

E CERTIFICATE OF TRANSLATION ACCURACY

I am a professional reviewer and coordinator specializing in translating Japanese, Korean, and Chinese to English and vice versa.

I served as Chief Examiner of the certified court interpreter test for the State of California and as a contract translator and interpreter for various federal agencies through the U.S. Department of State for more than a decade. I served as an instructor at the University of California at Berkeley and the Middlebury Institute of International Studies at Monterey (MIIS) Graduate Program in Translation.

I have more than 30 years of experience reviewing thousands of technical, legal, and business documents from Japanese to English submitted to, among others, Japanese judicial authorities, U.S. federal courts, the U.S. International Trade Commission (ITC), and the USPTO Patent Trial and Appeal Board (PTAB).

I certify that the following document translated from Japanese to English is a true, correct, and complete translation of the corresponding source text to the best of my knowledge and ability.

I certify under penalty of perjury that the foregoing is true and correct.

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(54) [Title of the Invention] **IMAGE MANAGEMENT METHOD AND DEVICE, AND ELECTRONIC CAMERA**

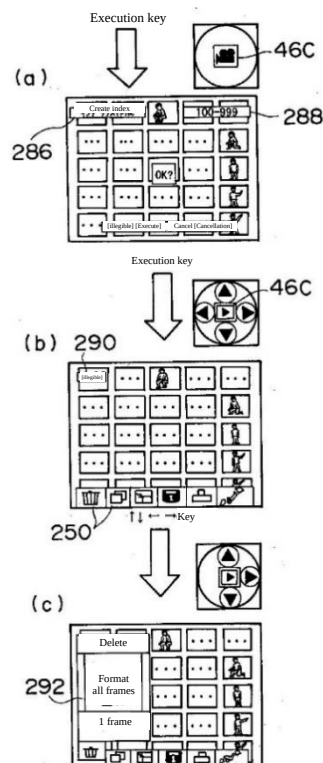
(57) ABSTRACT

PROBLEM

To provide an image management method and device that allows easy comprehension of all contents of consecutive images such as a video file, and an electronic camera that allows easy file search and image confirmation.

RESOLUTION MEANS

A plurality of frames are extracted from a video file according to a prescribed frame extraction rule, and an index image is created in which reduced images of the plurality of frames are arranged on one screen. This index image is recorded as a still image file on a memory card or other storage medium. By recording link information for specifying the original image of the reduced image included in the index image in association with the index image, the playback start frame of consecutive images can be designated from the display screen of the index image, and reproduction of one frame in the consecutive images can be designated.



What is claimed is:

[Claim 1] An image management method, comprising:
extracting a plurality of screens from consecutive images in chronological order;

creating an index image in which reduced images of the plurality of screens are arranged in one screen; and
recording the index image in a readable signal format in a recording device.

[Claim 2] The image management method according to claim 1, further comprising:
recording at least one of information for identifying an original image of each reduced image constituting the index image, and information for identifying consecutive images, together with the index image, in the recording device.

[Claim 3] The image management method according to claim 1, further comprising:
recording information for identifying an original image of each of the reduced images constituting the index image, together with the index image, in the recording device;
accepting a selection instruction for selecting a desired reduced image from the display screen of the index image; and

when a selection instruction is given, the information being used to start playback of the consecutive images from a screen depicting a reduced image related to the selection.

[Claim 4] The image management method according to claim 1, further comprising:
recording information for identifying an original image of each of the reduced images constituting the index image, together with the index image, in the recording device;
accepting an instruction for specifying a range to be played back from the display screen of the index image; and
when an instruction to specify a playback range is provided, the information being utilized to execute playback of the consecutive images within the specified playback range.

[Claim 5] The image management method according to claim 4, wherein the playback range is specified by selecting reduced images corresponding to a playback start image and a playback end image, respectively.

[Claim 6] The image management method according to claim 3 or claim 5, wherein the selected image is used as a representative image depicting the file contents of the consecutive images, and the representative image is changed in response to the selection.

[Claim 7] The image management method according to any one of claims 1 to 3, further comprising:
recording information for identifying an original image of each of the reduced images constituting the index image, together with the index image, in the recording device;
accepting a selection instruction for selecting a desired reduced image from the display screen of the index image; and

when a selection instruction is provided, the information being used for playing back one frame of the screen depicted by the reduced image related to the selection.

[Claim 8] The image management method according to any one of claim 1 to claim 7, further comprising: extracting one frame for every equal number of frames, or one frame which is thinned out for every equal number of frames, based on the relationship between the number of reduced

images to be arranged in the index image and the total number of frames in the consecutive images.

[Claim 9] An image management device, comprising:
image inputting means for capturing consecutive images acquired consecutively over time or intermittently at prescribed time intervals;

image extracting means for extracting a plurality of images in chronological order from the consecutive images obtained from the image inputting means in accordance with a prescribed rule;

index creating means for generating a reduced image of the screens extracted by the screen extracting means and creating an index image by arranging a plurality of the reduced images in one screen; and

recording means for recording the index image created by the index creating means in a readable signal format.

[Claim 10] The image management device according to claim 9, wherein at least one of information for identifying an original image of each reduced image constituting the index image, and information for identifying consecutive images, are recorded together with the index image, in the recording device.

[Claim 11] The image management device according to claim 9 or claim 10, wherein the image inputting means is media reading means for reading data from a storage medium where data of the consecutive images is stored.

[Claim 12] The image management device according to any one of claim 9 to claim 11, further comprising: displaying means for displaying the index image, having a function for enlarging and displaying a portion of the index image displayed on the displaying means.

[Claim 13] An electronic camera, comprising:
an image management device according to any one of claim 9 to claim 12;

a photographing element; and

signal processing means for processing an image signal output from the image photographing device;

wherein the consecutive images acquired by the photographing means and the index image of the consecutive images are recorded to the recording means.

[Claim 14] The electronic camera according to claim 13, wherein the index image is automatically created and recorded when consecutive images are photographed via the photographing element.

[Claim 15] The electronic camera according to claim 13, further comprising: instructing means for instructing creation of an index image, wherein the index image is created based on an index image creation instruction from the instructing means.

[Claim 16] A storage medium, for storing a program for executing the image management method according to any one of claim 1 to claim 8 using a computer.

DETAILED DESCRIPTION OF THE INVENTION

[0001]

TECHNOLOGICAL FIELD OF THE PRESENT INVENTION

The present invention relates to a method and device for managing image data, and more particularly to an image management method and device suitable for a digital camera having a video photographing function, and an electronic camera.

[0002]

CONVENTIONAL TECHNOLOGY

Recent digital cameras have a video photographing function, and it is now possible to record and play back still images and videos with a single camera. With this type of camera, still image files and video files are stored together on memory cards and other removable media. Some cameras are known to have a function for displaying a list (index display) of reduced images (thumbnails) of the files arranged in a prescribed arrangement in order to enable the user to check the image contents stored on the medium.

[0003]

PROBLEMS TO BE SOLVED BY THE INVENTION

However, while the image content of still image files can be grasped at a glance by a thumbnail, in the case of a video file, only the first frame is usually displayed in reduced size as a representative image, so grasping the content of the entire video is difficult.

[0004] In order to confirm the content of a video, the video file must be played from the beginning, which causes the problem that searching for a file is time-consuming.

[0005] In light of the foregoing, an object of the present invention is to provide an image management method and device that enables easy comprehension of the entire content of a series of consecutive images. Furthermore, another object of the present invention is to provide an electronic camera that can easily search for files and check images by applying the image management device.

[0006]

MEANS FOR SOLVING THE PROBLEM

In order to achieve the aforementioned object, the image management method according to claim 1 includes: extracting a plurality of screens from consecutive images in chronological order; creating an index image in which reduced images of the plurality of screens are arranged in one screen; and recording the index image in a readable signal format in a recording device.

[0007] According to the present invention, a plurality of frames are extracted at appropriate frame intervals from a series of image groups captured successively over time by video photographing, consecutive photographing, interval photographing, and the like, and an index image is created from these reduced images. An index image presents a partial digest of the contents of a series of images, and by looking at this index image, a user can easily grasp the overall content of a series of images (consecutive images).

[0008] In addition, an index image that has been created once is recorded in the recording device as one still image, so the next time the index image is referred to, reading the index image from the recording device is sufficient, and the process of creating the index image can be omitted.

[0009] One example of the recording device is a device that converts information content into a data format that can be read by electrical, magnetic, or optical means, or a combination thereof, and records the data on removable media.

[0010] The aforementioned image management method is configured similar to claim 2, further including: recording at least one of information for identifying an original image of each reduced image constituting the index image, and information for identifying consecutive images, together with the index image, in the recording device.

[0011] By recording link information for specifying the original image of the reduced image included in the index image in association with the index image, the playback start frame of consecutive images can be designated from the display screen of the index image, as described in claim 3, and the range of the consecutive images to be played back can be designated, as described in claim 4. One method for specifying the playback range is an embodiment in which reduced images corresponding to the playback start image and the playback end image are selected, as described in claim 5.

[0012] Furthermore, the invention according to claim 6 is the image management method according to claim 3 or claim 5, wherein the selected image is used as a representative image depicting the file contents of the consecutive images, and the representative image is changed in response to the selection.

[0013] For example, in the initial setting, the first frame of a video file is automatically selected as the representative image, but when the image management method of the present invention is applied, the representative image can be changed by selecting a desired image within the file, and the selected image becomes the representative image. This facilitates grasping the content of a file in a display format that uses a representative image, such as thumbnail list display or during single-frame playback.

[0014] As another aspect of the image management method according to any one of claims 1 to 3, by recording link information for identifying the original image of the reduced image included in the index image in association with the index image, it is possible to specify the playback of one frame in consecutive images, as described in claim 7.

[0015] By recording link information for specifying consecutive images corresponding to the index image in a recording device together with the index image, the corresponding relationship between the index image and the consecutive images becomes clear, and operations such as calling up consecutive images from the display screen of the index image or calling up the index image from the playback screen of the consecutive images become possible, and the video audio can also be played back while the index image is being displayed.

[0016] As a method for extracting images to be used as an index image from consecutive images, the image management method of claim 8 is characterized in that one frame is extracted for every equal number of frames based on the relationship between the number of reduced images to be arranged in the index image and the total number of frames in the consecutive images.

[0017] When handling video data as an electronic file, a plurality of frame images are extracted from a video file corresponding to the consecutive images in accordance with a prescribed frame extraction rule, the index image is created from the plurality of frame images, and the index image is recorded in the recording device as a still image file. Furthermore, at least one of information for identifying each frame image constituting the index image and information for identifying the original video file is recorded in the recording device together with the index image.

[0018] As an embodiment of the aforementioned method invention, the image management device according to claim 9 includes: image inputting means for capturing consecutive images acquired consecutively over time or intermittently at prescribed time intervals; image extracting means for extracting a plurality of images in chronological order from the consecutive images obtained from the image inputting means in accordance with a prescribed rule; index creating means for generating a reduced image of the screens extracted by the screen extracting means and creating an index image by arranging a plurality of the reduced images in one screen; and recording means for recording the index image created by the index creating means in a readable signal format.

[0019] According to another embodiment of the present invention, as disclosed in claim 10, at least one of information for identifying an original image of each reduced image constituting the index image, and information for identifying consecutive images, are recorded together with the index image, in the recording device.

[0020] The image inputting means described in claim 11 can be media reading means for reading data from a storage medium on which data of consecutive images is stored.

[0021] Furthermore, with the aforementioned image management device, a preferable embodiment includes a displaying means for displaying the index image, and has a function for enlarging and displaying a portion of the index image displayed on the displaying means, as described in claim 12.

[0022] The image management device of the present invention is applicable to various image information processing devices such as image play back devices, image recording devices, image searching devices, and the like. For example, claim 13 describes an embodiment where the aforementioned image management device is applied to an electronic camera having a photographing element and signal processing means for processing an image signal output from the photographing element, and successive images acquired via the photographing element and index images of the consecutive images are recorded in the recording means.

[0023] With this electronic camera, as described in claim 14, the index image may be created and recorded automatically when consecutive images are photographed via the photographing element, or as described in claim 15, when an instruction to create an index image is provided from appropriate instructing means, the index image may be created based on the instruction.

[0024] Furthermore, it is also possible to achieve the image management method of the present invention by means of a computer, and as described in claim 16, it is possible to provide a third party with image processing software (program) having the image management function of the present invention on a CD-ROM, magnetic disk or other storage medium, or to distribute the program via communication lines such as the Internet or the like.

[0025]

EMBODIMENTS OF THE INVENTION

Preferred embodiments of the image management method, device, and electronic camera according to the present invention will be described below in detail, with reference to the accompanying drawings.

[0026] FIG. 1 is a front view of a digital camera that applies the present invention, and FIG. 2 is a plan view thereof. The camera 10 is a digital camera capable of recording and playing back video, still images, and audio, and is provided with a lens barrier 12, a viewfinder window 14, a strobe light control sensor 16, a self-timer lamp 18, and a microphone unit 20 on a front of the camera. A photographing lens (not depicted in FIG. 1) is provided behind the lens barrier 12, and during photographing, the lens barrier 12 slides to a prescribed retracted position (open position) inside the body to reveal the photographing lens.

[0027] A CCD image sensor (not depicted in FIG. 1, but designated by reference numeral 66 in FIG. 5, hereinafter referred to as CCD) is provided behind the photographing lens as a photographing element, and an image signal read from the CCD 66 is converted into digital image data by predetermined signal processing. Furthermore, although not depicted in FIG. 1, a memory card insertion port (card slot), a speaker unit, a video output terminal (VIDEO OUT), a serial communication terminal, a USB terminal, and a power input terminal (for example, a terminal for DC IN 3V) are provided on a side of the camera 10 (right side in FIG. 1). In FIG. 1, reference numeral 22 denotes a card slot cover (card cover), 24 denotes a grip part, 26 denotes a strap attachment part, and 28 denotes a battery cover.

[0028] In addition, a release button 30, a mode dial 32, and a pop-up strobe light emitting device 34 are provided on an upper surface of the camera 10. The release button 30 is means for issuing an instruction to start recording an image, and also serves as a recording button for issuing an instruction to start and stop recording when recording a video. The mode dial 32 is a dial switch rotatably provided on the outer periphery of the release button 30. The mode of the camera 10 can be changed by rotating this dial and stopping at an indicator 35. These operating members can be provided on the camera body in a space-efficient manner by a configuration that arranges the release button 30 inside the ring-shaped mode dial 32.

[0029] FIG. 3 is a rear view of the camera 10. The rear surface of the camera 10 is provided with a viewfinder 36, a liquid crystal monitor 38, a power switch 40, a mode selecting lever 42, a cross key 44, a dot matrix liquid crystal display unit (hereinafter referred to as the dot matrix liquid crystal display) 46, a shift key 48, a display key 50, a menu/execute key 52, a cancel key 54, and the like.

[0030] The liquid crystal monitor 38 is composed of a color liquid crystal display, and displays images captured via the CCD and play back images read from the memory card, as well as various information such as mode information, battery remaining warning, photographing date and time, number of possible normal photographs, play back frame number, and the like.

[0031] The power switch 40 is a push switch, and pressing this switch can turn the power to the camera 10 ON and OFF. The camera 10 has an auto power-off function, and is configured to automatically turn OFF the power if an operation is not performed for a prescribed period of time (for example, two minutes). The auto power off function time can be set by the user. The power switch 40 should be pressed again to return the device from the power-off state caused by the auto power-off function.

[0032] The mode selecting lever 42 is means for selectively switching between a photographing system mode and a play back system mode. The mode selecting lever 42 is rotatably supported on the outer periphery of the power switch 40 and is configured as a lever switch that can stop at two positions: a photographing system mode position (upper stop position) and a play back system mode position (lower stop position).

[0033] The cross key 44 includes four push switches: an up key 44U, a down key 44D, a left key 44L, and a right key 44R, and these four keys are arranged with a symmetrical positional relationship along the same circumference. A circular window 56 is formed inside the cross key 44, and the dot matrix liquid crystal display 46 is provided in this window 56. The dot matrix liquid crystal display 46 device itself has a square display surface larger than the window part 56, but the display range is limited by the window part 56.

[0034] The dot matrix liquid crystal display 46 displays the functions and mode states of the up, down, left and right keys 44U, 44D, 44L, and 44R. The detailed display format will be described later, but the display surface of the dot matrix liquid crystal display 46 is divided into five display areas: an upper display part 46U, a lower display part 46D, a left display part 46L, a right display part 46R, located in the vicinity of each of the keys 44U, 44D, 44L, 44R, and a central display part 46C located in the middle thereof (see FIG. 7(a)). Each of the top, bottom, left and right display parts displays marks relating to the functions of each key 44U, 44D, 44L, 44R of the cross key 44 and, if applicable, a mark indicating the state set by that key, and the central display part 46C displays a mark indicating the operating mode (main mode) of the camera 10.

[0035] The display controls of the dot matrix liquid crystal display 46 and the liquid crystal monitor 38 are linked (interlocked), and a multi-function operating unit is achieved by the operating unit with display function, constituted by arranging the dot matrix liquid crystal display 46 inside the cross key 44.

[0036] The shift key 48 is a push switch for further expanding the functions of the cross key 44 and other key switches. When the shift key 48 is pressed as necessary, a shift guidance message is displayed on the liquid crystal monitor 38 as an on-screen display, which provides guidance on the extended operations using the shift key. By following the guidance and performing prescribed key operations, the user can input various settings, such as adjusting the brightness of the monitor, and the like.

[0037] The display key 50 is a switch for switching the display of the liquid crystal monitor 38 ON/OFF in the photographing mode. In playback mode, each time the key 50 is pressed, the display cycles from "single frame play back with on-screen display (OSD)" to "single frame play back without OSD" to "multi-frame play back (with 3 seconds of OSD display)." However, when the menu is displayed, the display switches between "single frame play back" and "multi-frame playback."

[0038] In photographing mode, pressing the display key 50 can turn the display on the liquid crystal monitor 38 ON and OFF, and can switch to a power-saving photographing mode in which the angle of view can be adjusted by looking through the viewfinder 36. However, in macro mode, the liquid crystal monitor 38 cannot be turned off.

[0039] A viewfinder lamp 58 is provided beside the viewfinder 36, and the operating condition and state of the camera 10 are indicated by a combination of the lighting color and lighting state (lit/blinking) of the lamp.

[0040] The menu/execute key 52 is used when transitioning from the normal screen of each mode to the menu screen, or when activating a selected item on the menu screen of each mode to transition to the normal screen (or the previous screen if there are a plurality of menu hierarchies). Specifically, this key is used in cases such as displaying the menu in photographing mode and playback mode, selection confirmation of a selection item, selection confirmation and deletion execution of a deletion item, selection confirmation and execution of a protection item, selection confirmation and execution of a print specification item, selection confirmation of a menu item, selection confirmation of date and time setting, and returning to the photographing menu, and the like.

[0041] The cancel key 54 is used to cancel an item selected from a menu or to return to the previous operating state (undo), and the like.

[0042] A row of small projections corresponding to the finger placement part 60 is formed in an embossed manner in the region between the mode selecting lever 42 and the left key 44L of the cross key 44. The finger placement part 60 is provided at approximately the center of the range of thumb movement when operating the cross key 44 and other operating parts, and is suitable as a location to place the thumb, and is also a position where the camera 10 can be stably held.

[0043] FIG. 4 is an enlarged view of the mode dial 32. The mode dial 32 is means for selecting and switching between various modes, including setup mode, movie photographing mode, continuous photographing mode, manual photographing mode, auto photographing mode, portrait photographing (portrait) mode, scenery photographing mode, and a night scenery photographing mode. The upper surface of the mode dial 32 is provided with a symbol mark (a pictogram or symbol representing the mode, or a combination thereof) representing each mode, and when the mark of a desired mode is aligned with the position of the indicator 35, that mode is set.

[0044] For example, when the setup mode is selected, a setup screen is displayed on the liquid crystal monitor 38. The setup menu includes various setting items such as recording image quality, number of pixels, ON/OFF selection of the liquid crystal monitor 38 at start-up, auto power-off time, opening screen display setting, date and time setting, and the like.

[0045] A photographer operates the up/down keys 44U, 44D of the cross key 44 to select an item to be changed from the setup screen, changes the setting contents with the left/right keys 44L, 44R, and then presses the execute key 52 to confirm.

[0046] For example, in the quality setting item, three types of image quality (recording compression rate) can be selected according to the purpose of photographing, namely fine, normal, and basic. Fine is 1/4 (JPEG) compression, normal is 1/8 (JPEG) compression, and basic is 1/16 (JPEG) compression. Pixel settings can be selected from 2400 x 1800, 1280 x 960, or 640 x 480. The auto power off time can be set to 5 minutes, 2 minutes, or the auto power function can be turned OFF. The opening screen settings can be selected from "ON setting" which displays a prescribed opening screen on the liquid crystal monitor when the power is turned ON, and "OFF setting" which does not display the opening screen. Furthermore, by selecting "Screen registration", the image to be displayed as the opening screen can be registered or changed.

[0047] FIG. 5 is a block diagram of the camera 10. The photographing optical system 62 provided behind the lens barrier 12 includes a 3x zoom lens (for example, f=7.4 mm to 22 mm: equivalent to 35 mm to 105 mm in a 35 mm camera), an aperture, and a mechanical shutter. The means for driving the lens barrier 12 to open and close also serves as zoom driving means 63 equipped with a zoom motor.

[0048] The viewfinder 36 is a zoom viewfinder that is linked to the photographing optical system 62. The viewfinder lamp 58 is composed of two LEDs, a red light emitting diode (LED) 58R and a green light emitting diode 58G, and these LEDs 58R, 58G are controlled to light/blink, or to simultaneously light/blink, depending on the operating status of the camera 10, thereby displaying the light/blinking of three colors: red, green, and orange.

[0049] Light incident via the photographing optical system 62 passes through an optical low-pass filter 64 and forms an image on the light receiving surface of a CCD 66. The CCD 66 has a honeycomb structure in which light receiving sensors corresponding to light sensitive pixels are arranged two-dimensionally in a honeycomb shape, and the color filters are arranged in a so-called "diagonal Bayer array". Of course, a CCD having a known structure such as a G-stripe or Bayer array may also be used.

[0050] The CCD 66 is provided with a shutter drain via a shutter gate, and the accumulated signal charge can be discharged to the shutter drain by driving the shutter gate

with a shutter gate pulse. In other words, the CCD 66 has a so-called electronic shutter function that controls the accumulation time (shutter speed) of charges accumulated in each sensor using a shutter gate pulse.

[0051] The photograph subject imaged on the light receiving surface of the CCD 66 is converted by each light receiving sensor into a signal charge that correlates to the amount of incident light. The signal charges thus accumulated are read by a CCD drive pulse applied from a CCD drive circuit 68, and are sequentially output from the CCD 66 as voltage signals (analog image signals) corresponding to the signal charges.

[0052] The signal read from the CCD 66 is applied to an analog processing unit 70. The analog processing unit 70 includes a sampling and holding circuit and a gain adjustment circuit, and the image signal output from the CCD 66 is subjected to correlated double sampling (CDS) processing and color separation processing into R, G, and B color signals in the analog processing unit 70, and thereby the signal levels of each color signal are adjusted (pre-white balance processing).

[0053] The signal output from the analog processing unit 70 is converted into R, G, and B digital signals in the A/D converter 72, and then stored in the SDRAM 82 via the built-in buffer 76 in the signal processing IC 74, the I/O bus interface 78, and the chip bus interface 80. The built-in buffer 76 is used to perform pixel reduction processing to match the screen size of the display system. The SDRAM 82 is used as an image memory.

[0054] A timing signal is provided to the CCD drive circuit 68, the analog processing unit 70 and the A/D converter 72 from a timing generator 84, and these circuits are synchronized by this timing signal.

[0055] The data stored in the SDRAM 82 is sent via a bus 86 to an auto calculating unit 88 and also to a signal processing unit 90. The automatic calculating unit 88 performs various calculations such as focus evaluation calculation and AE calculation based on the input image signal, and transmits the results of these calculations to a system controller 92. Based on the calculation results received from the auto calculating unit 88, the system controller 92 controls AF driving means 94 including an AF motor and shutter/iris driving means 96 including a shutter/iris motor to move the focus lens to an in-focus position, and sets the aperture to an appropriate aperture value to control the mechanical shutter and the electronic shutter of the CCD 66.

[0056] For example, the AF control uses a contrast AF method in which the focus lens is moved so as to maximize the high frequency components of the G signal. For AE control, the subject brightness (photographing EV) is calculated based on the integrated value of the R, G, and B signals for one frame, and the aperture value and shutter speed are determined based on this photographing EV. The aperture is driven via the shutter/iris driving means 96, and the charge accumulation time of the CCD 66 is controlled by the electronic shutter so as to achieve the determined shutter speed. Therefore, by simply pointing the lens of the camera 10 at the subject, optimal exposure adjustment is performed and focusing is automatically performed.

[0057] During photographing and recording, the aforementioned photometry operation is repeated a plurality of times when the release button 30 is "half-pressed" to obtain an accurate photographing EV, and the aperture value and shutter speed at the time of photographing are finally determined based on this photographing EV. When the release button 30 is "fully pressed", the aperture is driven to the finally determined aperture value, and the charge accumulation time is controlled by the electronic shutter to achieve the determined shutter speed. In addition to the method of controlling AE and AF based on the image signal obtained from the CCD 66, a distance measuring sensor including a well-known photometric sensor and an AF light projecting/receiving sensor may be used.

[0058] The signal processing unit 90 is a digital signal processing block including a luminance/color difference signal conversion circuit, a gamma correction circuit, and the like. The RGB data input to the signal processing unit 90 is converted into a luminance signal (Y signal) and color difference signals (Cr, Cb signals) and undergoes prescribed processing such as gamma correction before being written back to the SDRAM 82.

[0059] The luminance and color difference signals (abbreviated as YC signals) stored in the SDRAM 82 are supplied to a VRAM 94 via a bus 86. The data stored in the VRAM 94 is sent to an encoder 96 to be converted, together with character and symbol data supplied from a character generator 98, into a signal with a prescribed format for display (for example, a color composite video signal of the NTSC format).

[0060] The output of the encoder 98 is provided to a D/A converter 100 and an LCD controller 102. The image signal converted into an analog signal by the D/A converter 100 is supplied to an LCD controller 104, and the image is output to the liquid crystal monitor 38. The liquid crystal monitor 38 is provided with a backlight 106, and the backlight 106 is turned ON/OFF in conjunction with the ON/OFF of the monitor display. Note that the displaying means is not limited to a liquid crystal display, and other display devices capable of color display may be used.

[0061] Moreover, the output of the D/A converter 100 can be output to the outside from a video output terminal (VIDEO OUT) 112 via a low-pass filter 108 and a 75 Ω driver 110.

[0062] The image data is periodically rewritten by the image signal output from the CCD 66, and a video signal generated from the image data is supplied to the liquid crystal monitor 38, so that the image captured by the CCD 66 is displayed on the liquid crystal monitor 38 in real time as video (live image), or although not in real time, as an approximately continuous image.

[0063] The liquid crystal monitor 38 can be used as an electronic viewfinder, and the photographer can check the photographing angle of view by the image displayed on the liquid crystal monitor 38 or the viewfinder 36. Capturing image data for recording begins in response to a predetermined recording instruction (photography start instruction) operation, such as pressing the release button 30.

[0064] When the photographer inputs a command to photograph and record using the release button 30, the system controller 92 sends a command to a JPEG calculating unit (corresponding to a compression/decompression circuit) 114, which causes the JPEG calculating unit 114 to compress the image data in the SDRAM 82 in accordance using JPEG or another prescribed format. The compressed image data is supplied to a card interface 118 via a media controller 116 and recorded on a memory card 120 attached to the card interface 118.

[0065] When a mode for recording uncompressed image data (uncompressed mode) is selected, the image data is recorded in the memory card 120 in an uncompressed state without being compressed by the JPEG calculating unit 114.

[0066] The JPEG calculating unit 114 has both still image compression processing and video compression processing functions, and videos are recorded in accordance with the Motion JPEG format. Of course, MPEG, MPEG2, or other recording formats may also be used.

[0067] The digital camera 10 of this embodiment uses a memory card 120 as a recording means for storing image data. Specifically, for example, smart media (Solid-State Floppy Disk Card) is used. The form of the storage media is not limited to those described above, but various forms are possible, such as PC cards, microdrives, multimedia cards (MMC), magnetic disks, optical disks, magneto-optical disks, memory sticks, and the like, and signal processing means and an interface are used based on the medium that is used.

[0068] In playback mode, image data read from the memory card 120 is decompressed by the JPEG calculating unit 114 and output to the liquid crystal monitor 38 via the VRAM 94, the encoder 96, and the D/A converter 100.

[0069] A serial input/output unit 122 is connected to the bus 86, and data can be sent and received via a serial communication interface 124 to and from an external device (not depicted). Furthermore, an LCD controller 126 for controlling the dot matrix liquid crystal display 46, a D/A converter 128 with an electronic volume, and an EEPROM 130 are connected to the serial input/output unit 122.

[0070] Among the command signals output from the system controller 92 and the CPU block 132, an electronic shutter control command to be given to the CCD drive circuit 68, a guide number selection command for the strobe light emitting device 34, and a command to the LCD controller 104 are given as command signals converted into analog signals via a D/A converter 128 with electronic volume.

[0071] In addition to the circuit blocks mentioned above, the bus 86 is connected to a clock controller 134, a programmable input/output port 136, an A/D converter 138, a key-on controller 140, a multi-function timer 142, a watchdog timer 144, an interrupt controller 146, and a DMA controller 148, and each circuit block is connected to the CPU block 132 via an I/O bus interface 78.

[0072] The CPU block 132 is a controller (controlling means) that controls each circuit of the camera 10, and is composed of a CPU core 150, a cache memory 151, and an internal DRAM 152. The CPU block 132 is connected to an I/O controller 154 and an SDRAM controller 155, and is also connected to the SDRAM 82, a flash ROM 156, and a USB driver 158 via a chip bus interface 80. By connecting a cable to the USB terminal 160, the camera 10 can transmit and receive data to and from a personal computer or other external device (not depicted).

[0073] The CPU core 150 controls the operation of the corresponding circuits based on input signals received from operating units 162 and 164 and various detecting means. In other words, the CPU core 150 controls the zooming operation of the photographing optical system 62, the focus adjustment (AF) operation, the automatic exposure adjustment (AE) operation, and the like, and also controls the timing generator 84 to control the charge accumulation time of the CCD 90. The CPU core 150 also functions as a display controller for the dot matrix liquid crystal display 46.

[0074] The operating unit 162 is a block including the cross key 44, the shift key 48, the display key 50, the menu/execute key 52, and the cancel key 54, and the operating unit 164 is a block including switches corresponding to the release button 30, the mode dial 32, the power switch 40, and the mode selecting lever 42. When the power switch 40 is pressed, a signal is applied to a get-up signal generating circuit 165, and the get-up signal generating circuit 165 then applies a get-up signal to the signal processing IC 74, thereby starting the IC. In the camera 10 of this embodiment, the operating units 162, 164 are disposed on the camera body, but it is also possible to configure the parts corresponding to the operating units 162, 164 as remote control transmitters separated from the camera body.

[0075] The detecting means provided in the camera 10 includes a barrier open switch for detecting the open/closed

state of the lens barrier 12, a sensor for detecting the zoom position (for example, composed of a potentiometer or an encoder), a sensor for detecting the home position of the focus lens, a card detection switch 166 for detecting whether or not a memory card 120 is inserted, and cable connection detecting means for detecting whether or not a video cable is connected to the video output terminal 112.

[0076] The strobe light emitting device 34 is composed of a light emitting unit 168, a strobe light adjustment sensor 16, a capacitor 170, and a strobe control unit 172. Depending on a prescribed operation from the operating units 162, 164, the camera can be set to a "low brightness automatic light emission mode", a "red-eye reduction mode", which automatically flashes the flash when the brightness is low, a "forced flash mode", which flashes the flash regardless of the brightness of the subject, or a "flash prohibiting mode," which prohibits flashing.

[0077] The CPU block 132 provides commands to the strobe control unit 172 depending on the strobe mode selected by the user. The strobe control unit 172 controls the charging of the capacitor 170 and the timing of discharge (light emission) to the light emitting unit 168 (for example, a xenon tube) based on instructions from the CPU block 132, and also controls stopping of light emission based on the detection results of a strobe dimming sensor 16. The strobe light control sensor 16 uses a light receiving element that receives reflected light from a subject illuminated by the emission of a strobe, and converts the reflected light into an electrical signal according to the amount of received light. The detection signal of the strobe light adjustment sensor 16 is integrated by an integrating circuit (not depicted), and when the integrated amount of received light reaches a prescribed appropriate amount of received light, the emission of the strobe is stopped.

[0078] The power source for the camera 10 can be a battery 174 or an external power source connected to an external power input terminal 176. The battery 174 may be, for example, two AA batteries. Of course, a design is possible that uses a dedicated secondary battery.

[0079] The type of power source being used is detected by a battery detecting unit 178, and the detection information is input to the CPU core 150. Power provided from a battery 174 or an external power source connected to an external power input terminal 176 is converted to a required voltage by a DC/DC converter 180 and supplied to the prescribed circuit blocks.

[0080] The camera 10 also includes a microphone 182 and a speaker 184, and audio input via the microphone 182 is input to the CPU core 150 via the A/D converter 138. Furthermore, the audio data output by the CPU core 150 is supplied to a speaker 184 via an electronic volume D/A converter 128, and is output as audio from the speaker 184.

[0081] Audio data input from a microphone 182 can also be recorded on the memory card 120, and audio recorded on the memory card 120 can also be played back through the speaker 184.

[0082] Next, operation of the camera 10 configured as described above will be described.

[0083] FIG. 6 to FIG. 9 are explanatory diagrams depicting camera operation during movie photographing. When the mode selecting lever 42 is set to the "photographing system mode" and the mode dial 32 is set to the "movie photography mode", the power switch 40 is turned ON, and the camera 10 starts up in the movie photographing mode.

[0084] If "ON setting" is selected in the opening screen setting, "Hello!" is displayed on the dot matrix liquid crystal display 46 when the camera is started, as depicted in FIG. 6(a). Thereafter, as depicted in FIG. 6(b), a prescribed opening screen is displayed on the liquid crystal monitor 38, and at the same time, the dot matrix liquid crystal display 46 also switches to displaying a mark (movie mode mark) indicating that the mode is the movie photographing mode. The movie mode mark is a combination of a stylized movie camera, symbolizing that it is a video recording, and letters indicating the available recording time in units of seconds.

[0085] Note that if the opening screen is set to ON, turning the power switch 40 OFF displays the message "Bye!" on the dot matrix liquid crystal display 46, and then the power will be turned OFF.

[0086] On the other hand, if the "OFF setting" is selected in the opening screen settings, as depicted in FIG. 6(c), when the camera is started up, only the movie mode mark is displayed on the dot matrix liquid crystal display 46, and the liquid crystal monitor 38 remains OFF.

[0087] After a prescribed time has elapsed (for example, one second) from the state of FIG. 6(b) or FIG. 6(c), the screen is switched to a movie photographing screen as depicted in FIG. 7(a). During this one second, predetermined initial processing is carried out inside the camera to prepare for photographing.

[0088] When the camera 10 reaches a state in which recording is possible by movie photographing (in standby), the central display part 46C of the dot matrix liquid crystal display 46 displays a mark indicating that the camera is in movie mode. At this time, the up key 44U of the cross key 44 is assigned a telephoto operation function for the optical zoom, the down key 44D is assigned a wide-angle operation function for the optical zoom, and the left key 44L is assigned a macro mode setting/cancellation function for setting and canceling the macro mode.

[0089] To inform the user of the functions of these keys 44U, 44D, 44L, and 44R, a zoom up mark is displayed on the upper display part 46U of the dot matrix liquid crystal display 46, a zoom down mark is displayed on the lower display part 46D, and a macro mode mark is displayed on the left display part 46L. Regarding the macro mode mark, the macro mode is turned off when the power is turned ON, so a mark symbolizing that the macro mode is OFF is displayed to indicate the current setting state of the macro

mode. When the left key 44L is pressed in this state, the macro mode is turned ON, and the mark displayed on the left display part 46L is also switched to a mark indicating that the macro mode is ON (see FIG. 29(c)).

[0090] Furthermore, during movie standby depicted in FIG. 7(a), no function is assigned to the right key 44R of the cross key 44, so the right display part 46R of the dot matrix liquid crystal display 46 has no display (blinks). This allows the user to easily recognize that the right key 44R is an invalid operation key.

[0091] Although it is possible to assign the macro mode setting/cancellation function to the right key 44R, assigning this function to the left key 44L, which is located further from the end face of the camera body and closer to the center of the main body, can prevent the macro mode from being turned ON/OFF by an unintentional key touch (mis-operation). The camera 10 of this embodiment takes this operability into consideration and so the left key 44R serves as a macro mode setting/cancellation switch.

[0092] During standby, the liquid crystal monitor 38 displays a through image captured by the CCD 66, and displays mode information 202 indicating that the camera is in movie photographing mode in the upper left corner of the screen, text information 204 saying "standby" slightly above the center of the screen, and date information 206 in the lower left corner of the screen. This date display (206) disappears after a prescribed period of time (for example, after 3 seconds), and the display depicted in FIG. 7(b) appears. When the date setting is turned OFF during setup, instead of the date display, a flashing "----,--,--" display will appear, which will disappear after 3 seconds.

[0093] When the up key 44U or the down key 44D is pressed in the state depicted in FIG. 7(b), a zoom bar 208 indicating the zoom position is displayed on the left side of the liquid crystal monitor 38. The zoom bar 208 is displayed as a vertical bar, with the upper part indicating the telephoto side and the lower part indicating the wide-angle side, corresponding to the positional relationship of the up key 44U and the down key 44D. The letter "T" indicating the telephoto side is displayed at the top end of the zoom bar 208, and the letter "W" indicating the wide-angle side is displayed at the bottom end of the zoom bar. The zoom bar 208 display is configured to automatically disappear after a prescribed period of time (for example 3 seconds) has elapsed after the up key 44U or the down key 44D is pressed.

[0094] Moreover, when the shift key 48 is pressed in any of the states depicted in FIGS. 7(a) to 7(c), the screen transitions to a shift guidance screen as depicted in FIG. 8(a). At this time, text information 210 "SHIFT GUIDANCE" is displayed in the upper left corner of the screen of the liquid crystal monitor 38, and "Monitor brightness setting -> [SHIFT] + [DISPLAY]" is displayed in the center of the screen. This text display is an operation assistance display that guides the user to switch to a screen for adjusting the brightness of the liquid crystal monitor 38 by pressing the shift key 48 and the display key 50 successively (or simultaneously).

[0095] While this shift guidance screen is displayed, no function is assigned to the cross key 44, so that in the dot matrix liquid crystal display 46, only the main mode mark is displayed in the central display part 46C, and the up/down/left/right display parts 46U, 46D, 46L, 46R are blank.

[0096] When the shift key 48 and the display key 50 are pressed in accordance with the instructions on the shift guidance screen, a brightness adjustment block 212 is displayed on the screen of the liquid crystal monitor 38 as depicted in FIG. 8(b).

[0097] The brightness adjustment block 212 is displayed in an indicator format in which small blocks 213 are arranged in a row from left to right, and the number of displayed blocks indicates the degree of brightness. The left key 44L of the cross key 44 has the function of decreasing brightness (-), and the right key 44R has the function of increasing brightness (+). Correspondingly, a left arrow triangular mark is displayed on the left display part 44L of the dot matrix liquid crystal display 46, and a right arrow triangular mark is displayed on the right display part 44R.

[0098] Pressing the left key 46L increases the number of blocks 213 and increases the brightness, and pressing the right key 46R decreases the number of blocks 213 and makes the monitor screen darker. Since no function is assigned to the up key 44U and the down key 44D, the upper display part 46U and the lower display part 46D of the dot matrix liquid crystal display 46 are blank.

Furthermore, a movie mode mark, which is the current photographing mode, is displayed in the central display part 46C, and the characters indicating the available recording time are deleted. A special mark indicating that the brightness is being adjusted may be displayed in the central display part 46C.

[0099] When the screen brightness is adjusted to an appropriate level by operating the left key 44L or the right key 44R, the brightness setting is confirmed by pressing the menu/execute key 52. Moreover, pressing the cancel key 54 cancels the change in brightness adjustment and returns to the original setting. Operation guidance such as "Set → [execute]" and "Cancel → [Cancel]" is displayed below the brightness adjustment block 212.

[0100] When the brightness setting is completed by pressing the menu/execute key 52 or the cancel key 54, the device returns to the standby state of FIG. 7(b).

[0101] When the release button 30 is "fully pressed" in the standby state depicted in FIG. 7(b) and "S2 is ON", movie recording starts as depicted in FIG. 9(a). At this time, the recording time information 214 is displayed in the upper right corner of the screen of the liquid crystal monitor 38 in units of seconds.

[0102] The release button 30 also functions as a recording stop key. When the release button 30 is pressed for the second time (when S1 is ON), photographing ends and the captured image is recorded on the memory card 120. During recording on the card, the words "Saving on card" are displayed on the screen of the liquid crystal monitor 38 as depicted in FIG. 9(b).

[0103] At this time, the dot matrix liquid crystal display 46 displays a movie mode mark in the central display part 46C, and the upper, lower, left and right display parts 46U, 46D, 46L, 46R are blank. When the writing (storing) process to the memory card 120 is completed, the process

returns to the standby state described with reference to FIG. 7(b).

[0104] If the release button 30 is pressed again immediately after S2 is turned ON (photography starts), and S1 is turned ON (photography ends), recording is performed for a predetermined minimum recording time. For example, the camera 10 in this embodiment is designed to record 10 frames per second, and is designed to record for a minimum of 3 seconds in relation to the video index (25-screen multi-display) described later. Furthermore, when the memory card 120 reaches the recording limit during photographing, recording is stopped and automatic recording processing is continued.

[0105] Next, operation by the manual photographing mode will be described.

[0106] When the mode selecting lever 42 is set to "photographing system mode" and "manual photographing mode" is selected using the mode dial 32, the camera 10 starts up with the display indicated in FIG. 10 instead of the dot matrix liquid crystal display 46 display content indicated in FIG. 6(a). In other words, a mark composed of a combination of the letter "M" symbolizing that the dot matrix liquid crystal display 46 is in manual photographing mode and a mode mark having a camera as a design is displayed.

[0107] Below the mode mark, the standard number of pictures that can be taken, a quality indicator (N indicates normal), and information on the number of pixels (2400 indicates 2400×1800) are displayed. In this manner, when the camera 10 is started, a display depicting the state of the camera at the time of start-up is displayed on the dot matrix liquid crystal display 46.

[0108] When photographing using manual photographing mode is feasible, the screen of the dot matrix liquid crystal display 46 and the liquid crystal monitor 38 is as depicted in FIG. 11(a).

[0109] The central display part 46C of the dot matrix liquid crystal display 46 displays a mode mark indicating that the mode is manual photographing mode and a number indicating the number of standard pictures that can be taken, the upper display part 46U displays a zoom up mark, the lower display part 46D displays a zoom down mark, the left display part 46L displays a macro mode mark, and the right display part displays a strobe mark.

[0110] In other words, the up key 44U of the cross key 44 is assigned a telephoto optical zoom operation function, the down key 44D is assigned a wide-angle optical zoom operation function, the left key 44L is assigned a macro mode setting/cancellation function for setting and canceling the macro mode, and the right key 44R is assigned a strobe mode setting function.

[0111] FIG. 11(a) depicts a state where the macro mode is OFF and the strobe mode is set to the automatic light emission mode. When the left key 44L is pressed in this state, the macro mode is turned ON, and a mark indicating that the macro setting is ON (see FIG. 29(c)) is displayed on the left display part 46L. Furthermore, each time the right key 44R is pressed, the flash mode is cyclically changed from "Auto" → "Red-eye reduction" → "Forced flash" → "Flash prohibited" → "Auto"..., and the display of the symbol mark representing each flash mode is changed on the right display part 46R (see FIG. 31).

[0112] In the upper left corner of the screen of the liquid crystal monitor 38, the mode information 216 called "manual photographing mode" is displayed, and the macro mode mark, the self-timer mark, and the manual focus mark are displayed below as necessary. An AF target mark 218 is displayed in the center of the screen, and the zoom bar 208 is displayed on the left side of the screen, allowing the current zoom position to be visually grasped.

[0113] Various settings are displayed at the bottom of the screen, from left to right: liquid crystal screen brightness setting, flash light intensity setting, white balance setting, ISO sensitivity setting, and the like. The frame number is displayed in the upper right corner of the screen.

[0114] When the angle of view is determined on the screen of FIG. 11(a) and the release button 30 is "half-pressed" (S1 ON), the image is captured and the screen changes to that of FIG. 11(b). At this time, the screen of the liquid crystal monitor 38 is frozen, and AF processing and AE processing are executed inside the camera. During AF processing and AE processing, "!AF" is displayed on the top right corner of the liquid crystal monitor 38 as information on the internal processing status of the camera, which is later changed to display "!AE".

[0115] Next, when the release button 30 is "fully pressed" (S2 ON), photographing for recording (image recording) is performed. When the preview is set to OFF, after the image is saved to the memory card 120, the state returns to the photographing standby state depicted in FIG. 11(a).

[0116] On the other hand, when preview is set to ON, pressing the release button 30 fully (S2 ON) in the state depicted in FIG. 11(b) will perform photographing for recording (image recording) and the preview display screen depicted in FIG. 11(c) will appear. Information 220 indicating the operating status "Preview" is displayed in the upper left corner of the screen of the liquid crystal monitor 38, and operation guides "Record → [execute]" and "Cancel → [Cancel]" are displayed at the bottom of the screen.

[0117] Furthermore, during preview display, the up key 44U of the cross key 44 is assigned as an electronic zoom enlargement key, and the down key 44D is assigned as an electronic zoom reduction key. Correspondingly, a mark indicating the enlargement zoom function (+ sign in a magnifying glass) is displayed on the upper display portion 46U of the dot matrix liquid crystal display 46, and a mark indicating the reduction zoom function (- sign in a magnifying glass) is displayed on the lower display part 46D.

[0118] The left key 44L and the right key 44R of the cross key 44 are not assigned to a function, so nothing is displayed on the left display part 46L and the right display part 46R of the dot matrix liquid crystal.

[0119] When the up key 44U (or the down key 44D) is pressed in the state depicted in FIG. 11(c), the image displayed on the screen is enlarged (or reduced when the down key 44D is pressed) as depicted in FIG. 11(d).

Furthermore, although not depicted in the figure, by simultaneously pressing the shift key 48 and any key of the cross key 44 (44U, 44D, 44L, or 44R), the display range can be moved (panning or tilted) while maintaining the zoom screen. When the menu/execute key 52 is pressed at a desired angle of view, the image at the currently displayed angle of view is saved in the memory card 120. In this example, an image with a screen ratio of 4:3 was recorded, but the aspect ratio of the screen may be changed arbitrarily or selectively.

[0120] When the cancel key 54 is pressed while the screen is as depicted in FIG. 11(c) or (d), the image recording process is not executed and the screen returns to the manual photographing screen as depicted in (a). Note that depending on the settings, it is also possible to record only the original image, or to record both the currently displayed angle of view and the original image.

[0121] This makes it possible to zoom in/out and move the display range during preview, which is useful for checking focus during manual focusing and allows captured images to be cropped and saved on the spot.

[0122] When an image is captured with a pixel count of 1280×960, the captured image is expanded as YC data at a size of 1280 and stored in the SDRAM 82. When this image is to be displayed on the liquid crystal monitor 38, the data is thinned out by the built-in buffer 76, and converted to a size of 640 before being supplied to the VRAM 94. Therefore, even if enlargement zoom processing is performed in the preview display, the image can be displayed without reducing the resolution.

[0123] When the menu/execute key 52 is pressed on the manual photography screen depicted in FIG. 11(a), the screen transitions to a photography setting menu screen depicted in FIG. 12 and FIG. 13. The photograph setting menu includes eight items, namely brightness, strobe, white balance, ISO sensitivity, manual focus, photometry pattern, sharpness, and preview display, which are displayed on two pages of four items each. By operating the left key 44L or the right key 44R, the eight items, "Preview display" <-> "Sharpness" <-> "Photometry" <-> "Manual focus" <-> "Brightness" <-> "Strobe" <-> "White balance" <-> "ISO sensitivity", are switched in sequence.

[0124] As depicted in FIG. 12, the first page includes four items: "Brightness," "Strobe," "White Balance," and "ISO Sensitivity." A menu bar 222 for these four items is displayed at the bottom of the screen of the liquid crystal monitor 38, and a plurality of options are available for each item.

[0125] The "Brightness" item can set the brightness in increments of 0.3 within a range of -0.6 to +0.6. The "Strobe" item can set the brightness of the strobe in increments of 0.3 within a range of -0.6 to +0.6. The "White balance" item can select one from among strobe, cloudy outdoors, sunny outdoors, and indoors. The "ISO sensitivity" item can select one of 200, 400, or 800.

[0126] Setting items can be selected using the left key 44L or right key 44R and settings selected using the up key 44U or the down key 44D. After selecting the setting content using the up key 44U or down key 44D, the setting content can be confirmed by pressing the menu/execute key 52.

[0127] The menu balloon (submenu frame) 223 that pops up when a menu item is selected is also shifted sequentially from the left according to the order of the menu item display at the bottom of the screen. The "ISO sensitivity" item is at the bottom of the menu movement range, and the menu does not cycle around. Therefore, as depicted in FIG. 12(d), when the "ISO sensitivity" item is set, the right key 44R of the cross key 44 is invalid, and the right display part 46R of the dot matrix liquid crystal display 46 is not displayed. By not rotating the menu and setting a frequently used item at the bottom of the movement range (movement end), the user can easily stop the movement at the position of that item.

[0128] When the left key 44L is pressed on the "Brightness" setting screen of FIG. 12(a), the screen moves to the second page as depicted in FIG. 13(a). As depicted in FIG. 13, the second page is composed of the four items "Manual focus", "Photometry", "Sharpness", and "Preview display". A menu bar 222 with these four items is depicted at the bottom of the liquid crystal monitor 38 screen and a plurality of selections are prepared for each item.

[0129] For the "Manual focus" item, manual focus can be selected as either ON or OFF. For the "Photometry" item, photometry patterns can be selected such as average photometry that takes the average of the whole screen targeting the overall screen, spot photometry that targets photometry of only the center portion of the screen, or multi-photometry where the screen is divided into a plurality of areas for light metering. In "Sharpness", the degree of contour enhancement can be set to an appropriate range in the - direction or the + direction with "0" as a reference. For the "Preview display" item, preview can be selected as ON or OFF for whether or not to display a preview.

[0130] Menu items can be selected using the left key 44L or right key 44R and settings selected using the up key 44U or the down key 44D. After selecting the setting content using the up key 44U or down key 44D, the setting content can be confirmed by pressing the menu/execute key 52.

[0131] The menu balloon 233 of each item that pops up when a menu item is selected is also shifted sequentially from the right according to the order of the menu item display at the bottom of the screen. The "Preview display" item is at the end of menu movement on the second page and the menu does not cycle. Therefore, as depicted in FIG. 13(d), when the "Preview display" item is set, the left key 44L of the cross key 44 is invalid, and the left display part 46L of the dot matrix liquid crystal display 46 is not displayed.

[0132] When the menu/execute key 52 on the photograph standby screen described in FIG. 11(a) is pressed, the

setting menu for "Brightness" (FIG. 12 (a)) is displayed on the display screen as a default; however, if mode is not switched using the mode dial 32 or mode selecting lever 42, the most recent menu is displayed when viewed thereafter.

[0133] Also, if the shift key 48 is pressed at any of the screens depicted in FIGS. 11(a), (c), FIG. 12, or FIG. 13, the shift guidance screen described in FIG. 8 is displayed.

[0134] Next, operation by the auto photographing mode will be described.

[0135] When the mode selecting lever 42 is set to "photographing system mode" and "auto photographing mode" is selected using the mode dial 32, the camera 10 starts up with the display indicated in FIG. 14 instead of the dot matrix liquid crystal display 46 display content indicated in FIG. 6(b), (c). In other words, a mark composed of a combination of the letter "A" symbolizing that the dot matrix liquid crystal display 46 is in auto photographing mode and a mark having a camera as a design is displayed. Together with this mode mark, the standard number of pictures that can be taken, quality display, and pixel count display are as described in FIG. 10.

[0136] When photographing using auto photographing mode is feasible, the display indicates as is depicted in FIG. 15(a) on the dot matrix liquid crystal display 46 and the liquid crystal monitor 38. In the photographing standby state of the auto photographing mode, the up key 44U of the cross key 44 is assigned a telephoto (tele) operation function of the optical zoom, the down key 44D is assigned a wide-angle (wide) operation function of the optical zoom, the left key 44L is assigned a macro mode setting/deactivation function of setting and disabling the macro mode, and the right key 44R is assigned a strobe mode setting function, and marks indicating functions corresponding to the upper/lower/left/right display parts 44U, 44D, 44L, and 44R of the dot matrix LCD 46 are displayed. In addition, on the central display part 46C of the dot matrix liquid crystal display 46, a mode mark indicating currently in auto photographing mode and the number of standard images that can be taken are displayed.

[0137] In the upper left corner of the screen of the liquid crystal monitor 38, the mode information 230 called "auto photographing mode" is displayed, and the macro mode mark and the self-timer mark are displayed thereunder as necessary. An AF target mark 218 is displayed in the center of the screen and if a zoom key (in this case, up key 44U or down key 44D) is pressed, a zoom bar 208 is displayed on the left side of the screen. The zoom bar 208 is displayed for a prescribed amount of time (for example three seconds) after pressing the zoom key and then automatically disappears. In addition, date display 206 automatically disappears after a prescribed period of time has elapsed (for example, after three seconds) after being opened.

[0138] When the release button 30 on the auto photographing mode screen of FIG. 15(a) is pressed (S1 ON), the standby screen depicted in FIG. 15(b) is displayed. Here, further when the release button 30 (S2 ON) is fully pressed, image recording operation is executed. When the photographed image is saved to a memory card 120, the state returns to the auto photographing mode screen of FIG. 15(a). When a display key 50 is pressed on this auto photographing mode screen, the state transitions to a photographing support screen depicted in FIG. 15(c) to (e).

[0139] This camera 10 is provided with a photographing support function called best framing display. This means that an index line (called the best framing frame 232) which serves as a guide for framing is displayed on the screen of the liquid crystal monitor 38 based on photographing goals, and the photographer can obtain a photograph having a good composition by adjusting the angle of view with reference to this best framing frame 232.

[0140] FIG. 15(c) depicts displaying of the appearance of a best framing frame 232 suitable for landscape photography. When a shift key 48 is pressed on this screen, the function of the cross key 44 is changed, and the up key 44U is assigned a function to select a pattern of the best framing frame, the down key 44D is assigned a self-timer setting function, the left key 44L is assigned a resize (change number of pixels) function, and the right key 44R is assigned a quality setting function. The upper/lower/left/right display parts 46U, 46D, 46L, 46R of the dot matrix liquid crystal display 46 are also switched to the prescribed mark display corresponding to these function assignments.

[0141] When the shift key 48 and the up key 44U are continuously pressed at the state in FIG. 15(c), the display is switched to the best framing frame 232 suitable for a group photograph as depicted in FIG. 15(d), and the function of the cross key 44 is the same as described in FIG. 15(a). When the shift key 48 is pressed on the screen of FIG. 15(d), the cross key 44 function is changed as described in FIG. 15(c), and operating the shift key 48 plus up key 44U causes a best framing frame 232 suitable for photographing a person as depicted in FIG. 15(e) to be displayed.

[0142] When the release button 30 is pressed (S1 ON) after setting the composition using a photographing support screen of any of FIGS. 15(c) to (e), the standby screen of FIG. 15(b) is displayed. Based on S1 ON at the photographing support screen, the best framing frame 232 is also displayed on the standby screen. When the release button 30 is "fully pressed" (S2 ON) at the standby screen (b), the recording operation is executed and the image is saved in the memory card 120.

[0143] Pressing the display key 50 while at any of the photographing support screens of FIG. 15(c) to (e) exits the photographing support function and returns to the auto photographing mode screen of FIG. 15(a).

[0144] Next, the playback mode will be described.

[0145] When the mode selecting lever 42 is set to "play back system mode", the camera 10 starts up with the display indicated in FIG. 16 instead of the dot matrix liquid crystal display 46 display content indicated in FIG. 6(b) or (c). In other words, a mode mark with a right-facing

triangular mark symbolizing that the dot matrix liquid crystal display 46 is in playback mode is displayed. Note that the backlight color of the dot matrix liquid crystal display 46 may be changed based on photographing system mode and the play back system mode.

[0146] When the camera 10 starts up in playback mode, the last image file (the last image photographed) in the memory card 120 is displayed for play back one frame. FIG. 17(a) depicts an example of a play back display when the last image file is a still image file. Mode information 236 indicating playback mode is displayed on the upper left of the screen of the liquid crystal monitor 38, and frame number and file name information 238 is displayed on the upper right of the screen. In addition, the date and time when photographed are also displayed at the bottom of the screen. In addition, on the right side of the screen, information on the accidental deletion prevention (image protection) setting or a mark indicating the presence or absence of print information may be displayed as additional information of the image file.

[0147] When one frame is played back, the up key 44U of the cross key 44 is assigned a command of zooming in, the down key 44D is assigned a command of zooming out, the left key 44L is assigned previous image, and the right key 44R is assigned next image functions. Accordingly, marks indicating the functions of the keys 44U, 44D, 44L and 44R are displayed on the upper/lower/left/right display parts 46U, 46D, 46L and 46R of the dot matrix liquid crystal display 46, respectively. In addition, a mode mark indicating playback mode is displayed on the central display part 46C.

[0148] Pressing of the up key 44U or down key 44D on the screen in FIG. 17(a), causes the playback screen to zoom-in or zoom-out. For example, when the up key 44U is pressed, zoom-in of the image is achieved as indicated in FIG. 17(b), and a zoom bar 208 is displayed on the left side of the screen. Also, at the bottom of the screen, the following instruction is displayed: "Zoom Move → [Shift] + [↑↓←→]."

[0149] When the shift key 48 is pressed on the screen in FIG. 17(b), display transitions to the shift guidance screen depicted in the FIG. 17(c), and the brightness of the liquid crystal monitor 38 can be adjusted based on the guidance described in FIG. 8. Note that while in shift guidance, the cross key 44 is disabled so the display parts 46U, 46D, 46L, and 46R are not displayed on the upper/lower/left/right of the dot matrix liquid crystal display 46. In both of the screens of FIGS. 17(b) and (c), pressing the cancel key 48 returns to the frame playback screen of FIG. 17(a).

[0150] By simultaneously pressing the shift key 48 and any of the up, down, left, and right keys (44U, 44D, 44L, or 44R) according to the operation guide indicated on the screen of FIG. 17(b), the display range can be moved while remaining in the zoom screen as depicted in FIG. 18(a). In this case, the upper/lower/left/right keys 44U, 44D, 44L, or 44R function as direction indicating keys for moving the display range and triangular marks indicating respective directions are displayed in the upper/lower/left/right display parts 46U, 46D, 46L, and 46R of the dot matrix liquid crystal display 46. A mark symbolizing that parallel movement of the screen is possible is displayed on the central display part 46C.

[0151] In addition, on the screen of the liquid crystal monitor 38, a triangular mark 240 indicating each movable direction, up, down, left, and right, is displayed, and a zoom bar 208 is displayed on the left side of the screen.

When the zoom move operation reaches the edge of the screen (for example, the left edge of the screen) and no further movement is possible, the display of the triangular mark indicating that direction disappears as depicted in FIG. 18(b), and the indication key in this direction disappears on the dot matrix liquid crystal display 46. This makes it easy to recognize the limits of screen movement.

[0152] Pressing cancel key 54 on the screen of FIG. 18(a) or (b), returns to the original size and reverts to the frame play back display of FIG. 17(a). Note that pressing a shift key 54 during the frame play back display of FIG. 17(a) causes transition to the shift guidance screen described in FIG. 8, and the brightness of the monitor can be adjusted.

[0153] FIG. 19 is a diagram depicting an example screen of a play back still image menu screen. When the menu/execute key 52 is pressed on the still image (one frame) playback screen of FIG. 17(a), the play back still image menu of FIG. 19(a) is displayed. There are six items on the menu: 'Delete', 'Auto-play', 'Resize', 'Protect', 'DPOF' and 'Map Play back', with a plurality of selections for each item.

[0154] A menu bar with icons 250 indicating these items arranged in a row is displayed at the bottom of the screen of the liquid crystal monitor 38, and a menu balloon 252 of the submenu is displayed when an item is selected with the left key 44L or the right key 44R. The display position of the menu balloon 252 is arranged so as to move according to the array order of icons 250 indicating menu items at the bottom of the screen. The items 'Delete' and 'Map Play back' are at the end of the menu movement and the menu does not cycle from 'Delete' to 'Map Play back' or 'Map Play back' to 'Delete'.

[0155] Menu items are selected using the left key 44L or the right key 44R, and the setting contents are selected from the submenus by the up key 44U or the down key 44D. After selecting the setting content using the up key 44U or down key 44D, the setting content can be confirmed by pressing the menu/execute key 52.

[0156] When the "Delete" menu is selected as shown in FIG. 19 (a), the left key 44L of the cross key 44 is disabled, and the left display part 46L of the dot matrix liquid crystal display 46 is not displayed. Similarly, when the "Map Display" menu is selected in FIG. 19(f), the right key 44R is disabled, and the right display part 46R of the dot matrix liquid crystal display 46 is not displayed. Note that the items of the menu may be cycled, and in this case, the left/right keys 44L, 44R are always enabled, and an

indication for this function is displayed on the dot matrix liquid crystal display 46.

[0157] The menu balloon 252 of "Delete" includes three submenus: "Format," "Delete All Frames," and "Delete One Frame." When a sub-menu item is selected with the up/down keys 44U, 44D and the menu/execute key 52 is pressed, a confirmation screen for the respective delete execution is displayed and pressing the menu/execute key 52 again at this confirmation screen causes execution of the process. Images with image protection applied are not deleted either with execution of delete one frame or delete all frames processing. In this case, disable the image protection and then execute one frame delete or all frame delete processing.

[0158] "Auto-play" is a mode for automatically playing back image files in the memory card 120 sequentially. However, in the case of a video file, the image of the first frame is played as a representative image. In the "Auto-play" item, you can set the wipe pattern for switching screens, and you can choose "No Wipe", "Wipe 1", "Wipe 2", or "Wipe 3". A prescribed wipe pattern is defined for each of wipe 1 to 3. The number of pixels can be changed using the "Resize" item, and one of "2400 -> 1280", "2400 -> 640", or "1280 -> 640" can be selected.

[0159] The submenu of "Protect" includes three selections: "Unprotect All Frames", "Protect All Frames", and "Set One Frame". When a desired item is selected with the up/down keys 44U, 44D and the menu/execute key 52 is pressed, a confirmation screen for the respective protective process execution is displayed and pressing the menu/execute key 52 again at this confirmation screen causes execution of the protect process.

[0160] The submenu of "DPOF" includes the selections of "Select/Unselect All frames", "Select One frame", and "With a Date". The DPOF (Digital Print Order Format) standard describes instructions (print information) for when printing regarding print content such as the number of prints and cropping for each image recorded on the memory card 120 or other storage medium using predetermined parameters and formats. This is recorded on the storage medium as a print order file. By preparing a print order file in advance with a digital camera or PC and recording the file on a storage medium, the need to specify print details when ordering from a laboratory order or printing with a printing device can be eliminated. In "Map Play back", a desired map data can be selected from a plurality of sets of map data and the map for this selection is displayed on the liquid crystal monitor 38.

[0161] Next, the video play back is described. When the camera 10 is started in the playback mode, if the last image file of the memory card 120 is a video file, the movie play back standby screen as depicted in FIG. 20 (a) is displayed.

[0162] In the movie play back standby screen, an image of the first frame of the video file is displayed, a movie mode mark 260 is displayed at the upper left of the screen, and an operation display mark 262 is displayed at the bottom of the screen. The operation display marks 262 are arranged from the left to the right in the order of frame rewind, rewind, reverse play back, stop, pause, play back, fast forward, and frame forward, and the color of the motion status indication mark changes according to the operation of the cross key 44 to indicate the status.

[0163] With the cross key 44, the up key 44U functions as stop, the down key 44D functions as play back/pause, the left key 44L functions as frame rewind, and the right key 44R functions as frame forward operation keys. Marks indicating the functions of each key are displayed on upper/lower/left/right display parts 46U, 46D, 46L and 46R of the dot matrix liquid crystal display 46, and a movie mode mark is displayed on the central display part 46C.

[0164] Play back processing starts when the down key 44D is pressed on the movie play back standby screen of FIG. 20(a). As depicted in FIG. 20B, while the play back data is being read from the memory card 120, the screen of the liquid crystal monitor 38 is temporarily darkened and an hourglass mark 264 is displayed in the center.

[0165] When reading is complete, the video file is played back, as shown in FIG. 20(c). During play back, the color of a play back mark 266 of an operation display mark 262 changes, and a time bar 268 indicating the play back progress of the file is displayed at the bottom of the screen. During playback of a video file, a triangular mark indicating that the video is being played is displayed in the central display part 46C of the dot matrix liquid crystal display 46. During playback of a video, the up key 44U is assigned the stop function, the down key 44D the play/pause function, the left key 44L the rewind function, and the right key 44R the fast forward function, and marks indicating the functions of each key are displayed on the upper/lower/left/right display parts 46U, 46D, 46L, and 46R of the dot matrix liquid crystal display 46.

[0166] When the up key 44U (stop key) is pressed during playback of the video depicted in FIG. 20C, the play back process stops and returns to the first frame. You can play a video repeatedly from the beginning during video playback.

[0167] When the down key 44D is pressed during playback of the video depicted in FIG. 20(c), the movie play back is paused as depicted in FIG. 21(a). At this time, the color of the temporary pause mark 270 of the operation display mark 262 at the bottom of the screen of the liquid crystal monitor 38 changes, and a temporary pause mark is also displayed in the central display part 46C of the dot matrix liquid crystal display 46. While temporarily paused, the left key 44L of the cross key 44 functions as a frame rewind key, and the right key 44R functions as a frame advance key, and prescribed marks are displayed on the left and right display parts 46L and 46R of the dot matrix liquid crystal display 46, respectively.

[0168] When the shift key 48 is pressed while on this pause screen, the orientation of the triangular icon of the play

back mark is reversed in the lower display part 46D of the dot matrix liquid crystal display 46, as depicted in FIG. 21(b), and a play backwards key function is assigned to the down key 44D. Since the left key 44L and the right key 44R are disabled, the left/right display parts 46L, 46R of the dot matrix liquid crystal display 46 do not display anything.

[0169] When the down key 44D is pressed in the state depicted in FIG. 21(b), play backwards starts from the paused state. As depicted in FIG. 21(c), during play backwards, the color of a play backwards mark 272 of the operation display mark 262 changes, and a triangular mark (play backwards mark) indicating that play backwards is in progress is also displayed in the central display part 46C of the dot matrix liquid crystal display 46. In addition, during play backwards, the left key 44L of the cross key 44 functions as a rewind operation key, and the right key 44R functions as a fast forward operation key, and marks indicating these functions are displayed in the left/right display parts 46L, 46R of the dot matrix liquid crystal display 46.

[0170] When the shift key 48 is pressed during video play back in FIG. 20(c) to open shift guidance, the movie play back is temporarily stopped. In addition, when the shift key 48 is pressed on the movie play back standby screen of FIG. 20(a), the shift guidance screen appears, and as described with reference to FIG. 8, the brightness of the monitor can be adjusted.

[0171] FIG. 22 is a diagram depicting the operating procedure of the video play back menu.

[0172] When the menu/execute key 52 is pressed during movie play back standby as described using FIG. 20(a), the video play back menu screen depicted in FIG. 22(a) appears. The video play back menu includes three items: "Delete", "Index", and "Protect." A menu bar with icons 280 indicating these items arranged in a row is displayed at the bottom of the screen of the liquid crystal monitor 38, and a menu balloon 282 of the submenu is displayed when an item is selected with the left key 44L or the right key 44R. The display positions of the menu balloon 282 move in accordance with the arrangement order of the icons 280. "Delete" and "Protect" are the end points of motion and there is no cycling from "Delete" to "Protect" or from "Protect" to "Delete."

[0173] Therefore, while on "delete", the left key 44L is disabled and nothing is displayed at the left display part 46L of the dot matrix liquid crystal display 46 (FIG. 22(a)). Similarly, while on "protect", the right key 44R is disabled and nothing is displayed at the right display part 46R (FIG. 22(c)). Note that the items of the menu may be cycled, and in this case, the left/right keys 44L, 44R are always enabled, and a function indication for this is displayed on the dot matrix liquid crystal display 46.

[0174] The "Delete" and "Protect" selection operations are as described in FIG. 19. As depicted in FIG. 22(b), when the "Create Index" menu is selected, a submenu is displayed asking whether or not to create an index.

[0175] When "Execute" is selected by using the up key 44U or down key 44D of the cross key 44 and the menu/execute key 52 is pressed, an index image (called a video index) as depicted in FIG. 23(a) is displayed. This index image is produced by extracting representative frames at appropriate time intervals from the frame images in the video file, and displaying them on the liquid crystal monitor 38 as reduced images of 25 frames in a 5×5 matrix. [0176] The display format of the video index is not limited to a 5x5 25-screen multi-display, but may be a 4x4 16-screen multi-display, a 3x3 9-screen multi-display, or the like.

[0177] As a method for extracting frames for an index image from a video file, for example, a frame extraction ratio or thinning ratio is calculated based on the relationship between the total number of frames in the video file and the number of reduced images to be arranged in the index image (25 in this case), so that one frame is extracted or thinned out at approximately equal intervals of frames.

[0178] When the minimum recording time for a video is three seconds and 10 frame images per second of video are recorded, 30 frames of the screen are captured in three seconds. To reduce this to 25 frames and output them as an index image, 5 frames need to be removed, so in this example, frames are thinned out at a rate of 1 in 5 frames.

[0179] In addition, if a video file contains 100 frames of images, for example, in order to reduce this to 25 frames and output the frames as an index image, the number of frames needs to be reduced to 1/4, so the frames to be displayed are extracted in accordance with this ratio. When the number of frames in the video file is a number other than a multiple of 25, extraction and thinning are appropriately combined to extract frames evenly from the entire video file to create an index image. This allows the user to easily grasp the contents of the entire video file simply by viewing the index image.

[0180] When creating an index image, text information 286 indicating "Index Created" is displayed in the upper left of the screen of the liquid crystal monitor 38, and a message "OK?" asking whether or not to save the index is displayed in the center of the screen. In addition, a file number 288 is displayed in the upper right corner of the screen, and operation guides such as "Save → [execute]" and "Return → [Cancel]" are displayed at the bottom of the screen. On the index creation screen depicted in FIG. 23(a), the cross key 44 is disabled, and only the movie mode mark is displayed in the central display part 46C of the dot matrix liquid crystal display 46, with the upper/lower/left/right display parts 46U, 46D, 46L, 46R all remaining blank.

[0181] When the menu/execute key 52 is pressed on the create index screen (FIG. 23(a)), the index image is stored as a still image file in the memory card 120, and the screen transitions to the play back still image menu screen depicted in FIG. 23(b). In other words, mode information

290 indicating that the mode is "playback mode" is displayed at the top left of the screen of liquid crystal monitor 38, and a menu bar is displayed at the bottom of the screen on which icons 250 indicating the menu items "Delete", "Auto-play", "Resize", "Protect", "DPOF", and "Map Play back" are arranged. In addition, a triangular mark is displayed indicating that a play back still image is being displayed in the central display part 46C of the dot matrix liquid crystal display 46, and directional marks indicating each function of the cross key 44 are displayed in each of the upper/lower/left/right display parts 46U, 46D, 46L, 46R.

[0182] When any of the up, down, left, and right keys 44U, 44D, 44L and 44R is pressed on the screen of FIG. 23(b), a menu balloon 292 is displayed as depicted in FIG. 23(c). The menu operations thereafter are as described with reference to FIG. 19. In addition, when the desired frame is selected on the index image screen of FIG. 23(b) and the menu/execute key 52 is pressed, video play back is started from the selected frame. Furthermore, on the screen of FIG. 23(b), the display screen can be enlarged/reduced and the display range can be moved by the same operating procedure as that described for FIG. 18.

[0183] Link information for specifying the original image file of the reduced image in the index image is added to the image file of the index image. This link information may be information about the folder and file name in which the original image file is stored, or the information may be frame number information or offset information that associates the display position of the reduced image on the index image display screen to the frame position in the video file.

[0184] Such link information is recorded as tag information in, for example, the Exif file format or the AVI file format.

[0185] By using the link information described above, when the position of a desired reduced image is designated on the display screen of the index image, video play back can be started from the screen in the video file corresponding to the designated position. Moreover, when a desired reduced image is selected from the index image by pressing the upper/lower/left/right keys 44U, 44D, 44L, 44R while pressing the shift key 48, a screen related to the selection is read from the video file, and the screen is played back one frame at a time.

[0186] When an index image is saved on memory card 120, link information for identifying the video file that was the basis for creating the index image is added to the index image file, and link information for identifying the index image file is automatically added to the base video file. By using this link information, it is possible to read the corresponding video file from the index image playback screen and execute video play back, and the index image file can also be immediately opened from the video file. In addition, it is possible to only play back audio of the video while displaying the index image.

[0187] In this example, an index image for a video file is created and recorded when the user performs a prescribed operation, but it is also possible to automatically create an index image when a video file is recorded while capturing video which is recorded as a still image file on memory card 120.

[0188] Next, some convenient functions in the playback mode will be described.

[0189] FIG. 24 depicts the state of fast forward during still image playback. When the normal single frame playback screen depicted in FIG. 24A is displayed, the left and right keys 44L and 44R of the cross key 44 function as a frame forward key and a frame back key, respectively. On this single frame playback screen, pressing the left key 44L or the right key 44R for a prescribed period of time or longer (for example, pressing for 0.7 seconds) causes a transition to a fast forward mode.

[0190] When the fast forward mode is entered, as depicted in FIG. 24(b), three reduced images (thumbnails) are depicted in picture-in-picture format at the bottom of the screen of the liquid crystal monitor 38, and a play back bar 296 indicating the play back status is displayed above this thumbnail display part 294. While the left key 44L or the right key 44R is being pressed, the thumbnails are automatically displayed in the order of file numbers, and each thumbnail is exhibited in turn while moving from left to right in the thumbnail display part 294. The thumbnails move one frame at a time every prescribed amount of time (for example, 0.2 seconds).

[0191] The background of the screen stops at the single frame image reproduced when the fast forward mode is entered, and fast forward image confirmation can be performed using display on the thumbnail display part 294. In the case of a video file, a reduced image of the first frame is displayed as a representative image. Note that the screen size of a video is 640×480 and is smaller than the screen size of a normal still image file (for example, 1280×960), and reflecting this, the size of the reduced image is also small. The reduced image indicated by reference numeral 298 in FIG. 24(b) is a representative image of the video file.

[0192] When the desired image reaches the center of the thumbnail display part 294 and the left key 44L or the right key 44R is released for a prescribed amount of time (for example, 0.7 seconds), the mode switches to playback mode of this center image. For example, when the left key 44L or the right key 44R is released in the state of FIG. 24(b), the video file represented by the reference symbol 298 is selected, and the video file can be played back in full size, as depicted in FIG. 24(c). The procedure for reproducing the video is as described with reference to FIG. 20 to FIG. 24. If the left key 44L or the right key 44R is released and a prescribed time (for example, 0.7 seconds) has not elapsed, the left key 44L or the right key 44R can be pressed again to advance or rewind the thumbnails by one frame. In this example, three thumbnails are displayed and one thumbnail is moved from left to right (or from right to left in the case of rewinding), which has the

advantage that a desired image can be easily found during fast forwarding.

[0193] The thumbnail display part 294 may be formed at the bottom of the screen of the liquid crystal monitor 38 as in FIG. 24(b), or may be formed vertically on the left or right side of the screen so that fast forwarding of the thumbnails is performed by moving from top to bottom or bottom to top. The number of thumbnails displayed in the thumbnail display part 294 is not limited to three, and any appropriate number of two or more may be displayed.

[0194] FIG. 25 depicts the state of fast forward during still movie playback.

[0195] During movie play back standby depicted in FIG. 25(a), pressing the left key 44L or the right key 44R for a long period of time switches to fast-forward mode. As described in FIG. 24, in fast forward mode, thumbnails of three images are displayed at the bottom of the screen of the liquid crystal monitor 38 (FIG. 25(b)), and a play back bar 296 is displayed above the thumbnail display part 294.

[0196] While the left key 44L or the right key 44R is being pressed, the thumbnails are automatically displayed in order of file number from left to right on the thumbnail screen. When the desired image reaches the center of the thumbnail display part 294 and the left key 44L or the right key 44R is released for a prescribed amount of time (for example, 0.7 seconds), the mode switches to playback mode of this center image. For example, when the left key 44L or the right key 44R is released in the state depicted in FIG. 25(b), the still image file corresponding to the thumbnail indicated by the reference numeral 302 is selected, and the still image file is played back at full size, as depicted in FIG. 25(c).

[0197] FIG. 26 depicts the operating procedure when displaying thumbnails. When a display key 50 is pressed twice in succession (double-clicked) during single frame play back or movie play back standby in playback mode, a list of thumbnails is displayed on the liquid crystal monitor 38, as depicted in FIG. 26(a). This displays a list of image files in the memory card 120 as thumbnails, which are displayed on a 9-screen multi-display in which the monitor screen is divided into 9 parts (3×3). In the case of a video file, a reduced image of the first frame is displayed as a representative image.

[0198] When there are a large number of image files and all the thumbnails cannot be displayed on one screen, they are separated into a plurality of pages and displayed. When changing pages, the shift key 48 plus the left/right keys 44L and 44R are used to move forward or backward through the pages.

[0199] When the shift key 48 is pressed on the thumbnail list display screen of FIG. 26(a), the shift guidance screen depicted in FIG. 26(b) is displayed. This shift guidance screen displays operating guidance for setting the monitor brightness and operating guidance for moving between pages. Here, the left/right keys 44L and 44R of the cross key 44 function as input keys for page moving instructions, and the left/right display parts 46L and 46R of the dot matrix liquid crystal display 46 display a mark indicating the page moving function.

[0200] By pressing the shift key 48 + display key 50 according to the guidance indicated on the liquid crystal monitor 38, the display will transition to the monitor brightness setting screen as depicted in FIG. 26(c), where the monitor brightness can be adjusted by performing the prescribed operations according to the procedure described in FIG. 8.

[0201] Moving pages can be performed from the shift guidance screen of FIG. 26(b) using the shift key 48 and the left/right keys 44L and 44R. For example, the shift key 48 + right key 44R can be used to specify page forwarding as depicted in FIG. 27(a), and the shift key 48 + left key 44L can be used to specify page rewind (FIG. 27(b)). When the page of the thumbnail list display is changed, the central display part 46C of the dot matrix liquid crystal display 46 may be blank or may display a prescribed mark. [0202] Next, display variations in the dot matrix liquid crystal display 46 will be described.

[0203] When setup mode is selected with the mode dial 32, a mark (characters) indicating that the mode is in setup mode is displayed in the central display part 46C of the dot matrix liquid crystal 40 [sic], as depicted in FIG. 28(a). At this time, the cross key 44 functions as upper/lower/left/right cursor keys for selecting items and settings in the setup menu and triangular marks indicating the up/down/left/right direction instruction functions are displayed in the upper/lower/left/right display parts 46U, 46D, 46L, and 46R of the dot matrix liquid crystal display 40, respectively. Furthermore, if the up/down keys 44U and 44D of the cross key 44 become disabled depending on the circumstances, the upper/lower display parts 46U, 46D will blink as indicated in FIG. 28(b).

[0204] If the continuous photographing mode is selected with the mode dial 32 when the camera 10 is turned on, a display including a mode mark 302 indicating that the continuous shooting mode is selected is displayed as depicted in FIG. 29(a). When the camera is ready to capture pictures in continuous photographing mode, the display changes to that depicted in FIG. 29(b). In the continuous photographing mode, flash photography is prohibited, so the right key 44R of the cross key 44 is disabled, and nothing is displayed on the right display part 46 of the dot matrix liquid crystal display 46. The left key 44L is assigned the function of a macro setting key, and the left display part 46L displays a mark indicating the macro function and the setting status thereof. Since the up key 44U functions as a telephoto operation key for optical zoom and the down key 44D functions as a wide-angle operation key, marks indicating each function are displayed on the upper/lower display parts 46U and 46D of the dot matrix liquid crystal display 46.

[0205] FIG. 29(b) depicts a state in which the macro mode is set to OFF. When the left key 44L is pressed in this state, the camera 10 is set to macro mode, and the display changes to that shown in FIG. 29(c). By setting the macro

mode to ON, the AF scan range is shifted closer, enabling highly accurate focusing on a subject at close range.

[0206] If portrait photographing mode is selected using the mode dial 32 when the camera 10 is turned ON, a display including a mode mark 304 indicating that the portrait mode is selected is displayed as depicted in FIG. 30(a). When the camera is ready to capture pictures in portrait photographing mode, the display changes to that depicted in FIG. 30(b). In portrait photographing mode, the macro mode setting is prohibited, so the left key 44L of the cross key 44 becomes a disabled key, and nothing is displayed on the left display part 46 [sic] of the dot matrix liquid crystal display 46. The right key 44R is assigned the function of the strobe setting key, and the right display part 46R displays a mark indicating the strobe setting function and the setting status thereof.

[0207] FIG. 30(b) depicts a state in which the strobe setting is set to "auto mode". In this state, pressing the right key 44R allows the strobe mode to be switched. As depicted in FIG. 31, each time the right key 44R is pressed from the "auto mode" state (a), the mode is switched in a cyclic manner in the following order: "auto mode" (a) -> "red-eye reduction mode" (b) -> "forced flash mode" (c) -> "flash prohibition" (d) -> "auto mode" (a). In response to switching the strobe mode, the display content of the right display part 46R of the dot matrix liquid crystal display 46 is switched, and a mark indicating the setting state of the strobe mode is displayed (see FIG. 31).

[0208] If scenery mode is selected using the mode dial 32 when the camera 10 is turned ON, a display including a mode mark 306 indicating that the scenery photographing mode is selected is displayed as depicted in FIG. 32(a). When the camera is ready to photograph in scenery photographing mode, the display changes to the display depicted in FIG. 32(b). In scenery photographing mode, the macro mode setting is prohibited, so the left key 44L of the cross key becomes a disabled key, and nothing is displayed on the left display part 46L of the dot matrix liquid crystal display 46. The right key 44R is assigned the function of the strobe setting key, and the right display part 46R displays a mark indicating the strobe setting function and the setting status thereof.

[0209] If scenery photographing mode is selected using the mode dial 32 when the camera 10 is turned ON, a display including a mode mark 306 indicating that the scenery photographing mode is selected is displayed as depicted in FIG. 33(a). When the camera is ready to photograph in scenery photographing mode, the display changes to the display depicted in FIG. 33(b). In scenery photographing mode, the macro mode setting is prohibited, so the left key 44L of the cross key becomes a disabled key, and nothing is displayed on the left display part 46L of the dot matrix liquid crystal display 46. The right key 44R is assigned the function of the strobe setting key, and the right display part 46R displays a mark indicating the strobe setting function and the setting status thereof.

[0210] Next, a modification of the aforementioned embodiment of the present invention will be described.

[0211] FIG. 34 is an explanatory diagram depicting how a playback range is specified from the video index screen. According to the figure, the video index screen is a 4×4, 16-screen multi-display, in which 16 frames of images extracted from the video file are arranged according to a prescribed screen extraction rule.

[0212] The user can specify the image range to be played back on the video index screen. For example, the user designates the image of the seventh frame designated by reference numeral 340, as the playback start frame (first frame), and designates the fifteenth frame image designated by reference numeral 342 as the playback end frame.

[0213] When playing back a video, playback starts from the image of the specified first frame, based on the information of the specified frame. Furthermore, playback is performed in sequence and the video playback ends at the designated playback end frame.

[0214] It is also possible to specify only the playback start frame, in which case play back will proceed from the specified first frame to the final frame of the file. Alternatively, an embodiment is possible in which play back is executed from the playback start frame for a prescribed number of frames (prescribed play back time) until play back is stopped.

[0215] Furthermore, when a playback range is specified within a video file as depicted in FIG. 34, the image of the specified first frame (seventh frame image in the specified example of FIG. 34) is displayed as a representative image of the corresponding video file on an index screen for file selection (corresponding to the thumbnail list display screen described in FIG. 26), as depicted by reference numeral 344 in FIG. 35. Similarly, the image of the first frame of the specified playback range is displayed in the normal single frame playback screen, instead of the image of the first frame of the video file. Note that in FIG. 35, "still" indicates a thumbnail image of a still image file, and "video" indicates a thumbnail image of a video file.

[0216] In this manner, the representative image of the video file on the thumbnail list display screen or the normal single-frame playback screen can be changed based on user operations, so that the contents of the video file can be grasped even more easily. Of course, it is also possible to set the image at the beginning of a video file as the representative image, and it is also possible to restore the representative image, once changed, to the image at the beginning of the video file. Furthermore, the configuration may be such that the user can select either a mode in which the representative image is changed or a mode in which the representative image is not changed.

[0217] In the above embodiment, an external storage medium (removable media) that can be attached to and detached from the camera body is used as the storage medium. However, it is also possible to configure the storage medium to be an internal memory (or an internal hard disk) built into the camera. In this case, the image data

stored in the internal memory is output to the outside via wired or wireless communication means (interface).

[0218] The above description was provided as an example of applying the present invention to a digital camera, but the scope of application of the present invention is not limited to this and the present invention can be applied to a variety of image information processing devices, such as image management systems using personal computers, image search devices, or video cameras and video tape playback devices that use magnetic tape as a storage medium. [0219] In addition, in the above embodiment, an example was described in which a video file was treated as a series of consecutive images. However, in cases where a series of still images captured by continuous photographing or interval photographing are recorded and saved together in a single folder, the images in the folder correspond to consecutive images and can be handled in the same manner as the video file described above.

[0220]

EFFECT OF THE INVENTION

As described above, the image management method, device, and electronic camera of the present invention extract an appropriate number of frames from consecutive images, and create an index image in which reduced images of the plurality of frames are arranged on a single screen, which is then recorded on a recording device, so that the user can easily grasp the overall content of the series of images (consecutive images) by looking at the index image. [0221] Furthermore, by recording link information for specifying the original image of the reduced image included in the index image in association with the index image, the playback start frame of consecutive images can be designated from the display screen of the index image, and reproduction of one frame in the consecutive images can be designated.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front view of a digital camera using the present invention.

FIG. 2 is a plan view of the camera depicted in FIG. 1.

FIG. 3 is a rear view of the camera depicted in FIG. 1.

FIG. 4 is an enlarged view of the mode dial.

FIG. 5 is a block diagram depicting the configuration of a digital camera according to the present embodiment.

FIG. 6 is an explanatory diagram depicting the operating procedure of the camera in video photographing mode.

FIG. 7 is an explanatory diagram depicting the operating procedure of the camera in video photographing mode.

FIG. 8 is an explanatory diagram depicting the operating procedure of the camera in video photographing mode.

FIG. 9 is an explanatory diagram depicting the operating procedure of the camera in video photographing mode.

FIG. 10 is a diagram depicting an example of a dot matrix liquid crystal display at the time of start-up in manual photographing mode.

FIG. 11 is an explanatory diagram depicting the operating procedure of the camera in manual photographing mode.

FIG. 12 is an explanatory diagram depicting the operating procedure of the camera in manual photographing mode.

FIG. 13 is an explanatory diagram depicting the operating procedure of the camera in manual photographing mode.

FIG. 14 is a diagram depicting an example of a dot matrix liquid crystal display at the time of start-up in auto photographing mode.

FIG. 15 is an explanatory diagram depicting the operating procedure of the camera in auto photographing mode.

FIG. 16 is a diagram depicting an example of a dot matrix liquid crystal display at the time of start-up in playback mode.

FIG. 17 is an explanatory diagram depicting the procedure for playing a still image file.

FIG. 18 is an explanatory diagram depicting the procedure for playing a still image file.

FIG. 19 is an explanatory diagram depicting how a play back still image menu is changed.

FIG. 20 is an explanatory diagram depicting the procedure for playing a video file.

FIG. 21 is an explanatory diagram depicting the procedure for playing a video file.

FIG. 22 is an explanatory diagram depicting how a video play back menu is changed.

FIG. 23 is an explanatory diagram depicting a procedure for creating an index image of a video file.

FIG. 24 is an explanatory diagram of fast-forward mode in a playback mode.

FIG. 25 is an explanatory diagram of fast-forward mode in a playback mode.

FIG. 26 is an explanatory diagram depicting an example of a thumbnail list display.

FIG. 27 is an explanatory diagram depicting a method for switching pages during thumbnail list display.

FIG. 28 is a diagram depicting a display example of a dot matrix liquid crystal in setup mode.

FIG. 29 is a diagram depicting a display example of a dot matrix liquid crystal in continuous photographing mode.

FIG. 30 is a diagram depicting a display example on a dot matrix liquid crystal in portrait photographing mode.

FIG. 31 is an explanatory diagram depicting how strobe mode display is switched.

FIG. 32 is a diagram depicting a display example on a dot matrix liquid crystal in scenery photographing mode.

FIG. 33 is a diagram depicting a display example on a dot matrix liquid crystal in night photographing mode.

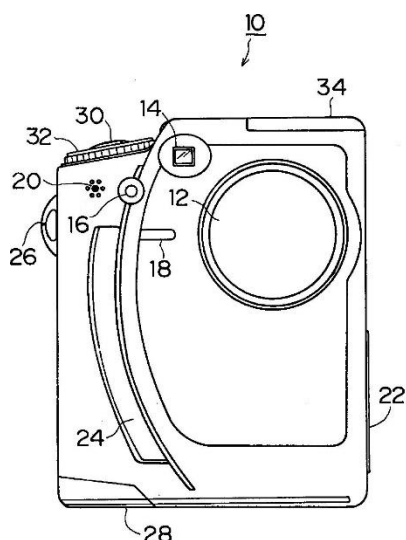
FIG. 34 is an explanatory diagram depicting how a playback range is specified from the video index screen.

FIG. 35 is an explanatory diagram depicting how a representative image of a video file is changed on the thumbnail list display screen.

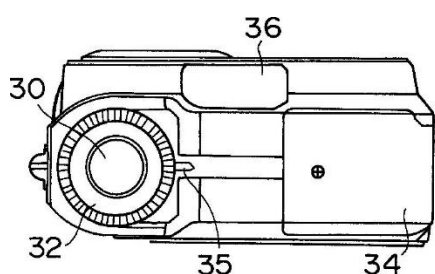
DESCRIPTION OF REFERENTIAL NUMERALS AND CODES

10. Camera (electronic camera), 30. Release button, 32. Mode dial, 38. Liquid crystal monitor, 42. Mode selecting lever, 44. Cross key (instructing means), 46. Dot matrix liquid crystal, 50. Display key (instructing means), 66. CCD (photographing element, image inputting means), 74. Signal processing IC (signal processing means), 118. Card interface (recording device, recording means, image inputting means, media reading means), 120. Memory card (storage medium), 132. CPU block, 150. CPU core (screen extracting means, index creating means), 340. Playback start frame (playback start image), 340. Playback end frame (playback end image)

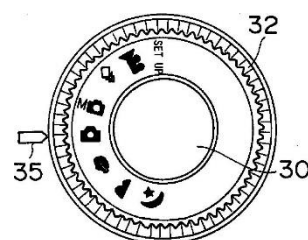
[FIG. 1]



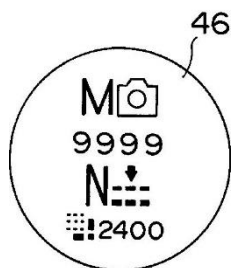
[FIG. 2]



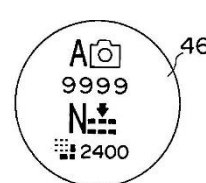
[FIG. 4]



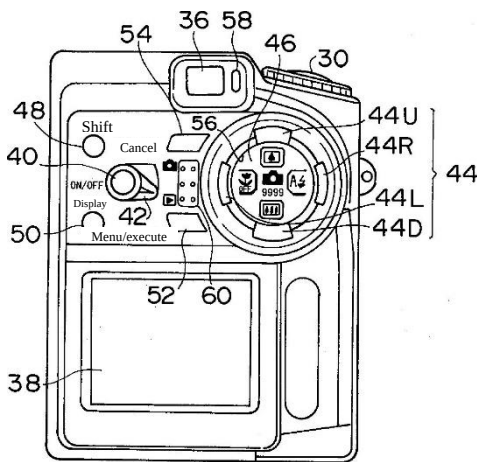
[FIG. 10]



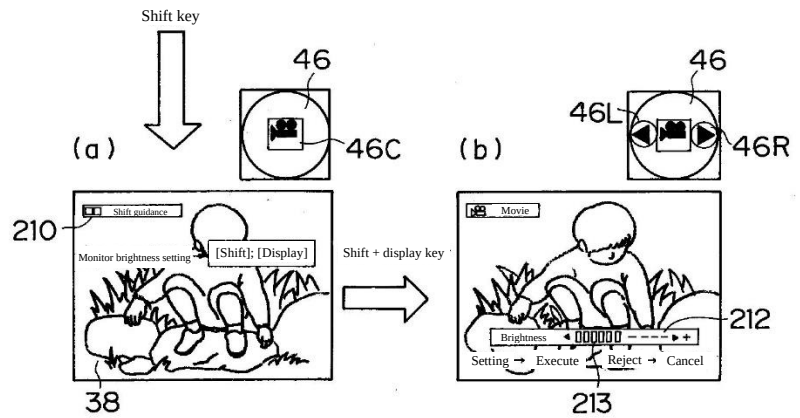
[FIG. 14]



[FIG. 3]

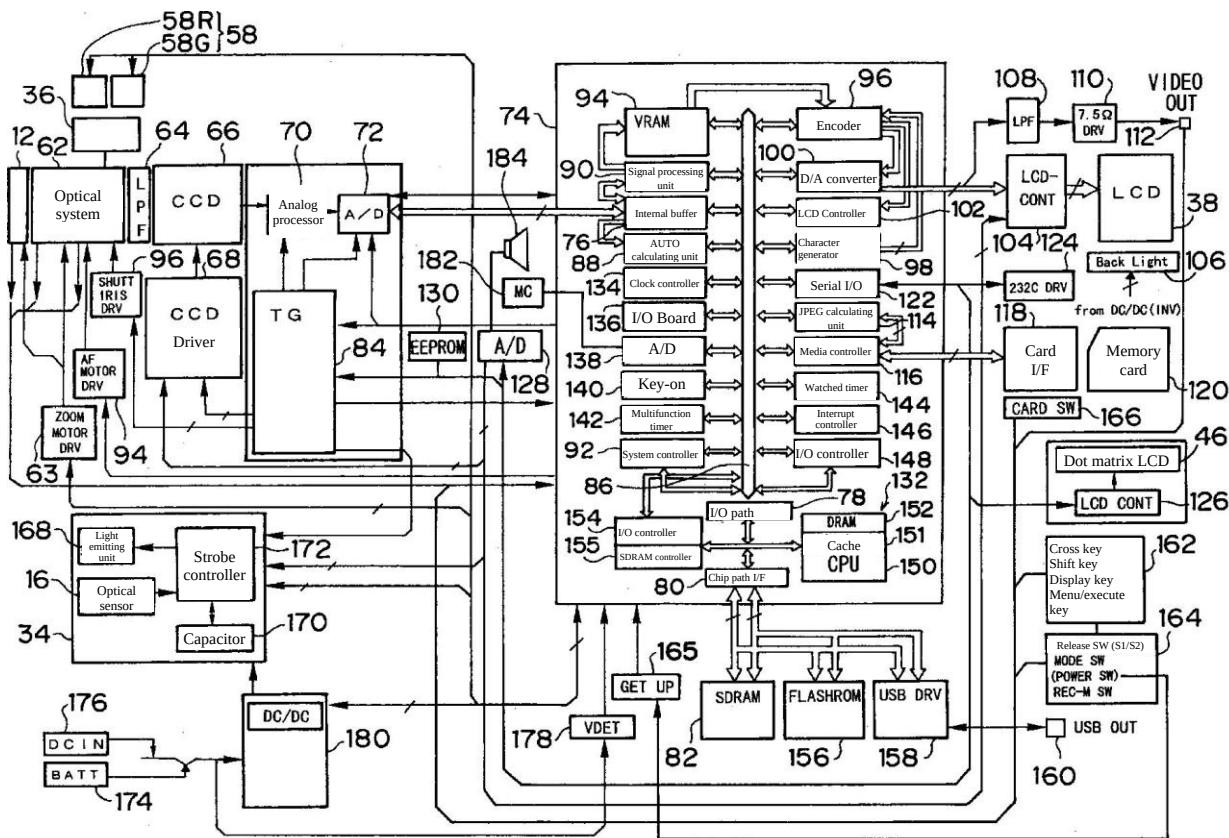


[FIG. 8]



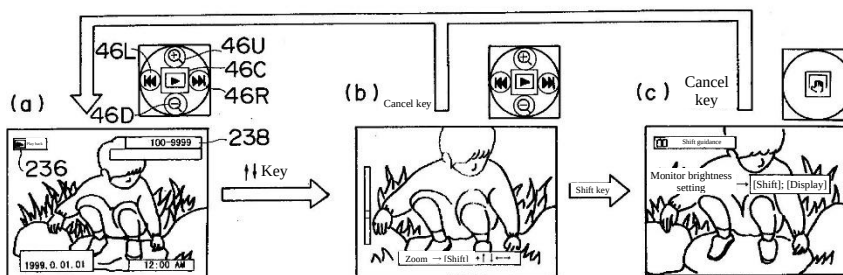
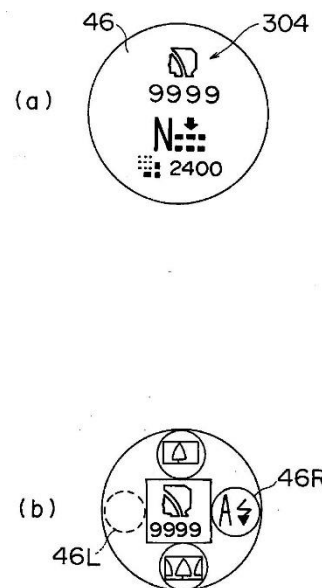
[FIG. 5]

[FIG. 16]

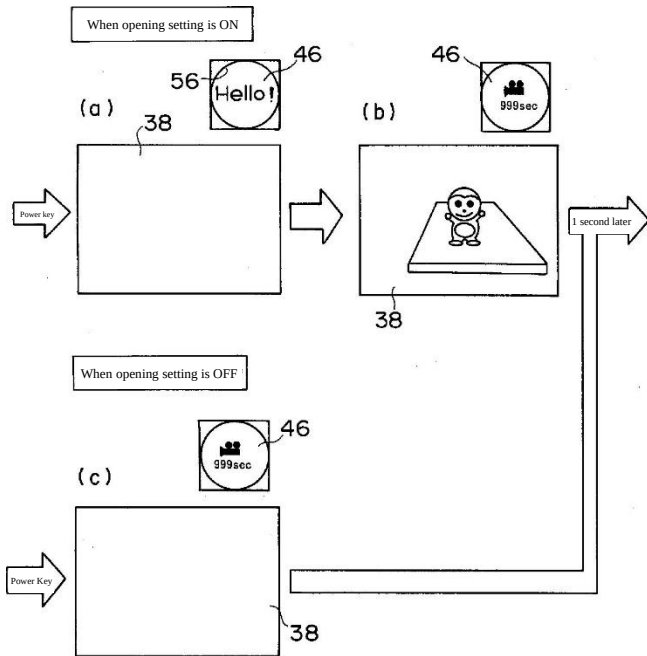


[FIG. 17]

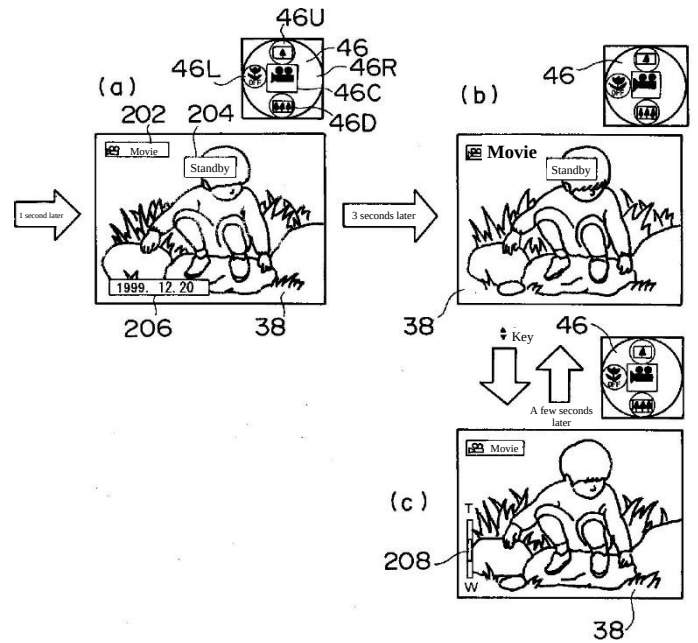
[FIG. 30]



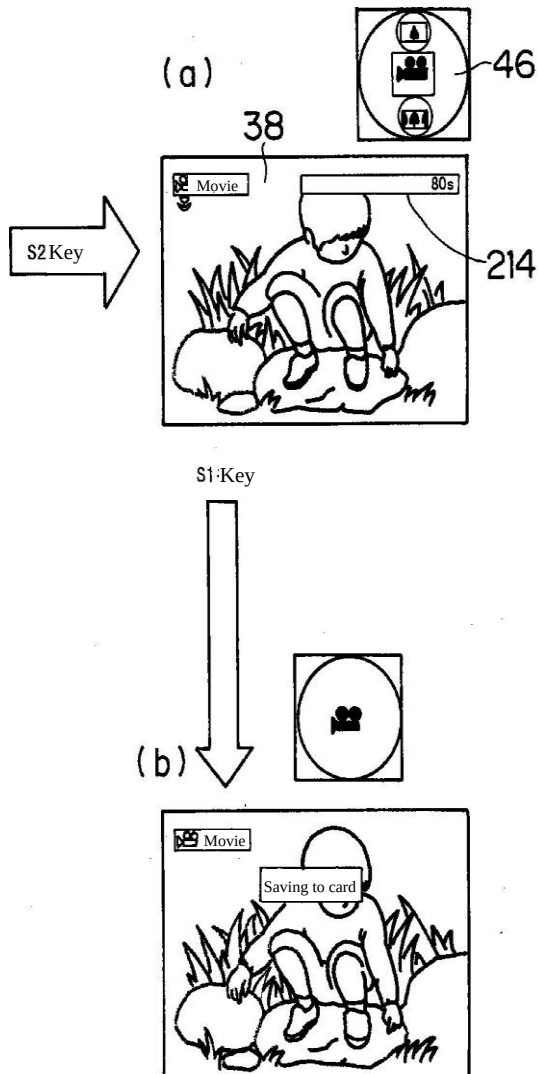
[FIG. 6]



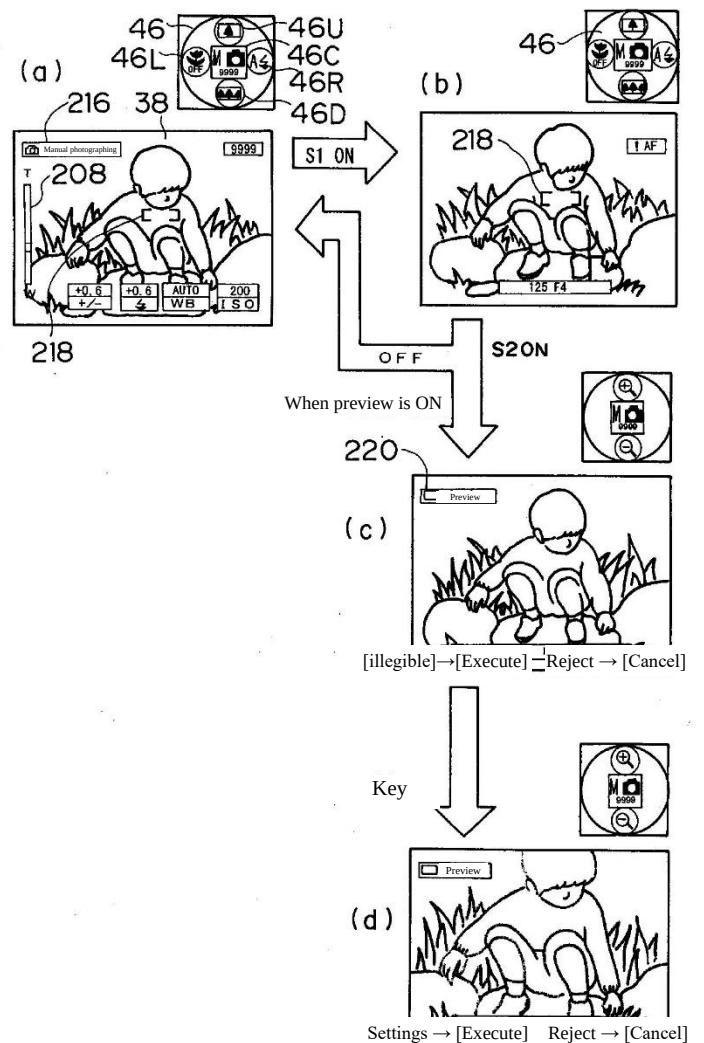
[FIG. 7]



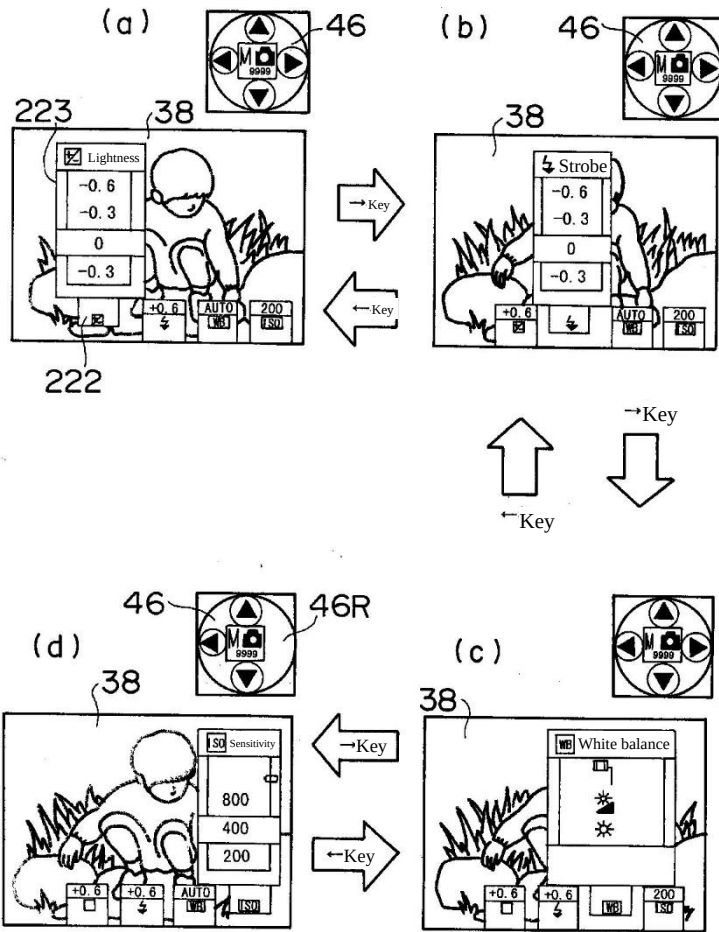
[FIG. 9]



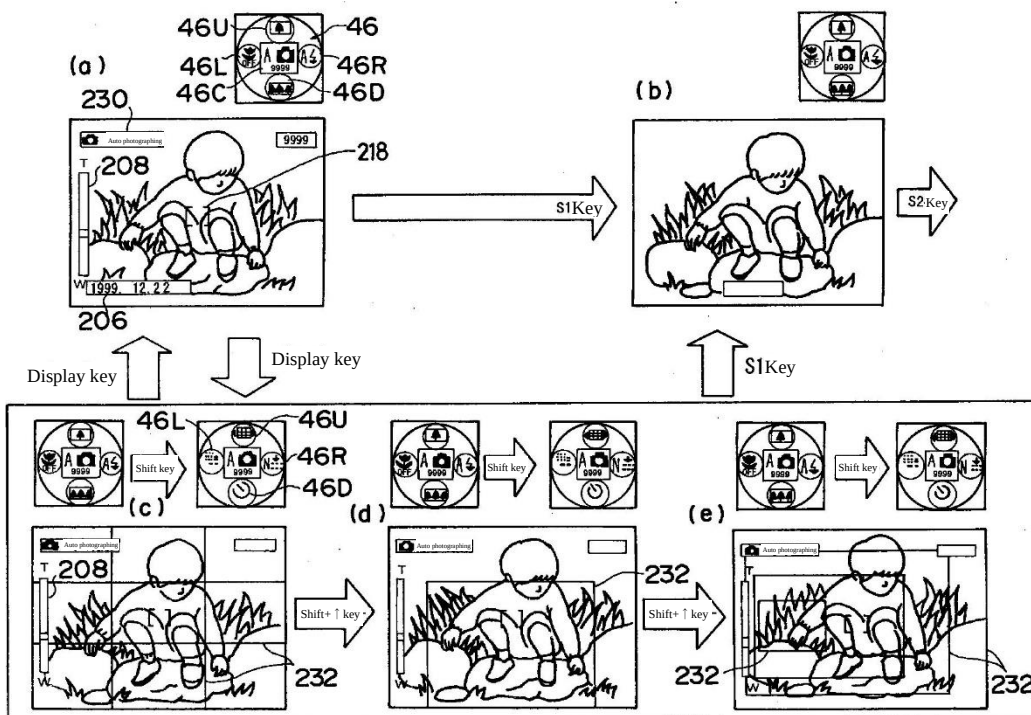
[FIG. 11]



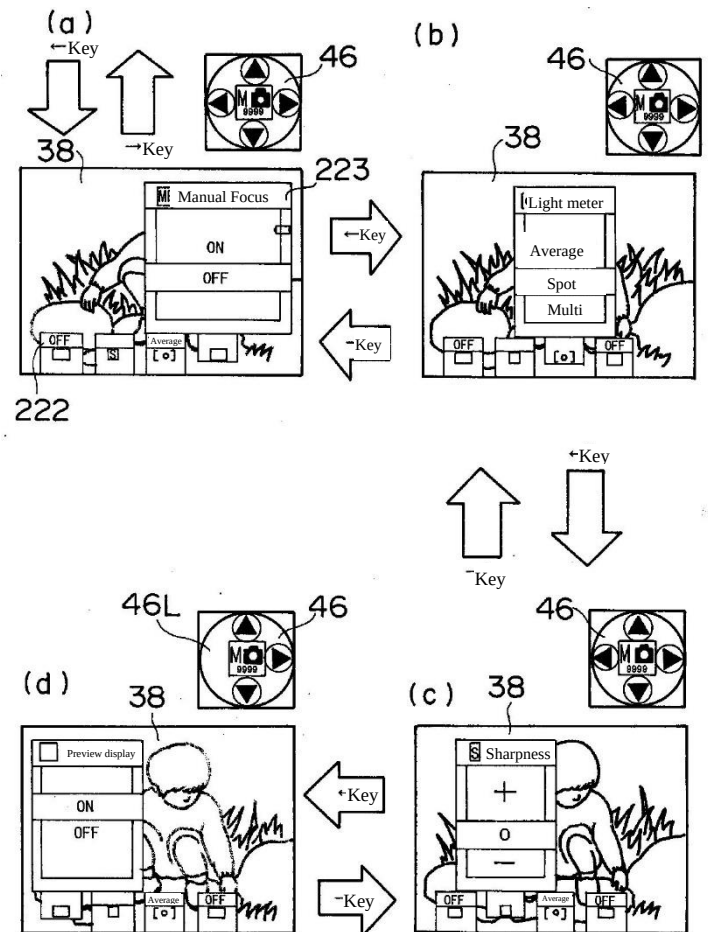
[FIG. 12]



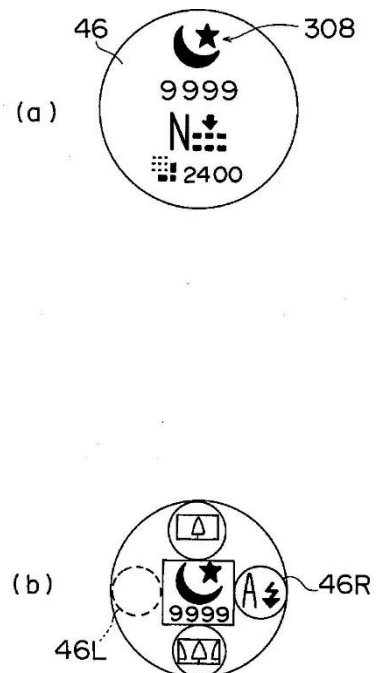
[FIG. 15]



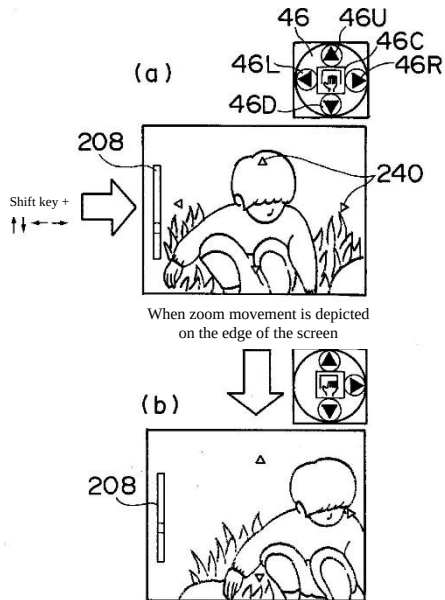
[FIG. 13]



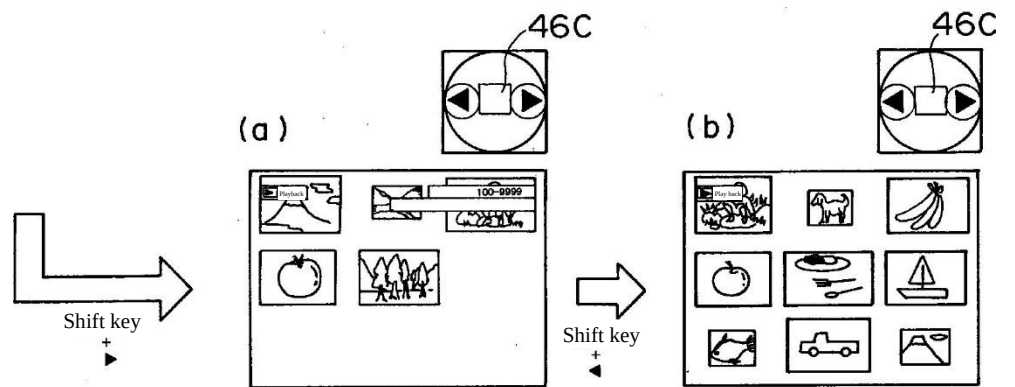
[FIG. 33]



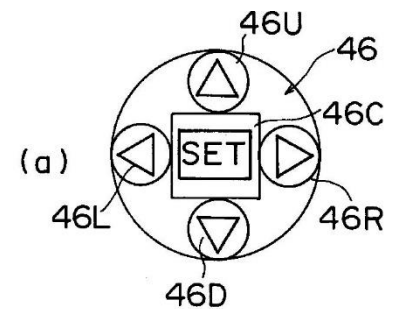
[FIG. 18]



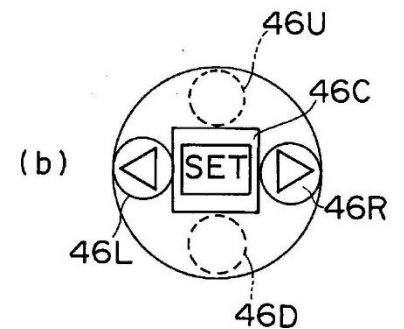
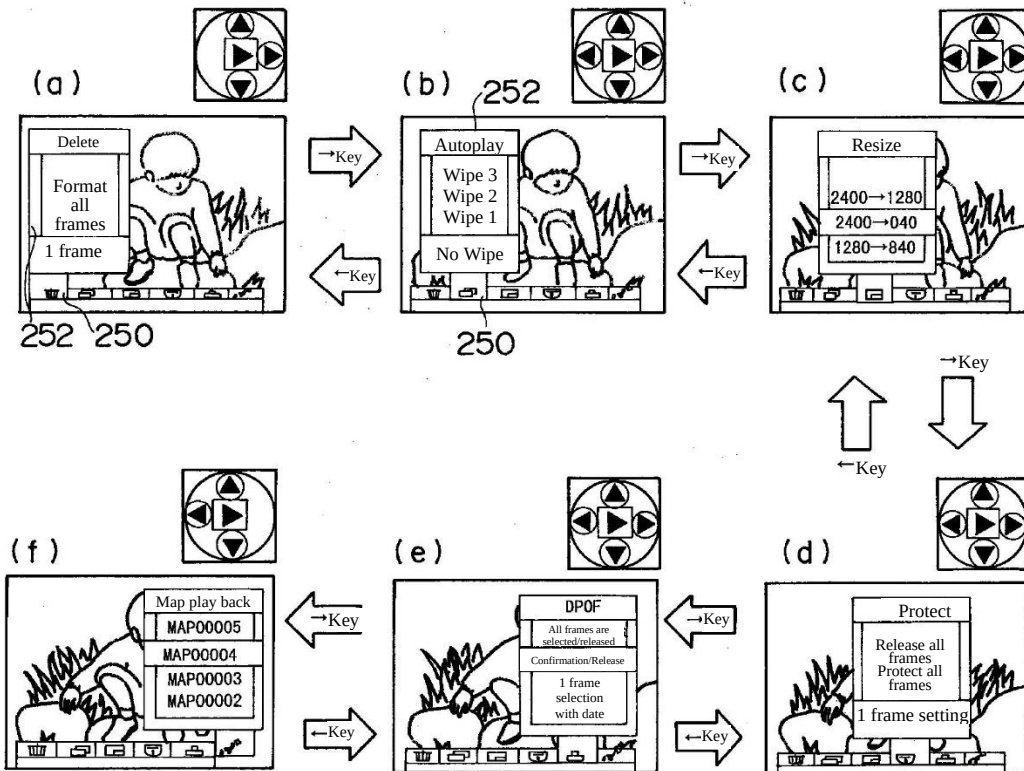
[FIG. 27]



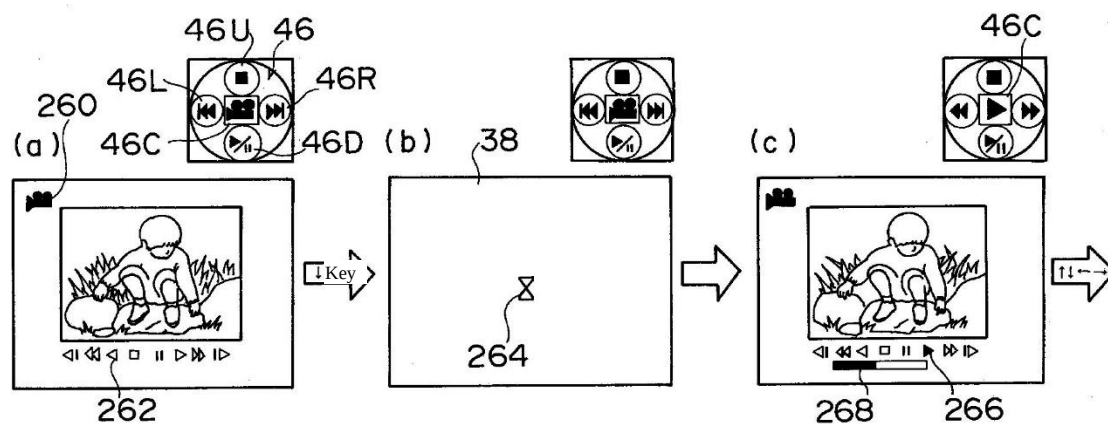
[FIG. 28]



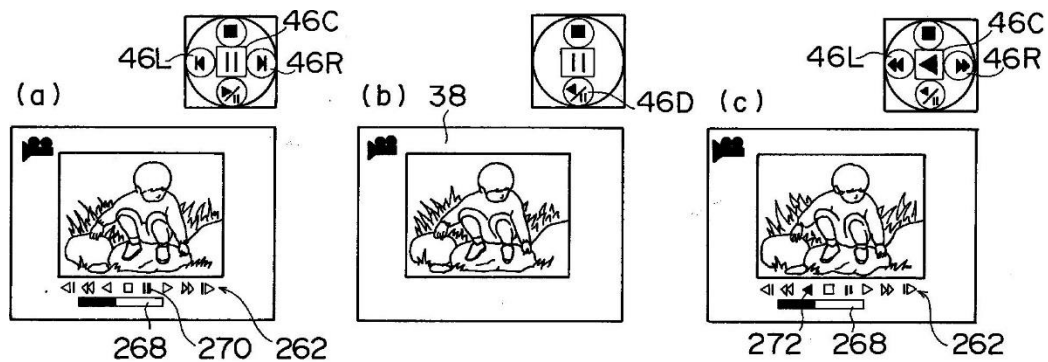
[FIG. 19]



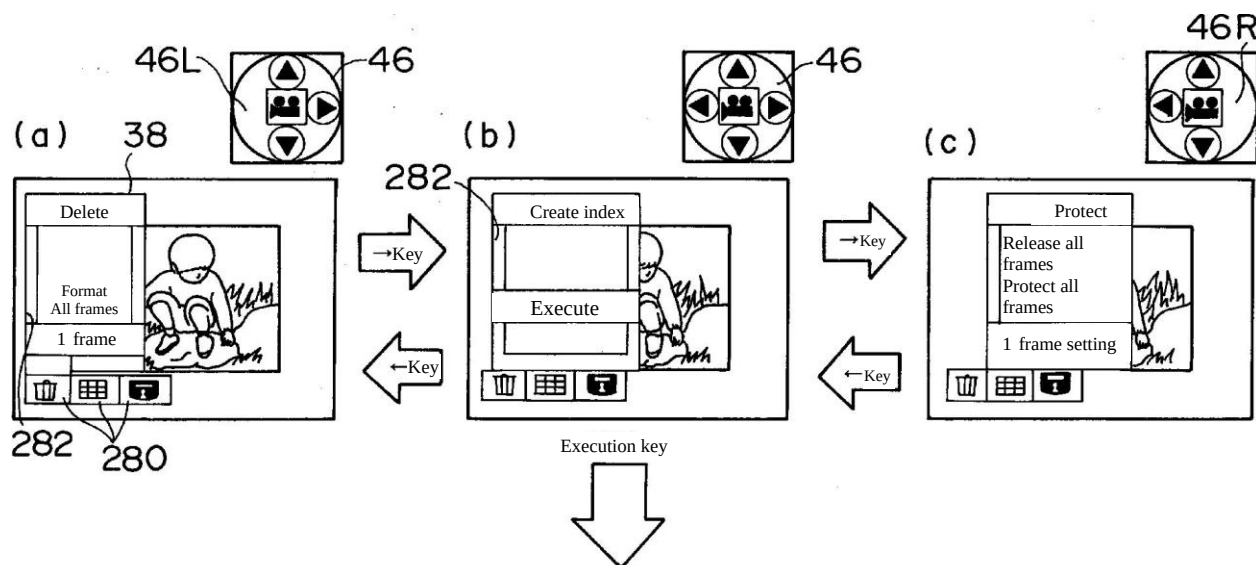
[FIG. 20]



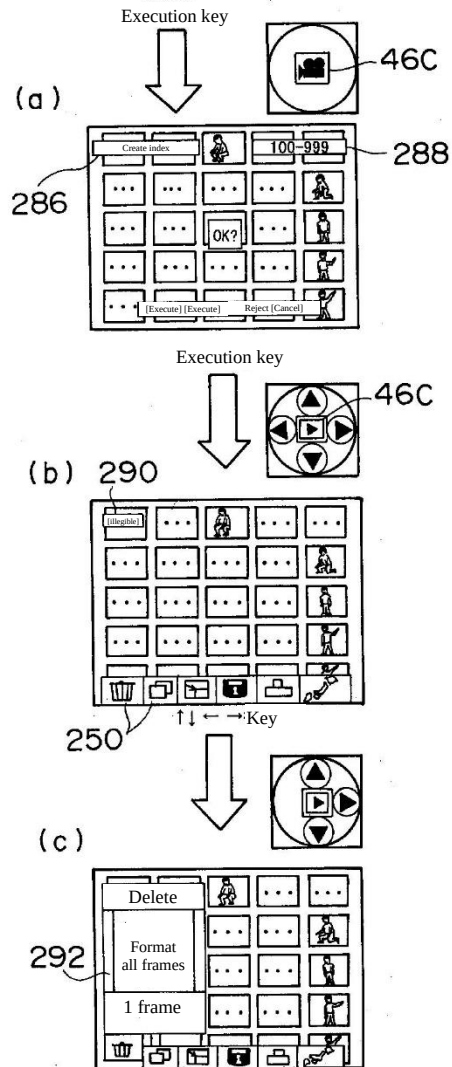
[FIG. 21]



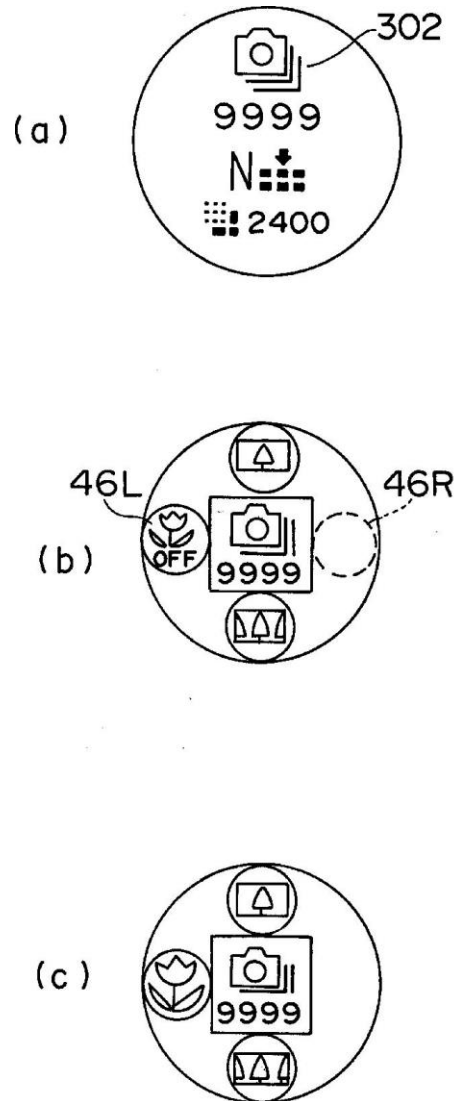
[FIG. 22]



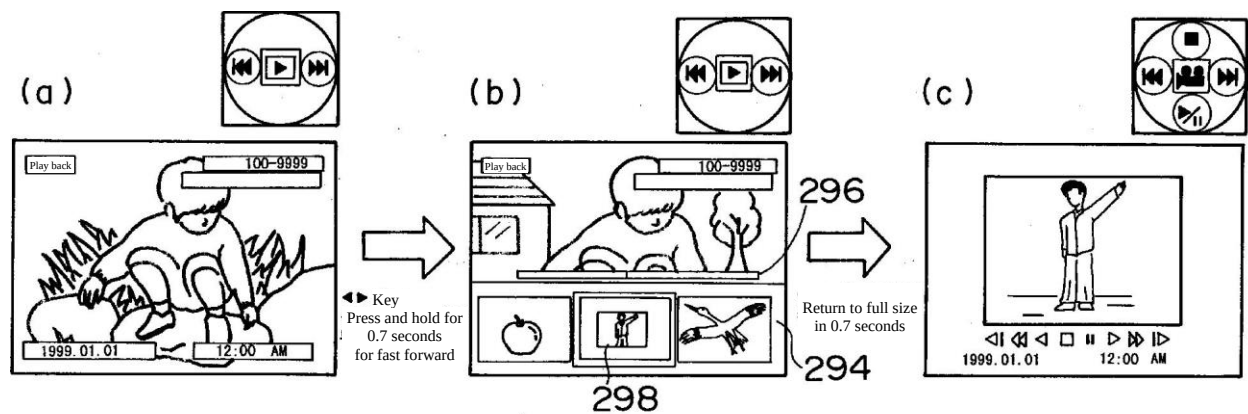
[FIG. 23]



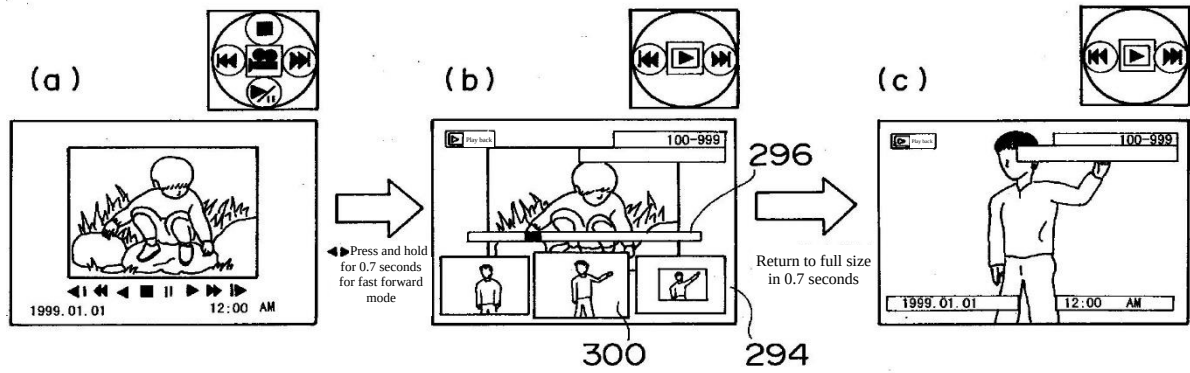
[FIG. 29]



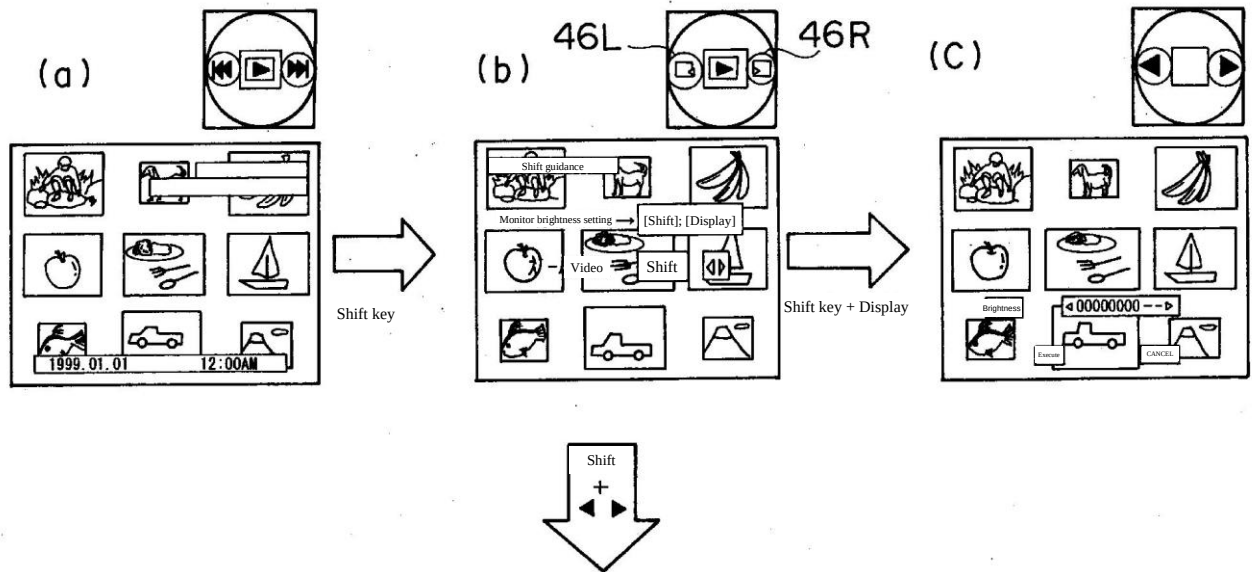
[FIG. 24]



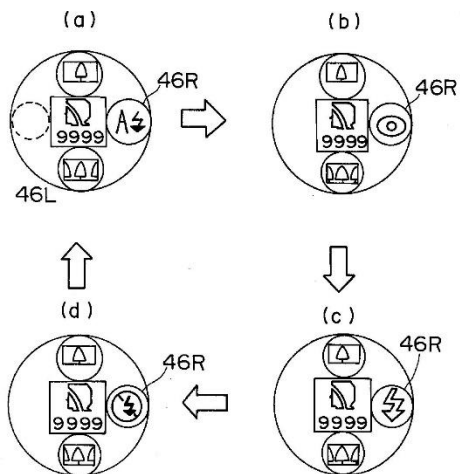
[FIG. 25]



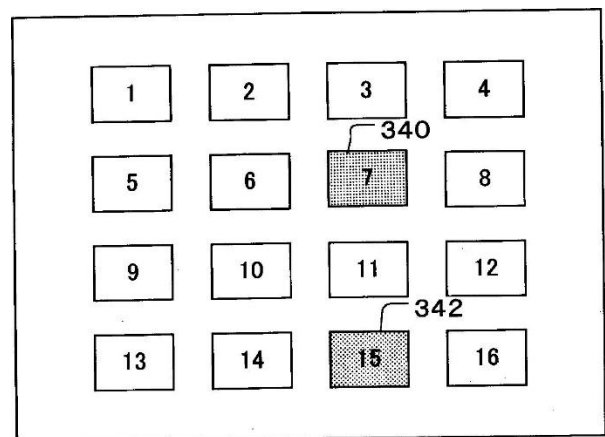
[FIG. 26]



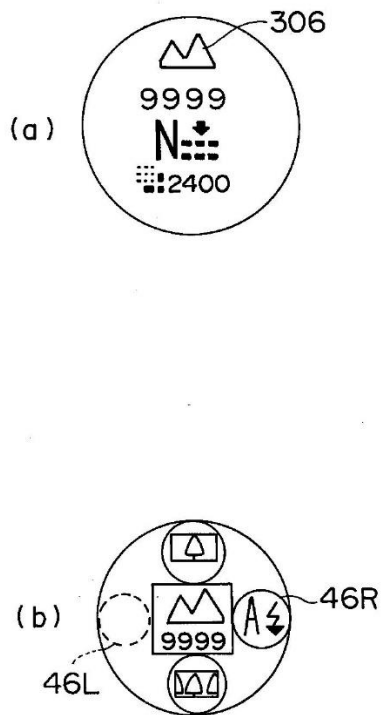
[FIG. 31]



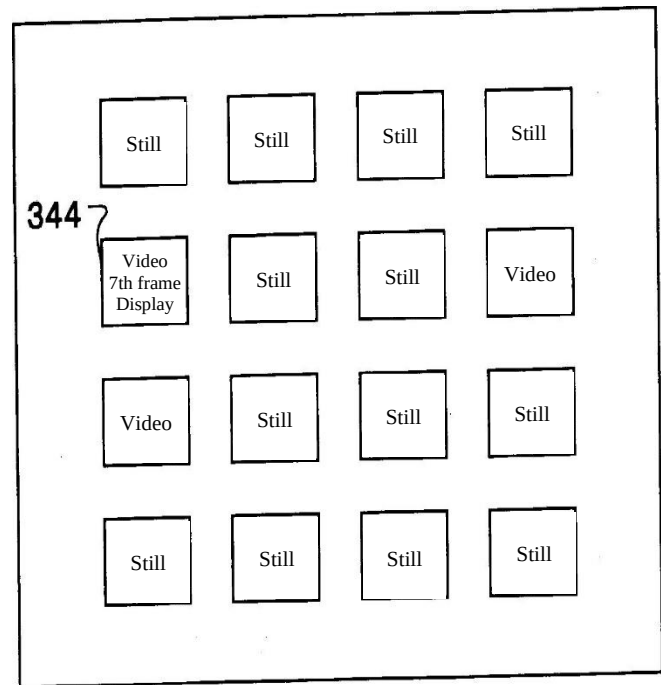
[FIG. 34]



[FIG. 32]



[FIG. 35]



Continued from front page

(51) Int. Cl.⁷

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 PQ02 PQ04 PQ29 PQ46 PQ48 PQ49
 UU40
 5C022 AA13 AB68 AC01 AC03 AC13 AC42
 AC54 AC69
 5C052 AA17 AB02 CC11 DD02 DD04 EE08
 5C053 FA05 FA14 FA27 GB06 GB36 HA29
 JA24 KA01 KA04 KA24 LA01