooting mode, signals are thinned out at a first ratio in a vertical direction of the imaging device and read out, and

In a macro photographing mode or in an external output connection for outputting a video signal to an external image display device A method of driving an image pickup device, comprising: reading out a signal by thinning out in a vertical direction of the image pickup device at a second rate lower than that in the normal photographing mode; or reading out a signal for all pixels without thinning out.

[Claim 2] Where a refresh rate is the number of times an image for one screen is refreshed per unit time. The method according to claim 1, wherein a refresh rate of an image obtained by the image pickup apparatus in the normal photographing mode is adjusted to frame frequencies in NTSC, PAL, SECAM and other predetermined color television systems.

[Claim 3] An electronic camera for imaging a subject by using an imaging device in which photoelectric conversion elements are two dimensionally arranged, comprising:

An image display unit configured to display an image acquired by the imaging device; and

A mode switching unit configured to perform mode switching between a normal shooting mode and a macro shooting mode;

In a normal photographing mode, a signal is read out by thinning out a vertical direction of an imaging device at a first rate, and in a macro photographing mode A drive control unit configured to drive the image pickup device so as to read out signals by thinning out the signals in a vertical direction of the image pickup device at a second ratio lower than that in the normal shooting mode or so as to read out signals for all pixels without thinning out the signals; and

The electronic camera according to claim 1, wherein

[Claim 4] An external output unit configured to send a video signal acquired via the imaging d

evice to an external image display device

Wherein, in an external output connection in which the video signal is output to an image display device via the external output unit, the drive control unit The electronic camera according to claim 3, wherein the image pickup device is driven so as to read out signals by thinning out the signals in a vertical direction of the image pickup device at a third rate lower than that in the normal photographing mode or to read out signals for all pixels without thinning out the signals.

[Claim 5] The image forming apparatus according to claim 1, further comprising a high-quality confirmation mode that can be set as needed in accordance with an external operation, wherein, when the high-quality confirmation mode is set, the drive control unit Reading out signals by unconditionally thinning out signals in the vertical direction of the image pickup device at a fourth rate which is lower than that in the normal shooting mode, or reading out signals for all pixels without thinning out.

The electronic camera according to claim 3 or 4, wherein

Detailed Description

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[Detailed description of the invention]

[0001]

[Technical field of invention] The present invention relates to the drive method and electronic camera of an imaging device, is used for the digital camera etc. which mounted the high pixel imaging device over especially 1 million pixels, and relates to the electronic camera using the drive method of a suitable imaging device, and its method.

[0002]

[Prior art] In a conventional digital camera, the number of pixels of an image pickup device is about 640×480 , which is relatively small. The image pickup device is always driven by the same driving method regardless of a mode such as AF (autofocus), AE (automatic exposure control), normal shooting, or macro shooting, and signal charges for all pixels are read out (this is referred to as normal driving). However, a digital camera having a large number of pixels has been gradually developed in accordance with a demand for high image quality, and as the number of pixels increases, signal processing cannot be performed in time if the image pickup device is normally driven at the time of AE or AF. In view of the above, there has been proposed an image pickup device in which vertical driving of the image pickup device is devised so that readout in the vertical direction is thinned out to about $1/2$ to $1/4$ at the time of AE or AF.

[0003]

[Problem to be solved by the invention] However, in the method of thinning out in the vertical direction as in the related art, if the amount of thinning out is increased, there is an advantage that the refresh of the image becomes faster. Since the data in the vertical direction is lost, it is not possible to precise focus cannot be confirmed in the macro photographing mode and that a picture appears rough when it is outputted to the outside and displayed on a monitor or the like.

[0004]The present invention has been made in view of such circumstances and it is an object of the present invention to increase a refresh rate at the time of normal photographing or AE / AF. To provide a method for driving an image pickup device capable of obtaining an image of high pixels in a macro photographing mode or at the time of output to an external monitor and to provide an electronic camera to which the method is applied.

[0005]

[Means for solving the problem] According to an aspect of the invention, there is provided an imaging device driving method for reading out a signal from an imaging device incorporated in an imaging apparatus, the imaging device driving method including: in a normal shooting mode, reading out a signal by thinning out the signal at a first ratio in a vertical direction of the imaging device; and in a macro shooting mode Alternatively, at the time of external output connection for outputting the video signal to an external image display device, the signal is read out by thinning the signal in the vertical direction of the image pickup device at a second rate lower than that in the normal photographing mode, or the signal is read out for all the pixels without thinning.

[0006]According to the present invention, it is used daily, and is usually *.

In the shadow mode, the vertical direction of the image pickup device is thinned out at a first rate and driven. Although the image acquired at this time is coarse, the refresh rate is high, and it is sufficient to check the composition in a range in which the video is observed on a small screen display (monitor) or the like attached to the imaging apparatus. When the mode is switched to the macro shooting (short-distance shooting) mode, the thinning-out is reduced (to the second ratio) or the driving is performed without thinning-out. As a result, data of a larger number of pixels can be taken in than in the normal photographing mode, and more precise focus confirmation can be performed. In addition, regardless of whether or not the macro photographing mode is provided, when the external output is connected, even in the normal photographing mode, the thinning-out is reduced (the thinning-out is performed at the second ratio) or the driving is performed without the thinning-out. Accordingly, when the captured image is output to the outside and checked on another large-screen monitor (image display device) or the like, a high-definition image can be viewed.

[0007]In particular, in the method of driving an imaging device according to the present invention, as described in claim 2, when the number of times that an image for one screen is refreshes

hed per unit time is referred to as a refresh rate. It is preferable that a refresh rate of an image obtained by the image pickup apparatus in the normal photographing mode is matched with frame frequencies in NTSC, PAL, SECAM and other predetermined color television systems. According to this aspect, since it is not necessary to store the image acquired by the imaging device in the frame memory once, there is an advantage that the power supply of the memory or the like can be cut off and unnecessary power consumption can be suppressed.

[0008] According to a third aspect of the present invention, there is provided an electronic camera for imaging a subject by using an imaging device in which photoelectric conversion elements are two dimensionally arranged, in order to provide an electronic camera embodying the method invention, the electronic camera comprising: An image display unit configured to display an image acquired by the image pickup device; a mode switching unit configured to perform mode switching between a normal shooting mode and a macro shooting mode; and a drive control means for driving the image pickup device so as to read out signals by thinning out the signals in the vertical direction of the image pickup device at a second rate smaller than that in the normal photographing mode or so as to read out the signals for all the pixels without thinning out the signals.

[0009] According to the present invention, when the normal photographing mode is selected, the image pickup device is driven by thinning out the vertical direction of the image pickup device at the first ratio, and when the macro photographing mode is selected by the mode switching means, the image pickup device is driven by automatically reducing the thinning-out or without the thinning-out. As a result, an image with a large number of pixels can be captured at the time of macro shooting, and more precise focus confirmation can be performed.

[0010] According to a fourth aspect of the present invention, in the electronic camera according to the first aspect, the image signal obtained via the image pickup device may be transmitted to an external image display device via an external output

In an external output connection in which the video signal is output to an image display device via an external output unit. It is preferable that the signals are read out by thinning out the signals in the vertical direction of the image pickup device at a third rate ($1/2$) lower than that in the normal photographing mode, or the signals are read out for all the pixels without thinning out the signals. The third ratio may be the same as the second ratio.

[0011] According to this aspect, even in the normal photographing mode, thinning is automatically reduced or driving is performed without thinning when the external output is connected, and thus it is possible to observe a high-quality image when an image is displayed on an external image display device. This is particularly effective when a large-screen monitor is used. According to a fifth aspect of the present invention, in the electronic camera according to the first aspect of the present invention, a high quality confirmation mode that can be set at any time in accordance with an external operation is provided, and when the high quality confirmation mode is set, the drive control unit is configured to: The vertical direction of the image pickup

device is unconditionally thinned to a fourth ratio (1 / 2) smaller than that in the normal photographing mode to read out a signal, or the signal is read out for all pixels without thinning. The fourth ratio may be the same as the second or third ratio.

[0012] That is, this electronic camera can be set to the high image quality confirmation mode by the user operating a predetermined operation unit as necessary. Even in a case where the normal photographing mode is selected, when the high image quality confirmation mode is set by the user, the thinning-out is unconditionally reduced (the thinning-out is performed at the fourth ratio) or the driving is performed without the thinning-out. According to this aspect, the user can freely select whether to view an image with a high number of pixels even if the refresh rate is low or to view an image with a high refresh rate even if the image is somewhat coarse.

[0013]

[Embodiment of invention] Preferred embodiments of a method of driving an image pickup device and an electronic camera according to the present invention will be described in detail below with reference to the accompanying drawings. First, thinning-out driving of the image pickup device will be described. An example of a CCD imaging device is shown in FIG. 1. In FIG. 1, the number of pixels is reduced for the sake of convenience, but the number of pixels is 1280×1024 , 1280×960 , or the like, which is equal to or larger than that of SVGA. A color filter of any one of R (red), G (green), and B (blue) is provided in front of each pixel. The pixel array shown in FIG. 1 is called a Bayer arrangement, but the array form is not limited to this.

[0014] The imaging device 10 mainly includes a photoelectric conversion element 12, a vertical transfer path 14, a horizontal transfer path 16, and the like. The photoelectric conversion elements 12 are two dimensionally arranged, and pixel columns and vertical transfer paths 14 are alternately arranged for each column in the vertical direction in the drawing. Each photoelectric conversion element 12 includes a read gate (not shown)

The vertical transfer paths 14 are connected to each other. The final stage (the lowermost stage in FIG. 1) of the vertical transfer path 14 is connected to the horizontal transfer path 16, and the final stage (the leftmost stage in FIG. 1) of the horizontal transfer path 16 is connected to an output unit (not shown).

[0015] The read gate is controlled by a read gate pulse given from a CCD drive circuit (image pickup device drive circuit), and when the read gate pulse is applied, the signal charge accumulated in the photoelectric conversion element 12 is transferred to the vertical transfer path 14. It is to be noted that charges which become unnecessary when the shutter operation is performed are swept away to the CCD substrate in advance by a shutter gate pulse preceding the readout gate pulse.

[0016] The vertical transfer path 14 vertically transfers the signal charge read from the photoelectric conversion element 12 in the downward direction in FIG. 1 by a vertical transfer pulse applied from the CCD driving circuit. The signal charges transferred to the last stage of the vert

ical transfer path 14 are sequentially transferred to the horizontal transfer path 16 for each horizontal retrace period. The horizontal transfer path 16 transfers signal charges to an output unit (not shown) in response to a horizontal transfer pulse applied from the CCD driving circuit. The output unit detects the input signal charge and outputs the signal charge as a signal voltage to the output terminal. In this way, in normal driving, signals are read out from all the pixels and output as a dot-sequential signal sequence.

[0017]Next, an example of 1/2 thinning-out driving will be described. FIG. 2 shows an example of 1/2 thinning-out driving. The method shown in FIG. 2 (a) is a method of uniformly thinning out the pixels to 1 / 2 every other horizontal line. As shown in FIG. 2 a, when lines including B (blue) (the first, third, and fifth rows in the drawing) are read out, only information of G (green) and B (blue) can be read out as color information in one readout drive, and color information of R (red) is lost. Therefore, the lines including R (the second and fourth rows in the drawing) are read in the next driving, and color information is made uniform by a total of two reading driving operations. In this way, in the case of a Bayer arrangement, a method of performing driving by 1/2 uniform thinning-out twice is adopted, but in the case of another array form (for example, an array called a G stripe in which all color information is included in one horizontal line), all color information can be made uniform by one readout driving by 1/2 uniform thinning-out. It is to be noted that a CCD of an interlace transfer drive system or the like reads out signal charges by such a method.

[0018]On the other hand, the method shown in FIG. 2 (b) is a readout method of reading two lines and skipping two lines. The method of thinning out every two lines as described above has as an advantage that all color information can be obtained by one read driving even in a Bayer arrangement. Next, an example of 1/4 thinning-out driving will be described. FIG. 3 a shows uniform reading, which is a method of uniformly performing 1/4 thinning in the vertical direction, reading one line, and skipping three lines. Also in this case, the read line is shifted by one line in the next driving, and the line including R (R line) is read.

As a result, the color information is aligned by two read driving operations.

[0019]Instead of the uniform thinning-out, as shown in Fig. 3 (b), the number of lines to be skipped is alternately changed to two lines or five lines. By reading out the R lines indicated by (or) at the same time, it is possible to arrange all the color information by one time of reading out drive (img GAIJI_ID=0001) (or (img GAIJI_ID=0002)). Next, an example of 1/8 thinning-out driving will be described. The 1/8 thinning-out driving is basically the same as the 1 / 4 thinning-out driving, and FIG. 4 a shows an example of uniform reading. In this case, 1 / 8 thinning is uniformly performed in the vertical direction, one line is read, and seven lines are skipped. Since all color information cannot be obtained by one driving, the R line is read out by the next driving, and the color information is aligned by two driving.

[0020]On the other hand, instead of the uniform thinning-out, as shown in Fig. 4 (b), the number of lines to be skipped is alternately changed to six lines or eight lines. By reading out the

R line indicated by (or img GAIJI_ID=0001), all the color information can be aligned by one readout driving operation (or img GAIJI_ID=0002). The example of the thinning-out driving (FIGS. 1 to 4) has been described on the assumption of the CCD, but the present invention is not limited to this, and can also be applied to thinning-out reading of a MOS type, a CID type, and other imaging devices.

[0021]The imaging apparatus having the imaging device has the above-described imaging device driving method, and a combination of such a driving method and a photographing mode will be described below. FIG. 5 is a system block diagram of the digital camera according to the embodiment of the present invention. The digital cameras (equivalent to an electronic camera) 20 are mainly the taking lens 22, the diaphragm 24, ***** 26, and a solid state image pickup device. The image pickup device 28 includes an analog signal processing circuit 30, an A / D converter 32, a digital signal processing unit 34, a memory 36, a D / A converter 38, a liquid crystal monitor 40, a compression / decompression circuit 42, a memory card 44, a control circuit 46, and a central processing unit (CPU) 48. The control circuit 46 and the CPU 48 correspond to a drive control unit.

[0022]The taking lens 22, which is shown in a simplified manner in FIG. 1, is composed of one or more lenses and may be a lens having a single focal length (fixed focal length) or a lens having a variable focal length such as a zoom lens or a step zoom lens. Focusing and zooming of the photographing lens 22 are controlled via a control circuit 46. The diaphragm 24 is formed by, for example, forming a plurality of diaphragm holes having different diameters in one diaphragm plate, and the diaphragm can be freely switched by an electric drive unit (not shown). In FIG. 1, the diaphragm 24 is shown as a diaphragm plate having two types of diaphragm holes, but it is also possible to use a fixed diaphragm, a continuous diaphragm capable of continuously (steplessly) changing the diaphragm, or a mode in which a shutter and a diaphragm are used in common.

[0023]***** 26 is the solid state image pickup device 28.

The incident light path of the solid-state image pickup element 28 is shielded / opened by an electric driving means (not shown) controlled through a control circuit 46. As the solid-state imaging device 28, a known two dimensional imaging device (for example, 1280 × 960 pixels) is used. There are various types of imaging devices such as a CCD type, a MOS type, and a CID type, and any type of imaging device may be employed, but in the present embodiment, the CCD imaging element as described in FIG. 1 is employed. The solid-state imaging device 28 has a so-called electronic shutter function of controlling an accumulation time (shutter speed) of electric charges accumulated in each sensor by a shutter gate pulse.

[0024]The light that has passed through the taking lens 22 is restricted by the diaphragm 24 and the mechanical shutter 26, and is projected onto the solid-state imaging element 28. On the solid-state image pickup device 28, the accumulation time is controlled by an electronic shutter. Of course, there may be a case where the diaphragm 24 is fixed, or a case where the m

mechanical shutter 26 and the diaphragm 24 are used in common, and there may be a case where the mechanical shutter 26 is not necessary in the case of an imaging device of all pixel reading.

[0025]The subject image formed on the light-receiving surface of the solid-state imaging device 28 is converted into signal charges of an amount corresponding to the amount of incident light by each sensor, sequentially read out as an imaging output signal, and then supplied to an analog signal processing circuit 30. The analog signal processing circuit 30 includes a CDS clamp circuit, a gain adjustment circuit, and the like, and appropriately processes the image pickup output signal (analog electric signal) input from the solid-state image pickup element 28 under the control of the control circuit 46. The signal output from the analog signal processing circuit 30 is converted into a digital signal by the A / D converter 32, and is then applied to the digital signal processing unit 34.

[0026]The digital signal processing unit 30 includes a gain control unit, an integration circuit for AE, a luminance (Y) signal generation circuit, a color difference (C) signal generation circuit, and other signal processing circuits. The data output from the A/D converter 32 is appropriately processed by a digital signal processing circuit 34, and the image data obtained here is temporarily stored in a memory 36. The image data stored in the memory 36 is decoded, then converted into an analog signal by a D / A converter 38, and supplied to a liquid crystal monitor 40 (corresponding to an image display unit). In this way, an image captured by the solid-state imaging device 28 is displayed on the liquid crystal monitor 40. On the liquid crystal monitor 40, a still image photographed based on reception of a photographing start signal issued by a pressing operation of a shutter button (not shown) or the like is displayed, and an image (a through moving image or a skipped image) before reception of the photographing start signal is also displayed. The photographing start signal may be applied from outside. The signal converted into the analog signal by the D/A converter 38 can be taken out as an external video output from an external output means 41 such as a video output terminal or a digital output terminal.

[0027]On the other hand, when the image data obtained in response to the reception of the photographing start signal is recorded in the memory card 44 or another recording medium, the image data is compressed and written as necessary. It is also possible to select the compression ratio of the recorded image, that is, the data guided from the memory 36 to the compression / decompression circuit 42 is compressed in accordance with a predetermined format (for example, JPEG) and then recorded in the memory card 44. It is also possible to select the compression ratio of the recorded image, and any one of 1 / 4 compression, 1 / 8 compression, and 1 / 16 compression can be selected in accordance with the purpose of photographing. The recording medium may be in various forms such as a smart medium and an IC card.

[0028]The image stored in the memory card 44 can be called through a CPU48, and the called image is outputted to a liquid crystal monitor 40 through a memory 36 and a D / Crystal moni

tor 40 via the memory 36 and the D / A convertor 38. Of course, such a reproduced image signal is also supplied to the external output means 41 and can be output to another external device.

[0029]The CPU48 is connected to the control circuit 46, the digital-signal processing circuit 34, the memory 36, and the like, and performs various calculations of an exposed value, a focus position, and the like in accordance with a predetermined algorithm to comprehensively manage control of automatic exposure control, auto focus, auto strobe, auto white balance, and the like. The CPU48 controls corresponding circuits based on various input signals input from the operation unit 50 such as a release button, a macro key (corresponding to a mode switching unit), and a mode setting dial.

[0030]For example, a focus evaluation value indicating the sharpness of the subject image is calculated from the image signal, and the focus position is calculated based on the focus evaluation value. Then, the imaging lens 22 is controlled via a focus drive circuit (not shown) in accordance with the calculated focus position, and the focus position is set. In addition, a known distance measuring unit such as an AF sensor may be used.

[0031]The control circuit 46 controls the drive circuit of the solid-state image pickup device 28 based on the exposure-control value notified from the CPU48, sets the charge accumulation time of the solid-state image pickup device 28, that is, the electronic shutter value, and controls the selection of the diaphragm 24, the opening / closing timing of the mechanical shutter 26, and the like. In this way, all the exposure control of the digital camera 20 is automatically performed.

[0032]Next, a method of driving the image pickup device in the digital camera configured as described above will be described. First, the case of normal photographing mode is described. The normal photographing mode is a photographing mode in which the camera automatically controls exposure (a combination of a shutter speed and an aperture value) and focus in accordance with a photographing situation, and is optimal for general photographing. In the case of the normal photographing mode, the solid-state imaging device 28 is driven by the $\frac{1}{4}$ thinning or $\frac{1}{8}$ thinning described in FIGS. 3 and 4.

It *. In this case, although the image is coarse (in the case of 960 lines in the vertical direction, the number of lines is 240 in the case of $\frac{1}{4}$ thinning and 120 in the case of $\frac{1}{8}$ thinning), the refresh rate is high, and it is sufficiently effective to check the composition in a range observed by the small liquid crystal monitor 40 attached to the digital camera 20.

[0033]Further, if the refresh rate is set in accordance with the NTSC, PAL, SECAM or other format adopted for the display of the liquid crystal monitor 40, since it is not necessary to store the image in the memory once, the power source of the memory 36 or the like can be turned off. In this case, the system has a configuration as shown in FIG. 6, and power consumption can be suppressed.

[0034]Also at the time of AE and AF, driving is performed by $\frac{1}{4}$ thinning-out or $\frac{1}{8}$ thinning

ng-out in the vertical direction, or 1 / 2 cut-out of the central portion thereof. Thus, the AE and AF processes can be performed in a short time. Next, the macro (short distance) photographing mode will be described. When a key corresponding to a macro key in an operation part 50 is depressed, the camera is set to a macro photographing mode, and a prescribed mark indicating the macro photographing mode is displayed on a liquid crystal monitor 40. When the macro photographing function is used, short-distance photographing from about 9 to 50cm can be performed. When the macro key is pressed again, the macro photographing mode is released and the normal photographing mode is restored.

[0035]When the macro photographing mode is set, as described with reference to FIGS. 1 and 2, the solid-state image pickup element 28 is driven with or without $\frac{1}{2}$ thinning. In the macro photographing, the focus is much severer than in the normal photographing, and it is preferable to obtain a fine image having a large number of pixels in order to check the in-focus state. Therefore, when the macro photographing mode is set, the solid-state image pickup device 28 is driven and controlled so as to automatically reduce the thinning-out (thinning-out driving to $\frac{1}{2}$ in the vertical direction) or to read all the pixels without thinning-out. Thus, it is possible to obtain an image having a higher image quality than that in the normal photographing mode.

[0036]Further, in the macro mode, there is a case where it is desired to mainly enlarge and confirm the central portion of the screen in order to confirm the focus. In order to respond to such a request, a confirmation operation unit such as a central portion enlargement button may be provided, and the central portion of the screen may be enlarged and displayed by operating the confirmation operation unit. In order to realize such a center portion enlarged display function, a method of performing the following processing in combination of driving of the image pickup device and display on the monitor is considered.

[0037]First, as shown in FIG. 7, a high-pixel image pickup unit is read out by normal driving (without thinning-out), and when the read-out image is displayed, only a central portion 52A of an image pickup area 52 is cut out and displayed. If the display device such as the liquid crystal monitor 40 has about 320×240 pixels, it is possible to perform display substantially one-to-one with respect to the pixels, and it is possible to perform confirmation of focus or the like severely.

[0038]Second, as shown in FIG. 8, an image pickup device having a large number of pixels (for example, 1280×960 pixels) is driven by $\frac{1}{2}$ thinning to read out 1280×480 pixels, and Only the central portion 54A in the vertical direction of the read area 54 is cut out to $\frac{1}{2}$ (hatched portion in FIG. 8), 1280 is reduced to $\frac{1}{2}$ in the horizontal direction, only the central portion is further cut out to $\frac{1}{2}$, and the image is finally displayed in a size of 320×240 .

[0039]By performing such processing, as a result, as shown in FIG. 9, a region of 320×240 corresponding to the display area 56 is cut out from a part of the imaging area 52 and is displayed. In the third method, as shown in FIG. 10, of an image pickup area 52 of an image pickup

unit having a large number of pixels (for example, 1280×960 pixels), a central $\frac{1}{2}$ area in the vertical direction is determined as a readout area 52B, and only the readout area 52B is subjected to readout driving by $\frac{1}{2}$ thinning. At the time of displaying the image, the image is horizontally reduced to $\frac{1}{2}$ and the center part is cut out to $\frac{1}{2}$ and displayed. Even with this processing, the relationship between the imaging area 52 and the display area 56 is the same as that shown in FIG. 9.

[0040]Next, a method of driving the image pickup device when the external output is connected will be described. When an image display device such as a large-screen monitor is connected to the video output terminal or a personal computer is connected to the digital output terminal, that is, when a video signal is output to an external device (at the time of external output connection), driving is automatically performed with or without $\frac{1}{2}$ thinning-out even in the standard photographing mode. Of course, in the macro mode, the pixels are also driven by $\frac{1}{2}$ thinning or without thinning.

[0041]When the detection means detects the connection of the external equipment, the detection signal is informed to the CPU48 and the driving system of the image pickup devices is automatically changed to $\frac{1}{2}$ thinning or no thinning. Alternatively, when the external output mode is set by a unit (mode selection unit) for setting a mode in which a video signal is transferred to an external device, the driving method of the imaging device may be automatically changed to $\frac{1}{2}$ thinning or no thinning.

[0042]Here, the external output connection includes not only a case where devices are directly connected to each other via a connector and a cable but also a state where data can be transmitted and received between devices by infrared communication or other non-contact communication functions. Although the connection partner of the external output is not always a monitor with a large screen, the monitor screen of the image display device by external connection is often larger than the screen size of the liquid crystal monitor 40 attached to the digital camera 20, and therefore, there is an advantage that a high-definition image can be observed in such a case.

[0043]As described above, the digital camera 20 of the present embodiment operates in the normal photographing mode, the macro mode, the external output mode, and the A

The readout driving method of the image pickup device is automatically switched in accordance with the mode and situation of the camera, such as during E/AF. Further, instead of or in addition to the above-described automatic switching of the driving method of the image pickup device, a high image quality confirmation mode may be separately provided so that the user can freely select the readout driving method of the device. That is, when the high image quality confirmation mode is selected, the $\frac{1}{2}$ thinning or the driving without thinning is unconditionally performed. By adding such a high image quality confirmation mode, the user can arbitrarily select whether to view a high-definition image even if the refresh rate is low or to view an image with a high refresh rate even if the image is somewhat coarse.

[0044]According to the digital camera 20 of the present embodiment, even if the solid-state imaging device 28 having a large number of pixels is mounted, when the digital camera 20 is used on a daily basis or at the time of AE and AF Since the 1 / 4 thin-out or 1 / 8 thin-out *** rate and less power consumption is performed, and image pickup with high pixels with less thinning (or without thinning) is performed when a macro is confirmed or when a video is externally output and confirmed, so that a finer image can be viewed.

[0045]In the above-described embodiment, the digital camera has been described as an example, but the driving method of the imaging device according to the present invention can be widely applied to an electronic camera (imaging apparatus) which electrically acquires an image signal, in addition to the digital camera. In the above-described embodiment, $\frac{1}{4}$ or $\frac{1}{8}$ is used as a value corresponding to the first ratio, and $\frac{1}{2}$ is used as each of the second, third, and fourth ratios. However, the thinning ratio is not limited to these numerical values, and can be freely determined in relation to the number of pixels of the imaging device.

[0046]

[Effect of the Invention] As described above, according to the driving method of the image pickup device and the electronic camera of the present invention, in the case of daily use (in the normal photographing mode) or in the case of AE and AF Thinning-out driving is performed in which an image is somewhat coarse but a refresh rate is high and power consumption is small, and driving is performed in which thinning-out is small (or thinning-out is not performed) in a macro photographing mode or when an external output is connected although the refresh rate is low.

Thus, when the macro is confirmed or when the image is externally outputted and confirmed, the image of high pixels can be viewed.

Brief description of the drawings

Close

[Brief Description of the Drawings]

[Fig. 1]The mimetic diagram showing the example of a usual drive of an imaging device

[Fig. 2]FIGS. 2 a and 2 b are diagrams illustrating an example of $\frac{1}{2}$ thinning-out driving of an imaging device, in which FIG.

[Fig. 3]FIGS. 4 a and 4 b are diagrams illustrating an example of $\frac{1}{4}$ thinning-out driving of an imaging device, FIG.

[Fig. 4]FIGS. 8 a and 8 b are diagrams illustrating an example of $\frac{1}{8}$ thinning-out driving of an imaging device, FIG.

[Fig. 5]The block diagram showing the composition of the digital camera concerning an embodiment of the invention

[Fig. 6]FIG. 10 is a block diagram used to describe a flow of a signal when a refresh rate of an imaging device is matched with a format such as NTSC.

[Fig. 7]The explanatory view showing the imaging device drive at the time of macro photographing mode, and the method of a monitor display

[Fig. 8]The explanatory view showing the imaging device drive at the time of macro photographing mode, and other methods of a monitor display

[Fig. 9]FIG. 10 is an explanatory diagram showing a relationship between an imaging area and a display area when the method shown in FIG. 8 is used;

[Fig. 10]The explanatory view showing the imaging device drive at the time of macro photographing mode, and the yet another method of a monitor display

[Explanation of letters or numerals]

10 -- Imaging device

12 -- Optoelectric transducer (pixel)

14 vertical transfer path

16 horizontal transfer path

28 -- Solid state image pickup device (imaging device)

40 -- Liquid crystal display monitor

46 -- Control circuit

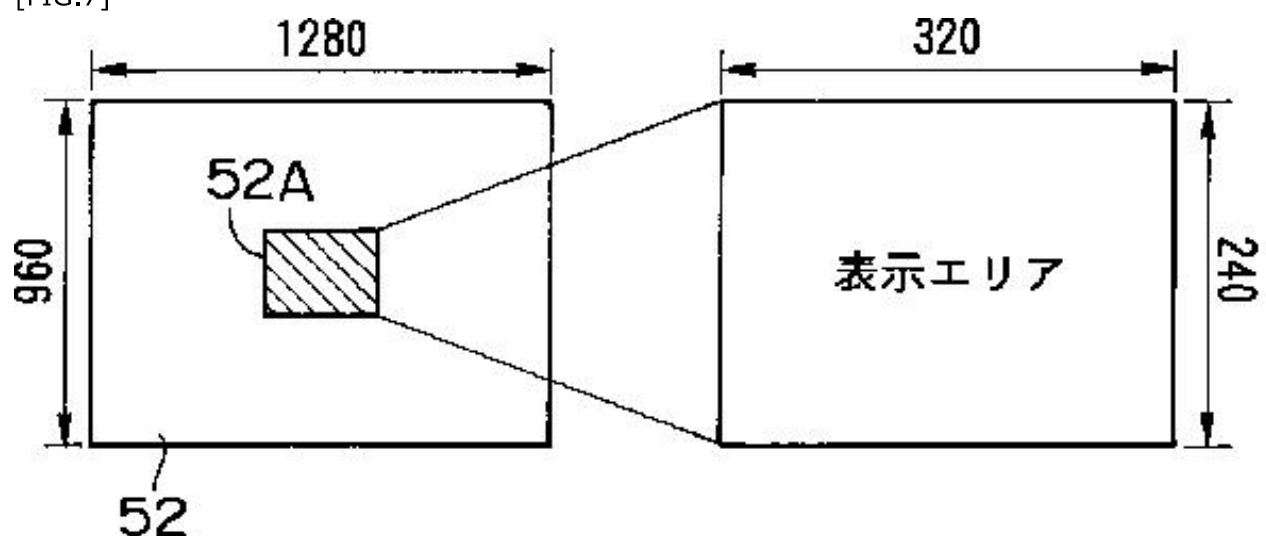
48: central processing unit (CPU)

50 -- Operating part

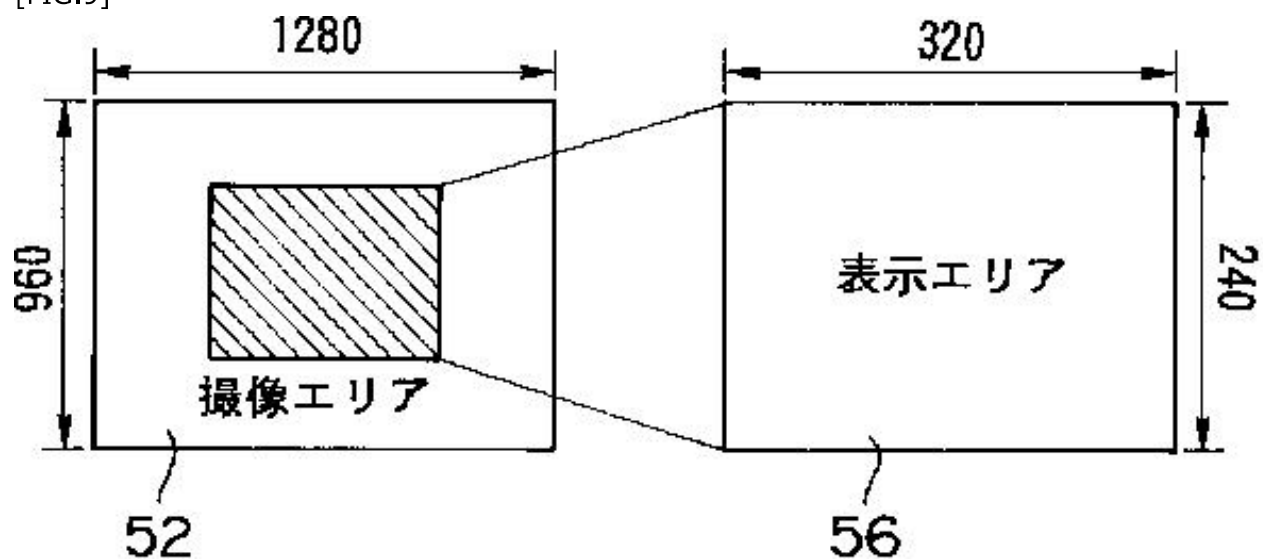
Drawings

Close —

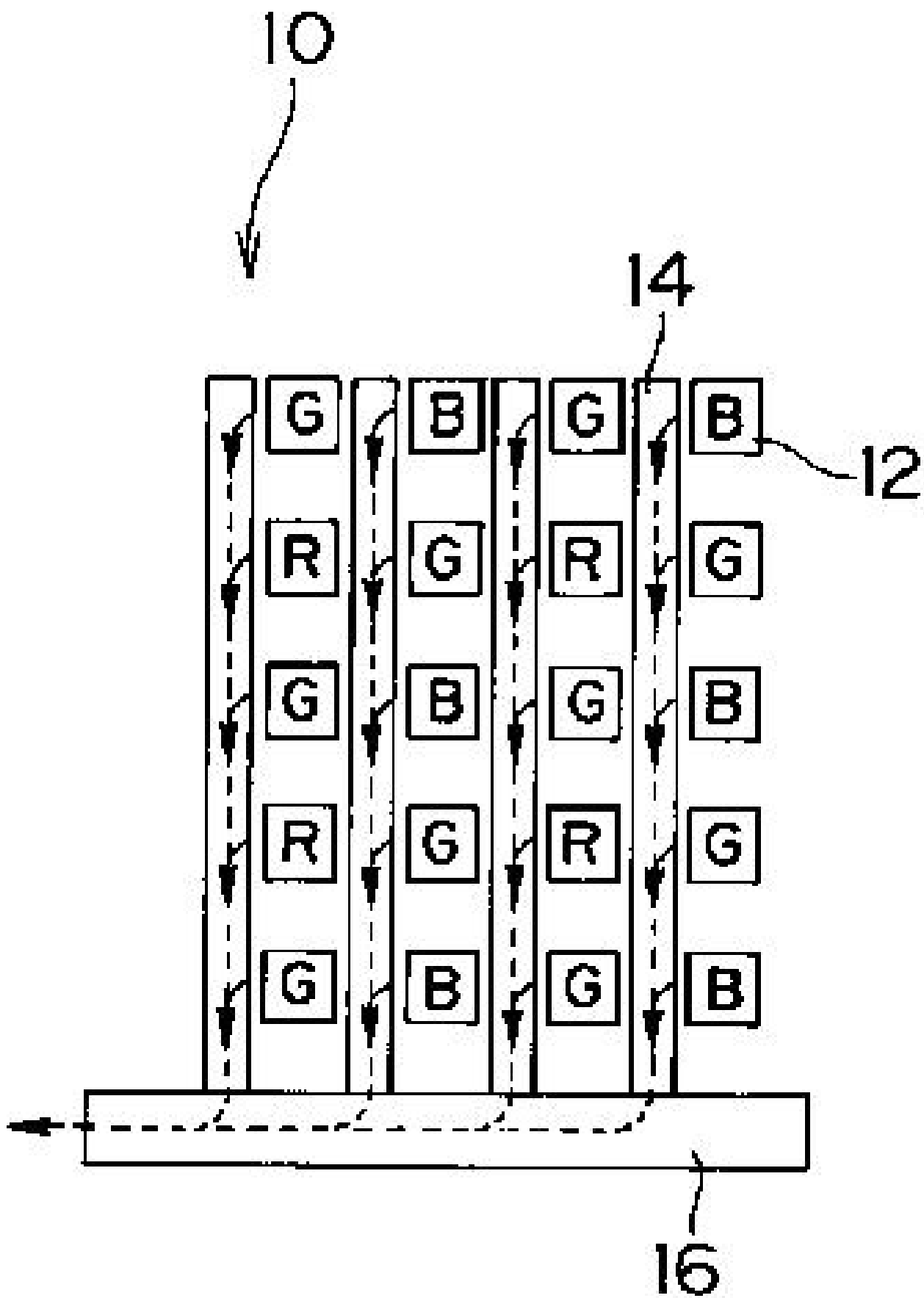
[FIG.7]



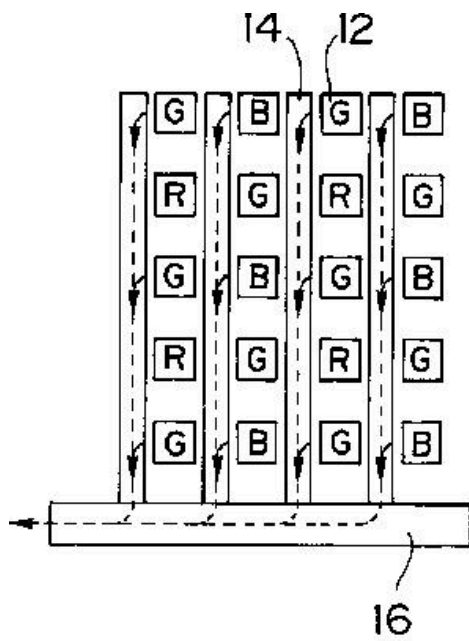
[FIG.9]



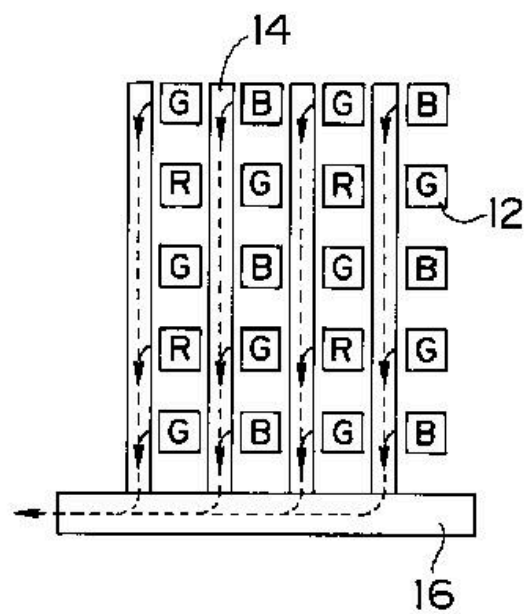
[FIG.1]



[FIG.2]

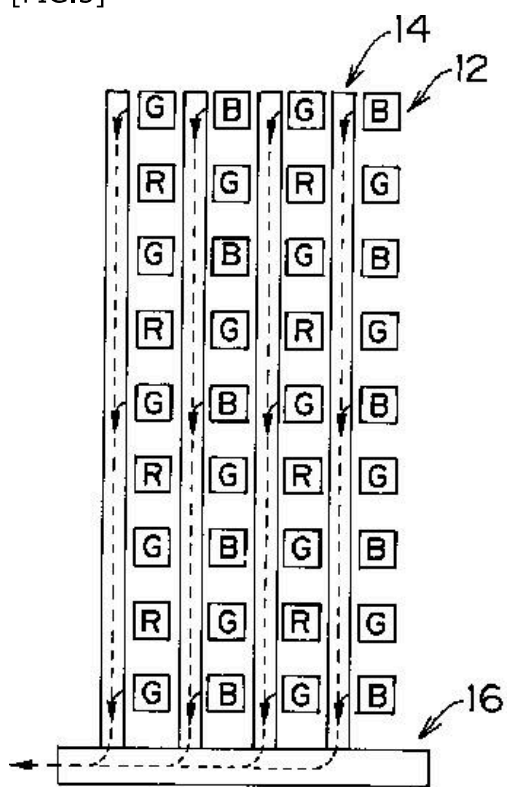


(a)

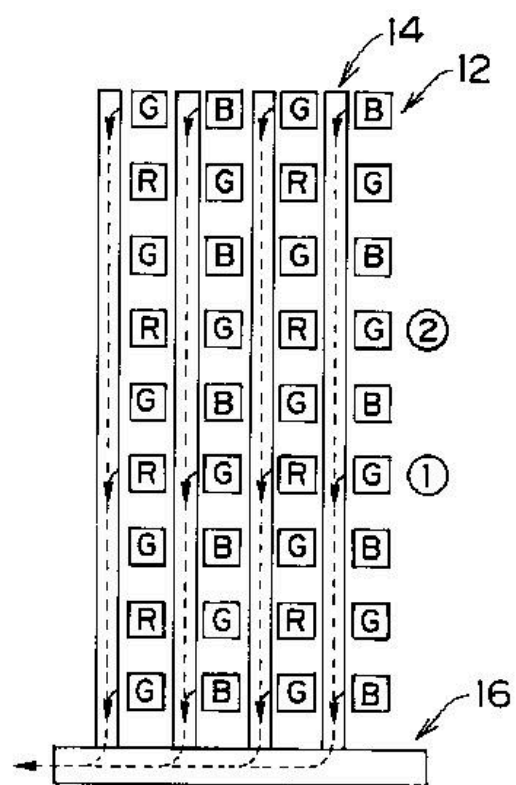


(b)

[FIG.3]

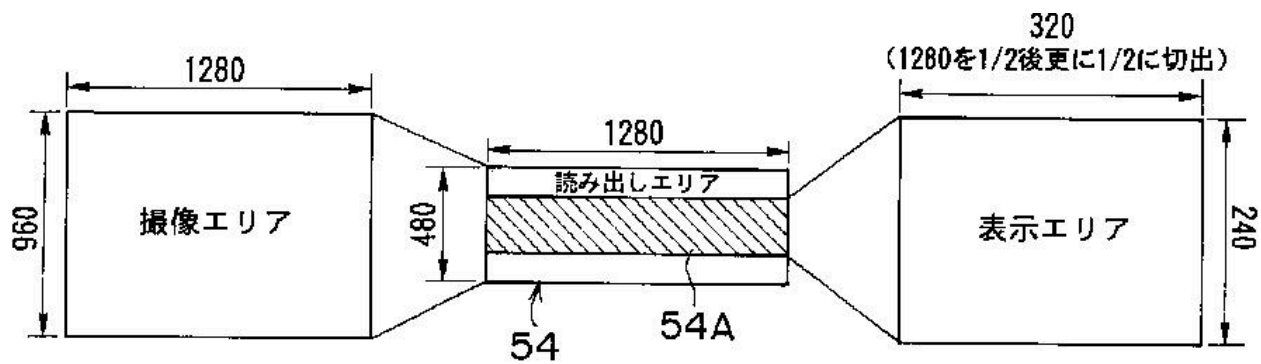


(a)

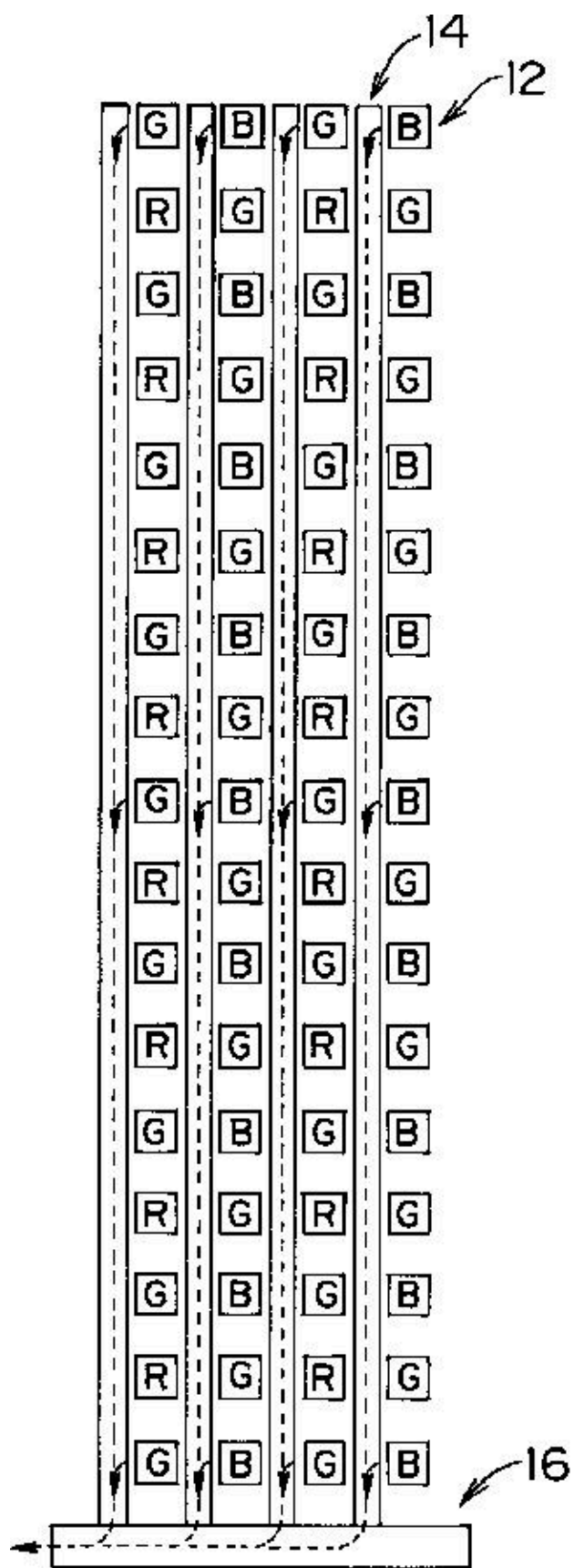


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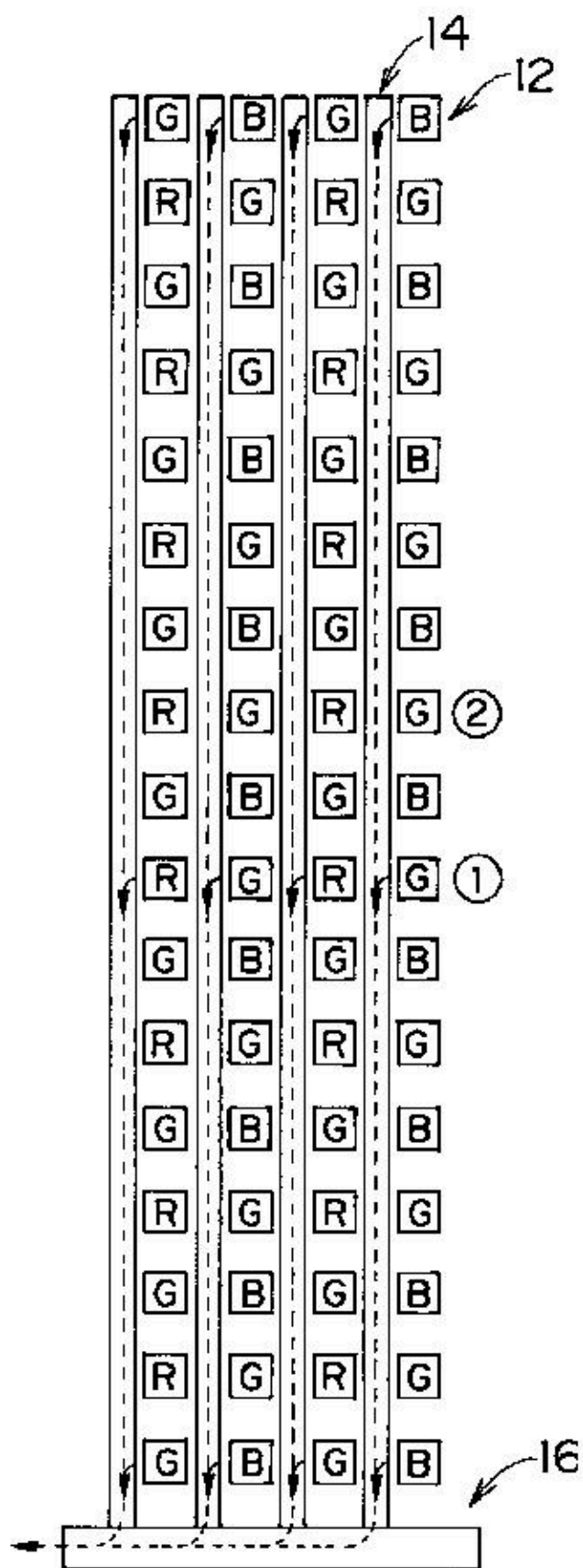
[FIG.8]



[FIG.4]

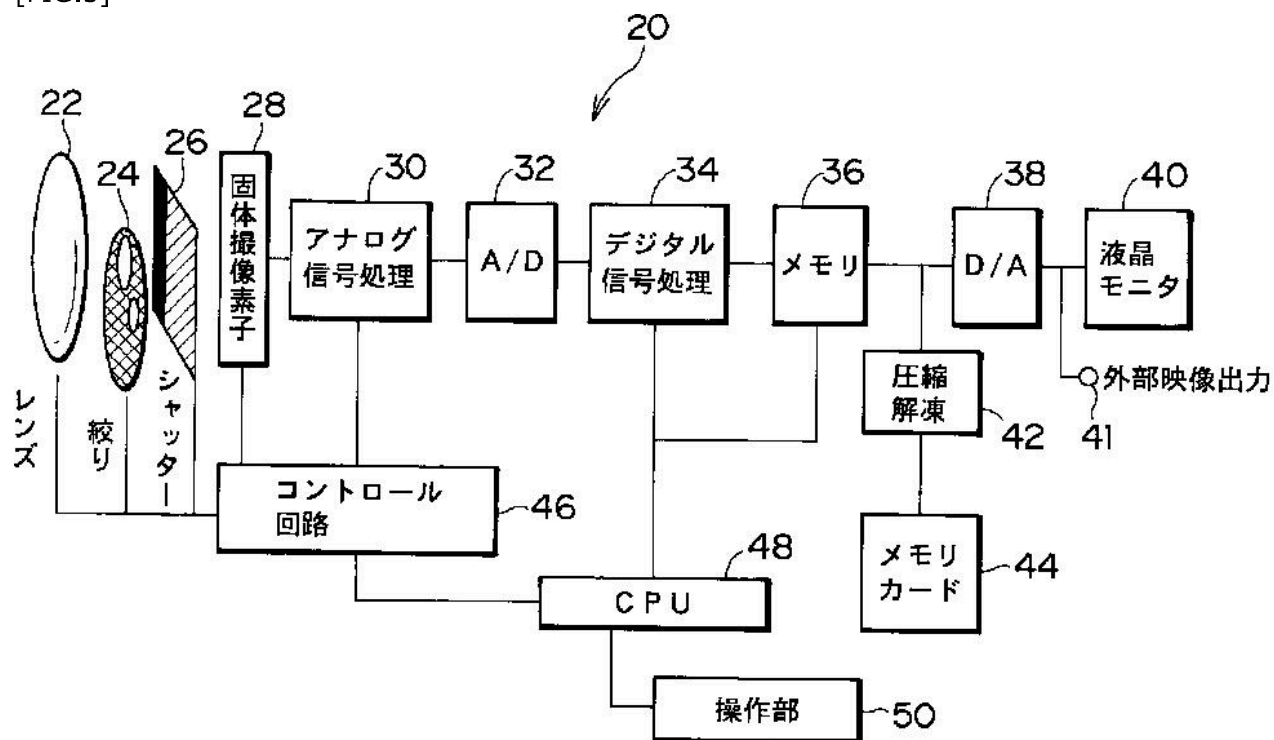


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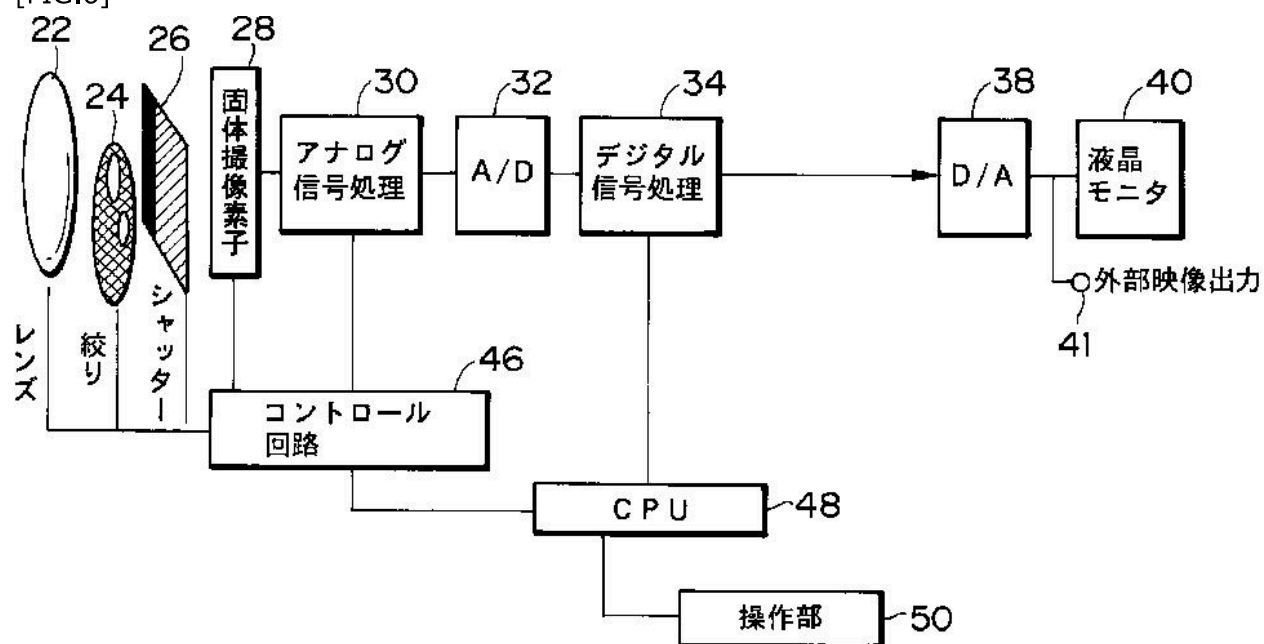


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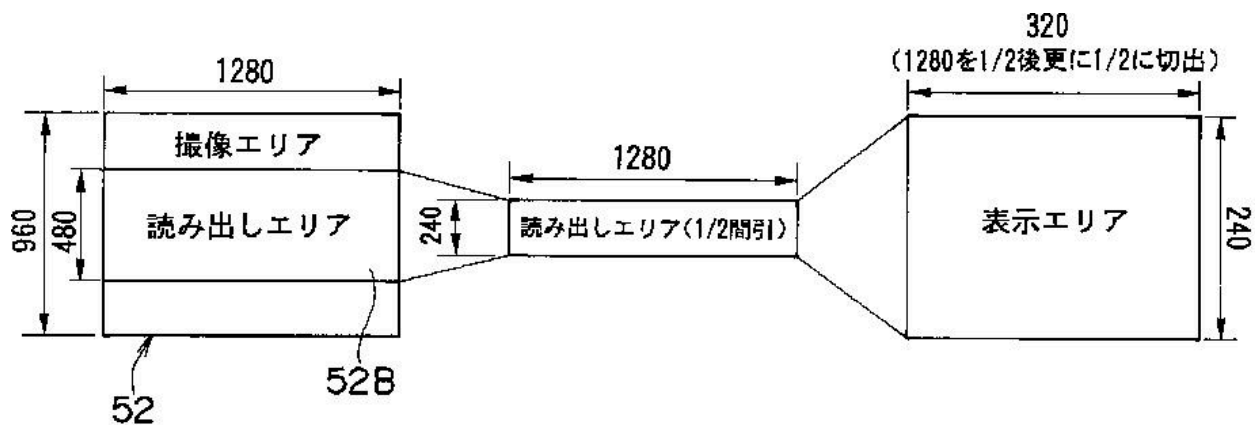
[FIG.5]



[FIG.6]



[FIG.10]



Drawings

Close

Representative drawing

[1](#)

[2](#)

[3](#)

[4](#)

[5](#)

[6](#)

[7](#)

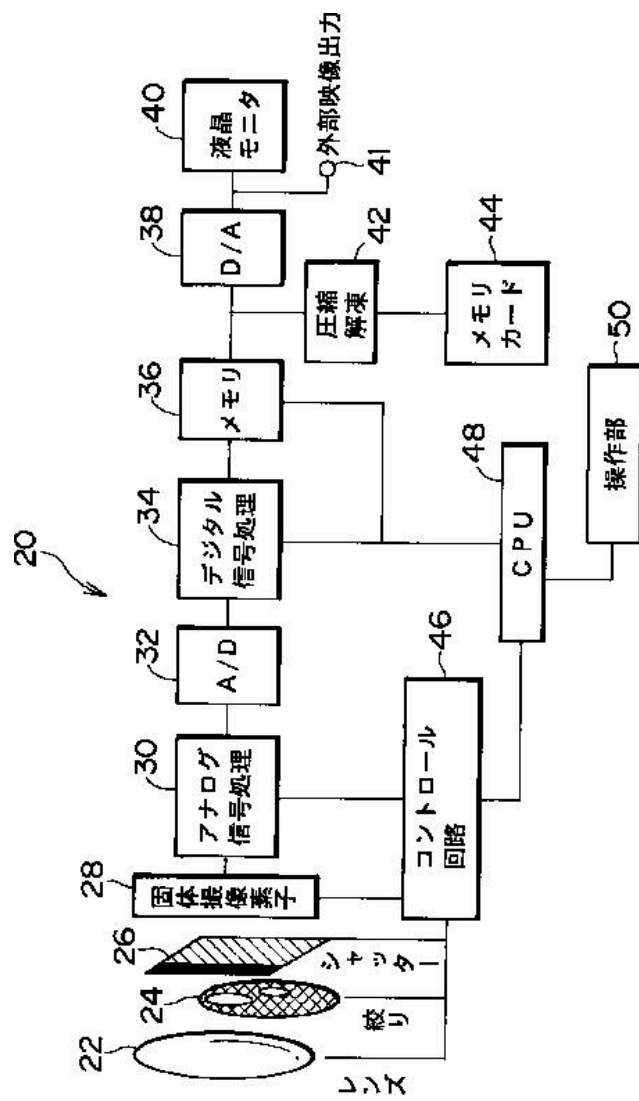
[8](#)

[9](#)

[...](#)

Enlarge and Rotate

>



Representative drawing