Delta Electronics 3D Display & Projection Patent Portfolio

18 Patent Families – 27 Active Assets

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Executive Summary

- RZV has been exclusively retained by Delta Electronics to support the monetization of a patent portfolio covering foundational 3D illumination, projection, and glasses-free display technologies with remaining life through the mid-to-late 2030s.
- The portfolio covers projection, illumination, and display optics for stereoscopic and multi-view systems and spans solid-state light engines, color-wheel architectures, rear-projection video-wall modules, autostereoscopic displays, and HMD optics.
- The key assets protect the following:
  - US'178 / US‘740: Multi-primary solid-state illumination systems using dual photoluminescence modules, path-routing optics, and multi-band spectral filtering to generate independent color sets for high-brightness stereoscopic projection.
  - US‘166: Rotating-disk color-wheel engines with co-located transmissive and reflective phosphor wavelength-conversion zones, enabling dual spectral outputs from a single illumination module.
  - US’227: Compact rear-projection video-wall display modules employing three-reflector folded optical paths to achieve full-size image projection within thin-depth cabinets.

Active Granted Patents:
18 US, 7 TW, 2 CN
Encumbrances & EOU Information:
Available under NDA
Price Expectations:
Consistent with current market
Deal Structure:
We will consider all proposals
Deadlines:
Offers will be considered in the order received

Portfolio (US Granted Patents)

INPADOC Family	Patent Number	Delta Number	Priority Date	Estimated Expiry	Title
451060734	US9507166B2	20120088-US	2013-01-09	2035-01-05	Illumination system for stereoscopic projection device
451164914	US9453955B2	20120389-US	2013-01-15	2034-02-20	Projection system
459066181	US10101587B2	201510089-US	2015-12-18	2036-07-18	Display apparatus
462014403	US10368060B2	201610221-US	2016-12-06	2037-06-12	Head mounted display
447518757	US8827456B2	20110080-US	2011-07-15	2033-01-09	Projector and splitting and combining units thereof
447910816	US8952996B2	20110038-US	2011-09-27	2033-04-06	Image display system
448743715	US9261703B2	20110382-US	2012-01-11	2033-04-30	Multi-view autostereoscopic display
449621350	US9151956B2	20120035-US	2012-05-23	2033-11-04	Light source system for stereoscopic projection
455267303	US9568740B2	20140076-US	2014-08-06	2035-10-14	Six-primary solid state illuminator and operating method using the same
455348202	US9684178B2	20140079-US	2014-08-19	2035-04-04	Solid state illuminator for emitting beams with different wavelengths and operating method using the same
455402289	US9442301B2	20140077-US	2014-08-28	2035-05-21	Autostereoscopic display device and autostereoscopic display method using the same
457749347	US9547227B1	20150090-US	2015-08-07	2035-12-04	Display apparatus
459367777	US10666931B2	201510171-US	2016-04-15	2038-07-28	Autostereoscopic display device and autostereoscopic display method
460189206	US10514551B2	201610072-US	2016-07-20	2037-08-24	Stereo display device
461525542	US9915773B1	201610371-US	2017-04-28	2037-06-18	Backlight module and stereo display device using the same
462951628	US10488664B2	201610195-US	2017-02-16	2038-03-12	Head mounted display
444527870	US9405059B2	27210-VD/US	2011-02-23	2034-09-07	Assembling apparatus for a light tunnel
453182410	US9664988B2	20130231-US	2013-11-28	2034-07-04	Light source system with light coupling module and display apparatus comprising the same

Note: Table shows US granted patents; corresponding TW and CN patents available in the provided spreadsheet.

US 9,568,740 B2

Title:	Six-primary solid state illuminator and operating method using the same
Priority:	06 August 2014
Est. Expiry:	14 October 2035
Independent Claims	1, 16
Abstract	A six-primary solid state illuminator includes a first light source, a second light source, a third light source, a first photoluminescence device, a second photoluminescence device, and a multi-band filter. The first light source provides a light with a first wavelength. The first photoluminescence device under excited state provides a light with a second wavelength. The second light source provides a light with a third wavelength. The third light source provides a light with a fourth wavelength. The second photoluminescence device under excited state provides a light with a fifth wavelength. The light beams of the first light source, the second light source, and the first photoluminescence device are converted to a first primary combination after passing through the multi-band filter. The light beams of the third light source and the second photoluminescence device are converted to a second primary combination after reflected at the multi-band filter.

1. A six-primary solid-state illuminator, comprising:

a first light source for providing a first light beam with a first wavelength;

a first optical module, wherein the first light beam passes through the first optical module and enters a first photoluminescence device, the first photoluminescence device is excited by a part of the first light beam and provides a second light beam with a second wavelength, and the other part of the first light beam is reflected at the first photoluminescence device, wherein the reflected first light beam and the second light beam travel toward and are reflected at the first optical module;

a second light source for providing a third light beam with a third wavelength, wherein the third light beam passes through the first light optical module;

a third light source for providing a fourth light beam with a fourth wavelength;

a second optical module, wherein the fourth light beam is reflected at the second optical module and enters a second photoluminescence device, the second photoluminescence device is excited by a part of the fourth light beam and provides a fifth light beam with a fifth wavelength, and the other part of the fourth light beam is reflected at the second photoluminescence device, wherein the reflected fourth light beam and the fifth light beam travel toward and pass through the second optical module; and

a multi-band filter for receiving the first light beam, the second light beam, and the third light beam coming from the first optical module and receiving the fourth light beam and the fifth light beam coming from the second optical module, wherein the first light beam, a part of the second light beam, and the third light passing through the multi-band filter are converted to a first primary-color combination, the fourth light beam and a part of the fifth light beam reflected at the multi-band filter are converted to a second primary-color combination, wherein the first primary-color combination and the second primary-color combination travel along the same direction.

US9,684,178 B2

Title:	Solid state illuminator for emitting beams with different wavelengths and operating method using the same
Priority:	19 August 2014
Est. Expiry:	04 April 2035
Independent Claims	1
Abstract	A solid state illuminator for generating time sequential 6-primary color includes a first light source, a second light source, a path choosing module, a multi-band filter, a first photoluminescence module, a second photoluminescence module, a first optical module, and a second optical module. The first light source and the second light source provide a first beam with a first wavelength and a second beam with a second wavelength respectively, and the first wavelength is not overlapped with the second wavelength. The first optical module enables the first beam to enter the first photoluminescence module and guide the beam to pass through the multi-band filter to arrive at a predetermined position. The second optical module enables the second beam to enter the second photoluminescence module and guide the beam to be reflected by the multi-band filter to arrive at the predetermined position.

1. A solid state illuminator, comprising:
a first light source for providing a first beam with a first wavelength;
a second light source for providing a second beam with a second wavelength, wherein ranges of the first wavelength and the second wavelength are not overlapped;
a path choosing module for controlling a plurality of directions of the first beam and the second beam;
a multi-band filter, wherein the second beam transmits through the multi-band filter, and the first beam is reflected by the multi-band filter;
a first photoluminescence module for providing a third beam or a fourth beam;
a second photoluminescence module for providing a fifth beam or a sixth beam;
a first optical module for receiving the first beam or the second beam from the path choosing module, the first optical module enabling the first beam to enter the first photoluminescence module and to be transformed into the third beam or the fourth beam, and guiding the second beam, the third beam, or the fourth beam to pass through the multi-band filter to arrive at a predetermined position; and
a second optical module for receiving the first beam or the second beam from the path choosing module, the second optical module enabling the second beam to enter the second photoluminescence module and to be transformed into the fifth beam or the sixth beam, and guiding the first beam, the fifth beam, or the sixth beam to be reflected by the multi-band filter to arrive at the predetermined position.

US 9,507,166 B2

Title:	Illumination system for stereoscopic projection device
Priority:	09 January 2013
Est. Expiry:	05 January 2035
Independent Claims	1, 11
Abstract	An illumination system for a stereoscopic projection device is provided. The illumination system comprises a luminous element and a color wheel module. The luminous element is adapted to generate a plurality of first wave band lights when the color wheel module has a plurality of wave band transmitting transforming areas and a plurality of wave band reflecting transforming areas. When the first wave band lights are projected to the wave band transmitting transforming areas, the first wave band lights are adapted to transmit the wave band transmitting transforming areas to excite a plurality of first selected wave band lights. When the first wave band lights are projected to the wave band reflecting transforming areas, the wave band reflecting transforming areas are adapted to excite and reflect a plurality of second selected wave band lights.

1. An illumination system for a stereoscopic projection device, comprising:
a luminous element generating a plurality of first wave band lights; and
a color wheel module having a rotating disk, a plurality of wave band transmitting transforming areas and a plurality of wave band reflecting transforming areas which are formed on the rotating disk;
wherein when the first wave band lights are projected to the wave band transmitting transforming areas, the first wave band lights transmit the wave band transmitting transforming areas to excite a plurality of first selected wave band lights different from the first wave band lights, and when the first wave band lights are projected to the wave band reflecting transforming areas, a plurality of second selected wave band lights different from the first wave band lights and the first selected wave band lights are excited and reflected from the wave band reflecting transforming areas.

US 9,547,227 B1

Title:	Display Apparatus
Priority:	07 August 2015
Est. Expiry:	04 December 2035
Independent Claims	1, 16
Abstract	A display apparatus includes multiple display modules. Each of the display modules includes a display surface, a projecting device, and first, second, and third reflectors. The display surface has long and short edges perpendicular to each other. The projecting device projects a first image having a first optical axis parallel to the short edge. The first reflector reflects the first image to form a first reflected image having a first reflection optical axis perpendicular to the short edge. The second reflector reflects the first reflected image to form a second reflected image having a second reflection optical axis perpendicular to the short edge. The third reflector is parallel to the second reflector and reflects the second reflected image to form a third reflected image having a third reflection optical axis perpendicular to the long and short edges. The third reflected image is projected on the display surface.

1. A display apparatus, comprising:
at least one first display module, comprising:
a first display surface having a first long edge and a first short edge perpendicular to the first long edge;
a first projecting device configured to project a first image having a first optical axis parallel to the first short edge;
a first reflector configured to reflect the first image to form a first reflected image having a first reflection optical axis perpendicular to the first short edge;
a second reflector configured to reflect the first reflected image to form a second reflected image having a second reflection optical axis perpendicular to the first short edge; and
a third reflector configured to reflect the second reflected image to form a third reflected image having a third reflection optical axis perpendicular to the first long edge and the first short edge, wherein the third reflected image is projected on the first display surface; and
at least one second display module, comprising:
a second display surface having a second long edge and a second short edge perpendicular to the second long edge, wherein the first display surface and the second display surface form a display surface of the display apparatus, the second long edge is parallel to the first long edge, and the second short edge is parallel to the first short edge;
a second projecting device configured to project a second image having a second optical axis parallel to the second short edge;
a fourth reflector configured to reflect the second image to form a fourth reflected image having a fourth reflection optical axis perpendicular to the second short edge;
a fifth reflector configured to reflect the fourth reflected image to form a fifth reflected image having a fifth reflection optical axis perpendicular to the second short edge; and
a sixth reflector configured to reflect the fifth reflected image to form a sixth reflected image having a sixth reflection optical axis perpendicular to the second long edge and the second short edge, wherein the sixth reflected image is projected on the second display surface, and the second reflector, the third reflector, the fifth reflector, and the sixth reflector is parallel to each other.

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