

A DISPLAY DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a field of optics, more specifically, to a curved display device.

2. Description of the Related Art

The existing rear projection screen is usually the flat screen, as the distance from the screen to a viewer's left eye is different from the distance from the screen to the viewer's right eye, problems such as no ideal effect, getting visual fatigue easily and poor visual effect always exists. Furthermore, there are other problems concerning: the light spot ghost shadow 6 (see Figure 1) of projection light source, the scattered beam 5 which is the projected light beam, and the fuzzy borders around the projected image

SUMMARY OF THE INVENTION

In order to solve the problems of the existing rear projection screen, as are described above, the invention provides a display device, with the specific purpose of eliminating the light spot ghost shadow and the fuzzy borders, and of promoting sensual experience of viewers.

The technical solution of the invention is:

A display device, applied to a rear projection system, comprising:

A screen, which is curved; incident rays penetrating into a concave side of the screen, then being transmitted by the screen, and form parallel rays to be emitted out from the convex side of the screen.

A projecting unit, configured to project rays of an image to the screen, the image including a valid area and an invalid area.

A cover, located between the screen and the projecting unit, configured to cover the invalid area of the image for getting the light of the valid area of the image emitted by the projecting unit to project to the screen.

Preferably, the screen is made from translucent resin.

Preferably, the projecting unit is a silicon based liquid crystal projecting unit or a digital light procession projecting unit.

Preferably, there are more than one of the covers, a number of the covers are arranged between the projecting unit and the screen in parallel and in sequence, with an orientation along a direction of emitting the light of the image emitted by the projecting unit, for covering the invalid area of the image.

Center areas of the covers are hollow areas, and the plurality of covers with increasing size of the hollow areas in sequence, positioned between the projecting unit and the screen equidistantly for eliminating

the invalid area of the image.

Preferably, the projecting unit comprises:

A receiver module, for receiving projected images.

A projector module, connecting to the receiver module, configured to project lights of the projected images to the screen.

The benefits of the invention compared to the prior art are:

Present invention eliminates the fuzzy borders of projected images with the use of the cover, and eliminates the light spot ghost shadow of projected images with the use of the curved screen made from translucent resin, increasing the utilization rate of the light source, highlighting the layering of images, thus promoting sensual experience of viewers.

BRIEF DESCRIPTIONS OF THE DRAWINGS

Figure 1 is a diagrammatic drawing of light spot ghost shadow of a projection light source of a rear projection screen in the art;

Figure 2 is a structural schematic drawing of a display device of an embodiment according to the invention;

Figure 3 is a schematic drawing of rays casting of a screen made from translucent resin of an embodiment according to the invention;

Figure 4a is a frame schematic drawing of the elliptical valid area of projected image of an embodiment according to the invention;

Figure 4b is a frame schematic drawing of the rectangular valid area of a projected image of an embodiment according to the invention;

Figure 4c is a frame schematic drawing of the polygonal valid area of a projected image of an embodiment according to the invention.

DETAILED DESCRIPTIONS

The following is the further description of the invention by combining the drawing and the embodiments, and it can not be the limitation for the invention.

As shown in Figure 2-4, a display device, applied to the rear projection system, comprising: a screen 1, a cover 2 and a projecting unit 3, wherein the screen 1 is curved, configured to make incident rays penetrate into the concave side of the screen 1 then transmit from the convex side of the screen 1, projecting out in the form of parallel rays 4; the projecting unit 3 is configured to project rays of an image to the screen 1, and the image includes a valid area A and an invalid area B; the cover 2 is located between the screen 1 and the projecting unit 3, configured to cover the invalid area B of the image for getting the light of the valid area A of the image emitted by the projecting unit 3 to project to the screen 1.

In this embodiment, the display device is applied to the rear projection system, which eliminates the fuzzy borders of

projected images with the use of the cover 2, this not only improves the contrast of projected images, but also eliminates the light spot ghost shadow 6 (see Figure 1 and Figure 3), with the use of the screen 1, which is able to let incident rays penetrate through itself and form parallel rays 4, increasing the utilization rate of light source. Moreover, the use of the curved screen 1 highlights the layering of images, thus promoting sensual experience of viewers.

In a preferable embodiment, the screen 1 is made from translucent resin. Furthermore, the screen 1 can use curved Fresnel lens whose surface is covered by a semi-transparent layer. Fresnel lens is a sheet lens which is made from polyolefin resin using injection molding, one side of its lens surface is a mirror side, the other side of that is engraved with concentric circles placed in sequence from small to large, which is able to let incident rays penetrate through the lens and emit out parallel rays, thus improving the contrast of images, more uniformly, and eliminating the light spot ghost shadow of projected images.

In a preferable embodiment, the projecting unit 3 is a silicon based liquid crystal projecting unit or a digital light procession projecting unit..

Liquid Crystal on Silicon (LCOS) uses a reflex process to form images, with 40% of utilization efficiency. Compared with other

projection technology, a remarkable advantage of LCOS technology is high resolution, and projecting units with LCOS technology have further advantages such as high efficiency of the light utilization, small size, high aperture ratio and so on.

Digital Light Procession (DLP) has a technology core based on a digital microscope system consisting of tens of thousands of lenses, with a distance of less than 1 μm between each lens, thereby achieving extremely high-duty factor. Reducing the distance among pixels of the projected images to the limit could generate seamless digital pictures, which can keep good image sharpness at any size, without any pixel scar or sieve pore caused by other technologies, thus achieving the level of high-definition LCD in displayed images. DLP projecting technology can promote black layer and shadow effect. When a movie is played, DLP movie theatre technology can display 350 trillion colors, which are more than 8 times over the movie.

In a preferable embodiment, there are more than one of the covers 2, a number of the covers are arranged between the projecting unit 3 and the screen 1 in parallel and in sequence, with an orientation along a direction of emitting light of the image emitted by the projecting unit 3, for covering the invalid area B of the projected image.

As shown in Figures 3-4, in a preferable embodiment, center areas of the covers 2 are hollow areas, and the plurality of covers with

increasing size of hollow areas in sequence, positioned between the projecting unit 3 and the screen 1 equidistantly for eliminating the invalid area B (fuzzy borders) of the projected image, thus displaying the valid area A, which is elliptical, rectangular, polygonal (see Figure 4a-4c) or in other shapes.

In a preferable embodiment, the projecting unit 3 comprises: a receiver module and a projector module, wherein the receiver module is configured to receive projected images; wherein the projector module, connected to the receiver module, is configured to project lights of the projected images to the screen 1.

When it is used, a video interface could be set in the projecting unit 3, such as HDMI, MIPI or RGB interface, and the projecting unit 3 is connected with an external control chip through the video interface. When the video interface of the projecting unit 3 have been connected with that of the control chip, the projecting unit 3 can receive video signals transmitted by the control chip, and with the use of the cover 2, the projecting unit 3 can project the valid area A of the received image to the curved screen 1 made from resin material, finally displaying the valid area A of the image on the curved screen 1 of a robot.

The above description is referred only to the preferred embodiments of the invention, and it does not limit the implement method and the protecting scope of the invention. It is obvious for the

skilled in the art that the changing and variation made by the specification and drawings of the invention should fall into the scope of the invention.

CLAIMS

What is claimed is:

1. A display device, applied to a rear projection system, comprising:

a screen, which is curved; incident rays penetrating into a concave side of the screen, then being transmitted by the screen, and form parallel rays to be emitted out from a convex side of the screen ;

a projecting unit, configured to project rays of an image to the screen, the image including a valid area and an invalid area;

a covering plank, located between the screen and the projecting unit, configured to cover the invalid area of the image for getting the light of the valid area of the image emitted by the projecting unit to project to the screen;

wherein a center area of the covering plank is a hollow area, and a plurality of covering planks with increasing size of the hollow areas in sequence are positioned between the projecting unit and the screen equidistantly for eliminating the invalid area of the image.

2. The display device as claimed in Claim 1, wherein the screen is made from translucent resin.

3. The display device as claimed in Claim 1, wherein the projecting unit is a silicon based liquid crystal projecting unit or a digital light procession projecting unit.

4. The display device as claimed in Claim 1, wherein the plurality of covering planks are arranged between the projecting unit and the screen in parallel and in sequence, with an orientation along a direction of emitting light of the image emitted by the projecting unit, for covering the invalid area of the image.

5. The display device as claimed in Claim 1, wherein the projecting unit comprises:

a receiver module, for receiving projected images.

a projector module, connecting to the receiver module, configured to project lights of the projected images to the screen

ABSTRACT

The invention discloses a display device, which is applied to rear projection system, comprising: a screen, which is curved; incident rays penetrating into a concave side of the screen, then being transmitted by the screen, and form parallel rays to be emitted out from the convex side of the screen; a projecting unit, configured to project rays of an image to the screen, the image including a valid area and an invalid area; a covering plank, located between the screen and the projecting unit, configured to cover the invalid area of the image for getting the light of the valid area of the image emitted by the projecting unit to project to the screen. The invention eliminates the fuzzy borders of the projected images with the use of the covering plank.

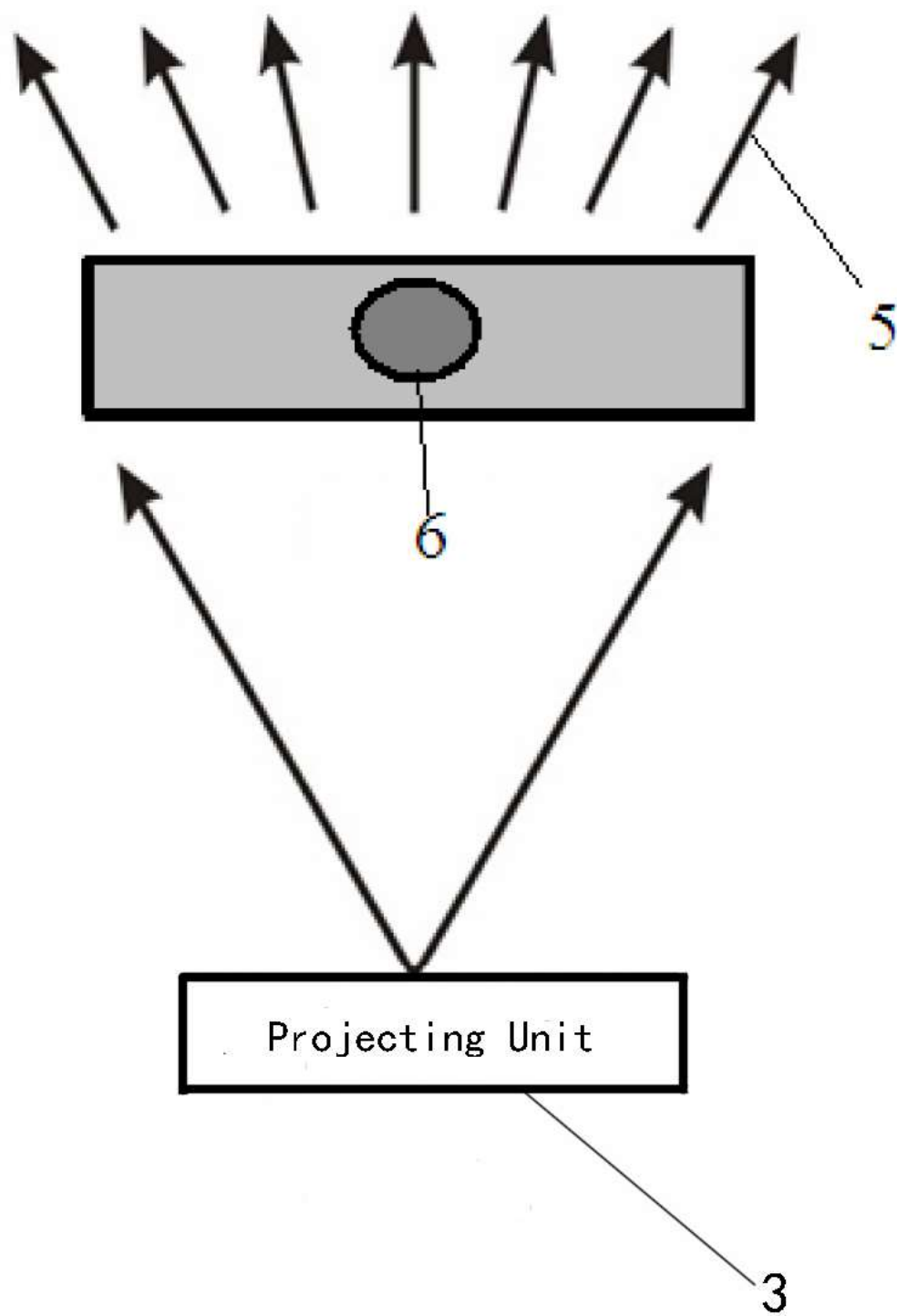


Figure 1

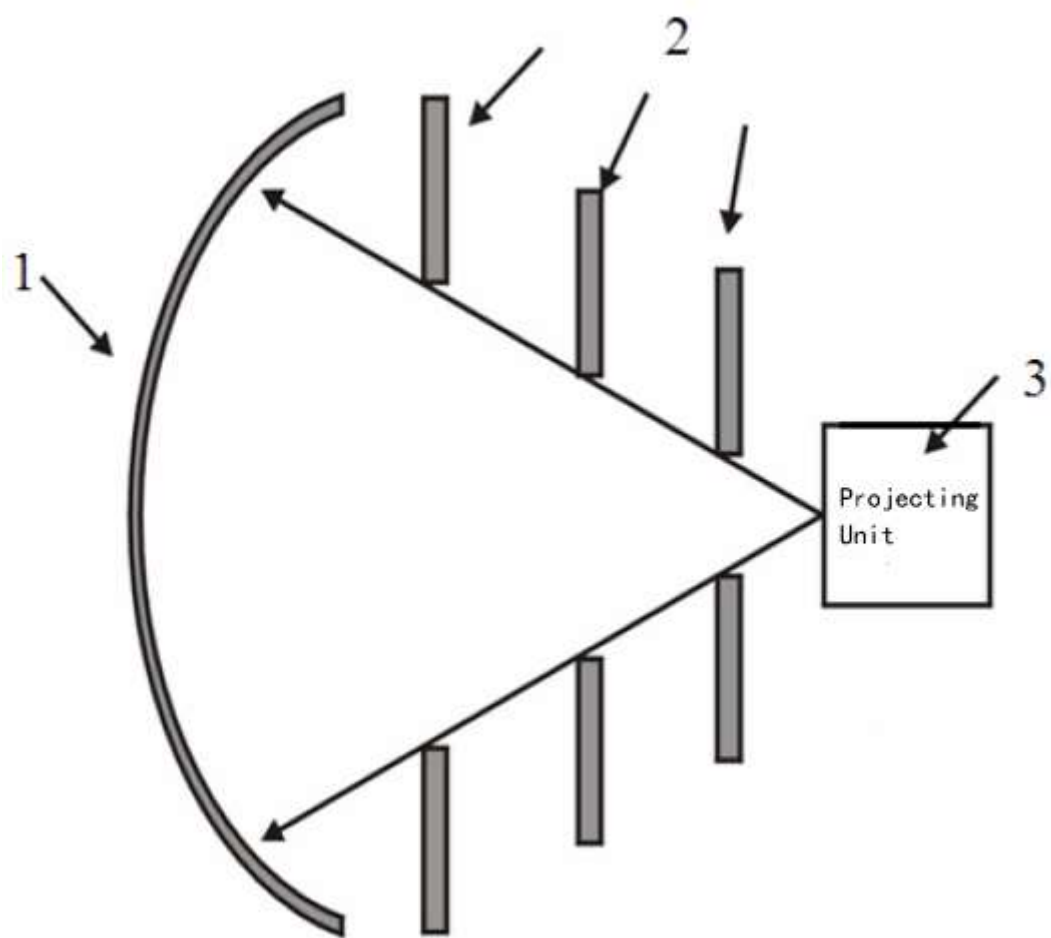


Figure 2

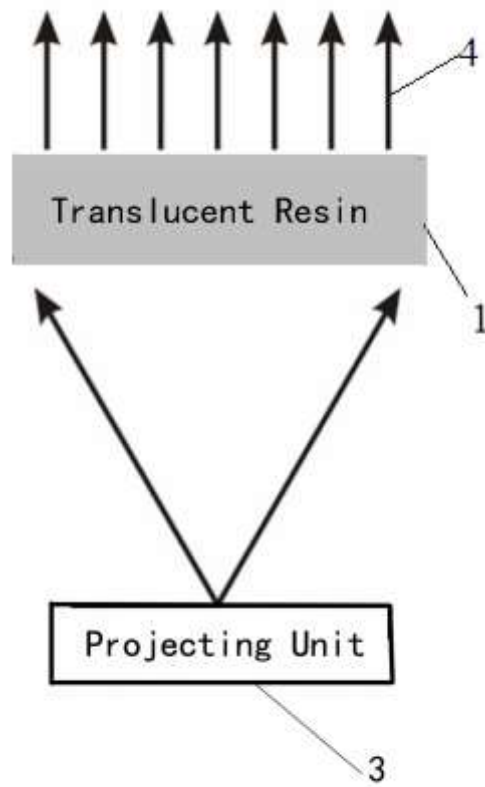


Figure 3

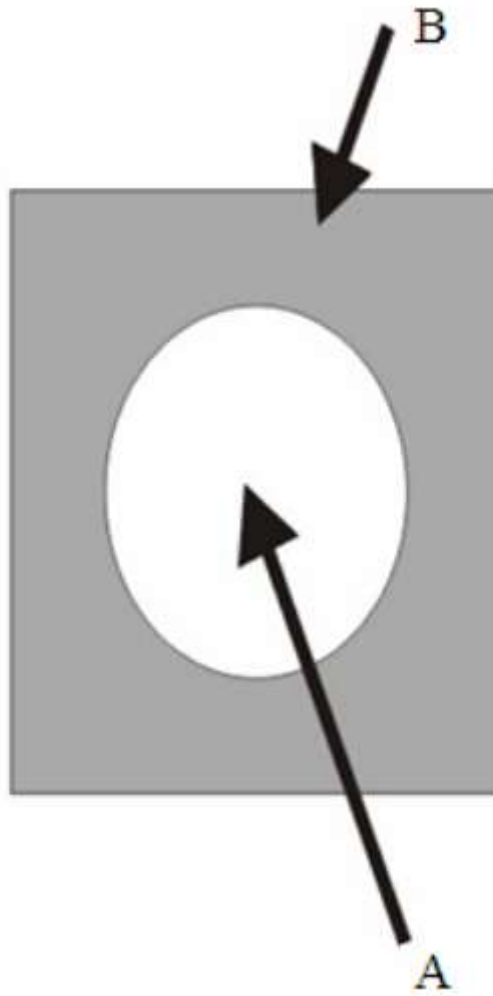


Figure 4a

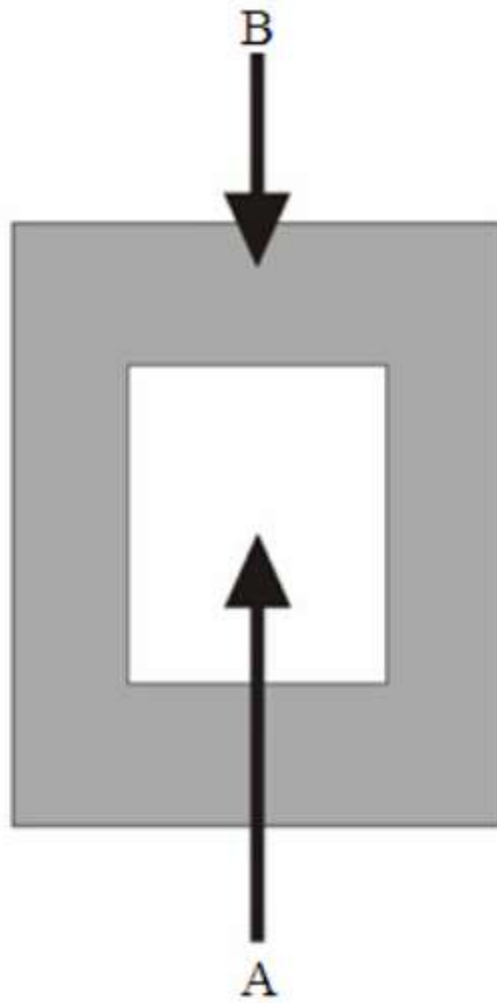


Figure 4b



Figure 4c