



TITLE OF THE INVENTION
**A DISPLAY CONFIGURATION EMPLOYING FLUORESCENCE EFFECT BY
ULTRAVIOLET PROJECTION**

BACKGROUND OF THE INVENTION

(1) Technical Field of the Invention

The present invention relates to display configuration, and in particular to a multicolor or monochromic display configuration, employing fluorescence effect. The display configuration is not restricted to viewing angle, shape and to high luminosity.

(2) Brief Description of the Prior Art

Cathode Ray Tube (CRT) utilizes cathodoluminescence effect where individual pixel fluorescence excited by an electron beam, and this will provide bright display that is easy to view at wide angle and under bright external light. However, CRT is inherently inflexible for the reason that CRT is constructed as a glass enclosure with vacuums interior, and it is difficult and expensive to fabricate irregular display or display dimensions that differs from what is currently being produced.

As a matter of fact, CRT utilized electron to cause pixel to fluoresce requires a vacuum enclose and therefore the cost of production is high.

For back projection displays, the display area can be irregular and multiple projectors can be used to meet more complicated requirement, but the back projection displays are not as bright as CRT and are difficult to view under bright external light.

Other displays such as TFT LCD display have the drawback of limited viewing angle and are also difficult to view under bright external light. Plasma display panels (PDP), uses the principle of fluorescent used in CRT display. The panel is compose of hundred thousands display unit that uses ultraviolet rays



discharged from exciting gas to cause the fluorescent layer to emit light. The Like CRT displays, TFT LCD and PDP are difficult and expensive to fabricate irregular display shape or display dimensions that differs from what is currently being produced.

Color plasma display panels (PDP) is teamed up with several hundred thousands display units in permutations and combination which is several hundred micrometers in size, the light source comes from applying a voltage on a discharging gas in order to produce ultraviolet rays. When the ultraviolet rays incident on different fluorescent layer, the fluorescent layers will emit three colors: red, green and blue depending on the material of that layer.

US Patent No. 5,012,999 discloses display unit for displaying two-dimensional images comprising: a fluorescent layer for emitting light when exposed to ultraviolet rays, said fluorescent layer including three different types of fluorescent material arranged in narrow strips in consecutive and repeating sequences that emit red, green and blue light, respectively, said fluorescent layer further having a thickness on the order of from approximately 1000 to 5000 angstroms; and an electric-field ultraviolet light emitting device having a positive electrode layer, a positive hole injection layer, a light emission layer, and a negative electrode layer, respectively, in a stacked face-to-face configuration, provided integrally behind said fluorescent layer for selective irradiation of said fluorescent layer.

US Patent No. 6,128,131 discloses flat-panel projection color display, comprising: a) a projection display screen of area A having a light transmissive support, a plurality of patterned fluorescent elements on one surface of the support capable of separately emitting red, green or blue light; b) the display screen area A being subdivided into a plurality of identical display tiles, each individual display tile and being seamlessly contiguous to at least one other display tile; c) a plurality of identical laser scanners arranged to form a two-dimensional array, each laser scanner being capable of projecting a laser beam onto a designated display tile for illuminating the patterned fluorescent elements; d) a projection distance D, being

defined as the distance from the laser scanner to the display screen; and e) the area of an individual display tile being selected to be in the range of from 0.01 to 0.1 times the area A of the projection display screen.

US Patent No. 5,612,713 discloses a digital micro-mirror device for imaging applications, having an array of mirror elements for forming the image and data loading circuitry for loading data for addressing the mirror elements. The data loading circuitry has a row of shift registers, which receive one row of data at a time, which they deliver to latches. The latches hold the data on bit-line, which run down columns of the array. The row to be loaded is selected with a row decoder. A block load circuit, comprised of a shift register and logic gates divides each row of memory cells into blocks and ensures that each block of a row of memory cells is sequentially loaded.

The present invention is related to a display configuration which utilizes fluoresce effect. The display configuration provides the advantages of both the fluoresce and the back projection displays.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a display configuration employing fluorescence effect comprising a light projection device including a short wavelength light source to project short wavelength light and a projection apparatus capable of selectively redirect the light from the light source; a display panel coated with fluorescent material for receiving the short wavelength light projected by the light projection device; whereby the short wavelength light from the light source causes the coated fluorescent material on the display panel to produce light display.

Another aspect of the present invention is to provide a display configuration employing fluorescence effect by ultraviolet projection comprising a first light projection device and a second light projection device, both the projection devices including a short wavelength light source to project short

wavelength light and a projection apparatus capable of selectively redirect the light from the light source, and in the event of failure of one light projection device, the other acts as a substitution to backup immediately; a display panel coated with fluorescent material for receiving the short wavelength light projected by the light projection device; whereby the short wavelength light from the light source causes the coated fluorescent material on the display panel to produce a display.

Yet another object of the present invention is to provide a display configuration employing fluorescence effect, wherein the projection and the display unit can be independently replaced for the reason that no vacuum is required between the two components.

Still another object of the present invention is to provide a display configuration employing fluorescence effect, wherein the display unit is lightweight which can be conveniently carried from place to place, and can be made to have a large, flat screen and/or may be of irregular shape to adapt to location constrained in space.

Another object of the present invention is to provide a display configuration employing fluorescence effect, wherein the display unit is not limited to viewing angle and high luminosity similar to that of the conventional Cathode Ray Tube (CRT).

Yet another object of the present invention is to provide a multi-color display comprising a light projection device including a short wavelength light source to project short wavelength light and three micro-mirror devices being positioned such that light projected from individual micro-mirror devices fall on three different fluorescent materials arranged in a predetermined configuration on a display panel to produce the three primary colors.

It is still another object of the present invention to provide an irregular display configuration comprising several light projection devices including a short wavelength light source to project short wavelength light and a projection apparatus capable of selectively redirect the light from the light source;

an irregular shaped display panel coated with fluorescent material for receiving the short wavelength light projected by the light projection device; whereby the short wavelength light from the light source causes the coated fluorescent material on the display panel to produce light display.

A further object of the present invention is to provide a display configuration employing fluorescence effect, wherein the display panel comprises a panel positioned a short distance away from the front surface of the projection; a fluorescent layer coating on the panel for emitting a longer wavelength light when exposed to a shorter wavelength light from the short wavelength light source; the panel is fabricated to provide enhancement for the light emitted by the fluorescent layer that will achieve the desired luminescent quality in terms of brightness and color purity.

Further objects of the invention together with additional features contributing thereto and advantages accruing therefrom will be apparent from the following description of preferred embodiments of the invention which is shown in the accompanying drawings with like reference numerals indicating corresponding parts throughout.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1A is a schematic view showing the display configuration in accordance with the present invention.

FIG. 1B is a sectional view of the display panel having a fluorescent layer and a panel substrate in accordance with the present invention.

FIG. 2 is a perspective view showing three projectors onto a display panel coated with appropriate material in accordance with the present invention.

FIG. 3 is a rear view of the display configuration, allowing the construction a display with irregular surface in accordance with the present invention.

FIG. 4 is a perspective view of the top portion of FIG. 3 in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1A, there is shown a display configuration 100 employing a fluorescence effect. In accordance with a preferred embodiment, the display configuration 100 comprises a light projection device 200 including a short wavelength light source 20 to project short wavelength light and a projection apparatus 30 capable of selectively redirect the light from the light source 20; and a display panel 40 having a fluorescent layer 42 for receiving the short wavelength light projected by the light projection device 200, and a panel substrate 44, as shown in FIG. 1B. The light projection device 200 comprises a short wavelength light source which is a UV, or near UV light source 20 and a projection apparatus 30 which capable of selectively redirecting the light from the UV light source 20 to be projected onto the display panel 40 located at a distance away from the projection apparatus. In accordance with the preferred embodiment of the present invention, a micro-mirror device, Digital Micromirror Device (DMD™), is used and the micro-mirror device is able to reflect the light selectively from an electronic control, Digital Light Processing (DLP™), 50, which where used currently in conjunction with DMD. As shown in FIGS. 1A and 2, in accordance with the present invention, DLP to covert video 60 to control signals for DMD to control the projections of short wavelength light onto the fluorescent coated panel.

In accordance with the present invention, the display panel 40 includes a fluorescent layer 42 coating on a rigid, transparent substrate 44. Examples of the materials that allows the fluorescent layer to emit different colors are (Y,Gd)BO₃ and EU for read, ZnSO₄ and Mn for green and BaMgAl₁₄O₂₃ and Eu for blue. Different materials deposited on the substrates are used to emit longer wavelength light which are visible to the eyes when the layers are exposed to shorter wavelength light. The panel with fluorescent layer described above is positioned at a short distance in the front of the display panel 40, opposing to the side where the projection apparatus is located, and the panel is transparent to the light emitted by the fluorescent layer. In accordance with the present invention, the panel contains

features that provide enhancement to the quality of fluorescent light in the aspect of intensity and color purity.

Color can be displayed by several means. One such arrangement is to vary the wavelength of the short wavelength light source; since fluorescent light is always longer in wavelength than the excitation light, it is possible to selectively excite the desired fluorescent material. Yet another arrangement is to utilize the polarization of the light source, and depositing individual polarized filter in front of each individual materials to allow only the desired fluorescent materials to excite by the light source. Yet another arrangement is to use only one fluorescent material that emits the full spectrum of light, while the substrate panel is fabricated with many small color filters that allows only red, blue or green light to pass through.

In another preferred embodiment of the present invention, a multi-color display system employing fluorescence effect can be obtained. A plurality of micro mirror devices, for instance three micro mirror devices, are used and are positioned in such a way that the light project from each of the micro mirror will fall on three different fluorescent materials arranged in a predetermined configuration to produce the three primary color on the display panel 40. Yet in another arrangement, the three primary color can be achieved by individual color filters on the panel while a uniform fluorescent material is used to produce all colors at the same time, to be filtered to different colors by the filter. Similarly, a UV light source 20 is employed to provide short wavelength light to the plurality of the micro mirror devices 30'. FIG. 2 is a perspective view showing three projection apparatus 30 are used in accordance with another preferred embodiment. The display panel 40 is coated with appropriate material and the projection apparatus 30' provide entire coverage over the area of the display panel 40.

FIG. 3 is a rear view of the display configuration of FIG. 2 in accordance with the present invention. FIG. 4 is a side view of the top portion of the display in accordance with the present invention.

As the light projection device 200 and the display panel 40 are made independently and are then mounted in a relative position, the display panel 40 and

the projection device 200 can be replaced independently as long as sufficient accuracy alignment between the projection device 200 and the display panel 40 can be obtained.

In another preferred embodiment, an irregular display configuration is disclosed and comprises multiple light projection devices described previously. The irregular display can be a one piece or multiple piece construction of display panel coated with the fluorescent material as described in previously. This embodiment allows optimization of all possible space given to a designer. Short wavelength light is not projected towards corner areas where the display panel is not present.

In another preferred embodiment of the present invention, the display configuration employing fluorescence effect by ultraviolet projection comprises a first light projection device and a second light projection device, both the projection devices including a short wavelength light source to project short wavelength light and a projection apparatus capable of selectively redirect the light from the light source, and in the event of failure of one light projection device, the other acts as a substitution to backup immediately.

In accordance with the preferred embodiments described above, UV light and shorter wavelength visible light are used to cause pixels on a display panel 40 to fluoresce. As UV light and shorter wavelength visible light can be transmitted through air, the display configuration provides numerous of implementations that cannot be obtained with that of conventional display system employing electrons transmission.

The display configuration of the present invention can be easily made and replaced for the reason that no vacuum enclosure is required.

Additional features can be added to the display panels, such as touch screen detection. This application may cause the serviceable life span of display panel to be reduced, but the invention allows the replacement of only the display panels without replacing the other parts of the system, saving cost.

While the invention has been described with reference to preferred embodiments, it will be understood by those skilled in the art that various changes

may be made and equivalents may be substituted for elements thereof without departing from the scope of the invention. In addition, many modifications may be made to adapt a particular configuration to the teachings of the invention without departing from the essential scope thereof. Therefore, it is intended that the invention not be limited to the particular embodiment disclosed as the best mode contemplated for carrying out this invention, but that the invention will include all embodiments falling within the scope of the appended claims.

CLAIMS

1. A display configuration employing fluorescence effect by ultraviolet projection comprising
a light projection device including a short wavelength light source to project short wavelength light and a projection apparatus capable of selectively redirect the light from the light source;
a display panel coated with fluorescent material for receiving the short wavelength light projected by the light projection device; whereby the short wavelength light from the light source causes the coated fluorescent material on the display panel to produce light display.
2. The display configuration of claim 1, wherein the projection apparatus includes a micro-mirror device capable of reflecting light selectively from an electronic control.
3. The display configuration of claim 1, wherein the display panel comprises
a fluorescent layer for emitting a longer wavelength light when exposed to a shorter wavelength light from the short wavelength light source;
a panel positioned a short distance away from the front surface of the projection, wherein the panel contains features that enhance or to determine the color of the fluorescent at each pixel.
4. A display configuration for producing a multi-color display comprising a light projection device including a short wavelength light source to project short wavelength light and three micro-mirror device being positioned such that light project from individual micro-mirror device fall on three different

fluorescent materials arranged in a predetermined configuration on a display panel to produce the three primary color.

5. An irregular display configuration employing fluorescence effect by ultraviolet projection comprising
a light projection device including a short wavelength light source to project short wavelength light and a projection apparatus capable of selectively redirect the light from the light source;
an irregular shaped display panel coated with fluorescent material for receiving the short wavelength light projected by the light projection device(s); whereby the short wavelength light from the light source causes the coated fluorescent material on the display panel to produce light display.
6. The irregular display configuration of claim 5, wherein the projection apparatus includes one or more micro-mirror devices capable of reflecting light selectively from an electronic control.
7. A display configuration employing fluorescence effect by ultraviolet projection comprising
a first light projection device and a second light projection device, both the projection devices including a short wavelength light source to project short wavelength light and a projection apparatus capable of selectively redirect the light from the light source, and in the event of failure of one light projection device, the other acts as a substitution to backup immediately;
a display panel coated with fluorescent material for receiving the short wavelength light projected by the light projection device; whereby the short wavelength light from the light source causes the coated fluorescent material on the display panel to produce light display.

8. The display configuration of claim 7, wherein the projection apparatus includes a micro-mirror device capable of reflecting light selectively from an electronic control.
9. The display configuration of claim 7, wherein the display panel comprises
 - a fluorescent layer for emitting a longer wavelength light when exposed to a shorter wavelength light from the short wavelength light source;
 - a panel positioned a short distance away from the front surface of the projection, wherein the panel contains features that enhance or to determine the color of the fluorescent at each pixel.