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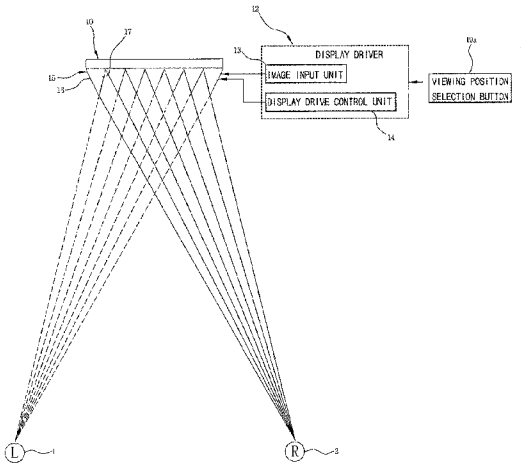
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(54) Title: THREE-DIMENSIONAL DISPLAY

[FIGURE 4]



(57) Abstract: Disclosed herein is a three-dimensional display which can create three-dimensional images more easily with simpler principle, process and configuration. Accordingly, the present invention provides a three-dimensional display for reproducing a three-dimensional effect in an optical image, the three-dimensional display including: an image display in which a plurality of pixels alternately displays image information for the left eye and image information for the right eye,- an image display driver for driving the image display so that the pixels of the image display alternately display the image information for the left eye and the image information for the right eye; a blocking display placed in front of the image display and alternately blocking light for the left eye and light for the right eye; and a blocking display driver for driving the blocking display to alternately block the light for the left eye and the light for the right eye in synchronization with the image display driver.

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【DESCRIPTION】

【Invention Title】

THREE-DIMENSIONAL DISPLAY

【Technical Field】

The present invention relates to a three-dimensional display and, more particularly, to a three-dimensional display which can create three-dimensional images by separating image information inputted to left and right eyes of a viewer.

【Background Art】

Three-dimensional images began in ancient Greece around 100 B.C. with three-dimensional pictures drawn according to the principles of perspective. Then, around 1600 A.D., Italian G. B. Della Porta introduced the first postcard bearing a three-dimensional image exhibiting binocular parallax, a phenomenon which makes the surface of a picture appear to project outward when viewed with both eyes. This sparked serious research into three-dimensional representation and its improvement, led by England's Charles Wheatstone, Scotland's David Brewster, American Wendell Holmse, etc. In 1903, F. E. Ives proposed a naked-eye stereogram using parallax barrier, and in 1918, American C. W. Kanolt proposed a parallax panoramagram which exploits

the eye's weakness of fixing on a certain visual point to generate a continuous three-dimensional image.

The development of three-dimensional image media goes beyond just the field of imaging. Due to its effectiveness in related industries, it has an effect on various fields from electronics and telecommunications to aerospace, visual art and automation, and it is anticipated that its technical spillover effect is higher than the High Definition Television (HDTV).

Owing to the above-mentioned early basic research, not only 3-D movies viewed through polarized glasses become commonplace, various methods for generating three-dimensional images, which are classified into a stereoscopic method and an autostereoscopic method, are becoming known.

Some technology has passed over the experimental stage and is actually being used in various fields such as 3D application imaging, 3D advertising, 3D television and video for the preservation and exhibition of cultural assets, computer vision, experiencing virtual reality, simulated training and operation, 3D video conferencing, 3D graphics, 3D video games, 3D movies, etc.

The main factors enabling humans to perceive three-dimensional objects and depth are biological factors of vision that stem from characteristics of the eye, as well as factors concerning psychology/memory that come from the

image on the retina, and non-visual factors (sense of hearing, smell, touch, etc.). Three-dimensional display technology can be grouped according to the methods of utilizing these factors. Various methods, in turn, are grouped based on how much information about a three-dimensional image they can provide to an observer through display. The main groups are depth imaging methods, 3D imaging methods, 3D object imaging methods, etc. Also, displayed images are classified as still images or moving images depending on whether they exhibit movements.

First, the "depth imaging methods" utilize psychological factors and an inhalation effect to give a three-dimensional feeling to a 2-dimensional image in the direction of depth rather than a flat display surface.

The former is commonly employed in three-dimensional computer graphics that display perspective, reiteration, shading, light and darkness, motion, etc. according to calculations. The latter is used, for example, in an IMAX movie technology for bringing about the three-dimensional effects by stimulating the field of vision with a large, wide-angle screen that makes the observer feel as if he or she were actually inside the image space.

Next, the "3D imaging methods" bring out information about the foreground and background of a display screen to give a three-dimensional feeling, by separately observing

objects by each of the left and right eyes from the directions corresponding to the left and right eyes.

Some 3D imaging methods require the use of special glasses and some do not. The former includes a stereoscopic method employing special glasses having different properties with respect to light wavelength and plane of polarization. The latter includes an autostereoscopic method that overlaps a display surface having strong directivity on the top of surface displaying images with parallax so that the images are separately observed by the left and right eyes to give the three-dimensional feeling.

The stereoscopic methods include a colored glasses (color modulation) method which has wavelength selectivity, a polarized glasses method which uses a polarization difference shadow effect, and a time-division glass method which alternately provides left and right images within the eye's afterimage time.

In addition, there is a method of disposing filters having different transmissivities over the left and right eyes to achieve the three-dimensional feeling with regard to the movement to the right or left based on a visual time difference brought about by the different transmissivities.

The above methods cannot be widely used because of the inconvenience of having to wear special glasses, public health concerns, adverse effects on the body, etc.

The autostereoscopic methods, which create a three-dimensional effect on the side of the display rather than the observer, include directional screening methods employing a parallax stereo method, a lenticular method, a corner cube mirror method, a holographic method, etc.

The depth imaging and the 3D imaging have some minor problems as methods of reproducing spatial images. Since only information on an object's front and rear (depth) is reproduced, an observer may be unable to observe an object from various viewing directions, or unable to bring a partially observed object into focus, etc.

Some "three-dimensional object imaging methods" which solve these problems include a depth full parallax method, a depth sampling method, a holographic display method, etc. Since the three-dimensional object imaging methods reproduce the image of a three-dimensional object in in three dimensional space, they are overcoming some of the problems related to limited viewing angle, inability to focus, etc.

The full parallax methods include a parallax barrier method, a lenticular method, and an integral method.

Also, the depth sampling methods include a varifocal mirror method such as a display surface vibration method, a rotating cylinder method, a display surface stacking method, and a semi-transparent mirror composite method.

These methods, which require mechanical moving parts,

utilize the eye's afterimage time, but there is a problem in a scan rate when displaying many images to represent depth information within the eye's afterimage time.

Furthermore, the display surface stacking method and the semi-transparent mirror composite method have a drawback of difficulty in increasing the number of depth images.

Meanwhile, the holographic method is known as the most sophisticated three-dimensional image display method and includes laser light reproduction holography and white light reproduction holography. However, the holographic method requires an enormous amount of data to display an object and considerable cost to increase the spatial resolution.

Among these conventional three-dimensional image display methods, a few methods that can promote understanding of the present invention will be described below.

FIG. 1 is an illustrative view showing a method using a lenticular lens array which is an example of a conventional three-dimensional display method.

As shown in FIG. 1, in the lenticular lens array method, image information L for the left eye 120 and image information R for the right eye 121 are arranged alternately in the horizontal direction on a display surface 100. And, a semi-cylindrical lenticular lens array 110 is interposed between the display surface 100 and the left and right eyes

120 and 121 and provides optically distinguishable directivity to the image information L for the left eye 120 and image information R for the right eye 121.

Due to the directive characteristic provided by the lenticular lens array 110, the images are separated and inputted to the left eye 120 and the right eye 121 to be seen as a three-dimensional solid body.

That is, the image information L for the left eye 120 is observed only by the left eye 120 and the image information R for the right eye 121 is observed only by the right eye 121. Thus, the depth information is received through binocular parallax, which provides the most significant three-dimensional effect among the biological factors of vision, and to perceive the three-dimensional effect.

FIG. 2 is an illustrative view showing a method of using a slit which is another example of a conventional three-dimensional display method.

The method using a slit, commonly called a parallax method, employs a parallax barrier 210, also called a slit, having a vertical lattice shape as shown in FIG. 2, instead of using a lenticular array of semi-cylindrical lenses. The method using a slit is similar to the lenticular lens array method in that it employs a display surface 200 on which image information L for the left eye 220 and image

information R for the right eye 221 are arranged alternately in the horizontal direction.

Here, the parallax barrier 210 separates an image into L, R images corresponding to the left and right eyes 220 and 221 using a vertical lattice of apertures.

FIG. 3 is an illustrative view showing a method of using a varifocal mirror which is still another example of a conventional three-dimensional display method.

The method using a varifocal mirror, or method using a vibrating optical device, has undergone numerous improvements since it was first proposed by T. Muirhead in 1961. As shown in FIG. 3, a thin film mirror is attached to the surface of a vibrating speaker 260, and an image of an object is displayed through this mirror on a screen of a monitor such as a cathode ray tube (CRT) so as to employ a phantom imaging effect that shows an inner image of the object.

Accordingly, an observer 250 can perceive a three-dimensional effect by observing a ghost image 280 on the monitor.

Meanwhile, a three-dimensional image creation device employing a stacked LCD device to enable creation of three-dimensional images has been proposed. Such a device reproduces a 2-dimensional slice image created based on variable focus as a three-dimensional image on the stacked

LCD device.

Here, in order to reproduce a three-dimensional effect in an optical image, the stacked LCD device sequentially displays the 2-dimensional slice images obtained in sequence according to the depth information, and a magnifying lens unit is interposed between the stacked LCD device and the observer so as to create three-dimensional images.

However, in such a three-dimensional image creation device, while it is possible to create an excellent three-dimensional image, a process of slicing a target image of three-dimensional recreation according to the depth information must be performed first, and then the 2-dimensional slice images must be displayed in sequence to construct a three-dimensional image.

That is, the 2-dimensional slice images obtained sequentially according to the depth information about the same object, and an LCD device including a plurality of stacked LCD layers for reconstructing a three dimensional image, are required. Moreover, in order to sequentially display the 2-dimensional slice images on the respective stacked LCD layers in order according to the depth information, many complex devices are required, such as a device to provide a corresponding 2-dimensional slice image signal to each LCD layer, and a liquid crystal drive controller to sequentially drive the LCD layers.

Thus, there is a need for a device capable of creating three-dimensional images more easily using a simpler process and equipment.

【Disclosure】

【Technical Problem】

The goal of the present invention is to provide a three-dimensional display which can create three-dimensional images more easily with simpler principle, process and configuration.

【Technical Solution】

In one aspect, the present invention provides a three-dimensional display for reproducing a three-dimensional effect in an optical image, the three-dimensional display comprising: an image display in which a plurality of pixels alternately displays image information for the left eye and image information for the right eye; an image display driver for driving the image display so that the pixels of the image display alternately display the image information input to the left eye and the image information input to the right eye; a blocking display placed in front of the image display and alternately blocking light from reaching the left eye and light from reaching the right eye; and a blocking display driver for driving the blocking display to

alternately block the light from reaching the left eye and the light from reaching the right eye in synchronization with the image display driver.

Preferably, the blocking display is provided in a sawtooth-shaped cross-sectional structure positioned in front of the pixels of the image display, in which the left slope with respect to the vertex of the two adjacent sawtooth-shaped slopes is a left eye blocking pixel and the right slope is a right eye blocking pixel, the left eye blocking pixel and the right eye blocking pixel being alternately driven by the blocking display driver to block the light.

Suitably, additional blocking pixels are provided at the sawtooth-shaped vertex formed by the adjacent left eye blocking pixel and right eye blocking pixel. The additional left eye blocking pixel and right eye blocking pixel arranged in a V-shape are provided on an extension line of the existing left eye blocking pixel and on an extension line of the existing right eye blocking pixel, respectively. The additional left eye blocking pixel and right eye blocking pixel being driven independently from the existing left eye blocking pixel and right eye blocking pixel.

Moreover, the blocking display has a structure in which a plurality of blocking displays selectively driven by the blocking display driver are stacked, and each of the

plurality of stacked blocking displays is provided in a sawtooth-shaped cross-sectional structure positioned in front of the pixels of the image display, in which the left slope with respect to the vertex of two adjacent sawtooth-shaped slopes is a left eye blocking pixel and the right slope is a right eye blocking pixel, the left eye blocking pixel and the right eye blocking pixel being alternately driven by the blocking display driver to block the light.

Furthermore, the plurality of stacked blocking displays has different slope angles and heights with respect to the left eye blocking pixel and the right eye blocking pixel.

In addition, the blocking display has a structure in which the left eye blocking pixel and the right eye blocking pixel are arranged alternately in the horizontal direction, and the same kind of pixels are arranged in the vertical direction so that, when viewed from the front of the blocking display, a plurality of vertical bands composed of the left eye blocking pixels and a plurality of vertical bands composed of the right eye blocking pixels are arranged alternately.

Additionally, the light blocking of the right eye blocking pixel and the light blocking of the left eye blocking pixel are alternated by the blocking display driver at the point of time when the display of the image

information for the left eye and the display of the image information for the right eye are alternated.

Besides, a viewing position selection button capable of inputting a signal is further provided in the image display driver and the blocking display driver, in which, when the viewing position selection button is operated, the image display driver drives the image display to alternately display an image for the left eye and an image for the right eye that a user can distinguish, by a signal input from the viewing position selection button, and the blocking display driver drives the blocking display to alternately block the light from reaching the left eye and the light from reaching the right eye in synchronization with the image display driver.

In another aspect, the present invention provides a three-dimensional display for reproducing a three-dimensional effect in an optical image, the three-dimensional display comprising: a support plate; a sawtooth-shaped image display disposed in front of the support plate and selectively displaying image information for the left eye and image information for the right eye; and a display driver for driving the sawtooth-shaped image display to separately display the image information for the left eye and the image information for the right eye, wherein the sawtooth-shaped image display is provided in a sawtooth-

shaped cross-sectional structure, in which the left slope with respect to the vertex of two adjacent sawtooth-shaped slopes is a left eye image pixel for displaying the image information for the left eye, and the right slope is a right eye image pixel for displaying the image information for the right eye.

Preferably, the display has a structure in which the left eye image pixel and the right eye pixel are arranged alternately in the horizontal direction, and the same kind of pixels are arranged in the vertical direction so that, when viewed from the front of the sawtooth-shaped image display, a plurality of vertical bands composed of the left eye image pixels and a plurality of vertical bands composed of the right eye image pixels are arranged alternately in the horizontal direction.

Suitably, a viewing position selection button capable of inputting a signal is further provided in the display, in which, when the viewing position selection button is operated, the display driver drives the image display to alternately display an image for the left eye and an image for the right eye that a user can distinguish.

In still another aspect, the present invention provides a three-dimensional display for reproducing a three-dimensional effect in an optical image, the three-dimensional display comprising: an image display in which a

plurality of left eye image pixels for displaying image information for the left eye and a plurality of right eye image pixels for displaying image information for the right eye are arranged alternately in the horizontal direction; a display driver for driving the image display to separately display image information for the left eye and image information for the right eye; and a barrier plate disposed in front of the image display and blocking the light from the left eye image pixel of the image display from reaching the right eye and the light from the right eye image pixel of the image display from reaching the left eye at the same time.

Preferably, the barrier plate has a structure in which a plurality of barrier walls inclined at a V-shaped angle is arranged on the front surface thereof and the barrier walls inclined at a V-shaped angle are formed by coating a light blocking material on two slopes corresponding to lateral surfaces of a plurality of V-shaped grooves formed along the plurality of the barrier walls inclined at a V-shaped angle, and each of the barrier walls inclined at a V-shaped angle in the barrier plate is formed at each of the boundaries of the left eye image pixels and the right eye image pixels so that an image displayed on the image display is transmitted between two adjacent barrier walls inclined at a V-shaped angle.

Suitably, a coating layer of a transparent material is further formed on the front surface of the barrier plate including the coated light blocking material such that the overall front surface of the barrier plate is a flat and smooth surface by the coating layer.

Moreover, the barrier plate has a structure in which a plurality of barrier walls inclined at a V-shaped angle is arranged on the front surface thereof and the barrier walls inclined at a V-shaped angle are formed by filling a light blocking material in the inside a plurality of V-shaped grooves formed along the plurality of the barrier walls inclined at a V-shaped angle, and each of the barrier walls inclined at a V-shaped angle in the barrier plate is formed at each of the boundaries of the left eye image pixels and the right eye image pixels so that an image displayed on the respective pixels of the image display is transmitted between two adjacent barrier walls inclined at a V-shaped angle.

Furthermore, a coating layer of a transparent material is further formed on the front surface of the barrier plate including the coated light blocking material.

In addition, a viewing position selection button capable of inputting a signal is further provided in the display, in which, when the viewing position selection button is operated, the display driver drives the image

display to alternately display an image for the left eye and an image for the right eye so that a user can distinguish.

【Advantageous Effects】

According to the three-dimensional display of the present invention having the above features, it is possible to create three-dimensional images more easily with simpler principle, process and configuration, compared with the conventional technology.

【Description of Drawings】

FIG. 1 is an illustrative view showing a method using a lenticular lens array which is an example of a conventional three-dimensional display method;

FIG. 2 is an illustrative view showing a method of using a slit which is another example of a conventional three-dimensional display method;

FIG. 3 is an illustrative view showing a method of using a varifocal mirror which is still another example of a conventional three-dimensional display method;

FIG. 4 is a configuration diagram showing a three-dimensional display in accordance with a preferred embodiment of the present invention;

FIG. 5 is a diagram showing a state where an image displayed on an image display is separated and inputted to

the left eye and the right eye in accordance with the embodiment of FIG. 4;

FIG. 6 is a configuration diagram showing a three-dimensional display in accordance with another preferred embodiment of the present invention;

FIG. 7 is a diagram showing a state where an image displayed on a sawtooth-shaped image display is separated and input to the left eye and the right eye in accordance with the embodiment of FIG. 6;

FIG. 8 is a configuration diagram showing a three-dimensional display in accordance with still another preferred embodiment of the present invention;

FIG. 9 is a diagram showing a state where an image displayed on an image display is separated and inputted to the left eye and the right eye in accordance with the embodiment of FIG. 8;

FIG. 10 is a diagram showing yet another preferred embodiment of the present invention, in which the height of a barrier is reduced by reducing the size of a left eye image pixel and a right eye image pixel;

FIG. 11 is a cross-sectional view showing still yet another embodiment of the present invention, in which barrier walls are formed on a barrier plate;

FIGS. 12 and 13 are a cross-sectional view and a front view showing a further preferred embodiment of the present

invention, in which barrier walls are formed on a barrier plate;

FIG. 14 is a cross-sectional view showing another further preferred embodiment of the present invention, in which barrier walls are formed on a barrier plate;

FIG. 15 is a front view showing a state where a light blocking material is filled to form the barrier walls of FIG. 14;

FIG. 16 is a front view showing a viewing position selection button and a selection button of a display in accordance with the present invention;

FIG. 17 is a diagram illustrating a problem of a reduction in the amount of light in accordance with the present invention;

FIG. 18 is a cross-sectional view showing still another further preferred embodiment of the present invention, in which two blocking displays are installed;

FIG. 19 is a diagram showing a state in which an outside blocking display is used when a user is positioned away from the display in the embodiment of FIG. 18;

FIG. 20 is a diagram showing a state in which an inside blocking display is used when a user is positioned adjacent to the display in the embodiment of FIG. 18;

FIG. 21 is a cross-sectional view showing an embodiment in which more than two blocking displays having

different angles are installed assuming at least two users with different inter-pupillary distances in accordance with the present invention;

FIGS. 22 and 23 are cross-sectional views showing yet another further preferred embodiment of the present invention, in which the length of pixels of the blocking display is adjustable; and

FIG. 24 is a cross-sectional view showing still yet another further embodiment of the present invention, in which the size of respective pixels of an image display and a blocking display is reduced.

【Mode for Invention】

Hereinafter, preferred embodiments in accordance with the present invention will be described with reference to the accompanying drawings. The preferred embodiments are provided so that those skilled in the art can sufficiently understand the present invention, but can be modified in various forms and the scope of the present invention is not limited to the preferred embodiments.

When a human observes an 3D object, the left and right eyes observe different images, and the human visual system perceives it as a three-dimensional object.

Using the above principle, a three-dimensional display shows different images to the left eye and the right eye to

form a three-dimensional effect.

FIG. 4 is a configuration diagram showing a three-dimensional display in accordance with a preferred embodiment of the present invention, and FIG. 5 is a diagram showing a state where an image (including a moving image and a still image) displayed on an image display is separated by a blocking display and inputted to the left eye and the right eye in accordance with the embodiment of FIG. 4.

As shown in FIG. 4, the three-dimensional display for reproducing a three-dimensional effect in an optical image in accordance with the preferred embodiment of the present invention comprises an image display 10 in which a plurality of pixels alternately displays image information targeted for the left eye 1 and image information targeted for the right eye 2, an image display driver 12 for driving the image display 10 so that the plurality of pixels alternately displays the image information for the left eye 1 and the image information for the right eye 2, a blocking display 15 disposed in front of the image display 10 to alternately block light emitted from the image display 10 from reaching the left eye 1 and light emitted from the image display 10 from reaching the right eye 2, and a blocking display driver 18 for driving the blocking display 15 to alternately block the light emitted from the image display 10 from reaching the left eye 1 and the light emitted from the image display

10 from reaching the right eye 2 in synchronization with the image display driver 12.

Here, the pixels 11 of the image display 10 alternately display the image information for the left eye 1 and the image information for the right eye 2 by the image display driver 12. That is, the whole pixels constituting the image display 10 repeat an operation that displays the image information for the left eye 1 and then displays the image information for the right eye 2 at a predetermined period of time so that the image display 10 alternately displays the images for the left and right eyes 1 and 2.

In this case, the image display driver 12 comprises an image input unit 13 for alternately providing an image signal for the left eye 1 and an image signal for the right eye 2 to the image display 10, and a display drive control unit 14 for controlling the image display 10 to display the image signals provided from the image input unit 13.

The image display 10 may be a liquid crystal display (LCD), an organic light emitting diode (OLED), a plasma display panel (PDP), a cathode ray tube (CRT), and the like.

The blocking display 15 is provided in a sawtooth-shaped cross-sectional structure positioned in front of the pixels of the image display 10. The rear surface of the blocking display 15 is placed on the front surface of the image display 10 such that the blocking display 15 is

stacked on the image display 10, and the front surface of the blocking display 15 has a structure in which sawtooth-shaped slopes are repeatedly formed.

The blocking display 15 has a structure in which a pixel 16 for blocking light from reaching the left eye 16, i.e., a left eye blocking pixel 16, and a pixel 17 for blocking light from reaching the right eye, are repeatedly formed in a sawtooth shape in the horizontal direction. In particular, the left eye blocking pixel 16 corresponds to the left slope (aiming at the left eye) and the right eye blocking pixel 17 corresponds to the right slope (aiming at the right eye) with respect to the vertex of two adjacent sawtooth-shaped slopes.

That is, the blocking display 15 is a display panel in which a plurality of left eye blocking pixels 16 and a plurality of right eye blocking pixels 17 are arranged alternately in the horizontal direction, and the same kind of pixels are arranged in the vertical direction. Accordingly, when viewed from the front of the blocking display 15, it appears that two kinds of vertical bands, that is, a plurality of vertical bands composed of the left eye blocking pixels 16 and a plurality of vertical bands composed of the right eye blocking pixels 17, are arranged alternately.

Referring to FIG. 4, a pair of the left eye blocking

pixel 16 and the right eye blocking pixel 17 are assigned to each pixel of the image display 10.

In the blocking display 15, the left eye blocking pixels 16 block the light from reaching the left eye 1 at a certain point of time and the right eye blocking pixels 17 block the light from reaching the right eye 2 at a certain point of time. As the left eye blocking pixels 16 and the right eye blocking pixels 17 repeat the process of blocking the light at a predetermined period of time, the blocking display 15 alternately blocks the light from reaching the left eye 1 and the light from reaching the right eye 2.

The operation of the blocking display 15, in which the left eye blocking pixels 16 and the right eye blocking pixels 17 alternately block the light from reaching either the right eye or the left eye, is controlled by the blocking display driver 18. The left eye blocking pixels 16 and the right eye blocking pixels 17 are alternately displayed as black by the blocking display controller 18, thus blocking the light. In particular, when all of the left eye blocking pixels 16 are activated to block the light from reaching the left eye, the image information displayed by the image display 10 reaches only the right eye 2. On the other hand, when all of the right eye blocking pixels 16 are activated to block the light from reaching the right eye, the image information displayed by the image display 10 reaches only

the left eye 1.

At this time, the blocking display driver 18 controls the blocking display 15 to alternately activate the left eye blocking pixels 16 and the right eye blocking pixels 17 in synchronization with the image display driver 12.

In other words, the blocking display driver 18 controls the blocking display 15 so that the activation of the right eye blocking pixels 17 and the activation of the left eye blocking pixels 16 will be alternated at the point of time when the image information for the left eye 1 and the image information for the right eye 2 are alternated by the image display driver 12.

Accordingly, when the image display 10 displays the image for the left eye 1, the right eye blocking pixels 17 blocks the light from reaching the right eye 2, whereas, when the image display 10 displays the image for the right eye 2, the left eye blocking pixels 16 blocks the light from reaching the left eye 1.

In summary, when the image display 10 displays the image information for the left eye 1, the right eye blocking pixels 17 become black (opaque) to block all of the light from reaching the right eye 2, and thus the image information reaches only the left eye 1 through the left eye blocking pixels 16 in a transparent state. Contrarily, when the image display 10 displays the image information for the

right eye 2, the left eye blocking pixels 16 become black (opaque) to block all of the light from reaching the left eye 1, and thus the image information reaches only the right eye 2 with the right eye blocking pixels 17 in a transparent state.

In this way, it is possible to accurately control the light reaching each eye by the blocking display 15. Moreover, since the image information of the image display reaches the left eye 1 and the right eye 2 alternately, a viewer can perceive a three-dimensional effect.

The blocking display 15 may be an LCD and may be substituted with a display capable of selectively transmitting and blocking the light by pixels.

However, the angle and the height of the sawtooth in the blocking display 15 should be determined by considering the angles of the left eye 1 and the right eye 2 as shown in FIG. 5.

That is, the angle and the height of the sawtooth in the blocking display 15 should be determined by considering the position of the left and right eyes, the position of the pixels, the size of the pixels, etc. Moreover, when the angle and the height of the sawtooth are determined by considering the distance between the display and the eyes, the distance between the left and right eyes (interpupillary

distance), and the size of the pixels, an optimal result can be obtained.

Moreover, since the surface of the blocking display 15 has the sawtooth shape, it may be contaminated with dust in a practical use. Accordingly, in order to solve the problem, the surface may be coated with a transparent material so that the overall front surface may be a flat and smooth surface.

FIG. 6 is a configuration diagram showing a three-dimensional display in accordance with another preferred embodiment of the present invention, and FIG. 7 is a diagram showing a state where image information displayed on a sawtooth-shaped image display is separated and inputted to the left eye and the right eye in accordance with the embodiment of FIG. 6.

The sawtooth-shaped display shown in FIG. 6 in accordance with another preferred embodiment of the present invention does not block the light but directly displays the image information for the left and right eyes 1 and 2. Accordingly, since the sawtooth-shaped display displays the image information, it will be referred to as a sawtooth-shaped image display in this embodiment.

As shown in FIG. 6, the three-dimensional display for reproducing a three-dimensional effect in an optical image in accordance with another preferred embodiment of the

present invention comprises a support plate 20, a sawtooth-shaped image display 21 placed in front of the support plate 20 and separately displaying image information for the left eye 1 and image information for the right eye 2, and a display driver 24 for driving the sawtooth-shaped image display to separately display the image information for the left eye 1 and the image information for the right eye 2.

In the same manner as the blocking display 15 described in the embodiment of FIG. 4, the sawtooth-shaped image display 21 is provided in a sawtooth-shaped cross-sectional structure. The rear surface thereof is bonded to the front surface of the support plate 20 such that the sawtooth-shaped image display 21 is stacked on the support plate 20, and the front surface thereof has a structure in which sawtooth-shaped slopes 22 and 23 are repeatedly formed.

The sawtooth-shaped image display 21 has a structure in which a left eye image pixel 22 and a right eye image pixel 23 are repeatedly formed in a sawtooth shape in the horizontal direction. In particular, the left slope (aiming at the left eye) corresponds to a pixel for the left eye, i.e., the left eye image pixel 22 for displaying the image information for the left eye 1, and the right slope (aiming at the right eye) corresponds to a pixel for the right eye, i.e., the right eye image pixel 23 for displaying the image information for the right eye 2.

That is, the sawtooth-like image display 21 is a display panel in which a plurality of left eye image pixels 22 and a plurality of right eye image pixels 23 are arranged alternately in the horizontal direction and the same kind of pixels are arranged in the vertical direction.

Accordingly, when viewed from the front of the sawtooth-shaped image display 21, it appears that two kinds of vertical bands, that is, a plurality of vertical bands composed of the left eye image pixels 22 and a plurality of vertical bands composed of the right eye image pixels 23, are arranged alternately in the horizontal direction.

As described above, in the sawtooth-shaped image display 21, the left eye image pixels 22 display an image for the left eye 1 and the right eye image pixels 23 display an image for the right eye 2. The sawtooth-shaped image display 21 is controlled by the display driver 24. The pixels of the sawtooth-shaped image display 21 form a sawtooth shape to separate the image for the left eye 1 and the image for the right eye 2, thus enabling a viewer to perceive a three-dimensional effect.

The display driver 24 comprises an image input unit 25 for providing an image signal for the left eye 1 and an image signal for the right eye 2 to the sawtooth-shaped image display 10, and a display drive control unit 26 for controlling the sawtooth-shaped image display 21 so that the

pixels display the image signals provided from the image input unit 25.

The sawtooth-shaped image display 21 may be an LCD having a sawtooth shape formed on the surface thereof and may be substituted with a display capable of displaying a left eye image and a right eye image.

The angle of the sawtooth in the sawtooth-shaped image display 21 should be determined by considering the angles of the left eye 1 and the right eye 2 as shown in FIG. 7.

That is, the angle and the height of the sawtooth in the sawtooth-shaped display 21 should be determined by considering the position of the left and right eyes, the position of the pixels, the size of the pixels, etc. Moreover, when the angle and the height of the sawtooth are determined by considering the distance between the display and the eyes, the distance between the left and right eyes (interpupillary distance), and the size of the pixels, an optimal result can be obtained.

Moreover, since the surface of the sawtooth-shaped display 21 has the sawtooth shape, it may be contaminated with dust in a practical use. Accordingly, in order to solve the problem, the surface may be coated with a transparent material so that the overall front surface may be a flat and smooth surface.

In the embodiment of FIG. 6, since the image displayed

on the sawtooth-shaped image display 21 simultaneously reaches both left and right eyes 1 and 2 without blocking the light at all, the light amount can be doubled compared with the embodiment of FIG. 4, thus providing a bright image.

Next, FIG. 8 is a configuration diagram showing a three-dimensional display in accordance with still another preferred embodiment of the present invention, and FIG. 9 is a diagram showing a state where image information displayed on an image display is separated and inputted to the left eye and the right eye in accordance with the embodiment of FIG. 8.

As shown in FIG. 9, the three-dimensional display for reproducing a three-dimensional effect in an optical image in accordance with still another preferred embodiment of the present invention comprises an image display 30 in which a left eye image pixel 31 and a right eye image pixel 32 are arranged alternately in the horizontal direction, a display driver 35 for driving the image display 30 to display image information for the left eye 1 and image information for the right eye 2, and a barrier plate 33, placed in front of the image display 30, in which the inside thereof is formed of a transparent material and a plurality of barrier walls 34 is arranged on the front surface thereof. In this case, the barrier walls 34 of the barrier plate 33 block light so that the images displayed on the pixels 31 and 32 of the image

display 30 reach the targeted eye, not to the opposite eye.

The image display 30 is driven by the display driver 35 so that the left eye image pixel 31 displays the image information for the left eye 1 and the right eye image pixel 32 displays the image information for the right eye 2. In the image display 30, a plurality of left eye image pixels 31 and a plurality of right eye image pixels 32 are arranged alternately in the horizontal direction.

That is, the image display 30 is a display panel in which the plurality of left eye image pixels 31 and the plurality of right eye image pixels 32 are arranged alternately. The left eye image pixels 31 and the right eye image pixels 32 are arranged alternately in the horizontal direction, and the same kind of pixels are arranged in the vertical direction. Accordingly, when viewed from the front of the image display 30, it appears that two kinds of vertical bands, that is, a plurality of vertical bands composed of the left eye image pixels 31 and a plurality of vertical bands composed of the right eye image pixels 32, are arranged alternately.

The image display 30 may be an LCD, an OLED, a PDP, a CRT, and the like.

The display driver 35 comprises an image input unit 36 for providing an image signal for the left eye 1 and an image signal for the right eye 2 to the image display 30,

and a display drive control unit 37 for controlling the image display 30 so that the pixels display the image signals provided from the image input unit 36.

The barrier plate 33 has a structure in which the plurality of barrier walls 34 is formed on the front surface thereof in parallel.

The barrier walls 34 may be implemented with a structure in which a plurality of V-shaped groove for blocking light by a light blocking material is formed in parallel. The rear surface of the barrier plate 33 is bonded to the front surface of the image display 10 such that the barrier plate 33 is stacked on the image display 30.

In more details, the barrier plate 33 has a structure in which the plurality of barrier walls 34 formed in the vertical direction are arranged on the front surface thereof in parallel at regular intervals and each of two adjacent barrier walls 34 forms a V-shaped groove. As shown in FIG. 8, the plurality of barrier walls 34 (hereinafter referred to as V-shaped barrier walls) are implemented in such a manner that the plurality of V-shaped grooves is formed at regular intervals and, when viewed from the cross-sectional direction, it appears that a trapezoid shape is repeatedly formed on the horizontal direction on the front surface of the image display 30.

In the barrier plate 33, each of the V-shaped grooves

is formed at each of the boundaries of the left eye image pixels 31 and the right eye image pixels 32. The V-shaped barrier walls 34 for blocking the light of the image display 30 may be formed by coating a light blocking material on the slopes corresponding to the lateral surfaces of the V-shaped grooves. Here, the barrier plate 33 is formed of a transparent material and thus a portion between two adjacent V-shaped barrier walls 34 transmits the light.

The barrier plate 33 may be formed in such a manner that the V-shaped grooves in the vertical direction are formed on the surface of a transparent material in parallel at regular intervals and then a light blocking material is coated on the slopes corresponding to the lateral surfaces of the V-shaped grooves.

Referring to FIG. 8, the barrier plate 33 has a structure in which each trapezoid shape is positioned in front of each pair of two adjacent pixels, i.e., the left eye image pixel 31 and the right eye image pixel 32, and each V-shaped barrier wall 34 is formed between the adjacent pairs.

As shown in FIG. 9, in the display device of the present invention in which the above-described barrier plate 33 is used, the image information displayed on the left eye image pixel 31 is transmitted through the inside of the barrier plate 33 between adjacent V-shaped barrier walls 34

and reaches only the left eye 1, and the light is blocked by the slope of the V-shaped barrier wall 34 so that the image information for the left eye 1 does not reach the right eye 2.

Moreover, the image information displayed on the right eye image pixel 32 is transmitted through the barrier plate 33 between adjacent V-shaped barrier walls 34 and reaches only the right eye 2, and the light is blocked by the slope of the V-shaped barrier wall 34 so that the image information for the right eye 2 does not reach the left eye 1.

The angle and the height of the slopes of the V-shaped barrier wall should be determined by considering the position of the left and right eyes, the position of the pixels, the size of the pixels, and the like. Moreover, when the angle and the height of the slopes of the V-shaped barrier wall are determined by considering the distance between the display and the eyes and the distance between the left and right eyes (interpupillary distance), an optimal result can be obtained.

As a result, according to the above-described barrier plate 33, the images for the left and right eyes displayed on the image display 30 positioned behind the barrier plate 33 reach the targeted eye, not to the opposite eye of the viewer. Accordingly, the viewer observes the images for the

left and right eyes separately, thus perceiving a three-dimensional effect.

The embodiment of FIG. 8 has an advantage in that it is very easy to implement the barrier plate 33, i.e., a barrier by which the images for the left and right eyes of the viewer are separately viewed.

Moreover, in the case where the size of the pixels of the image display 30 is reduced, it is possible to adjust the height of the V-shaped barrier wall 34, i.e., the depth of the barrier plate 33. FIG. 10 is a diagram showing yet another preferred embodiment of the present invention, in which the height of the V-shaped barrier wall 34 is reduced by reducing the size of the left eye image pixel 31 and the right eye image pixel 32 of the image display 30.

As a preferred method, in the case where the front surface of the barrier plate corresponding to the front surface of the display device is formed with the V-shaped grooves (in the case where the V-shaped barrier walls are formed by thinly coating a light blocking paint on the lateral surfaces of the respective V-shaped grooves), it may be contaminated with dust. As shown in FIG. 11, in order to solve this problem, a coating layer 34a of a transparent material may be filled in the inside of the respective V-shaped grooves and be coated on the front surface of the barrier plate 33 so that the overall front surface of the

barrier plate 33 may be a flat and smooth surface.

As another method of forming the barrier walls 34 of the barrier plate 33, in order to form the respective barrier walls 34 inclined at a V-shaped angle on the barrier plate 33 with respect to the boundaries of the pixels of the image display 30, a plurality of grooves formed along the vertical direction are arranged on the surface of a transparent substrate which is directed to the base material of the barrier plate 33, each of two adjacent grooves is formed in an inclined direction to form a V-shaped angle, and a light blocking material is filled in the inside of the grooves, thus forming the barrier walls 34 inclined at a V-shaped angle. However, since the height of the barrier walls may be changed according to the position of the pixels, the height of the transparent substrate should be determined by considering the above change.

Here, the groove is not formed in a certain portion of the top and bottom of the substrate. As shown in FIG. 13, after forming the grooves except for a certain portion of the top and bottom of the substrate, a light blocking material is filled only in the portion where the grooves are formed.

In this case, when viewed from the front of the barrier plate 33, the light blocking material filled in two lines in parallel forms the respective barrier walls 34 of

FIG. 12 inclined at a V-shaped angle. As a result, the barrier walls 34 inclined at a V-shaped angle are formed by coating the light blocking material on the two slopes corresponding to the lateral surfaces of the V-shaped grooves, the same as the example of FIG. 11.

Moreover, as shown in FIG. 12, a coating layer 34a of a transparent material may be additionally formed on the front surface of the barrier plate 33 in a state where the light blocking material is filled in the inside of the respective V-shaped grooves so that the overall front surface of the barrier plate 33 may be a flat and smooth surface.

As a further method of forming the barrier walls 34 of the barrier plate 33, as shown in the cross-sectional view of FIG. 14 and the front view of FIG. 15, after a plurality of V-shaped grooves is formed along the vertical direction on a transparent plane, a light blocking material may be filled in the inside of the respective V-shaped grooves so that the overall front surface of the barrier plate 33 may be a flat and smooth surface. Even in this case, the same effect can be obtained; however, since the height of the barrier walls is changed according to the position of the pixels, it should be taken into account.

Here, in order to prevent contamination due to dust, a surface coating layer 34a may be additionally formed using a

transparent material on the front surface of the barrier plate 33 including the coated light blocking material.

As described above, according to the present invention, it is possible to configure a three-dimensional display with a simpler configuration compared with the conventional technology.

In the above embodiments of the present invention, it has been described that the slope angle and the height of the blocking means such as the blocking display 15 and the barrier wall 34, and the slope angle and the height of the sawtooth-shaped image display 21 are determined by considering the position of the pixels, the distance between both eyes, i.e., between the left eye 1 and the right eye 2 (interpupillary distance), and the distance between the display and the eyes of a user assuming that the user is positioned at the center of the display.

In practical circumstances, there is a variation in the distance between the both eyes and a variation in the distance between the display and the eyes of the user. In this case, there may occur a problem in that the amount of light reaching both eyes is reduced and a problem in that the light to be blocked reaches either the left eye or the right eye.

Accordingly, since finding an optimal viewing position is a important issue to maximize the three-dimensional

effect of the three-dimensional image, it is possible to enable the user to select an optimal viewing position with a method of determining an optimal viewing position in which an image for the left eye and an image for the right eye are displayed alternately.

That is, when the user presses a viewing position selection button 19a of FIG. 16, the three-dimensional display of the present invention may alternately display the image for the left eye and the image for the right eye that the user can distinguish.

In this case, as the image for the left eye and the image for the right eye, the corresponding pixels may display distinguishable images including specific texts (for example, sentences such as 'This is an image for the left eye.' and 'This is an image for the right eye.') or distinguishable colors.

As shown in FIG. 16, the viewing position selection button 19a may be provided on the display in the case where the distance between the user and the display such as a PC monitor, a mobile terminal, and the like is close. Otherwise, in the case where the distance between the user and the display is greater than the length of the user's arm, the viewing position selection button 19a may be provided on a remote controller.

To describe with respect to the above embodiments, in

the case where the viewing position selection button 19a is provided as shown in FIGS. 4 and 16, a signal is inputted to the image display driver 12 and the blocking display driver 18 through the viewing position selection button 19a. When the user presses the viewing position selection button 19a, the image display driver 12 and the blocking display driver 18 receive the signal, respectively, and control the image display 10 and the blocking display 15 as follows:

When the user presses the viewing position selection button 19a, the pixels 11 of the image display 10 alternately display the image for the left eye and the image for the right eye, and the pixels 17 of the blocking display 15 alternately activate the left eye blocking pixels 16 and the right eye blocking pixels 17 in synchronization with the image display 10.

In another method, it is possible to display a stereo image which is easy to select the position, i.e., a stereoscopic image having a certain sense of distance, so that the user may select an optimal position.

In this case, when the pixels 11 of the image display 10 display an image including a specific text or a color image, which is distinguishable as the image for the left eye, the right eye blocking pixels 17 of the blocking display 15 are activated to be displayed as black to block the light and, at the same time, the image is transmitted

only to the left eye through the left eye blocking pixels 16.

On the other hand, when the pixels 11 of the image display 10 display an image including a specific text or an image of a color, which is distinguishable as the image for the right eye, the left eye blocking pixels 16 of the blocking display 15 are activated to be displayed as black to block the light and, at the same time, the image is transmitted only to the right eye through the right eye blocking pixels 17.

Like this, after pressing the viewing position selection button 19a, the user adjusts his or her eye position to check whether the image for the left eye is seen by the left eye and the image for the right eye is seen by the right eye. Accordingly, when the user selects the eye position where the image for the left eye and the image for the right eye are seen by the left eye and the right eye, respectively, the user can observe a three-dimensional image in an optimal state, which is provided from the three-dimensional display. As another method of achieving the same effect, the display may be moved in the front, rear, left and right directions, and a joystick and a driving motor may be used for that purpose.

In this case, as the user presses the viewing position selection button 19a, the image display drivers 12 and 18 control the image display 10 and the blocking display 15 as

described above.

Moreover, in the case where the viewing position selection button 19a is provided in accordance with the embodiment of FIG. 6, a signal is inputted to the display driver 24 through the viewing position selection button 19a and, when the user presses the viewing position selection button 19a, the display driver 24 receives the signal to control the sawtooth-shaped image display 21 as follows:

When the user presses the viewing position selection button 19a, the left eye image pixels 22 and the right eye image pixels 23 of the sawtooth-shaped image display 21 are activated alternately to display the image for the left eye and the image for the right eye alternately. In the same manner as the embodiment of FIG. 4, after pressing the viewing position selection button 19a, the user adjusts his or her eye position to the front, rear, left and right to check whether the image for the left eye is seen by the left eye and the image for the right eye is seen by the right eye.

Accordingly, when the user selects the eye position where the image for the left eye and the image for the right eye are seen by the left eye and the right eye, respectively, the user can observe a three-dimensional image in an optimal state provided from the three-dimensional display.

In the case where the viewing position selection button 19a is provided in accordance with the embodiment of

FIG. 8, a signal is inputted to the display driver 35 through the viewing position selection button 19a and, when the user presses the viewing position selection button 19a, the display driver 35 receives the signal and controls the image display 30 as follows:

That is, when the user presses the viewing position selection button 19a, the left eye image pixels 31 and the right eye image pixels 32 of the image display 30 are activated alternately to display the image for the left eye and the image for the right eye alternately. In the same manner as the previous embodiment, the user selects the position to observe a three-dimensional image in an optimal state provided from the three-dimensional display.

Meanwhile, there may occur a problem in that the amount of light reaching both eyes is reduced (refer to FIG. 17) and a problem in that the light to be blocked reachs either the left eye or the right eye due to the distance between the left and right eyes of the user, the distance between the user and the display, and the relative position, when the slope angle and the height of the blocking means such as the blocking display and the barrier wall and the slope angle and the height of the sawtooth-shaped image display are determined.

FIG. 17 illustrats the problem of a reduction in the amount of light which may be caused in the embodiment of FIG.

4. In Fig. 17, some of the image information for the right eye fails to reach the right eye due the to the left eye blocking pixels 16 of the blocking display 15.

In FIG. 17, it can be seen that the dotted lines from the front right eye 2' are not connected to the boundaries of the pixels of the image display 10 but connected to the inside of the pixels of the image display 10, which means that a portion of the image displayed by the pixels of the image display 10, i.e., a portion outside the dotted lines, fails to reach the right eye 2' of the user by the left eye blocking pixels 16.

Moreover, there may occur a problem in that the image for the left eye reaches the right eye and the image for the right eye reaches the left eye dpending on the distance between both eyes of the user and the distance between the user's eyes and the display, although the image for the left eye should be blocked from reaching the right eye by the blocking means and the image for the right eye should be blocked from reaching the left eye by the blocking means.

Thus, if the user's eye position is too close to or far from the display and, if the interpupillary distance of the user is too short or long in the present position, there may occur crosstalk problem. In order to solve the problem in that the light to be blocked reaches either the left eye or the right eye, the size of the pixels may be reduced or

the height of the blocking means may be increased.

However, in this case, there may also occur a problem in that the amount of light reaching both eyes is reduced.

Accordingly, it is possible to adjust the size of the pixels and the height of the blocking means in compliance with the use conditions.

For example, as shown in FIG. 18, at least two blocking means having different angles and heights may be installed assuming at least two users with different interpupillary distances in the embodiment of FIG. 4 in which the blocking display is used.

Referring to FIG. 18, left eye blocking pixels 16a and 16b and right eye blocking pixels 17a and 17b are divided into two groups according to the slope angle and the height thereof.

In the figure, two blocking display 15a and 15b are stacked on the front surface of the image display 10, and thus pixels 16a, 16b, 17a and 17b having different slope angles and heights are provided at each pixel position.

That is, the left eye blocking pixels 16a having smaller slope angle and height are provided inside the left eye blocking pixels 16b having larger slope angle and height, and the right eye blocking pixels 17a having smaller slope angle and height are provided inside the right eye blocking pixels 17b having larger slope angle and height.

As a result, in the state where the user's both eyes 1' and 2' are positioned near to the display, the left eye blocking pixels 16a and the right eye blocking pixels 17a having smaller slope angle and height are used, and in the state where the user's both eyes 1 and 2 are positioned further away from the display, the left eye blocking pixels 16b and the right eye blocking pixels 17b having larger slope angle and height are used.

Thus, it is possible to provide an optimal three-dimensional image to two positions where the user's both eyes are close to and far from the display by selectively driving the left eye blocking pixels 16a and 16b and the right eye blocking pixels 17a and 17b having different slope angles and heights.

In order to selectively drive one of the two blocking displays 15a and 15b, a selection button 19b as shown in FIG. 6 may be provided so as to input a signal to the blocking display driver 18. When the user selects one of the blocking display 15a and 15b according to his or her eye position using the selection button 19b, the blocking display driver 18 drives the corresponding blocking display selected using the selection button 19b.

FIG. 19 is a diagram showing a state in which an outer blocking display 15b is used when the user is positioned away from the display, and FIG. 20 is a diagram showing a

state in which an inner blocking display 15a is used when the user is positioned near to the display.

Of course, in order to select the blocking display 15a and 15b in correspondence with the user's position, the user should select the position, where the image for the left eye and the image for the right eye are seen as distinguished, and the blocking displays 15a and 15b while adjusting his or her eye position using the viewing position selection button 19a and the selection button 19b.

Thus, it is possible to provide at least two blocking means having different angles on the assumption that there are at least two distances between the user and the display. Moreover, as shown in FIG. 21, it is possible to provide at least two blocking displays 15a and 15b having different angles on the assumption that there are two users with different interpupillary distances.

As modified examples of the embodiments of FIGS. 4 and 8, it is possible to adjust the size of the pixels of the blocking display (the left eye blocking pixels and the right eye blocking pixels in the embodiment of FIG. 4) and the size of the barrier walls (in the embodiment of FIG. 8).

FIGS. 22 and 23 shows modified examples of the embodiment of FIG. 4 using the blocking display, in which the length of pixels of the blocking display is adjusted to effectively provide a three-dimensional image, even though

the position and the condition of the user are somewhat changed.

In FIGS. 22 and 23, additional blocking pixels 16d and 17d arranged in a V-shape are provided on the sawtooth-shaped vertex formed by adjacent left eye blocking pixel 16c and right eye blocking pixel 17c in the blocking display 15. The additional blocking pixels 16d and 17d are provided on extension lines of the existing blocking pixels 16c and 17c so that the existing blocking pixels 16c and 17c and the additional blocking pixels 16d and 17d may function as a single blocking pixel.

That is, the existing left eye blocking pixel 16c and the additional left eye blocking pixel 16d on the extension line thereof are driven as a single left eye blocking pixel 16, and the existing right eye blocking pixel 17c and the additional right eye blocking pixel 17d on the extension line thereof are driven as a single right eye blocking pixel 16, in which the edges of the left eye blocking pixel 16 including the additional left eye blocking pixel 16d and the right eye blocking pixel 17 including the additional right eye blocking pixel 17d intersect each other.

In the above structure of the blocking display, the existing blocking pixels 16c and 17c and the additional blocking pixels 16d and 17d are independently driven by the blocking display driver 18. For example, only the existing

left eye blocking pixel 16c or the existing right eye blocking pixel 17c may be driven to block the image displayed on the pixels 11 of the image display 10, the existing left eye blocking pixel 16c and the additional left eye blocking pixel 16d may be driven together to block the right eye image of the image display 10, or the existing right eye blocking pixel 17c and the additional right eye blocking pixel 17d may be driven together to block the left eye image of the image display 10.

Referring to FIG. 22, if the distance between the user's eyes (interpupillary distance) 2' is relatively large, the existing left eye blocking pixel 16c and the existing right eye blocking pixel 17c are driven alternately. While the image for the left eye is displayed on the pixels 11 of the image display 10, the existing right eye blocking pixel 17c is activated to block the light and, while the image for the right eye is displayed on the respective pixels 11 of the image display 10, the existing left eye blocking pixel 16c is activated to block the light.

On the other hand, if the distance between the user's oth eyes 2' is relatively small, the existing left eye blocking pixel 16c and the additional left eye blocking pixel 16d on the extension line thereof are activated together to simultaneously block the light, and the existing right eye blocking pixel 17c and the additional right eye

blocking pixel 17d on the extension line thereof are activated together to simultaneously block the light.

That is, the existing left eye blocking pixel 16c and the additional left eye blocking pixel 16d on the extension line thereof are activated as a single left eye blocking pixel 16, and the existing right eye blocking pixel 17c and the additional right eye blocking pixel 17d on the extension line thereof are activated as a single right eye blocking pixel 16. Even in this case, the left eye blocking pixel 16 (including the existing left eye blocking pixel 16c and the additional left eye blocking pixel 16d on the extension line thereof) and the right eye blocking pixel 17 (including the existing right eye blocking pixel 17c and the additional right eye blocking pixel 17d on the extension line thereof) are activated alternately.

At this time, while the image for the left eye is displayed on the pixels 11 of the image display 10, the existing right eye blocking pixel 17c and the additional right eye blocking pixel 17d on the extension line thereof are activated together to block the light at the same time and, while the image for the right eye is displayed on the pixels 11 of the image display 10, the existing left eye blocking pixel 16c and the additional left eye blocking pixel 17d on the extension line thereof are activated together to block the light are driven together to block the

light at the same time.

As described above, it is possible to effectively provide a three-dimensional image by increasing the length of the pixels of the blocking display 15, even though the relative position of both eyes is somewhat changed.

Next, FIG. 24 is a diagram showing another example in which the length of the blocking means can be reduced by reducing the size of the respective pixels of the blocking display a little bit more.

Referring to FIG. 24, it can be seen that the size of the left eye blocking pixel 16 and the right eye blocking pixel 17 placed on the slopes is reduced as the size of the pixels 11 of the image display 10, on which the image for the left eye and the image for the right eye are displayed alternately, is reduced.

Moreover, as shown in the figure, it can be seen that it is unnecessary that the barrier walls should not be adjacent to the image display. However, it has a drawback in that the image appears darker due to the reduction in the amount of light.

As above, various kinds of three-dimensional displays proposed by the present invention have been described and, if the blocking means in the front surface of the display is removed, the three-dimensional display may be used as a general display.

For this purpose, the blocking displays 15, 15a and 15b disposed in front of the image display 10 and the barrier plate 21 disposed in front of the sawtooth-shaped image display 20 may be detached from the image displays 10 and 20.

Moreover, it is possible to provide a plurality of blocking displays or barrier plates having different blocking angles (such as slope angles and heights of the blocking pixels and the barrier walls) depending on the distance between the user and the display and the distance between the interpupillary distance and to select an appropriate blocking display or barrier plate in compliance with the use conditions.

The invention has been described in details with reference to preferred embodiments thereof. However, it will be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the invention, the scope of which is defined in the appended claims and their equivalents.

【CLAIMS】

【Claim 1】

A three-dimensional display for reproducing a three-dimensional effect in an optical image, the three-dimensional display comprising:

an image display in which a plurality of pixels alternately displays image information for the left eye and image information for the right eye;

an image display driver for driving the image display so that the pixels of the image display alternately display the image information input to the left eye and the image information input to the right eye;

a blocking display placed in front of the image display and alternately blocking light from reaching the left eye and light from reaching the right eye; and

a blocking display driver for driving the blocking display to alternately block the light from reaching the left eye and the light from reaching the right eye in synchronization with the image display driver.

【Claim 2】

The three-dimensional display of claim 1, wherein the blocking display is provided in a sawtooth-shaped cross-sectional structure positioned in front of the pixels of the image display, in which the left slope with respect to the

vertex of two adjacent sawtooth-shaped slopes is a left eye blocking pixel and the right slope is a right eye blocking pixel, the left eye blocking pixel and the right eye blocking pixel being alternately activated by the blocking display driver to block the light.

【Claim 3】

The three-dimensional display of claim 2, wherein an additional blocking pixel, in which the left eye blocking pixel and the right eye blocking pixel are arranged in a V-shape on the sawtooth-shaped vertex formed by adjacent left eye blocking pixel and right eye blocking pixel, is provided in the blocking display, and

wherein the additional left eye blocking pixel and right eye blocking pixel arranged in a V-shape are provided on an extension line of the existing left eye blocking pixel and on an extension line of the existing right eye blocking pixel, respectively, the additional left eye blocking pixel and right eye blocking pixel being activated independently from the existing left eye blocking pixel and right eye blocking pixel.

【Claim 4】

The three-dimensional display of claim 1, wherein the blocking display has a structure in which a plurality of

blocking displays selectively activated by the blocking display driver is stacked, and

wherein each of the plurality of stacked blocking displays is provided in a sawtooth-shaped cross-sectional structure positioned in front of the pixels of the image display, in which the left slope with respect to the vertex of two adjacent sawtooth-shaped slopes is directed to a left eye blocking pixel and the right slope is directed to a right eye blocking pixel, the left eye blocking pixel and the right eye blocking pixel being alternately activated by the blocking display driver to block the light.

【Claim 5】

The three-dimensional display of claim 4, wherein the plurality of stacked blocking displays has different slope angles and heights with respect to the left eye blocking pixel and the right eye blocking pixel.

【Claim 6】

The three-dimensional display of any one of claims 2 to 5, wherein the blocking display has a structure in which the left eye blocking pixel and the right eye blocking pixel are arranged alternately in the horizontal direction, and the same kind of pixels are arranged in the vertical direction so that, when viewed from the front of the

blocking display, a plurality of vertical bands composed of the left eye blocking pixels and a plurality of vertical bands composed of the right eye blocking pixels are arranged alternately.

【Claim 7】

The three-dimensional display of any one of claims 2 to 5, wherein the light blocking of the right eye blocking pixel and the light blocking of the left eye blocking pixel are alternated by the blocking display driver at the point of time when the display of the image information for the left eye and the display of the image information for the right eye are alternated.

【Claim 8】

The three-dimensional display of claim 1, wherein a viewing position selection button capable of inputting a signal is further provided in the image display, and

wherein, when the viewing position selection button is operated, the image display driver drives the image display to alternately display an image for the left eye and an image for the right eye that a user can distinguish, by a signal input from the viewing position selection button, and the blocking display driver drives the blocking display to alternately block the light from reaching the left eye and

the light from reaching the right eye in synchronization with the image display driver.

【Claim 9】

A three-dimensional display for reproducing a three-dimensional effect in an optical image, the three-dimensional display comprising:

a support plate;

a sawtooth-shaped image display disposed in front of the support plate and separately displaying image information for the left eye and image information for the right eye; and

a display driver for driving the sawtooth-shaped image display to alternately display the image information for the left eye and the image information for the right eye,

wherein the sawtooth-shaped image display is provided in a sawtooth-shaped cross-sectional structure, in which the left slope with respect to the vertex of two adjacent sawtooth-shaped slopes is a left eye image pixel for displaying the image information for the left eye, and the right slope is a right eye image pixel for displaying the image information for the right eye.

【Claim 10】

The three-dimensional display of claim 9, wherein the

sawtooth-shaped display has a structure in which the left eye image pixel and the right eye pixel are arranged alternately in the horizontal direction, and the same kind of pixels are arranged in the vertical direction so that, when viewed from the front of the sawtooth-shaped image display, a plurality of vertical bands composed of the left eye image pixels and a plurality of vertical bands composed of the right eye image pixels are arranged alternately in the horizontal direction.

【Claim 11】

The three-dimensional display of claim 9, wherein a viewing position selection button capable of inputting a signal is further provided in the display driver, and

wherein, when the viewing position selection button is operated, the display driver drives the image display to alternately display an image for the left eye and an image for the right eye that a user can distinguish, by a signal input from the viewing position selection button.

【Claim 12】

A three-dimensional display for reproducing a three-dimensional effect in an optical image, the three-dimensional display comprising:

an image display in which a plurality of left eye

image pixels for displaying image information for the left eye and a plurality of right eye image pixels for displaying image information for the right eye are arranged alternately in the horizontal direction;

a display driver for driving the image display to display image information for the left eye and image information for the right eye; and

a barrier plate placed in front of the image display and blocking light from the left eye image pixel from reaching the right eye and light from the right eye image pixel of the image display from reaching the left eye at the same time.

【Claim 13】

The three-dimensional display of claim 12, wherein the barrier plate has a structure in which a plurality of barrier walls inclined at a V-shaped angle is arranged on the front surface thereof and the barrier walls inclined at a V-shaped angle are formed by coating a light blocking material on two slopes corresponding to lateral surfaces of a plurality of V-shaped grooves formed along the plurality of the barrier walls inclined at a V-shaped angle, and

wherein each of the barrier walls inclined at a V-shaped angle in the barrier plate is formed at each of the boundaries of the left eye image pixels and the right eye

image pixels so that an image displayed on the pixels of the image display is transmitted between two adjacent barrier walls inclined at a V-shaped angle.

【Claim 14】

The three-dimensional display of claim 13, wherein a coating layer of a transparent material is further formed on the front surface of the barrier plate including the coated light blocking material such that the overall front surface of the barrier plate is a flat and smooth surface by the coating layer.

【Claim 15】

The three-dimensional display of claim 12, wherein the barrier plate has a structure in which a plurality of barrier walls inclined at a V-shaped angle is arranged on the front surface thereof and the barrier walls inclined at a V-shaped angle are formed by filling a light blocking material in the inside a plurality of V-shaped grooves formed along the plurality of the barrier walls inclined at a V-shaped angle, and

wherein each of the barrier walls inclined at a V-shaped angle in the barrier plate is formed at each of the boundaries of the left eye image pixels and the right eye image pixels so that an image displayed on the pixels of the

image display is transmitted between two adjacent barrier walls inclined at a V-shaped angle.

【Claim 16】

The three-dimensional display of claim 15, wherein a coating layer of a transparent material is further formed on the front surface of the barrier plate including the coated light blocking material.

【Claim 17】

The three-dimensional display of claim 12, wherein a viewing position selection button capable of inputting a signal is further provided in the display, and

wherein, when the viewing position selection button is operated, the display driver drives the image display to alternately display an image for the left eye and an image for the right eye that a user can distinguish, by a signal input from the viewing position selection button.

【Claim 18】

A barrier plate, detachably provided in front of a display for reproducing a three-dimensional effect in an optical image, for blocking light from a left eye image pixel of an image display from reaching the right eye and blocking light from a right eye image pixel of the image

display from reaching the left eye,

wherein the barrier plate has a structure in which a plurality of barrier walls inclined at a V-shaped angle is arranged on the front surface thereof and the barrier walls inclined at a V-shaped angle are formed by coating a light blocking material on two slopes corresponding to lateral surfaces of a plurality of V-shaped grooves formed along the plurality of the barrier walls inclined at a V-shaped angle, and

wherein each of the barrier walls inclined at a V-shaped angle in the barrier plate is formed at each of the boundaries of the left eye image pixel and the right eye image pixel so that an image displayed on the respective pixels of the image display is transmitted between two adjacent barrier walls inclined at a V-shaped angle.

【Claim 19】

The barrier plate of claim 18, wherein a coating layer of a transparent material is further formed on the front surface of the barrier plate including the coated light blocking material such that the overall front surface of the barrier plate is a smooth surface by the coating layer.

【Claim 20】

A barrier plate, detachably provided in front of a

display for reproducing a three-dimensional effect in an optical image, for blocking light directed from a left eye image pixel of an image display to the right eye and blocking light directed from a right eye image pixel of the image display to the left eye,

wherein the barrier plate has a structure in which a plurality of barrier walls inclined at a V-shaped angle is arranged on the front surface thereof and the barrier walls inclined at a V-shaped angle are formed by filling a light blocking material in the inside a plurality of V-shaped grooves formed along the plurality of the barrier walls inclined at a V-shaped angle such that the overall front surface of the barrier plate is a smooth surface, and

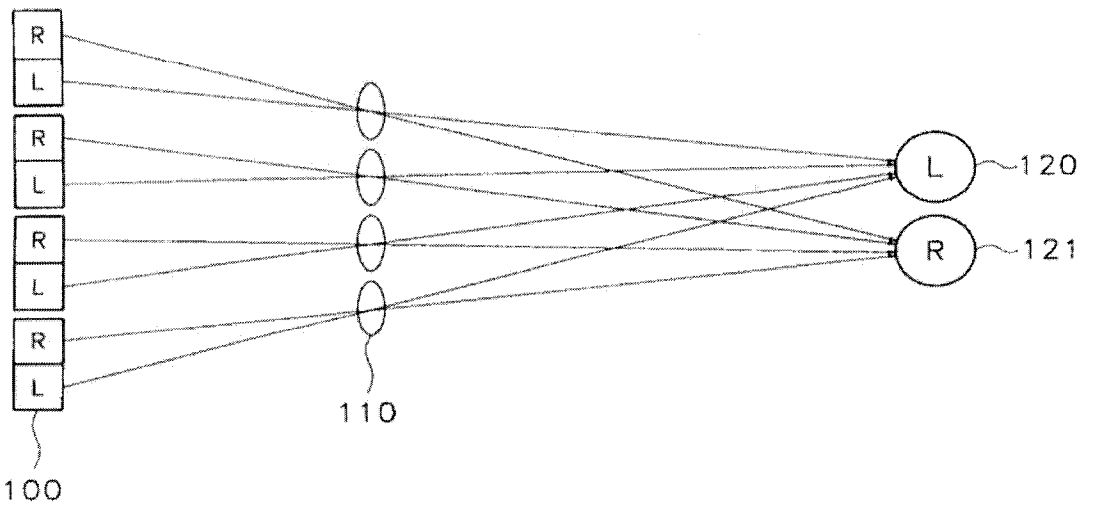
wherein each of the barrier walls inclined at a V-shaped angle in the barrier plate is formed at each of the boundaries of the left eye image pixel and the right eye image pixel so that an image displayed on the respective pixels of the image display is transmitted between two adjacent barrier walls inclined at a V-shaped angle.

【Claim 21】

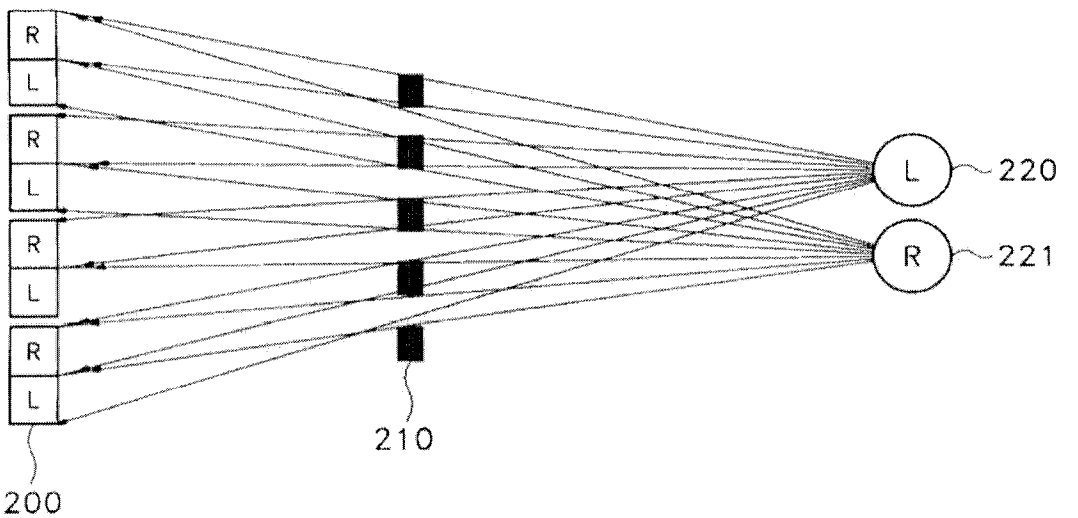
The barrier plate of claim 20, wherein a coating layer of a transparent material is further formed on the front surface of the barrier plate including the coated light blocking material.

【DRAWINGS】

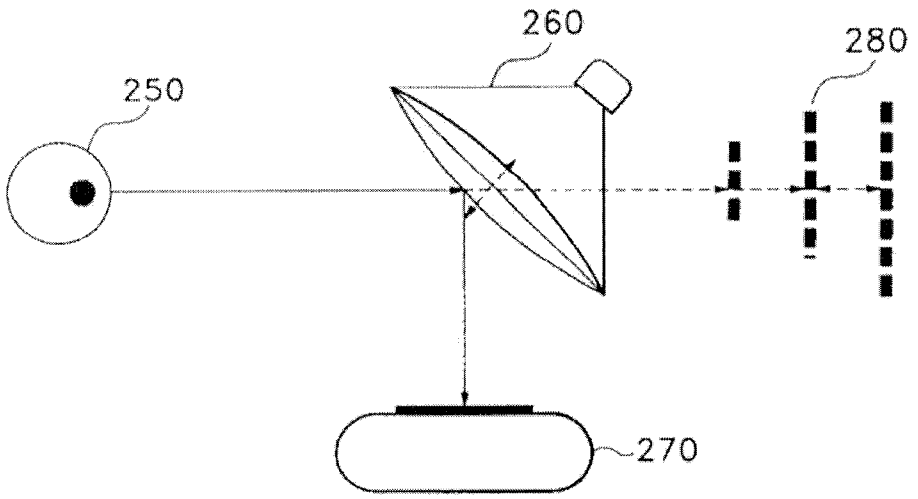
【FIGURE 1】



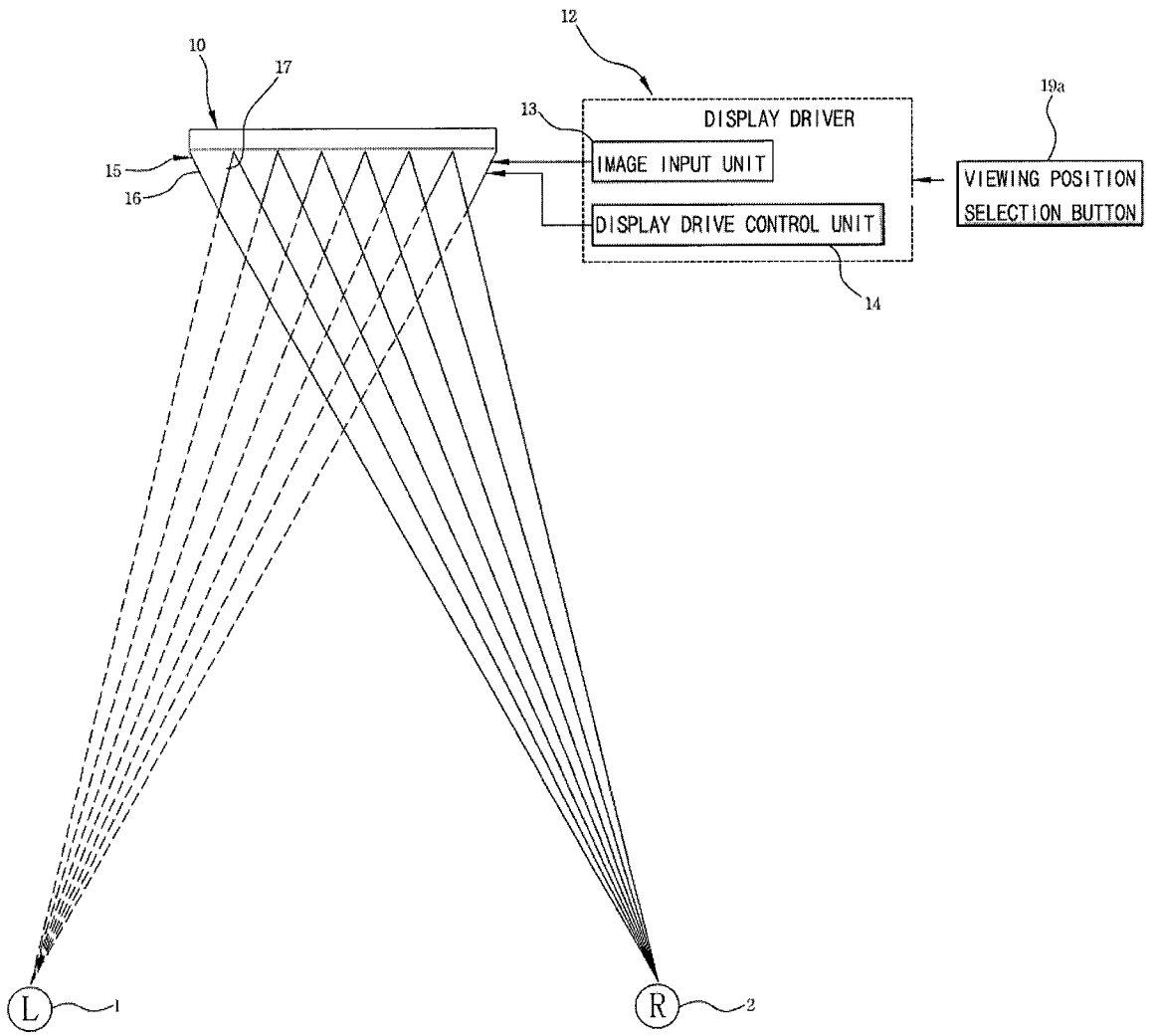
【FIGURE 2】



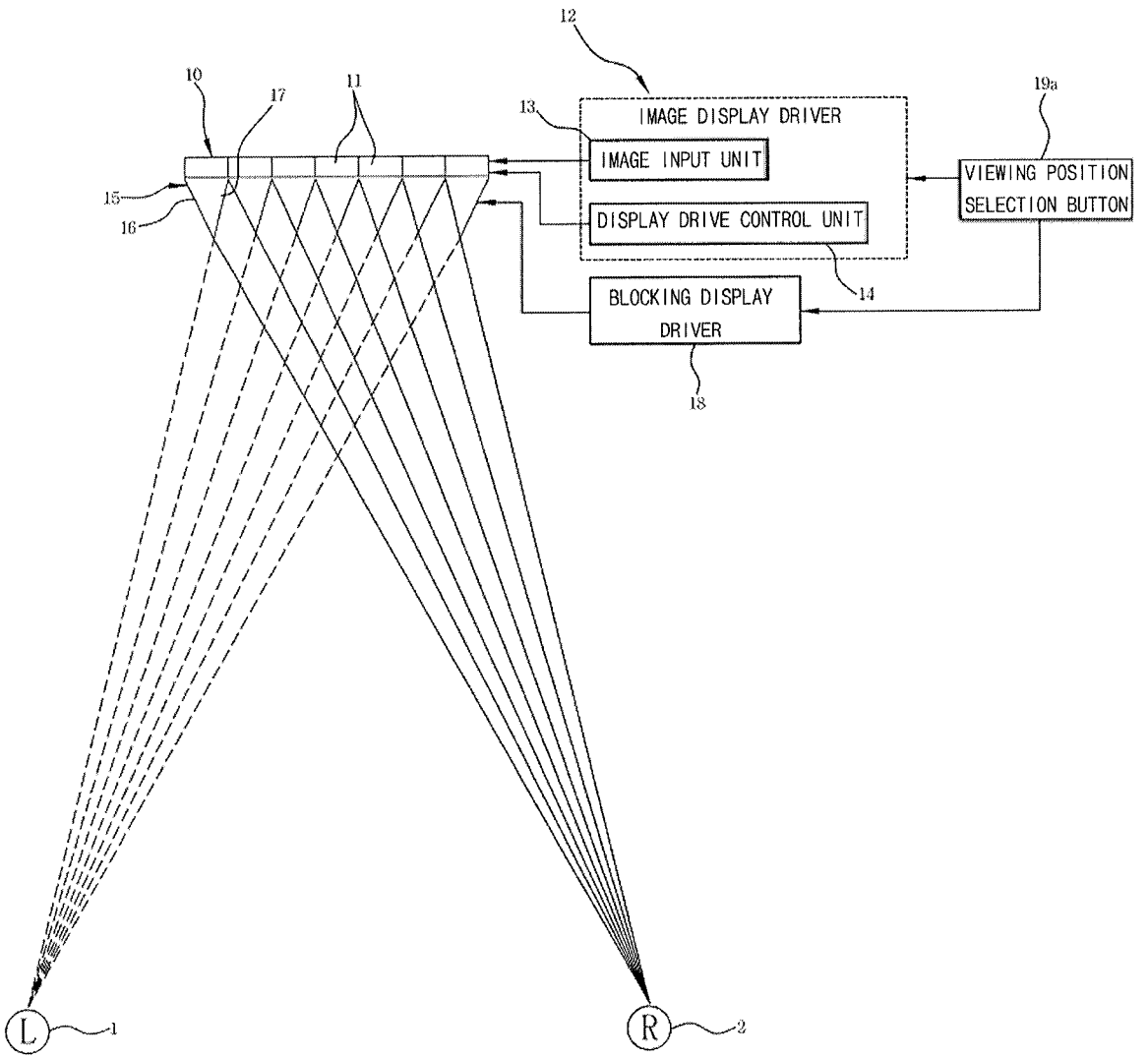
【FIGURE 3】



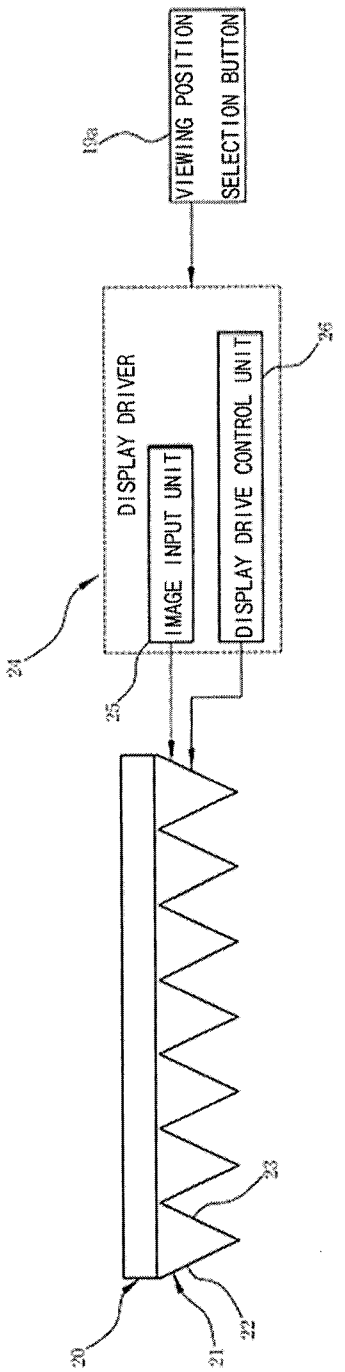
【FIGURE 4】


12
10
17
13
DISPLAY DRIVER
19a
15
IMAGE INPUT UNIT
VIEWING POSITION SELECTION BUTTON
16
DISPLAY DRIVE CONTROL UNIT
14
L
1
R
2

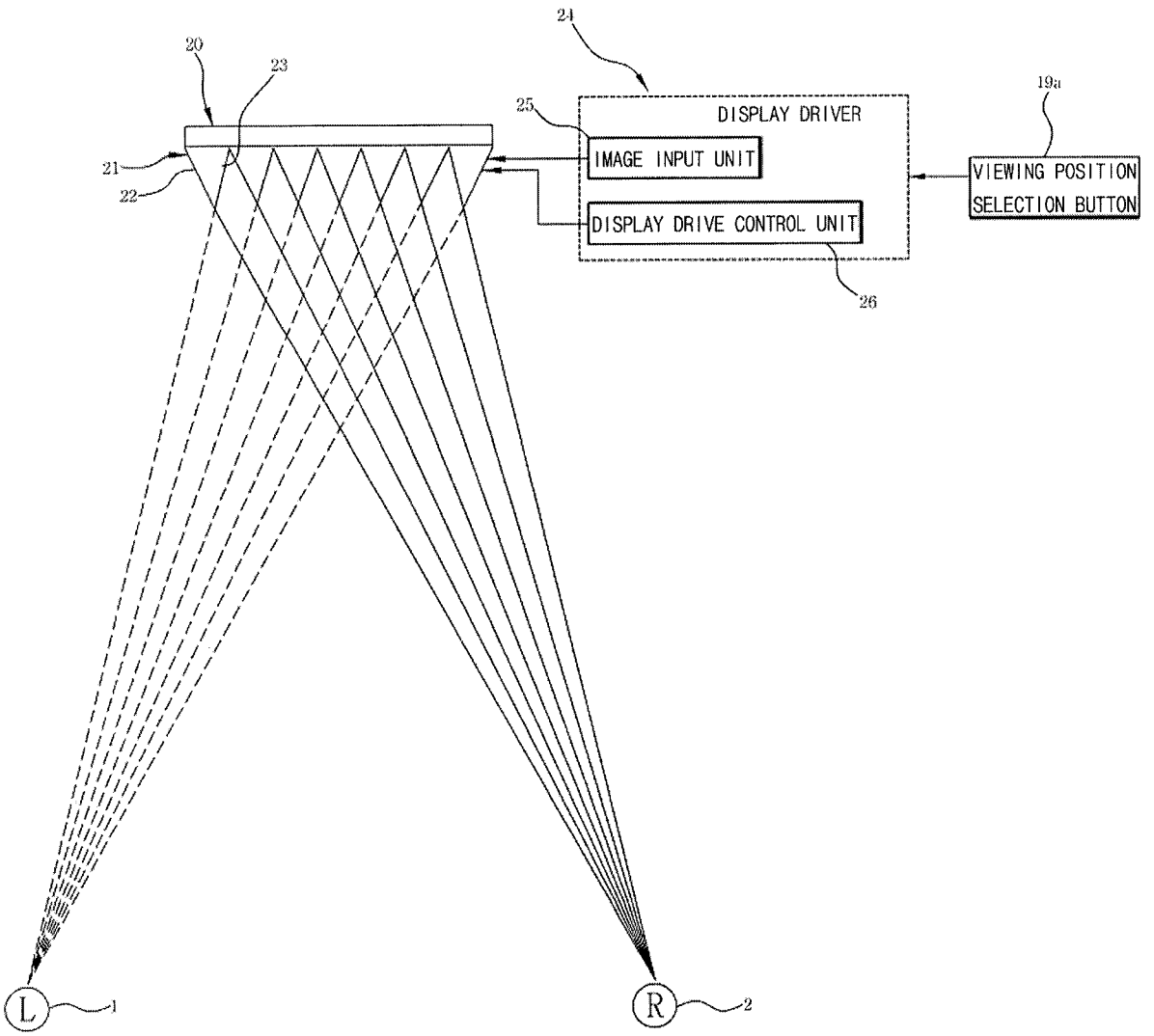
【FIGURE 5】


12
10
17
11
13
IMAGE DISPLAY DRIVER
19a
IMAGE INPUT UNIT
VIEWING POSITION SELECTION BUTTON
15
16
DISPLAY DRIVE CONTROL UNIT
14
BLOCKING DISPLAY DRIVER
18
L
1
R
2

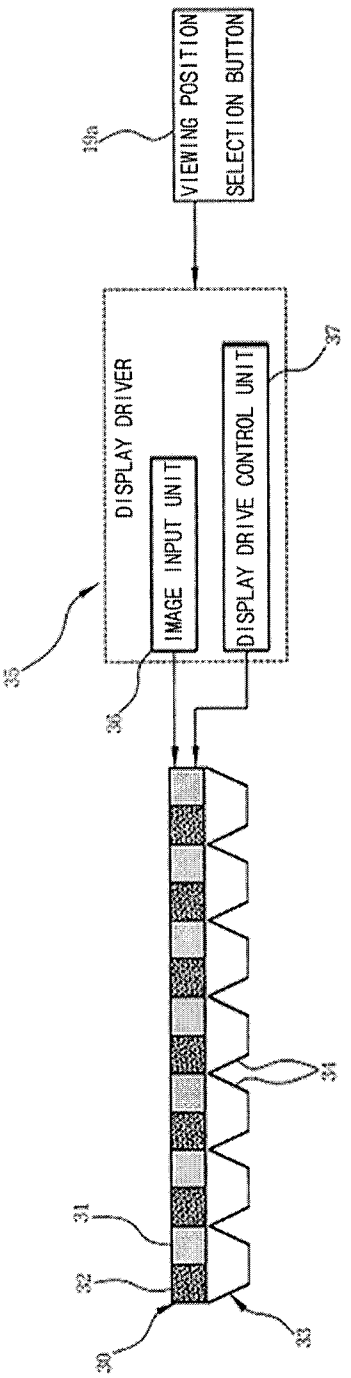
【FIGURE 6】


VIEWING POSITION SELECTION BUTTON
DISPLAY DRIVER
IMAGE INPUT UNIT
DISPLAY DRIVE CONTROL UNIT
24
25
26
20
21
22
23

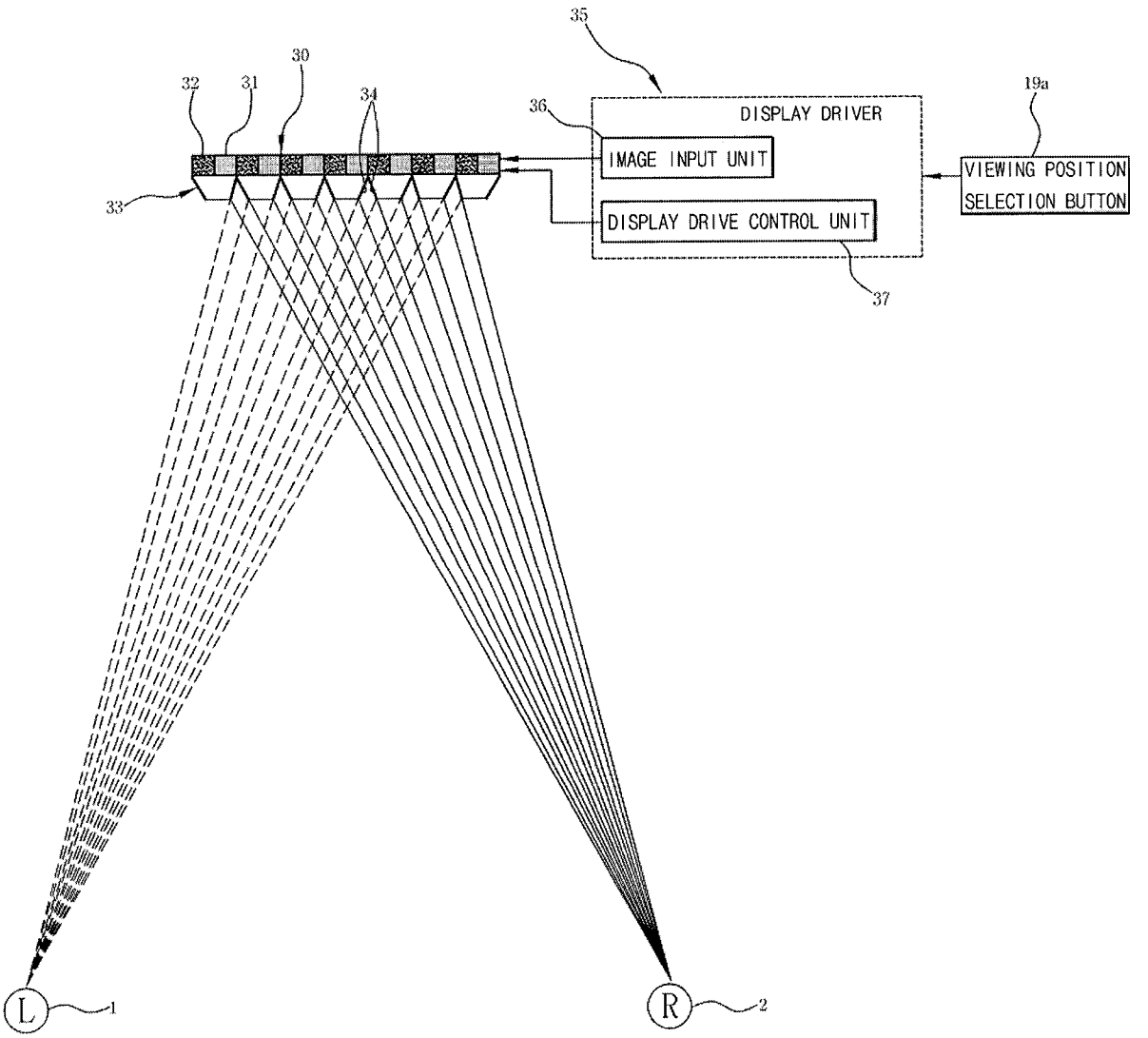
【FIGURE 7】


24
20
23
25
DISPLAY DRIVER
19a
21
22
IMAGE INPUT UNIT
VIEWING POSITION SELECTION BUTTON
DISPLAY DRIVE CONTROL UNIT
26
L
1
R
2

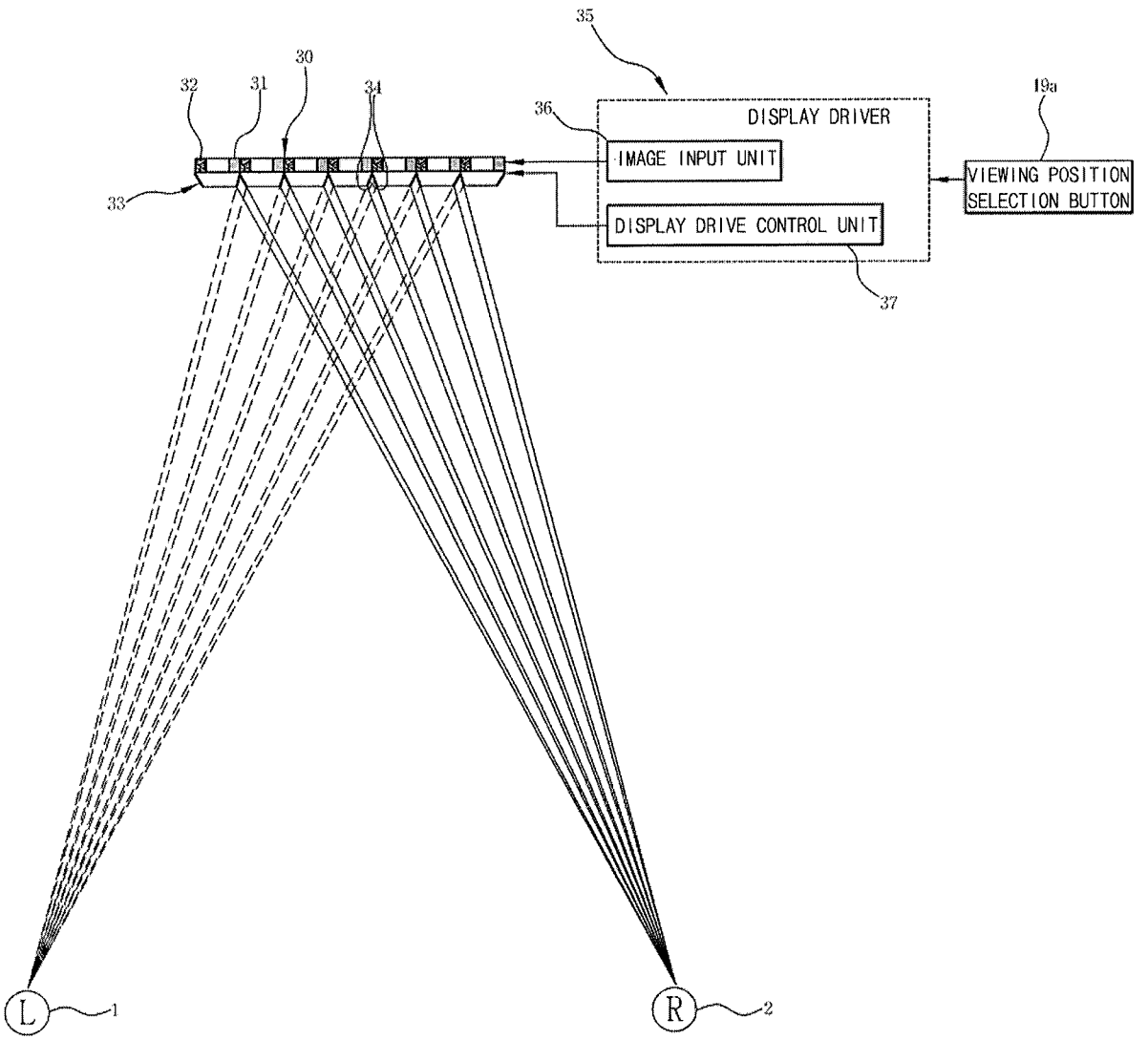
【FIGURE 8】


VIEWING POSITION SELECTION BUTTON
15a
DISPLAY DRIVER
IMAGE INPUT UNIT
DISPLAY DRIVE CONTROL UNIT
37
35
36
34
31
32
33
30

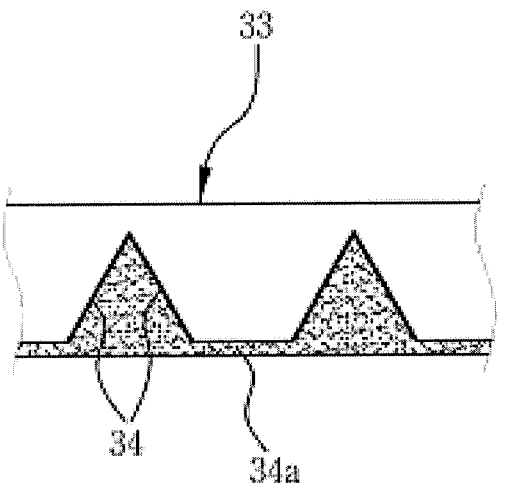
【FIGURE 9】


35
30
32
31
34
36
DISPLAY DRIVER
19a
IMAGE INPUT UNIT
VIEWING POSITION SELECTION BUTTON
33
DISPLAY DRIVE CONTROL UNIT
37
L
1
R
2

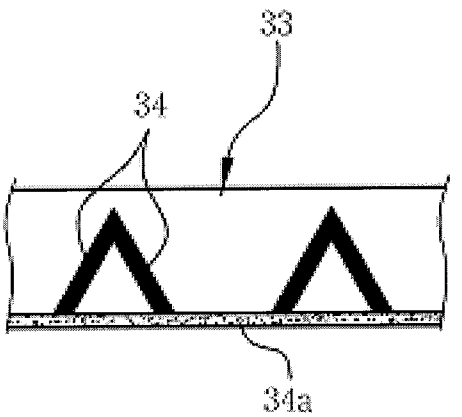
【FIGURE 10】


35
30
32
31
34
36
DISPLAY DRIVER
19a
IMAGE INPUT UNIT
VIEWING POSITION SELECTION BUTTON
33
DISPLAY DRIVE CONTROL UNIT
37
L
1
R
2

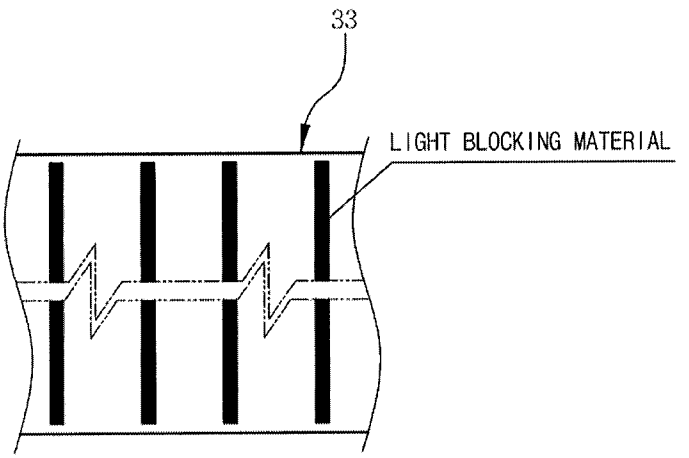
【FIGURE 11】



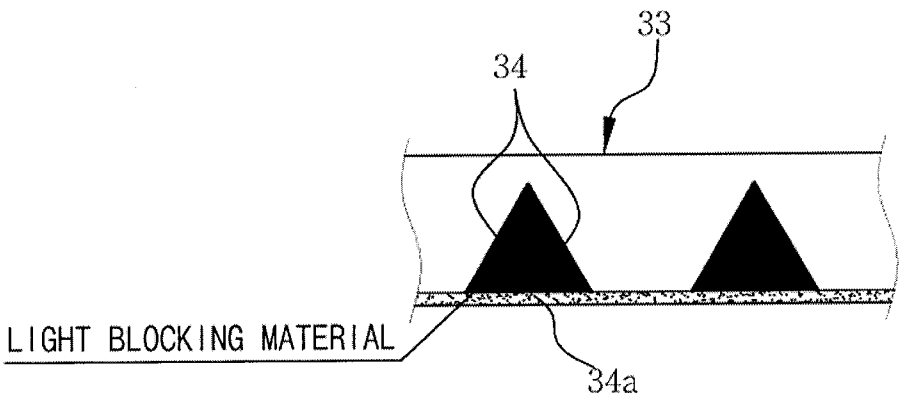
【FIGURE 12】



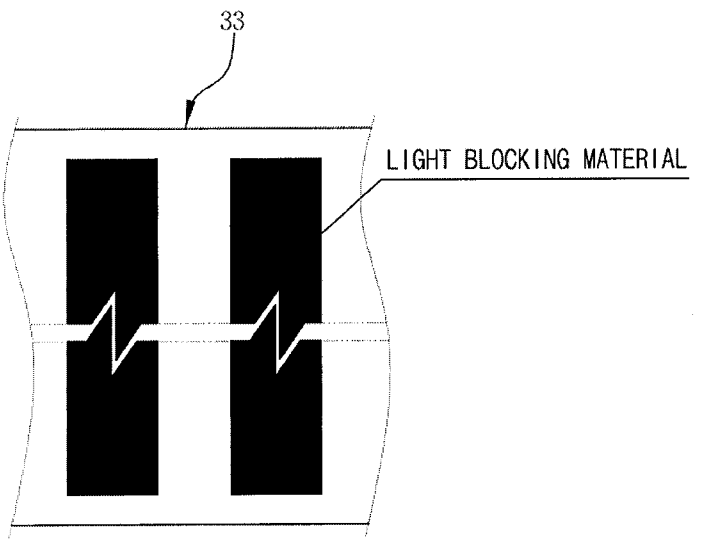
【FIGURE 13】



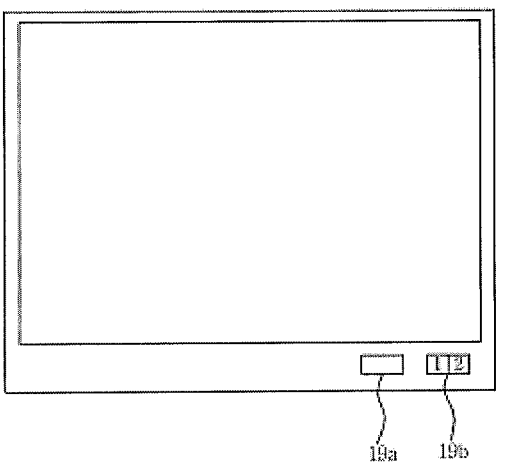
【FIGURE 14】



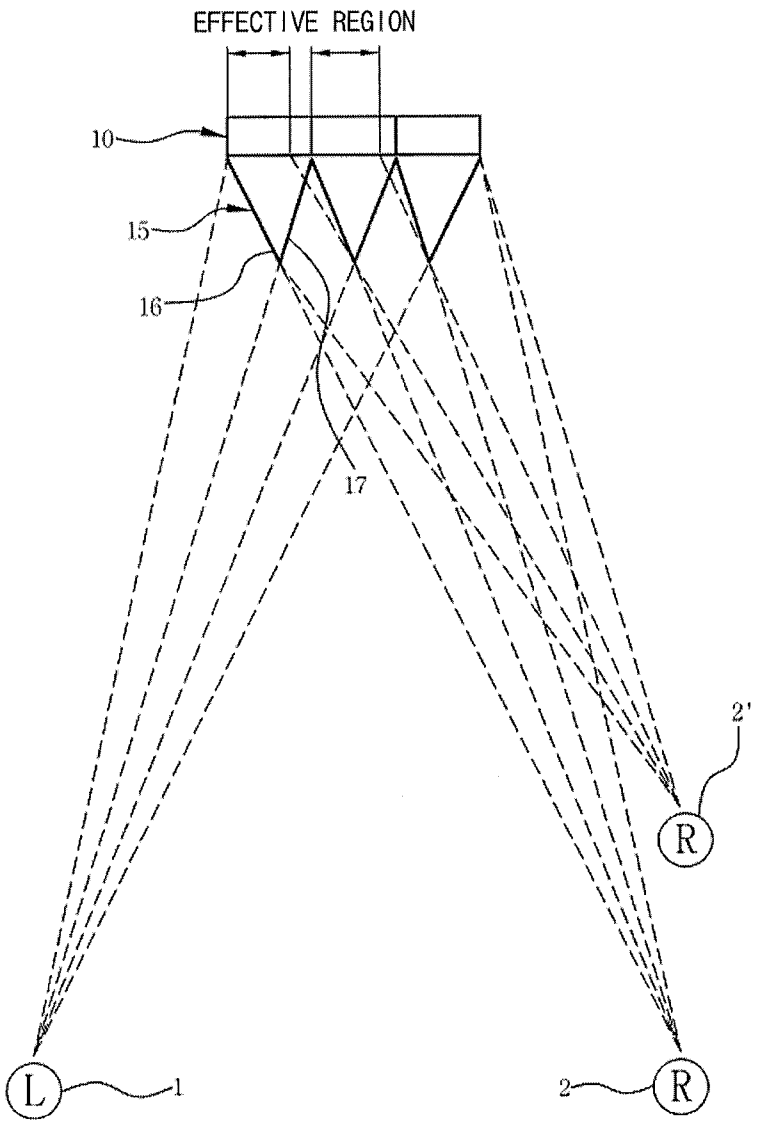
【FIGURE 15】



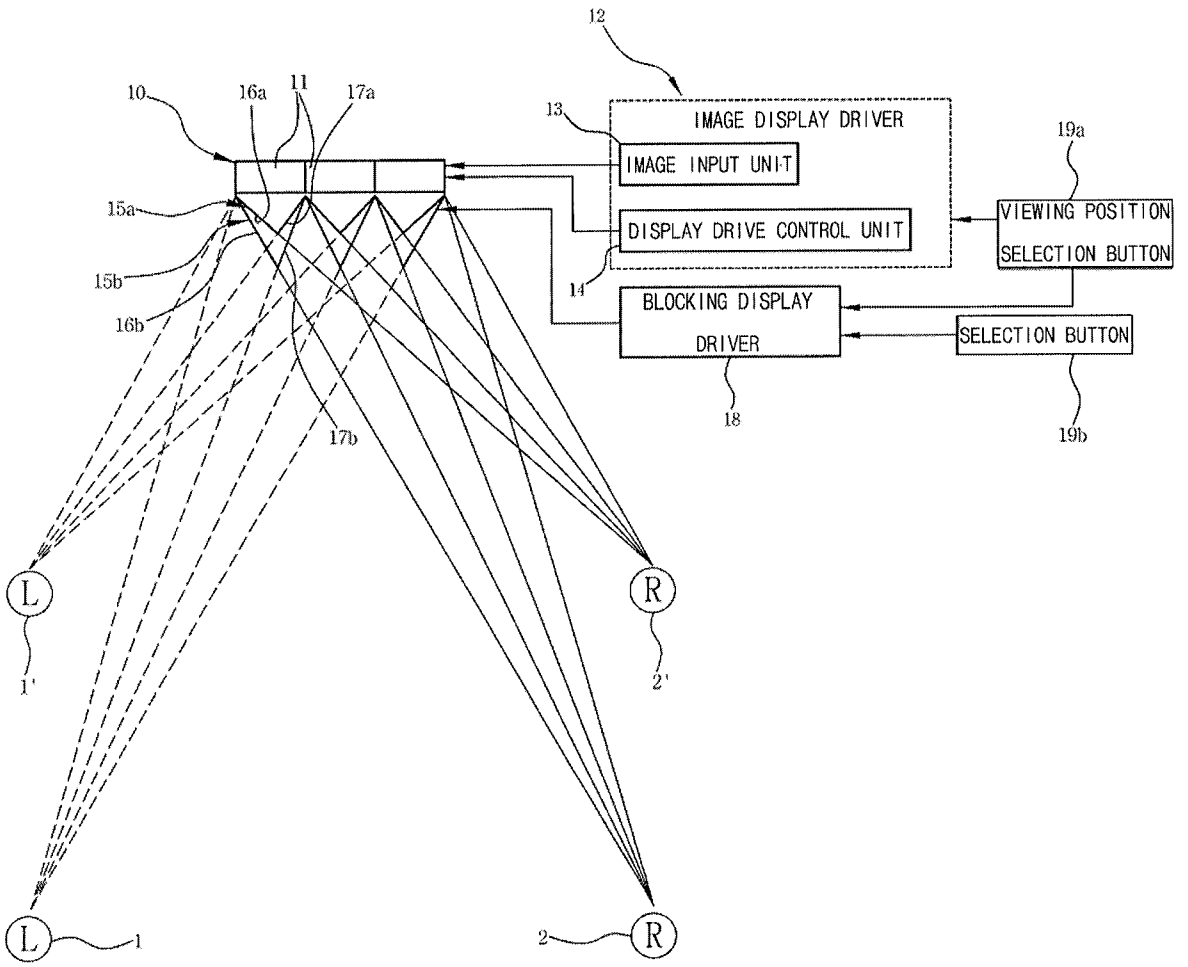
【FIGURE 16】



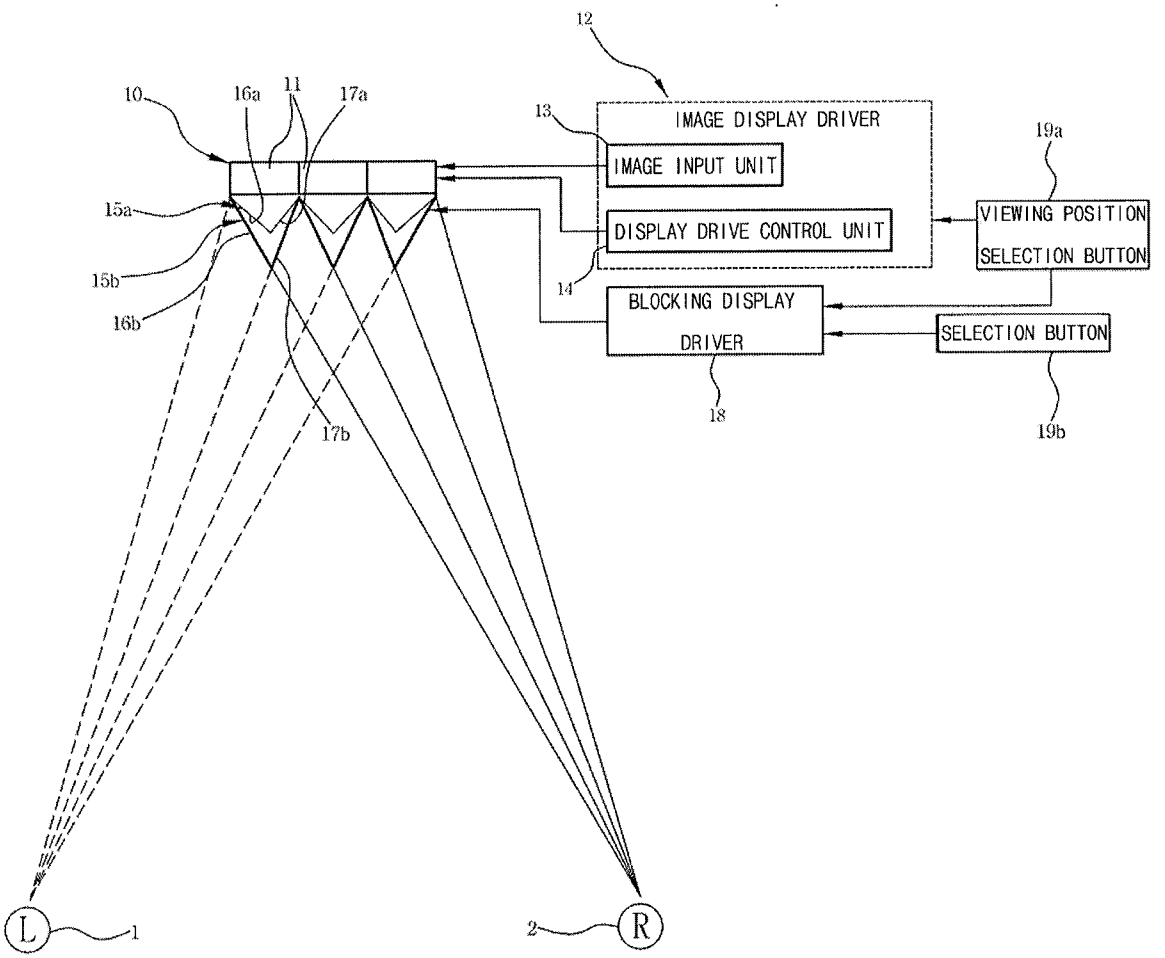
【FIGURE 17】



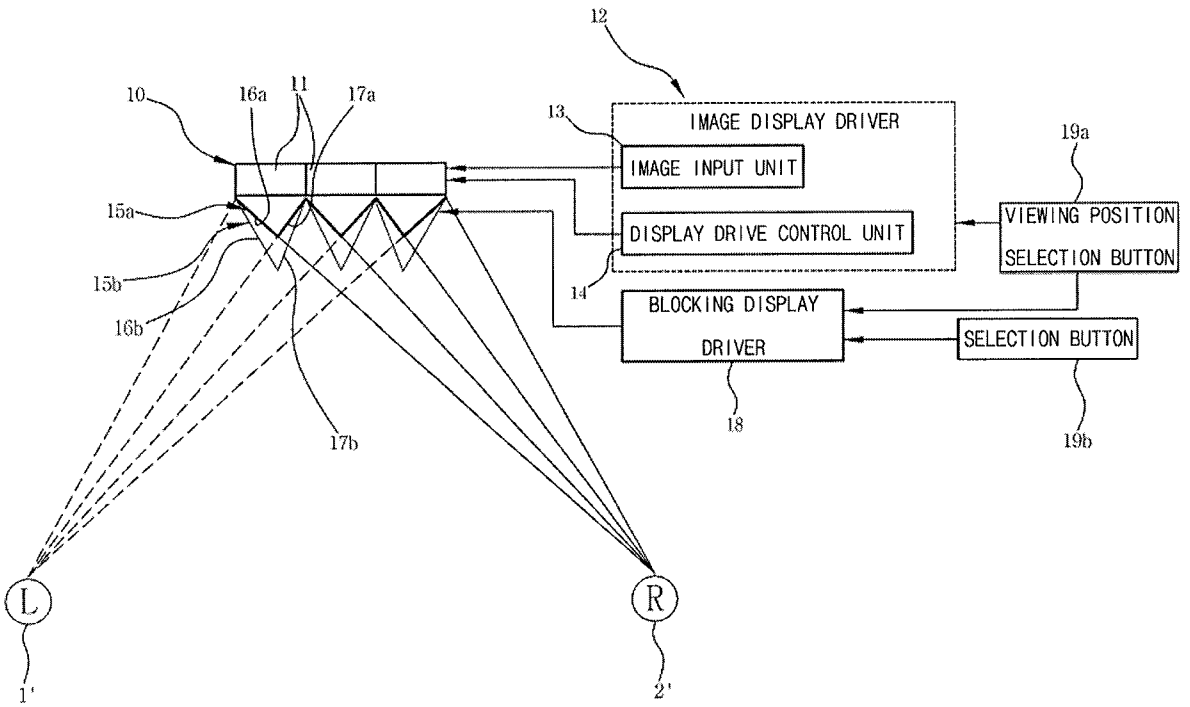
【FIGURE 18】


12
10
16a
11
17a
13
IMAGE DISPLAY DRIVER
IMAGE INPUT UNIT
19a
15a
DISPLAY DRIVE CONTROL UNIT
VIEWING POSITION SELECTION BUTTON
15b
14
16b
BLOCKING DISPLAY DRIVER
SELECTION BUTTON
18
19b
17b
L
R
1'
2'
L
1
2
R

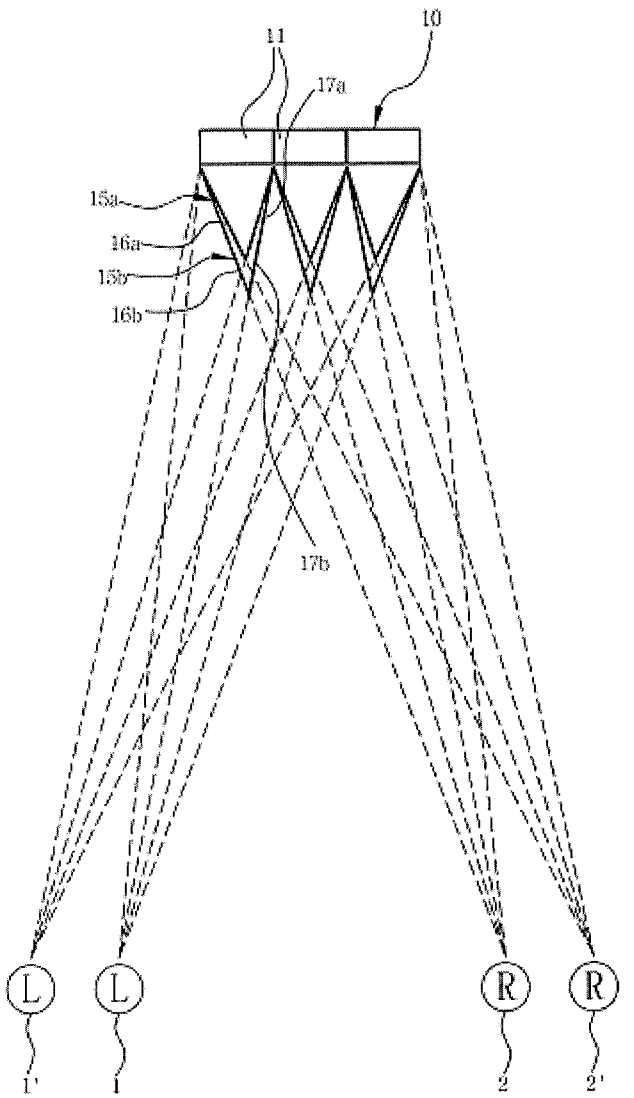
【FIGURE 19】


12
10
16a
11
17a
13
IMAGE DISPLAY DRIVER
IMAGE INPUT UNIT
DISPLAY DRIVE CONTROL UNIT
19a
VIEWING POSITION SELECTION BUTTON
15a
15b
16b
14
BLOCKING DISPLAY DRIVER
SELECTION BUTTON
18
19b
17b
L
1
2
R

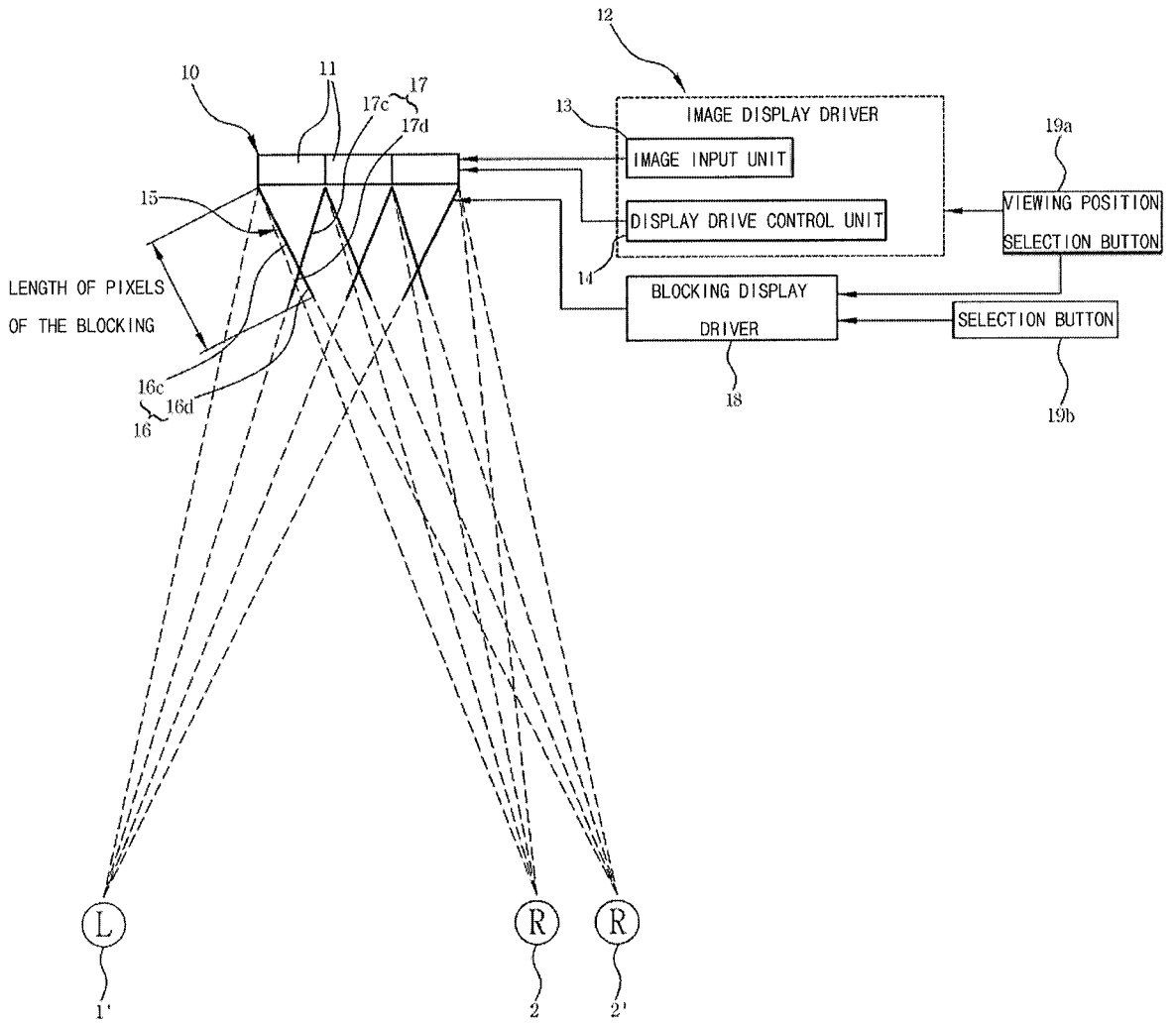
【FIGURE 20】


12
10
16a
11
17a
13
IMAGE DISPLAY DRIVER
IMAGE INPUT UNIT
19a
15a
DISPLAY DRIVE CONTROL UNIT
VIEWING POSITION SELECTION BUTTON
15b
14
16b
BLOCKING DISPLAY DRIVER
SELECTION BUTTON
18
19b
17b
L
R
1'
2'

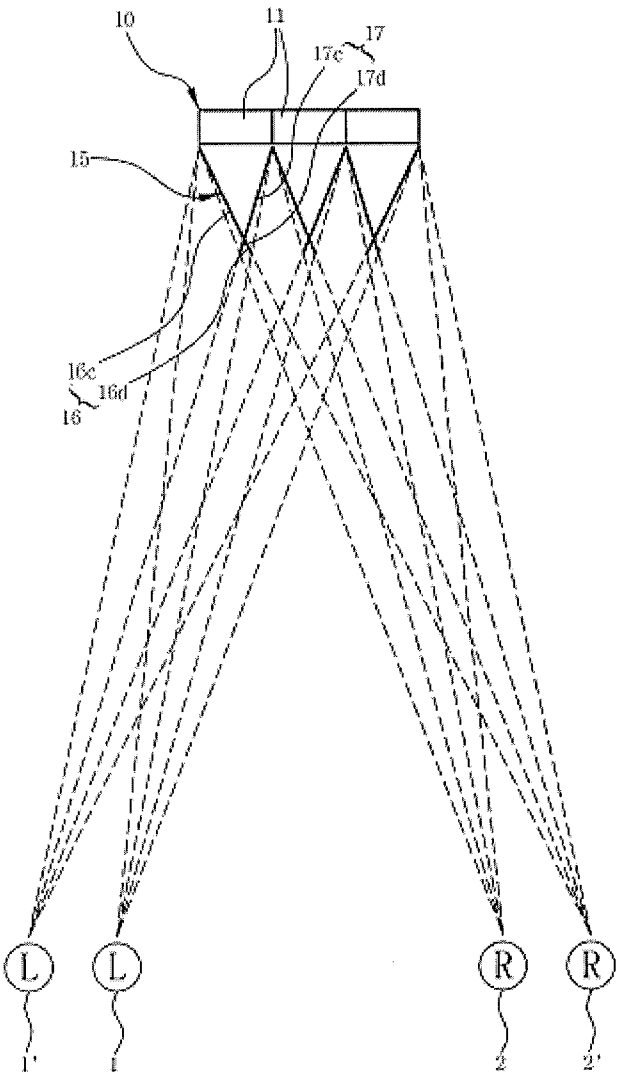
【FIGURE 21】



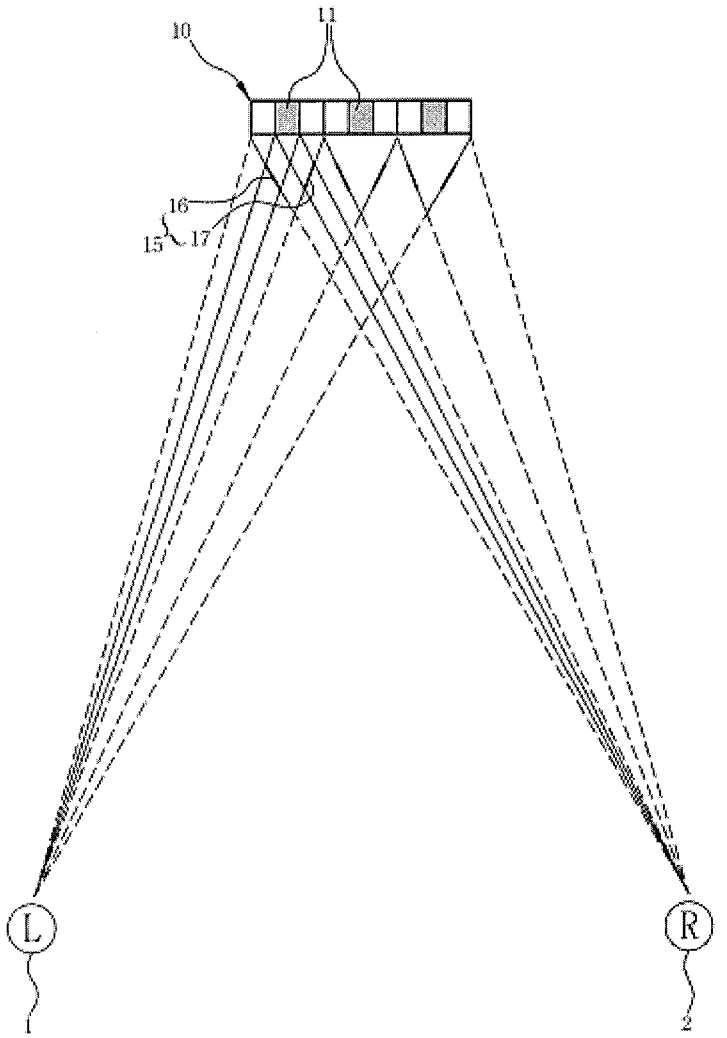
【FIGURE 22】


12
10
11
17
17c
17d
13
IMAGE DISPLAY DRIVER
19a
IMAGE INPUT UNIT
15
DISPLAY DRIVE CONTROL UNIT
VIEWING POSITION SELECTION BUTTON
LENGTH OF PIXELS OF THE BLOCKING
14
BLOCKING DISPLAY DRIVER
SELECTION BUTTON
16c
16d
16
18
19b
L
R
R
1'
2
2'

【FIGURE 23】



【FIGURE 24】



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2008/000191

A. CLASSIFICATION OF SUBJECT MATTER

G02B 27/22(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 8 G02B, H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Utility models and Applications for Utility models since 1975.
Japanese Utility models and Applications for Utility models since 1975.

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKIPASS(KIPO Internal)
"Keywords: stereoscopic, three, dimension, barrier"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 10-2003-0088244 A (Samsung SDI Inc.) 19 November 2003 See Abstract, Figure1 and Figure4	1-21
A	US 6049424 A (Goro Hamagishi) 11 April 2000 See Abstract, Figure1	1-21
A	US 6069650 A (Stephen J. Battersby) 30 May 2000 See Abstract, Column4 line 32 - column 5 line 10, Figure 2	1-21

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 MAY 2008 (30.05.2008)	**30 MAY 2008 (30.05.2008)**

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Authorized officer

MUN, Tae Jin

Telephone No. 82-42-481-8479

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2008/000191

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
KR 10-2003-0088244 A	19.11.2003	None	
US 6049424 A	11.04.2000	JP 03229824 B2	19.11.2001
US 6069650 A	30.05.2000	DE 69728647 C0	19.05.2004
		EP 0877966 B1	14.04.2004
		GB 9623682 A0	08.01.1997
		WO 98-21620 A1	22.05.1998