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(54) BACKLIGHT CONTROL METHOD AND DEVICE, AND 3D DISPLAY SYSTEM

RÜCKBELEUCHTUNGSSTEUERUNGSVERFAHREN UND -VORRICHTUNG SOWIE 3D-ANZEIGESYSTEM

PROCÉDÉ ET DISPOSITIF DE COMMANDE DE RÉTROÉCLAIRAGE ET SYSTÈME D'AFFICHAGE 3D

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(56) References cited:
WO-A1-2011/029293
WO-A2-2010/032927
CN-A- 101 650 922
CN-A- 101 697 595
CN-A- 101 697 595
CN-A- 101 848 398
JP-A- 2009 232 249

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Description

[0001] This application claims priority from Chinese Patent Application No. 201110113997.8, filed with the Chinese Patent Office on May 4, 2011 and entitled "Backlight control method, apparatus and 3D display system".

Field of the Invention

[0002] The present invention relates to the field of 3D display technologies and, more particularly, to a backlight control method, apparatus and a 3D display system based on such apparatus.

Background of the Invention

[0003] Along with the continuous development of modern sciences and technologies, 3D (three dimensional) display technologies also develop rapidly. The 3D display technologies make use of the principle of human binocular parallax, in which the left and right eyes of a person receive different images respectively, and then the brain superposes the images and regenerates image information to constitute an image with a stereoscopic direction effect of front-back, up-down, left-right, far-near, etc., so that a viewer may watch a film or a video with highly realistic effect. In order to achieve such a stereoscopic effect on a flat display, the left-eye and right-eye images have to be separated. At present, the 3D display technologies are used in cooperation with 3D glasses. Particularly, there are three solutions which use color separation, light separation and time division methods to be used in cooperation with the 3D glasses.

[0004] Recently, time division method is most widely used, and it generally relates to an active shutter-based 3D display approach in which left-eye and right-eye images are alternately displayed in a temporal sequence and also an infrared synchronization signal transmitter and shutter glasses cooperate therewith to present a stereoscopic image. The structure of a system using the active shutter-based 3D display approach is illustrated in Fig.1, and generally includes a display device, a computer, an infrared transmitter and shutter glasses. In this approach, the display device displays 3D data at a frame frequency of 120Hz. Particularly 60 frames of left-eye images and 60 frames of right-eye images are alternately displayed in a temporal sequence, and since each frame includes data refresh time and data hold time (T in Fig.2 represents the time of one frame of data), i.e., Vertical Blanking Interval (VBI) time in Fig.2, the left eyeglass L of the shutter glasses is open (the open state represents a state at which light can be transmitted) when refreshing of data of the left eye (L1, L2, etc., in Fig.2) is finished, that is, when the data hold time (VBI) arrives after each image frame of the left eye has been scanned; and similarly, the right eyeglass R of the shutter glasses is open when the data hold time (VBI) arrives after each frame of image of the right eye (R1, R2, etc., in Fig.2) has been scanned (as illustrated in Fig.2, response time Ton of liquid crystals when the eyeglass is open and response time Toff of the liquid crystals when the eyeglass is closed are included); and the shutter glasses are synchronized with the display device in timing sequence through the infrared transmitter in cooperation with an infrared receiver integrated on the shutter glasses. This approach can separate the left-eye images to achieve the 3D effect.

[0005] However, since the eyeglasses of the shutter glasses typically include a liquid crystal display, and the response of liquid crystals requires time (on the order of ms), it has to take a certain period of time for the eyeglasses to be open or closed completely; and in the foregoing approach, the shutter glasses are open only in the VBI time and thus there is a greatly shortened time for response remaining for the liquid crystals, and there is a loss of brightness because the opening of the eyeglasses is delayed due to the response time required for the liquid crystals; and there is a delay in closing the eyeglasses due to the response time required for the liquid crystals, so that the left-eye and right-eye images may be visible at the same time to a viewer, thus resulting in a problem of considerable crosstalk between the left-eye and right-eye images, tending to cause a residual image and lowering the effect of a dynamic image.

[0006] Furthermore, the following drawbacks may result from the shutter glasses constituted of the liquid crystal display as required in the foregoing solution: firstly, the cumbersome glasses may make the observer uncomfortable after wearing the glasses for a long period of time and may be further inconvenient particularly to those with nearsighted glasses; secondly, the glasses are electronic devices with rechargeable lithium battery and therefore release electromagnetic radiation, and furthermore the battery is at a risk of explosion; thirdly, when the glasses are signal-synchronized through the infrared receiver with the infrared transmitter connected to the computer, an infrared signal may be interrupted if the propagation path of the signal is hindered, thus degrading the display effect; and fourthly, the glasses are costly, have a short service period of time and a low drop number, are easily damaged and have high usage cost. A 3D display system in the prior art for which the shutter glasses are required is further costly due to the foregoing drawbacks of the glasses.

[0007] In WO 2011/029293A1, a method for displaying 3D image is provided. The method includes: 3D image signals, which comprise consecutive one frame of left-eye signal and one frame of right-eye signal, are received; the 3D image signals are processed by frequency multiplication, and n consecutive frames of left-eye signals and n consecutive frames of right-eye signals are obtained, n being the times number of the frequency multiplication and equal to or greater than 2; light-emitting diode (LED) driving signals drive the LED to display the n consecutive frames of left-eye signals and the n consecutive frames of right-eye signals; in the n consecutive frames of left-eye signals, the first frame of left-eye signal corresponds to an LED driving signal which is off, the nth frame of left-eye signal corresponds to an LED driving signal which is on, and in the n consecutive frames of right-eye signals, the first frame of right-eye signal corresponds to an LED driving signal which is off, the nth frame of right-eye signal corresponds to an LED driving signal which is on. The present invention also provides a TV set for displaying 3D image and a pair of glasses for viewing 3D image. By the present invention, the problem of crosstalk between leftimage and rightimage is solved, and backlight sources energy consumption and complete apparatus cost are reduced.

[0008] In CN 101 697 595 A, it is disclosed a method for displaying a 3D image, a television and glasses. The method comprises: receiving a 3D image signal which comprises a frame of left eye signal and a frame of right eye signal that are continuous; multiplying the frequency of the 3D image signal to obtain n continuous frames of left eye signals and n continuous right eye signals, wherein n is the number by which the frequency is multiplied and is more than or equal to 2; and displaying the n continuous frames of left eye signals and the n continuous right eye signals by using an LED driving signals for drive, wherein the LED driving signal corresponding to the first frame of left eye signal in the n continuous frames of left eye signals is closed, the LED driving signal corresponding to the nth frame of left eye signal is open, the LED driving signal corresponding to the first frame of right eye signal in the continuous n frames of right eye signals is closed and the LED driving signal corresponding to the nth frame of right eye signal is open. In the invention, mutual interference of left and right frames is avoided, the energy consumption of a backlight source is reduced and the cost of the whole machine is reduced.

Summary of the Invention

[0009] In view of this, the invention provides a backlight control method and apparatus and a 3D display system so as to overcome the problems in the prior art of crosstalk between left-eye and right-eye images, a residual image, reduced power consumption of the system and an decreased cost of the system, all of which may occur because shutter glasses can not be open and closed rapidly due to a time response required by liquid crystals to respond.

[0010] In order to attain the foregoing object, the invention is carried out based on the features defined by the independent claims.

[0011] The dependent claims define further advantageous modifications.

Brief Description of the Drawings

[0012] In order to make the technical solutions in the embodiments of the invention or in the prior art more apparent, the drawings required to be used in describing the embodiments or the prior art will be introduced briefly, and obviously the drawings described herein are merely illustrative of certain embodiments of the invention, and those ordinarily skilled in the art can further derive other drawings from the provided drawings without inventive effort.

Fig.1 is a schematic structural diagram of an active shutter-based 3D display system in the prior art;

Fig.2 is a schematic diagram of an operation principle of the active shutter-based 3D display system in the prior art;

Fig.3 is a schematic structural diagram of a backlight control apparatus according to an embodiment of the invention;

Fig.4 is a schematic structural diagram of a display device according to an embodiment of the invention;

Fig.5 is a schematic structural diagram of row sections of a backlight source and a liquid crystal panel according to an embodiment of the invention;

Fig.6 is a schematic structural diagram of a backlight source with a light source type being an LED according to an embodiment of the invention;

Fig.7 is a schematic structural diagram of a backlight source with a light source type being an array of CCFL tubes according to an embodiment of the invention;

Fig.8 is a flow chart of a backlight control method according to an embodiment of the invention;

Fig.9 is a schematic diagram of a scheme to preprocess 3D data images according to an embodiment of the invention;

Fig.10 is a schematic structural diagram of a 3D display system according to an embodiment of the invention;

Fig.11 is a schematic diagram of a sequence to process and display 3D images in the system illustrated in Fig.10 according to an embodiment of the invention;

Fig.12 is a timing diagram of backlight control in the system illustrated in Fig.10 according to an embodiment of the invention;

Fig.13 is a contrast timing diagram of backlight control of shutter glasses in the system illustrated in Fig.10 according to an embodiment of the invention and that in the prior art;

Fig.14 is a schematic structural diagram of a 3D display system according to an embodiment of the invention;

Fig.15 is an optics principle diagram of an active polarization 3D system according to an embodiment of the invention; and

Fig.16 is a timing diagram of backlight control in the system illustrated in Fig.13 according to an embodiment of the invention.

Detailed Description of the Embodiments

[0013] For the sake of reference and clarity, definitions or abbreviations of technical terms used hereinafter are provided below:

3D: Three-Dimensional;
TFT: Thin Film Transistor;
TN pattern: Twisted Nematic pattern;
VBI: Vertical Blanking Interval; and
LED: Light Emitting Diode.

[0014] The technical solutions in the embodiments of the present invention are described below clearly and fully with reference to the drawings in the embodiments of the invention, and obviously the embodiments described herein are merely a part of the embodiments of the invention, which is defined by the appended claims.

[0015] The embodiments of the present invention disclose a backlight control method and apparatus and a 3D display system incorporating the backlight control method and apparatus. A backlight source and a liquid crystal panel each are divided into a plurality of row sections, and dynamic control is performed on the row sections of the backlight source in cooperation with image processing and display to thereby achieve a crosstalk-free 3D effect while lowering the power consumption of the system, and the row sections of the backlight source are dynamically controlled to thereby lower a response speed of liquid crystals as required by shutter glasses, and shutter glasses with liquid crystals in a TN pattern can be used to enable a lower usage cost of both the shutter glasses and the system. Furthermore, the backlight control method and apparatus according to the embodiments of the invention can also be applicable in compatibility with both shutter glasses and an active polarization 3D system to thereby gain a wider applicability scope thereof. The invention will be described below in details in connection with the embodiments thereof.

First Embodiment

[0016] Referring to Fig.3, which is a schematic structural diagram of a backlight control apparatus according to an embodiment of the invention, the apparatus mainly includes a preprocessing unit 1, a pre-dividing unit 2, an obtaining unit 3, a scanning control unit 4 and a backlight control unit 5.

[0017] The preprocessing unit 1 is generally configured to preprocess obtained 3D data images to generate and output, in a complementary format, a first left-eye image, a second left-eye image, a first right-eye image and a second right-eye image preserving odd and even row sections of original left-eye and right-eye images.

[0018] The pre-dividing unit 2 is generally configured to divide correspondingly a backlight source 61 and a crystal liquid panel 62 in a display device 6 respectively into N horizontal row sections.

[0019] The display device 6 as illustrated in Fig.4 includes the backlight source 61 and the crystal liquid panel 62. As illustrated in Fig.5, the backlight source 61 and the crystal liquid panel 62 each are divided correspondingly into N horizontal row sections, where N represents a number greater than or equal to 3, that is, $N \geq 3$. Particularly the width of each row section of the crystal liquid panel 62 (in the Y direction) can be consistent with that of a pixel in the X row, and the number of pixels located in the X row is greater than or equal to 1.

[0020] It shall be noted that the crystal liquid panel 62 may not be really divided in physical sense into N row sections, that is, the crystal liquid panel 62 is not physically modified. In a backlight control process according to an embodiment of the invention, TFTs of the liquid crystal panel are controlled in an original row scanning pattern to be turned on and off to refresh display data. Thus, the crystal liquid panel 62 can be controlled per a row section without any modification to its physical architecture.

[0021] The backlight source 61 can be divided into N row sections in combination with the structural design of the backlight source to thereby control the backlight of each of the N row sections to be turned on and off separately.

[0022] In an embodiment of the invention, the structure of the backlight source 61 can be any structure which enables the backlight source to be controlled by a row section, and such structures may include, but will not be limited to, a straight-down backlight source and a side-light backlight source, and the type of light source on the backlight source 61 in an embodiment of the invention may include but will not be limited to a Light Emitting Diode (LED), a Cold Cathode Fluorescent Lamp (CCFL), a Hot Cathode Fluorescent Lamp (HCFL), an External Electrode Fluorescent Lamp (EEFL) and an Organic Light Emitting Diode (OLED), etc.

[0023] Fig.6 and Fig.7 illustrate two feasible structures of the backlight source, where in the structure illustrated in Fig.6, two LED lamp strips or one LED lamp strip (there is a higher requirement on light guidance plates in the case of one LED lamp strip) with incident light being Y side-directed are used, and the backlight is controlled dynamically per row section in cooperation with an arranged network of light guidance plates, that is, the backlight corresponding to each row section is controlled separately to be turned on and off; and in the structure illustrated in Fig.7, straight-down CCFL tubes are used to control the backlight per row section to control separately the backlight of each row section to be turned on and off.

[0024] The obtaining unit 3 is generally configured to obtain 3D data images processed by the preprocessing unit 1, that is, to obtain the first left-eye image, the second left-eye image, the first right-eye image and the second right-eye image, of the odd and even row sections of the original left-eye and right-eye images, output in the complementary format.

[0025] Since each of the 3D data images includes left-eye images and right-eye images, the preprocessing operation performed in the preprocessing unit 1 is to split the left-eye and right-eye images into corresponding two images. Specifically, the left-eye image is split into two images, where the first image is the first left-eye image preserving the odd (or even) row section image of the original left-eye image, and the other row sections of this image are black pictures; and the second image is the second left-eye image preserving the even (or odd) row section image of the original left-eye image, and the other row sections of this image are black pictures, and the combination of the first left-eye image with the second left-eye image can recover the original left-eye image.

[0026] Similarly, the right-eye image is split into the first right-eye image and the second right-eye image correspondingly preserving the odd (or even) row section image of the original right-eye image. However, it shall be noted that when the left-eye and right-eye images are processed in the same way, the displayed row sections of the first image resulting from splitting the right-eye (left-eye) image shall be complementary in format to those of the second image resulting from splitting the left-eye (right-eye) image, that is, if the second left-eye image preserves the even row sections of the original left-eye image, then the first right-eye image shall preserve the odd row sections of the original right-eye image.

[0027] The scanning control unit 4 is generally configured to scan sequentially the obtained first and second left-eye and right-eye images according to the backlight source and the liquid crystal panel of which horizontal row sections are pre-divided and to the format and sequential order in which the images are output, and particularly includes a determining module 41 and a scanning control module 42.

[0028] The determining module 41 is configured to determine the format and sequential order in which the first and second left-eye and right-eye images obtained in the obtaining unit 3 are output.

[0029] The scanning control module 42 is configured to scan each image sequentially from the top to the bottom in the order determined by the determining module 41 according to the backlight source and the liquid crystal panel of which the horizontal row sections are pre-divided.

[0030] In the process of using the backlight control apparatus, the scanning control unit 4 therein is arranged on the liquid crystal panel 62 of the display device 6 and enabled in the process of scanning the images per row in the liquid crystal panel 62.

[0031] The backlight control unit 5 is configured, in the scanning process by the scanning control unit 4 and after a row section of one image is scanned, i.e., after a odd or even row section image is preserved, to control the backlight of the row section to be turned on and then turned off until the same row section of a next image of the obtained first and second left-eye images and first and second right-eye images starts to be scanned, i.e., turned off until a next image preserving the odd row sections or the even row sections starts to be scanned, and to repeat this process until the scanning process ends. It shall be noted that the same row section of the next image may not necessarily be a row section with a display picture.

[0032] Since an operation mode of the backlight control apparatus according to the embodiment of the invention relates to the output format of the 3D data images (the obtained splitting format after processing) and the sequential order of obtaining the left-eye and right-eye images, either the left-eye images or the right-eye images can be scanned firstly.

[0033] An example will be disclosed as follows:

[0034] The 3D data images are displayed by scanning firstly the left-eye image and then the right-eye image sequentially.

[0035] The left-eye image is split into two images which are respectively the first left-eye image obtained by preserving the odd row section image of the original left-eye image and the second left-eye image obtained by preserving the even row section image of the original left-eye image. The right-eye image is split into two images, where the first image is obtained by preserving the odd row sections of the original right-eye image and the second image is obtained by preserving the even row sections of the original right-eye image.

[0036] When the scanning control unit 4 starts scanning control, an initial state of the backlight source 61 is all turned off, and the scanning control unit 4 arranged on the liquid crystal panel 62 controls the scanning start with the first row of the first left-eye image, because the liquid crystal panel 62 operates in a row scanning mode and the liquid crystal panel 62 and the backlight source 61 are divided consistently into N row sections.

[0037] When performing the scanning, firstly the first left-eye image is scanned, then the second left-eye image, the first right-eye image and the second right-eye image are scanned sequentially, then the first left-eye image is scanned again, and this sequential scanning process is then repeated.

[0038] In the scanning process from the top to the bottom in the liquid crystal panel 62, the backlight source 61 is concurrently controlled dynamically so that for images preserving the odd row sections of the original left-eye and right-eye images (e.g., L1 and R1 illustrated in Fig.9), the backlight of a first odd row section of a first image is turned on after the row section is scanned, until the same row section of the second image subsequent thereto, i.e., a first odd row section starts to be scanned, and then the backlight corresponding to the first odd row section of the first image is turned off; and for images preserving the even row sections of the original left-eye and right-eye images (e.g., L2 and R2 illustrated in Fig.9), the backlight of a first even row section of a first image is turned on after the row section is scanned, until the same row section of a second image subsequent thereto, i.e., a first even row section of the second image, starts to be scanned, and then the backlight corresponding to the first even row section of the first image is turned off.

[0039] In summary, after a row section of a image is scanned, the initialized backlight of the row section is controlled to be turned on and then turned off until the same row section of a next image starts to be scanned, and this process is repeated sequentially until all the images are scanned. It shall be noted that the same row section of the next image may not necessarily be a row section with a display picture.

[0040] In backlight control by the foregoing apparatus according to the embodiment of the invention, the backlight source is controlled dynamically per row section to lower the power consumption of the backlight source and the system and also display the 3D images without any crosstalk.

[0041] Furthermore, the foregoing apparatus according to the embodiment of the invention further includes a first backlight control unit which can be used in cooperation with a pair of shutter glasses and which is generally configured to control a left eyeglass of the shutter glasses to be open and a right eyeglass to be closed when the scanning image is the left-eye image; and to control the right eyeglass of the shutter glasses to be open and the left eyeglass to be closed when the scanning image is the right-eye image.

[0042] For cooperation with a 3D display system with an active polarization light valve, the apparatus according to the embodiment of the invention further includes a second backlight control unit generally configured to control the active polarization light valve in the 3D display system to be open when the scanning image is the left-eye image and to control the active polarization light valve to be closed when the scanning image is the right-eye image; or to control the active polarization light valve in the 3D display system to be open when the scanning image is the right-eye image and to control the active polarization light valve in the 3D display system to be closed when the scanning image is the left-eye image.

[0043] With various settings in the foregoing backlight control apparatus according to the embodiment of the invention, the backlight source can be controlled dynamically per row section, the 3D images can be displayed without any crosstalk and the power consumption of the backlight source can be lowered, and also the backlight control apparatus can be compatible with both the shutter glasses and the active polarization 3D system to thereby gain a wider applicability scope thereof.

Second Embodiment

[0044] The backlight control apparatus has been described in details in the above embodiment of the invention, and based upon this apparatus, the invention further discloses a backlight control method of a backlight control apparatus, and referring to Fig.8 illustrating a flow chart of a backlight control method according to an embodiment of the invention, the method mainly includes the following steps:

At step S101, a backlight source and a crystal liquid panel are divided correspondingly into N horizontal row sections respectively.

At step S102, each of the 3D data images to be displayed is preprocessed to respectively obtain a first left-eye image, a second left-eye image, a first right-eye image and a second right-eye image preserving odd and even row section images of original left-eye and right-eye images, output in a complementary format.

[0045] In preprocessing of the 3D data images in the step S102, since a 3D data image includes a left-eye image and a right-eye image, in fact, the left-eye image and the right-eye image are processed respectively to split the left-eye and right-eye images respectively into two images, that is, to obtain the first left-eye image and the second left-eye image, output in the complementary format, preserving the original left-eye image as well as the first right-eye image and the second right-eye image in the similar splitting way, and the obtained left-eye second image and first right-eye image are complementary in format.

[0046] At step S103, the first left-eye and right-eye images and the second left-eye and right-eye images corresponding to the left-eye and right-eye images are sequentially scanned starting from the top to the bottom of the liquid crystal panel according to the backlight source and the liquid crystal panel of which the horizontal row sections are pre-divided and according to the obtained format and sequential order in which the first images and the second images of the left and the right eyes are output.

[0047] At step S104, after scanning a row section of an image of the obtained first and second left-eye images and first and second right-eye images, an initialized backlight of the row section is controlled to be turned on and then turned off until the same row section of a next image of the obtained first and second left-eye images and first and second right-eye images starts to be scanned, and this process is repeated sequentially until all the images are scanned, where the same row section of the next image may not necessarily be a row section with a display picture.

[0048] It shall be noted that an initial state of the backlight source is all-off when the step S104 is performed for scanning.

[0049] Furthermore, the control of the backlight source, i.e., a period of time for which the backlight is turned on, in the scanning process generally involves the following two scenarios:

[0050] In a first scenario, after a row section of the preserved image is scanned, the initialized backlight of the row section is controlled to be turned on immediately, that is, the backlight source corresponding to the row section is turned on directly.

[0051] In a second scenario, after a row section of the preserved image is scanned, the initialized backlight of the row section is controlled, after a delay time t, to be turned on, that is, the backlight source corresponding to the row section is turned on after the predetermined delay time t.

[0052] The above predetermined delay time, i.e., the delay time t, is defined by the following expression:

$$t \leq (N-1)/N*T;$$

[0053] Where T represents a period of one image time, and N represents the number of horizontal row sections into which the backlight source and the liquid crystal panel are divided.

[0054] The step S105 is to repeat the step S104 until all the images, i.e., the first left-eye and right-eye images and the second left-eye and right-eye images corresponding to the left-eye and right-eye images, are scanned.

[0055] With the backlight control method according to the embodiment of the invention, dynamic control per row section is used in cooperation with image processing and display processes to reduce residual images and achieve a crosstalk-free 3D effect while lowering the power consumption of both the backlight source and the system.

[0056] It shall be noted that the 3D data images including the left-eye and right-eye images are preprocessed to obtain respectively the first images and the second images preserving complementarily the original left-eye and right-eye images in an output format of the odd and even row section images, and the scanning process is performed in the determined sequential order, and since the first images and the second images of the left-eye and right-eye images are output in different formats and obtained in different sequential orders, they will be described respectively below.

[0057] In preprocessing of the 3D data images, the left-eye image is split into two images as follows:

[0058] The first left-eye image preserves the odd row section image of the original left-eye image, and the other row sections thereof are black pictures, and the second left-eye image preserves the even row section image of the original left-eye image, and the other row sections thereof are black pictures; and the right-eye image is split in the same way as splitting the left-eye image, and the displayed row sections of the first right-eye image resulting from splitting are complementary in format to those of the second left-eye image. The foregoing first images and second images of the left and right eyes constitute together the original left-eye and right-eye images, and firstly the first images and then the second images are displayed in the scanning and display processes. Reference can be made to Fig.9 for a specific format where L represents a left-eye image, L1 represents the first left-eye image, L2 represents the second left-eye image, R represents a right-eye image, R1 represents the first right-eye image, R2 represents the second right-eye image, and Section represents the row number.

[0059] When the images are obtained in an order of firstly the left-eye image and then the right-eye image:

[0060] The first left-eye image, the second left-eye image, the first right-eye image and the second right-eye image are scanned sequentially.

[0061] In an initial state, all the backlight sources are in turn-off state, and the liquid crystal panel is ready to scan starting with the first left-eye image preserving the odd row section image, and after a first odd row section of the first left-eye image is scanned, the backlight corresponding to the odd row section is controlled to be turned on and then turned off until a first odd row section of the second left-eye image subsequent thereto starts to be scanned, and this process is repeated to perform the scanning.

[0062] When the second left-eye image preserving the even row section image is scanned, in the same way, after a first even row section of the second left-eye image is scanned, the backlight corresponding to the even row section is controlled to be turned on and then turned off until a first even row section of the first right-eye image subsequent thereto starts to be scanned, and this process is repeated until the first right-eye image starts to be scanned.

[0063] The backlights corresponding to the odd and even row sections of the first right-eye image and the second right-eye image are controlled repeatedly in the same backlight control way until the left-eye and right-eye images are already scanned.

[0064] When the images are obtained in an order of firstly the right-eye image and then the left-eye image:

[0065] The first right-eye image, the second right-eye image, the first left-eye image and the second left-eye image are scanned sequentially.

[0066] In an initial state, all the backlight sources are in turn-off state, and the liquid crystal panel is ready to scan starting with the first right-eye image preserving the odd row section image, and after a first odd row section of the first right-eye image is already scanned, the backlight corresponding to the odd row section is controlled to be turned on and then turned off until a first odd row section of the second right-eye image subsequent thereto starts to be scanned, and this process is repeated to perform the scanning.

[0067] When the second right-eye image preserving the even row section image is scanned, in the same way, after a first even row section of the second right-eye image is already scanned, the backlight corresponding to the even row section is controlled to be turned on and then turned off until a first even row section of the first left-eye image subsequent thereto starts to be scanned, and this process is repeated until the first left-eye image starts to be scanned.

[0068] The backlights corresponding to the odd and even row sections of the first left-eye image and the second left-eye image are controlled repeatedly in the same backlight control way until the left-eye and right-eye images are already scanned.

[0069] In preprocessing of the 3D data images, the left-eye image is split into two images as follows:

[0070] The first left-eye image preserves the even row section image of the original left-eye image, and the other row sections thereof are black pictures, and the second left-eye image preserves the odd row section image of the original left-eye image, and the other row sections thereof are black pictures; and the right-eye image is split in the same way as splitting the left-eye image, and the displayed row sections of the first right-eye image resulting from splitting are complementary in format to those of the second left-eye image. The foregoing first images and second images of the left and right eyes constitute together the original left-eye and right-eye images, and firstly the first images and then the second images are displayed in the scanning and display processes.

[0071] When the images are obtained in an order of firstly the left-eye image and then the right-eye image:

[0072] The first left-eye image, the second left-eye image, the first right-eye image and the second right-eye image are scanned sequentially.

[0073] In an initial state, all the backlight sources are in an turn-off state, and the liquid crystal panel is ready to scan starting with the first left-eye image preserving the even row section image, and after a first even row section of the first left-eye image is already scanned, the backlight corresponding to the even row section is controlled to be turned on and then turned off until a first even row section of the second left-eye image subsequent thereto starts to be scanned, and this process is repeated to perform the scanning.

[0074] When the second left-eye image preserving the odd row section image is scanned, in the same way, after a first odd row section of the second left-eye image is already scanned, the backlight corresponding to the odd row section is controlled to be turned on and then turned off until a first odd row section of the first right-eye image subsequent thereto starts to be scanned, and this process is repeated to perform the scanning.

[0075] The backlights corresponding to the odd and even row sections of the first right-eye image and the second right-eye image are controlled repeatedly in the same backlight control way until the left-eye and right-eye images are already scanned.

[0076] When the images are obtained in an order of firstly the right-eye image and then the left-eye image:

[0077] The first right-eye image, the second right-eye image, the first left-eye image and the second left-eye image are scanned sequentially.

[0078] In an initial state, all the backlight sources are in turn-off state, and the liquid crystal panel is ready to scan starting with the first right-eye image preserving the even row section image, and after a first even row section of the first right-eye image is already scanned, the backlight corresponding to the even row section is controlled to be turned on and then turned off until a first even row section of the second right-eye image subsequent thereto starts to be scanned, and this process is repeated to perform the scanning.

[0079] When the second right-eye image preserving the odd row section image is scanned, in the same way, after a first odd row section of the second right-eye image is already scanned, the backlight corresponding to the odd row section is controlled to be turned on and then turned off until a first odd row section of the first left-eye image subsequent thereto starts to be scanned, and this process is repeated to perform the scanning.

[0080] The backlights corresponding to the odd and even row sections of the first left-eye image and the second left-eye image are controlled repeatedly in the same backlight control way until the left-eye and right-eye images are already scanned.

[0081] It shall be noted that when the scanning proceeds from one image to another image, if the last row section of the preceding image preserves the odd or even row section image, then the backlight corresponding to the last row section of the preceding image is controlled to be turned off before the first row section of the succeeding image preserving the odd or even row section image starts to be scanned.

[0082] In the foregoing embodiment of the invention, the 3D data images are preprocessed, and the backlights corresponding to the left-eye and right-eye images resulting from different splitting approaches are controlled in the scanning process, that is, the invention performs dynamic control on the row sections of the backlight source in cooperation with image processing and display to thereby reduce residual images and achieve a crosstalk-free 3D effect while lowering the power consumption of both the backlight source and the system.

[0083] Furthermore, in the process of achieving a crosstalk-free 3D effect in the backlight control approach in the foregoing embodiment of the invention, for cooperation with shutter glasses, the left eyeglass of the shutter glasses is controlled to be open and the right eyeglass is controlled to be closed when the scanning image is the left-eye image; and the right eyeglass of the shutter glasses is controlled to be open and the left eyeglass is controlled to be closed when the scanning image is the right-eye image.

[0084] Furthermore, in the process of achieving a crosstalk-free 3D effect in the backlight control approach in the foregoing embodiment of the invention, for cooperation with an active polarization light valve in a 3D display system, the active polarization light valve is controlled to be open when the scanning image is the left-eye image, and the active polarization light valve is controlled to be closed when the scanning image is the right-eye image. Alternatively, the active polarization light valve in the 3D display system is controlled to be open when the scanning image is the right-eye image, and the active polarization light valve in the 3D display system is controlled to be closed when the scanning image is the left-eye image.

[0085] With the foregoing method according to the embodiment of the invention, dynamic control is performed on the row sections of the backlight source to thereby lower a response speed of liquid crystals as required for shutter glasses, and shutter glasses with liquid crystals in a TN pattern can be used in cooperation with reception of 3D images to thereby facilitate a lowered usage cost of both the shutter glasses and the system. Furthermore, the backlight control method and apparatus according to the embodiments of the invention can also be applicable in compatibility with both shutter glasses and an active polarization 3D system to thereby gain a wider applicability scope thereof.

[0086] Based upon the backlight control apparatus and method described above in details in the embodiments of the invention, the invention further discloses a 3D display system which mainly includes a display device, 3D glasses and the backlight control apparatus disclosed in the above embodiment, where the backlight control apparatus processes and displays 3D images in the backlight control method disclosed above in the embodiment of the invention. To further detail the description, the system will be described below in embodiments thereof.

[0087] An example is disclosed as follows:

[0088] As illustrated in Fig.10, a 3D display system according to an embodiment of the invention includes, in part, a backlight control apparatus, a computer 9, an infrared transmitter 10 and shutter glasses 13 (including a left eyeglass 131 and a right eyeglass 132).

[0089] A display device 6 in the backlight control apparatus includes a backlight source 61 and a liquid crystal panel 62, and the backlight source 61 is an LED backlight source having following characteristics: two LED lamp strips with incident light being Y side-directed are used, and the backlight is controlled per row section in cooperation with a network arrangement of light guidance plates to separately control the backlight corresponding to each row section to be turned on and off.

[0090] In this example, the backlight source 61 is divided into three row sections, and accordingly, the liquid crystal panel 62 is also divided correspondingly into three row sections.

[0091] A display card of the computer 9 is configured to output a signal of processed 3D data images to the liquid crystal panel 62; the infrared transmitter 10 is configured to transmit a frequency synchronization signal of the images to the shutter glasses 13; and the shutter glasses 13 are integrated with an infrared signal receiver thereon through which the synchronization signal of the infrared transmitter is received, so that the backlight control apparatus controls the left and right eyeglasses to be open and closed.

[0092] Since an operation mode of backlight control relates to the output format of the 3D data images and the sequential order of obtaining the left-eye and right-eye images, either the left-eye images or the right-eye images can be scanned firstly.

[0093] In this example, taking Fig.11 as an example (the reference character "A" represents the unprocessed 3D data images, and the reference character "B" represents the processed 3D data images), firstly the left-eye image and then the right-eye image among the 3D data images are displayed, and the displayed images are then sequentially scanned and backlight-controlled repeatedly.

[0094] As can be seen from Fig. 11, the left-eye image is split into two images (L1, L2), where L1 is obtained by preserving the odd row section image of the original left-eye image and L2 is obtained by preserving the even row section image of the original left-eye image. Also the right-eye image is split into two images (R1, R2), where R1 is obtained by preserving the odd row section image of the original right-eye image and R2 is obtained by preserving the even row section image of the original right-eye image.

[0095] In an initial state, the backlight source is all turn-off, and the liquid crystal panel 62 scans starting with the first row of the first left-eye image L1, and then the second left-eye image L2, the first right-eye image R1 and the second right-eye image R2 are scanned sequentially; and next the first left-eye image L1 is scanned again, and this scanning process is repeated until all images have been scanned. The liquid crystal panel 62 scans from the top to the bottom, and the backlight control apparatus controls the backlight to be turned on and off in the scanning process in the timing diagram as illustrated in Fig.12:

[0096] After the first row section of the L1 image has been scanned, the backlight of the first row section is turned on and then turned off until the first row section of the L2 image starts to be scanned; after the third row section of the L1 image is already scanned, the backlight of the third row section is turned on and then turned off until the third row section of the L2 image starts to be scanned; after the second row section of the L2 image is already scanned, the backlight of the second row section is turned on and then turned off until the second row section of the R1 image starts to be scanned; after the first row section of the R1 image is scanned, the backlight of the first row section is turned on again and then turned off again until the first row section of the R2 image starts to be scanned; after the third row section of the R1 image is already scanned, the backlight of the third row section is turned on and then turned off until the third row section of the R2 image starts to be scanned; and after the second row section of the R2 image is already scanned, the backlight of the second row section is turned on and then turned off until the second row section of the first left-eye image (not illustrated in figure) of the next subsequent image starts to be scanned. In the process of scanning the images, the backlight is controlled by performing dynamic control on the row sections of the backlight source repeatedly in the foregoing timing sequence.

[0097] The shutter glasses 13 in the 3D display system according to the embodiment is open and closed in the timing sequence as illustrated in Fig.12: the left eyeglass is open (on) at the starting time of the L1 image and then closed (off) until the end of the L2 image; and the right eyeglass is open (on) at the starting time of the R1 image and then closed (off) until the end of the R2 image.

[0098] Control of the shutter glasses in the backlight control method above according to the embodiment of the invention is compared with that in the prior art as illustrated in Fig.13. Conventional shutter glasses are open (on) only in the period of VBI, and there is a very short response time left for liquid crystals. There is a loss of brightness because opening of the eyeglasses is delayed due to the response time required for the liquid crystals; and there is a delay in closing (off) the eyeglasses due to the response time required for the liquid crystals. The left-eye and right-eye images may be visible at the same time to a viewer, thus resulting in considerable crosstalk.

[0099] In the system according to the embodiment of the present invention, the shutter glasses can be open (on) once the first image of the left eye or the right eye starts and then closed (off) until the second image of the left eye or the right eye ends to significantly lower the requirement on the response time of the liquid crystals. Liquid crystals in a TN pattern can thus be used for the shutter glasses according to the embodiment of the invention to achieve opening and closing of the shutter glasses, and a crosstalk-free 3D display effect can also be ensured without requiring the use of quickly responding liquid crystals to reduce or eliminate crosstalk between the left-eye and right-eye images.

[0100] Further comparing with the prior art techniques, the present invention can lower power consumption and also improve the effect of displaying a dynamic image under dynamic backlight control through scanning.

[0101] Another example is disclosed as follows:

[0102] As illustrated in Fig.14, a 3D display system according to this embodiment of the invention mainly includes a backlight control apparatus, an active polarization light valve 14, a valve control system 15, a computer 9 and polarization glasses 16 (including a left eyeglass 161 and a right eyeglass 162).

[0103] A display device 6 in the backlight control apparatus includes a backlight source 61 and a liquid crystal panel, where the structure of backlight source 61 is a straight-down CCFL backlight source in cooperation with diffusion plates and diffusion sheets to control separately the backlight corresponding to each row section to be turned on and off.

[0104] In this example, the backlight source 61 is divided into three row sections, and thus the liquid crystal panel 62 is also divided correspondingly into three row sections. Referring to Fig. 15, the liquid crystal panel includes a lower polarized plate 121 and an upper polarized plate 122. The polarization direction of the upper polarized plate is 45°.

[0105] The active polarization light valve 14 is fitted closely on the upper polarized plate 122 for acting as an active polarization rotator to actively control the polarization state of emergent light. The active polarization light valve 14 can alternatively be replaced by another device capable of actively controlling polarization rotation or rotating light, but is not limited to the liquid crystal light valve mentioned in this example. Thus, the liquid crystal light valve can be replaced by liquid crystal light valves, lithium niobate photoelectric modulators, Faraday rotators and the like in various structures but is not limited thereto.

[0106] The liquid crystal light valve in this example structurally includes upper and lower substrates with a liquid crystal layer sandwiched therebetween, and when there is no potential difference between the upper and lower substrates, the light valve is in a closed (off) state, and at this time the polarization direction of transmitted light is the same as the polarization direction of the upper polarized plate (as illustrated with C in Fig.15); and when there is a potential difference between the upper and lower substrates of the light valve, the light valve is in an open (on) state, and at this time the polarization direction of transmitted light is orthogonal to the polarization direction of the upper polarized plate (as illustrated with D in Fig.15). The polarization directions of the left and right eyeglasses of the polarization glasses 16 correspond respectively to the polarization states of the transmitted light when the light valve is closed and open.

[0107] A display card of the computer 9 is configured to output a signal of processed 3D data images to the liquid crystal panel 62. The light valve control system 15 is configured to receive a image frequency synchronization signal of the images from the liquid crystal panel 62 and transmitting the signal to the active polarization light valve, so that the backlight control apparatus controls the light valve to be open and closed in the timing sequence as illustrated in Fig.16. At this time a crosstalk-free 3D image can be seen through the polarization glasses.

[0108] A specific operation principle is described as follows:

[0109] In this example, the split images in the preceding example are taken as an example, that is, as illustrated in Fig.11 (the reference character "A" represents the unprocessed 3D data images, and the reference character "B" represents the processed 3D data images), firstly the left-eye image and then the right-eye image among the 3D data images are displayed and sequentially scanned and backlight-controlled repeatedly.

[0110] As can be seen from Fig. 11, the left-eye image is split into two images (L1, L2), where L1 is obtained by preserving the odd row section image of the original left-eye image and L2 is obtained by preserving the even row section image of the original left-eye image. Also the right-eye image is split into two images (R1, R2), where R1 is obtained by preserving the odd row section image of the original right-eye image and R2 is obtained by preserving the even row section image of the original right-eye image.

[0111] In an initial state, the backlight source is all turned off, and the liquid crystal panel scans starting with the first row of the first left-eye image L1, and then the second left-eye image L2, the first right-eye image R1 and the second right-eye image R2 are scanned sequentially; and next the first left-eye image L1 is scanned again, and this process is repeated until the scanning ends. The liquid crystal panel scans from the top to the bottom, and the backlight control apparatus controls the backlight to be turned on and off in the scanning process in the timing diagram as illustrated in Fig.16: after the first row section of the L1 image is already scanned, the backlight of the first row section is turned on and then turned off until the first row section of the L2 image starts to be scanned; after the third row section of the L1 image is already scanned, the backlight of the third row section is turned on and then turned off until the third row section of the L2 image starts to be scanned; after the second row section of the L2 image is already scanned, the backlight of the second row section is turned on and then turned off until the second row section of the R1 image starts to be scanned; after the first row section of the R1 image is scanned, the backlight of the first row section is turned on again and then turned off again until the first row section of the R2 image starts to be scanned; after the third row section of the R1 image is already scanned, the backlight of the third row section is turned on and then turned off until the third row section of the R2 image starts to be scanned; and after the second row section of the R2 image is already scanned, the backlight of the second row section is turned on and then turned off until the second row section of the first left-eye image (not illustrated) of the next subsequent image starts to be scanned. In the process of scanning the images, the backlight is controlled by performing dynamic control on the row sections of the backlight source repeatedly in the foregoing timing sequence.

[0112] The active polarization light valve 14 in the 3D display system according to this embodiment is open and closed in the timing sequence as illustrated in Fig.16: the light valve is in a closed (off) state at the starting time of the L1 image and then turned into an open (on) state until the end of the L2 image, that is, the light valve is open (on) at the starting time of the R1 image and then closed (off) until the end of the R2 image, and a crosstalk-free 3D image can be viewed using a pair of polarization glasses.

[0113] As compared with the prior art, this example based on the foregoing described backlight control method according to the embodiment of the invention can be combined with a CCFL backlight source and an active polarization 3D system, and the use of inexpensive polarization glasses can further lower the system costs and usage costs of a user, and furthermore the polarization glasses are characterized as to provide energy saving, environment protection, light weight, a high drop number, etc., which are superior to shutter glasses and thus can further extend the applicability scope of the system and have the characteristic of wide applicability.

[0114] The respective embodiments have been described progressively in the specification, each of the embodiments has laid an emphasis on its difference(s) from the other embodiments, and mutual reference can be made to the description of the same or similar part(s) between the respective embodiments. For the apparatus according to the embodiment, it has been described briefly because it corresponds to the method according to the embodiment, and reference can be made to the description of the method for the relevant part(s).

[0115] The foregoing description of the disclosed embodiments enables those skilled in the art to practice or use the invention. Numerous modifications to these embodiments will be obvious to those skilled in the art, and the general principle defined herein can be embodied in other embodiments without departing from or scope of the invention, as defined by the appended claims.

Claims

1. A method of controlling a backlight unit of a liquid crystal panel (62), **characterized in that** the method comprises the steps of:

    obtaining and preprocessing 3D data images each of which including a right-eye image (R) and a left-eye image (L), whereby the left-eye image (L) is split into two images, where the first image is the first left-eye image (L1) preserving the odd or even row section image of the left-eye image (L), and the other row sections of this image are black pictures; and the second image is the second left-eye image (L2) preserving the other one of the even or odd row section image of the left-eye image (L), and the other row sections of this image are black pictures,

    whereby the right-eye image (R) is split into two images, where the first image is the first right-eye image (R1) preserving the odd or even row section image of the right-eye image (R), and the other row sections of this image are black pictures; and the second image is the second right-eye image (R2) preserving the other one of the even or odd row section image of the right-eye image (R), and the other row sections of this image are black pictures,

and the displayed row sections of the first image resulting from splitting the right-eye (R) or left-eye image (L) are complementary in format to those of the second image resulting from splitting the other of right-eye or left-eye image, so that, if the second left-eye image preserves the even row sections of the left-eye image, then the first right-eye image shall preserve the odd row sections of the right-eye image;
output the first left-eye image (L1), the second left-eye image (L2), the first right-eye image (R1) and the second right-eye image (R2) by scanning sequentially the obtained first and second left-eye images (L1, L2) and first and second right-eye images (R1, R2) according to division of a backlight source (61) and a liquid crystal panel (62) of which horizontal row sections are pre-divided and according to the format and sequential order in which the images are output;

wherein said process of scanning sequentially the obtained first and second left-eye images (L1, L2) and first and second right-eye images (R1, R2) according to division of the backlight source (61) and the liquid crystal panel (62) of which horizontal row sections are pre-divided and according to the format and sequential order in which the images are output comprises the steps of:

determining that the images are obtained in an order of firstly the left-eye images (L1, L2) and then the right-eye images (R1, R2) or firstly the right-eye images (R1, R2) and then the left-eye images (L1, L2), wherein the left-eye images include the first left-eye image (L1) preserving the odd row section image and the second left-eye image (L2) preserving complementarily the even row section image;
or
determining that the images are obtained in an order of firstly the left-eye images (L1, L2) and then the right-eye images (R1, R2) or firstly the right-eye images (R1, R2) and then the left-eye images (L1, L2), wherein the left-eye images include the first left-eye image (L1) preserving the even row section image and the second left-eye image (L2) preserving complementarily the odd row section image;
after having scanned a row section of an image of the obtained first and second left-eye images (L1, L2) and first and second right-eye images (R1, R2) starting with the first row of the first left-eye image (L1), sequentially scanning the second left-eye image (L2), the first right-eye image (R1) and the second right-eye image (R2) according to the determined order,
controlling an initialized backlight of said row section to be turned on and then turned off until the next image preserving the same rows of the scanned image starts to be scanned, and repeating the scanning until all sections of all images are scanned.

2. The method according to claim 1, wherein after scanning the row section of the image, the method specifically comprises:

after scanning the row section of the image, controlling the initialized backlight of the row section to be turned on; or
after scanning the row section of the preserved image, controlling the initialized backlight of the row section to be turned on with a delay time t, the delay time t satisfying the expression $t \leq (N-1)/N^*T$, wherein T represents a time period of one frame, and N represents the number of horizontal row sections into which the backlight source and the liquid crystal panel are divided.

3. The method according to any one of claims 1 to 2, further comprising: controlling in cooperation with a pair of shutter glasses (13, 16) a left eyeglass (131, 161) of the pair of shutter glasses to be open and a right eyeglass (132, 162) to be closed when the scanning image is the left-eye image (L) being split in the first left-eye image (L1) and the second left-eye image (L2); and controlling the right eyeglass (132, 162) of the pair of shutter glasses to be open and the left eyeglass (131, 161) to be closed when the scanning image is the right-eye image (R) being split in the first right-eye image (R1) and the second right-eye image (R2).

4. The method according to any one of claims 1 to 2, further comprising:

scanning the images in cooperation with an active polarization light valve (14); and
controlling the active polarization light valve (14) to be open when the scanning image is the left-eye image (L); and
controlling the active polarization light valve (14) to be closed when the scanning image is the right-eye image (R); or
controlling the active polarization light valve (14) to be open when the scanning image is the right-eye image (r); and
controlling the active polarization light valve (14) to be closed when the scanning image is the left-eye image (L).

5. A backlight control apparatus for a liquid crystal panel (62), **characterized in that** the apparatus comprises:

an obtaining unit (3) configured to obtain and

preprocess 3D data images including a right-eye image (R) and a left-eye image (L), whereby the apparatus is adapted to split the left-eye image (L) into two images, where the first image is the first left-eye image (L1) preserving the odd or even row section image of the left-eye image (L), and the other row sections of this image are black pictures; and the second image is the second left-eye image (L2) preserving the other one of the even or odd row section image of the left-eye image (L), and the other row sections of this image are black pictures, the backlight control apparatus further being adapted to split the right-eye image (R) into two images, where the first image is the first right-eye image (R1) preserving the odd or even row section image of the right-eye image (R), and the other row sections of this image are black pictures; and the second image is the second right-eye image (R2) preserving the other one of the even or odd row section image of the right-eye image (R), and the other row sections of this image are black pictures,
wherein the displayed row sections of the first image resulting from splitting the right-eye (R) or left-eye image (L) are complementary in format to those of the second image resulting from splitting the other of right-eye or left-eye image, so that, if the second left-eye image preserves the even row sections of the left-eye image, then the first right-eye image shall preserve the odd row sections of the right-eye image;
the backlight control apparatus further being adapted to output the first left-eye image (L1), the second left-eye image (L2), the first right-eye image (R1) and the second right-eye image (R2),
the backlight control apparatus further comprising a scanning control unit (4) configured to scan sequentially the obtained first and second left-eye images (L1, L2) and first and second right-eye images (R1, R2) according to division of a backlight source (61) and a liquid crystal panel (62) of which horizontal row sections are pre-divided and according to the format and sequential order in which the images are output;

wherein the scanning control unit (4) comprises:

a determining module (41) configured to determine the format and sequential order in which the obtained first and second left-eye (L1, L2) and right-eye images (R1, R2) are output; and
a scanning control module (42) configured to scan each image sequentially in a top to bottom manner in the order determined by the determining module (41) according to the division of backlight source (61) and the liquid crystal panel (62) of which the horizontal row sections are pre-divided, until all images are scanned;
wherein the determining module (41) is further configured to:

determine that the images are obtained in an order of firstly the left-eye images (L1, L2) and then the right-eye images (R1, R2) or firstly the right-eye images (R1, R2) and then the left-eye images (L1, L2), wherein the left-eye images include the first left-eye image (L1) preserving the odd row section image and the second left-eye image (L2) preserving complementarily the even row section image
or
determine that the images are obtained in an order of firstly the left-eye images (L1, L2) and then the right-eye images (R1, R2) or firstly the right-eye images (R1, R2) and then the left-eye images (L1, L2), wherein the left-eye images include the first left-eye image (L1) preserving the even row section image and the second left-eye image (L2) preserving complementarily the odd row section image;

wherein the backlight control apparatus further comprises:

a backlight control unit (5) configured to, after having scanned a row section of an image of the obtained first and second left-eye images (L1, L2) and first and second right-eye images (R1, R2), starting with the first row of the first left-eye image (L1), sequentially scanning the second left-eye image (L2), the first right-eye image (R1) and the second right-eye image (R2) according to the determined order,
to control an initialized backlight of the said section to be turned on and then turned off until the next image preserving the same rows of the scanned image starts to be scanned, and to repeat the scanning until all the sections of all images are scanned.

6. The apparatus according to claim 5, further comprising:

a first backlight control unit, in cooperation with a pair of shutter glasses (13, 16), configured to control a left eyeglass (131, 161) of the pair of shutter glasses to be open and a right eyeglass (132, 162) to be closed when the scanning image is the left-eye image (L) being split in the first left-eye image (L1) and the second left-eye image (L2); and to control the right eyeglass (132, 162) of the pair of shutter glasses to be open and the left eyeglass (131, 161) to be closed when the scanning image is the right-eye image (R) being split in the first right-eye image (R1) and the second right-eye image (R2).

7. A 3D display system comprising a display device (6) and 3D glasses (13, 16), wherein the system further comprises the backlight control apparatus according to claim 5.

Patentansprüche

1. Verfahren zum Steuern einer Hintergrundbeleuchtungseinheit eines Flüssigkristallfelds (62), **dadurch gekennzeichnet, dass** das Verfahren die folgenden Schritte umfasst:

Gewinnen und Vorverarbeiten von 3D-Daten-Bildern, von denen jedes ein Bild für das rechte Auge (R) und ein Bild für das linke Auge (L) beinhaltet, wobei das Bild für das linke Auge (L) in zwei Bilder aufgeteilt ist, wobei es sich bei dem ersten Bild um das erste Bild für das linke Auge (L1) handelt, welches das Bild der ungeradzahligen oder der geradzahligen Zeilenteile des Bilds für das linke Auge (L) beibehält, und die anderen Zeilenteile dieses Bilds schwarze Abbildungen sind; und wobei es sich bei dem zweiten Bild um das zweite Bild für das linke Auge (L2) handelt, welches das andere aus dem Bild der geradzahligen oder der ungeradzahligen Zeilenteile des Bilds für das linke Auge (L) beibehält, und die anderen Zeilenteile dieses Bilds schwarze Abbildungen sind,
wobei das Bild für das rechte Auge (R) in zwei Bilder aufgeteilt ist, wobei es sich bei dem ersten Bild um das erste Bild für das rechte Auge (R1) handelt, welches das Bild der ungeradzahligen oder der geradzahligen Zeilenteile des Bilds für das rechte Auge (R) beibehält, und die anderen Zeilenteile dieses Bilds schwarze Abbildungen sind; und wobei es sich bei dem zweiten Bild um das zweite Bild für das rechte Auge (R2) handelt, welches das andere aus dem Bild der geradzahligen oder der ungeradzahligen Zeilenteile des Bilds für das rechte Auge (R) beibehält, und die anderen Zeilenteile dieses Bilds schwarze Abbildungen sind,
wobei die angezeigten Zeilenteile des ersten Bilds, das aus dem Aufteilen des Bilds für das rechte Auge (R) oder des Bilds für das linke Auge (L) resultiert, im Format komplementär zu jenen des zweiten Bilds sind, das aus dem Aufteilen des anderen aus dem Bild für das rechte Auge oder das linke Auge resultiert, so dass, wenn das zweite Bild für das linke Auge die geradzahligen Zeilenteile des Bilds für das linke Auge beibehält, das erste Bild für das rechte Auge die ungeradzahligen Zeilenteile des Bilds für das rechte Auge beibehält;
Ausgeben des ersten Bilds für das linke Auge (L1), des zweiten Bilds für das linke Auge (L2), des ersten Bilds für das rechte Auge (R1) und des zweiten Bilds für das rechte Auge (R2) durch sequenzielles Abtasten des erhaltenen ersten und zweiten Bilds für das linke Auge (L1, L2) und des ersten und zweiten Bilds für das rechte Auge (R1, R2) gemäß der Unterteilung einer Hintergrundbeleuchtungsquelle (61) und eines Flüssigkristallfelds (62), dessen horizontale Zeilenteile vorgeteilt sind, und gemäß dem Format und der sequenziellen Reihenfolge, in der die Bilder ausgegeben werden;
wobei der Vorgang des sequenziellen Abtastens des erzielten ersten und zweiten Bilds für das linke Auge (L1, L2) und des ersten und zweiten Bilds für das rechte Auge (R1, R2) gemäß der Unterteilung der Hintergrundbeleuchtungsquelle (61) und des Flüssigkristallfelds (62), dessen horizontale Zeilenteile vorgeteilt sind, und gemäß dem Format und der sequenziellen Reihenfolge, in der die Bilder ausgegeben werden, die folgenden Schritte umfasst:

Bestimmen, dass die Bilder in der folgenden Reihenfolge gewonnen werden: zuerst die Bilder für das linke Auge (L1, L2) und anschließend die Bilder für das rechte Auge (R1, R2) oder zuerst die Bilder für das rechte Auge (R1, R2) und anschließend die Bilder für das linke Auge (L1, L2), wobei die Bilder für das linke Auge Folgendes beinhalten: das erste Bild für das linke Auge (L1), welches das Bild der ungeradzahligen Zeilenteile beibehält, und das zweite Bild für das linke Auge (L2), welches auf komplementäre Weise das Bild der geradzahligen Zeilenteile beibehält;
oder
Bestimmen, dass die Bilder in der folgenden Reihenfolge gewonnen werden: zuerst die Bilder für das linke Auge (L1, L2) und anschließend die Bilder für das rechte Auge (R1, R2) oder zuerst die Bilder für das rechte Auge (R1, R2) und anschließend die Bilder für das linke Auge (L1, L2), wobei die Bilder für das linke Auge Folgendes beinhalten: das erste Bild für das linke Auge (L1), welches das Bild der geradzahligen Zeilenteile beibehält, und das zweite Bild für das linke Auge (L2), welches auf komplementäre Weise das Bild der ungeradzahligen Zeilenteile beibehält;
nach dem Abtasten eines Zeilenteils eines Bilds aus dem gewonnenen ersten und zweiten Bild für das linke Auge (L1, L2) und

dem ersten und zweiten Bild für das rechte Auge (R1, R2) beginnend mit der ersten Zeile des ersten Bilds für das linke Auge (L1) sequenzielles Abtasten des zweiten Bilds für das linke Auge (L2), des ersten Bilds für das rechte Auge (R1) und des zweiten Bilds für das rechte Auge (R2) gemäß der bestimmten Reihenfolge,

Steuern einer initialisierten Hintergrundbeleuchtung des Zeilenteils, so dass diese eingeschaltet und anschließend ausgeschaltet wird, bis die Abtastung des nächsten Bilds beginnt, das die gleichen Zeilen des abgetasteten Bilds beibehält, und Wiederholen der Abtastung, bis alle Teile aller Bilder abgetastet sind.

2. Verfahren nach Anspruch 1, wobei das Verfahren nach dem Abtasten des Zeilenteils des Bilds spezifisch Folgendes umfasst:

nach dem Abtasten des Zeilenteils des Bilds derartiges Steuern der initialisierten Hintergrundbeleuchtung des Zeilenteils, dass diese eingeschaltet wird; oder

nach dem Abtasten des Zeilenteils des beibehaltenen Bilds derartiges Steuern der initialisierten Hintergrundbeleuchtung des Zeilenteils, dass diese mit einer Verzögerungszeit t eingeschaltet wird,

wobei die Verzögerungszeit t den Ausdruck $t \leq (N-1)/N*T$ erfüllt, wobei T für eine Zeitdauer eines Rahmens steht und N für die Anzahl der horizontalen Zeilenteile steht, in welche die Hintergrundbeleuchtungsquelle und das Flüssigkristallfeld unterteilt sind.

3. Verfahren nach einem der Ansprüche 1 bis 2, ferner umfassend: in Zusammenarbeit mit einer Verschluss-Brille (13, 16) derartiges Steuern eines linken Brillenglases (131, 161) der Verschluss-Brille, dass dieses offen ist, und eines rechten Brillenglases (132, 162), dass dieses geschlossen ist, wenn das Abtastbild das Bild für das linke Auge (L) ist, das in das erste Bild für das linke Auge (L1) und das zweite Bild für das linke Auge (L2) aufgeteilt ist; und derartiges Steuern des rechten Brillenglases (132, 162) der Verschluss-Brille, dass dieses offen ist, und des linken Brillenglases (131, 161), dass dieses geschlossen ist, wenn das Abtastbild das Bild für das rechte Auge (R) ist, das in das erste Bild für das rechte Auge (R1) und das zweite Bild für das rechte Auge (R2) aufgeteilt ist.

4. Verfahren nach einem der Ansprüche 1 bis 2, ferner umfassend:

Abtasten der Bilder in Zusammenarbeit mit einem aktiven Polarisationslichtventil (14); und

Steuern des aktiven Polarisationslichtventils (14), so dass dieses offen ist, wenn das Abtastbild das Bild für das linke Auge (L) ist; und

Steuern des aktiven Polarisationslichtventils (14), so dass dieses geschlossen ist, wenn das Abtastbild das Bild für das rechte Auge (R) ist; oder

Steuern des aktiven Polarisationslichtventils (14), so dass dieses offen ist, wenn das Abtastbild das Bild für das rechte Auge (R) ist; und

Steuern des aktiven Polarisationslichtventils (14), so dass dieses geschlossen ist, wenn das Abtastbild das Bild für das linke Auge (L) ist.

5. Vorrichtung zum Steuern einer Hintergrundbeleuchtung für ein Flüssigkristallfeld (62), **dadurch gekennzeichnet, dass** die Vorrichtung Folgendes umfasst:

eine Gewinnungseinheit (3), die dafür ausgelegt ist, 3D-Daten-Bilder zu gewinnen und vorzuverarbeiten, die ein Bild für das rechte Auge (R) und ein Bild für das linke Auge (L) beinhalten, wobei die Vorrichtung dafür geeignet ist, das Bild für das linke Auge (L) in zwei Bilder aufzuteilen, wobei es sich bei dem ersten Bild um das erste Bild für das linke Auge (L1) handelt, welches das Bild der ungeradzahligen oder der geradzahligen Zeilenteile des Bilds für das linke Auge (L) beibehält, und die anderen Zeilenteile dieses Bilds schwarze Abbildungen sind; und wobei es sich bei dem zweiten Bild um das zweite Bild für das linke Auge (L2) handelt, welches das andere aus dem Bild der geradzahligen oder der ungeradzahligen Zeilenteile des Bilds für das linke Auge (L) beibehält, und die anderen Zeilenteile dieses Bilds schwarze Abbildungen sind, wobei die Vorrichtung zum Steuern der Hintergrundbeleuchtung ferner dafür geeignet ist, das Bild für das rechte Auge (R) in zwei Bilder aufzuteilen, wobei es sich bei dem ersten Bild um das erste Bild für das rechte Auge (R1) handelt, welches das Bild der ungeradzahligen oder der geradzahligen Zeilenteile des Bilds für das rechte Auge (R) beibehält, und die anderen Zeilenteile dieses Bilds schwarze Abbildungen sind; und wobei es sich bei dem zweiten Bild um das zweite Bild für das rechte Auge (R2) handelt, welches das andere aus dem Bild der geradzahligen oder der ungeradzahligen Zeilenteile des Bilds für das rechte Auge (R) beibehält, und die anderen Zeilenteile dieses Bilds schwarze Abbildungen sind,

wobei die angezeigten Zeilenteile des ersten Bilds, das aus dem Aufteilen des Bilds für das rechte Auge (R) oder des Bilds für das linke Auge (L) resultiert, im Format komplementär zu je-

nen des zweiten Bilds sind, das aus dem Aufteilen des anderen aus dem Bild für das rechte Auge oder für das linke Auge resultiert, so dass, wenn das zweite Bild für das linke Auge die geradzahligen Zeilenteile des Bilds für das linke Auge beibehält, das erste Bild für das rechte Auge die ungeradzahligen Zeilenteile des Bilds für das rechte Auge beibehält;
wobei die Vorrichtung zum Steuern der Hintergrundbeleuchtung ferner dafür geeignet ist, das erste Bild für das linke Auge (L1), das zweite Bild für das linke Auge (L2), das erste Bild für das rechte Auge (R1) und das zweite Bild für das rechte Auge (R2) auszugeben,
wobei die Vorrichtung zum Steuern der Hintergrundbeleuchtung ferner eine Abtaststeuerungseinheit (4) umfasst, die dafür ausgelegt ist, das erhaltene erste und zweite Bild für das linke Auge (L1, L2) und das erste und zweite Bild für das rechte Auge (R1, R2) gemäß der Unterteilung einer Hintergrundbeleuchtungsquelle (61) und eines Flüssigkristallfelds (62), dessen horizontale Zeilenteile vorgeteilt sind, und gemäß dem Format und der sequenziellen Reihenfolge, in der die Bilder ausgegeben werden, sequenziell abzutasten;
wobei die Abtaststeuerungseinheit (4) Folgendes umfasst:

ein Bestimmungsmodul (41), das dafür ausgelegt ist, das Format und die sequenzielle Reihenfolge zu bestimmen, in der die gewonnenen ersten und zweiten Bilder für das linke Auge (L1, L2) und das rechte Auge (R1, R2) ausgegeben werden; und
ein Abtaststeuerungsmodul (42), das dafür ausgelegt ist, jedes Bild sequenziell von oben nach unten in der durch das Bestimmungsmodul (41) bestimmten Reihenfolge gemäß der Unterteilung der Hintergrundbeleuchtungsquelle (61) und des Flüssigkristallfelds (62), dessen horizontale Zeilenteile vorgeteilt sind, abzutasten, bis alle Bilder abgetastet sind;

wobei das Bestimmungsmodul (41) ferner dafür ausgelegt ist:

zu bestimmen, dass die Bilder in der folgenden Reihenfolge gewonnen werden: zuerst die Bilder für das linke Auge (L1, L2) und anschließend die Bilder für das rechte Auge (R1, R2) oder zuerst die Bilder für das rechte Auge (R1, R2) und anschließend die Bilder für das linke Auge (L1, L2), wobei die Bilder für das linke Auge Folgendes beinhalten: das erste Bild für das linke Auge (L1), welches das Bild der ungeradzahligen Zeilenteile beibehält, und das zweite Bild für das linke Auge (L2), welches auf komplementäre Weise das Bild der geradzahligen Zeilenteile beibehält
oder
zu bestimmen, dass die Bilder in der folgenden Reihenfolge gewonnen werden: zuerst die Bilder für das linke Auge (L1, L2) und anschließend die Bilder für das rechte Auge (R1, R2) oder zuerst die Bilder für das rechte Auge (R1, R2) und anschließend die Bilder für das linke Auge (L1, L2), wobei die Bilder für das linke Auge Folgendes beinhalten: das erste Bild für das linke Auge (L1), welches das Bild der geradzahligen Zeilenteile beibehält, und das zweite Bild für das linke Auge (L2), welches auf komplementäre Weise das Bild der ungeradzahligen Zeilenteile beibehält;
wobei die Vorrichtung zum Steuern der Hintergrundbeleuchtung ferner Folgendes umfasst:

eine Hintergrundbeleuchtungs-Steuerungseinheit (5), die dafür ausgelegt ist, nach dem Abtasten eines Zeilenteils eines Bilds aus dem gewonnenen ersten und zweiten Bild für das linke Auge (L1, L2) und dem ersten und zweiten Bild für das rechte Auge (R1, R2) beginnend mit der ersten Zeile des ersten Bilds für das linke Auge (L1) das zweite Bild für das linke Auge (L2), das erste Bild für das rechte Auge (R1) und das zweite Bild für das rechte Auge (R2) gemäß der bestimmten Reihenfolge sequenziell abzutasten,
um eine initialisierte Hintergrundbeleuchtung des Teils derart zu steuern, dass diese eingeschaltet und anschließend ausgeschaltet wird, bis die Abtastung des nächsten Bilds beginnt, das die gleichen Zeilen des abgetasteten Bilds beibehält, und die Abtastung zu wiederholen, bis alle Teile aller Bilder abgetastet sind.

6. Vorrichtung nach Anspruch 5, ferner umfassend:

eine mit einer Verschluss-Brille (13, 16) zusammenwirkende erste Hintergrundbeleuchtungs-Steuerungseinheit, die dafür ausgelegt ist, ein linkes Brillenglas (131, 161) der Verschluss-Brille derart zu steuern, dass dieses offen ist, und ein rechtes Brillenglas (132, 162) derart zu steuern, dass dieses geschlossen ist, wenn das Abtastbild das Bild für das linke Auge (L) ist, das in das erste Bild für das linke Auge (L1) und das zweite Bild für das linke Auge (L2) aufgeteilt ist; und das rechte Brillenglas (132, 162) der Verschluss-Brille derart zu steuern, dass dieses offen ist, und das linke Brillenglas (131, 161) derart zu steuern, dass dieses geschlossen ist, wenn das Abtastbild das Bild für das rechte Auge (R) ist, das in das erste Bild für das rechte Auge (R1) und das zweite Bild für das rechte Auge (R2) aufgeteilt ist.

7. 3D-Anzeigesystem, umfassend eine Anzeigevorrichtung (6) und eine 3D-Brille (13, 16), wobei das System ferner die Vorrichtung zum Steuern der Hintergrundbeleuchtung nach Anspruch 5 umfasst.

Revendications

1. Procédé de contrôle d'une unité de rétroéclairage d'un panneau à cristaux liquides (62), **caractérisé en ce qu'**il comprend les étapes suivantes :

acquisition et prétraitement d'images de données en 3D dont chacune comprend une image pour l'oeil droit (R) et une image pour l'oeil gauche (L), l'image pour l'oeil gauche (L) étant divisée en deux images, la première image étant la première image pour l'oeil gauche (L1) qui conserve l'image des sections de lignes paires ou impaires de l'image pour l'oeil gauche (L), les autres sections de lignes de cette image étant des figures noires ; et la deuxième image étant la deuxième image pour l'oeil gauche (L2) qui conserve l'autre image de sections de lignes impaires ou paires de l'image pour l'oeil gauche (L), les autres sections de lignes de cette image étant des figures noires,
l'image pour l'oeil droit (R) étant divisée en deux images, la première image étant la première image pour l'oeil droit (R1) qui conserve l'image des sections de lignes paires ou impaires de l'image pour l'oeil droit (R), les autres sections de lignes de cette image étant des figures noires ; et la deuxième image étant la deuxième image pour l'oeil droit (R2) qui conserve l'autre image des sections de lignes impaires ou paires de l'image pour l'oeil droit (R), les autres sections de lignes de cette image étant des figures noires,
et les sections de lignes affichées de la première image résultant de la division des l'image pour l'oeil droit (R) ou l'oeil gauche (L) ayant un format complémentaire de celles de la deuxième image résultant de la division de l'autre image pour l'oeil droit ou l'oeil gauche de sorte que, si la deuxième image pour l'oeil gauche conserve les sections de lignes paires de l'image pour l'oeil gauche, la première image pour l'oeil droit conservera les sections de lignes impaires de l'image pour l'oeil droit ;
émission en sortie de la première image pour l'oeil gauche (L1), de la deuxième image pour l'oeil gauche (L2), de la première image pour l'oeil droit (R1) et de la deuxième image pour l'oeil droit (R2) par balayage successif des première et deuxième images pour l'oeil gauche (L1, L2) et des première et deuxième images pour l'oeil droit (R1, R2) acquises selon une division d'une source de rétroéclairage (61) et d'un panneau de cristaux liquides (62) dont des sections de lignes horizontales sont pré-divisées et selon le format et l'ordre de succession dans lequel les images sont émises en sortie ;
dans lequel ledit procédé de balayage successif des première et deuxième images pour l'oeil gauche (L1, L2) et des première et deuxième images pour l'oeil droit (R1, R2) acquises selon la division de la source de rétroéclairage (61) et du panneau de cristaux liquides (62) dont des sections de lignes horizontales sont pré-divisées et selon le format et l'ordre de succession dans lequel les images sont émises en sortie comprend les étapes suivantes :
détermination du fait que les images sont acquises dans l'ordre de, premièrement, les images pour l'oeil gauche (L1, L2) puis les images pour l'oeil droit (R1, R2) ou premièrement les images pour l'oeil droit (RI, R2) puis les images pour l'oeil gauche (L1, L2), les images pour l'oeil gauche incluant la première image pour l'oeil gauche (L1) qui conserve l'image des sections de lignes impaires et la deuxième image pour l'oeil gauche (L2) qui conserve, de façon complémentaire, l'image des sections de lignes paires ;
ou
détermination du fait que les images sont acquises dans l'ordre de, premièrement, les images pour l'oeil gauche (L1, L2) puis les images pour l'oeil droit (R1, R2) ou premièrement les images pour l'oeil droit (R1, R2) puis les images pour l'oeil gauche (L1, L2), les images pour l'oeil gauche incluant la première image pour l'oeil gauche (L1) qui conserve l'image des sections de lignes paires et la deuxième image pour l'oeil gauche (L2) qui conserve, de façon complémentaire, l'image des sections de lignes impaires ;
après le balayage d'une section de lignes d'une image des première et deuxième images pour l'oeil gauche (L1, L2) et des première et deuxième images pour l'oeil droit (R1, R2) acquises, en partant de la première ligne de la première image pour l'oeil gauche (L1), balayage successif de la deuxième image pour l'oeil gauche (L2), de la première image pour l'oeil droit (R1) et de la deuxième image pour l'oeil droit (R2) selon l'ordre déterminé,

commande d'allumage puis d'extinction d'un rétroéclairage initialisé de ladite section de lignes jusqu'à ce que l'image suivante conservant les mêmes lignes de l'image balayée commence à être balayée, et répétition du balayage jusqu'à ce que toutes les sections de toutes les images soient balayées.

2. Procédé selon la revendication 1 dans lequel, après le balayage de la section de lignes de l'image, le procédé comprend spécifiquement :

après le balayage de la section de lignes de l'image, la commande d'allumage du rétroéclairage initialisé de la section de lignes ou
après le balayage de la section de lignes de l'image conservée, la commande d'allumage du rétroéclairage initialisé de la section de lignes avec un temps de retard t,
le temps de retard t satisfaisant l'expression $t \leq (N\text{-}1)/N^*T$, où T représente un intervalle de temps d'une trame et N représente le nombre de sections de lignes horizontales dans lequel la source de rétroéclairage et le panneau de cristaux liquides sont divisés.

3. Procédé selon l'une quelconque des revendications 1 à 2, comprenant en outre la commande, en coopération avec une paire de verres de lunettes à obturateurs (13, 16), de l'ouverture d'un verre pour l'oeil gauche (131, 161) de la paire de verres de lunettes à obturateurs et l'obturation d'un verre pour l'oeil droit (132, 162) quand l'image balayée est l'image pour l'oeil gauche (L) divisée en la première image pour l'oeil gauche (L1) et la deuxième image pour l'oeil gauche (L2), et la commande d'ouverture du verre pour l'oeil droit (132, 162) de la paire de verres de lunettes à obturateurs et l'obturation du verre pour l'oeil gauche (131, 161) quand l'image balayée est l'image pour l'oeil droit (R) divisée en la première image pour l'oeil droit (R1) et la deuxième image pour l'oeil droit (R2).

4. Procédé selon l'une quelconque des revendications 1 à 2, comprenant en outre :

le balayage des images en coopération avec un modulateur de lumière à polarisation active (14) ; et
la commande de l'ouverture du modulateur de lumière à polarisation active (14) quand l'image balayée est l'image pour l'oeil gauche (L) ; et
la commande de la fermeture du modulateur de lumière à polarisation active (14) quand l'image balayée est l'image pour l'oeil droit (R) ; ou
la commande de l'ouverture du modulateur de lumière à polarisation active (14) quand l'image balayée est l'image pour l'oeil droit (R) ; et
la commande de la fermeture du modulateur de lumière à polarisation active (14) quand l'image balayée est l'image pour l'oeil gauche (L).

5. Appareil pour le contrôle du rétroéclairage d'un panneau à cristaux liquides (62), **caractérisé en ce qu'**il comprend :

une unité d'acquisition (3) configurée pour acquérir et prétraiter des images de données en 3D comprenant une image pour l'oeil droit (R) et une image pour l'oeil gauche (L), l'appareil étant adapté pour diviser l'image pour l'oeil gauche (L) en deux images, la première image étant la première image pour l'oeil gauche (L1) qui conserve l'image des sections de lignes paires ou impaires de l'image pour l'oeil gauche (L), les autres sections de lignes de cette image étant des figures noires ; et la deuxième image étant la deuxième image pour l'oeil gauche (L2) qui conserve l'autre image de sections de lignes impaires ou paires de l'image pour l'oeil gauche (L), les autres sections de lignes de cette image étant des figures noires, l'appareil de contrôle du rétroéclairage étant en outre adapté pour diviser l'image pour l'oeil droit (R) en deux images, la première étant la première image pour l'oeil droit (R1) qui conserve l'image des sections de lignes impaires ou paires de l'image pour l'oeil droit (R), les autres sections de lignes de cette image étant des figures noires ; et la deuxième image étant la deuxième image pour l'oeil droit (R2) qui conserve l'autre image des sections de lignes paires ou impaires de l'image pour l'oeil droit (R), les autres sections de lignes de cette image étant des figures noires,
les sections de lignes affichées de la première image résultant de la division des l'image pour l'oeil droit (R) ou l'oeil gauche (L) ayant un format complémentaire de celles de la deuxième image résultant de la division de l'autre image pour l'oeil droit ou l'oeil gauche de sorte que, si la deuxième image pour l'oeil gauche conserve les sections de lignes paires de l'image pour l'oeil gauche, la première image pour l'oeil droit conservera les sections de lignes impaires de l'image pour l'oeil droit ;

l'appareil de contrôle du rétroéclairage étant en outre adapté pour émettre en sortie la première image pour l'oeil gauche (L1), la deuxième image pour l'oeil gauche (L2), la première image pour l'oeil droit (R1) and la deuxième image pour l'oeil droit (R2),
l'appareil de contrôle du rétroéclairage comprenant en outre une unité de contrôle du balayage (4) configurée pour balayer successivement les première et deuxième images pour l'oeil gauche (L1, L2) et les première et deuxième images pour l'oeil droit

(R1, R2) acquises selon la division d'une source de rétroéclairage (61) et d'un panneau de cristaux liquides (62) dont des sections de lignes horizontales sont pré-divisées et selon le format et l'ordre de succession dans lequel les images sont émises en sortie ;
l'unité de contrôle du balayage (4) comprenant :

un module de détermination (41) configuré pour déterminer le format et l'ordre de succession dans lequel les premières et deuxièmes images pour l'oeil droit (L1, L2) et pour l'oeil gauche (R1, R2) acquises sont émises en sortie ; et
un module de contrôle du balayage (42) configuré pour balayer chaque image successivement de haut en bas dans l'ordre déterminé par le module de détermination (41) selon la division de la source de rétroéclairage (61) et du panneau de cristaux liquides (62) dont les sections de lignes horizontales sont pré-divisées jusqu'à ce que toutes les images soient balayées ;

le module de détermination (41) étant en outre configuré pour :

déterminer que les images sont acquises dans l'ordre, premièrement, des images pour l'oeil gauche (L1, L2) puis des images pour l'oeil droit (R1, R2) ou premièrement des images pour l'oeil droit (R1, R2) puis des images pour l'oeil gauche (L1, L2), les images pour l'oeil gauche comprenant la première image pour l'oeil gauche (L1) qui conserve l'image des sections de lignes impaires et la deuxième image pour l'oeil gauche (L2) qui conserve l'image des sections de lignes paires complémentaire
ou
déterminer que les images sont acquises dans l'ordre, premièrement, des images pour l'oeil gauche (L1, L2) puis des images pour l'oeil droit (R1, R2) ou premièrement des images pour l'oeil droit (R1, R2) puis des images pour l'oeil gauche (L1, L2), les images pour l'oeil gauche comprenant la première image pour l'oeil gauche (L1) qui conserve l'image des sections de lignes impaires et la deuxième image pour l'oeil gauche (L2) qui conserve l'image des sections de lignes paires complémentaire,

l'appareil de contrôle du rétroéclairage comprenant en outre :

une unité de contrôle du rétroéclairage (5) configurée pour, après avoir balayé une section de lignes d'une image des première et deuxième images pour l'oeil gauche (L1, L2) et des première et deuxième images pour l'oeil droit (R1, R2) acquises, en commençant par la première ligne de la première image pour l'oeil gauche (L1), balayer successivement la deuxième image pour l'oeil gauche (L2), la première image pour l'oeil droit (R1) et la deuxième image pour l'oeil droit (R2) selon l'ordre déterminé,
afin de commander l'allumage puis l'extinction d'un rétroéclairage initialisé de ladite section jusqu'à ce que l'image suivante conservant les mêmes lignes de l'image balayée commence à être balayée, et de répéter l'acquisition jusqu'à ce que toutes les sections de toutes les images soient balayées.

6. Appareil selon la revendication 5, comprenant en outre :

une première unité de contrôle du rétroéclairage coopérant avec une paire de verres de lunettes à obturateurs (13, 16), configurée pour commander l'ouverture d'un verre pour l'oeil gauche (131, 161) de la paire de verres de lunettes à obturateurs et l'obturation d'un verre pour l'oeil droit (132, 162) quand l'image balayée est l'image pour l'oeil gauche (L) divisée en la première image pour l'oeil gauche (L1) et la deuxième image pour l'oeil gauche (L2) et pour commander l'ouverture du verre pour l'oeil droit (132, 162) de la paire de verres de lunettes à obturateurs et l'obturation de verre pour l'oeil gauche (131, 161) quand l'image balayée est l'image pour l'oeil droit (R) divisée en la première image pour l'oeil droit (R1) et la deuxième image pour l'oeil droit (R2).

7. Système d'affichage en 3D comprenant un dispositif d'affichage (6) et des lunettes 3D (13, 16), lequel système comprend en outre l'appareil de contrôle du rétroéclairage selon la revendication 5.

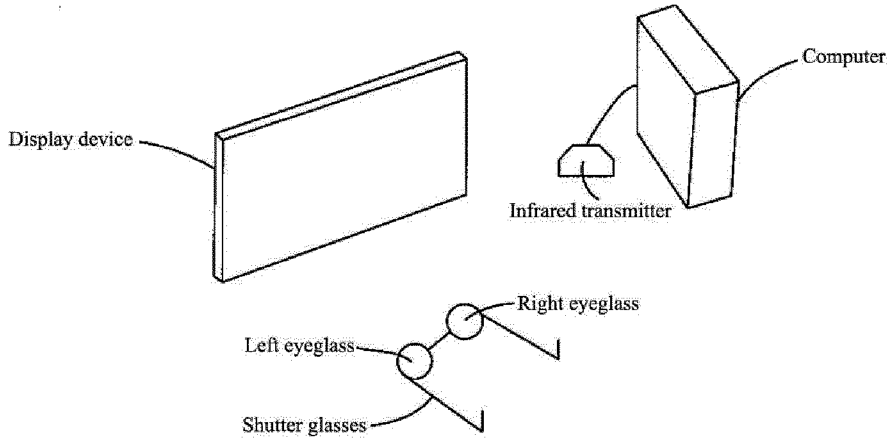
Computer
Display device
Infrared transmitter
Right eyeglass
Left eyeglass
Shutter glasses

Fig.1

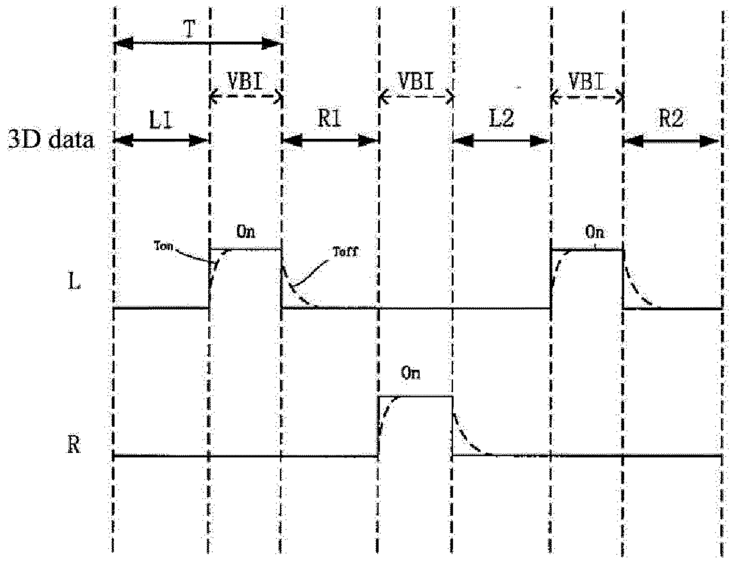
T
VBI
VBI
VBI
3D data
L1
R1
L2
R2
On
Ton
Toff
L
On
On
R

Fig.2

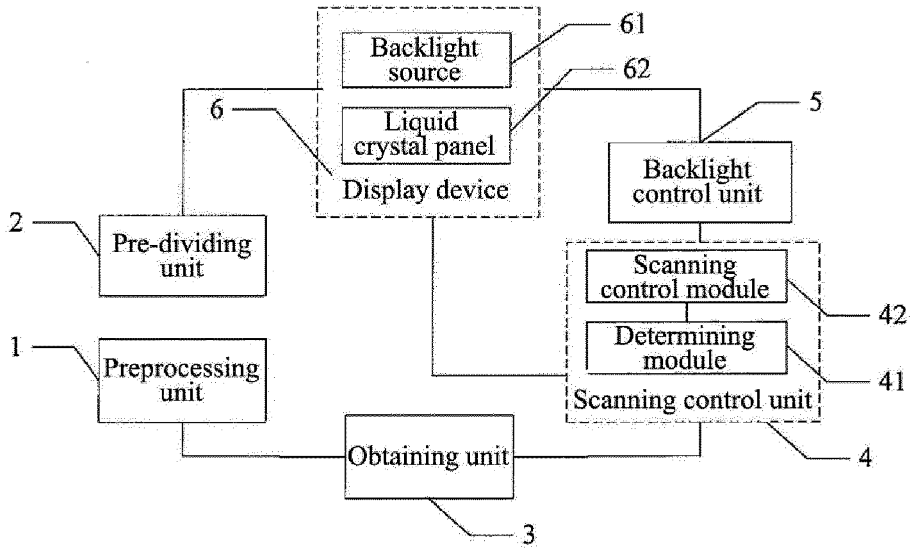
61
Backlight source
62
6
Liquid crystal panel
Display device
5
Backlight control unit
2
Pre-dividing unit
Scanning control module
42
1
Determining module
Preprocessing unit
41
Scanning control unit
Obtaining unit
4
3

Fig.3

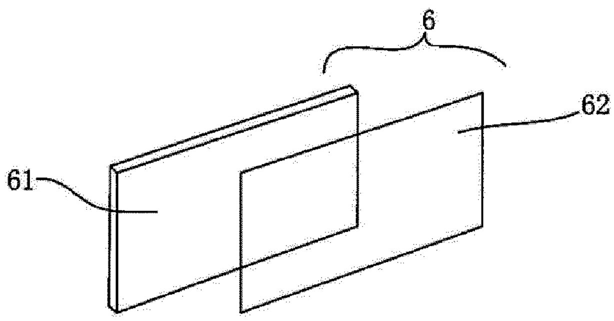
6
62
61

Fig.4

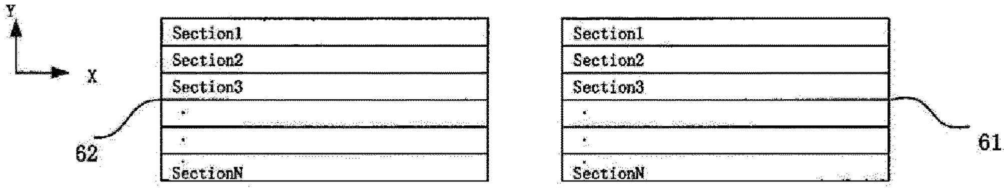

Fig.5

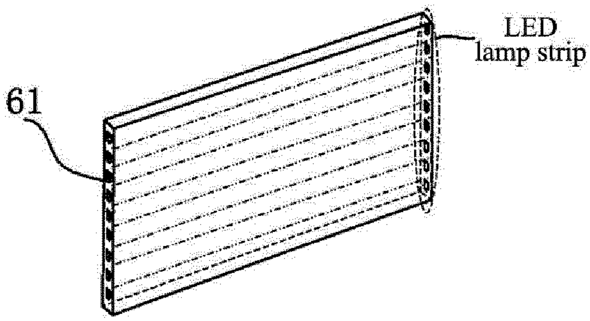

Fig.6

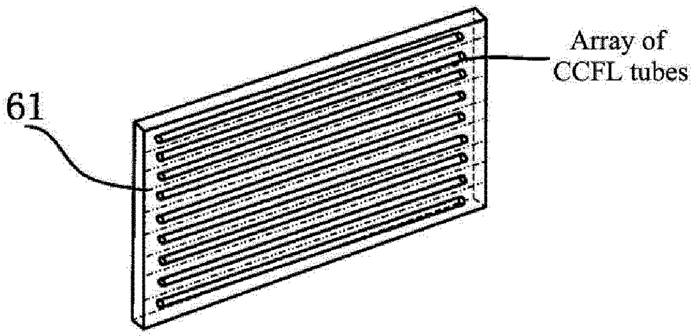

Fig.7

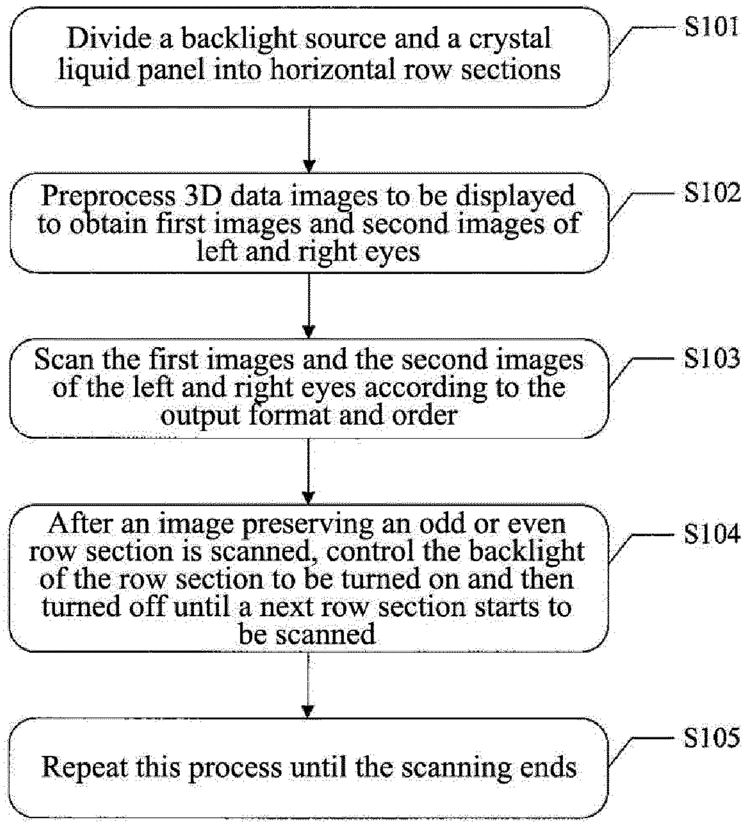
Divide a backlight source and a crystal liquid panel into horizontal row sections
S101
Preprocess 3D data images to be displayed to obtain first images and second images of left and right eyes
S102
Scan the first images and the second images of the left and right eyes according to the output format and order
S103
After an image preserving an odd or even row section is scanned, control the backlight of the row section to be turned on and then turned off until a next row section starts to be scanned
S104
Repeat this process until the scanning ends
S105

Fig.8

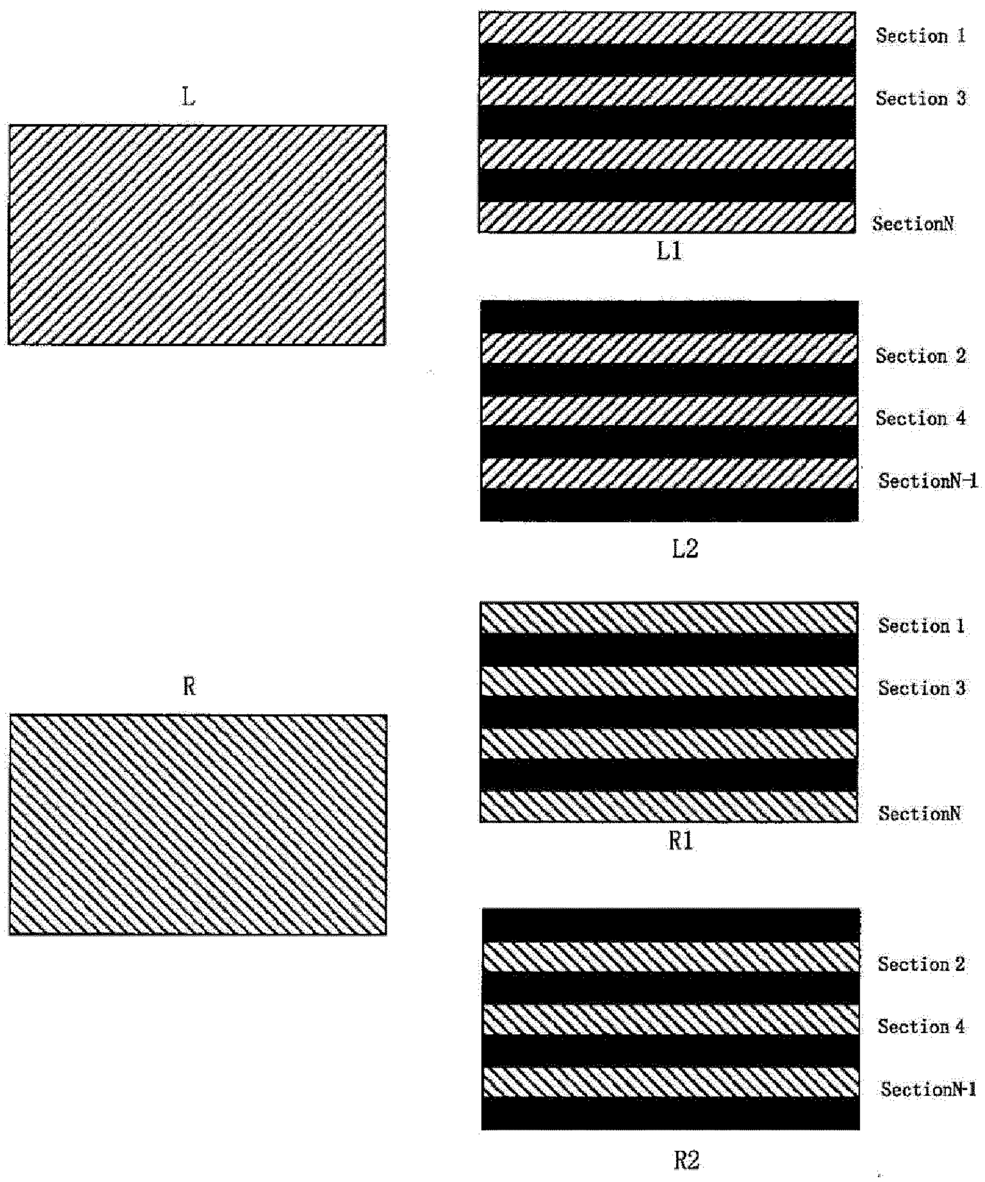
L
Section 1
Section 3
SectionN
L1
Section 2
Section 4
SectionN-1
L2
R
Section 1
Section 3
SectionN
R1
Section 2
Section 4
SectionN-1
R2

Fig.9

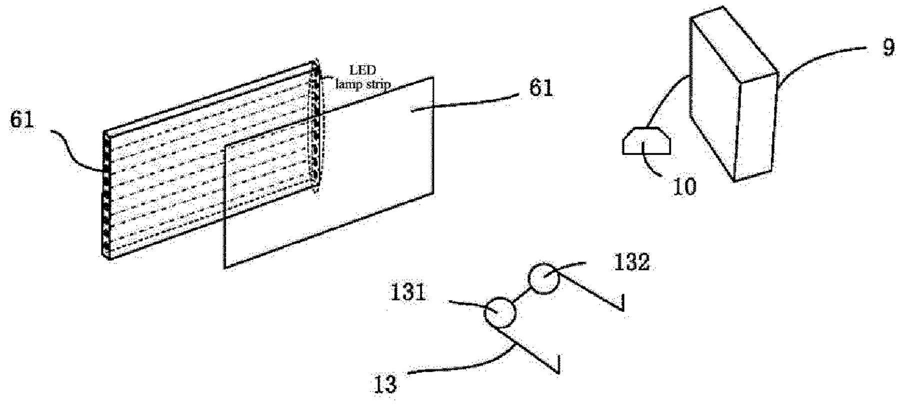

Fig.10

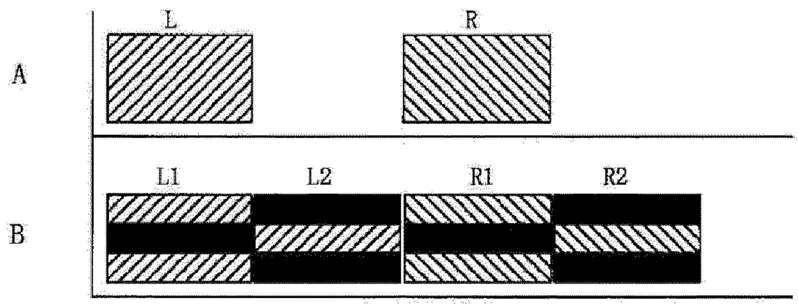

Fig.11

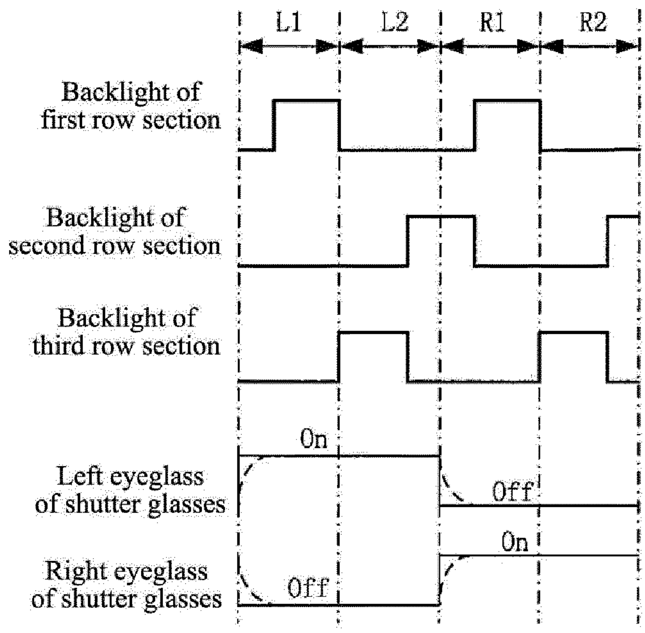
L1
L2
R1
R2
Backlight of first row section
Backlight of second row section
Backlight of third row section
On
Left eyeglass of shutter glasses
Off
On
Right eyeglass of shutter glasses
Off

Fig.12

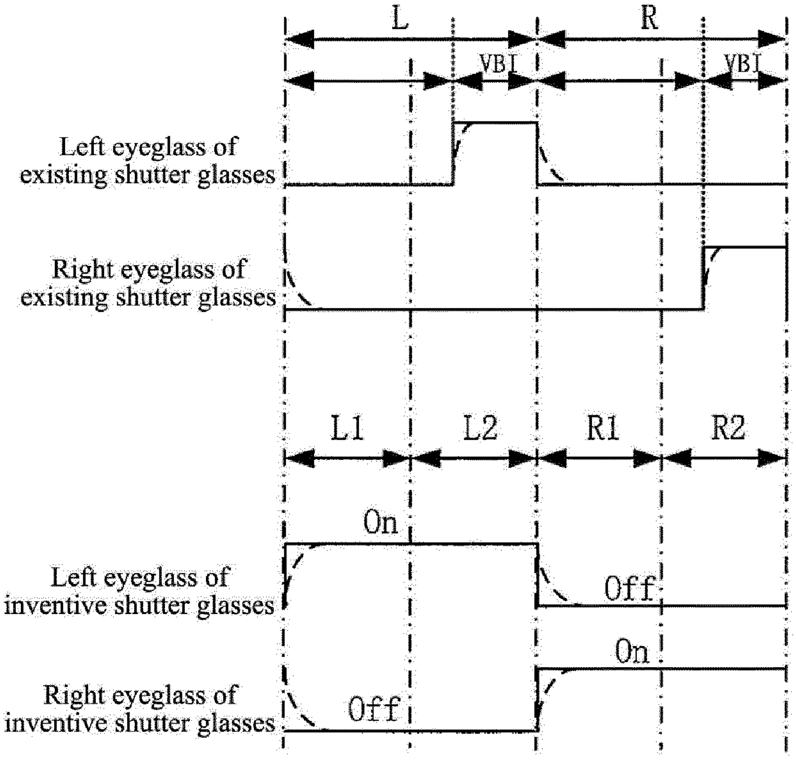
L
R
VBI
VBI
Left eyeglass of existing shutter glasses
Right eyeglass of existing shutter glasses
L1
L2
R1
R2
On
Left eyeglass of inventive shutter glasses
Off
On
Right eyeglass of inventive shutter glasses
Off

Fig.13

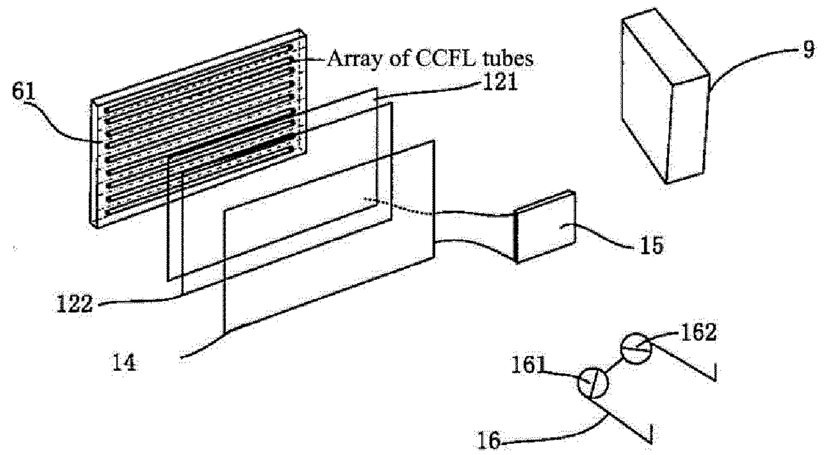
Array of CCFL tubes
61
121
9
15
122
14
162
161
16

Fig.14

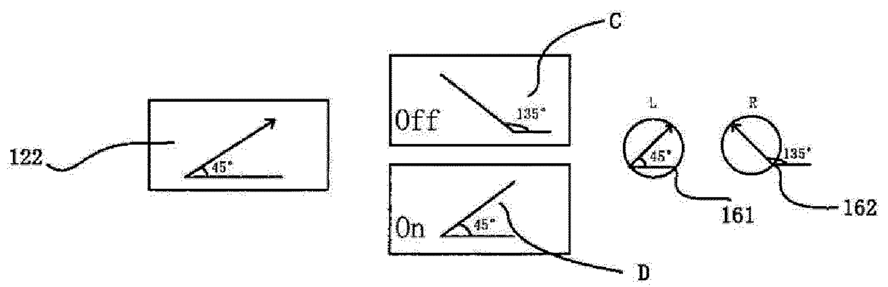
C
122
Off
135°
45°
On
45°
D
L
R
45°
135°
161
162

Fig.15

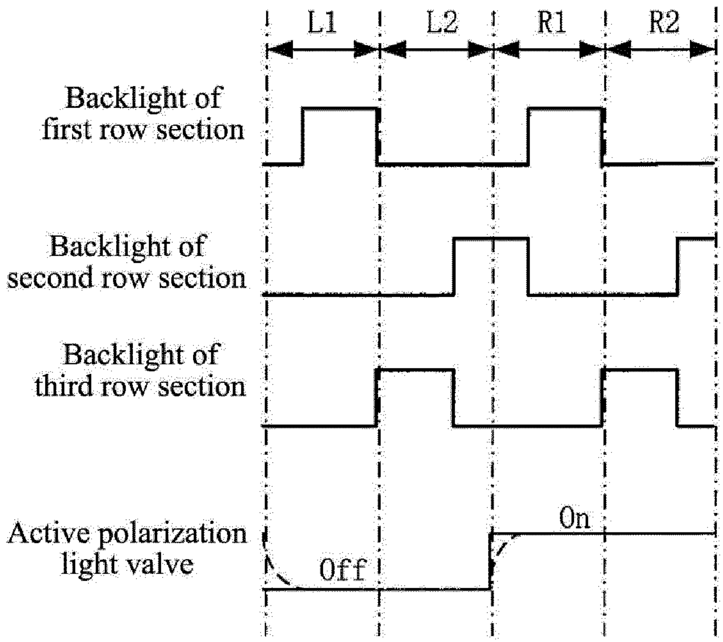
L1
L2
R1
R2
Backlight of first row section
Backlight of second row section
Backlight of third row section
Active polarization light valve
Off
On

Fig.16

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 201110113997 **[0001]**
- WO 2011029293 A1 **[0007]**
- CN 101697595 A **[0008]**

专利名称(译)	背光控制方法和装置，以及3D显示系统		
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[标]申请(专利权)人(译)	上海中航光电子有限公司		
申请(专利权)人(译)	上海中航光电科技LTD.		
当前申请(专利权)人(译)	上海中航光电科技LTD.		
[标]发明人	XING LIANG XU WEI XU LIHUA		
发明人	XING, LIANG XU, WEI XU, LIHUA		
IPC分类号	G09G3/36 G09G3/34 G09G3/00		
CPC分类号	G09G3/003 G09G3/342 G09G2310/0224 G09G2310/0237 G09G2310/024 G09G2320/0209 G09G2330/021 G02B30/34 G02F1/133602		
优先权	201110113997.8 2011-05-04 CN		
其他公开文献	EP2706524A1 EP2706524A4		
外部链接	Espacenet		

摘要(译)

本发明公开了一种背光控制方法，装置和3D显示系统，该方法包括：将相应的背光源和液晶面板分别分为N个水平行部分;预处理3D数据图像以分别获得以互补格式输出的左眼和右眼的第一图像和第二图像，其保留原始左眼图像和右眼图像的奇数和偶数行部分图像，并扫描第一图像和第二图像根据输出图像的格式和顺序，左眼和右眼从上到下依次排列;并且在扫描保留奇数或偶数行部分的图像之后，控制行部分的背光打开然后关闭，直到开始扫描保留奇数或偶数行部分的下一图像，并重复该过程直到扫描结束。利用本发明，与图像处理和显示相结合，对背光源的行部分进行动态控制，以实现无串扰的3D效果，并降低背光源和系统的功耗。