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IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF NEW YORK

TOMITA TECHNOLOGIES USA, LLC, AND TOMITA TECHNOLOGIES INTERNATIONAL, INC.,	)
Plaintiffs	)
vs.	)
NINTENDO CO., LTD., AND NINTENDO OF AMERICA, INC.	)
Defendants.	)

Civil Action No. 14cv9560

COMPLAINT

Tomita Technologies USA, LLC ("TTUSA") and Tomita Technologies International, Inc. ("TTI"), hereby asserts claims against Nintendo Co., Ltd. ("NINTENDO LTD") and Nintendo of America, Inc. ("NINTENDO AMERICA") (collectively, "NINTENDO") for infringing U.S. Patent No. 7,417,664 ("the '664 patent") and alleges as follows:

INTRODUCTION

1. This is an action for patent infringement by TTUSA and TTI against NINTENDO LTD and NINTENDO AMERICA.

2. The inventor of the '664 patent is Seijiro Tomita. Mr. Tomita is an accomplished scientist and engineer.

3. After working at Sony for nearly 30 years, Mr. Tomita retired in 2002 in order to pursue his goals of inventing and developing technology of interest to him.

4. As a result of his research efforts, Mr. Tomita is listed as an inventor or co-inventor on over 100 patent applications world-wide. Mr. Tomita is an inventor or co-inventor of nearly 70 patents world-wide.

5. Mr. Tomita has done substantial research and development in the area of stereoscopic (3-D) display technology. Among other things, Mr. Tomita invented and developed technology relating to displaying stereoscopic images on-screen for viewing with the naked eye. The '664 patent asserted in this action covers 3-D technology invented and developed by Mr. Tomita.

6. The '664 patent was issued by the United States Patent and Trademark Office on August 26, 2008 to Mr. Seijiro Tomita.

7. In recognition of the importance and uniqueness of Mr. Tomita's technology, the '664 patent and related patents have been licensed by third parties.

THE PLAINTIFFS

8. Plaintiff TTUSA is a corporation organized and existing under the laws of New York having a place of business in New York, NY 10075.

9. Plaintiff TTUSA is the exclusive U.S. licensee of the asserted patent and technology invented and developed by Mr. Tomita.

10. Plaintiff TTI is a corporation organized and existing under the laws of Japan having a place of business at 2-18-3 Sotokanda, Chiyoda-ku, Tokyo, Japan.

11. Plaintiff TTI is the owner of the '664 patent and other patents and patent applications, world-wide, invented and developed by Mr. Tomita.

THE DEFENDANTS

12. Upon information and belief, Defendant NINTENDO LTD is a corporation organized and existing under the laws of Japan having a place of business at 11-1 Kamitoba Hokotate-cho, Minami-ku, Kyoto, 601-8501, Japan.

13. Upon information and belief, Defendant NINTENDO AMERICA is a corporation organized and existing under the laws of Washington having a place of business at 4600 150th Avenue NE, Redmond, WA 98052.

14. Upon information and belief, NINTENDO AMERICA is a wholly owned subsidiary of NINTENDO LTD.

15. Upon information and belief, NINTENDO LTD is a provider of video game products, and related materials, that it manufactures, ships, distributes, sells, and/or offers for sale throughout the United States, including within the Southern District of New York.

16. Upon information and belief, NINTENDO AMERICA is a provider of video game products, and related materials, that it manufactures, ships, distributes, sells, and/or offers for sale throughout the United States, including in the Southern District of New York.

THE FIRST INFRINGEMENT SUIT

17. TTUSA and TTI previously asserted claims against NINTENDO LTD and NINTENDO AMERICA for infringement of the '664 patent by the Nintendo 3DS ("3DS"), in the case captioned *Tomita Technologies USA, LLC, and Tomita Technologies International, Inc. v. Nintendo Co., Ltd. and Nintendo of America Inc.*, Case No. 1:11-cv-04256-JSR (the "First Infringement Suit"), in this District.

18. On January 3, 2012, the Court in the First Infringement Suit issued an Order construing terms of the '664 patent (the "Claim Construction Order"), and on February 22, 2012, the Court issued a Memorandum explaining the reasons for its claim constructions (the "Claim Construction Memorandum").

19. All discovery in the First Infringement Suit closed on February 13, 2012.

20. On March 12, 2013, the jury in the First Infringement Suit returned a verdict finding that NINTENDO had infringed the '664 patent and that the '664 patent was not invalid.

21. On August 13, 2013, the Court in the First Infringement Suit issued a Memorandum Order, in response to NINTENDO's post-trial motions, upholding the jury verdict of infringement and validity.

THE NEW 3DS XL PRODUCT

22. Upon information and belief, on August 19, 2012 NINTENDO LTD and NINTENDO AMERICA launched a product called the Nintendo 3DS XL ("3DS XL") in the United States.

23. Since its introduction, the 3DS XL has realized substantial sales, largely as a result of the incorporation of 3-D technology.

24. The launch of the 3DS XL occurred after the Court's Claim Construction Order and Claim Construction Memorandum in the First Infringement Suit. The 3DS XL launch also occurred after the close of discovery in the First Infringement Suit. Accordingly, NINTENDO launched the 3DS XL in the U.S. after receiving a claim construction in the First Infringement Suit that did not comport with NINTENDO's positions, and NINTENDO continued to sell the 3DS XL after the Court upheld the jury verdict of infringement and validity.

25. Upon information and belief, the 3DS XL is substantially the same with respect to the capture and display of 3-D images as the 3DS product found to infringe the '664 patent in the First Infringement Suit.

26. NINTENDO AMERICA has marketed the 3DS XL in a manner that emphasizes the 3-D technology implemented therein by focusing on the 3-D technology on its website:

> "The Nintendo 3DS XL system features a stereoscopic 3D display on the upper screen to give objects within the game world a feeling of space and depth. It becomes easier to see the position of the characters and obstacles, making many game experiences even more intuitive for all types of players."
>
> "The Nintendo 3DS XL system can take photos in 3D, thanks to the two outward-facing lenses."

See 3DS XL webpage, annexed hereto as Exhibit B, pp. 2-3.

27. Upon information and belief, NINTENDO LTD has made and/or aided in the making of materials used to sell and/or market the 3DS XL in the U.S. and elsewhere.

JURISDICTION AND VENUE

28. The claims asserted in this Complaint arise under the Patent Laws of the United States, 35 U.S.C. §§ 1-376.

29. Subject matter jurisdiction is proper pursuant to 28 U.S.C. §§ 1331 and 1338.

30. This Court has personal jurisdiction over NINTENDO AMERICA and NINTENDO LTD. NINTENDO AMERICA and NINTENDO LTD have committed and continue to commit, have contributed to and continue to contribute to, and have induced and continue to induce, acts of patent infringement in this District.

31. Venue is proper in this judicial district pursuant to 28 U.S.C. §§ 1391 and 1400.

THE PATENT-IN-SUIT

32. The '664 patent, entitled "Stereoscopic Image Picking Up and Display System Based Upon Optical Axes Cross-Point Information," was lawfully issued by the United States Patent and Trademark Office ("PTO") on August 26, 2008 to the inventor Seijiro Tomita. The '664 patent issued from U.S. Patent Application Serial No. 10/475,849, which is the U.S. National Stage application of PCT Application No. PCT/JP03/03405, filed March 20, 2003. A copy of the '664 patent is attached as Exhibit A.

33. The '664 patent was assigned to TTI. TTI is the rightful owner of the '664 patent, and holds the entire right, title and interest in the '664 patent. TTUSA was granted by TTI an exclusive license to the '664 patent in the U.S.A., which includes the exclusive rights in the U.S.A. to make, have made, modify, use, sell, import, export, distribute, lease or otherwise transfer products within the scope of the '664 patent and to recover for all present, future, and past infringements of the '664 patent.

COUNT I – INFRINGEMENT OF THE '664 PATENT

34. TTUSA and TTI reallege and incorporate by reference each of the preceding paragraphs.

35. Upon information and belief, NINTENDO LTD and/or NINTENDO AMERICA have infringed one or more claims of the '664 patent by making, using, offering for sale, selling, and/or importing into the United States video game products, including the 3DS XL, having stereoscopic 3-D technology embodying the patented invention.

36. NINTENDO LTD and/or NINTENDO AMERICA's infringement relating to the 3DS XL began after the Court in the First Infringement Suit construed the terms of the '664 patent and has continued after the jury reached its verdict in the First Infringement Suit and after

the Court in the First Infringement Suit issued its Memorandum Order upholding the jury verdict of infringement and validity.

37. Upon information and belief, the 3DS XL product has the same specific functions and features found in the 3DS product that the jury and the Court found to infringe the '664 patent.

38. Specifically, the 3DS XL has two outer cameras that are used to capture stereoscopic images.

39. The 3DS XL has a stereoscopic display that is capable of displaying stereoscopic images.

40. The 3DS XL has a medium for transmitting video image information from its outer cameras to its stereoscopic image display device.

41. Upon information and belief, the 3DS XL has both a 3DS Camera application and an AR Games application that are capable of determining a focus value at the time a stereoscopic image is captured.

42. Upon information and belief, in the 3DS Camera application, the focus value can be determined based on user input from the circle pad or touch screen, or automatically based on the position of objects picked up by the 3DS XL's outer cameras.

43. Upon information and belief, in the AR Game application, the focus value is determined based on the location of an AR game card.

44. The focus value represents an offset between selected subsets of the left and right images and determines the location of the cross-point of the optical axes of the 3DS XL's outer cameras.

45. The focus value constitutes "CP information," as construed by the Court in the Claim Construction Order, that is stored or otherwise transmitted with the left and right images.

46. Accordingly, the 3DS XL satisfies the "cross-point measuring means" limitation recited in the claims of the '664 patent.

47. Upon information and belief, when displaying 3D images, the 3DS Camera application and AR Games application in the 3DS XL determines a second offset based on the focus value (CP information) and information on the size of the image that is displayed.

48. Accordingly, the 3DS XL satisfies the "offset presetting means" limitation recited in the claims of the '664 patent.

49. Upon information and belief, NINTENDO LTD and/or NINTENDO AMERICA have infringed one or more claims of the '664 patent by inducing others to infringe the '664 patent and/or contributing to the infringement of the '664 patent by others.

50. As a consequence of NINTENDO LTD's and/or NINTENDO AMERICA's infringement of the '664 patent, TTUSA and TTI have been damaged in an amount not yet determined.

51. Upon information and belief, NINTENDO LTD's and/or NINTENDO AMERICA's infringement of the '664 patent will continue in the future, and TTUSA and TTI will continue to suffer damages as a consequence, unless NINTENDO LTD's and/or NINTENDO AMERICA's infringing acts are enjoined by this Court.

52. Upon information and belief, NINTENDO LTD and/or NINTENDO AMERICA continue to sell the 3DS XL even though NINTENDO LTD and NINTENDO AMERICA are aware (a) of the Court's prior claim construction in the First Infringement Suit, (b) that the 3DS XL is substantially similar to the 3DS, a product found to be infringing the '664 patent in the

First Infringement Suit, and (c) that their continued sale and promotion of the 3DS XL after the jury verdict in the First Infringement Suit was and is in contravention of the Court's post-verdict rulings. Therefore, NINTENDO LTD's and/or NINTENDO AMERICA's infringement of the '664 patent has been, and continues to be, willful.

PRAYER FOR RELIEF

WHEREFORE, TTUSA and TTI respectfully requests that the Court enter judgment against NINTENDO LTD and/or NINTENDO AMERICA:

A. determining that NINTENDO LTD and/or NINTENDO AMERICA have infringed and continue to infringe one or more claims of the '664 patent;

B. permanently enjoining NINTENDO LTD and/or NINTENDO AMERICA, their respective officers, agents, servants, directors, employees and attorneys, and all persons acting in concert or participation with them, directly or indirectly, or any of them who receive actual notice of the judgment, from further infringing, inducing others to infringe, or contributing to the infringement of any claim of the '664 patent;

C. ordering NINTENDO LTD and/or NINTENDO AMERICA to account for and pay to TTUSA and TTI all damages suffered by TTUSA and TTI as a consequence of NINTENDO LTD's and/or NINTENDO AMERICA's infringement of the '664 patent, together with interest and costs as fixed by the Court;

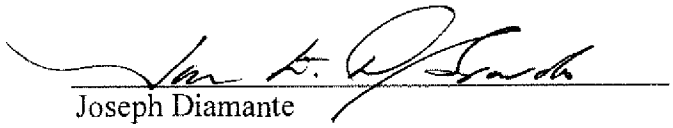
D. ordering NINTENDO LTD and/or NINTENDO AMERICA to pay ongoing royalties to TTUSA and TTI to compensate TTUSA and TTI for any further direct or indirect infringement by NINTENDO LTD and/or NINTENDO AMERICA of any claim of the '664 patent after the verdict in this case;

E. trebling TTUSA and TTI's damages under U.S.C. § 284 on the ground that NINTENDO LTD's and/or NINTENDO AMERICA's infringement of the '664 patent was, and continues to be, deliberate and willful;

F. declaring that this case is exceptional and awarding TTUSA and TTI its costs and attorneys' fees in accordance with 35 U.S.C. § 285; and

G. granting TTUSA and TTI such other and further relief as the Court may deem just and proper.

STROOCK & STROOCK & LAVAN L.L.P.



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December 3, 2014

Exhibit A

US007417664B2

(12) **United States Patent**
Tomita

(10) **Patent No.: US 7,417,664 B2**
(45) **Date of Patent: Aug. 26, 2008**

(54) **STEREOSCOPIC IMAGE PICKING UP AND DISPLAY SYSTEM BASED UPON OPTICAL AXES CROSS-POINT INFORMATION**

(76) Inventor: **Seijiro Tomita**, 13-5, Inogata 3-chome, Komae-shi, Tokyo 201-0015 (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 829 days.

(21) Appl. No.: **10/475,849**

(22) PCT Filed: **Mar. 20, 2003**

(86) PCT No.: **PCT/JP03/03405**

§ 371 (c)(1),
(2), (4) Date: **Oct. 31, 2003**

(87) PCT Pub. No.: **WO2004/084560**

PCT Pub. Date: **Sep. 30, 2004**

(65) **Prior Publication Data**

US 2004/0233275 A1 Nov. 25, 2004

(51) **Int. Cl.**
H04N 13/00 (2006.01)

(52) **U.S. Cl.** **348/43**; 348/47; 348/51

(58) **Field of Classification Search** 348/43, 348/47, 51; *H04N 13/00*
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,937,212 A * 8/1999 Kurahashi et al. 348/47

* cited by examiner

Primary Examiner—Young Lee
(74) *Attorney, Agent, or Firm*—Edwards Angell Palmer & Dodge LLP

(57) **ABSTRACT**

A stereoscopic video image pick-up and display system having a stereoscopic video image pick-up device including two video image pick-ups for outputting video information from the pick-ups; a stereoscopic video image display device for displaying different video images; and a medium for transmitting the video image information from the stereoscopic video image pick-up device to the stereoscopic video image display device. The stereoscopic video image pick-up device includes a cross-point measuring device for measuring CP information on the cross-point (CP) of optical axes of pick-ups and outputs information including the CP information and video image information to the medium. The stereoscopic video image display device includes an offset presetting device for offsetting and displaying different video images based upon the video image information, the cross-point information and information on the size of the image which is displayed by the stereoscopic video image display device.

22 Claims, 15 Drawing Sheets

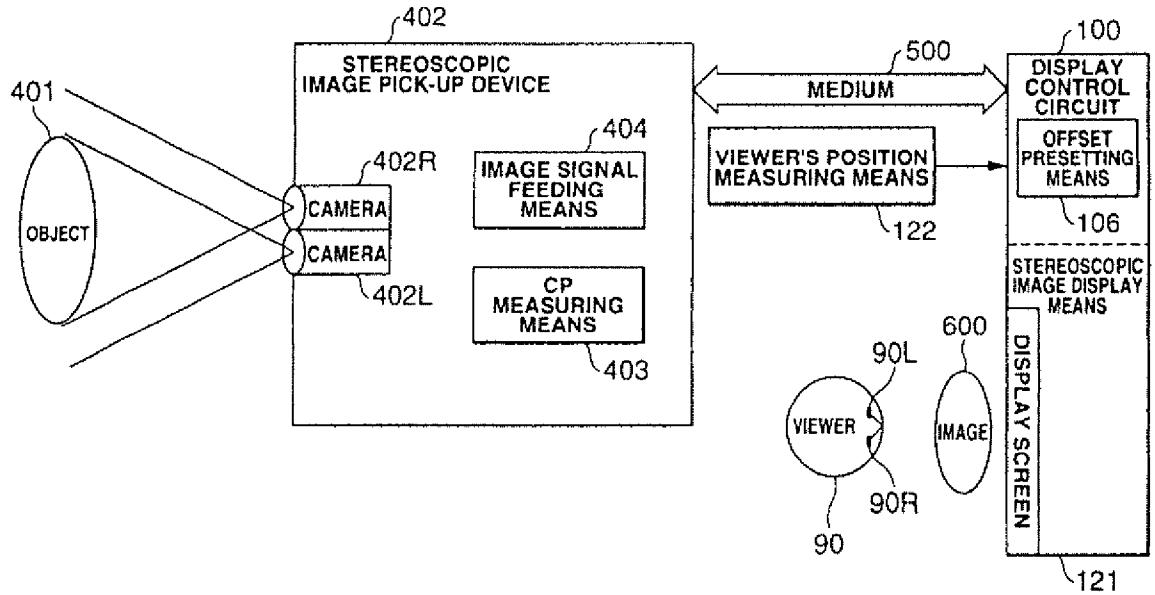


FIG.1

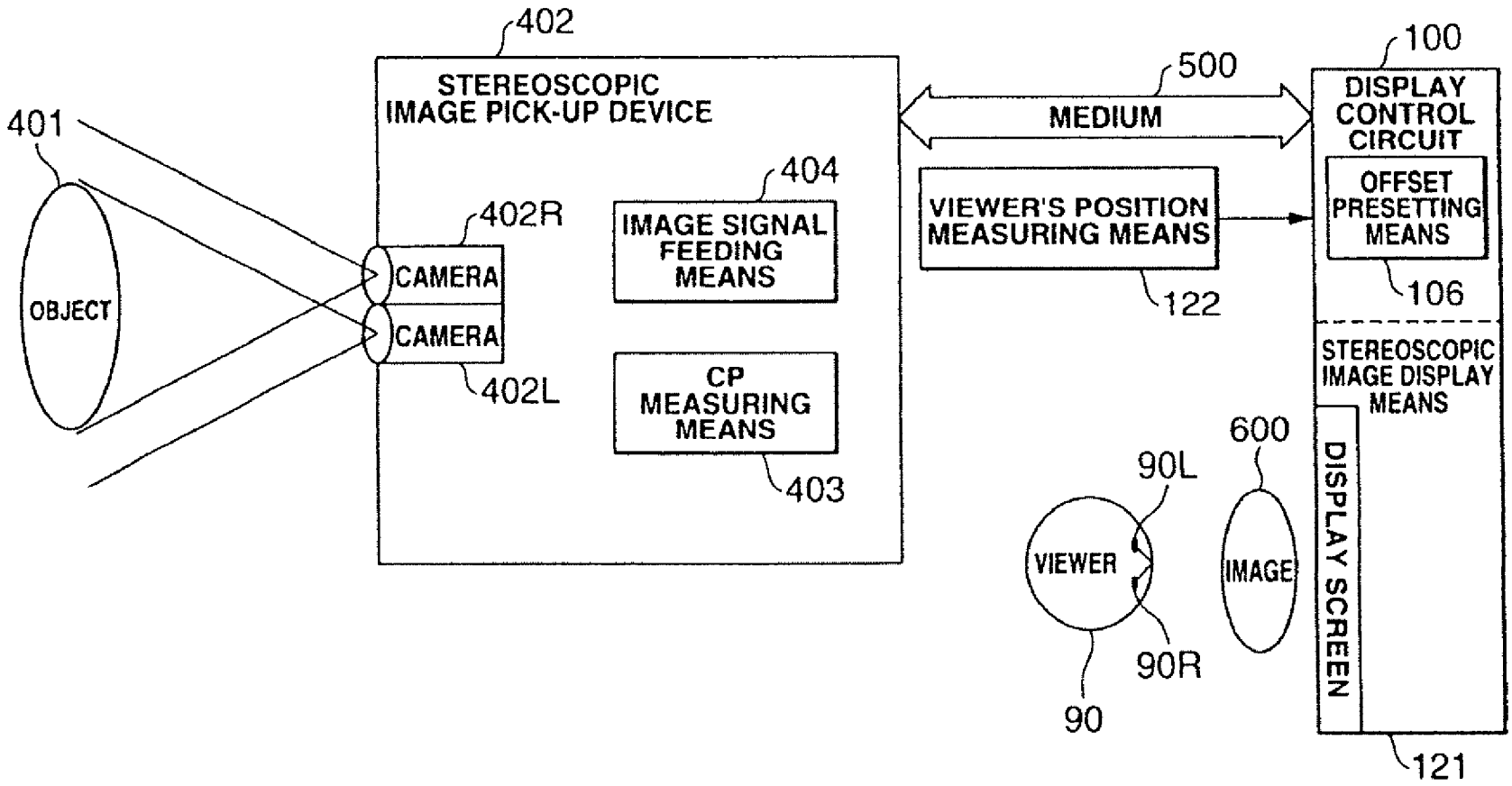

402
STEREOSCOPIC IMAGE PICK-UP DEVICE
401
OBJECT
402R
CAMERA
CAMERA
402L
404
IMAGE SIGNAL FEEDING MEANS
CP MEASURING MEANS
403
500
MEDIUM
VIEWER'S POSITION MEASURING MEANS
122
100
DISPLAY CONTROL CIRCUIT
OFFSET PRESETTING MEANS
106
STEREOSCOPIC IMAGE DISPLAY MEANS
DISPLAY SCREEN
121
600
IMAGE
90L
VIEWER
90R
90

FIG.2

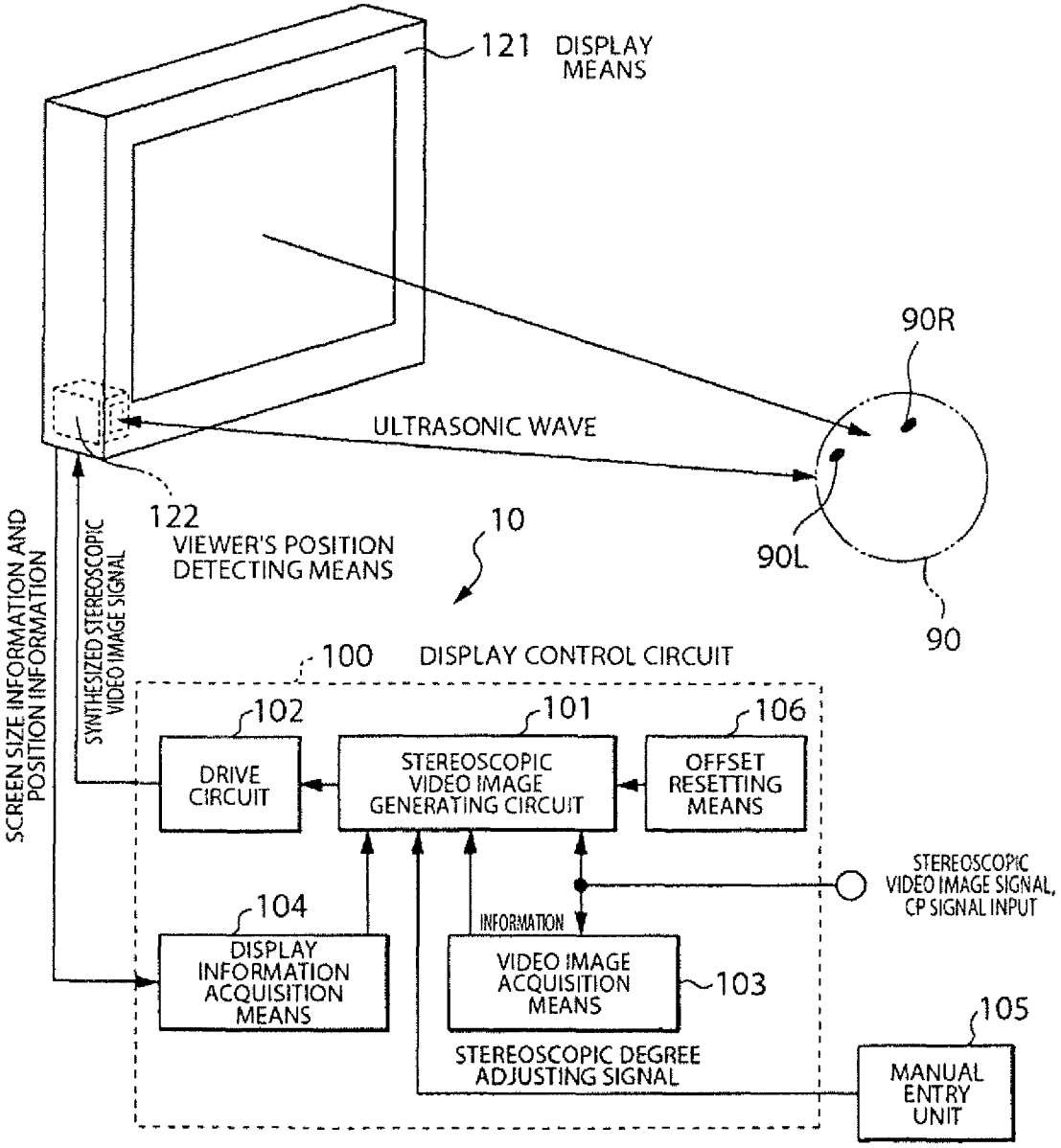

121 DISPLAY MEANS
90R
ULTRASONIC WAVE
122
VIEWER'S POSITION DETECTING MEANS
10
90L
90
SCREEN SIZE INFORMATION AND POSITION INFORMATION
SYNTHESIZED STEREOSCOPIC VIDEO IMAGE SIGNAL
100 DISPLAY CONTROL CIRCUIT
102
DRIVE CIRCUIT
101
STEREOSCOPIC VIDEO IMAGE GENERATING CIRCUIT
106
OFFSET RESETTING MEANS
STEREOSCOPIC VIDEO IMAGE SIGNAL, CP SIGNAL INPUT
104
DISPLAY INFORMATION ACQUISITION MEANS
INFORMATION
VIDEO IMAGE ACQUISITION MEANS
103
105
STEREOSCOPIC DEGREE ADJUSTING SIGNAL
MANUAL ENTRY UNIT

FIG.3

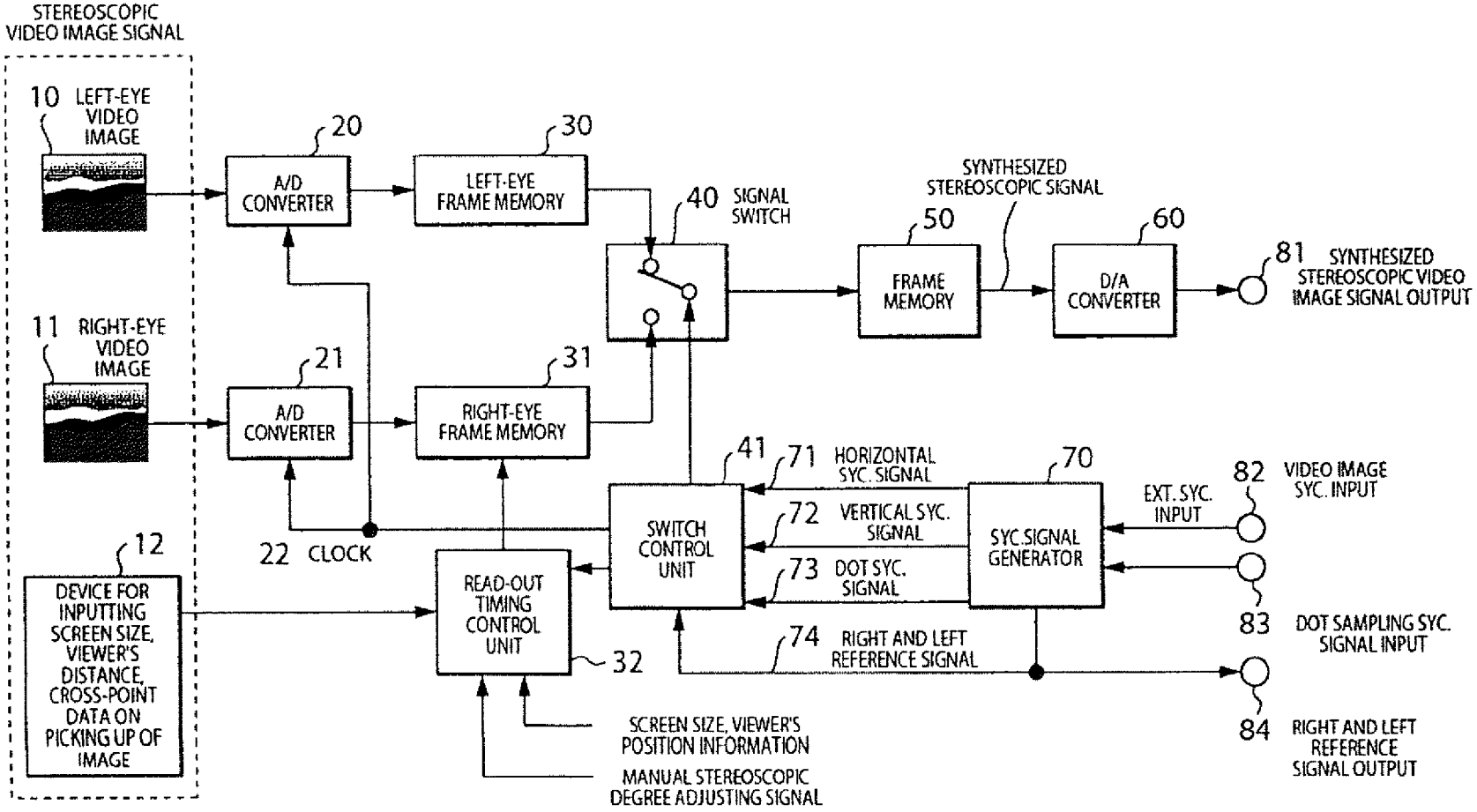

STEREOSCOPIC VIDEO IMAGE SIGNAL
10 LEFT-EYE VIDEO IMAGE
11 RIGHT-EYE VIDEO IMAGE
12 DEVICE FOR INPUTTING SCREEN SIZE, VIEWER'S DISTANCE, CROSS-POINT DATA ON PICKING UP OF IMAGE
20 A/D CONVERTER
21 A/D CONVERTER
22 CLOCK
30 LEFT-EYE FRAME MEMORY
31 RIGHT-EYE FRAME MEMORY
32 READ-OUT TIMING CONTROL UNIT
40 SIGNAL SWITCH
41 SWITCH CONTROL UNIT
50 FRAME MEMORY
60 D/A CONVERTER
70 SYC.SIGNAL GENERATOR
71 HORIZONTAL SYC. SIGNAL
72 VERTICAL SYC. SIGNAL
73 DOT SYC. SIGNAL
74 RIGHT AND LEFT REFERENCE SIGNAL
SYNTHESIZED STEREOSCOPIC SIGNAL
81 SYNTHESIZED STEREOSCOPIC VIDEO IMAGE SIGNAL OUTPUT
82 VIDEO IMAGE SYC. INPUT
EXT. SYC. INPUT
83 DOT SAMPLING SYC. SIGNAL INPUT
84 RIGHT AND LEFT REFERENCE SIGNAL OUTPUT
SCREEN SIZE, VIEWER'S POSITION INFORMATION
MANUAL STEREOSCOPIC DEGREE ADJUSTING SIGNAL

FIG.4

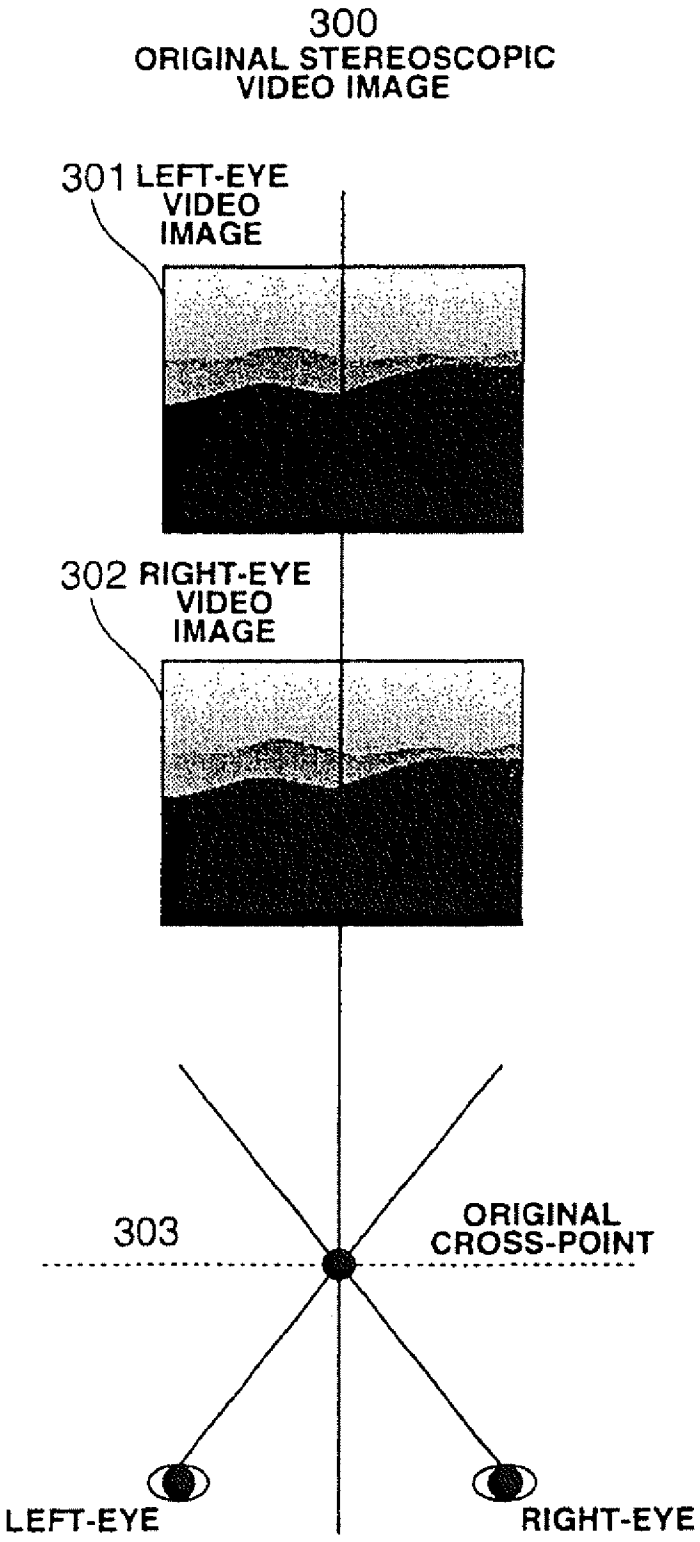

300
ORIGINAL STEREOSCOPIC VIDEO IMAGE
301 LEFT-EYE VIDEO IMAGE
302 RIGHT-EYE VIDEO IMAGE
303
ORIGINAL CROSS-POINT
LEFT-EYE
RIGHT-EYE

FIG.5

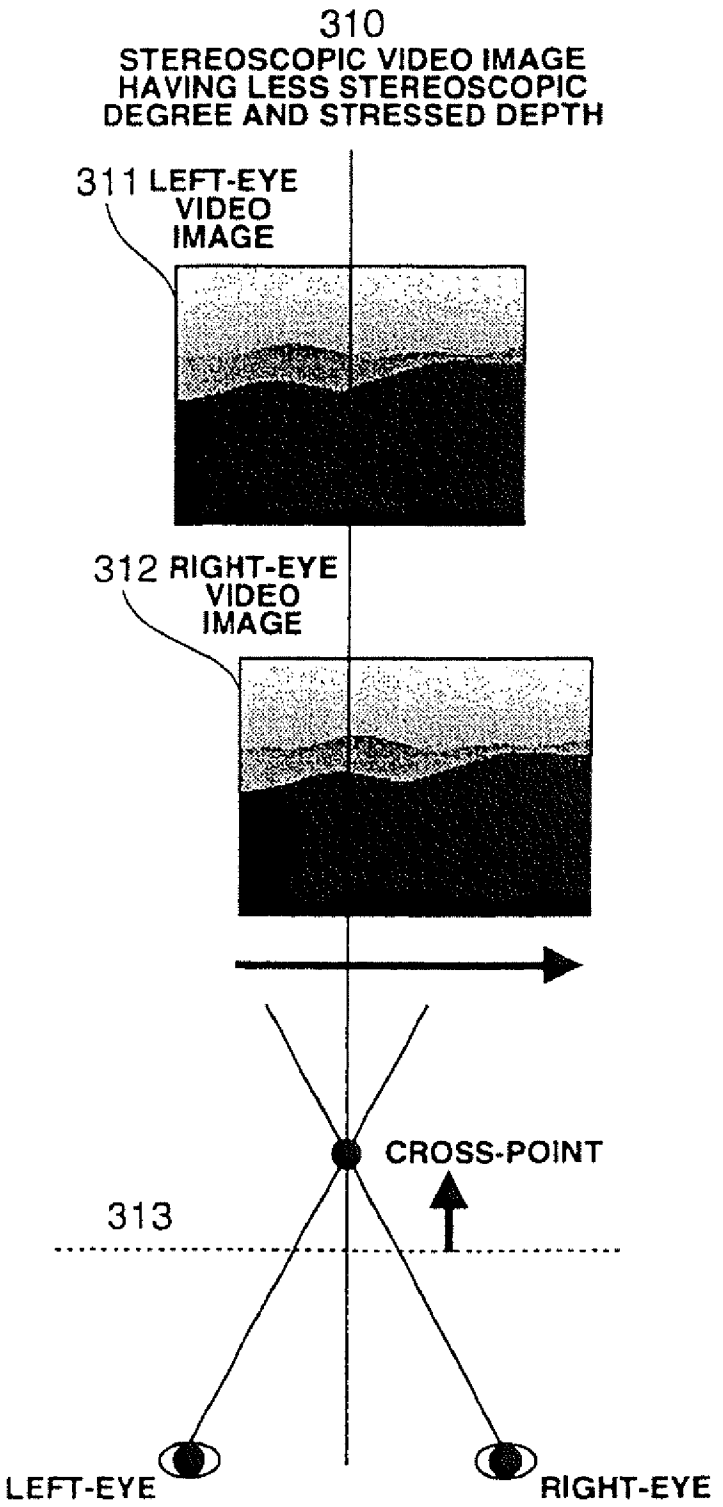

310
STEREOSCOPIC VIDEO IMAGE HAVING LESS STEREOSCOPIC DEGREE AND STRESSED DEPTH
311 LEFT-EYE VIDEO IMAGE
312 RIGHT-EYE VIDEO IMAGE
CROSS-POINT
313
LEFT-EYE
RIGHT-EYE

FIG.6

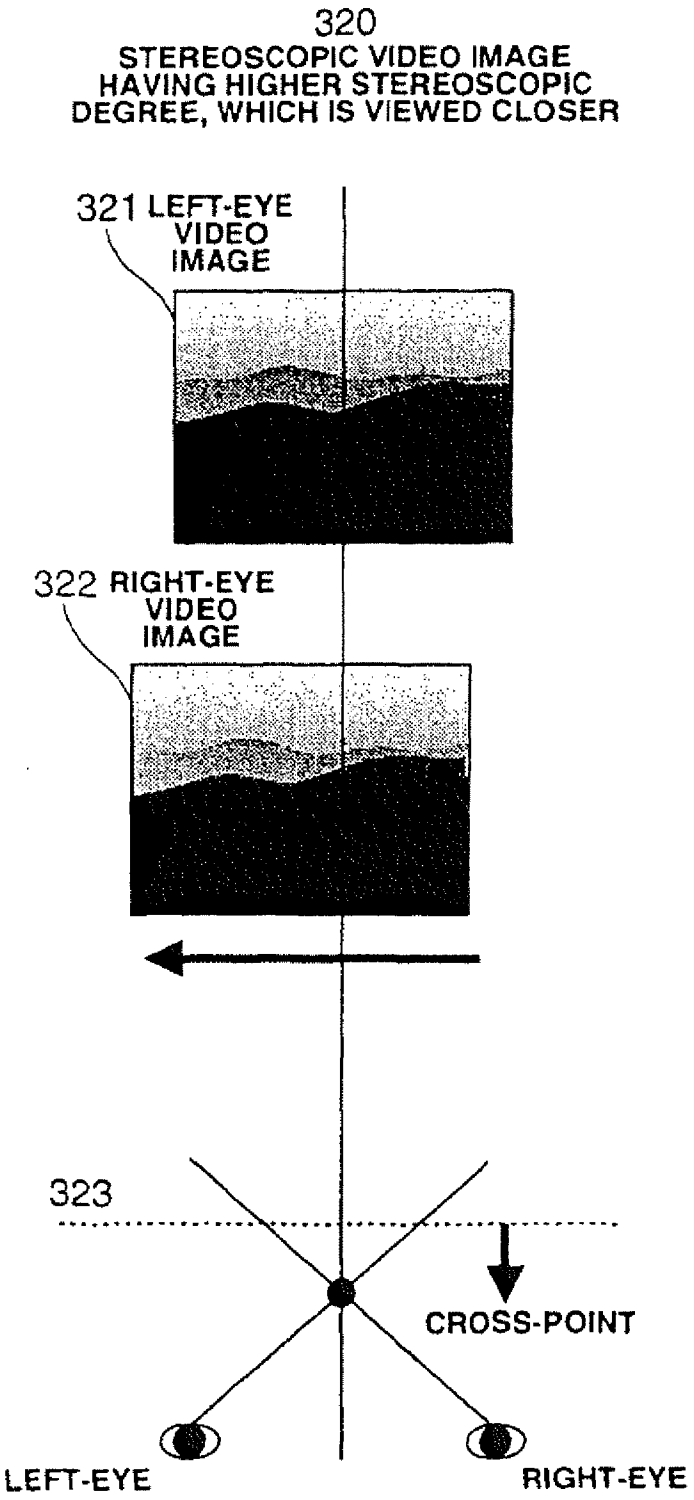
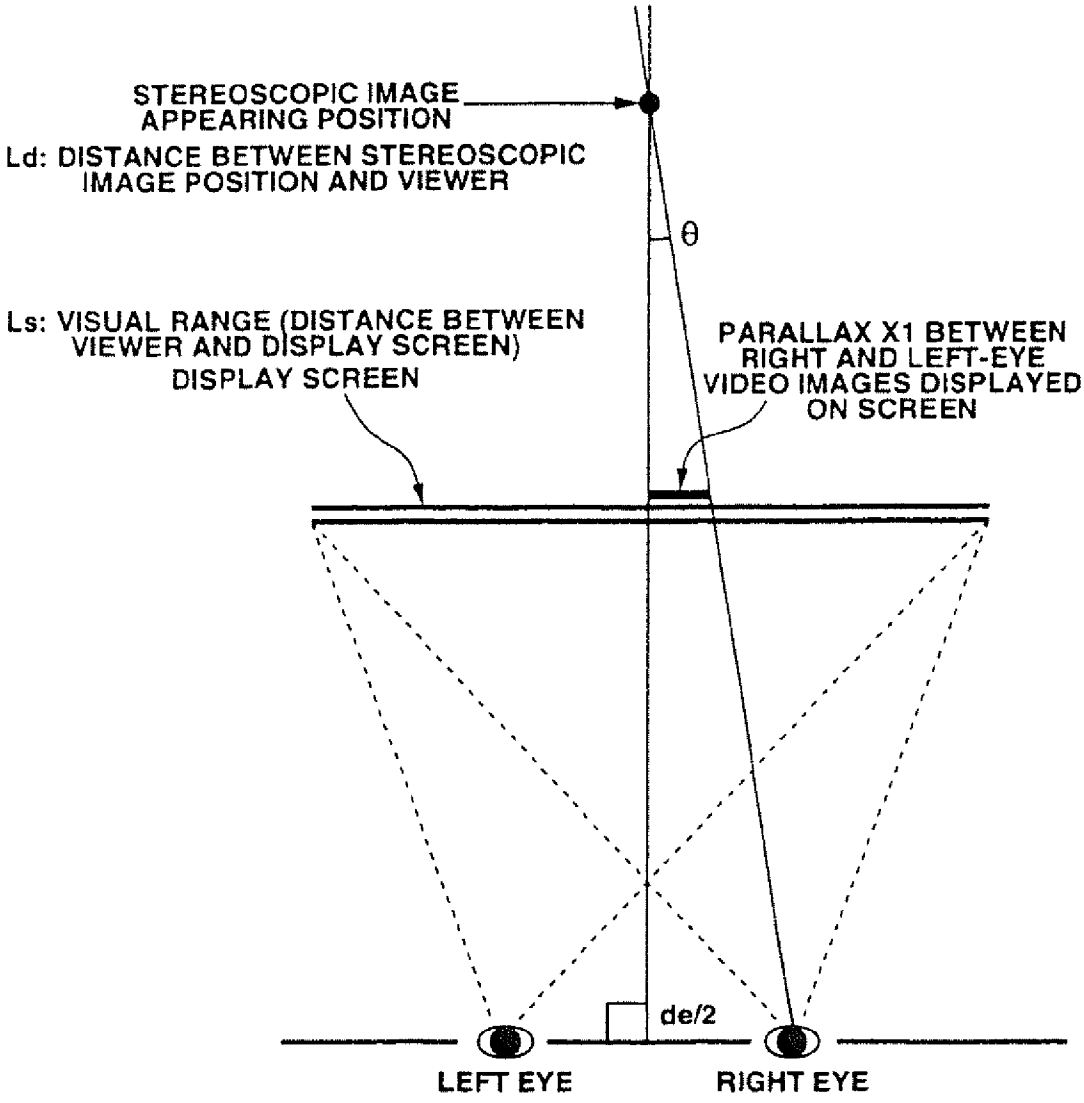
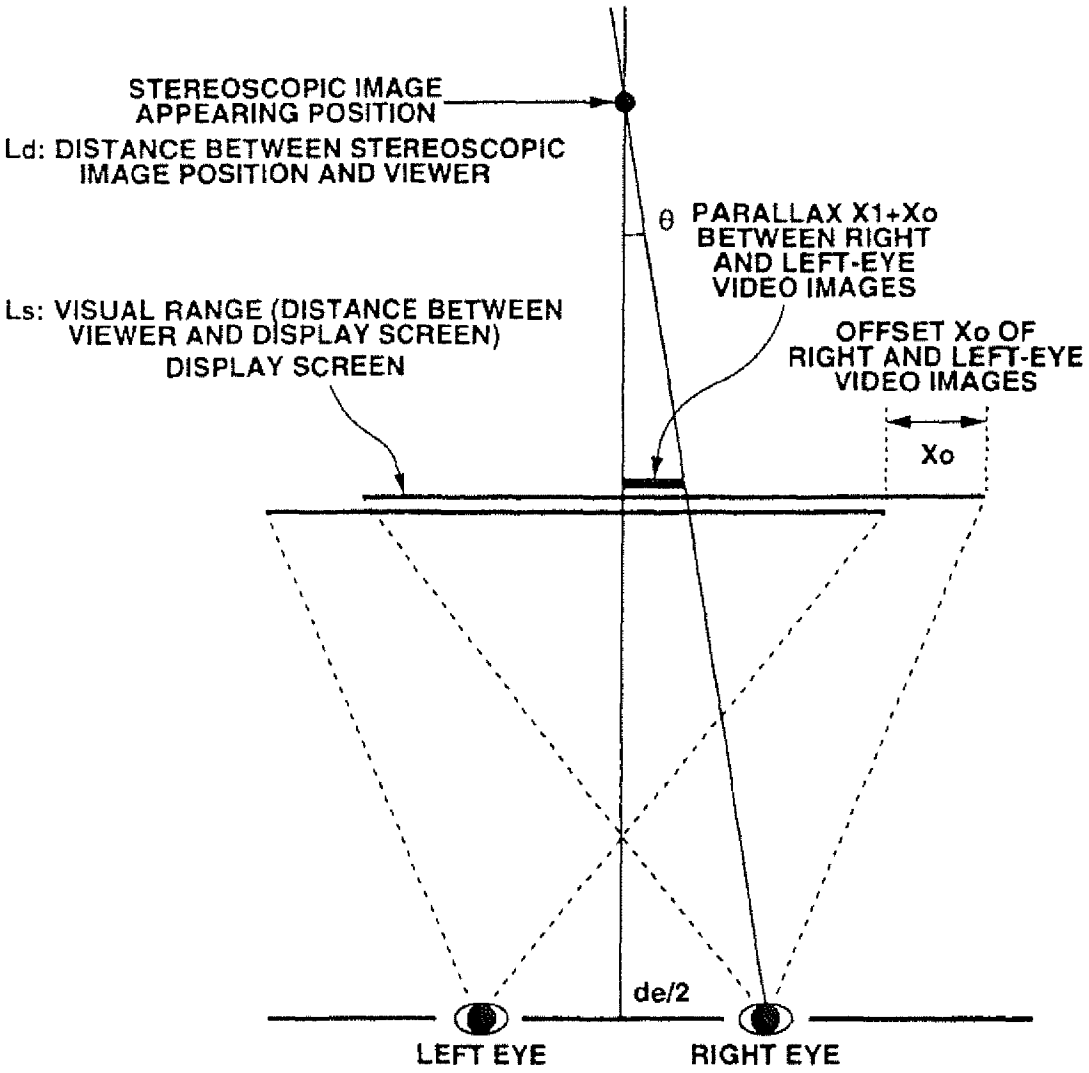

320
STEREOSCOPIC VIDEO IMAGE HAVING HIGHER STEREOSCOPIC DEGREE, WHICH IS VIEWED CLOSER
321 LEFT-EYE VIDEO IMAGE
322 RIGHT-EYE VIDEO IMAGE
323
CROSS-POINT
LEFT-EYE
RIGHT-EYE

FIG.7



$$Ld : Ld - Ls = \frac{de}{2} : X1 \quad (1)$$

FIG.8



$$Ld : Ld - Ls = \frac{de}{2} : X1+Xo \qquad (2)$$

FIG.9

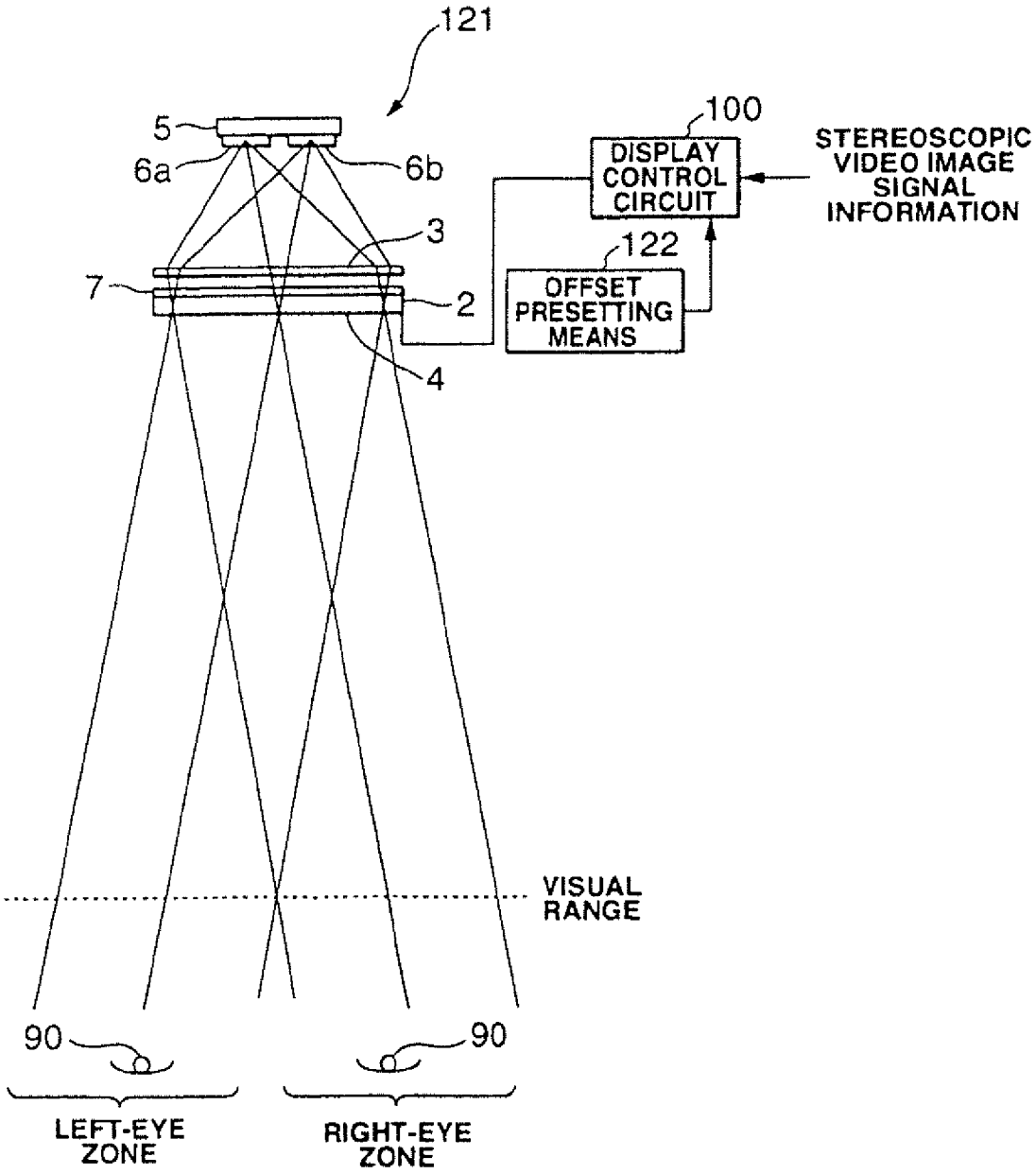
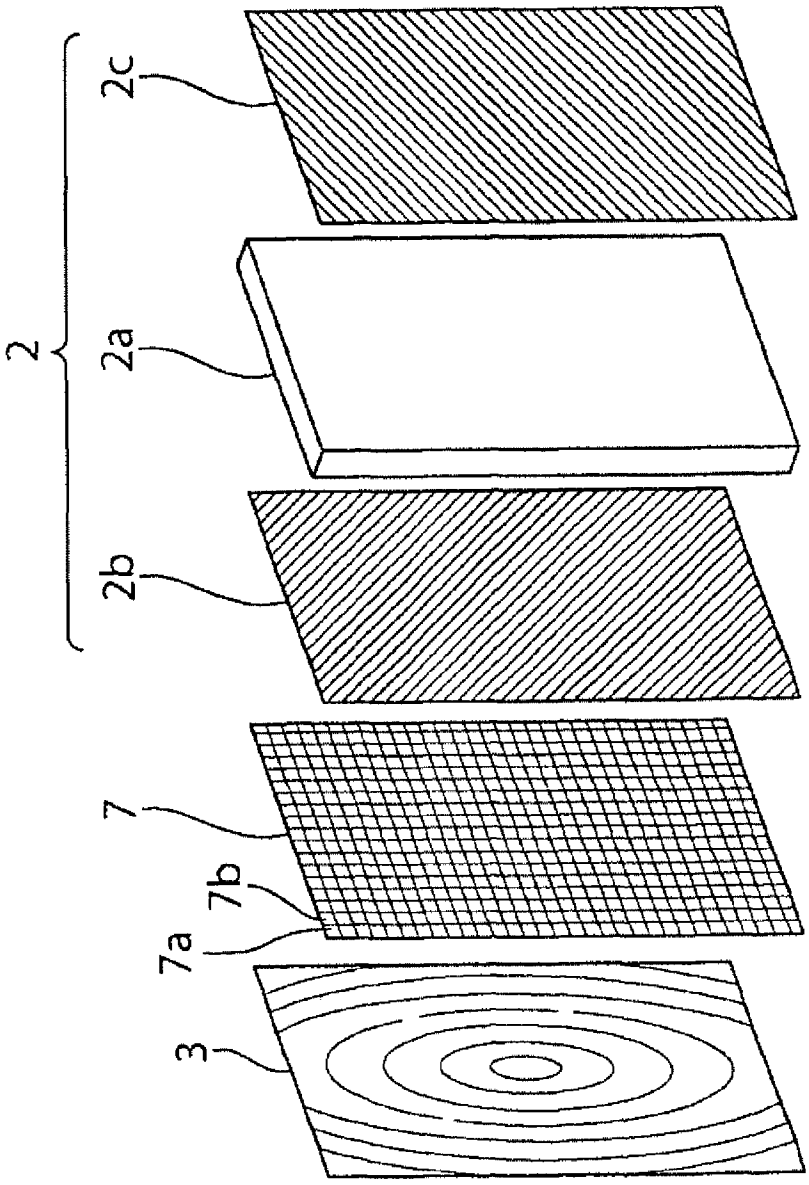

121
5
6a
6b
100
DISPLAY CONTROL CIRCUIT
STEREOSCOPIC VIDEO IMAGE SIGNAL INFORMATION
3
122
7
2
OFFSET PRESETTING MEANS
4
VISUAL RANGE
90
90
LEFT-EYE ZONE
RIGHT-EYE ZONE

FIG.10



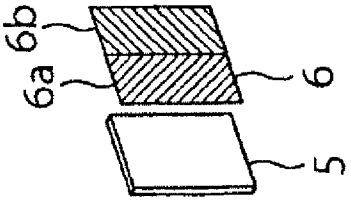


FIG.11

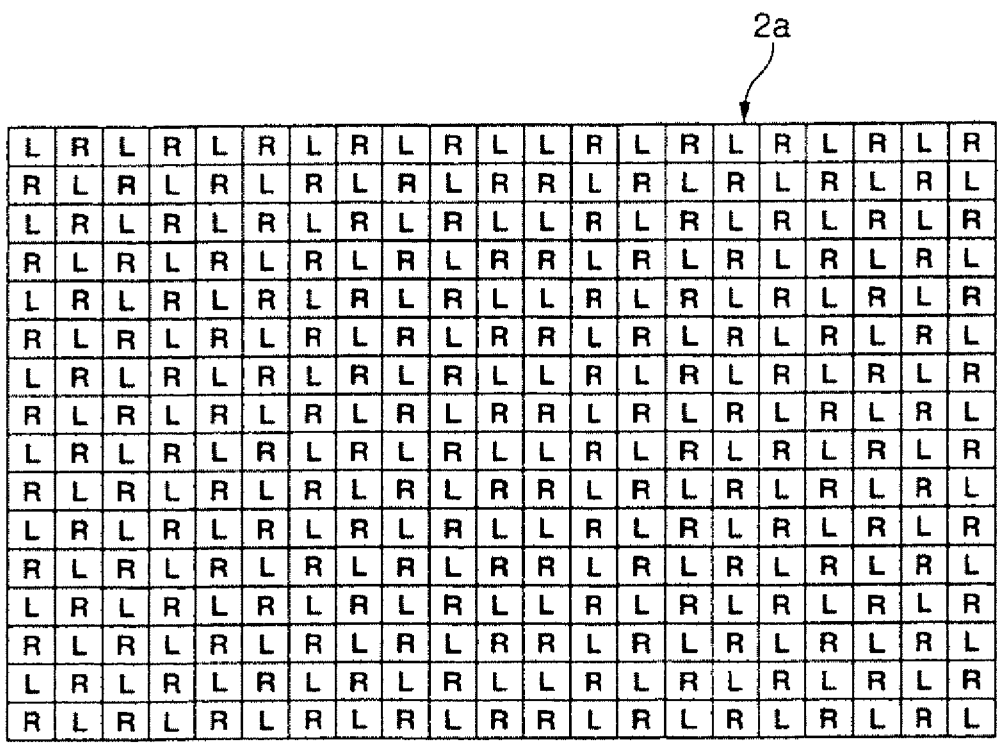

2a
L R L R L R L R L R L L R L R L R L R L R
R L R L R L R L R L R R L R L R L R L R L
L R L R L R L R L R L L R L R L R L R L R
R L R L R L R L R L R R L R L R L R L R L
L R L R L R L R L R L L R L R L R L R L R
R L R L R L R L R L R R L R L R L R L R L
L R L R L R L R L R L L R L R L R L R L R
R L R L R L R L R L R R L R L R L R L R L
L R L R L R L R L R L L R L R L R L R L R
R L R L R L R L R L R R L R L R L R L R L
L R L R L R L R L R L L R L R L R L R L R
R L R L R L R L R L R R L R L R L R L R L
L R L R L R L R L R L L R L R L R L R L R
R L R L R L R L R L R R L R L R L R L R L
L R L R L R L R L R L L R L R L R L R L R
R L R L R L R L R L R R L R L R L R L R L

FIG.12

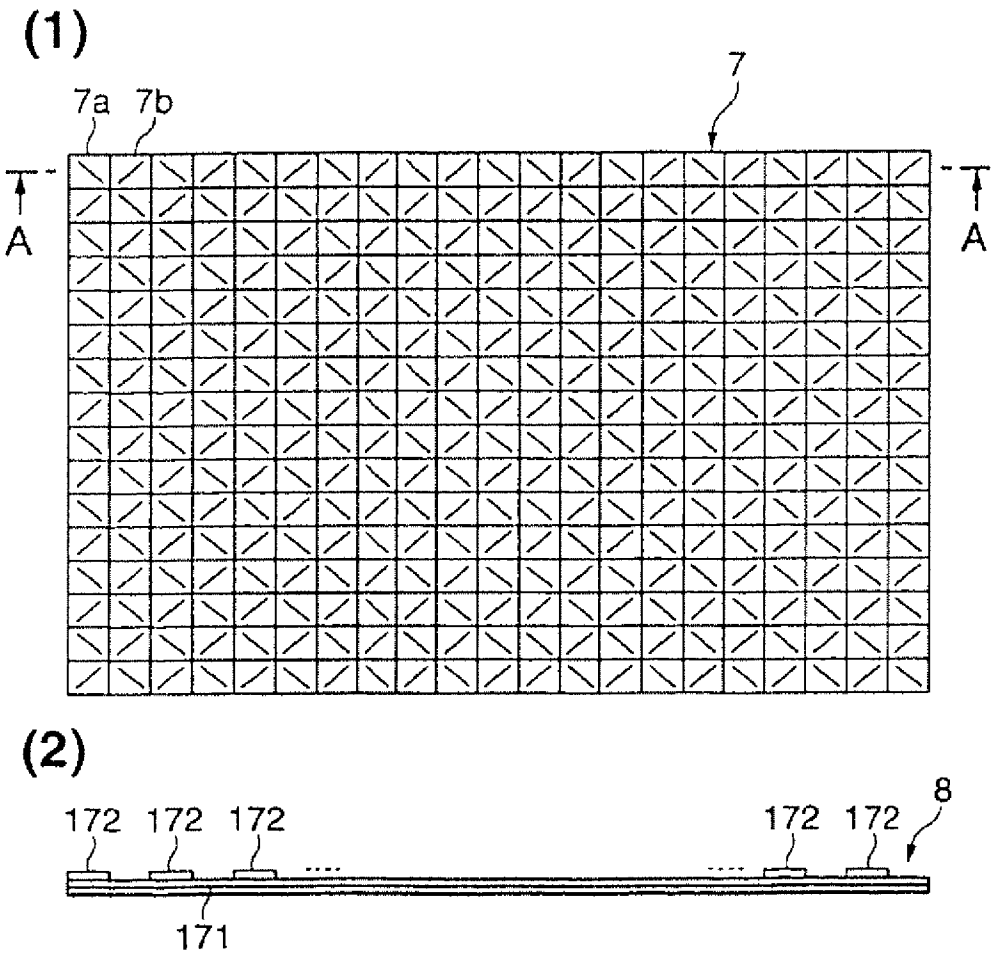


FIG.13

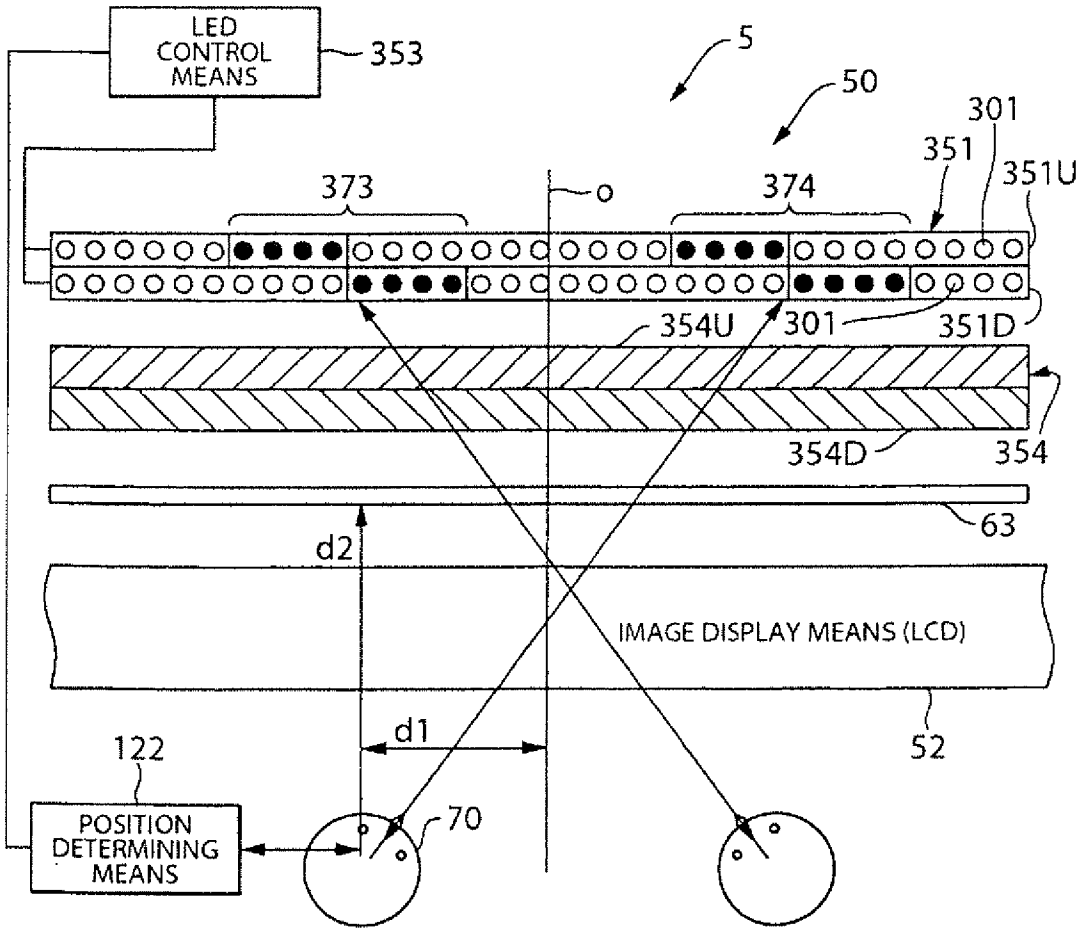

LED CONTROL MEANS
353
5
50
301
351
351U
373
o
374
354U
301
351D
354D
354
63
d2
IMAGE DISPLAY MEANS (LCD)
52
d1
122
POSITION DETERMINING MEANS
70

FIG. 14

PRIOR ART

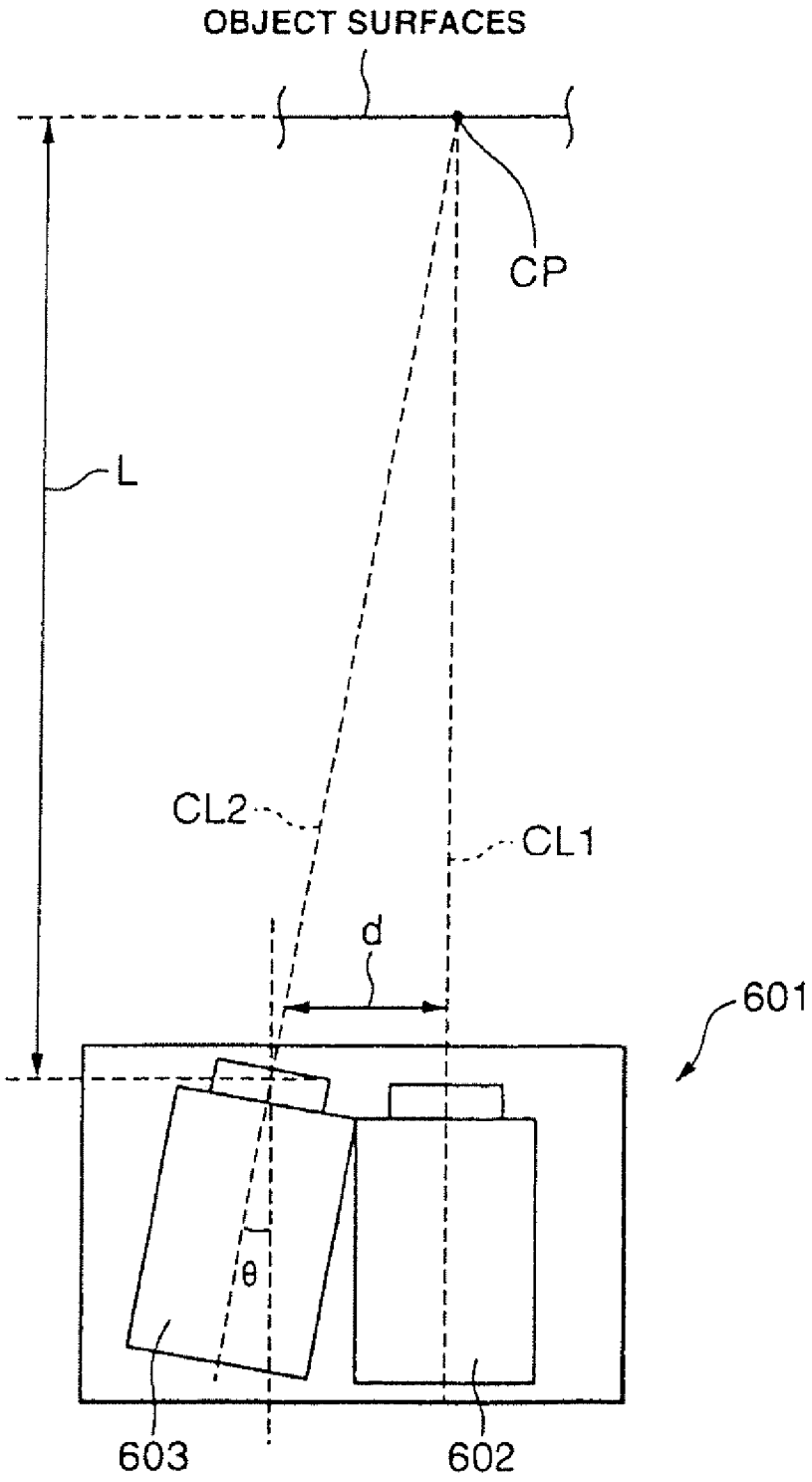
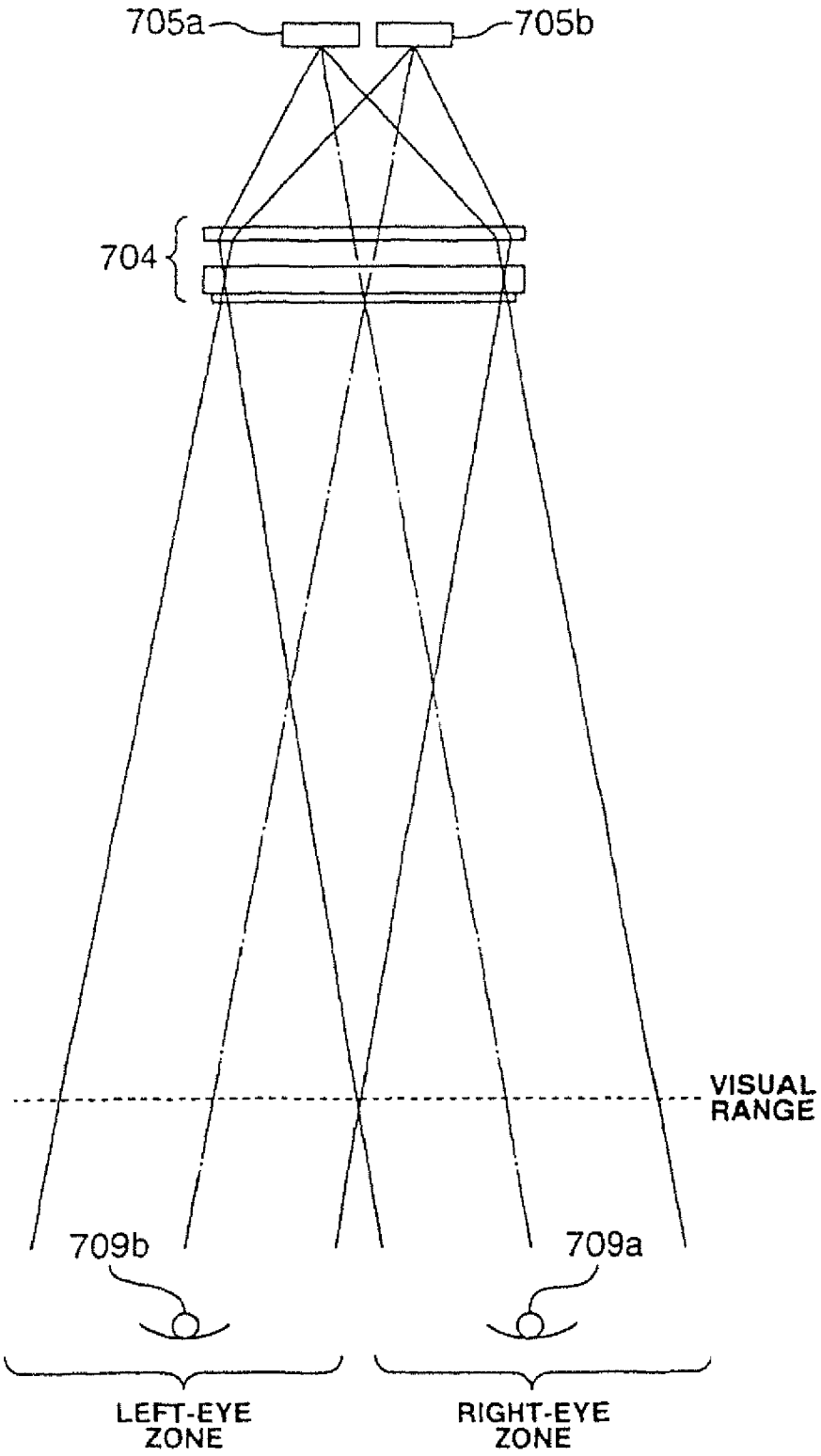


FIG. 15

PRIOR ART



STEREOSCOPIC IMAGE PICKING UP AND DISPLAY SYSTEM BASED UPON OPTICAL AXES CROSS-POINT INFORMATION

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a stereoscopic image pick-up and display system and in particular to a stereoscopic image pick-up and display system which is capable of displaying an appropriate stereoscopic images by changing the stereoscopic degree depending upon the size of a display screen and different stereoscopic image pick-up conditions.

2. Description of the Prior Art

There have heretofore been stereoscopic image pick-up and display systems each comprising a stereoscopic image pick-up device, a stereoscopic image display device which displays the stereoscopic image which has been picked up by the stereoscopic image pick-up device and a medium which are disposed between both devices for transmitting image data and the like.

For example, a stereoscopic image pick-up device which is disclosed in Japanese Published Patent Application JP-A-2001-231055 comprises a image pick-up unit **601** including two CCD cameras **602** and **603** as shown in FIG. **14**. Right-eye and left-eye images are picked up by first and second cameras **602**, and **603**, respectively. At this time, a cross-point (convergence point) CP on the surface of an object (subject) to be picked up S at which optical axes CL1 and CL2 of the first and second cameras **602**, and **603**, respectively are intersected is formed, so that the stereoscopic images are picked up. A technology has been proposed for determining the distance between the surface of the object and the image pick-up device L (that is, the distance between the pick-up device and CP) based upon the angle of the optical axis and the spacing between two cameras **602** and **603**.

Japanese Published Patent Application JP-A-Hei 8-262370 discloses a stereoscopic image display device as shown in FIG. **15**, which displays the image which is picked up by the stereoscopic image pick-up device disclosed in the JP-A-2001-231055.

In addition to the stereoscopic display device requiring special glasses, a stereoscopic display device which requires no special glasses and the like has been proposed. In this case, right-eye and left-eye images having a parallax therebetween as stereoscopic information are alternately switched for every image signal (one field) by a liquid crystal device circuit (not shown) and alternate blinking operation of two backlights **705***a* and **705***b* is conducted in synchronization with the switched image display on a liquid crystal display unit **704**.

When a signal of image for the right-eye is displayed on the liquid crystal display unit **704**, one of the backlights **705***a* is lit in synchronization with an input signal so that light of the backlight is incident upon the right-eye **709***a* of a viewer (observer). Subsequently, when a signal of the image for the left-eye is displayed on the liquid crystal display unit **704**, the other backlight **705***b* is lit in synchronization with the signal so that light of the backlight is incident upon the left-eye **709***b* of the viewer. Since one image for right-eye on the liquid crystal display unit can be viewed by only the right-eye of the viewer while one image for left-eye on the liquid crystal display unit can be viewed by only the left-eye of the viewer, both images are merged in the brain of the viewer by the afterimage effect on the retina of the viewer, so that the merged image can be viewed as a stereoscopic image by the three-dimensional perception based upon so-called binocular parallax.

Even when the distance between the pick-up device and CP is measured by the technology of the invention as defined in JP-A-2001-231055 on picking-up the stereoscopic image, the distance between the pick-up device and CP (CP information) is not recorded simultaneously with the stereoscopic image recording. Even if the CP information of the picked-up image is recorded, the CP information is not utilized as a signal for the reference of binocular vision by the technology disclosed in JP-A-Hei 8-262370 when the stereoscopic image is played back.

In particular, when the same content are played back on display devices having different screen sizes, the stereopsis from the screen may vary due to difference in screen size since the amount of the parallax between the right-eye and the left-eye varies, resulting in a problem in that a natural stereoscopic image can not be obtained. Since the stereoscopic image contents for large amusement parks are produced assuming that the display devices have a large size screen on which the contents are displayed, appropriate stereoscopic feeling can not obtained unless the displays have the same screen size. Large size screen provides two strong stereoscopic feeling, making viewers uncomfortable, while small size screen provides less stereoscopic feeling, giving no satisfaction to the viewers.

Since these contents are combinations of various scenes, pick-up conditions, focal-length of the lens of the pick-up unit and the spacing between two pick-up units may not be uniform throughout various contents. If these scenes are simply jointed, different stereoscopic feelings are provided by one content, which provides the viewers with different feeling and physical discomfortability.

Furthermore, the positional relationship between the stereoscopic image pick-up and display device is not necessarily constant and the viewer may not be positioned in the position that is intended by the contents producer. If the viewer is offset from the predetermined viewing position of the stereoscopic display device, he or she is not able to view correct stereoscopic image.

Accordingly, when the stereoscopic video image is produced, the cross-point of the pick-up stereoscopic cameras and the parallax of the computer graphics is adjusted while assuming the size of the display screen on which ultimately the image is displayed. Since the contents which have been produced provide different stereoscopic feeling on the different screens of the stereoscopic image pick-up and display systems, it is necessary to reproduce the stereoscopic video image depending upon the screen size. If the stereoscopic video image is produced by the CG (Computer Graphics), it is necessary to conduct rerendering.

Since there is no way to adjust the parallax which has been determined by the once produced contents when they are played back, the viewer has to adjust the stereoscopic feeling depending upon the distance between the viewing position and the screen.

If the stereoscopic video image is broadcast, there is no way to automatically adjust the stereoscopic feeling of the stereoscopic video image in responsive to an indefinite number of viewers and stereoscopic video image pick-up and display systems having various screen sizes. Therefore, broadcasting of the stereoscopic video images for the indefinite number of viewers is difficult. A technology to adjust the stereoscopic feeling depending upon the screen size is essential for the widespread of the stereoscopic video images.

Therefore, it is an object of the present invention to provide a stereoscopic video image pick-up and display system which is capable of providing the stereoscopic video image having a

natural stereopsis even if the video image producing and playback conditions are different.

SUMMARY OF THE INVENTION

In order to solve the above-mentioned object, the present invention adopts means as follows:

An invention as set forth in Claim **1** resides in a stereoscopic video image pick-up and display system comprising a stereoscopic video image pick-up device including two video image pick-up means for outputting video information from said pick-up means; a stereoscopic video image display device for displaying different video images for the eyes of a viewer; and

a medium for transmitting said video image information from said stereoscopic video image pick-up device to said stereoscopic video image display device, in which said stereoscopic video image pick-up device includes cross-point measuring means for measuring CP information on the cross-point (CP) of optical axes of said pick-up means and outputs information including the CP information and video image information to said medium; and

in which said stereoscopic video image display device includes offset presetting means for offsetting and displaying said different video images based upon said video image information, said cross-point information and information on the size of the image which is displayed by said stereoscopic video image display device.

In accordance with the present invention, a stereoscopic video image can be obtained which is adjusted to provide an optimal stereoscopic degree (depth) depending upon the stereoscopic video image pick-up and display system.

An invention as set forth in Claim **2** resides in a stereoscopic video image display system as defined in Claim **1** wherein said stereoscopic video image display device includes viewer's position information measuring means for measuring information on the position of a viewer relative to a display screen, and further includes offset presetting means for offsetting and displaying said different video images based upon said video image information, said cross-point information, information on the size of the image which is displayed by said stereoscopic video image display device and the information on the position of the viewer.

In accordance with the present invention, a stereoscopic video image having an optimal stereoscopic degree (depth) corresponding to the positions of the stereoscopic video image pick-up and display system and the viewer can be obtained.

An invention as set forth in Claim **3** resides in a stereoscopic video image pick-up and display system as defined in Claim **1** or **2** in which said cross-point measuring means calculates the cross-point position based upon the angle of the intersection of the optical axes in said two pick-up means.

In accordance with the present invention, the distance between two image pick-up means can be measured based upon triangulation techniques and the distance between the pick-up means and the cross-point and object (scene) can be measured based upon the value of the angle at the intersection between the optical axes of said image pick-up means. The distance between two objects can be also measured.

An invention as set forth in Claim **4** resides in a stereoscopic video image pick-up and display system as defined in Claim **1** or **2** in which said cross-point measuring means calculates the cross-point based upon the position of picking-up of an object in said two pick-up means which are disposed in a parallel relationship.

In accordance with the present invention, the distance between two image pick-up means can be measured based upon triangulation techniques and the distance between the pick-up means and the cross-point and object (scene) can be measured based upon the value of the angle at the intersection between the optical axes of said image pick-up means. The distance between two objects can be also measured.

An invention as set forth in Claim **5** resides in a stereoscopic video image pick-up and display system as defined in any of Claims **1** through **4** in which said stereoscopic video image pick-up device is adapted to feed out information on the depth of the areas, the image of which is picked-up in a depth direction and said stereoscopic video image display device includes offset presetting means for offsetting and displaying said different video images based upon said video image information, said cross-point information, information on the size of the image which is displayed by said stereoscopic video image display device and the information on the position of the viewer.

In accordance with the present invention, more appropriate stereoscopic video image display can be carried out since the display means can obtain more exact information on image pick-up conditions.

An invention as set forth in Claim **6** resides in a stereoscopic video image pick-up and display system as defined in Claim **2** in which said viewer's position detecting means is disposed integrally with the main body of said stereoscopic video image pick-up and display system.

In accordance with the present invention, it is not necessary to separately provide the viewers position detecting means in addition to the main body of the stereoscopic video image pick-up and display system.

An invention as set forth in Claim **7** resides in a stereoscopic video image pick-up and display system as defined in Claim **2** in which said viewer's position detecting means is disposed in a position remote from the main body of said stereoscopic video image pick-up and display system.

In accordance with the present invention, the viewer's position detecting means can be disposed in an appropriate position to detect the position of the viewer, so that the position of the viewer can be accurately detected.

An invention as set forth in Claim **8** resides in a stereoscopic video image pick-up and display system as defined in Claim **6** or **7** in which said viewer's position detecting means includes an ultrasonic wave transmitter and ultrasonic wave receiver.

In accordance with the present invention, the detection of a viewer is not liable to be influenced by the peripheral noise in comparison with that using ultra-red means, so that accurate detection can be achieved.

An invention as set forth in Claim **9** resides in a stereoscopic video image pick-up and display system as defined in Claim **6** or **7** in which said viewer's position detecting means detects the position based upon the picked-up image of the viewer.

In accordance with the present invention, the detection of a viewer is not liable to be influenced by the peripheral noise in comparison with that using ultra-red means, so that accurate detection can be achieved.

An invention as set forth in Claim **10** resides in a stereoscopic video image pick-up and display system as defined in any of Claims **1** through **9** in which said offset presetting means presets the offset of the right-eye and left-eye video images based upon the information input to said input means for adjusting the stereoscopic feeling of the image which is displayed by said display means.

In accordance with the present invention, the stereoscopic video image having a stereoscopic degree (depth) which is adjusted to meet the viewer's preferences can be obtained.

An invention as set forth in Claim **11** resides in a stereoscopic video image pick-up and display system as defined in any of Claims **1** through **10** in which said system includes a memory for the left-eye video image for storing a left-eye video image and a memory for the right-eye video image for storing a right-eye video image, said offset presetting means includes timing control means for controlling the timing of the read-out of video image data from said frame memory for left-eye video image and/or said frame memory for right-eye video image; and

said timing control means presets the offset of said left-eye video image and right-eye video image by advancing or delaying the timing of the read-out of the video image data from one of said frame memories for left-eye and right-eye video images relative to the timing of the read-out of the video image data from the other of said from memories for the left-eye and right-eye video images.

In accordance with the present invention, an offset of the right-eye and left-eye video images can be preset by a simple circuit.

An invention as set forth in Claim **12** resides in a stereoscopic video image pick-up and display system as defined in any one of Claims **1** through **11** in which said system comprises a stereoscopic video image frame memory for storing the stereoscopic video image therein, and signal switching means for switching between the left-eye video image data read-out from said frame memory for the left-eye video image and right-eye video image read-out from said from memory for said right-eye video image to input the data to said frame memory for the stereoscopic video image.

In accordance with the present invention, video image in which the offset of the right-eye and left-eye video images is preset can be synthesized and be stored in the frame memory.

An invention as set forth in Claim **13** resides in a stereoscopic video image pick-up and display system as defined in any of Claim **1** through **12** in which the offset of said left-eye and right-eye video images is preset by advancing or delaying the horizonal phase of said left-eye and right-eye video images.

In accordance with the present invention, presetting of the offset of the right-eye and left-eye video images can be easily controlled.

An invention as set forth in Claim **14** resides in a stereoscopic video image pick-up and display system as defined in any of Claims **1** through **13** in which an area of one or both of said left-eye and right-eye video image in the vicinity of its lateral edge is enlarged in a horizontal and vertical directions so that it fills a blank area which is caused by the presetting of the offset of said left-eye and right-eye video images.

In accordance with the present invention, display causing no blank area even if the right-eye and left-eye video images are shifted and displayed, and which gives quite normal feeling can be achieved.

An invention as set forth in Claim **15** resides in a stereoscopic video image pick-up and display system as defined in any of Claims **1** through **14** in which said display means includes video image display means for displaying a video image with transmitted light and a light source device, said light source device comprising an LED array in which white LEDs or RGB LEDs are integrally arrayed, said offset presetting means including LED control means for controlling the lighting of said white LEDs or RGB LEDs of said LED array based upon said offset.

In accordance with the present invention, lighting of the light source can be freely achieved by the control of the LED control means and power consumption can be reduced since white LEDs or RBG LEDs having less power consumption and high switching speed are used as the light source.

An invention as set forth in Claim **16** resides in a stereoscopic video image pick-up and display system as defined in Claim **15** in which said LED control means of said offset presetting means controls the lighting of said white LEDs or RGB LEDs based upon said viewer's position information so that the video image which is viewed by a viewer is maintained.

In accordance with the present invention, an appropriate video image can be displayed even if the viewer moves or viewers are in a plurality of different positions.

An invention as set forth in Claim **17** resides in a stereoscopic video image pick-up and display system as defined in Claim **15** in which each LED array which is provided at upper and lower areas of said light source device forms a right-eye video image display unit and left-eye video image display unit.

In accordance with the present invention, contort of display of stereoscopic video image can be achieved at a high freedom degree by controlling the lighting of the right-eye video image display unit and left-eye video image display unit of the LED array by the LED control means.

An invention as set forth in Claim in **18** resides in a stereoscopic video image pick-up and display system as defined in any of Claims **1** through **17** which is adapted to a display system of portable digital assistant (PDA).

In accordance with the present invention, the display of the portable digital assistant can be made stereoscopic.

An invention as set forth in Claim in **19** resides in a stereoscopic video image pick-up and display system as defined in any of Claims **1** through **17** which is adapted to a display system of mobile communication terminal.

In accordance with the present invention, the display of mobile communication terminal can be made stereoscopic.

An invention as set forth in Claim **20** resides in a stereoscopic video image pick-up and display system as defined in any of Claims **1** through **17** which is adapted to a terminal of car navigation system.

In accordance with the present invention, the display of car navigation system can be made stereoscopic.

An invention as set forth in Claim **21** resides in a stereoscopic video image pick-up and display system as defined in any of Claims **17** through **20** in which said video image information and CP information is communicated between said terminal devices.

In accordance with the present invention, stereoscopic video image information can be communicated between terminal devices, so that the same video image information can be shared.

An invention as set forth in Claim **22** resides in a stereoscopic video image pick-up and display system as defined in any of Claims **1** through **21** in which said medium is a communication medium.

In accordance with the present invention, a stereoscopic video image can be displayed even if both the stereoscopic video image pick-up device and stereoscopic video image display device are in the same position, and even if both devices are remote. The communication medium may include wireless communication, wired communication and optical communication.

An invention as set forth in Claim **23** resides in a stereoscopic video image pick-up and display system as defined in any of Claims **1** through **21** in which said medium is a communication medium.

In accordance with the present invention, stereoscopic video image information which is picked-up by the stereoscopic video image pick-up device can be stored and reproduced by the stereoscopic video image display device. The communication medium may include wireless communication, wired communication and optical communication.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram for showing the basic configuration of the stereoscopic video image pick-up and display device of the present embodiment.

FIG. **2** is a block diagram showing the configuration of the stereoscopic video image pick-up and display system shown in FIG. **1**.

FIG. **3** is a block diagram showing the display control circuit for the stereoscopic video image pick-up and display device shown in FIG. **1**.

FIG. **4** is a view showing how the stereoscopic image is viewed by a viewer.

FIG. **5** is a view showing how the stereoscopic image is viewed by a viewer.

FIG. **6** is a view showing how the stereoscopic image is viewed by a viewer.

FIG. **7** is a view showing how the stereoscopic image is viewed by a viewer.

FIG. **8** is a view showing how the stereoscopic image is viewed by a viewer.

FIG. **9** is a view showing the configuration of the display means.

FIG. **10** is an exploded perspective view showing the configuration of the display device in detail.

FIG. **11** is a view showing the displaying state of the liquid crystal of the display device.

FIG. **12** is a view showing the polarization direction of a checkered plate of the display device.

FIG. **13** is a view showing the configuration of the stereoscopic video image pick-up and display system of the other embodiment.

FIG. **14** is a view showing the configuration of the pick-up means of prior art stereoscopic video image pick-up and display system.

FIG. **15** is a view showing the configuration of the display means of prior art stereoscopic video image pick-up and display system.

BEST MODES FOR EMBODYING THE INVENTION

Now, modes of embodying the present invention will be described with reference to the drawings.

FIG. **1** is a block diagram for showing the basic configuration of the stereoscopic video image pick-up and display device of the present embodiment. FIG. **2** is a block diagram showing the configuration of the stereoscopic video image pick-up and display system shown in FIG. **1**. FIG. **3** is a block diagram showing the display control circuit for the stereoscopic video image pick-up and display device shown in FIG. **1**. FIGS. **4** through **6** are views showing how the stereoscopic image is viewed by a viewer. FIGS. **7** and **8** are views explaining the position at which the stereoscopic image appears. FIG. **9** is a view showing the configuration of the display means. FIG. **10** is an exploded perspective view showing the configuration of the display device in detail. FIG. **11** is a view showing the displaying state of the liquid crystal of the display device. FIG. **12** is a view showing the polarization direction of a checkered plate of the display device. FIG. **13** is a view showing the configuration of the stereoscopic video image pick-up and display system of the other embodiment.

As shown in FIGS. **1** and **2**, the stereoscopic video image pick-up and display system one embodiment of the present invention comprises left and right image pick-up means (cameras) **402**L, **402**R for picking-up an object (subject) **401**, CP measuring means **403** for measuring the distance between the cameras and the object and cross-point information (CP information) based upon the angles between the optical axes of the cameras and video signal feeding means **404** for feeding video image information and CP information to a medium **500**. The CP information is able to calculate the position of the cross point based upon the picked-up position of the object in two pick-up means which are disposed. The stereoscopic video image pick-up and display system further comprises a display control circuit **100** for controlling the display means **121** to display a stereoscopic video image **600** for a viewer **90** based upon the video image information and CP information which is received via the medium **500** and further comprises display means **121** having a liquid crystal screen. In the present embodiment, information on the depth of the image picked-up area is fed. Appropriate stereoscopic video image display can be accomplished in the stereoscopic video image display device by using the depth in addition to the video image information and the cross-point information.

Preferably the stereoscopic video image pick-up and display system of the present embodiment is adapted to the display system of portable digital assistant (PDA). The stereoscopic video image pick-up and display system of the present embodiment is preferable for the display of mobile communication terminals such as cellular phones.

Preferably the stereoscopic video image pick-up and display system of the present embodiment is adapted to the display system of the car navigation system and may include communication means so that it is possible to communicate the video image information and CP information between the portable digital assistants, mobile communication terminals and car navigation system terminals.

In the present embodiment, the media of the stereoscopic video image display system may be any one of wireless, wired and optical communications. The media may be magnetic recording media such as magnetic disc, optical recording media such as CD, CD-R, CD-RW, DVD, DVD-R, DVD-RW, MD and the like, and semiconductor storage media using memory chips. The stereoscopic video image display system may be applicable to various stereoscopic displays such as stereoscopic television sets and stereoscopic projectors and is also applicable to stereoscopic movie theater motion picture playback device for the playback of stereoscopic video images which are distributed via the Internet, stereoscopic game machines, simulators for aircraft and vehicles.

In the present embodiment, the display control circuit **100** comprises a stereoscopic video image signal generating circuit **101** for generating a stereoscopic video image signal comprising a left-eye and right-eye video images as shown in FIG. **2**. The stereoscopic video image signal generating circuit **101** comprises a video image information acquisition means **103** for acquiring video image information on the stereoscopically viewable video images, such as the size of the displayed image which is assumed on production, the position of a viewer and the cross-point information, information acquisition means **104** for acquiring the display device information on the display area of the display means,

that is the size of the screen on which the images are actually displayed, the position of the viewer relative to the display device, and offset presetting means for presetting a offset value to display the left-eye and right-eye video images so that they are shifted each other based upon said video image information and said display device information and for causing the display means **121** to display the stereoscopic video image signal providing the viewers with the same stereoscopic feeling irrespective of video and display information representative of different conditions.

The left-eye image **10**, right-eye image **11** and the distance **13** (CP information) between the cameras and the cross-point on picking-up of the image are input to the stereoscopic video image signal generating circuit **101** of the present embodiment **101** as data which is recorded on picking-up of the image as shown in FIG. **3**. The left-eye image **10** is picked-up by the left-eye camera and the right-eye image **11** is picked-up by the right-eye camera which is juxtaposed with the left-eye camera. The left-eye and right-eye cameras are disposed in such a manner that their optical axes intersect with each other. The intersection of these axes is the cross-point (CP) which is present on a plane of the object.

The image pick-up device includes a cross-point data input device **12** which measures the distance between the cameras and CP by means of laser distance measuring technique or based upon the inclination angle between the optical axes of the left-eye and right-eye cameras or to which an operator inputs the distance. The information on the distance between the cameras and CP is recorded as CP information together with the stereoscopic video image when the stereoscopic video image is picked-up. The distance between the left-eye camera and the right-eye camera (intereye distance) is also recorded as CP information. This distance information corresponds to the distance between the eyes of human.

The left-eye video image **10** which is input to the stereoscopic video signal generating circuit is digitalized by an A/D converter **20** and is stored in a left-eye video image frame memory **30**. Similarly, input right-eye video image **11** is digitalized by an A/D converter **21** and is stored in a right-eye video image frame memory **31**. A clock signal **22** for A/D conversion is input to the A/D converters **20** and **21** from a switch control unit **1**.

The left-eye and right-eye video images which have been digitalized and stored in the frame memories **30** and **31** are input to a signal switch **40**. The signal switch **40** records synthesized stereoscopic video image in a synthesis frame memory **50** to generate the synthesized stereoscopic video image signal by switching the read-outs of the left-eye and right-eye video images.

The signal switch **40** is a switch (semiconductor switching element) which is operative in response to a timing signal issued from the switch control unit **41**. In the stereoscopic video signal generating circuit, synthesized stereoscopic video signal image in which alternate horizontal lines of the left-eye and right-eye video images **10** and **11** are synthesized is generated from the left-eye and right-eye video images **10** and **11**. Since the video image is displayed in every one scanning line in the interlace format, the video signal which is written into the synthesis frame memory **50** is switched for every field (for example, every 16.6833 msec which is a vertical synchronization period of NTSC format) by means of the signal switch **40**. On the other hand, since the scanning lines are sequentially displayed in case of non-interlace format, the video signal which is to be written into the synthesis frame memory **50** is switched for every scanning line (for example, every 63.5555 μsec which is a horizontal synchronization period) so that scanning lines of the left-eye and right-eye video signals are alternately displayed.

The timing when the right-video data to be written into the synthesis frame memory **50** is read out from the right-eye video frame memory **31** is controlled by the reading out timing control unit **32**, to which the CP information **12**, a timing signal for the signal switch **40** from the switch control unit **41**, the screen size information and a stereoscopic degree adjusting signal are input. The read-out timing control unit **32** calculates the timing when the read-out from the right-eye video from memory **31** is conducted based upon these items of information and generates a clock signal for reading out of the right-eye video data from the right-eye video frame memory **31** ahead of (or behind of) normal timing, so that the timing which provides the parallax giving appropriate stereoscopic feeling is adjusted. That is, the timing of read-out of the right-eye signal from the right-eye video frame memory **31** is controlled relative to the timing of reading-out of the left-eye signal, so that both signals are read out in such timing to provide optimal stereoscopic feeling.

The switch control unit **41** is operative to control the signal switch **40**. It controls the operation of the signal switch **40** in response to a horizontal synchronization signal **71**, vertical synchronization signal **72**, dot synchronization signal **73** and right and left reference signal **74** input from a synchronization signal generator **70**. As mentioned above, the switch control unit **41** presets the timing of switching of the signal switch **40** for writing of video data into synthesis frame memory **50** to generate the synthesized stereoscopic video signal.

The synchronization signal generator **70** generates the horizontal synchronization signal **71** and vertical synchronization signal **92** in response to a video synchronization signal **82** input internally from the stereoscopic video signal generating circuit (for example, display controller) and further generates a dot synchronization signal **73** in response to an externally input dot sampling signal **83** and generates a right and left reference signal **74**. The right and left signal **74** identifies whether the video signal is left-eye or right-eye signal when the stereoscopic video signal is transmitted and displayed by using general video signal and is input to the switch control unit and is output externally of the stereoscopic video signal generating circuit.

The D/A converter **60** converts the digitalized video signal into analog signal for outputting it as a synthesized stereoscopic video signal.

Although appropriate stereoscopic feeling is provided by controlling the timing of read-out of the right-eye video data depending upon the CP information **12** and the screen size information in the above-mentioned embodiment, the parallax can be adjusted by controlling the timing of read-out of the right-eye video data depending upon the screen size even if the distance to CP is infinite (there is no CP information **12**).

The stereoscopic video signal which is supplied to the above-mentioned stereoscopic video signal generating circuit is recorded by a stereoscopic video image pick-up device having a pair of right and left cameras (lenses and image pick-up elements) and a capability of recording the spacing between the right and left image pick-up elements (intereye distance) and the distance between the cameras and the intersection of the optical axes of the right-eye and left-eye video cameras (cross-point) as cross-point information simultaneously with the right and left video recording. In other words, the stereoscopic video image pick-up device records data on the stereoscopic feeling as well as the stereoscopic video images.

The stereoscopic video signal which is supplied to the above-mentioned stereoscopic video signal generating circuit

is produced by a stereoscopic video image producing device having a capability of producing a pair of right and left video images by computer graphics (CG) technology and a capability of recording the intereye distance and the distance to a optical cross point of the right and left video images (a point at which the right and left lines of sight intersects with each other) as cross-point information simultaneously with recording of the right and left video images. In other words, the stereoscopic video image producing device produces and records the data related with stereoscopic feeling together with stereoscopic CG video image.

FIGS. **4** through **6** are views explaining the adjustment of the stereoscopic degree by a change in relative positions of the right and left video images.

FIG. **4** shows a case in which the right-eye and left-eye video images are positioned at the same place as when they are picked-up.

An original video image **300** comprises a left-eye video image **301** and a right-eye video image **302**. Under this condition, the positions of the left-eye video image **301** and the right-eye video image **302** are equal to those when they are picked-up, so that relative positions of the left-eye and right-eye video images are correctly reproduced. Therefore, the cross-point **303** is positioned in position (original cross-point) when image picking up is carried out.

FIG. **5** shows that the right-eye video image is shifted rightwards and is displayed.

The stereoscopic video image **310** comprises the left-eye video image **311** and the right-eye video image **312**. If an offset in which the right-eye video image is shifted rightwards relative to the left-eye video image by delaying the timing of the read-out of the right-eye video image to that of the left-eye video image (delaying the phase of the right-eye signal) is preset and the video images are displayed, the line of sight from the left-eye to the left-eye video image intersect with the line of sight from the right-eye to the right-eye video image behind the display screen, so that the cross-point **313** moves behind the position on picking-up. Therefore, the stereoscopic video image has less stereoscopic degree and stressed depth than those of the original stereoscopic video image, so that the stereoscopic video image is viewed as far image as a whole.

FIG. **6** shows that the right-eye video image is shifted leftwards and is displayed.

The stereoscopic video image **320** comprises the left-eye video image **321** and the right-eye video image **322**. If an offset in which the right-eye video image is shifted leftwards relative to the left-eye video image by delaying the timing of the read-out of the right-eye video image to that of the left-eye video image (advancing the phase of the right-eye signal) is preset and the video images are displayed, the line of sight from the left-eye to the left-eye video image intersect with the line of sight from the right-eye to the right-eye video image in front of the display screen, so that the cross-point **323** moves in front of the position on picking-up. Therefore, the stereoscopic video image has a higher stereoscopic degree and a lower depth than those of the original stereoscopic video image, so that the stereoscopic video image is viewed as closer image as a whole.

When the offset is preset and left-eye and right-eye video images are displayed, any one of the opposite ends of the right eye and the left-eye video images is not displayed. It suffices to enlarge the video images in the vicinity of the blank areas and display them. At this time, the video images are also enlarged in a vertical direction according to the aspect ratio of the display screen. Specifically, although an area in the vicinity of the left end of the right-eye video image is blanked under the offset condition as shown in FIG. **5**, the video image of the right-eye video image in the vicinity of the left end thereof is extended until the end reaches the left end of the screen, so that the right-eye video image is displayed. Although an area in the vicinity of the right end of the right-eye video image is blanked under the offset condition as shown in FIG. **6**, the video image of the right-eye video image in the vicinity of the right end thereof is extended until the end reaches the right end of the screen, so that right-eye video image is displayed. Natural stereoscopic video image can be displayed without causing any blank area which is offset from the screen by extending the side areas of the offset video image and also extending the side video images in a vertical direction according to the aspect ratio of the screen.

Now, the amount of the offset of the right-eye and left-eye video images will be described.

FIG. **7** shows the relationship between the parallax of the original stereoscopic video image and the stereoscopic image appearing position. In the original stereoscopic video image, the right-eye and left-eye video images are in the positional at the same place as relationship when image picking-up is carried out as shown in FIG. **4**. If the stereoscopic image appearing position (the distance between the position at which the stereoscopic view can be viewed and the viewer), the visual range (the distance between the viewer and the display screen), the parallax between the left-eye and right-eye video images which are displayed on the screen and the intereye distance are represented as Cd, Ls, X2 and de (about 65 mm), respectively, the parameters have a relationship which is defined in expression (1) in FIG. **7**. The stereoscopic image appearing position Ld can be determined as a function of the parallax X1 by solving the expression (1). The X1 varies depending upon the size of the screen (in proportion to the screen size).

FIG. **8** shows the relationship between the parallax of the right-eye and left-eye video images and the stereoscopic image appearing position when both the right-eye and left-eye images are offset. If the stereoscopic image appearing position (the distance between the position at which the stereoscopic view can be viewed and the viewer), the visual range (the distance between the viewer and the display screen), the offset of the right-eye and left-eye video images, the parallax between the left-eye and right-eye video images which are displayed on the screen and the intereye distance are represented as Cd, Ls, Xo, X1 and de, respectively, the parameters have a relationship which is defined in expression (2) in FIG. **8**. In order to obtain the stereoscopic image appearing position Ld which is same as that of the original video image, Ld which is determined by the expression (1) in FIG. **7** is input to expression (2). The offset Xo of the right-eye and left-eye video images is determined.

FIGS. **9** through **13** are views showing the configuration of the stereoscopic video image display device of the present embodiment.

Display means **121** comprises a display device using liquid crystal. As shown in FIGS. **9** through **10**, polarization filter units **6***a* and **6***b* for the right-eye left-eye **6***a* and **6***b* having polarization directions which are at normal angles are disposed on the right and left sides of the light emitting plane of a light source **5**. Even if no light emitting element and no polarization filter is used, it suffices to configure the display means so that lights having different polarizations are emitted from different positions. For example, two light emitting elements for emitting lights having different polarization may be provided so that the lights having different polarizations are incident upon a Fresnel lens **3** from different positions.

In the present embodiment, reference numeral **3** denotes a Fresnel lens. The lights which have passed through the filter units **6***a*, **6***b* are changed into parallel lights by the Fresnel lens **3** and are incident upon the liquid crystal display element **2**. In the present embodiment, the display panel **2***a* of the liquid crystal display element **2** comprises pixels (L, R) which form first and second video images which are stereoscopically viewed. The pixels L and R are alternately disposed in both lateral and vertical directions to form a checkered pattern. Polarization panels **2***b* and **2***c* are applied to the display panel on the sides facing the light source and the viewer, respectively.

In the present embodiment, the liquid crystal display panel comprises two transparent plates (for example, glass plates) between which a liquid crystal is sandwitched. The liquid crystal has an orientation which is twisted at a given angle (for example 90°. Thus, TFT type liquid crystal display panel is formed. Light which is incident upon the liquid crystal display panel is emitted therefrom after the polarization of the incident light is twisted at 90° when no voltage is applied to the liquid crystal. On the other hand, when a voltage is applied to the liquid crystal, the incident light having original polarization is emitted since the twisting of the orientation of the liquid crystal is released.

A checker patterned filter **7** is applied to the side of the display panel facing the light source in the present embodiment.

Therefore, light which has passed through the polarization filter **6** is incident upon the Fresnel lens **3**. The Fresnel lens **3** changes the light emitted from the light source in a diffusing manner into substantially parallel light rays, which then pass through the checker patterned filter and are incident upon the liquid crystal display panel.

The light from the checker patterned filter **7** is emitted so that it will not be enlarged in a vertical direction, and is then incident upon the liquid crystal panel **2**. In other words, the light which has passed through a predetermined area of the checker patterned filter **7** will pass through a portion of predetermined display unit of the liquid crystal display panel **2**.

The lights which were incident upon the liquid crystal display panel and have passed through the right and left polarization filter portions a and b of the polarization filter **6** will be incident upon the Fresnel lens **3** at different angles and are refracted by the Fresnel lens **3** and are emitted from the liquid crystal display panel **2** via right and left different paths.

The checker patterned filter **7** has areas for changing the phases of the light transmitted therethrough, which are spacedly and repeatedly disposed to form a checkered pattern as shown in FIG. **11**(**1**). Specifically, as shown in FIG. **11**(**2**), the light transmitting substrate **171** is provided with areas **7***a* each on which a half wave length plate **172** having a very small width is placed and areas **7***b* each on which no half wave length plate **172** is placed. The areas **7***a* are disposed alternately with areas **7***b* in a lateral vertical directions. The half wave length plates may be provided on the light source side or display panel side.

In such a manner, the areas **7***a* which change the phase of the transmitting light by means of half wave length plate **172** and areas **7***b* which do not change the phase of the transmitting light since no half wave length plate **172** is provided are regularly disposed to form a checkered pattern. The half wave length plates **172** function as plates for shifting the phase of the light transmitting therethrough. The half wave length plates **172** are disposed in such a manner that their optical axes are inclined at 45° relative to the polarization axes of the light transmitted through the right side polarization filter unit a for rotating the polarization axes of the light which has transmitted therethrough by 90°. In other words, the polarization axis of the light which has been transmitted through the left side polarization filter unit b is rotated by 90° so that it is equal to the polarization of the light which has transmitted through the left side polarization filter unit b. The areas **7***b* having no half wave length plates **172** provided thereon transmit the light which has passed through the left side polarization filter unit b and has the same polarization as that of the polarization plate **2***b*. The areas **7***a* having half wave length plates **172** provided thereon rotate the light which has transmitted through the right polarization filter unit a and has a polarization optical axis intersecting with the polarization plate **21** so that its polarization axis is equal to that of the polarization plate **2***b*.

Repetition of the polarization characteristics of the checkered filter **7** provides polarization of the light transmitting therethrough which is different for each display unit (that is, horizontal line in a lateral direction and vertical line in a vertical direction of the display unit) at the same pitch as the display unit of the liquid crystal display panel **2**. The polarization characteristics of the very fine phase shift plate corresponding to each display unit of the liquid crystal display panel **2** in the scanning and subsidiary scanning lines are different, so that the directions of the light emitting from adjacent pixels are different.

In the present invention, repetition of the polarization characteristics of the checker patterned filter **7** may be in such a manner that the polarization characteristics of the checkered filter **7** change for each of a plurality of display units at a pitch of a multiple of that of the display unit of the liquid crystal display panel.

Since it is necessary to impinge light which is different for each of repeated polarization characteristics of the very fine phase shift plate upon the display unit of the liquid crystal display panel **2**, the diffusion of light which has transmitted through the checkered filter **7** and impinges upon the liquid crystal panel **2** should be suppressed in a vertical direction.

In other words, the areas **7***a* which changes the phase of the light passing through the checkered filter **7** make the polarization of the light which has transmitted through the right side polarization filter unit a of the polarization filter **6** equal to that which has transmitted through the left side polarization filter unit b. The areas **7***b* which do not change the phase of the light of the checker patterned filter **7** transmit the light which has transmitted through the left side polarization filter unit b of the polarization filter **6** as it. The light emitted from the checkered filter **7** has the same polarization with that of the light which has transmitted through the left side polarization filter unit b and is incident upon the polarization plate **2***b* which is provided on the side of the liquid crystal display panel **2** facing the light source.

The polarization plate **2***b* functions as a second polarization plate and has polarization characteristics which transmits the light having the same polarization as that of the light which has transmitted through the checker patterned filter **7**. In other words, the light which has transmitted through the left side polarization filter b of the polarization filter **6** will transmit through the second polarization filter **2***c* whereas the light which has transmitted through the right side polarization filter unit a of the polarization filter **6** will be subjected to the rotation of the polarization axis by 90° and transmits through second polarization plate **2***b*. The polarization plate **2***c* functions as first polarization plate and has polarization characteristics which transmit the light having polarization characteristics which is different from that of the polarization plate **21** by 90.

Such a combination of the checker patterned filters **7** and **8**, polarization plate **2***b*, liquid crystal panel **2***a* and polarization plate **2***c* constitute an image display device.

Therefore, in the stereoscopic video image display device of the present invention right and left images are displayed so that they form a checkered pattern on a plane. Since the filter is also disposed on a plane in a checkered pattern, the stereoscopic video image can be displayed without lowering its horizontal and vertical resolution.

As mentioned above, the stereoscopic video image signal generating circuit **101** generates a synthesized stereoscopic video image signal from the input stereoscopic video image signals and supplies the generated stereoscopic video image signal to a drive circuit **102**. Screen size information on the size of the displayable area of the display element provided on the display means **121** is output from the display means **121**. The screen size information is preset for each display means and is information on the number of dots on the screen in a lateral and vertical directions and the size of the display area which are stored in a storage (memory) provided in the display means. Sight range information on the distance between the video image displayed on the display means **121** and a viewer who views the image is output from the display means **121**. The sight range information may be defined depending upon the size of the display area. Position and distance information may be obtained by providing the display means **121** with means for detecting a viewer so that the positional relation between the viewer **90** and the display means **121** is measured by the display means **121**.

The screen size information and sight range and positional information output from the display means **121** is input to the display information acquisition means **104** and is converted into data of the type which is required by the stereoscopic video image signal generating circuit **101** and supplied to the circuit **101**.

The video image information acquisition means **103** extracts from the stereoscopic video image signal input to the display control circuit **100**, adaptable screen size information on the screen size which is suitable for the playback of the stereoscopic video image, adaptable sight range distance information on the distance between the viewer and the display screen which is suitable for the viewer to view it, camera distance information on the distance between the optical axes of the left-eye and right-eye video image cameras and cross-point information on the distance to the intersection of the optical axes of the left-eye and right-eye video image cameras and converts it into data of the type which is required by the stereoscopic video image signal generating circuit **101** and supplies the data to the circuit **101**.

A stereoscopic degree adjusting signal is input to the stereoscopic video image signal generating circuit **101** from an entry unit **105**. The stereoscopic video image signal generating circuit **101** offsets and displays the right-eye and left-eye video images depending upon the stereoscopic degree which is instructed to the entry unit **105** by a viewer, so that the stereoscopic degree of the stereoscopic video image displayed on the display means **121** can be changed.

The manual entry unit **105** may be switch and/or variable resistor which is actuated by the viewer depending upon user's preferences for changing the operation conditions of the display control circuit. The manual entry unit **105** outputs the above-mentioned screen size changing signal to the display information acquisition means **104** and further outputs the above-mentioned stereoscopic degree adjusting signal to the stereoscopic video image signal generating circuit **101** for adjusting the parallax so that it provides the stereoscopic feeling depending upon the viewer's preference.

The right-eye and left-eye video image signals which reaches the right-eye and left-eye respectively are alternately displayed in a checkered pattern. The offset between the right-eye and left-eye video images is preset by delaying or advancing the timing of the read-out of the right-eye video image from the right-eye from memory **31** by the stereoscopic video image generating circuit **101** to delay or advance the horizontal phase of the right-eye and left-eye video images. Thus, the stereoscopic degree is adjusted by adjusting the parallax between the eyes.

Now, a case when the position of a viewer is changed will be described.

The position information is detected by the viewer position detecting means **122**. Then this information is acquired by the display information acquisition means **104**. The offset is calculated by the offset presetting means **105**. The display means **102** is driven by the drive circuit **102** so that the video images can be normally viewed depending upon the distance of the viewer and his or her position in a lateral direction.

Another embodiment of the present invention will be described. FIG. **13** show another embodiment in which the light source **5** of the liquid crystal display device is changed. In the embodiment shown in FIG. **13**, a plurality of white LEDs **301** are juxtaposed in a horizontal direction. The liquid crystal display device comprises two column of left and right LED arrays **351**U, **351**D, an image display means (liquid crystal display plate) **354**, and two polarizing elements **354** corresponding to the LED arrays **351**U, **351**D having a polarization direction which is normal to the Fresnel lens **63** which functions as a convex lens.

Lighting of the LED array **351** is controlled by LED control means **353** provided on the display control circuit **100**. The LEDs which are lit and are not lit are represented as ● and ○, respectively in FIG. **13**.

In the present embodiment, there is provided with viewer's position determining means **122** which measures the displacement d1 of the viewer **70** from the optical axis of the image display means **52** and the distance d2 between the viewer and the image display device **252** for generating a measurement signal. In the present embodiment, the viewer's position determining means **122** may be ultrasonic type sensor, ultra-red ray type sensor or any other means if it is suitable.

An LED control means **353** controls the lighting portions **374**, **373** of the white LED1 of the LED array **351** to light them. The LED control means **353** is capable of moving the lighting position of the LED array **351** at a high speed as represented by an arrow D in response to the movement of the viewer as represented by an arrow d so that natural stereoscopic images can be always displayed.

Since no mechanical operation is accompanied by the control of the light source of the image display device, high speed and high precision operation is enabled and the image display device has a high durability and the configuration of control mechanism of the servo-control can be simplified.

If the number and positions of viewers relative to the image display device is measured and output by the position determining means **122** and lighting of the LED array **351** is controlled by the LED control means **353**, appropriate stereoscopic image can be displayed for the viewers who are positioned in different positions.

In the embodiment shown in FIG. **13**, the LED array **351** of the light source **5** comprises upper and lower arrays **351**U and **351**D. Right and left polarization filters **354** corresponding to the upper and lower arrays **351**U and **351**D are disposed in positions corresponding to each white LED **301** of the upper and lower arrays **351**U and **351**D, respectively. The polariza-

tion filter **354** comprise polarization filters **354**U and **354**D through which the light from the upper and lower arrays **351**U and **351**D of the LED array passes. The polarization filters **354**U, **354**D comprises polarization filters having polarization directions which intersect at right angles.

Now, a case in which there is one viewer will be described.

The position of the viewer **70** is determined by the above-mentioned viewer position detecting means **122** and the lighting position **374** of the upper and lower LED arrays **354**U and **354**D are lit for displaying the stereoscopic image for the viewer. The lighting position is moved using the viewer's position detecting means which has been described in the foregoing embodiment, so that the stereoscopic image can be displayed depending upon the position of the viewer **70**.

Now, a case in which there are a plurality of viewers, for example, two viewers **70**, **71** will be described. At this time, LED control means **353** receives a signal from the viewer's position detection means **122** to preset two lighting positions **373**, **374** on two LED arrays **351**, so that these lighting areas are alternately lit at a high speed. Accordingly, LED1 other than those at lighting areas **373**, **374** is not lit at one time and any one of the lighting areas **373** and **374** is lit at other times.

Accordingly, unwanted afterimage and interference of images can be eliminated and power consumption can be reduced by carrying out the blinking control so that the white LED **1** is turned off for the period of the synchronization signal and blanking period of the image display means **52**. Furthermore, an image having a wide visual field angle can be obtained using a small number of LEDs in planar image display device together with a Fresnel lens and limited light source.

Since the right and left LEDs are disposed so that they are divided into upper and lower arrays in the present embodiment, the spacing between LEDs for display of the right and left areas is made larger so that interference of light from each LED is reduced, cross-talk between right and left images which gives an adverse influence upon the stereoscopic image is reduced.

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An invention as set forth in Claim **1** resides in a stereoscopic video image pick-up and display system comprising a stereoscopic video image pick-up device including two video image pick-up means for outputting video information from said pick-up means; a stereoscopic video image display device for displaying different video images for the eyes of a viewer; and

a medium for transmitting said video image information from said stereoscopic video image pick-up device to said stereoscopic video image display device, in which said stereoscopic video image pick-up device includes cross-point measuring means for measuring CP information on the cross-point (CP) of optical axes of said pick-up means and outputs information including the CP information and video image information to said medium; and

in which said stereoscopic video image display device includes offset presetting means for offsetting and displaying said different video images based upon said video image information, said cross-point information and information on the size of the image which is displayed by said stereoscopic video image display device.

In accordance with the present invention, a stereoscopic video image can be obtained which is adjusted to provide an optimal stereoscopic degree (depth) depending upon the stereoscopic video image pick-up and display system.

An invention as set forth in Claim **2** resides in a stereoscopic video image display system as defined in Claim **1** wherein said stereoscopic video image display device includes viewer's position information measuring means for measuring information on the position of a viewer relative to a display screen, and further includes offset presetting means for offsetting and displaying said different video images based upon said video image information, said cross-point information, information on the size of the image which is displayed by said stereoscopic video image display device and the information on the position of the viewer.

In accordance with the present invention, a stereoscopic video image having an optimal stereoscopic degree (depth) corresponding to the positions of the stereoscopic video image pick-up and display system and the viewer can be obtained.

An invention as set forth in Claim **3** resides in a stereoscopic video image pick-up and display system as defined in Claim **1** or **2** in which said cross-point measuring means calculates the cross-point position based upon the angle of the intersection of the optical axes in said two pick-up means.

In accordance with the present invention, the distance between two image pick-up means can be measured based upon triangulation techniques and the distance between the pick-up means and the cross-point and object (scene) can be measured based upon the value of the angle at the intersection between the optical axes of said image pick-up means. The distance between two objects can be also measured.

An invention as set forth in Claim **4** resides in a stereoscopic video image pick-up and display system as defined in Claim **1** or **2** in which said cross-point measuring means calculates the cross-point based upon the position of picking-up of an object in said two pick-up means which are disposed in a parallel relationship.

In accordance with the present invention, the distance between two image pick-up means can be measured based upon triangulation techniques and the distance between the pick-up means and the cross-point and object (scene) can be measured based upon the value of the angle at the intersection between the optical axes of said image pick-up means. The distance between two objects can be also measured.

An invention as set forth in Claim **5** resides in a stereoscopic video image pick-up and display system as defined in any of Claims **1** through **4** in which said stereoscopic video image pick-up device is adapted to feed out information on the depth of the areas, the image of which is picked-up in a depth direction and said stereoscopic video image display device includes offset presetting means for offsetting and displaying said different video images based upon said video image information, said cross-point information, information on the size of the image which is displayed by said stereoscopic video image display device and the information on the position of the viewer.

In accordance with the present invention, more appropriate stereoscopic video image display can be carried out since the display means can obtain more exact information on image pick-up conditions.

An invention as set forth in Claim **6** resides in a stereoscopic video image pick-up and display system as defined in Claim **2** in which said viewer's position detecting means is disposed integrally with the main body of said stereoscopic video image pick-up and display system.

In accordance with the present invention, it is not necessary to separately provide the viewer's position detecting means in addition to the main body of the stereoscopic video image pick-up and display system.

An invention as set forth in Claim **7** resides in a stereoscopic video image pick-up and display system as defined in Claim **2** in which said viewer's position detecting means is disposed in a position remote from the main body of said stereoscopic video image pick-up and display system.

In accordance with the present invention, the viewer's position detecting means can be disposed in an appropriate position to detect the position of the viewer, so that the position of the viewer can be accurately detected.

An invention as set forth in Claim **8** resides in a stereoscopic video image pick-up and display system as defined in Claim **6** or **7** in which said viewer's position detecting means includes an ultrasonic wave transmitter and ultrasonic wave receiver.

In accordance with the present invention, the detection of a viewer is not liable to be influenced by the peripheral noise in comparison with that using ultra-red means, so that accurate detection can be achieved.

An invention as set forth in Claim **9** resides in a stereoscopic video image pick-up and display system as defined in Claim **6** or **7** in which said viewer's position detecting means detects the position based upon the picked-up image of the viewer.

In accordance with the present invention, the detection of a viewer is not liable to be influenced by the peripheral noise in comparison with that using ultra-red means, so that accurate detection can be achieved.

An invention as set forth in Claim **10** resides in a stereoscopic video image pick-up and display system as defined in any of Claims **1** through **9** in which said offset presetting means presets the offset of the right-eye and left-eye video images based upon the information input to said input means for adjusting the stereoscopic feeling of the image which is displayed by said display means.

In accordance with the present invention, the stereoscopic video image having a stereoscopic degree (depth) which is adjusted to meet the viewer's preferences can be obtained.

An invention as set forth in Claim **11** resides in a stereoscopic video image pick-up and display system as defined in any of Claims **1** through **10** in which said system includes a memory for the left-eye video image for storing a left-eye video image and a memory for the right-eye video image for storing a right-eye video image, said offset presetting means includes timing control means for controlling the timing of the read-out of video image data from said frame memory for left-eye video image and/or said frame memory for right-eye video image; and

said timing control means presets the offset of said left-eye video image and right-eye video image by advancing or delaying the timing of the read-out of the video image data from one of said frame memories for left-eye and right-eye video images relative to the timing of the read-out of the video image data from the other of said from memories for the left-eye and right-eye video images.

In accordance with the present invention, an offset of the right-eye and left-eye video images can be preset by a simple circuit.

An invention as set forth in Claim **12** resides in a stereoscopic video image pick-up and display system as defined in any one of Claims **1** through **11** in which said system comprises a stereoscopic video image frame memory for storing the stereoscopic video image therein, and signal switching means for switching between the left-eye video image data read-out from said frame memory for the left-eye video image and right-eye video image read-out from said from memory for said right-eye video image to input the data to said frame memory for the stereoscopic video image.

In accordance with the present invention, video image in which the offset of the right-eye and left-eye video images is preset can be synthesized and be stored in the frame memory.

An invention as set forth in Claim **13** resides in a stereoscopic video image pick-up and display system as defined in any of Claim **1** through **12** in which the offset of said left-eye and right-eye video images is preset by advancing or delaying the horizontal phase of said left-eye and right-eye video images.

In accordance with the present invention, presetting of the offset of the right-eye and left-eye video images can be easily controlled.

An invention as set forth in Claim **14** resides in a stereoscopic video image pick-up and display system as defined in any of Claims **1** through **13** in which an area of one or both of said left-eye and right-eye video image in the vicinity of its lateral edge is enlarged in a horizontal and vertical directions so that it fills a blank area which is caused by the presetting of the offset of said left-eye and right-eye video images.

In accordance with the present invention, display causing no blank area even if the right-eye and left-eye video images are shifted and displayed, and which gives quite normal feeling can be achieved.

An invention as set forth in Claim **15** resides in a stereoscopic video image pick-up and display system as defined in any of Claims **1** through **14** in which said display means includes video image display means for displaying a video image with transmitted light and a light source device, said light source device comprising an LED array in which white LEDs or RGB LEDs are integrally arrayed, said offset presetting means including LED control means for controlling the lighting of said white LEDs or RGB LEDs of said LED array based upon said offset.

In accordance with the present invention, lighting of the light source can be freely achieved by the control of the LED control means and power consumption can be reduced since white LEDs or RBG LEDs having less power consumption and high switching speed are used as the light source.

An invention as set forth in Claim **16** resides in a stereoscopic video image pick-up and display system as defined in Claim **15** in which said LED control means of said offset presetting means controls the lighting of said white LEDs or RGB LEDs based upon said viewer's position information so that the video image which is viewed by a viewer is maintained.

In accordance with the present invention, an appropriate video image can be displayed even if the viewer moves or viewers are in a plurality of different positions.

An invention as set forth in Claim **17** resides in a stereoscopic video image pick-up and display system as defined in Claim **15** in which each LED array which is provided at upper and lower areas of said light source device forms a right-eye video image display unit and left-eye video image display unit.

In accordance with the present invention, contort of display of stereoscopic video image can be achieved at a high freedom degree by controlling the lighting of the right-eye video image display unit and left-eye video image display unit of the LED array by the LED control means.

An invention as set forth in Claim in **18** resides in a stereoscopic video image pick-up and display system as defined in any of Claims **1** through **17** which is adapted to a display system of portable digital assistant (PDA).

In accordance with the present invention, the display of the portable digital assistant can be made stereoscopic.

An invention as set forth in Claim in **19** resides in a stereoscopic video image pick-up and display system as defined in any of Claims **1** through **17** which is adapted to a display system of mobile communication terminal.

In accordance with the present invention, the display of mobile communication terminal can be made stereoscopic.

An invention as set forth in Claim **20** resides in a stereoscopic video image pick-up and display system as defined in any of Claims **1** through **17** which is adapted to a terminal of car navigation system.

In accordance with the present invention, the display of car navigation system can be made stereoscopic.

An invention as set forth in Claim **21** resides in a stereoscopic video image pick-up and display system as defined in any of Claims **17** through **20** in which said video image information and CP information is communicated between said terminal devices.

In accordance with the present invention, stereoscopic video image information can be communicated between terminal devices, so that the same video image information can be shared.

An invention as set forth in Claim **22** resides in a stereoscopic video image pick-up and display system as defined in any of Claims **1** through **21** in which said medium is a communication medium.

In accordance with the present invention, a stereoscopic video image can be displayed even if both the stereoscopic video image pick-up device and stereoscopic video image display device are in the same position, and even if both devices are remote. The communication medium may include wireless communication, wired communication and optical communication.

An invention as set forth in Claim **23** resides in a stereoscopic video image pick-up and display system as defined in any of Claims **1** through **21** in which said medium is a communication medium.

In accordance with the present invention, stereoscopic video image information which is picked-up by the stereoscopic video image pick-up device can be stored and reproduced by the stereoscopic video image display device. The communication medium may include wireless communication, wired communication and optical communication.

What is claimed is:

1. A stereoscopic video image pick-up and display system comprising:

a stereoscopic video image pick-up device including two video image pick-up means for outputting video information from said pick-up means;

a stereoscopic video image display device for displaying different video images for the eyes of a viewer; and

a medium for transmitting video image information from said stereoscopic video image pick-up device to said stereoscopic video image display device,

in which said stereoscopic video image pick-up device includes cross-point measuring means for measuring CP information on the cross-point (CP) of optical axes of said pick-up means and outputs information including the CP information and video image information to said medium; and

in which said stereoscopic video image display device includes offset presetting means for offsetting and displaying said different video images based upon said video image information, said cross-point information and information on the size of the image which is displayed by said stereoscopic video image display device.

2. A stereoscopic video image display system as defined in claim **1** wherein said stereoscopic video image display device includes viewer's position information measuring means for measuring information on the position of a viewer relative to a display screen, and further includes offset presetting means for offsetting and displaying said different video images based upon said video image information, said cross-point information, information on the size of the image which is displayed by said stereoscopic video image display device and the information on the position of the viewer.

3. A stereoscopic video image pick-up and display system as defined in claim **2** in which a viewer's position detecting means is disposed integrally with the main body of said stereoscopic video image pick-up and display system.

4. A stereoscopic video image pick-up and display system as defined in claim **3** in which a viewer's position detecting means includes an ultrasonic wave transmitter and ultrasonic wave receiver.

5. A stereoscopic video image pick-up and display system as defined in claim **3** in which a viewer's position detecting means detects the position based upon the picked-up image of the viewer.

6. A stereoscopic video image pick-up and display system as defined in claim **2** in which a viewer's position detecting means is disposed in a position remote from the main body of said stereoscopic video image pick-up and display system.

7. A stereoscopic video image pick-up and display system as defined in claim **1** in which said cross-point measuring means calculates the cross-point position based upon the angle of the intersection of the optical axes in said two pick-up means.

8. A stereoscopic video image pick-up and display system as defined in claim **1** in which said cross-point measuring means calculates the cross-point based upon the position of picking-up of an object in said two pick-up means which are disposed in a parallel relationship.

9. A stereoscopic video image pick-up and display system as defined in claim **1** in which said stereoscopic video image pick-up device is adapted to feed out information on the depth of an area, the image of which is picked-up in a depth direction and

said stereoscopic video image display device includes offset presetting means for offsetting and displaying said different video images based upon said video image information, said cross-point information, information on the size of the image which is displayed by said stereoscopic video image display device and the information on the position of the viewer.

10. A stereoscopic video image pick-up and display system as defined in claim **1** in which said offset presetting means presets the offset of the right-eye and left-eye video images based upon the information input to a input means for adjusting the stereoscopic feeling of the image which is displayed by a display means.

11. A stereoscopic video image pick-up and display system as defined in claim **1** in which said system includes a memory for the left-eye video image for storing a left-eye video image and a memory for the right-eye video image for storing a right-eye video image,

said offset presetting means includes timing control means for controlling the timing of the read-out of video image data from a frame memory for left-eye video image and/or a frame memory for right-eye video image; and

said timing control means presets the offset of said left-eye video image and right-eye video image by advancing or delaying the timing of the read-out of the video image data from one of said frame memories for left-eye and right-eye video images relative to the timing of the read-

out of the video image data from the other of said from memories for the left-eye and right-eye video images.

12. A stereoscopic video image pick-up and display system as defined in claim **1** in which said system comprises a stereoscopic video image frame memory for storing the stereoscopic video image therein, and

signal switching means for switching between left-eye video image data read-out from said frame memory for the left-eye video image and right-eye video image read-out from said frame memory for said right-eye video image to input the data to said frame memory for the stereoscopic video image.

13. A stereoscopic video image pick-up and display system as defined in claim **1** in which the offset of said left-eye and right-eye video images is preset by advancing or delaying the horizontal phase of said left-eye and right-eye images.

14. A stereoscopic video image pick-up and display system as defined in claim **1** in which an area of one or both of left-eye and right-eye video image in the vicinity of its lateral edge is enlarged in a horizontal and vertical directions so that it fills a blank area which is caused by the presetting of the offset of said left-eye and right-eye video images.

15. A stereoscopic video image pick-up and display system as defined in claim **1** in which a display means includes video image display means for displaying a video image with transmitted light and a light source device, said light source device comprising an LED array in which white LEDs or RGB LEDs are integrally arrayed, said offset presetting means including LED control means for controlling the lighting of said white LEDs or RGB LEDs of said LED array based upon said offset.

16. A stereoscopic video image pick-up and display system as defined in claim **15** in which said LED control means of said offset presetting means controls the lighting of said white LEDs or RGB LEDs based upon a viewer's position information so that the video image which is viewed by a viewer is maintained.

17. A stereoscopic video image pick-up and display system as defined in claim **15** in which each LED array which is provided at upper and lower areas of said light source device forms a right-eye video image display unit and left-eye video image display unit.

18. A stereoscopic video image pick-up and display system as defined in claim **17** in which said video image information and CP information is communicated between terminal devices.

19. A stereoscopic video image pick-up and display system as defined in claim **1** which is adapted to a display system of portable digital assistant (PDA).

20. A stereoscopic video image pick-up and display system as defined in claim **1** which is adapted to a display system of mobile communication terminal.

21. A stereoscopic video image pick-up and display system as defined in claim **1** which is adapted to a terminal of car navigation system.

22. A stereoscopic video image pick-up and display system as defined in claim **1** in which said medium is a communication medium.

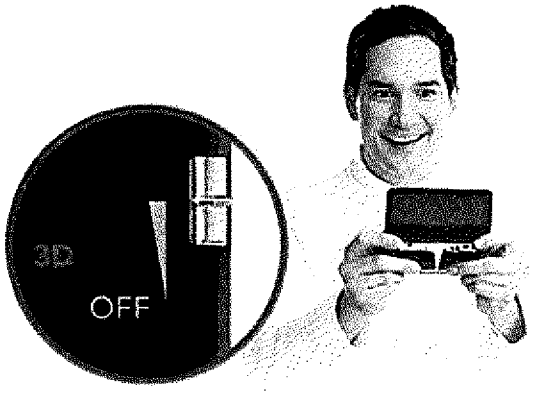
* * * * *

Exhibit B

Nintendo 3DS XL

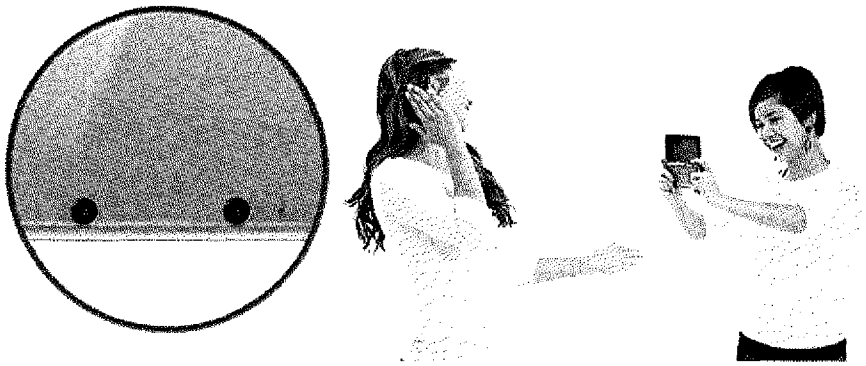
3D screen

The Nintendo 3DS XL system features a stereoscopic 3D display on the upper screen to give objects within the game world a feeling of space and depth. It becomes easier to see the position of characters and obstacles, making many game experiences even more intuitive for all types of players.



3D Depth Slider

A built-in 3D Depth Slider allows you to adjust the intensity of the 3D settings on the Nintendo 3DS XL system to your liking. The 3D effect can also be turned down completely—all Nintendo 3DS games and applications can be played in 2D.



3D camera

The Nintendo 3DS XL system can take photos in 3D, thanks to the two outward-facing lenses. Capture eye-popping images of your friends and family, have fun with filters like the Merge lens, or even use the system's AR technology and included AR Cards to make Mii™ characters and Nintendo heroes appear in the real world with you.

Learn about AR Cards ›

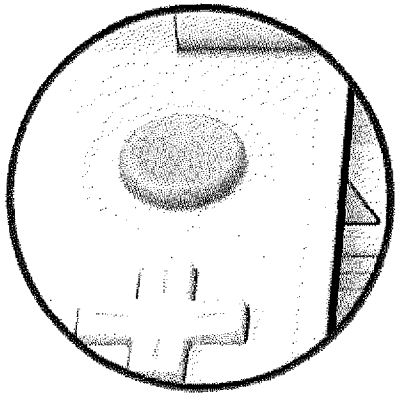
You can share your 3D photos with others by submitting them to the Nintendo 3DS Photo Showcase. Browse featured galleries or submit your own masterpiece to the Showcase here.

In a creative mood? You can record your own 3D videos, or 3D stop-motion animation using the built-in 3D camera.

* *3D viewing and depth slider not available on Nintendo 2DS*

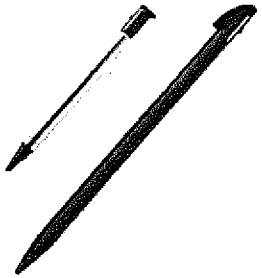
Motion sensor & gyro sensor

Portable play control reaches a new level with these amazing features, allowing for unique gameplay mechanics. A built-in motion sensor and gyro sensor can react to the motion and tilt of the system, so whether players are twisting their systems side to side or moving them up and down, their motion-compatible Nintendo 3DS games respond instantly.



Analog control

With the Circle Pad, located above the + Control Pad, systems in the Nintendo 3DS family offer full analog control. Combined with the touch screen, traditional buttons, camera and microphone input, and advanced motion control of the motion sensor and gyro sensor, the potential is extraordinary.



Stylus

All systems in the Nintendo 3DS family come with a Stylus to allow for precise touch controls on the bottom screen.

Two screens

Games look better than ever on the two screens of the Nintendo 3DS family of systems.

On the Nintendo 3DS XL, a widescreen display on the top screen shows 800x240 pixel resolution, allocating 400 pixels for each eye to create the 3D effect.

The bottom LCD touch screen operates at a resolution of 320x240—with both screens capable of displaying a brilliant 16.77 million colors.

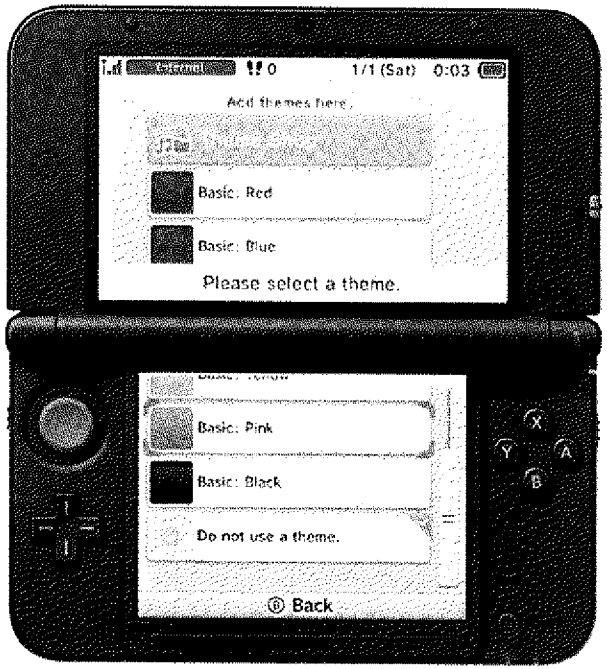
The Nintendo 2DS offers a widescreen display on the top screen, showing 400x240 resolution, while the bottom touch screen operates at a resolution of 320x240.

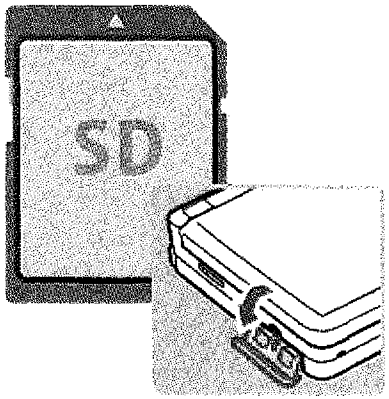
HOME Menu Themes

Choose a color and decorate your system's background, icons, and folders. Five themes are available for your system at no charge, so you can switch things up whenever you like. Simply tap the HOME Menu Settings icon in the upper left corner to change your theme.

And if you want even more customization, you can purchase special themes featuring Nintendo characters and games. These include fan favorites such as Mario and The Legend of Zelda series—and many even come with music and sound effects.

A system update may be required for some features. To learn how to perform a system update, click here.


1/1 (Sat) 0:03
Add themes here.
Basic: Red
Basic: Blue
Please select a theme.
Basic: Pink
Basic: Black
Do not use a theme.
Back
X
Y
A
B



SD Memory Card included

All systems in the Nintendo 3DS family come packed with an SD Memory Card*. You can use this SD Memory Card to store your 3D photos, sound recordings created on the system, and music** from your PC. You can also use it to store games downloaded from the Nintendo eShop. The Nintendo 3DS family of systems feature SDHC card compatibility to increase your storage space even further.

* *Nintendo 3DS XL and Nintendo 2DS systems come with a 4GB SD Memory Card.*

** *Nintendo 3DS is compatible with MP3 and AAC file formats.*

Nintendo 3DS Game Card

Nintendo DSi Game Card

Backwards compatibility

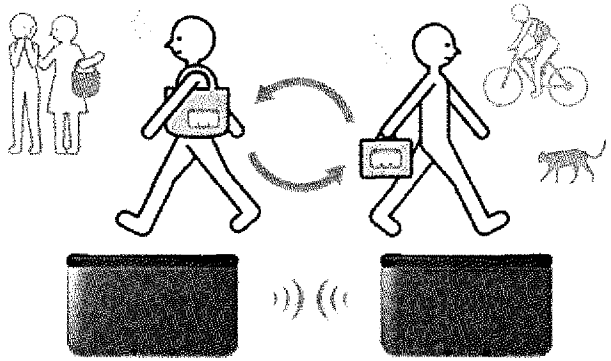
Almost all existing Nintendo DS and Nintendo DSi games can be played on the Nintendo 3DS family of systems in 2D. With backwards compatibility, your existing portable games look and play just as well*.

If you've downloaded Nintendo DSiWare games and applications on your Nintendo DSi system, you can easily transfer most of those games to any system in the Nintendo 3DS family. You can also transfer downloaded software, sounds, and images between systems in the Nintendo 3DS family. Some games cannot be transferred. See the full list, and to learn how to perform system transfers here.

* *Nintendo DS and Nintendo DSi games will be displayed in 2D graphics. Select Nintendo DS games that use accessories in the Game Boy™ Advance slot of the Nintendo DS system are not compatible with the Nintendo 3DS system.*

* *Flipnote Studio cannot be transferred to the Nintendo 3DS system. Nintendo will be developing a similar application for the Nintendo 3DS.*

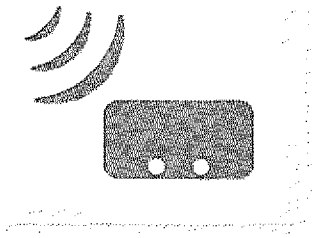
A system update may be required for some features. To learn how to perform a system update, click here.



StreetPass™

The Nintendo 3DS family of systems brings players together in exciting new ways with StreetPass communication. Set your system to Sleep Mode and carry it with you wherever you go to exchange game data like Mii™ characters, high scores, and custom characters with other users you pass on the street. You control what data you exchange, and you can exchange data for multiple games at once, making virtual connections with real world people you encounter in your daily life.

Find out more about StreetPass and how to interact with other Nintendo 3DS owners ›



SpotPass™

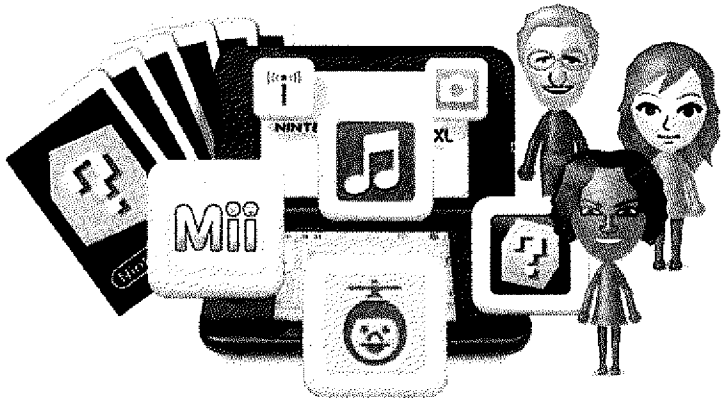
The Nintendo 3DS family of systems can automatically connect to a wireless Internet access point. Once connected, special items will download automatically to your system via the SpotPass feature, even while in sleep mode. Some of these surprise items include exclusive content and promotions from Nintendo Zone™, unique 3D videos from the Nintendo Video™ service, and add-on game content from your favorite Nintendo 3DS games.

Look for the blue LED light on the outside of your Nintendo 3DS system or a blue dot on your favorite HOME Menu icon to find out if you've received something.

Getting SpotPass on the go is easier than ever! Enjoy a free and automatic connection to Wi-Fi at over

29,000 Nintendo Zone locations across the U.S. and Canada.

nintendo zone.



Built-in software

Featuring enhanced graphics, a host of built-in software, and robust wireless connectivity, the Nintendo 3DS family of systems advances the realm of portable entertainment in a number of ways.

See the software›

About Nintendo 3DS
What is Nintendo 3DS?

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AR Cards & AR Games

Nintendo 3DS Support
System Update

Nintendo 2DS
Built-in Software
Nintendo 3DS Games
Where to Buy

Nintendo eShop
Nintendo Video
Netflix
StreetPass
Accessories
Where to Experience Nintendo 3DS

How to Update System
How to Connect to the Internet
Troubleshooting
Parental Controls

Health & Safety/Privacy

Health & Safety Precautions Manual
Privacy Notice
Terms of Use

Change Region

Contact Us Newsletter Signup Website Feedback