Appeal decision

Appeal No. 2018-7716

Appellant Materion Corporation

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The case of appeal against the examiner's decision of refusal of Japanese Patent Application No. 2015-523608, entitled "Compact Light Engine" (International Publication No. WO 2014/016574 published on January 30, 2014, Publication of International Patent Application No. 2015-529843 published on October 8, 2015, the number of claims: (20)) has resulted in the following appeal decision.

Conclusion

The examiner's decision is revoked.

The Invention of the present application shall be granted a patent.

Reason

No. 1 History of the procedures

The application relating to this case (hereinafter, referred to as "the present application") is an international patent application filed on July 22, 2013 claiming priority under the Paris Convention based on a patent application filed in the United Kingdom (United Kingdom of Great Britain and Northern Ireland) on July 23, 2012 (hereinafter, referred to as "the priority date").

Regarding the present application, a notice of reasons for refusal was issued on December 16, 2016, and a written opinion was submitted and amendment to the scope of claims for patent was made on May 18, 2017, and a notice of reasons for refusal was issued again on September 1, 2016, and a written opinion was submitted and amendment to the scope of claims for patent was made on December 5, 2016. However, the examiner's decision of refusal (hereinafter, referred to as "the examiner's decision") was issued on January 31, 2018, and a certified copy of the examiner's decision was delivered on February 6, 2018.

Against this, an appeal against the examiner's decision of refusal was made on June 5, 2018.

Furthermore, as a result of a collegial examination by the collegial body, reasons for refusal composed of Reason 1 and Reason 2 (hereinafter, referred to as "Reasons for refusal of the body") were issued on February 28, 2019, and against this, a written amendment was submitted and an amendment regarding the scope of claims (hereinafter, referred to as "the Amendment") was made on June 3, 2019.

Further, the number of Claims of the present application was 22 before the Amendment (that is, at the time of the examiner's decision), and is 20 after the Amendment.

No. 2 The Invention

The inventions relating to Claim 1 to Claim 20 (hereinafter, respectively referred to as "Invention 1" to "Invention 20") of the present application are specified by the matters described in Claim 1 to Claim 20 of the scope of patent amended by the Amendment as follows.

"[Claim 1]

A light engine, comprising:

(I) a wavelength conversion device, arranged to receive source light of a first wavelength range and a first polarization and to generate light of a second wavelength range being non-overlapping with the first wavelength range from a portion of the received source light, the wavelength conversion device including

(i) a phosphor wheel including a disc portion having a plurality of segments, which comprise (A) a segment including the phosphor element, and (B) a gap segment, the segment including the phosphor element generating the light of the second wavelength range and reflecting the light of the second wavelength range, and

(ii) a polarization converter, configured to set the source light to a second polarization different from the first polarization, and to reflect the light of the second polarization; and

(II) a dichroic element, arranged to receive the reflected light of the second wavelength range and the light of the second polarization, the dichroic element configured to transmit or reflect (A) the light of the first wavelength range and the first polarization differently from (B) the light of the second polarization and the light of the second wavelength range,

wherein the phosphor wheel is arranged between the dichroic element and the polarization converter.

[Claim 2]

The light engine according to Claim 1, wherein the dichroic element is further arranged to transmit or reflect the source light so as to be incident onto the wavelength conversion device.

[Claim 3]

The light engine according to Claim 1, wherein the dichroic element is configured to (A) transmit the light of the first wavelength range and the first polarization, and to (B) reflect (i) the light of the first wavelength range and the second polarization and (ii) the light of the second wavelength range.

[Claim 4]

The light engine according to Claim 1, wherein the dichroic element is configured to (A) reflect the light of the first wavelength and the first polarization, and to (B) transmit (i) the light of the second wavelength range and (ii) the light of the first wavelength range and the second polarization.

[Claim 5]

The light engine according to any one of Claim 1 to Claim 4, wherein the second wavelength range is substantially non-overlapping with the first wavelength range.

[Claim 6]

The light engine according to any one of Claim 1 to Claim 5, wherein the wavelength conversion device is further configured to generate light of a third wavelength range being non-overlapping with the first wavelength range and the second wavelength range from a portion of the received source light, and the dichroic element is configured to transmit or reflect the light of the third wavelength range in the same way as the light of the second wavelength range.

[Claim 7]

The light engine according to Claim 6, wherein in the segment including the phosphor element, a first segment is configured to generate the light of the second wavelength range, and a second segment is configured to generate the light of the third wavelength range.

[Claim 8]

A light engine comprising: a phosphor wheel; a polarization converter; and a dichroic element, the dichroic element arranged to cause source light of an initial polarization to be incident onto the phosphor wheel, a portion of the source light converted into light of a different color, a portion of the source light reflected with changes in polarization without changes in color, the converted light and the reflected source light being incident onto the dichroic element, the dichroic element configured to transmit or reflect the converted light and the reflected source light differently from the source light of the initial polarization,

wherein the phosphor wheel is configured to transmit the source light to the polarization converter positioned behind the phosphor wheel changing the polarization of the source light and reflecting the source light.

[Claim 9]

The light engine according to any one of Claim 1 to Claim 8, further including a light source arranged to emit the source light.

[Claim 10]

A projector comprising the light engine according to any one of Claim 1 to Claim 9.

[Claim 11]

A method of generating light, comprising:

receiving source light of a first wavelength range and a first polarization with a wavelength conversion device including a fluorescent wheel and a polarization converter;

generating light of a second wavelength range being non-overlapping with the first wavelength range from a portion of the received source light, at the wavelength conversion device;

transmitting a portion of the received source light to the polarization converter through the phosphor wheel so as to set at least a portion of the source light to be a second polarization different from the first polarization;

reflecting the light of the second polarization toward a dichroic element; and

reflecting the generated light of the second wavelength range from the wavelength conversion device, wherein the dichroic element is configured to transmit or reflect (A) the light of the first wavelength range and the first polarization differently from (B) the light of the second polarization and the light of the second wavelength range.

[Claim 12]

The method according to Claim 11, further comprising: receiving the source light at the dichroic element; and directing the source light so as to be incident onto the wavelength conversion device, using the dichroic element.

[Claim 13]

The method according to Claim 11, further comprising transmitting the light of the first wavelength range and the first polarization which is received at the dichroic element, and

reflecting the light of the first wavelength range and the second polarization, and the light of the second wavelength range which is received is received at the dichroic element.

[Claim 14]

The method according to Claim 11, further comprising: reflecting the light of the first wavelength range and the first polarization which is received at the dichroic element; and

transmitting the light of the first wavelength range and the second polarization, and the light of the second wavelength range at the dichroic element

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[Claim 15]

The method according to any one of Claim 11 to Claim 14, wherein the second wavelength range is substantially non-overlapping with the first wavelength range.

[Claim 16]

The method according to Claim 15, wherein generating the light of the second wavelength range includes using a fluorescent element.

[Claim 17]

The method according to any one of Claim 11 to Claim 16, wherein a first part of a surface of the phosphor wheel is configured to generate the light of the second wavelength range.

[Claim 18]

The method according to any one of Claim 11 to Claim 17, further comprising generating light of a third wavelength range from a portion of the received source light, at the wavelength conversion device; and reflecting the generated light of the third wavelength range from the wavelength conversion device toward the dichroic element; wherein the dichroic element is configured to transmit or reflect the light of the third wavelength range in the same way as for the light of the second wavelength range, and the third wavelength range is different from the first wavelength range and the second wavelength range.

[Claim 19]

The method according to Claim 18, wherein the first part of the surface of the phosphor wheel is configured to generate the light of the second wavelength range, and a second part of the surface of the phosphor wheel is configured to generate the light of the third wavelength range.

[Claim 20]

A method of operating a light engine, comprising: receiving source light of an initial polarization to cause the source light to be incident onto a phosphor wheel;

converting a portion of the source light onto light of a different color in the fluorescent wheel;

reflecting a portion of the source light behind the phosphor wheel with changes in polarization without changes in color; and

causing the converted light and the reflected source light to be incident upon the dichroic element, the dichroic element transmitting or reflecting the reflected source light and the converted light differently from the source light of the initial polarization."

No. 3 Outline of reasons for refusal stated in the examiner's decision

The inventions according to Claim 1 to Claim 22 of the present application could have been easily invented by a person skilled in the art based on the inventions described in the following Cited Document 1 to Cited Document 4, and thus the appellant should not be granted a patent for the Invention in accordance with the provisions of Article 29(2) of the Patent Act.

Cited Document 1. Japanese Unexamined Patent Application Publication No. 2011-165555
Cited Document 2. Japanese Unexamined Patent Application Publication No. 2012-123179
Cited Document 3. Japanese Unexamined Patent Application Publication No. 2012-32553
Cited Document 4. Japanese Unexamined Patent Application Publication No. 2012-108486

No. 4 Invention and others described in the Cited Documents

1 Cited Document 1

Cited Document 1 cited in the examiner's decision has the descriptions below. Further, underlines were added by the body.

(1) From Paragraph 0009 to Paragraph 0012

"[Summary of Invention]

[Problem to be solved by the invention]

[0009]

As was mentioned in the above, since the super high-pressure mercury lamp, which is used as the light source in the projection-type display apparatus, generates a large amount of the UV rays, therefore it gives a large stress upon the parts which are made up with organic materials, such as, a liquid crystal valve and a polarizing plate, etc., building up the lighting optic system, in particular. For that reason, the lifetimes of those parts are detracted from. Also, the lamp itself brings about lowering of brightness due to abrasion of electrodes and/or cloudiness of a light emitting tube, in a relatively short time period. Further, it has a problem of difficulty in disposal of waste matter thereof, etc., because it contains mercury therein. And, as was mentioned above, though various kinds of the light sources are proposed for the projection-type display apparatus, applying the light emitting diodes and/or the laser diodes therein, in the place of such super high-pressure mercury lamp, in the Patent Document(s) mentioned above; however, in particular, the light source for the projection-type display apparatus has the following problems.

[0010]

Thus, the projection-type display apparatus enlarges and projects the optical image, which is formed with modification of light intensities of the white color light from a point-like light source having high light emitting efficiency, such as, the super high-pressure mercury lamp, representatively, depending on the video signal, by means of a liquid crystal panel of the transmission-type or the reflection type, or the digital mirror device (DMD) aligning plural numbers of micro mirrors, or the like (in an optical element portion). On the contrary to this, the light source devices (i.e., the solid-state light sources), which are proposed by the conventional arts including the Patent Documents mentioned above, do not necessarily provided a light source being suitable for the projection-type display apparatus. Thus, the light obtainable from the light source devices according to the conventional arts mentioned above are collection or assemblage of lights from a large number of solid-state light sources, which are disposed integrally within a relatively large area, and for that reason, it does not build up a point-like light source of white color light having a necessary amount or intensity of lights, and therefore, in case of applying the solid-state light source mentioned above in the place of the mercury lamp of the conventional art, it is impossible to obtain sufficient powers or performances in a part of an optical system including the light intensity modulator portion, and this may results into a reason of generating deterioration of white-balance and/or color shading on a projection surface.

[0011]

Then, according to the present invention, it is accomplished by taking the problem(s) of the conventional technologies mentioned above into the consideration thereof, and further in more details thereof, an object thereof is to provide a solid-state light source device, being suitable to be applied as the light source, in particular, within the projection-type display apparatus.

[0012]

According to the present invention, for accomplishing the object mentioned above, there is provided a solid-state light source device, comprising: a solid-state light emitting portion to emit excitation light therefrom; a beam condensing means to condense the excitation light from said solid-state light emitting portion to be point-like; a reflecting/scattering and wavelength converting means to repeat reflection/scattering of said excitation light and conversion of said excitation light, alternately, or a transmitting/scattering and wavelength converting means to repeat transmitting/scattering of said excitation light and wavelength conversion of said excitation light, alternately, in vicinity of a focus point of the excitation light, which is condensed to be point-like by said beam condensing means; and a means to take out the excitation light reflected/scattered or transmitted/scattered by said means, and the excitation lights converted in wavelength thereof by said means, on a same optical path, thereby outputting a white color light emitting, approximately, from a point light source. Also, as the fluorescent substance excited by the excitation light from the solid-state light emitting elements, such as, light emitting diodes and lasers, if selecting a substance emitting a light flux of a region of wavelength, having a relation of being a complementary color to the excitation light for a white color, it is possible to achieve a light source being simple in the structure and having a high efficiency."

(2) From Paragraph 0036 to Paragraph 0043
"[0036]Following to the above, explanation will be given hereinafter, on the details of the light source unit (the solid-state light source device) 10 made up with the solid-state light emitting elements, for emitting light rays of the white color light almost parallel with the optical axis 101, in the projection-type display apparatus, the structures thereof being explained in the above, in particular, in the lighting optic system 100 thereof.
[Embodiment 1]
[0037]
FIG. 1 attached herewith is a view for explaining the principle of the light source unit 10, according to an embodiment 1. As is apparent from the figure, that unit 10 comprises a semiconductor laser element group 110, aligning plural numbers of semiconductor laser elements or light emitting diodes, each emitting a light of blue color band (B-color), on an almost disc-like substrate, as a light emitting source of the solid-state elements, a separation mirror 120 disposed inclining at an angle of about 45 degree, facing to a laser beam emitting surface of the semiconductor laser element group 110 mentioned above, a reflection mirror (a reflector) 130 having a parabolic surface, for example, which is disposed at a position facing to that laser beam emitting surface of the

semiconductor laser element group 110 mentioned above, a disc (or wheel) member 140 rotating round in the vicinity of a focus point (F) of that reflection mirror, and a driving means for rotationally drive that disc (or wheel) member 140 at a rotation speed desired, for example, an electromotive motor 150. However, the vertical cross-section of this light source unit 10 (but, excepting the electromotive motor 150) is shown in FIG. 2 attached herewith.

[0038]

In the structures of the light source unit 10 mentioned above, firstly will be given an explanation on the semiconductor laser element group 110, for generating excitation lights. As will be apparent from the explanation given hereinafter, as a light source for generating the excitation lights, although the solid-state light emitting element, such as, the light emitting diode or the laser light source is superior, for example, however, in general, since the laser having a high output is expensive, then it is preferable to use plural numbers of semiconductor laser elements of the blue color laser in combination, as was mentioned above, as an excitation light source. In particular, because of that it belongs to the blue color band in the visible ray region, that it has a high-energy efficiency, that it has a narrow band, and further that it has a single polarization, it is preferable to use a blue color laser beam, and in the present embodiment, a large number of the semiconductor laser elements, each emitting the light of the blue color band (B-color) are aligned on the substrate having the disc-like shape, as was mentioned above, a rectangular shape, or a polygonal shape, for example; thereby building up the semiconductor laser element group 110. Also, those semiconductor elements of large number thereof are so disposed that the beams emitting from the light emitting surfaces of those are aligned into a predetermined direction in a plane of polarization thereof.

[0039]

Next, the separation mirror 120, which is obliquely disposed facing to the laser light emitting surface of the semiconductor laser element group mentioned above, as will be apparent from the explanation that will be given hereinafter, passes the blue color laser beams emitting from the semiconductor laser element group and aligned the plane of polarization thereof into the predetermined direction therethrough, directing to the reflection mirror (the reflector) 130, and it also receives them from the reflection mirror (the reflector), and with the lights received from the reflection mirror (the reflector) and having the plane of polarization in the direction perpendicular to that plane of polarization, this mirror has a function of reflecting them thereupon. Further, an example of the characteristics of this separation mirror 120 will be shown in FIG. 3 attached herewith.

[0040]

Further, the reflection mirror (the reflector) 130 defines a reflection mirror (surface) 131 having a parabolic surface, which can be obtained by rotating a parabola, or a curved surface based on that parabolic surface or an oval surface, which can be obtained by rotating an oval, on an inner surface side thereof, and has a shape being cut to half (1/2) approximately, along the rotation axis thereof. Further, through will be mentioned later, the blue color laser beams emitting from the semiconductor laser element group 110 and passing through the separation mirror 120, as was mentioned above, are reflected upon the reflection surface on the inner surface side of this reflection mirror (the reflector) 130, and are condensed to the vicinity of the focus point thereof (shown by "F" in FIG. 1 mentioned above). Also, the mirror reflects the lights emitting from the vicinity of that focus point to be parallel lights, directing to the separation mirror 120 mentioned above.

[0041]

And, in FIGS. 4A and 4B attached herewith are shown the details of the disc (or wheel) member 140 mentioned above. However, FIG. 4A shows a side-surface cross-section view of the disc (or wheel) member 140, and FIG. 4B shows an upper view thereof.

[0042]

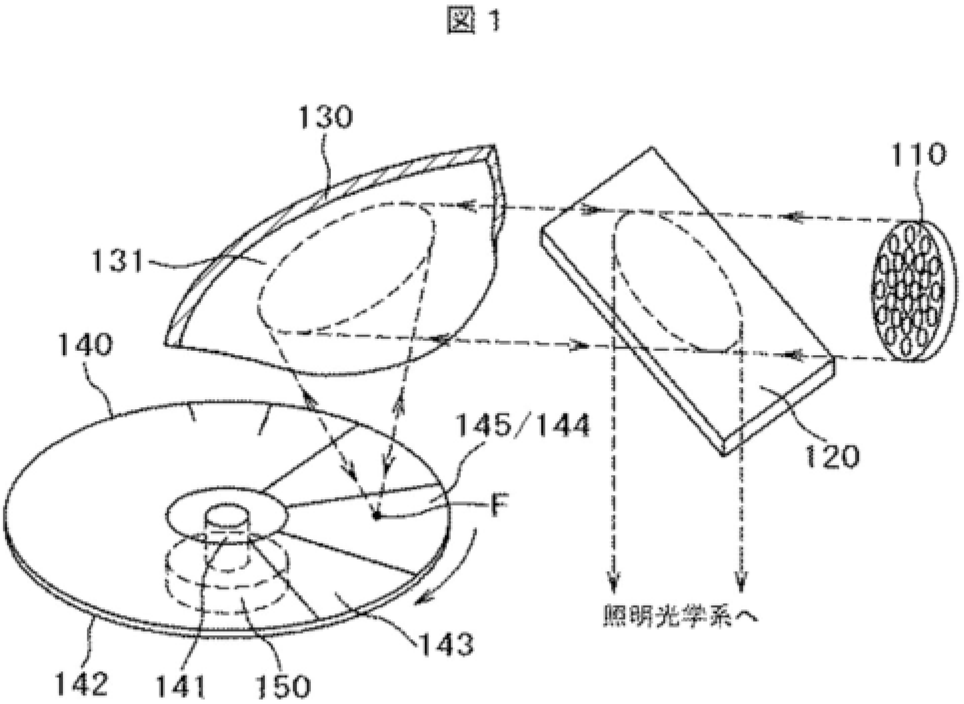
As is apparent from those figures, this disc (or wheel) member 140 has a rotation shaft 141 at a central portion thereof, for a rotational driving, and a disc-like shaped base member 142, as well. And, on the surface of the disc-like base member 142, rotation of which is controllable, there are provided (or divided) plural numbers (12 pieces in the present example) of segment regions. Those plural numbers of segment regions can be divided into two (2) regions. On one segment region (shown by "Y" in FIG. 4B) is provided a fluorescence surface 143 made from a fluorescence layer, receiving an excitation light (blue color (B) laser beam) of the visible ray region and emitting a light of a predetermined region of wavelength band therefrom, while on other segment region is provided a reflection surface 144 for reflecting/scattering the excitation light, and further thereon is provided a penetration film 145, as a phase conversion means for shifting the phase of the excitation light by only 1/4 wavelength (1/4 X) (shown by "B" in FIG. 4B), covering on that surface thereof. And, with rotation of this base element 142 at a predetermined speed, the excitation light reflected upon the reflection mirror (the reflector) 130 and condensed at the vicinity of the focus point "F" results to be incident or enter onto the fluorescence surface 143 (Y) and the reflection surface 144 covered with the penetration film 145 on the surface thereof, alternately, as is shown by a circle of thick line in FIG. 4B. As a result thereof, from the disc (or wheel) member

140 mentioned above can be taken out a ray of light emitting from the fluorescent substance and the excitation light scattering/reflecting upon the reflection surface 144 of the base member 142, in a time-sharing manner.

[0043]

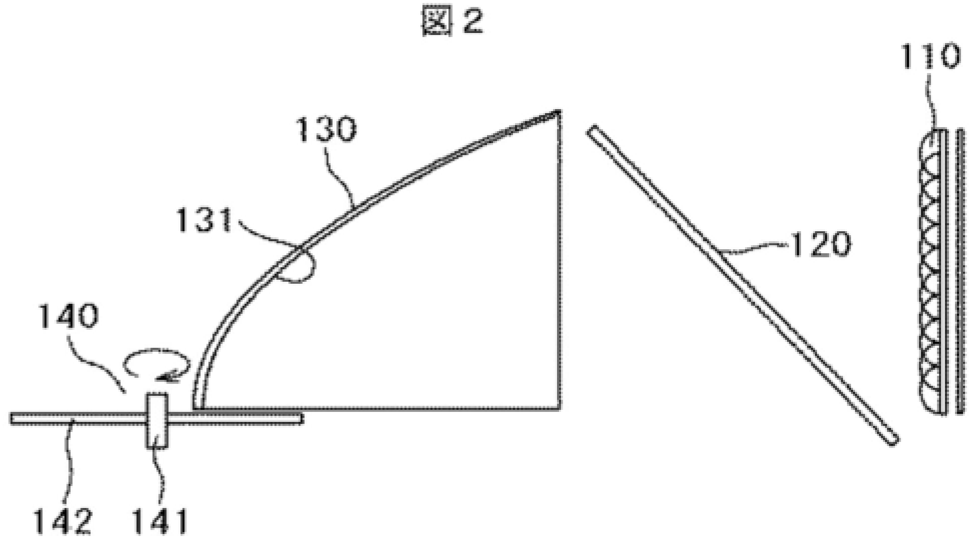
However, as the fluorescent substance to be applied to form the one segment region "Y" on the base member 142 mentioned above, i.e., the fluorescent substance, being excited by the excitation light of the blue region and emitting the light therefrom, it is common to use YAG fluorescent substance ((Y,Gd)3(Al,Ga)O12:Ce3+), emitting a yellow light at high efficiency having a complementary color relationship for the blue light. However, according to the present invention, it should not be limited to this, but may be other than that, as far as it is excited and by the excitation light of the blue region and thereby emitting the yellow light therefrom. Further, as to the excitation light of this blue color region and the fluorescent substance of Y-color, being excited by that excitation light and emitted therefrom, an example of the relationship between the wavelength and the intensity of those will be shown in FIG. 5 attached herewith."

[FIG. 1]

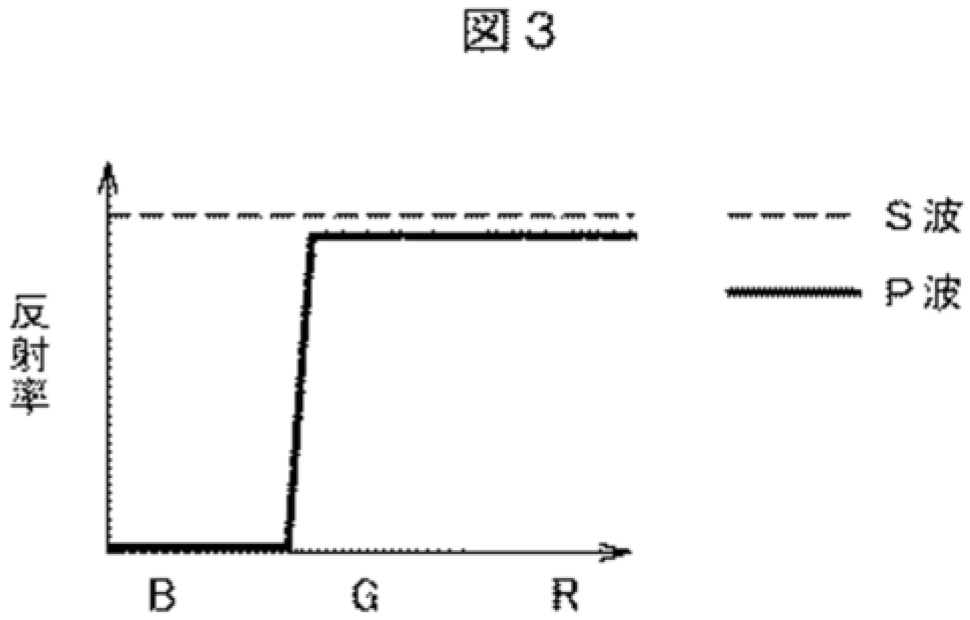


照明光学系へ　To lighting optic system

[FIG. 2]



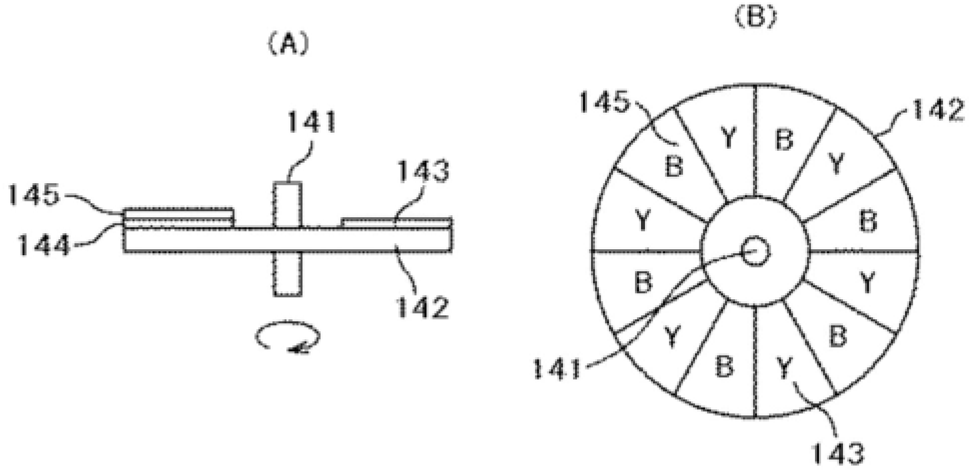
[FIG. 3]



反射率　Reflectivity
Ｓ波　S-wave
Ｐ波　P-wave

[FIG. 4]

図4



(3) From Paragraph 0046 to Paragraph 0047

"[0046]

Again, explaining by referring to FIG. 16 mentioned above, the light of the blue color band (B-color) from the semiconductor laser element group 110, aligning the plane of polarization thereof into the predetermined direction, passes through the separation mirror 120, directing to the reflection mirror (the reflector) 130, and is reflected upon the reflection mirror (surface) 131 on the inner surface side thereof; thereby being focused in the vicinity of the focus point "F" thereof. The light of the blue color band (B-color) focused in the vicinity of the focus point "F", accompanying rotation of the disc (or wheel) member 140, is incident upon or enters onto the fluorescence surface 143 (Y) and the reflection surface 144 (B), which are formed on the surface of the disc-like base member 142 building up that member, sequentially. As a result of that, the light of the blue color band (B-color) is received on the layer of the fluorescent substance as the excitation light, on the fluorescence surface 143 mentioned above, and is converted to the fluorescent light, i.e., the yellow color light; thereby emitting the light. On the other hand, it is reflected/scattered on the surface thereof, on the reflection surface 144 (B) mentioned above, and this is repeated, continuously. However, in this instance, since the light, being incident upon the reflection surface 144 (B) and thereby being reflected/scattered on the reflection surface thereof, passes through the penetration film 145 covering on the surface thereof, as the phase converting means for shifting the phase by 1/4 wavelength (1/4 X), two (2) times, therefore the plane of polarization thereof is changed by 90 degree only (i.e., the phase is shifted only by 1/2 wavelength (1/2λ)).

[0047]

And, as was mentioned above, the light (i.e., the yellow color light), emitting from the fluorescence surface 143 of the disc (or wheel) member 140, and the B-color light, the reflection light from the reflection surface 144 (B) thereof are directed to the reflection mirror (the reflector) 130 mentioned above, again, and they are reflected upon the reflection mirror (surface) 131 on the inner surface side thereof, to be directed to the separation mirror 120, again, in the form of a parallel light beam or flux. Further, this separation mirror 120, as was mentioned above, reflects the B-color light, the polarization of which is changed by means of the penetration film 145 only by 90 degree. Also, the light (i.e., the yellow color light) emitting from the fluorescence surface 143 is reflected upon the separation mirror 120, in the similar manner. As a result of that, the B-color light as the excitation light and the yellow color light from the fluorescence surface are mixed accompanying with the rotation of the disc (or wheel) member 140 mentioned above, and come to a light having almost while color. Thus, by means of the light source unit 10 mentioned above, an illuminating light of the white color can be obtained, being incident upon the lighting optic system 100 of the projection-type display apparatus, emitting from the reverse surface of the separation mirror 120 (i.e., the surface opposite to the surface, on which the polarized light from the semiconductor laser element group 110 is incident upon or enters) towards a down direction in FIG. 1."

According to the descriptions of (1) to (3) above, it is recognized that Cited Document 1 describes the following invention (hereinafter, referred to as "Cited Invention").

"A light source unit (solid light source device) 10 suitable for use as a light source in a projection display device, comprising:

a semiconductor laser element that emits light in a blue band (B color), which is a light source of a solid element, or a semiconductor laser element group 110 on which a plurality of light emitting diodes are arranged on a generally disc-shaped substrate;

a separation mirror 120 which is disposed to be inclined at an angle of approximately 45 degrees so as to oppose a laser light emission surface of the semiconductor laser element group 110;

a reflection mirror (reflector) 130 which is disposed at a position opposite the laser light emission surface of the separation mirror 120;

a disc (wheel) member 140 which rotates at a vicinity of a focal point (F) of the reflection mirror; and an electric motor 150 for rotation-driving the disc (wheel) member at a desired rotational speed, wherein

the large number of the semiconductor laser elements of the semiconductor laser element group 110 are arranged so that the polarization surfaces of light emitted from the light emitting surfaces thereof are aligned in a predetermined direction;

the separation mirror 120 transmits the blue laser light that is emitted from the semiconductor laser element group and whose polarization surfaces are aligned in a predetermined direction toward the reflection mirror (reflector) 130, and works to reflect light that is incident from the reflection mirror (reflector) and has a polarization surface in a direction orthogonal to the polarization surface;

the disc (wheel) member 140 includes a rotation shaft 141 for rotational driving at the center portion thereof and a base material 142 formed in a disc shape, a plurality of segment regions are provided (divided) on the surface of the disc-shaped base material 142 that can be controlled in rotation, the plurality of segment regions are divided into two areas, in one segment region, a phosphor screen 143 is provided, which is made from a phosphor that receives excitation light (blue (B) laser light) in the visible light region and emits light and on the other segment region, a reflective surface 144 that reflects and scatters excitation light is provided, and a transmission film 145 that covers the surface thereof and further is a phase conversion means for moving a phase of the excitation light by a quarter wavelength (1/4 λ) is formed; and

the light in the blue band (B color) whose polarization surfaces from the semiconductor laser element group 110 are aligned in a predetermined direction passes through the separation mirror 120 toward the reflection mirror (reflector) 130, is reflected by the reflection mirror (surface) 131 on the inner surface side thereof, and is collected in the vicinity of the focal point F thereof, the light in the blue band (B color) collected in the vicinity of the focal point F, as accompanied with rotations of the disc (wheel) member 140, is sequentially incident onto the phosphor screen 143 (Y) and the reflective surface 144 (B) which are formed on the surface of the disc-shaped base material 142 constituting the member, as a result, the light in the blue band (B color) is received by a phosphor layer as excitation light and converted into yellow light that is the fluorescence light thereof to emit light, on the phosphor screen 143, and on the other hand, on the reflective surface 144 (B), it is reflected and scattered on the surface, at this time, since the light reflected/scattered by the reflective surface passes twice through the transmission film 145 that covers the surface thereof and is the phase conversion means for moving the phase by a quarter wavelength (1/4 λ), the polarization surface is changed by 90 degrees, then, the light (yellow light) emitted from the phosphor screen 143 of the disc (wheel) member 140 and the B-color light that is the reflected light from the reflective surface 144 (B) are directed once again to the above-mentioned reflection mirror (reflector) 130, are reflected by the reflection mirror (surface) 131 on the inner surface side thereof, and are again directed to the separation mirror 120 as a parallel luminous flux, the separation mirror 120 reflects the B-color light whose polarization surface is changed by 90 degrees by the transmission film 145 and the light (yellow light) emitted from the phosphor screen 143, and as a result, the B-color light that is the excitation light and the yellow light from the phosphor screen are mixed with the rotations of the disc (wheel) member 140 and extracted as generally white light, thereby outputting white light emitted from the generally point light source."

2 Cited Document 2

Cited Document 2 cited in the examiner's decision has the descriptions below. Further, underlines were added by the body.

(1) From Paragraph 0021 to Paragraph 0028

"[0021]

Hereinafter, each component of a projector 1 will be described.

A light source device 2 has a structure in which a laser light source 9 (a solid-state light source), a dichroic mirror 10, a 1/4 wavelength plate 11 (a phase difference plate), a phosphor wheel 12 (a light emitting element), a collimating optical system 13, lens arrays 14 and 15, a polarization conversion element 16, and a superimposing lens 17 are arranged in this order.

[0022]

The laser light source 9 emits a blue laser light with a central wavelength of emission intensity of 450 nm, as an excitation light for exciting a phosphor of a phosphor wheel 12 to be described later. The blue laser light emitted from the laser light source 9 is linearly polarized light having a constant polarization state and the polarization state with respect to a selective reflection surface 10a of the dichroic mirror 10 is P-polarized light. In this embodiment, a wavelength of 450 nm corresponds to a first wavelength region, and the P-polarized light corresponds to a first polarization component. Note that, although the laser light source 9 is shown as an example using one laser light source in FIG. 1, a plurality of laser light sources may be arranged side by side. Further, so long as the light has a wavelength capable of exciting a phosphor to be described later, a laser light source that emits a color light having a center wavelength other than 450 nm may be used.

[0023]

The dichroic mirror 10 is disposed on an optical path of excitation light between the laser light source 9 and the phosphor wheel 12. The selective reflection surface 10a of the dichroic mirror 10 forms an angle of 45 degrees with respect to an optical axis of the excitation light L1 which is emitted from the laser light source 9 toward the phosphor wheel 12 and is incident on the dichroic mirror 10. In a state where an angle formed by the selective reflection surface 10a and the optical axis of the excitation light L1 is 45 degrees, the dichroic mirror 10 has polarization separation characteristics such that it transmits the blue laser light of the P-polarized light with a central wavelength of emission intensity of 450 nm, and reflects blue laser light of S-polarized light with a central wavelength of emission intensity of 450 nm and fluorescence in the yellow wavelength region with a central wavelength of emission intensity of 550 nm. The polarization separation characteristics of the dichroic mirror 10 will be described in detail later. In this embodiment, a wavelength of 550 nm corresponds to a second wavelength region, and the S-polarized light corresponds to a second polarization component.

[0024]

The 1/4 wavelength plate 11 is disposed on an optical path of excitation light between the phosphor wheel 12 and the dichroic mirror 10. Accordingly, the excitation light that transmits through the dichroic mirror 10 from the laser light source 9 toward the phosphor wheel 12, and the excitation light that is reflected by the phosphor wheel 12 and returns to the dichroic mirror 10 and the fluorescence light emitted from the phosphor wheel 12 pass through the 1/4 wavelength plate 11. In the following description, the excitation light that transmits through the dichroic mirror 10 from the laser light source 9 toward the phosphor wheel 12 is referred to as excitation light L1 in the forward path, and the excitation light that is reflected by the phosphor wheel 12 and returns to the dichroic mirror 10 is referred to as excitation light L2 in the return path. Since the fluorescence emitted from the phosphor wheel 12 is not uniform in a polarization state, the 1/4 wavelength plate 11 has no effect on the polarization state of the fluorescence. On the other hand, since the polarization state of the excitation light emitted from the laser light source 9 is aligned with P-polarized light, the 1/4 wavelength plate 11 effects the polarization state of the excitation light. In other words, the 1/4 wavelength plate 11 imparts a phase difference of 1/2 wavelength to the forward excitation light L1 in the forward path and the excitation light L2 in the return path, and converts the polarization state of the excitation light in the return path from P-polarized light to S-polarized light.

[0025]

The phosphor wheel 12 has a support substrate 19 (support base material), a reflective film 20 (reflective surface) provided on one surface 19a (support surface) of the support substrate 19, and a light emitting layer 21 (phosphor layer) provided on the reflective film 20. The light emitting layer 21 includes phosphor particles which are not shown and is supported by the support surface 19a of the support substrate 19 via the reflective film 20. The phosphor wheel 12 is arranged such that the support surface 19a opposes the laser light source 9, and is arranged so that excitation light from the laser light source 9 is irradiated onto the light emitting layer 21. The phosphor wheel 12 reflects a portion of the excitation light (blue laser light with a central wavelength of emission intensity of 450 nm) emitted from the laser light source 9. Further, the phosphor wheel 12 absorbs the remainder of the excitation light, converts it into yellow fluorescence with a central wavelength of emission intensity of 550 nm, and reflects the generated yellow fluorescence to emit it toward the dichroic mirror 10.

[0026]

As shown in FIG. 2, a planar shape of the phosphor wheel 12 viewed from the laser light source 9 side is circular. The support surface 19a of the support substrate 19 is divided into 8 regions, and 4 light emitting regions C in which the light emitting layer 21 is provided and 4 non-light emitting regions D in which the light emitting layer 21 is not provided are alternately arranged in the circumferential direction on the support surface 19a of the support substrate 19. In this embodiment, the light emitting regions C correspond to a first region of the support surface 19a, and the non-light emitting regions D correspond to s second region of the support surface 19a.

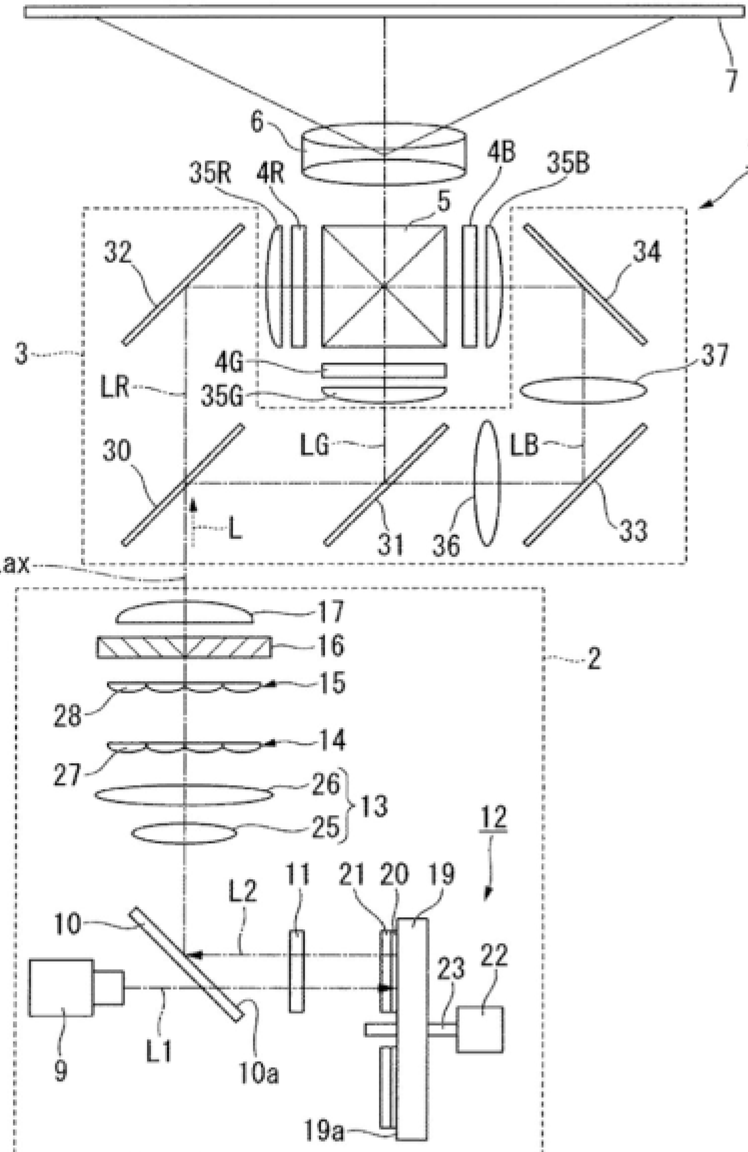
[0027]

The support substrate 19 may be formed using an inorganic material such as glass or ceramic, a metal such as copper, or a resin such as acrylic. These materials are excellent in terms of light weight, low cost, and good workability. In addition, among glass, a material such as quartz glass or neoceram has low linear expansion and excellent heat resistance. Further, among glass, a material such as quartz or sapphire has high thermal conductivity and excellent heat dissipation.

[0028]

A reflective film 20 is formed on the support surface 19a of the support substrate 19. The reflective film 20 is formed over the entire surface of the support surface 19a of the support substrate 19, and is thus formed over both the light-emitting region C and the non-light emitting region D. Therefore, the excitation light emitted from the laser light source 9 and the fluorescence emitted from the light emitting layer 21 are reflected by the reflective film 20. As a material of the reflective film 20, there is used a metal having high light reflectance such as aluminum or silver, a dielectric multilayer film having a plurality of layers of silicon oxide and titanium oxide stacked alternately, or the like."

[FIG. 1]



According to the description of (1) above, it is recognized that Cited Invention 2 describes the following technical matter.

"In a light source device 2 of a projector 1, a laser light source 9 (a solid-state light source), a dichroic mirror 10, a 1/4 wavelength plate 11 (a phase difference plate), and a phosphor wheel 12 (a light emitting element) are arranged in this order, and one surface 19a (support surface) having a reflective film 20 (reflective surface) and a light emitting layer 21 (phosphor layer) of the phosphor wheel 12 is opposed to the laser light source 9, and is arranged so that excitation light from the laser light source 9 is irradiated onto the light emitting layer 21."

3 Cited Document 3 and Cited Document 4

Cited Document 3 and Cited Document 4 cited in the examiner's decision have the descriptions below. Further, underlines were added by the collegial body.

(1) From Paragraph 0067 to Paragraph 0078 of Cited Document 3

"[0067]

As shown in FIG. 13, the projection display apparatus 100 includes a color wheel 180 instead of the luminous body 41 and the reflection mirror 42.

[0068]

The color wheel 180 is formed so as to be rotatable. As shown in FIG. 14, the color wheel 180 includes a red region 180R and a green region 180G. The color wheel 180 is arranged at the first focal position of the ellipsoidal reflector 40 so that a surface (the red region 180R or the green region 180G) of the color wheel 180 can be irradiated with the light reflected on the ellipsoidal reflector 40.

[0069]

Meanwhile, the red region 180R (green region 180G) includes a luminous body 181R (a luminous body 181G) and a reflection mirror 182R (a reflection mirror 182G) as shown in FIG. 15.

[0070]

The luminous body 181R (luminous body 181G) is arranged closer to the ellipsoidal reflector 40 than the reflection mirror 182R (reflection mirror 182G). The luminous body 1818 (luminous body 181G) is a fluorophor or a phosphor. Specifically, the luminous body 181R emits the red component light R in response to the blue component light B (excitation light) reflected on the ellipsoidal reflector 40. The luminous body 181G emits the green component light G in response to the blue component light B (excitation light) reflected on the ellipsoidal reflector 40.

[0071]

The reflection mirror 182R (reflection mirror 182G) reflects the red component light R (green component light G) emitted from the luminous body 181R (luminous body 181G) toward the ellipsoidal reflector 40. Note that the reflection mirror 182R (reflection mirror 182G) may reflect the remaining component light of the blue component light B toward the luminous body 181R (luminous body 181G).

[0072]

[Modification 4]

Hereinbelow, a description is given of Modification 1 of First Embodiment. In the following description, differences from Modification 3 are mainly explained.

[0073]

In Modification 3, the optical path of the blue component light B is different from the optical path of the red component light R and the green component light G. In contrast in Modification 4, the optical path of the blue component light B is the same as the optical path of the red component light R and the green component light G.

[0074]

(Projection Display Apparatus)

Hereinbelow, a description is given of a projection display apparatus according to Modification 4 by referring to the drawings. FIG. 16 is a diagram showing a projection display apparatus 100 according to Modification 4. In FIG. 16, the same components as those in FIG. 13 are denoted by the same signs.

[0075]

As shown in FIG. 16, the projection display apparatus 100 includes a color wheel 180A instead of the color wheel 180.

[0076]

The color wheel 180A is formed so as to be rotatable like the color wheel 180. As shown in FIG. 17, the color wheel 180A includes a blue region. 180B in addition to the red region 180R and the green region 180G. The structure of the red region 180R and the green region 180G is the same as the structure thereof shown in FIG. 15.

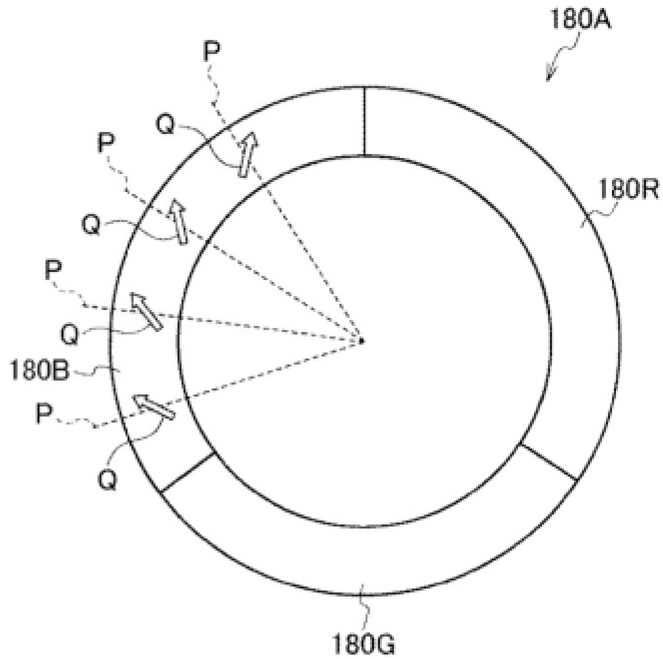
[0077]

As shown in FIG. 18, the blue region 180B includes a 114 wave plate 181B and a reflection mirror 182B.

[0078]

The 1/4 wave plate 181B is arranged closer to the ellipsoidal reflector 40 than the reflection mirror 182B. The 1/4 wave plate 181B is an element for adjusting the polarization state of the blue component light B. Specifically, the 1/4 wave plate 181B adjusts the polarization direction of the blue component light B from a linear polarization direction to a circular polarization direction. Alternatively, the 1/4 wave plate 181B adjusts the polarization direction of the blue component light B from the circular polarization direction to the linear polarization direction."

[FIG. 17]



(2) From Paragraph 0082 to Paragraph 0085 of Cited Document 4
"[0082]

(Embodiment 3)

A light source device in Embodiment 3 will be described with reference to FIGS. 6A and 6B. Since the present embodiment is equivalent to the configuration of Embodiment 1 expect for a phosphor layer part formed on the base, the illustration of the entire configuration of the light source device will be omitted. The descriptions regarding the same elements will be omitted. Output light from the light source device of the present embodiment contains light ranging from green to yellow, red light as main components and a blue light component, and can be used as illumination light of an image display apparatus, etc.

[0083]

As shown in FIG. 6A, although a configuration composed of the base 2, the dichroic coating 2a, and the rotation device 4 is identical to that of Embodiment 1, a configuration of a phosphor layer 17 formed on the dichroic coating 2a is different from that of Embodiment 1. Specifically, in the present embodiment, as shown in FIG. 6B, a surface of the disk-shaped base 2 is divided into three segments 17a, 17b and 17c, and a phosphor layer is formed on two of these segments. A red phosphor is applied on the segment 17a, and a green phosphor is applied on the segment 17b. No phosphor, but a reflection coating with respect to excitation light is applied on the segment 17c, so as to form a mirror surface.

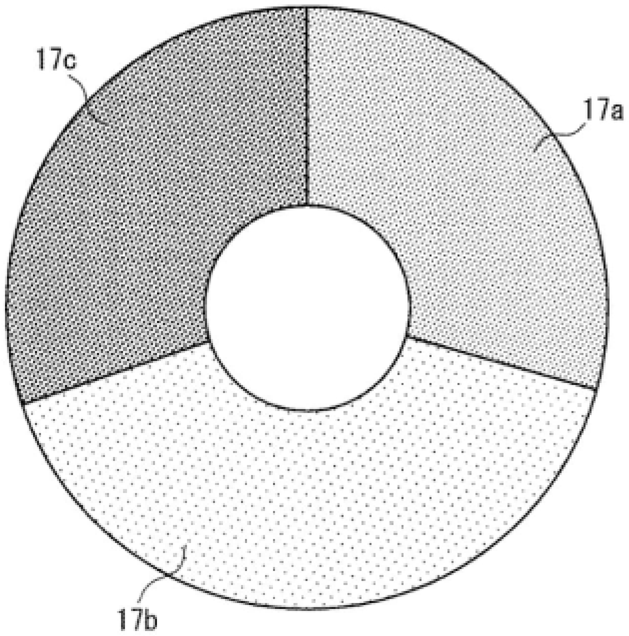
[0084]

With this configuration, when the base 2 is rotated around the z-axis, the position of the spot to be irradiated with excitation light is changed with time across the three segments. When the segment 17a faces a condensed spot of excitation light, blue excitation light is converted into red light by the red phosphor. Similarly, when the segment 17b faces the condensed spot of excitation light, blue excitation light is converted into green light by the green phosphor.

[0085]

Meanwhile, when the segment 17c faces the condensed spot of excitation light, blue excitation light is reflected by the surface of the base 2 without being subjected to frequency conversion, and passes through the quarter wave plate 8 again via the condenser lens 9 (see FIG. 1) so as to be converted into linearly polarized light of s-polarization. Further, the light is reflected by the dichroic mirror 7 and exits from the light source device 1. In the two segments 17a and 17b on which the phosphors are applied, the converted green fluorescence and red fluorescence also are reflected by the dichroic mirror 7 and exits from the light source device. Therefore, in a time average, it is possible to obtain output light obtained by additive color mixing of red, green and blue from the light source device."

[FIG. 6B]



According to the descriptions of (1) and (2) above, it is recognized that the following technical matter was well known before the priority date of the present application.

"A color wheel used for a light source of a display apparatus is divided into three segments on the circumference, and phosphor layers of different colors are formed on two of these segments. No phosphor layer is formed , but a reflection surface with respect to excitation light is formed, on the remaining one segment."

No. 5 Comparison/Judgment
1 Regarding Invention 1
(1) Comparison

In comparison of Invention 1 and Cited Invention described in No. 4-1 above, the following are recognized.

A "A light source unit (solid light source device) 10" of Cited Invention corresponds to "a light engine" of Invention 1.

B "a disc (wheel) member 140 which rotates at a vicinity of a focal point (F) of the reflection mirror" in Cited Invention has "a phosphor layer that receives excitation light (blue (B) laser light) in the visible light region and emits yellow light having a complementary color relationship with blue light" and thus corresponds to "a wavelength conversion device" in Invention 1.

Also, in Cited Invention, "the light in the blue band (B color) whose polarization surfaces are aligned in a predetermined direction" emitted from "a semiconductor laser element that emits light in a blue band (B color), which is a light source of a solid element, or a semiconductor laser element group 110 on which a plurality of light emitting diodes is arranged on a generally disc-shaped substrate" corresponds to "source light of a first wavelength range and a first polarization" of Invention 1, and "yellow light having a complementary color relationship with blue light" emitted from "a phosphor layer that receives excitation light (blue (B) laser light) in the visible light region and emits yellow light having a complementary color relationship with blue light" corresponds to "light of a second wavelength range being non-overlapping with the first wavelength range" of Invention 1.

That is, the matter that "a phosphor layer" of "a disc (wheel) member 140" "receives" "the light in the blue band (B color) whose polarization surfaces are aligned in a predetermined direction" and "emits yellow light having a complementary color relationship with blue light" in Cited Invention corresponds to the matter "the wavelength conversion device being arranged to receive source light of a first wavelength range and a first polarization and to generate light of a second wavelength range being non-overlapping with the first wavelength range from a portion of the received source light" in Invention 1.

C "The disc-shaped base material 142 that can be controlled in rotation" on which "a plurality of segment regions are provided (divided)" in Cited Invention corresponds to "a phosphor wheel including a disc portion having a plurality of segments" in Invention 1.

In "one segment region" of "the segment regions" "divided into two areas" of "the surface of the disc-shaped base material 142" in Cited Invention, "a phosphor screen 143 is provided, which is made from a phosphor that receives excitation light (blue (B) laser light) in the visible light region and emits yellow light having a complementary color relationship with blue light, and therefore, "the light in the blue band (B color)" "reflected by the reflection mirror (surface) 131 on the inner surface side" of "the reflection mirror (reflector) 130" and being "incident" onto "a phosphor screen 143" is "converted into yellow light" and is "directed once again to the above-mentioned reflection mirror (reflector) 130," and thus it can be said that the "one segment region" corresponds to "a segment including the phosphor element" "generating the light of the second wavelength range and reflecting the light of the second wavelength range" in Invention 1.

D In "the other segment region" of "the segment regions" "divided into two areas" of "the surface of the disc-shaped base material 142" in Cited Invention, "a reflective surface 144 that reflects and scatters excitation light is provided, and a transmission film 145 that covers the surface thereof and further is a phase conversion means for moving a phase of the excitation light by a quarter wavelength (1/4 λ) is formed," and therefore, "the light in the blue band (B color)" is "reflected and scattered on the surface" of "the reflective surface 144 (B)," "at this time, since the light reflected/scattered by the reflective surface passes through the transmission film 145 that covers the surface thereof and is the phase conversion means for moving the phase by a quarter wavelength (1/4 λ) twice, the polarization surface is changed by 90 degrees."

That is, since "the reflective surface 144" and "the transmission film 145" in "the other segment region" in Cited Invention have a function of "reflecting/scattering" "the light in the blue band (B color) whose polarization surfaces are aligned in a predetermined direction" emitted by "the semiconductor laser element 110" while "the polarization surface is changed by 90 degrees," they correspond to "a polarization converter" "configured to set the source light to a second polarization different from the first polarization, and to reflect the light of the second polarization" in Invention 1.

E In Cited Invention, "the light in the blue band (B color) whose polarization surfaces from the semiconductor laser element group 110 are aligned in a predetermined direction passes through the separation mirror 120" and "the separation mirror 120 reflects the B-color light whose polarization surface is changed by 90 degrees by the transmission film 145 and the light (yellow light) emitted from the phosphor screen 143."

That is, "the separation mirror 120" in Cited Invention is arranged to receive "the B-color light whose polarization surface is changed by 90 degrees by the transmission film 145 and the light (yellow light) emitted from the phosphor screen 143" and transmits "the light in the blue band (B color) whose polarization surfaces from the semiconductor laser element group 110 are aligned in a predetermined direction," whereas, differently from that, it has characteristics of reflecting "the B-color light whose polarization surface is changed by 90 degrees by the transmission film 145 and the light (yellow light) emitted from the phosphor screen 143," and thus, it can be said that it corresponds to "a dichroic element" "arranged to receive the reflected light of the second wavelength range and the light of the second polarization" and "configured to transmit or reflect (A) the light of the first wavelength range and the first polarization differently from (B) the light of the second polarization and the light of the second wavelength range" in Invention 1.

(2) Corresponding feature and the different feature

When the results of the comparison of the above (1) are summarized, the corresponding features and the different features between Invention 1 and Cited Invention are as indicated below.

A Corresponding feature

"A light engine, comprising:

(I) a wavelength conversion device, arranged to receive source light of a first wavelength range and a first polarization and to generate light of a second wavelength range being non-overlapping with the first wavelength range from a portion of the received source light, the wavelength conversion device including

(i) a phosphor wheel including a disc portion having a plurality of segments, which comprise (A) a segment including the phosphor element, the segment including the phosphor element generating the light of the second wavelength range and reflecting the light of the second wavelength range, and

(ii) a polarization converter, configured to set the source light to a second polarization different from the first polarization, and to reflect the light of the second polarization; and

(II) a dichroic element, arranged to receive the reflected light of the second wavelength range and the light of the second polarization, the dichroic element configured to transmit or reflect (A) the light of the first wavelength range and the first polarization differently from (B) the light of the second polarization and the light of the second wavelength range."

B The different feature

In Invention 1, "a plurality of segments" of "a phosphor wheel" include "a gap segment" in addition to "a segment including the phosphor element," and "the phosphor wheel is arranged between the dichroic element and the polarization converter," whereas, in Cited Invention, "a plurality of segment regions" on "the surface" of "the disc-shaped base material 142" (corresponding to "the phosphor wheel") include, in addition to "one segment region" (corresponding to a segment including the phosphor element) in which "a phosphor screen 143 made from a phosphor that receives excitation light (blue (B) laser light) in the visible light region and emits yellow light having a complementary color relationship with blue light" is provided, and "the other segment region." "The other segment region" is not "a gap zone," and "a reflective surface 144" and "a transmission film 145" (corresponding to "a polarization converter) are arranged in "the other segment region"; that is, the configuration corresponding to "a phosphor wheel" and the configuration corresponding to "a polarization converter" are integrated and provided at the same position.

(3) Judgment on the different feature

In order for Cited Invention to have the configuration of Invention 1 relating to the different feature described in (2), B above, although in Cited Invention, "a plurality of segment regions are provided (divided) on the surface of the disc-shaped base material 142 that can be controlled in rotation, the plurality of segment regions are divided into two areas, in one segment region, a phosphor screen 143 is provided, which is made from a phosphor that receives excitation light (blue (B) laser light) in the visible light region and emits light and on the other segment region, a reflective surface 144 that reflects and scatters excitation light is provided, and a transmission film 145 that covers the surface thereof and further is a phase conversion means for moving a phase of the excitation light by a quarter wavelength (1/4λ) is formed," it is necessary to change "the other segment region" to "a gap segment" through which light passes, and to provide "a reflective surface 144" and "a transmission film 145" at a position where the excitation light that has passed through "the other segment region" behind "the disc-shaped base material 142" (in a direction on the opposite side surface to "a phosphor screen 143") reaches. That is, it is necessary to separate "a reflective surface 144" and "a transmission film 145" which are integrally provided with "a phosphor screen 143" in "the disc-shaped base material 142" from "the disc-shaped base material 142" and to arrange it behind "the disc-shaped base material 142." However, Cited Document 1 does not describe any matter suggesting such a thing.

Cited Document 1 describes a problem that "the light obtained by the above-described conventional light source device is a collection of light from a large number of solid-state light sources integrated and arranged in a relatively large area, and thus does not form a point light source of a necessary amount of white light. If it is adopted instead of the conventional mercury lamp, sufficient performance cannot be obtained in the optical system portion including the light intensity modulation portion, and it may also be a cause of deterioration of white balance and uneven color on the projection surface" (see Paragraph 0010 described in No. 4-1(1) above), and in order to solve the problem, in Cited Invention, "a disc (wheel) member 140" is arranged at "a vicinity of a focal point

(F) of a reflection mirror," and "the light (yellow light) emitted from the phosphor screen 143" on "the surface of the disc-shaped base material 142" of the disc (wheel) member 140 rotating at the vicinity of the focal point (F) of the reflection mirror" and "the B-color light that is the reflected light from the reflective surface 144 (B)" are extracted through "a reflection mirror (reflector) 130" and "a separation mirror 120," thereby "outputting white light emitted from the generally point light source." Then, in Cited Invention, as described above, if "a reflective surface 144" and "a transmission film 145" are separated from "the disc-shaped base material 142," and are arranged behind "the disc-shaped base material 142," since "a reflective surface 144" and "the transmission film 145" are arranged at a position deviated from "the vicinity of the focal point (F) of the reflection mirror," it becomes impossible to "output white light emitted from the generally point light source," and it is obvious that the above mentioned problem cannot be solved.

That is, Cited Document 1 not only does not suggest to separate "the reflective surface 144" and "the transmission film 145" which are integrally provided with "the phosphor screen 143" in "the disc-shaped base material 142" from "the disc-shaped base material 142" and to arrange it behind "the disc-shaped base material 142," but also conversely suggests that there is a disincentive to doing so.

Furthermore, none of Cited Document 2 to Cited Document 4 suggests to separate "the reflective surface 144" and "the transmission film 145" which are integrally provided with "the phosphor screen 143" in "the disc-shaped base material 142" from "the disc-shaped base material 142" and to arrange it behind "the disc-shaped base material 142."

Especially, as described in No. 4 (2) above, Cited Document 2 describes the technical matter "In a light source device 2 of a projector 1, a laser light source 9 (a solid-state light source), a dichroic mirror 10, a 1/4 wavelength plate 11 (a phase difference plate), and a phosphor wheel 12 (a light emitting element) are arranged in this order, and one surface 19a (support surface) having a reflective film 20 (reflective surface) and a light emitting layer 21 (phosphor layer) of the phosphor wheel 12 is opposed to the laser light source 9, and is arranged so that excitation light from the laser light source 9 is irradiated onto the light emitting layer 21"; that is, although the technical matter that light is guided from a light source to a wheel without using "the reflection mirror (reflector) 130" forming "a focal point" as in Cited Invention, there is no motivation of adopting such a technical matter in Cited Invention, and even if adopting that, the technical matter does not suggest to arrange "the reflective surface 144" and "the transmission film 145" behind "the disc-shaped base material 142." Therefore, it cannot be said that the configuration of Invention 1 relating to the different feature described in (2) B above can be easily conceived by a person skilled in the art based on the techniques described in Cited Document 2.

Further, as described in No. 4-3 above, although in Cited Document 3 and Cited Document 4, a well-known technical matter that "a color wheel used for a light source of a display apparatus is divided into three segments on the circumference, and phosphor layers of different colors are formed on two of these segments. No phosphor layer is formed, but a reflection surface with respect to excitation light is formed, on the remaining one segment " is disclosed, the well-known technical matter does not suggest to arrange "the reflective surface 144" and "the transmission film 145" behind "the disc-shaped base material 142," and thus it cannot be said that the configuration of Invention relating to the different feature described in (2) B above can be easily conceived by a person skilled in the art based on the well-known technical matter.

Therefore, it cannot be said that the configuration of Invention 1 relating to the different feature described in (2) B above can be easily conceived by a person skilled in the art based on Cited Invention, and the technical matter described in Cited Document 2 or the well-known technical matters described in Cited Document 3 and Cited Document 4.

(4) Summary regarding Invention 1

As described above, it cannot be said that Invention 1 could have been easily invented by a person skilled in the art based on the inventions described in Cited Document 1 to Cited Document 4.

2 Regarding Invention 2 to Invention 7

Invention 2 to Invention 7 include all the configurations of Invention 1, and thus are different from Cited Invention at least in a different feature between Invention 1 and Cited Invention which was described in 1 (2) B above.

Then, as described in 1 (3) above, since it cannot be said that the configuration of Invention 1 relating to the different feature can be easily conceived by a person skilled in the art based on Cited Invention, and the technical matter described in Cited Document 2 or the well-known technical matters described in Cited Document 3 and Cited Document 4, the same is also applied to the configurations of Invention 2 to Invention 7 relating to the different feature.

Therefore, it cannot be said that Invention 2 to Invention 7 could have been easily invented by a person skilled in the art based on the inventions described in Cited Document 1 to Cited Document 4.

3 Regarding Invention 8

Invention 8 includes the matter corresponding to the configuration of Invention 1 relating to the different feature described in 1 (2) B above, that is the matter "the phosphor wheel is configured to transmit the source light to the polarization converter positioned behind the phosphor wheel changing the polarization of the source light and reflecting the source light," and has a point that Invention 8 includes such a matter, whereas Cited Invention does not include such a matter, as a different feature from Cited Invention.

Then, in order for Cited Invention to include the configuration of Invention 8 relating to the different feature, although it is necessary to separate "a reflective surface 144" and "a transmission film 145" which are integrally provided with "a phosphor screen 143" in "the disc-shaped base material 142" from "the disc-shaped base material 142" and to arrange it behind "the disc-shaped base material 142," as described in 1 (3) above, since Cited Document 1 not only does not suggest to separate "the reflective surface 144" and "the transmission film 145" which are integrally provided with "the phosphor screen 143" in "the disc-shaped base material 142" from "the disc-shaped base material 142" and to arrange it behind "the disc-shaped base material 142," but also conversely suggests that there is a disincentive to doing so, and none of Cited Document 2 to Cited Document 4 suggests to separate "the reflective surface 144" and "the transmission film 145" which are integrally provided with "the phosphor screen 143" in "the disc-shaped base material 142" from "the disc-shaped base material 142" and to arrange it behind "the disc-shaped base material 142," it cannot be said that the configuration of Invention 8 relating to the different feature can be easily conceived by a person skilled in the art based on Cited Invention, and the technical matter described in Cited Document 2 or the well-known matter described in Cited Document 3 or Cited Document 4.

Therefore, it cannot be said that Invention 8 could have been easily invented by a person skilled in the art based on the inventions described in Cited Document 1 to Cited Document 4.

4 Regarding Invention 9 and Invention 10

Invention 9 and Invention 10 include all the configurations of Invention 1 or Invention 8, and thus are different from Cited Invention at least in a different feature between Invention 1 and Cited Invention which was described in 1 (2) B above, and the different feature between Invention 8 and Cited Invention which was described in 3 above.

Then, as described in 1 (3) or 3 above, since it cannot be said that the configuration of Invention 1 or Invention 8 relating to the different feature can be easily conceived by a person skilled in the art based on Cited Invention, and the technical matter described in Cited Document 2 or the well-known technical matters described in Cited Document 3 and Cited Document 4, the same is also applied to the configurations of Invention 9 and Invention 10 relating to the different feature.

Therefore, it cannot be said that Invention 9 and Invention 10 could have been easily invented by a person skilled in the art based on the inventions described in Cited Document 1 to Cited Document 4.

5 Regarding Invention 11 to Invention 19

Invention 11 is substantially the invention of a method of generating light using "a light engine" according to Invention 1, and includes the matter corresponding to the configuration of Invention 1 relating to the different feature described in 1 (2) B above; that is, the matter "transmitting a portion of the received source light to the polarization converter through the phosphor wheel so as to set at least a portion of the source light to be a second polarization different from the first polarization."

Then, as described in 1 (3) above, since Cited Document 1 not only does not suggest to separate "the reflective surface 144" and "the transmission film 145" which are integrally provided with "the phosphor screen 143" in "the disc-shaped base material 142" from "the disc-shaped base material 142" and to arrange it behind "the disc-shaped base material 142," but also conversely suggests that there is a disincentive to doing so, and none of Cited Document 2 to Cited Document 4 suggests to separate "the reflective surface 144" and "the transmission film 145" which are integrally provided with "the phosphor screen 143" in "the disc-shaped base material 142" from "the disc-shaped base material 142" and to arrange it behind "the disc-shaped base material 142," it cannot be said that the above mentioned matter of Invention 11 can be easily conceived by a person skilled in the art based on Cited Invention, and the technical matter described in Cited Document 2 or the well-known technical matters described in Cited Document 3 and Cited Document 4.

Furthermore, Invention 12 to Invention 19 include all the matters of Invention 11, and thus include the matter "transmitting a portion of the received source light to the polarization converter through the phosphor wheel so as to set at least a portion of the source light to be a second polarization different from the first polarization." It cannot be said that such a matter can be easily conceived by a person skilled in the art based on Cited Invention, and the technical matter described in Cited Document 2 or the well-known technical matters described in Cited Document 3 and Cited Document 4.

Therefore, it cannot be said that Invention 11 to Invention 19 could have been easily invented by a person skilled in the art based on the inventions described in Cited Document 1 to Cited Document 4.

6 Regarding Invention 20

Invention 20 is substantially the invention of a method of operating "a light engine" according to Invention 1, and includes the matter corresponding to the configuration of Invention relating to the different feature described in 1 (2) B above; that is, the matter "reflecting a portion of the source light behind the phosphor wheel with changes in polarization without changes in color."

Then, as described in 1 (3) above, since Cited Document 1 not only does not suggest to separate "the reflective surface 144" and "the transmission film 145" which are integrally provided with "the phosphor screen 143" in "the disc-shaped base material 142" from "the disc-shaped base material 142" and to arrange it behind "the disc-shaped base material 142," but also conversely suggests that there is a disincentive to doing so, and any none Cited Document 2 to Cited Document 4 suggests to separate "the reflective surface 144" and "the transmission film 145" which are integrally provided with "the phosphor screen 143" in "the disc-shaped base material 142" from "the disc-shaped base material 142" and to arrange it behind "the disc-shaped base material 142," it cannot be said that the above mentioned matter of Invention 20 can be easily conceived by a person skilled in the art based on Cited Invention, and the technical matter described in Cited Document 2 or the well-known technical matters described in Cited Document 3 and Cited Document 4.

Therefore, it cannot be said that Invention 20 could have been easily invented by a person skilled in the art based on the inventions described in Cited Document 1 to Cited Document 4.

No. 6 Regarding the examiner's decision

As described in No. 5, it cannot be said that Invention 1 to Invention 20 which were amended by the Amendment could have been easily invented by a person skilled in the art based on the inventions described in Cited Document 1 to Cited Document 4.

Therefore, the reasons for refusal stated in the examiner's decision cannot be maintained.

No. 7 Regarding the reasons for refusal by the body

1 Outline of the reasons for refusal of the body

Reason 1) Since the inventions according to Claims 1 to Claim 21 of the present application are not clear, the description of the scope of claim of the present application does not meet the requirement stipulated in Article 36(6)(ii) of the Patent Act.

Reason 2) Since the inventions according to Claim 7 to Claim 11, Claim 20, and Claim 21 are not described in the detailed description of the invention, the scope of claim of the present application does not meet the requirement stipulated in Article 36(6)(i) of the Patent Act.

2 Judgment regarding the reasons for refusal by the body

By the Amendment, Reason 1 and Reason 2 of the reasons for refusal by the body were resolved.

No. 8 Closing

As described above, it cannot be said that the present application should be rejected due to the reasons of the examiner's decision.

In addition, no other reasons for rejecting the present application are found.

Therefore, the appeal decision shall be made as described in the conclusion.

July 22, 2019

Chief administrative judge: KOBAYASHI, Norifumi
Administrative judge: SAKURAI, Kenta
Administrative judge: NAKATSUKA, Naoki