UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CORETRONIC CORPORATION and
OPTOMA CORPORATION,

Petitioners,

v.

MAXELL, LTD.,

Patent Owner.

Case No.: IPR2025-00476

U.S. Patent No. 9,547,226

PETITION FOR INTER PARTES REVIEW

OF U.S. PATENT NO. 9,547,226

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I. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8

A. Real Parties-in-Interest

The Petitioners are Coretronic Corporation ("Coretronic") and Optoma Corporation ("Optoma") (collectively, "Petitioners"). Coretronic, Optoma, and Optoma Technology, Inc. ("Optoma USA") are real parties-in-interest.

B. Related Matters

U.S. Patent No. 9,547,226 (the "'226 Patent") is one of multiple patents asserted in *Maxell, Ltd. v. Coretronic Corp, et al.*, No. 5:24-cv-000888 (E.D. Tex.), filed July 9, 2024. That case is currently pending.

Petitioners are not aware of any other related matters.

C. Lead and Back-up Counsel and Service Information

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II. GROUNDS FOR STANDING

Petitioners certify that the '226 Patent is available for *inter partes* review and that Petitioners are not barred or estopped from requesting *inter partes* review challenging the patent claims on the grounds identified in this Petition.

III. REQUESTED RELIEF

Petitioners ask that the Board review the accompanying prior art and analysis, institute a trial for an *inter partes* review of Claims 8, 10, and 12 of the '226 Patent (the "Challenged Claims") and cancel those claims as unpatentable.

IV. REASONS FOR THE REQUESTED RELIEF

The Challenged Claims of the '226 Patent would have been anticipated by the prior art or obvious to a person of ordinary skill in the art ("POSITA") and are unpatentable. The ’226 Patent claims recite obvious combinations of projection-type image display devices and related optical devices that had been used by POSITAs prior to the filing of the ’226 Patent.

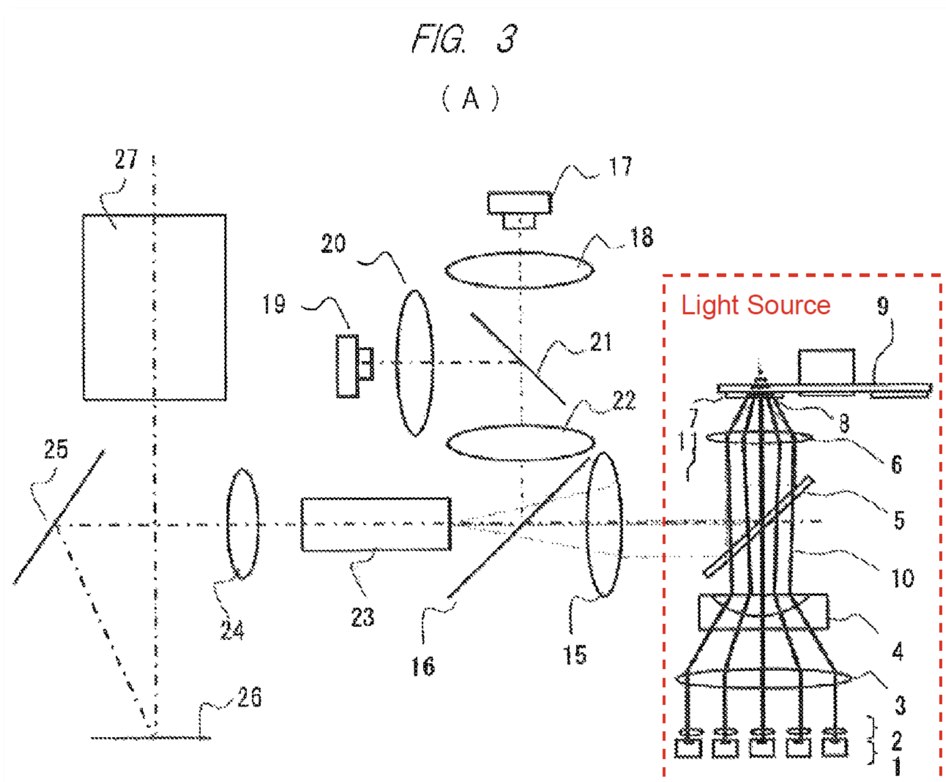
This Petition’s showing that the cited art renders the Challenged Claims unpatentable is fully supported by the Declaration of Dr. Jose Sasian (EX1004), a Professor of Optical Sciences for over 20 years at the University of Arizona. EX1004, ¶9. Dr. Sasian is familiar with and the state of the projection-type image display and related optical device arts before the ’226 Patent was filed, and fully supports the showing herein that the Challenged Claims merely recite known aspects of such devices. *Id.*, ¶¶ 21-218.

Accordingly, the Board should institute trial and cancel the Challenged Claims.

A. Summary of the ’226 Patent

Claims 8 recites a projection-type image display device that includes a “light source device,” an “image display element,” an “illumination optical system” for irradiating the image display element, and a “projection lens,” which projects an enlarged image of an optical image formed by the image display element with light from the light source device. The light source includes an “excitation light source,” a “fluorescent material” that emits a fluorescent light when excited by the excitation light from the excitation light source, and an "optical member" directing the excitation light to the fluorescent material. The "optical member" has a curvature that is set such that "a light-condensing position of the excitation light is positioned on an emission side of the excitation light relative to the fluorescent material." Claim 8 further recites a "dichroic mirror," "condenser lens," "convex lens," "concave lens," and relative special relationships among the various components. Claims 10 and 12 are dependent claims of claim 8.

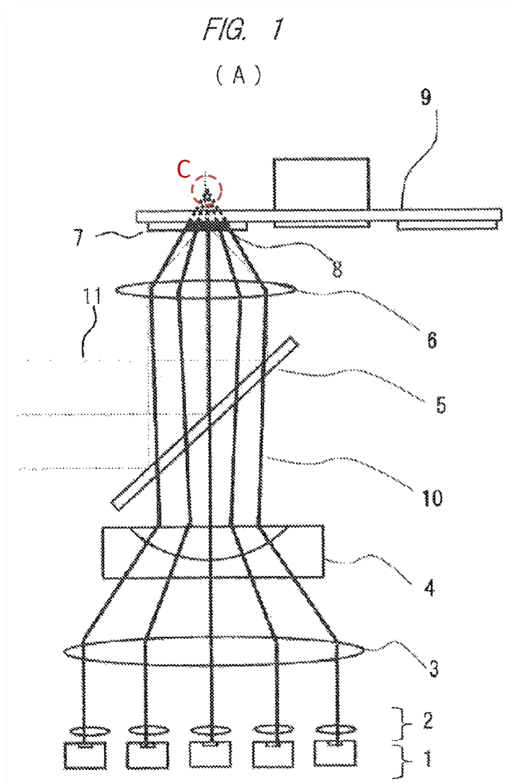
Fig. 3(A) shows an optical system of a projection-type image display device (color annotations added):



EX1001, FIG. 3 (annotated)

In the optical system, an illumination optical system that include a condenser lens 15, multiplex reflection element 23, condenser lens 24, and reflection mirror 25 irradiates the image display element 26 with the light 11 from the light source. EX1001, 5:5-9; 50-67. The image display element 26 reflects the irradiated light on the projection lens 27, which projects the light onto a screen. EX1001, 6:7-10.

Fig. 1 shows the light source used in the optical system in Fig. 3:



EX1001, FIG. 1 (annotated)

Excitation light sources 1 emit excitation light 10, which passes through collimate lenses 2, convex lens 3, concave lens 4, dichroic mirror 5, and condenser lens 6, and is incident on a fluorescent material 7 coating a rotating disc 9. EX1001, 3:39-45, Fig. 6, 2:30-42. The fluorescent material 7 emits fluorescent light 11 when excited by the excitation light 10. The fluorescent light 11 is reflected by the dichroic mirror 5 after passing through the condenser lens 6 and is incident on the illumination optical system. EX1001, 2:48-51.

The convex lens 3 and the concave lens 4 are configured such that the excitation light 10 is "incident on the fluorescent material 7 at the front side of the fluorescent material 7 as a light-condensing position (such that the light-condensing position is positioned on the emission side of the excitation light 10 relative to the fluorescent material 7)." EX1001, 3:40-51. While it is unclear from this description what a "light-condensing position" is or what is the "front side of the fluorescent material" or "emission side of the excitation light," the effect of the configuration of the convex lens 3 and the concave lens 4 is evidently to cause the excitation light rays to be incident on the surface of the fluorescent layer facing the excitation light sources in a more concentrated area, such that imaginary extensions of the excitation light rays substantially meet at a point ("C" in annotated Fig. 1A) on the opposite side of the fluorescent layer from the excitation light sources. EX1004, ¶ 48. Because the excitation light rays are not irradiated onto one single portion, but onto scattered positions in an irradiation region 8, the temperature rise in the center of the irradiation region 8 is prevented, and the light-emitting efficiency and service life of the fluorescent material is improved. EX1001, 3:64-4:4.

B. The Prosecution History of the '226 Patent

The '226 Patent issued on January 17, 2017, from the U.S. Application No. 14/439,931 (the "'931 Application), filed on April 30, 2015, which is a national stage of the International Application No. PCT/JP2012/078280, filed under the Patent Cooperation Treaty ("PCT") on November 1, 2012. EX1001, Cover. The '931 Application was filed with a Preliminary Amendment including original claim 1 and new claims 6-20. EX1002, 285-293. In a June 23, 2016, Office Action, the Examiner rejected claims 1, 6, 7, 9, 10, 11, 14, 15 and 17-20 over prior art references but deemed claims 8, 12, 13, and 16 as including allowable subject matter. As relevant to this Petition, the Examiner found that the subject matter of claim 12 that was found to be allowable is "the optical member is a convex lens and a concave lens, with the convex lens and the concave lens being disposed in this order from the excitation light source toward the dichroic mirror." EX1002, 51-62.

As relevant to this Petition, claim 9 was amended to incorporate the limitations of claims 11 and 12, which are also found in the rejected claim 19, and was issued as the challenged claim 8 ; claim 13 that was issued as the challenged claim 10 has the limitations that are also found in the rejected claim 20. EX1002, 40-48. A Notice of Allowance was issued on October 13, 2016 (EX1002, 23-32), and a Corrected Notice of Allowability was issued on December 13, 2016, correcting a claim listing error. EX1002, 2-7.

C. Priority Date

The '226 Patent issued from the national stage of an international application filed under the PCT on November 1, 2012. EX1001, Cover. That date is the assumed priority date for purposes of this Petition. All references cited in the instant Petition qualify as prior art based on that priority date.

D. Discretionary Denial under § 325(d) or § 314(a) Is Not Warranted.

Petitioners have not been involved in any previous review of the '313 Patent. The Office has not considered the references or combinations of references forming the grounds for this Petition. Additionally, the Petition cites the Declaration of Dr. Sasian, which has likewise not been presented to the Office before. EX1004. As the same or similar arguments have not been previously considered by the Office, discretionary denial under §325(d) is not warranted here.

Likewise, denial under §314(a) is not warranted. The discretionary factors set forth in *Apple Inc. v. Fintiv, Inc.*, do not favor denying institution. IPR2020-00019, Paper 11 (PTAB Mar. 20, 2020) (precedential).

Fintiv factor one is neutral. Upon institution of this petition, Petitioners may file a motion to stay the parallel litigation. Furthermore, while no motion to stay pending IPR has yet been filed in the Texas district court case, courts commonly stay cases upon IPR institution. *Cf. VMWare, Inc. v. Intell. Ventures II LLC*, IPR2020-00859, Paper 13 at 12 (PTAB Nov. 5, 2020) (finding factor one neutral, even though Petitioner had not previously sought a stay, and despite Patent Owner's argument that the district court judge was "unlikely" to issue a stay).

Fintiv factor two is neutral. Although the trial date in the Texas litigation is currently March 23, 2026, that date could get pushed back. EX1008. In this regard, the USPTO's Interim *Fintiv* Guidance recognizes that "[a] court's scheduled trial date... is not by itself a good indicator of whether the district court trial will occur before the statutory deadline for a final written decision" and allows parties to "present evidence regarding the most recent statistics on median time-to-trial for civil actions" in the applicable district court. Interim *Fintiv* Guidance at 8-9 (June 21, 2022). The most recent statistics on median time-to-trial for civil actions in the

Eastern District of Texas is 21.9 months.[1] Here, the complaint in the Texas litigation was filed on July 9, 2024, making the calculated trial date based on the median statistics in May 2026. The Board's final written decision (FWD) in this case is expected in approximately July 2026—meaning that the district court trial could easily occur after the FWD if the trial gets pushed back only slightly more than a median trial in the Texas district court.

Fintiv factor three weighs against discretionary denial. The court proceeding is at an early stage, with relatively little investment from the court and parties. The court has not yet issued any substantive orders relating to the '313 Patent. Expert reports have not been prepared on any issues in the Texas litigation. And Petitioners have been diligent—Petitioners filed this Petition around two and half months after receiving Patent Owner's infringement contentions, less than two month after Patent Owner supplemented those contentions, and over five months before Petitioners' bar date. Petitioners have not delayed filing for any strategic advantage.

Fintiv factor four weighs against discretionary denial. If this Petition is instituted, Petitioners stipulate that they will not pursue the grounds identified in this Petition before the district court. *See Sand Revolution II, LLC v. Cont'l Intermodal*

[1] *See* https://www.uscourts.gov/sites/default/files/2024-12/fcms_na_distprofile0930.2024.pdf.

Grp.-Trucking LLC, IPR2019-01393, Paper 24 at 11-12 (June 16, 2020). Given the word limit imposed by 37 C.F.R. § 42.24(a)(1)(i), this Petition presents all grounds that Petitioners could have reasonably raised in one petition. Thus, there will be no overlap of issues between the two proceedings, and this factor weighs against the Board exercising discretion to deny. Additionally, Patent Owner asserts only three claims in the district court, and this Petition challenges all three of those claims.

Fintiv factor five is neutral because Petitioners and Patent Owner are the same parties as in the district court.

Regarding *Fintiv* factor six, the strong merits of this Petition weigh heavily against discretionary denial. Petitioners raise compelling, meritorious challenges that the Patent Owner cannot meaningfully rebut, which underscores the conclusion that one or more claims of the '313 Patent are unpatentable by a preponderance of the evidence.

Thus, considering the *Fintiv* factors overall, institution would best serve the efficiency and integrity of the system. Discretionary denial is not warranted.

E. Secondary Considerations

Neither Petitioners nor Dr. Sasian are aware of any secondary considerations of nonobviousness that support patentability of the Challenged Claims. EX1004, ¶ 218.

V. CLAIM CONSTRUCTION

Terms not construed in the discussion below have their plain and ordinary meaning consistent with the claim construction standards set forth under *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005). EX1004, ¶ 23.

VI. STATUTORY GROUNDS FOR CHALLENGES AND REFERENCES USED

Ground #1: Claims 8, 10, and 12 are invalid under pre-AIA 35 U.S.C. §§ 102(e)(2) and/or 103(a) as being anticipated by, or obvious over, Kurosaki.

Ground #2: Claims 8 and 10 are invalid under pre-AIA 35 U.S.C. § 102(a) and/or 103(a) as being anticipated by, or obvious over, Miyamae.

Ground #3: Claim 12 is invalid under pre-AIA 35 U.S.C. § 103(a) as being obvious over Miyamae in view of Kurosaki.

Ground #4: Claims 8, 10, and 12 are invalid under pre-AIA 35 U.S.C. § 103(a) as being obvious over Kitano in view of Kurosaki.

VII. LEVEL OF ORDINARY SKILL IN THE ART

A POSITA at the time of the invention of the ’226 Patent would have had a Ph.D. in electrical engineering, physics, optical sciences, optical engineering, or a related scientific or engineering field, and at least one to two years of work or research experience in optical engineering, optical design, or a related field.

EX1004, ¶¶ 30-31. Alternatively, a POSITA could have a Bachelor's degree in one of the foregoing areas and at least three to four years of work or research experience in optical engineering, optical design, optoelectronics, or a related field. *Id*.

VIII. CLAIMS 8, 10, AND12 ARE UNPATENTABLE.

A. Ground 1: Kurosaki anticipates, or renders obvious, Claims 8, 10, and 12.

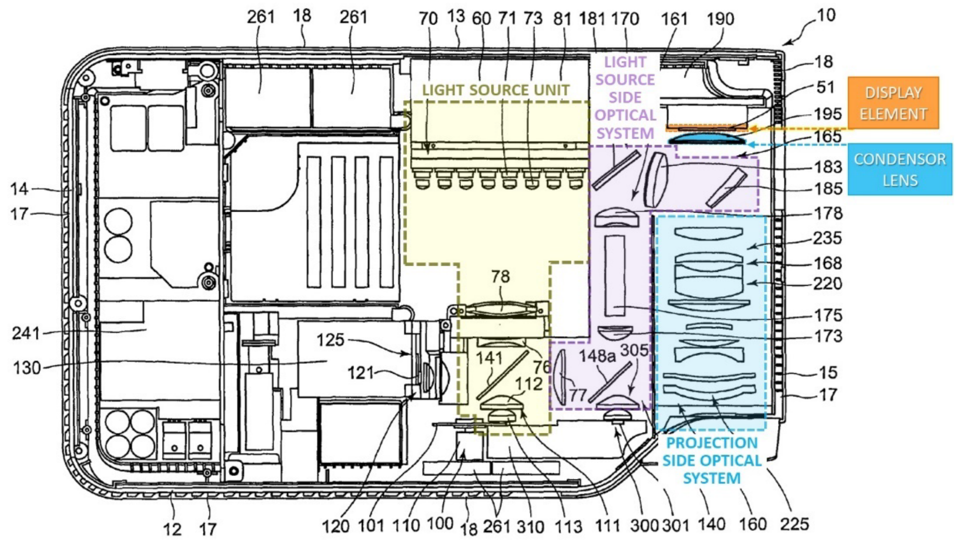
1. Overview of Kurosaki

a) Qualification as prior art

Kurosaki was filed as a U.S. Patent Application No. 13/435,982 on March 30, 2012, and issued as U.S. Patent No. 8,721,087 on May 13, 2014. EX1005. Accordingly, Kurosaki qualifies as prior art under 35 U.S.C. § 102(e) (pre-AIA) at least because it was filed before the priority date of the '226 Patent (November 1, 2012) and later patented. *Id*. Kurosaki was neither cited nor considered by the Examiner during prosecution of the '226 Patent. *Id.*

b) Overview

Kurosaki describes a projector 10:

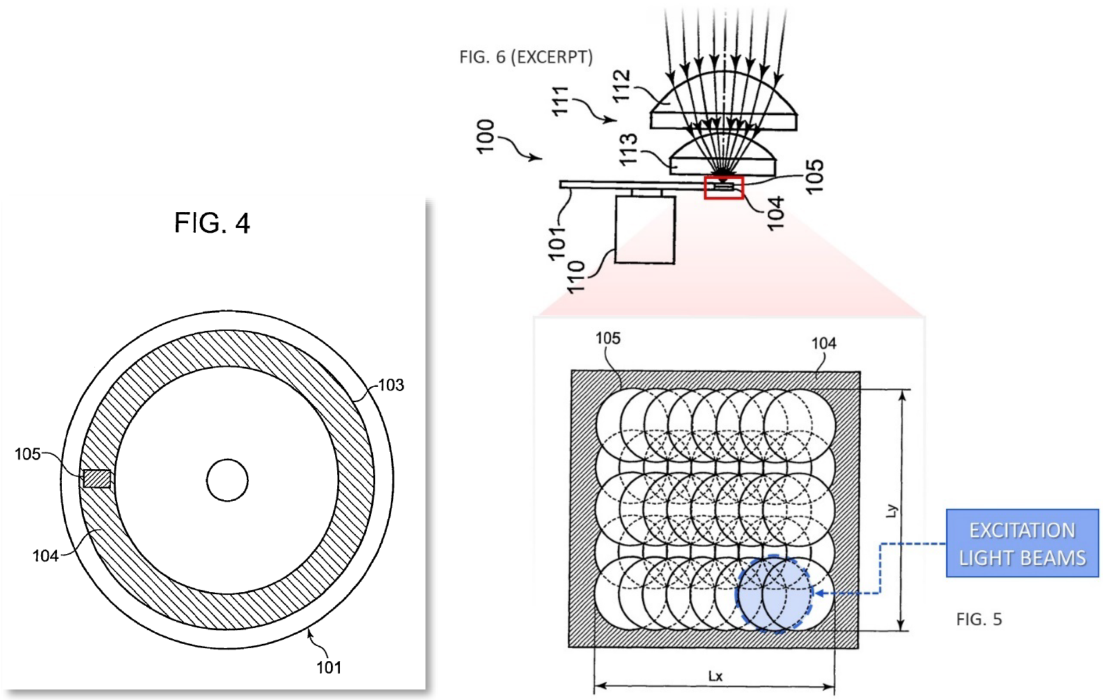


EX1005, FIG 3 (annotated)

The projector includes a light source unit 60, a display element 51, a light-source-side optical system 170 for guiding the light from the light source unit to the display element, and a projection-side optical system 220 for projecting the image formed on the display device. EX1005, 4:54-55; 7:36-8:25. In one embodiment, the projector includes a rectangular digital micromirror device ("DMD") (display element 51) and a light tunnel 175 having a rectangular cross section for converting light source light originating from the light source unit 60 into a light beam having a uniform intensity distribution. EX1005, 6:7-10, 7:60-64.

The light source includes, in order, an excitation light sources 71, collimator lens 73, condenser lens 78, concave lens 76, dichroic mirror 141, condenser lens group 111, and phosphor wheel 101, carrying a phosphor layer 104. EX1005, 5:16-

20, 35-54; 6:22-27. A region 105 of a prescribed shape, such as a rectangular shape, of the phosphor layer 104 is illuminated with excitation light from the excitation light sources 71 (EX1005, 5:59-65):



EX1005, FIGS. 4, 5 and 6 (annotated)

Excitation light beams emitted from the respective excitation light sources 71 fall on region 105 of the phosphor layer 104, such that excitation light beams have an ***approximately uniform illumination intensity distribution in the rectangular region 105*** having a width Lx in the right-left direction and a width Ly. The rectangular region 105 can have the same shape as the display element 51 and the light tunnel 175. EX1005, 5:66-6:13 (emphasis added).

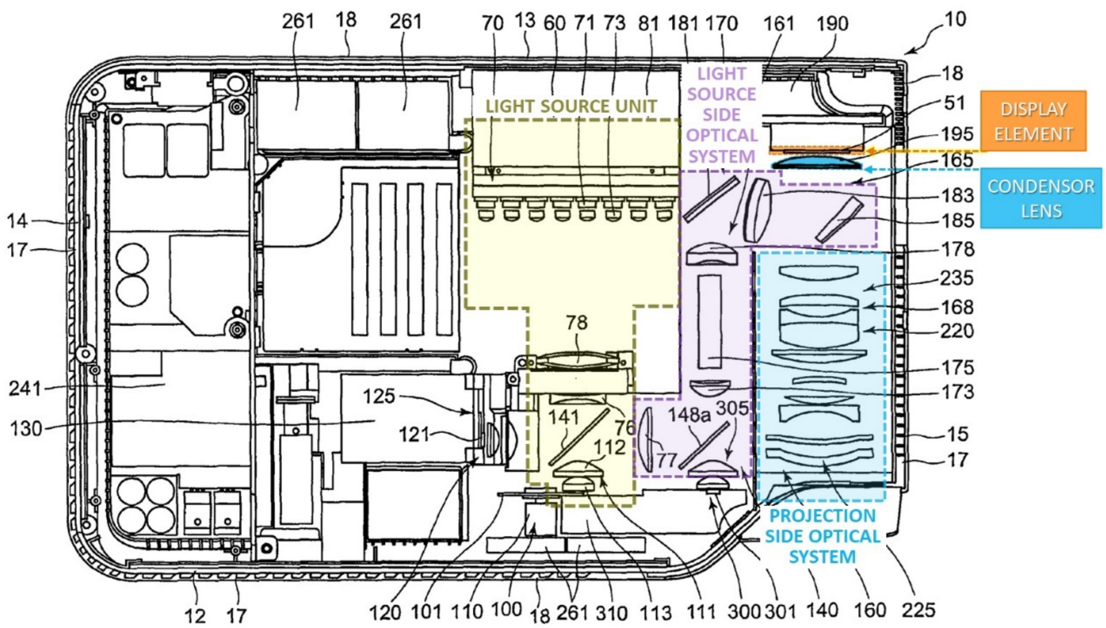
2. Element-by-element claim analysis

a) Independent Claim 8

[8.0] A projection-type image display device comprising:

Kurosaki discloses a projection-type image display device. EX1004, ¶¶ 70-71.

Kurosaki discloses that one or more embodiments of the present invention relate to a light source device and a projector. EX1005, 1:14-15. FIG.3 of Kurosaki shows a schematic plan view showing the internal structure of the projector. *Id*. 2:35-37.



EX1005, FIG 3 (annotated)

[8.1] a light source device;

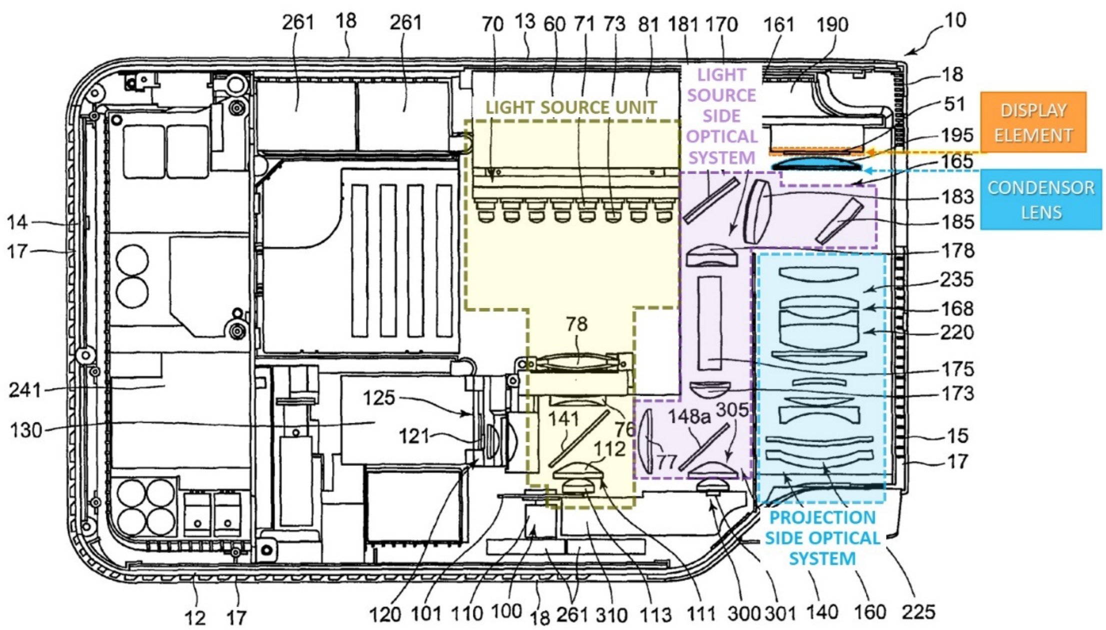
Kurosaki discloses a light source device. EX1004, ¶¶ 72-73.

Kurosaki discloses that "the projector 10 is provided with the light source 60 …." EX1005, 4:54-55.

[8.2] an image display element;

Kurosaki discloses an image display element. EX1004, ¶¶ 74-75.

Kurosaki discloses that "[t]he image generation block 165 is also provided with the display element 51 which is a DMD." *Id.*, 8:8-10.

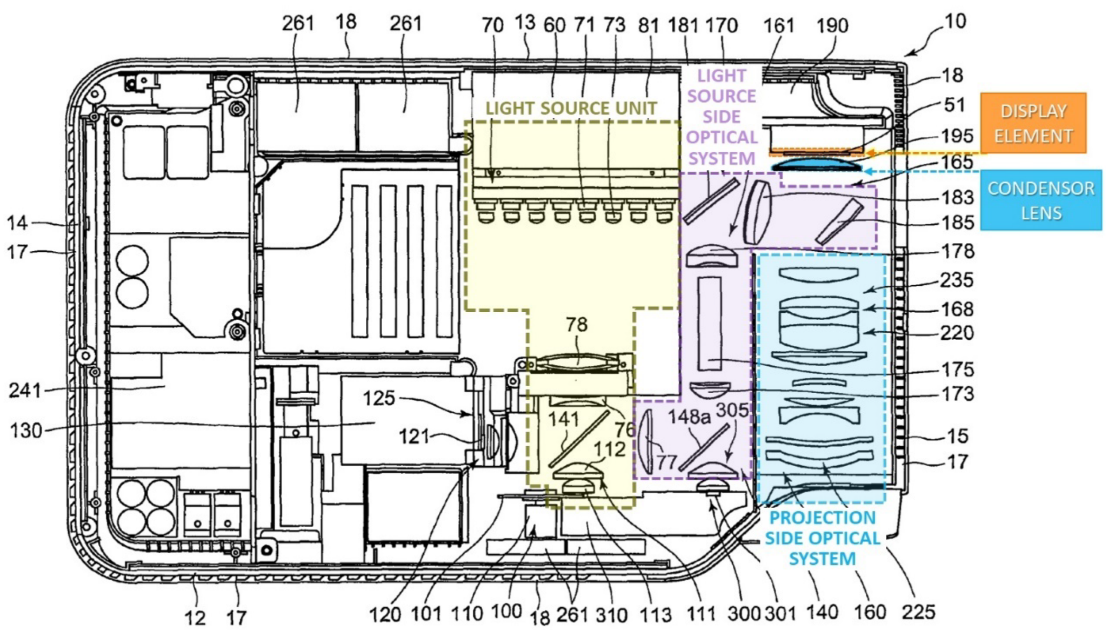


EX1005, FIG 3 (annotated)

[8.3] an illumination optical system having a plurality of optical elements for irradiating the image display element with light from the light source device; and

Kurosaki discloses an illumination optical system having a plurality of optical elements for irradiating the image display element with light from the light source device. EX1004, ¶¶ 76-77.

Kurosaki discloses that "[l]ight beams emitted from a light source unit 60 are applied to the display element 51 via a guiding optical system, whereby an optical image is formed by light reflected from the display element 51."



EX1005, FIG. 3 (annotated)

Kurosaki further discloses that "[t]he guiding optical system 140 consists of condenser lenses for condensing light beams in red, green, and blue wavelength ranges, dichroic mirrors for changing the optical paths of light beams in respective wavelength ranges so that they come to travel along the same optical axis, and other components." *Id.*, 7:20-25. *See*, further, *Id.*, 7:36-8:8 and Fig. 3.

[8.4] a projection lens for enlarging an optical image formed by the image display element to project the resulting image,

Kurosaki discloses a projection lens for enlarging an optical image formed by the image display element to project the resulting image. EX1004, ¶¶ 78-79.

Kurosaki discloses that "[a] condenser lens 195 is disposed immediately in front of the display element as an element of a projection-side optical system 220. The projection-side block 168 has a lens group of the projection-side optical system 220 for projecting, onto a screen, on-light that is reflected from the display element 51." EX1005, 8:12-18.

[8.5] wherein the light source device includes: an excitation light source for emitting excitation light;

Kurosaki discloses an excitation light source for emitting excitation light. EX1004, ¶¶ 80-81.

Kurosaki discloses that "[t]he light source unit 60 is equipped with an excitation light illumination device 70 …." EX1005, 4:61-62. "The excitation light illumination device 70 is equipped with excitation light sources 71, ..." *Id.*, 5:16-20.

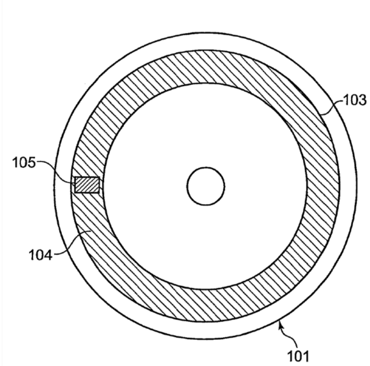
[8.6] a fluorescent material for emitting fluorescent light when excited by the excitation light; and

Kurosaki discloses a fluorescent material for emitting fluorescent light when excited by the excitation light. EX1004, ¶¶ 82-84.

Kurosaki discloses that "[t]he light source unit 60 is equipped with … a fluorescent light emitting device 100 …." EX1005, 4:61-65.

Kurosaki further discloses, "The fluorescent light emitting device 100 is equipped with the phosphor wheel 101 (phosphor plate) …." *Id.*, 5:35-36. "[T]he phosphor wheel 101 functions as a phosphor plate for emitting fluorescent light when receiving excitation light. The excitation-light-sources-71-side surface, including the fluorescent light emitting area, of the phosphor wheel 101 is a reflection surface capable of reflecting light because it is mirror-finished by silver evaporation, for example. A green phosphor layer 104 ("illumination subject body") is formed on this reflection surface." *Id.*, 5:47-59. "As shown in FIG. 3, light beams that are emitted from the excitation light sources 71 and applied to the green phosphor layer 104 of the phosphor wheel 101 via the collimator lenses 73, the condenser lens 78, the concave lens 76, and a dichroic mirror 141 excite the green phosphor of the green phosphor layer 104. As a result, fluorescent light that is emitted from the green phosphor in all directions goes toward the side of the excitation light sources 71 directly or after being reflected by the reflection surface of the phosphor wheel 101." *Id.*, 6:22-30.

FIG. 4



[8.7] an optical member for directing the excitation light to the fluorescent material, and

Kurosaki discloses an optical member for directing the excitation light to the fluorescent material. EX1004, ¶¶ 85-86.

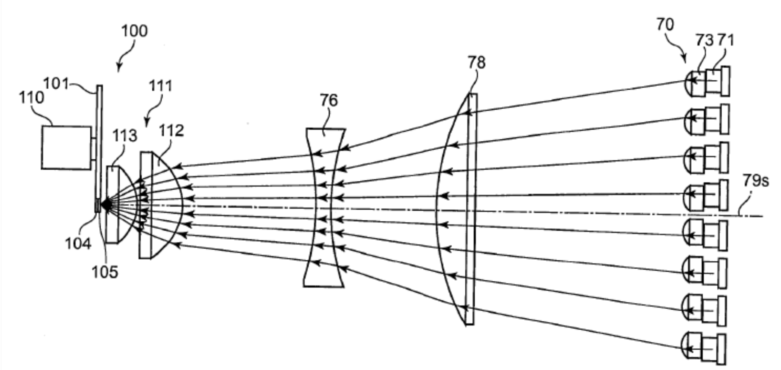
Kurosaki discloses: "As shown in FIG. 3, light beams that are emitted from the excitation light sources 71 and applied to the green phosphor layer 104 of the phosphor wheel 101 via the collimator lenses 73, the condenser lens 78, the concave lens 76, and a dichroic mirror 141 excite the green phosphor of the green phosphor layer 104." EX1005, 6:22-27. "The condenser lens group 111 condenses excitation light beams refracted by the concave lens 76 and transmitted by the first dichroic mirror 141 on the phosphor layer 104 of the phosphor wheel 101 and focuses fluorescent light emitted from the phosphor layer 104." *Id.*, 13:62-66.

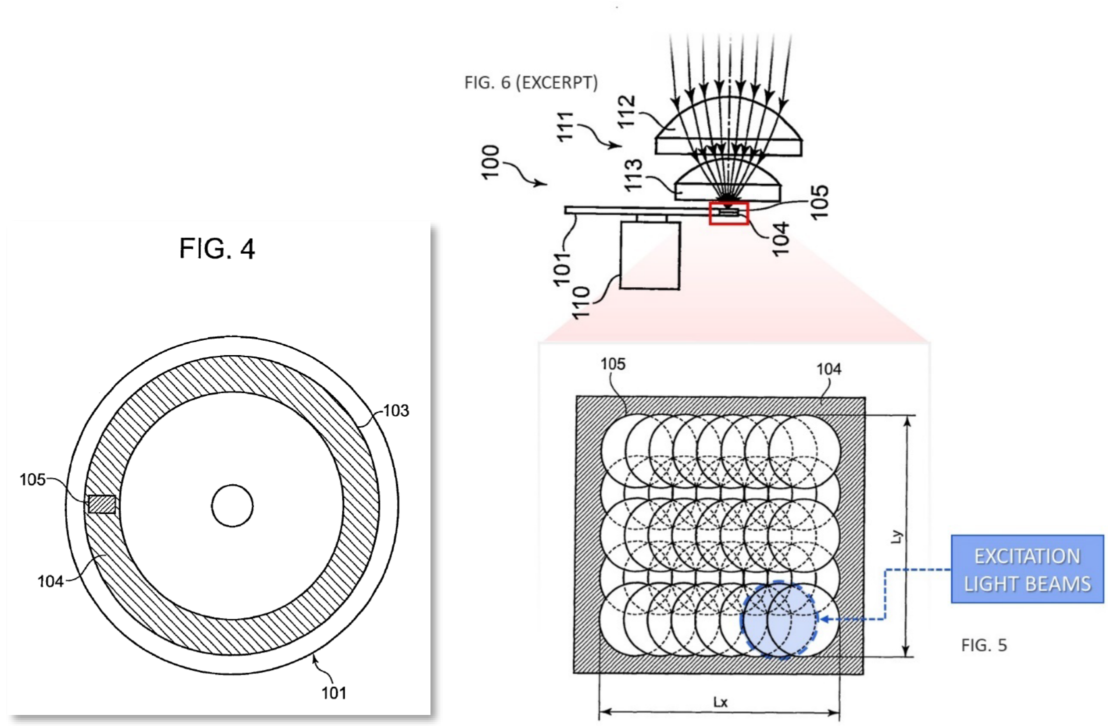
[8.8] the optical member has a curvature that is set such that a light-condensing position of the excitation light is positioned on an emission side of the excitation light relative to the fluorescent material,

As an initial matter, the terms, "a light-condensing position" and "an emission side of the excitation light relative to the fluorescent material" are ambiguous EX1004, ¶¶ 26-29. However—and without waiving any indefiniteness position for purposes of related litigation—in this petition, Petitioners will proceed to map this claim element to the prior art notwithstanding its ambiguity. *Id*. Specifically, Petitioners believe that, to the extent these term is amenable to construction, the most reasonable interpretation of "a light-condensing position" is an illumination region formed by converging light rays, and the most reasonable interpretation of "an emission side of the excitation light relative to the fluorescent material" is the surface of the fluorescent material on the side facing the excitation light source. *Id*.

Kurosaki discloses the optical member having a curvature that is set such that a light-condensing position of the excitation light is positioned on an emission side of the excitation light relative to the fluorescent material: At least the condenser lens 78 and the concave lens 76 each have a curvature. EX1004, ¶ 87. Because beams converge toward the phosphor layer 104 due to the combined effects of the curvatures of the lenses 78, 76, 112, and 113, the fact that at least some of the beams do not coincide (i.e., completely lie on each other) as explicitly shown in Fig. 5 means that the beams from the excitation light sources 71 are more concentrated in the rectangular area Lx×Ly on the phosphor layer 104 with an approximately uniform illumination intensity distribution. Therefore, the excitation light is incident on the fluorescent material l as a light-condensing position that is an emission side of the excitation light relative to the fluorescent material. *Id*.

FIG. 6





EX1005, FIGS. 4, 5 and 6 (annotated)

[8.9] a dichroic mirror disposed between the excitation light source and the fluorescent material; and

Kurosaki discloses a dichroic mirror disposed between the excitation light source and the fluorescent material. EX1004, ¶¶ 88-89.

Kurosaki discloses that the dichroic mirror 141 is disposed between the excitation light sources 71 and the phosphor layer 104 carried on the phosphor wheel 101." *Also See*. Figs. 3, 4, and 6.

[8.10] a condenser lens for condensing the excitation light disposed between the fluorescent material and the dichroic mirror,

Kurosaki discloses a condenser lens for condensing the excitation light disposed between the fluorescent material and the dichroic mirror. EX1004, ¶¶ 90-91.

The convex lenses 112 and 113 in the condenser lens group 111 are for condensing the excitation light and are disposed between the phosphor layer 104 and the dichroic mirror 141. *Also See*, Figs. 3, 4, and 6.

[8.11] wherein the optical member is disposed between the excitation light source and the dichroic mirror, and

Kurosaki discloses the optical member being disposed between the excitation light source and the dichroic mirror. EX1004, ¶¶ 92-93.

The condenser lens 78 and the concave lens 76 are disposed between the excitation light sources 71 and the dichroic mirror 141. *Also See*, Figs. 3, 4, and 6.

[8.12] wherein the optical member is a convex lens and a concave lens, with the convex lens and the concave lens being disposed in this order from the excitation light source toward the dichroic mirror.

Kurosaki discloses the optical member being a convex lens and a concave lens, with the convex lens and the concave lens being disposed in this order from the excitation light source toward the dichroic mirror. EX1004, ¶¶ 94-96.

The condenser lens 78 is a convex lens, and the condenser lens 78 and the concave lens 76 disposed in this order from the excitation light source 71 toward the dichroic mirror 141. *Also See*, Figs. 3, 4, and 6.

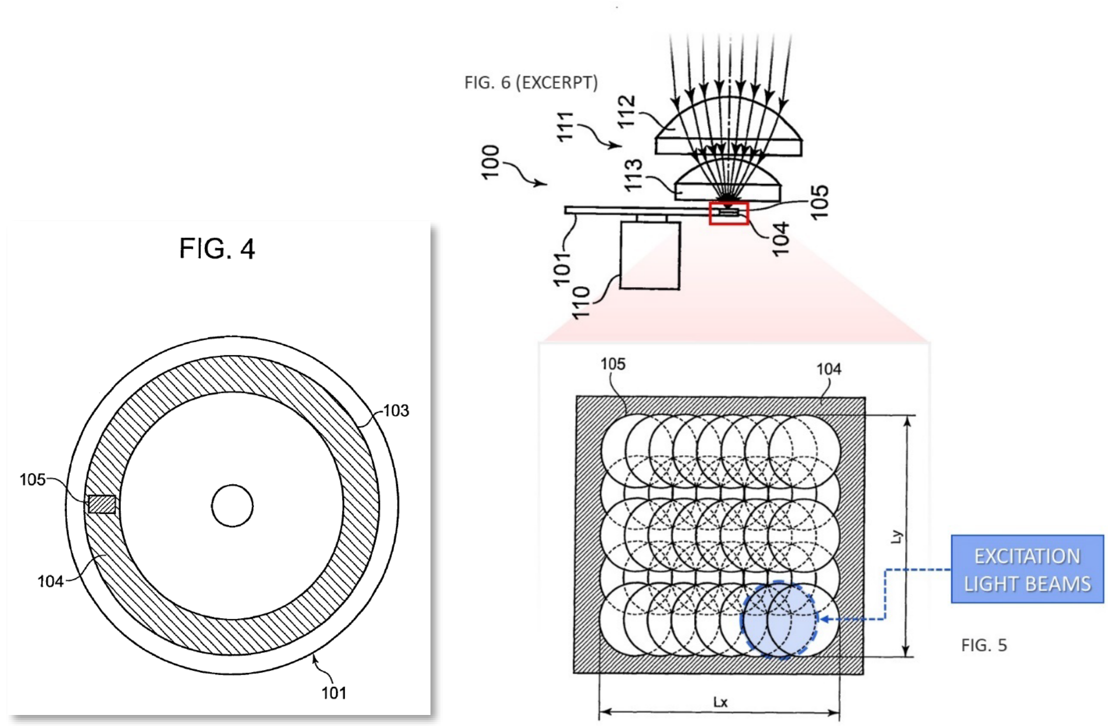
b) Dependent Claim 10

> **[10.0/10.1] The projection-type image display device according to claim 8, wherein at least either one of the convex lens and the concave lens has a curvature that is set so as to allow the excitation light to be made incident on the fluorescent material at a front side of the fluorescent material as a light-condensing position.**

Kurosaki discloses at least either one of the convex lens and the concave lens having a curvature that is set so as to allow the excitation light to be made incident on the fluorescent material at a front side of the fluorescent material as a light condensing position. EX1004, ¶¶ 97-101.

Kurosaki discloses the excitation light irradiated onto the fluorescent material having a luminance distribution that is substantially analogous to the image display element. EX1004, ¶ 98.

Kurosaki discloses that "as shown in FIG. 5, excitation light beams emitted from the respective excitation light sources 71 and refracted by the respective collimator lenses 73 overlap with each other or completely lie on each other in the certain region 105 of the phosphor layer 104. Settings are made so that excitation light beams have an approximately uniform illumination intensity distribution in the rectangular certain region 105 having a width Lx in the right-left direction and a width Ly in the top-bottom direction (see FIG. 5)." EX1005, 5:66-6:7.



EX1005, FIGS. 4, 5 and 6 (annotated)

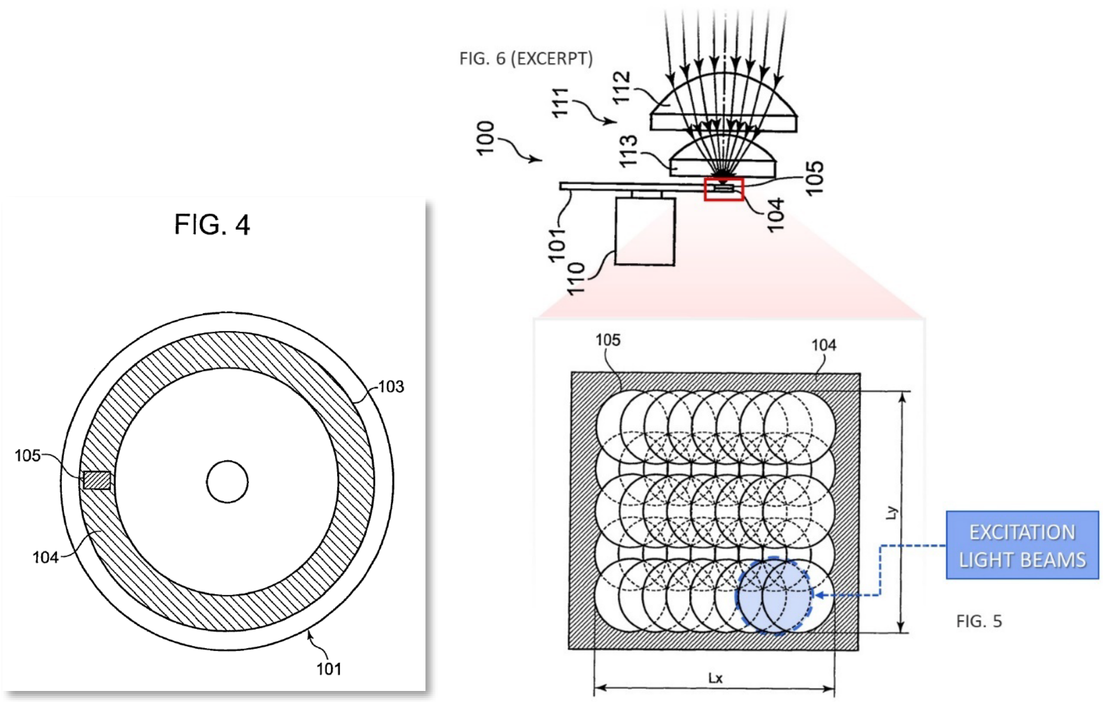
Because beams converge toward the phosphor layer 104 due to the combined effects of the curvatures of the lenses 78, 76, 112, and 113, the fact that at least some of the beams do not coincide (i.e., completely lie on each other)， as explicitly shown in Fig. 5， means that the beams from the excitation light sources 71 are more concentrated in the rectangular area Lx×Ly on the phosphor layer 104. Therefore, the excitation light is incident on the fluorescent material at a front side of the fluorescent material as a light-condensing position. EX1004, ¶ 99.

c) Dependent Claim 12

[12.0/12.1] The projection-type image display device according to claim 8, wherein the excitation light irradiated onto the fluorescent material has a luminance distribution that is substantially analogous to the image display element.

Kurosaki discloses the excitation light irradiated onto the fluorescent material having a luminance distribution that is substantially analogous to the image display element. EX1004, ¶¶ 102-104.

Kurosaki teaches that "as shown in FIG. 5, excitation light beams emitted from the respective excitation light sources 71 and refracted by the respective collimator lenses 73 overlap with each other or completely lie on each other in the certain region 105 of the phosphor layer 104. Settings are made so that excitation light beams have an approximately uniform illumination intensity distribution in the rectangular certain region 105 having a width Lx in the right-left direction and a width Ly in the top-bottom direction (see FIG. 5). [T]he projector 10 according to the embodiment is equipped with a rectangular DMD (display element 51) and the light tunnel 175 having a rectangular cross section. ***The certain region 105 which is illuminated with excitation light beams is given a generally rectangular shape so as to have the same shape as the DMD*** and the light tunnel 175." EX1005, 5:66-6:13 (emphasis added).



EX1005, FIGS. 4, 5 and 6 (annotated)

B. Ground 2: Miyamae anticipates, or renders obvious, Claims 8 and 10.

1. Overview of Miyamae

a) Qualification as prior art

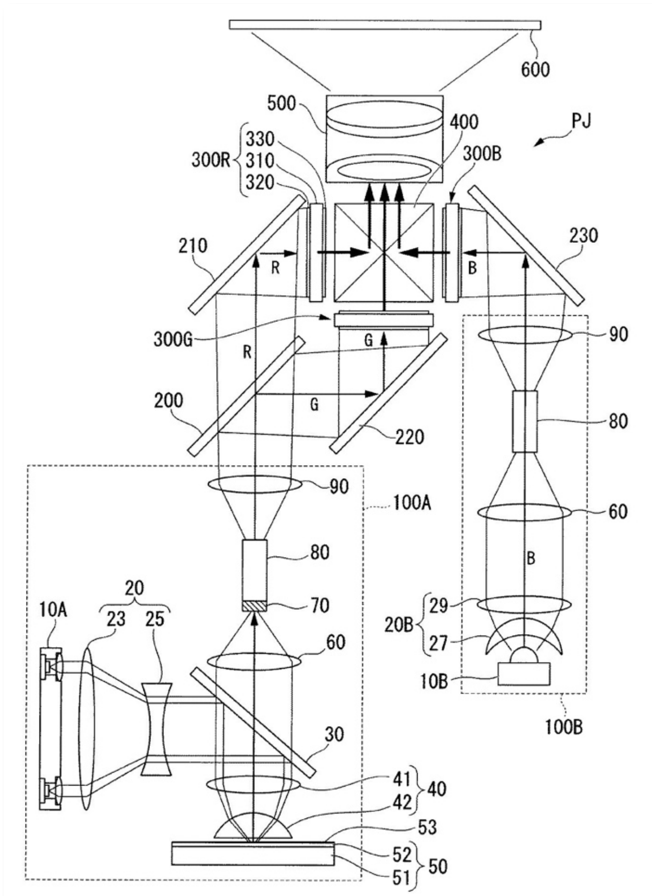
Miyamae was filed as a Japanese Application No. 2011-62417 on March 22, 2011, and published as Japanese Patent Publication No. 2012-199075 on October 18, 2012. EX1006. Accordingly, Miyamae qualifies as prior art under 35 U.S.C. § 102(a) (pre-AIA) at least because it was published before the priority date of the

’226 Patent (November 1, 2012). *Id*. Miyamae was neither cited nor considered by the Examiner during prosecution of the ’226 Patent. *Id.*

b) Overview

Miyamae describes a light source and a projector that includes the light source, a light modulation device for modulating light emitted from the light source device in response to image information, and projection optics for projecting modulated light from the light modulation device as a projected image. EX1006, [0032].

In one embodiment, shown in Fig. 1, the projector PJ includes a light source 100A, a second light source device 100B, a dichroic mirror 200, liquid crystal light valves (optical modulators) 300R, 300G, 300B, a color synthesizing element 400, and projection optics 500. EX1006, [0036].

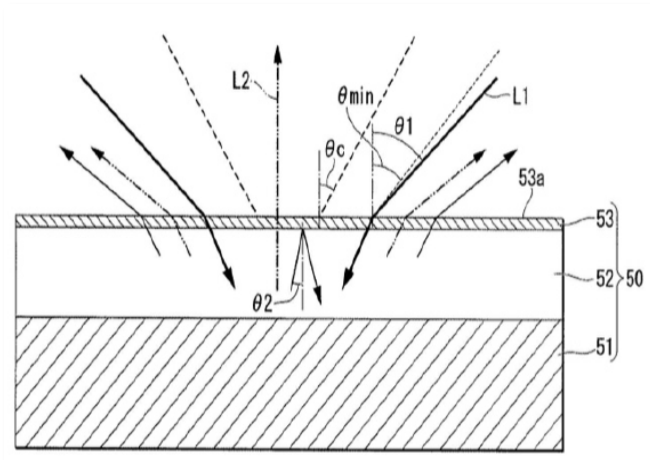


EX1006, FIG. 1

Light emitted from first light source device 100A is separated into red light R and green light G by dichroic mirror 200. Blue light B is emitted from second light source device 100B. The red-, green- and blue lights are incident on and modulated by the respective liquid crystal light valves 300R, 300G, and 300B. Each modulated lights are incident on color synthesizing element 400 and synthesized. The synthesized light is magnified and projected onto a projection surface 600. EX1006, [0037], [0048].

The light source device 100A includes excitation light source 10A, collimating optics 20, a dichroic mirror 30, pickup optics 40, a light emitting element 50 (including a reflector 51, a fluorescent layer 52, and wavelength selecting reflective layer 53), focusing optics 60, a polarized light conversion element 70, a rod integrator 80, and a collimating lens 90, arranged in that order on the optical path. Fluorescence is emitted from fluorescent layer 52 when irradiated by the excitation light. EX1006, [0038]. The rod integrator 80 is a prism-shaped optical member extending in the optical path direction and blends light emitted from polarized light conversion element 70, thereby homogenizing the luminance distribution. The cross-sectional shape of rod integrator 80 is similar to the external shape of the image forming area of liquid crystal light valves 300R, 300G, 300B. EX1006, [0051].

As shown in Fig. 5, excitation light, L1, is made incident on the phosphor layer 52 at angles, θ_1, that is greater than a cutoff angle, θ_c. θ_c is a property of the wavelength selecting reflective layer 53 such that the excitation light incident at angles greater than θ_c is transmitted into the phosphor layer 52, and light incident at angles smaller than θ_c is reflected. Thus, excitation light is transmitted into the phosphor layer 52, wherein some of the some of the excitation light is converted into fluorescence. The excitation light scattered without being converted into fluorescence in phosphor layer 52 and incident on the wavelength selecting reflective layer 53 at angles θ_2 less than θ_c is reflected back into the phosphor layer 52, and a portion of the reflected excitation light is converted into fluorescence. The luminous efficiency of the phosphor can thus be improved. EX1006, [0067]-[0069], [0074]-[0080].



EX1006, FIG. 5

2. Element-by-element invalidity analysis

a) Independent Claim 8

[8.0] A projection-type image display device comprising:

Miyamae discloses a projection-type image display device. EX1004, ¶¶ 106-107.

Miyamae explains that "Fig. 1 is a schematic diagram showing a light source device 100A and projector PJ of the present embodiment." EX1006, [0036].

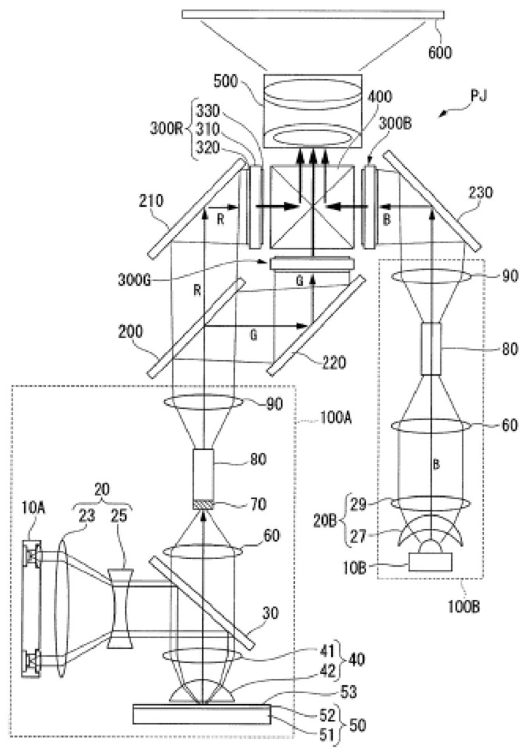


FIG. 1

[8.1] a light source device;

Miyamae discloses a light source device. EX1004, ¶¶ 108-109.

Miyamae explains that "Fig. 1 is a schematic diagram showing a light source device 100A and projector PJ of the present embodiment." EX1006, [0036].

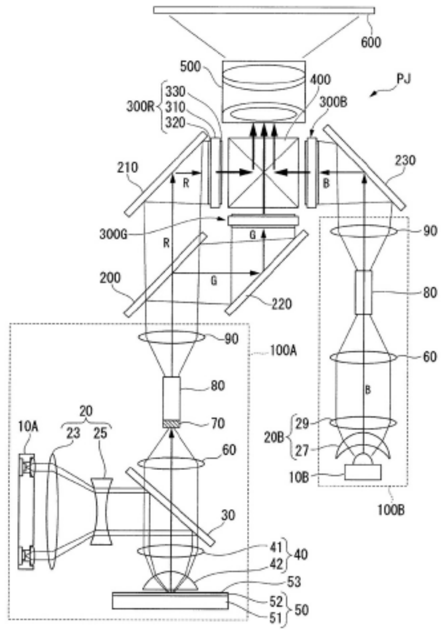


FIG. 1

[8.2] an image display element;

Miyamae discloses an image display element. EX1004, ¶¶ 110-112.

A liquid crystal light valve is an image display element. In the liquid crystal valve, light passes through liquid crystal layer and is modulated to create images or patterns that correspond to the input signal. EX1004, ¶ 111.

Miyamae discloses that "… a liquid crystal light valve (optical modulator) 300R, a liquid crystal light valve 300G, a liquid crystal light valve 300B …." EX1006, [0036].

[8.3] an illumination optical system having a plurality of optical elements for irradiating the image display element with light from the light source device; and

Miyamae discloses an illumination optical system having a plurality of optical elements for irradiating the image display element with light from the light source device. EX1004, ¶¶ 113-115.

Miyamae describes that "[l]ight source device 100A consists of a light source unit (excitation light source) 10A, collimating optics 20, a dichroic mirror 30, pickup optics 40, a light emitting element 50, focusing optics 60, a polarized light conversion element 70, a rod integrator 80, and a collimating lens 90, arranged in that order on the optical path. EX1006, [0038].

Miyamae further discloses that "[r]ed light R contained in fluorescence RG passes through dichroic mirror 200, is reflected at mirror 210, and is incident on liquid crystal light valve 300R. Green light G contained in fluorescence RG is reflected by dichroic mirror 200, reflected at mirror 220, and incident on liquid crystal light valve 300G." *Id*. [0055].

[8.4] a projection lens for enlarging an optical image formed by the image display element to project the resulting image,

Miyamae discloses a projection lens for enlarging an optical image formed by the image display element to project the resulting image. EX1004, ¶¶ 116-117.

Miyamae discloses that "[l]ight modulated by liquid crystal light valve 300R, liquid crystal light valve 300G, and liquid crystal light valve 300B (the formed image) is incident on color synthesizing element 400. … The three colored lights ([of the] image) are thus superimposed and synthesized, and the synthesized colored light magnified and projected onto the projection surface 600 by projection optics 500. EX1006, [0058]-[0059].

[8.5] wherein the light source device includes: an excitation light source for emitting excitation light;

Miyamae discloses a light source device that includes an excitation light source for emitting excitation light. EX1004, ¶¶ 118-119.

Miyamae describes that "[i]n light source device 100A, by irradiating excitation light emitted from light source portion 10A onto light emitting element 50, fluorescence used as liquid crystal light valve illumination light is made to emit from fluorescent layer 52 provided in light emitting element 50." EX1006, [0038].

[8.6] a fluorescent material for emitting fluorescent light when excited by the excitation light; and

Miyamae discloses a light source device that includes a phosphor (a fluorescent material) for emitting fluorescent light when excited by the excitation light. EX1004, ¶¶ 120-121.

Miyamae discloses that "[i]n light source device 100A, by irradiating excitation light emitted from light source portion 10A onto light emitting element

50, fluorescence used as liquid crystal light valve illumination light is made to emit from fluorescent layer 52 provided in light emitting element 50." EX1006, [0038].

[8.7] an optical member for directing the excitation light to the fluorescent material, and

Miyamae discloses a light source device that includes at least an optical member, *e.g.*, a condensing lens, *etc.*, for directing the excitation light to the fluorescent material. EX1004, ¶¶ 122-124.

Miyamae explains that "[a]s shown in Fig. 3, excitation light emitted from light source portion 10A is collimated by the collimator lens array 21 included in light source portion 10A, focused by condensing lens 23, then transmitted through collimating lens 25 to narrow the overall excitation light beam. Condensing lens 23 bends the optical path of the multiple laser light incident on the periphery of said condensing lens 23 to cause the excitation light to enter wavelength-selecting reflective layer 53. Excitation light is focused onto the wavelength-selecting reflective layer 53 at a relatively large incident angle." EX1006, [0041].

Miyamae further notes that "wavelength-selecting reflective layer 53 is formed on the surface (incident surface) of phosphor layer 52." *Id.*, [0038].

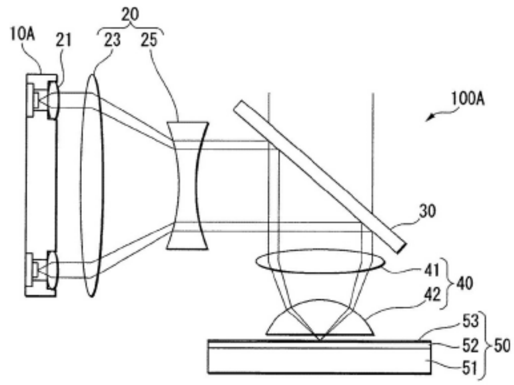


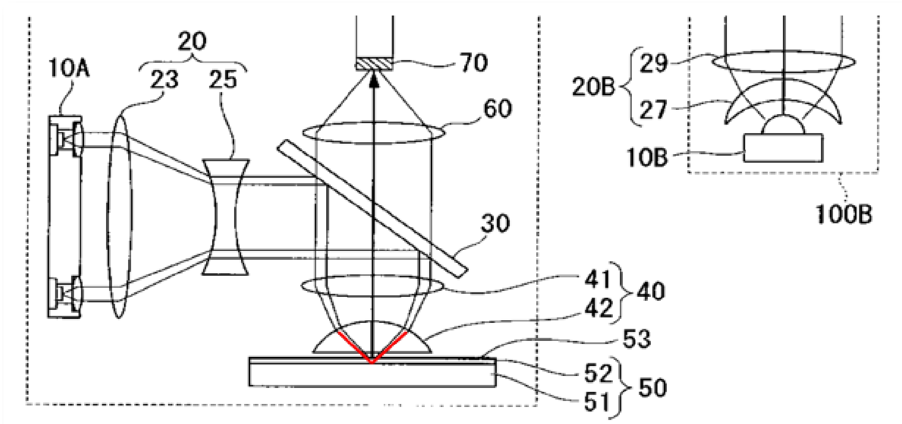
FIG. 3

[8.8] the optical member has a curvature that is set such that a light-condensing position of the excitation light is positioned on an emission side of the excitation light relative to the fluorescent material,

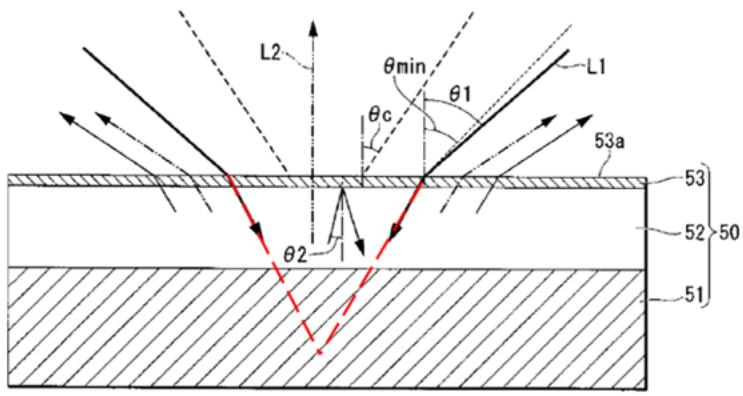
Miyamae discloses a light source device that includes an optical member, *e.g.* a condensing lens, having a curvature that is set such that a light-condensing position of the excitation light is positioned on an emission side of the excitation light relative to the fluorescent material. EX1004, ¶¶ 125-128.

See, Section VIII.A.2.a, Element 8.8, *supra*, for the construction of this element.

See annotated FIG. 1 and FIG. 5.



EX1006, FIG. 1 (excerpt)



EX1006, FIG. 5 (annotated)

Miyamae discloses that "[o]n light emitting element 50, the individual spots of the laser light sources 12 incorporated in light source portion 10A are set so that their focusing positions do not completely overlap …." EX1006, [0046].

Thus, Miyamae discloses that a light-condensing position of the excitation light is positioned on an emission side of the excitation light relative to the fluorescent material. EX1004, ¶ 128. The imaginary extensions of the excitation light rays substantially meet at a point in annotated Fig. 5 on the opposite side of fluorescent layer 52 from the excitation light sources 102, just as shown in the Fig. 1 of the '226 Patent. *Id*.

[8.9] a dichroic mirror disposed between the excitation light source and the fluorescent material; and

Miyamae discloses a light source device that includes a dichroic mirror disposed between the excitation light source and the phosphor (fluorescent material). EX1004, ¶¶ 128-131.

The dichroic mirror is disposed between the excitation light source 10A and the phosphor 52. *Id*., ¶ 130; EX1006, Fig. 1, [0038].

Miyamae discloses that "[e]xcitation light transmitted through collimating optics 20 is reflected by dichroic mirror 30. EX1006, [0044].

[8.10] a condenser lens for condensing the excitation light disposed between the fluorescent material and the dichroic mirror,

Miyamae discloses a light source device that includes a condenser lens for condensing the excitation light disposed between the phosphor (fluorescent material) and the dichroic mirror. EX1004, ¶¶ 132-133.

Miyamae discloses that "[p]ickup optics 40 comprises a first lens 41, which is a convex lens, and a second lens 42, which is a single convex lens into which excitation light enters through the first lens 41. Pickup optics 40 is disposed on the beam axis of excitation light LB reflected by dichroic mirror 30, and focuses excitation light LB on light emitting element 50." EX1006, [0045].

[8.11] wherein the optical member is disposed between the excitation light source and the dichroic mirror, and

Miyamae discloses a light source device that includes the optical member, *e.g.,* condensing lens, *etc.,* disposed between the excitation light source and the dichroic mirror. EX1004, ¶¶ 134-136.

Miyamae discloses, "As shown in Fig. 3, excitation light emitted from light source portion 10A is collimated by the collimator lens array 21 included in light source portion 10A, focused by condensing lens 23, then transmitted through collimating lens 25 to narrow the overall excitation light beam. Condensing lens 23 bends the optical path of the multiple laser light incident on the periphery of said condensing lens 23 to cause the excitation light to enter wavelength-selecting reflective layer 53. Excitation light is focused onto the wavelength-selecting reflective layer 53 at a relatively large incident angle." EX1006, [0041].

Miyamae further discloses that "[e]xcitation light transmitted through collimating optics 20 is reflected by dichroic mirror 30." *Id*., [0044].

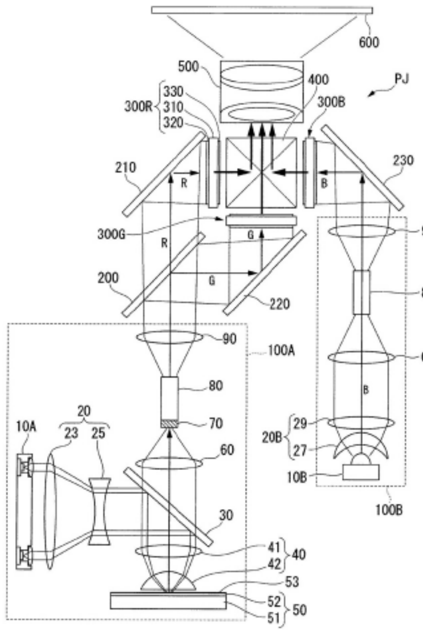


FIG. 1

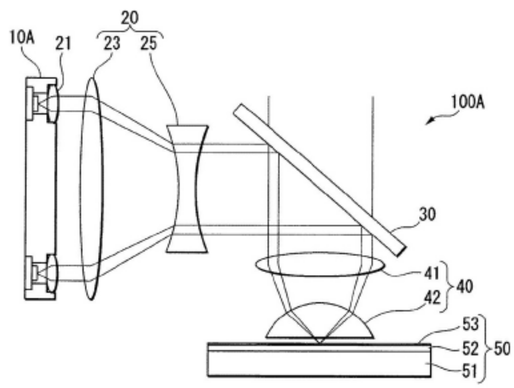


FIG. 3

[8.12] wherein the optical member is a convex lens and a concave lens, with the convex lens and the concave lens being disposed in this order from the excitation light source toward the dichroic mirror.

Miyamae discloses a light source device having an optical member that is a convex lens and a concave lens, with the convex lens and the concave lens being disposed in this order from the excitation light source toward the dichroic mirror. EX1004, ¶¶ 137-141.

Miyamae explains that, "as shown in Fig. 3, excitation light emitted from light source portion 10A is collimated by the collimator lens array 21 included in light source portion 10A, focused by condensing lens 23, then transmitted through collimating lens 25 to narrow the overall excitation light beam. Excitation light is focused onto the wavelength-selecting reflective layer 53 at a relatively large incident angle." EX1006 [0041].

Miyamae further notes that "wavelength-selecting reflective layer 53 is formed on the surface (incident surface) of phosphor layer 52." *Id*., [0038]. Miyamae further discloses that "[e]xcitation light transmitted through collimating optics 20 is reflected by dichroic mirror 30." *Id*., [0044].

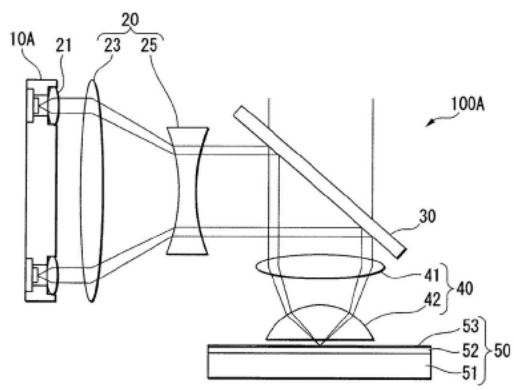


FIG. 3

b) Dependent Claim 10

[10.0/10.1] The projection-type image display device according to claim 8, wherein at least either one of the convex lens and the concave lens has a curvature that is set so as to allow the excitation light to be made incident on the fluorescent material at a front side of the fluorescent material as a light-condensing position.

Miyamae discloses that at least either one of the convex lens and the concave lens has a curvature that is set so as to allow the excitation light to be made incident on the fluorescent material at a front side of the fluorescent material as a light-condensing position. EX1004, ¶¶ 142-147.

See, Section VIII.A.2.b, *supra*, for the construction of this element.

The excitation light will be condensed at a light-condensing position at a front side of the fluorescent material after it passes the convex lens (condensing lenses 311 and 312) as shown in the annotated figure below. EX1004, ¶ 143.

See annotated FIG. 1 and FIG. 5.

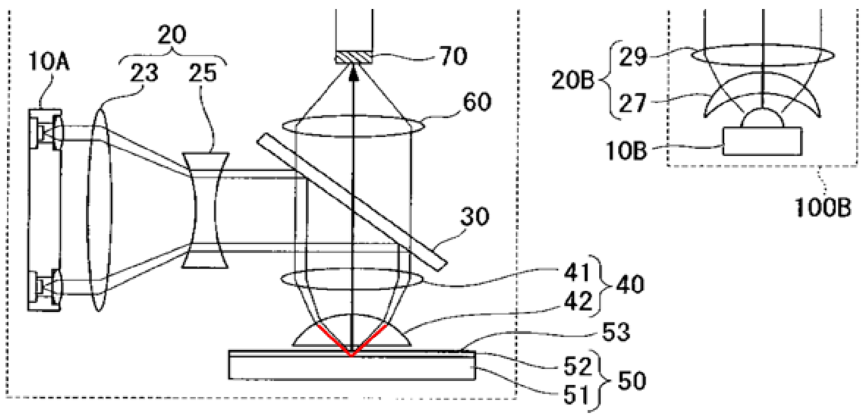
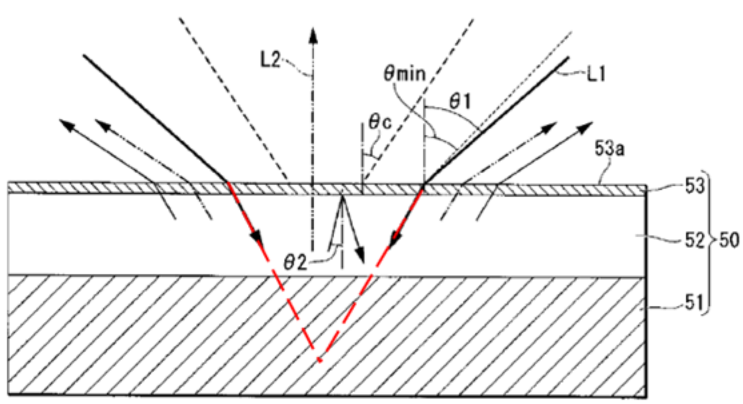


FIG. 1 (excerpt, annotated)



Miyamae discloses that "[o]n light emitting element 50, the individual spots of the laser light sources 12 incorporated in light source portion 10A are set so that their focusing positions do not completely overlap" EX1006, [0046].

Thus, the excitation light is incident on the fluorescent material at a front side of the fluorescent material as a light-condensing position. EX1004, ¶ 145-146.

C. Ground 3: Miyamae in view of Kurosaki renders Claim 12 obvious.

1. Overview of Miyamae and Kurosaki

a) Miyamae

(1) Qualification as prior art

See, Section VIII.B.1.a, *supra*.

(2) Overview

See, Section VIII.B.1.b, *supra*.

b) Kurosaki

(1) Qualification as prior art

See Section VIII.A.1.a, *supra*.

(2) Overview

See Section VIII.A.1.b, *supra*.

2. Reasons to combine Miyamae and Kurosaki

A POSITA would have been motivated to combine the teachings of Miyamae with the teachings of Kurosaki, as explained by Dr. Sasian. EX1004, ¶¶ 149-151.

Both are directed to projection-type image display devices, the subject matter of the Challenged Claims. The invention described in Miyamae "pertains to a light source device and a projector". EX1006, [0001]. Miyamae further describes a light source and a projector using the light source, as in the overview above. Kurosaki is in the same field of endeavor as Miyamae and the '226 Patent, and POSITAs would naturally have looked to both Miyamae and Kurosaki in their work in this area. EX1004, ¶ 150. Moreover, a POSITA would have recognized that Kurosaki describes optical subsystems, such as fluorescent-material (phosphor)-based light sources that are compatible with system described in Miyamae, and that combining Miyamae and Kurosaki would have amounted to simple substitution of one known element for another to obtain predictable results. *Id.*, ¶ 150.

Furthermore, a POSITA would have recognized that substituting certain components by those disclosed in Kurosaki offer certain advantages. For example, Miyamae describes a rod integrator 80 having a cross-sectional shape similar to the external shape of the image forming area of liquid crystal light valves 300R, 300G, 300B. EX1006, [0051]. Similarly, Kurosaki describes the display element and the light tunnel as having the same shape and, additionally, a region illuminated with excitation light beams as having the same shape as both the display element and light tunnel. EX1006, 6:10-13. One combination of Miyamae and Kurosaki would have been a simple substitution of light source of Kurosaki for the light source of Miyamae. Furthermore, a POSITA would have found motivation in the prior art for such a combination. For example, Kitano explains,

> With an illumination device for an image display device, it is generally ***necessary*** to use illumination light having a rectangular spatial intensity distribution that matches the shape of the [display device]. Therefore, illuminance homogenizer such as a rod integrator or other having a rectangular cross section is sometimes used. In this case, ***to obtain an efficient light source device*** in which a phosphor is used as the light source, it is effective for the shape of the emission face of the phosphor to be substantially equivalent to the shape of the rod integrator.

EX1007, [0014] (emphases added). A POSITA would therefore have had a motivation to combine Miyamae and Kurosaki to obtain an efficient light source for projectors. EX1004, ¶ 151.

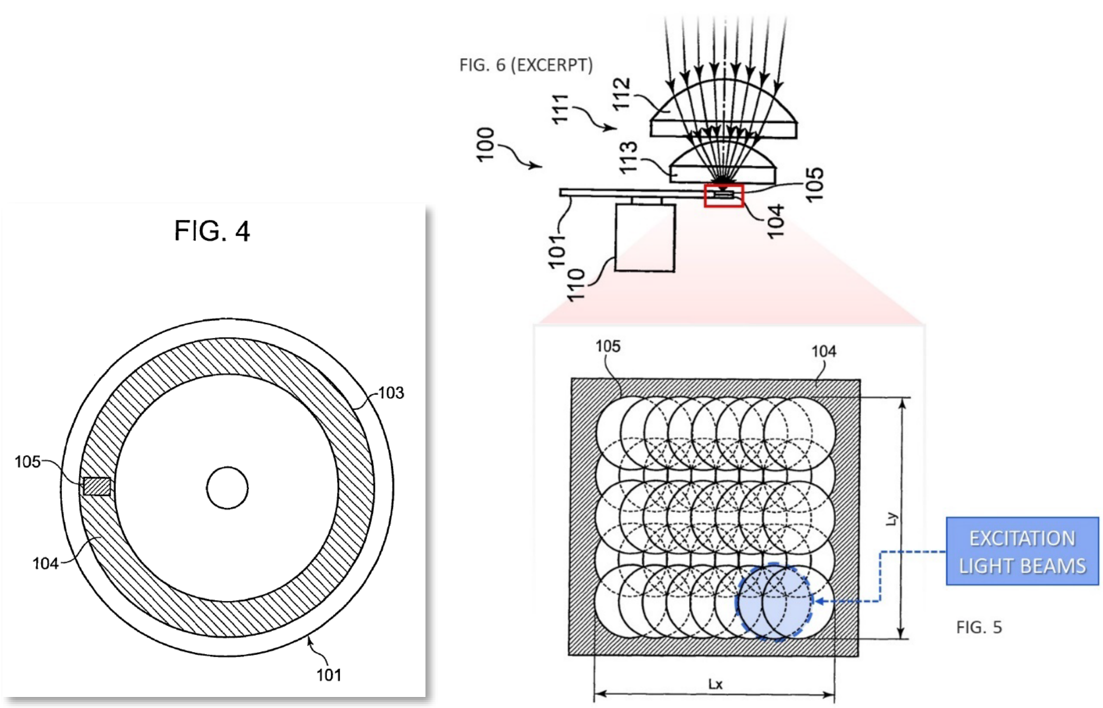
3. Element-by-element invalidity analysis

a) Dependent Claim 12

[12.0/12.1] The projection-type image display device according to claim 8, wherein the excitation light irradiated onto the fluorescent material has a luminance distribution that is substantially analogous to the image display element.

Kurosaki discloses that the excitation light irradiated onto the fluorescent material has a luminance distribution that is substantially analogous to the image display element. EX1004, ¶ 155-157. A POSITA would have had a motivation to combine Kurosaki's teachings with Miyamae to arrive at the invention of this claim. *Id*. ¶¶ 155-157.

See, Section VIII.A.2.c, *supra*, and EX1005, FIGS. 4 and 5 for Kurosaki's disclosure of this element and Section VIII.C.2, *supra*, for motivation to combine Kurosaki with Miyamae.



EX1005, FIGS. 4, 5 and 6 (annotated)

D. Ground 4: Kitano in view of Kurosaki renders Claims 8, 10, and 12 obvious.

1. Overview of Kitano and Kurosaki

a) Kitano

(1) Qualification as prior art

Kitano was filed as a U.S. Patent Application No. 13/645,474 on October 4, 2012, and published as U.S. Patent Application Publication No. 2013/0088471 on April 11, 2013. EX1007. Accordingly, Kitano qualifies as prior art under 35 U.S.C. § 102(e)(1) (pre-AIA) at least because it was filed before the priority date of the ’226 Patent (November 1, 2012) and later published. *Id*. Kitano was cited and considered by the Examiner during prosecution of the ’226 Patent. *Id.*

(2) Overview

Kitano discloses projectors as image display devices for projecting and enlarging various video and the like onto a screen. EX1007, [0005]. A projector is shown in Fig. 9:

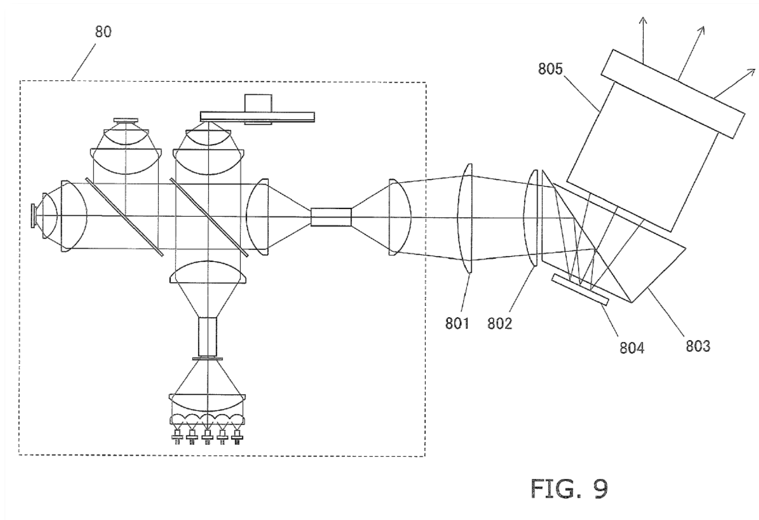


FIG. 9

EX1007, FIG. 9

The projector includes a light source 80, which correspond to the light source 30 in Fig. 3:

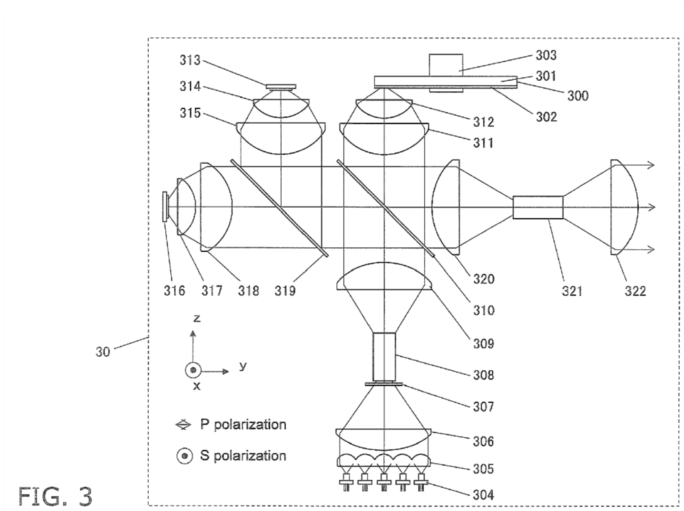


FIG. 3

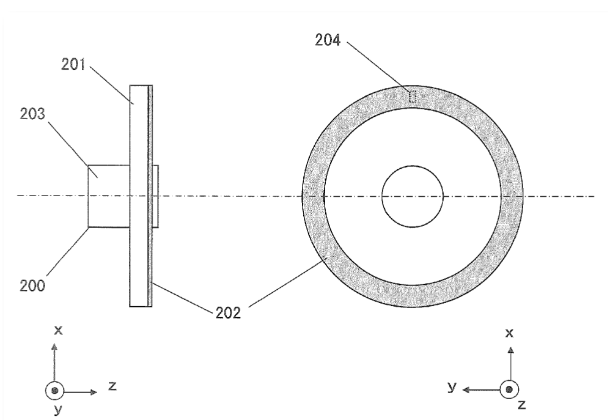
EX1007, FIG. 3

The output light of the light source device 80 passes through the second rod integrator 321, relay lens 801, field lens 802, and full reflection prism 803, and is incident on a DMD 804, which is an image display element. The optical systems 801, 802, and 803 are configured so that the emission face shape of the second rod integrator 321 will be efficiently and uniformly condensed or focused on the DMD 804. EX1007, [0119].

The light source 30 includes a blue laser light source 304, a collimator lens array 305, a condensing lens 306, and a diffuser plate 307. The laser light flux that has passed through the diffuser plate 307 is incident on a first rod integrator 308, which is a rectangular solid piece of dense quartz glass. The emission end face shape of the first rod integrator 308 is substantially equivalent to the incident end face shape of a second rod integrator 321. EX1007, [0038], [0062]-[0064]

The blue laser light from the first rod integrator 308 passes through the collimator lens 309, the dichroic mirror 310, and condensing lenses 311, 312, and converges onto a phosphor 302 on a substrate 301. EX1007, [0066]-[0071]. The fluorescent light (green) from the phosphor 302 is reflected by the substrate 301, collimated by the condensing lenses 311, 312, and reflected by the dichroic mirror 310. EX1007, [0077]. The fluorescent light reflected by the dichroic mirror 310, combined with the blue and red light from other parts of the light source 30, is condensed by a condensing lens 320. This light flux is then incident on the second rod integrator 321. The light emitted from the second rod integrator 321 is collimated by a collimating lens 322 and is taken off as output light from the light source device 30. EX1007, [0082].

Kitano further recognizes that, with an illumination device for an image display device, it is generally necessary to use illumination light having a spatial intensity distribution that matches the shape of the display device to obtain an efficient light source device. With a phosphor used as the light source, it is effective for the shape of the emission face of the phosphor to be substantially equivalent to the shape of the rod integrator. EX1007, [0014]. Kitano further describes adjusting the flux shape of the fluorescent light incident on the second rod integrator to be substantially the same as the rod integrator incident end face shape so that the fluorescent light can be efficiently coupled to the rod integrator. EX1007, [0087]. Additionally, Kitano describes forming a laser light irradiation spot of a prescribed shape (e.g., spot 204 in FIG. 2). EX1007, [0052].



EX1007, FIG. 2

b) Kurosaki

(1) Qualification as prior art

See Section VIII.A.1.a, *supra*.

(2) Overview

See Section VIII.A.1.b, *supra*.

2. Reasons to combine Kitano and Kurosaki

A POSITA would have been motivated to combine the teachings of Kitano with the teachings of Kurosaki, as explained by Dr. Sasian. EX1004, ¶¶ 159-164.

Both are directed to projection-type image display devices, the subject matter of the Challenged Claims. Kitano describes projectors as being widely used as image display devices for projecting and enlarging various kinds of video or the like onto a screen, and describes a type of projector, in which light emitted from a light source is condensed by a spatial light modulation element (a DMD (digital micromirror device) or a liquid crystal display element). Kitano further describes the condensed light being emitted after being modulated and the emitted light being displayed on a screen as a color image. EX1007, [0005]. Kitano further describes light source used in conventional projectors and the drawbacks of those light sources (*see*, EX1007, [0006]-[0017]) and proposes a "technology … in light of the [drawbacks of the traditional technologies], and provides a light source device that uses a phosphor to obtain illumination light of high brightness and high efficiency. EX1007, [0018].

Similarly, Kurosaki, as explained in Section VIII.A.2, *Supra*, is in the same field of endeavor as Kitano and the '226 Patent, and POSITAs would naturally have looked to both Kitano and Kurosaki in their work in this area. EX1004, ¶ 161. Moreover, a POSITA would have recognized that Kurosaki describes optical subsystems, such as fluorescent-material (phosphor)-based light sources that are compatible with system described in Kitano, and that combining Kitano and Kurosaki would have amounted to simple substitution of one known element for another to obtain predictable results. *Id*.

Furthermore, a POSITA would have recognized that substituting certain components by those disclosed in Kurosaki offer certain advantages. For example, a POSITA would have been motivated to incorporate the combination of convex and concave lenses as taught by Kurosaki. Section VIII.A.2, *supra*.

3. Element-by-Element invalidity analysis

a) Independent Claim 8

[8.0] A projection-type image display device comprising:

Kitano discloses a projection-type image display device. EX1004, ¶¶ 165-166.

Kitano discloses that "[p]rojectors are widely used as image display devices for projecting and enlarging various kinds of video or the like onto a screen." EX1007, [0005]. Kitano further describes that "FIG. 9 is a diagram of the configuration of the light source device pertaining to a fifth embodiment. This embodiment is an image display device that makes use of the light source device of the second embodiment." EX1007, [0118].

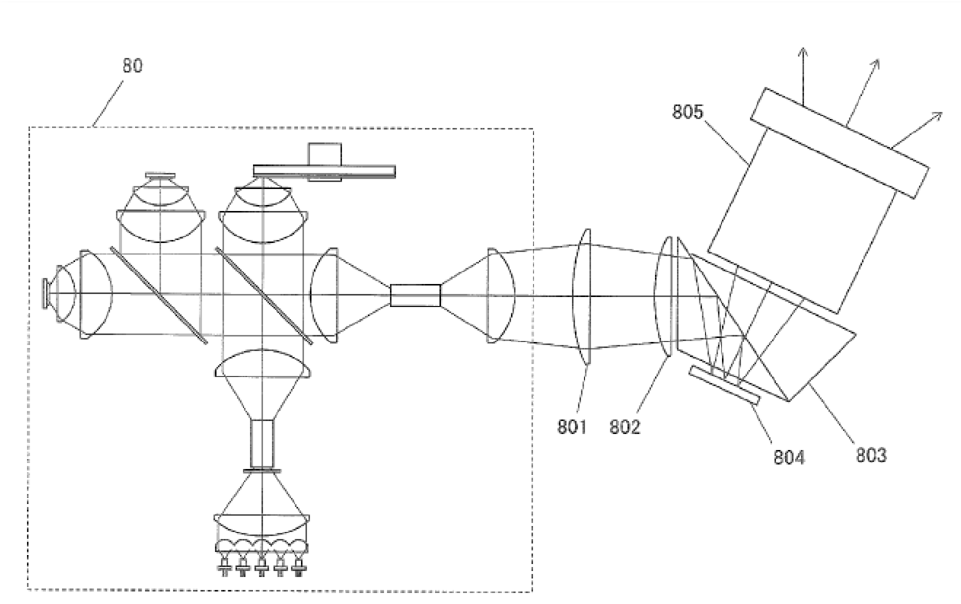


FIG. 9

[8.1] a light source device;

Kitano discloses a light source device. EX1004, ¶¶ 167-168.

Kitano discloses that "FIG. 3 is a diagram of the configuration of the light source device 30 pertaining to a second embodiment." EX1007, [0061]

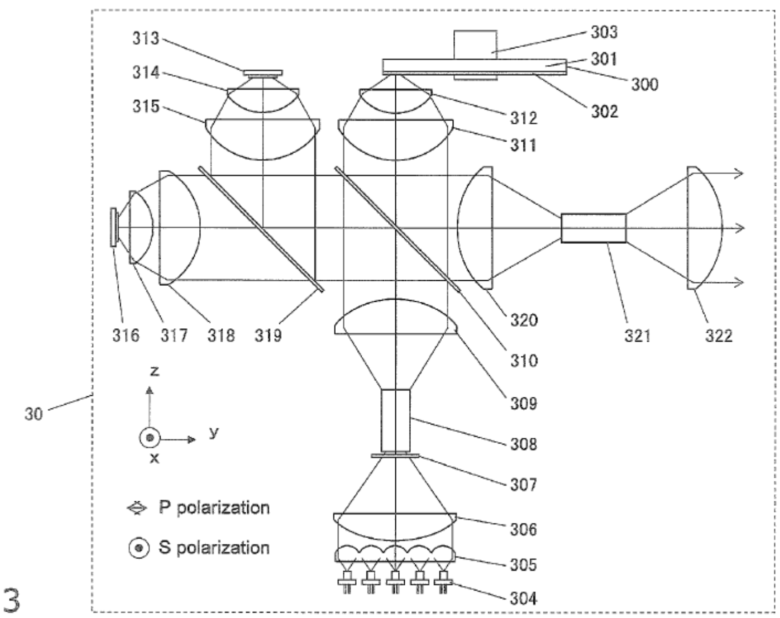


FIG. 3

Kitano notes that "[a] light source device 80 corresponds to the light source device 30 shown in FIG. 3 in the second embodiment." *Id*. [0119].

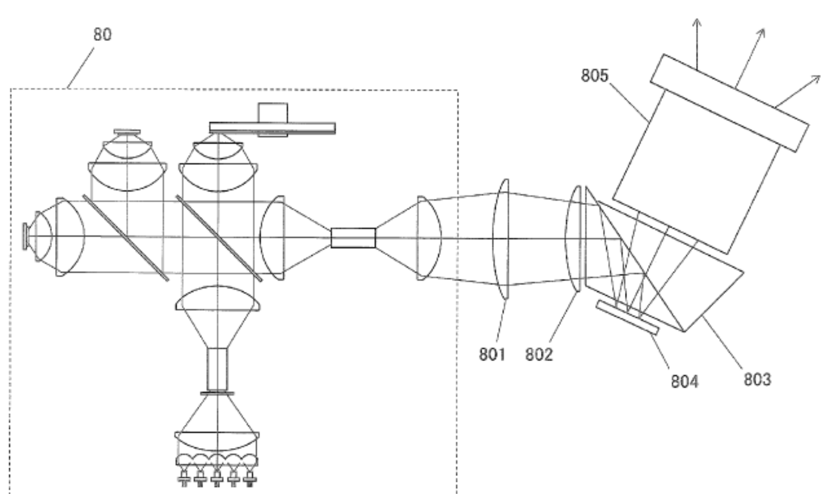


FIG. 9

[8.2] an image display element;

Kitano discloses an image display element. EX1004, ¶¶ 170-171.

Kitano describes that "This output light … is incident on a DMD 804, which is an image display element." EX1007, [0119].

[8.3] an illumination optical system having a plurality of optical elements for irradiating the image display element with light from the light source device; and

Kitano discloses an illumination optical system having a plurality of optical elements for irradiating the image display element with light from the light source device. EX1004, ¶¶ 172-174.

The light from the light source is directed to the element display element DMD 804 by multiple optical elements. EX1004, ¶ 173.

Kitano explains that "[a] light source device 80 corresponds to the light source device 30 shown in FIG. 3 in the second embodiment. The illuminance of the output light of the light source device 80 is equalized at the emission face of the second rod integrator 321. This output light passes through a relay lens 801, a field lens 802, and a full reflection prism 803, and is incident on a DMD 804, which is an image display element." *Id.*, [0119].

[8.4] a projection lens for enlarging an optical image formed by the image display element to project the resulting image,

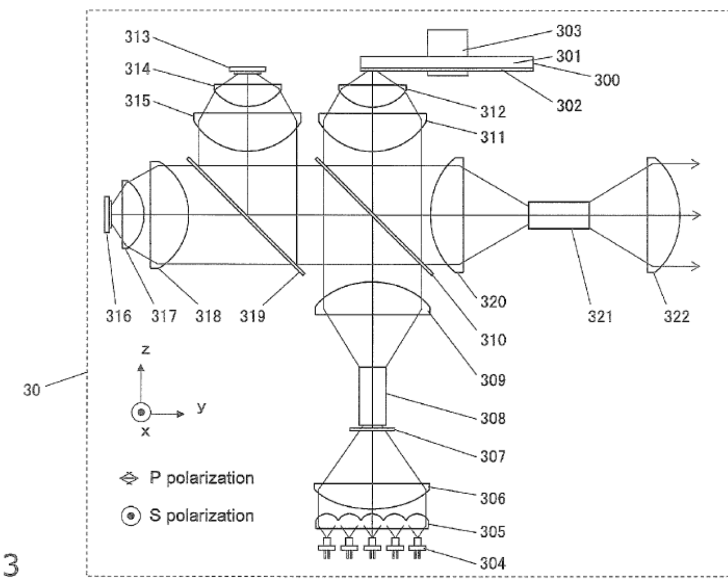
Kitano discloses a projection lens for enlarging an optical image formed by the image display element to project the resulting image. EX1004, ¶¶ 175-176.

Kitano explains that "[t]he signal light modulated by the DMD 804 is projected onto a screen (not shown) by a projecting lens 805." EX1007, [0120].

[8.5] wherein the light source device includes: an excitation light source for emitting excitation light;

Kitano discloses a light source device that includes an excitation light source for emitting excitation light. EX1004, ¶¶ 177-178.

Kitano describes that "FIG. 3 is a diagram of the configuration of the light source device 30 pertaining to a second embodiment …. A laser light source 304 (an example of a first light source component), a collimator lens array 305, a focusing lens or a condensing lens 306, and a diffuser plate 307 are the same as in the first embodiment." *Id*., [0061]-[0062].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304
30
z
y
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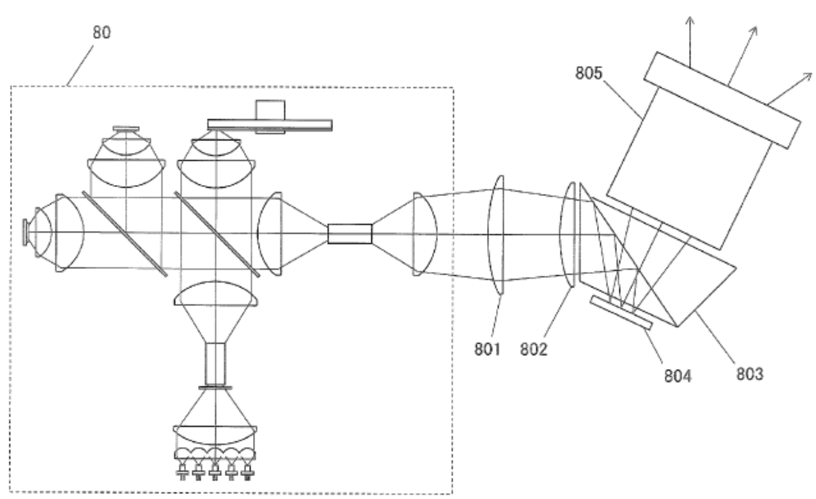
P polarization
S polarization
FIG. 3


80
805
801
802
804
803
FIG. 9

[8.6] a fluorescent material for emitting fluorescent light when excited by the excitation light; and

Kitano discloses a light source device that includes a phosphor (a fluorescent material) for emitting fluorescent light when excited by the excitation light. EX1004, ¶¶ 179-180.

Kitano explains that "[t]he phosphor wheel 300 (an example of a fluorescent component) is made up of a substrate 301, a phosphor 302 applied by coating the substrate 301, and a motor 303." *Id.*, [0071].

[8.7] an optical member for directing the excitation light to the fluorescent material, and

Kitano combined with Kurosaki to disclose a light source device that includes at least an optical member for directing the excitation light to the fluorescent material. EX1004, ¶¶ 181-186.

Kitano discloses that the excitation light has passed through the dichroic mirror and is incident on the fluorescent material (phosphor). *Id.*, ¶ 182.

Kitano discloses that "[a] laser light source 304 (an example of a first light source component), a collimator lens array 305, a focusing lens or a condensing lens 306, and a diffuser plate 307 are the same as in the first embodiment." EX1007, [0062]. Kitano further discloses that "[t]he laser light flux emitted from the first rod integrator 308 is collimated by a collimator lens 309, after which it is incident on a dichroic mirror 310 (an example of a first color separator)." *Id*. [0066]. Kitano further discloses that "[t]he laser light flux that has passed through the dichroic mirror 310 is condensed or focused by focusing lenses or condensing lenses 311 and 312 and is incident on the phosphor." *Id*., [0069].

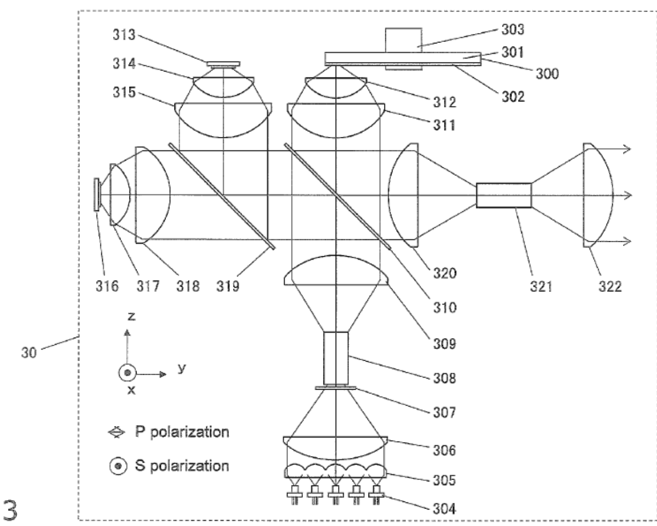
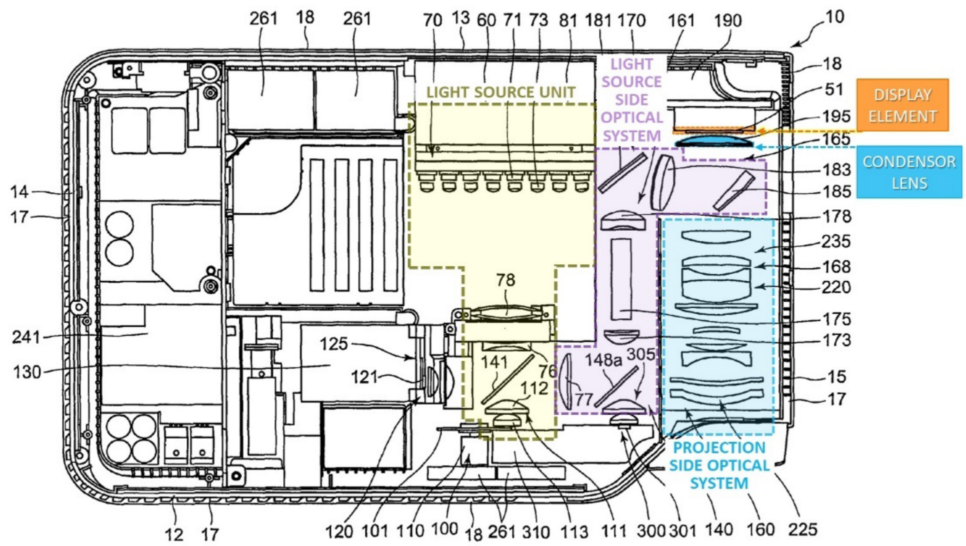


FIG. 3

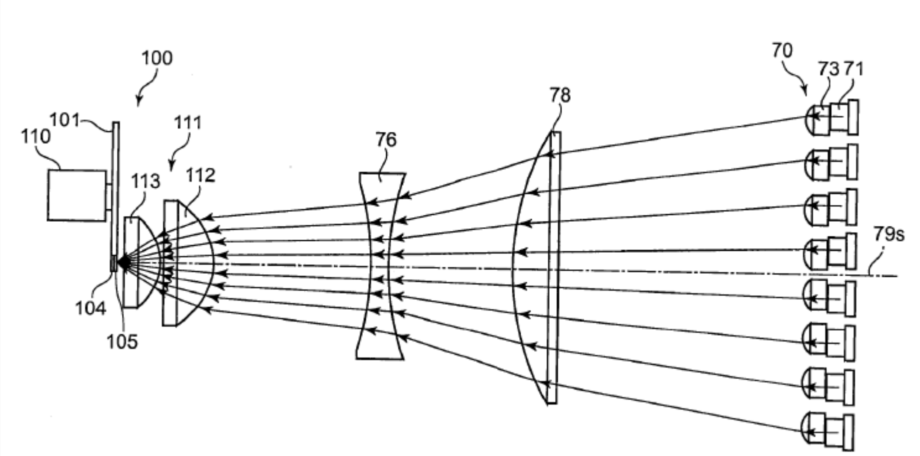
Kurosaki discloses that an optical member, *e.g.,* the convex lens (condenser lens 78) and the concave lens 76, directs the excitation light to the fluorescent material (green phosphor layer). EX1004, ¶ 184.

Kurosaki teaches that "[a]s shown in FIG. 3, light beams that are emitted from the excitation light sources 71 and applied to the green phosphor layer 104 of the phosphor wheel 101 via the collimator lenses 73, the condenser lens 78, the concave lens 76, and a dichroic mirror 141 excite the green phosphor of the green phosphor layer 104." EX1005, 6:22-27.



EX1005, FIG. 3 (annotated)

FIG. 6



As discussed in Section VIII.A.2, *supra*, Kurosaki identifies certain benefits of using a combination of convex and concave lenses disposed in the specified order between the excitation light source and fluorescent material. A POSITA would therefore have been motivated to combine the teaching of Hirata and Kurosaki.

[8.8] the optical member has a curvature that is set such that a light-condensing position of the excitation light is positioned on an emission side of the excitation light relative to the fluorescent material,

Kitano combined with Kurosaki to disclose a light source device that includes at least an optical member having a curvature that is set such that a light-condensing position of the excitation light is positioned on an emission side of the excitation light relative to the fluorescent material. EX1004, ¶¶ 188-193.

See, Section VIII.A.2.a, Element 8.8, *supra*, for the construction of this element.

Kitano discloses that the excitation light is condensed at a light-condensing position on an emission side of the excitation light relative to the fluorescent material, as shown in the annotated figure below. EX1004, ¶ 188.

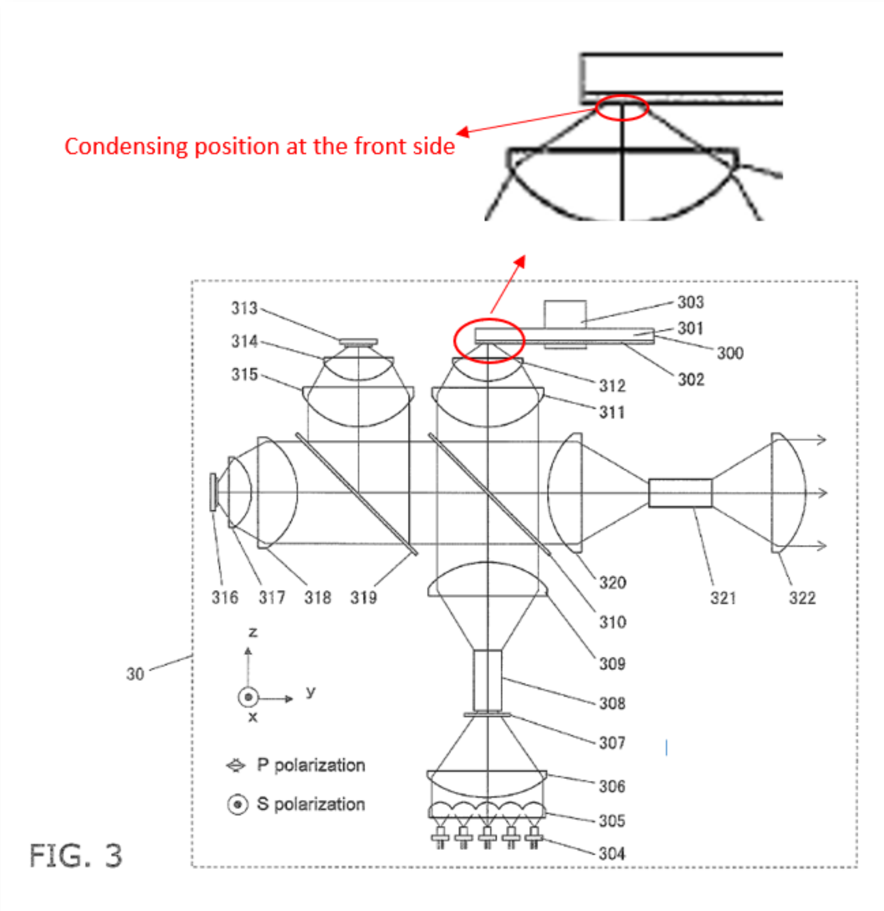


FIG. 3

Specifically, in Kitano, "FIG. 2 shows a specific configuration of the phosphor wheel 100 [in the first embodiment] as seen in the z axis direction… The outermost peripheral portion of the substrate 201 is coated with a phosphor 202 ... The shape of a laser light irradiation spot 204 on the phosphor 202 is indicated by the broken line." *Id*., [0052]. "A laser light source 304 (an example of a first light source component), a collimator lens array 305, a focusing lens or a condensing lens 306, and a diffuser plate 307 are the same as in the first embodiment. Here again, the laser light flux that has passed through the diffuser plate 307 is incident on a first rod integrator 308 (an example of a first illuminance homogenizer)….The laser light flux emitted from the first rod integrator 308 is collimated by a collimator lens 309, after which it is incident on a dichroic mirror 310 (an example of a first color separator)….The laser light flux that has passed through the dichroic mirror 310 is condensed or focused by focusing lenses or condensing lenses 311 and 312 and is incident on the phosphor. … The spot of the laser light flux formed on the phosphor measures 2×1.5 mm.” Id., [0062]-[0070].

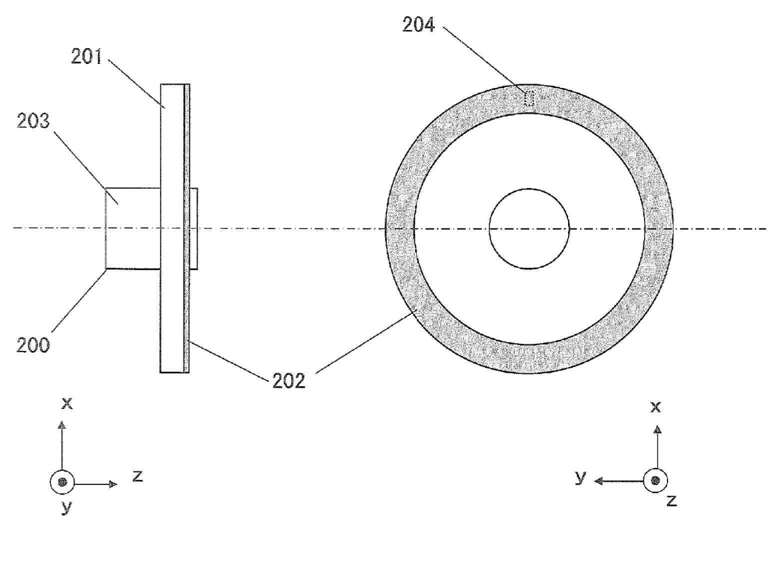


FIG. 2

Kitano further discloses that in the second embodiment, “The outermost peripheral portion of the substrate 301 is coated with the phosphor 302 ...” *Id.*, [0074].

Kitano further discloses that "the flux shape of the green fluorescent light, … incident on the second rod integrator is adjusted to be substantially the same as the rod integrator incident end face shape. Therefore, each kind of light can be efficiently coupled to the rod integrator." *Id*., [0087].

Thus, Kitano discloses a light source in which the convergent excitation light irradiates the phosphor layer over a shaped area, and the shape can be substantially the same as the rod integrator incident end face shape. EX1004, ¶ 192. A light-condensing position of the excitation light is positioned on an emission side of the excitation light relative to the fluorescent material. *Id*. Moreover, the imaginary extensions of the excitation light rays substantially meet at a point on the opposite side of the phosphor layer from the excitation light source, just as shown in the Fig. 1 of the '226 Patent. *Id*.

Alternatively, Kurosaki discloses the optical member having a curvature that is set such that a light-condensing position of the excitation light is positioned on an emission side of the excitation light relative to the fluorescent material. EX1004, ¶ 193. *See*, Section VIII.A.2.a, Element 8.8, *supra*, and EX1005, FIGS. 5 and 6.

[8.9] a dichroic mirror disposed between the excitation light source and the fluorescent material; and

Kitano discloses a light source device that includes a dichroic mirror disposed between the excitation light source and the phosphor (fluorescent material). EX1004, ¶¶ 94-95.

The dichroic mirror is disposed between the excitation light source 304 and the phosphor 302: "The laser light flux emitted from the first rod integrator 308 is collimated by a collimator lens 309, after which it is incident on a dichroic mirror 310 (an example of a first color separator)." EX1007, [0066]. "The laser light flux that has passed through the dichroic mirror 310 is condensed or focused by focusing lenses or condensing lenses 311 and 312 and is incident on the phosphor." *Id.*, [0069].

[8.10] a condenser lens for condensing the excitation light disposed between the fluorescent material and the dichroic mirror,

Kitano discloses a light source device that includes a condenser lens for condensing the excitation light disposed between the phosphor (fluorescent material) and the dichroic mirror. EX1004, ¶¶ 196-197.

Kitano discloses that "[t]he laser light flux that has passed through the dichroic mirror 310 is condensed or focused by focusing lenses or condensing lenses 311 and 312 and is incident on the phosphor."

[8.11] wherein the optical member is disposed between the excitation light source and the dichroic mirror, and

Kitano discloses a light source device that includes the optical member disposed between the excitation light source and the dichroic mirror. EX1004, ¶¶ 198-199.

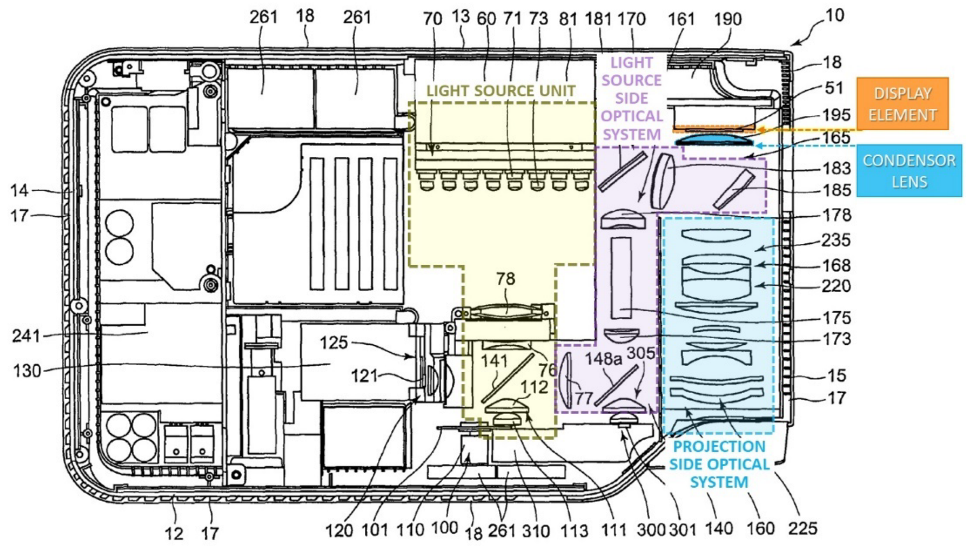
> The light source 30 includes a blue laser light source 304, a collimator lens array 305, a condensing lens 306, and a diffuser plate 307. The laser light flux that has passed through the diffuser plate 307 is incident on a first rod integrator 308, which is a rectangular solid piece of dense quartz glass. The emission end face shape of the first rod integrator 308 is substantially equivalent to the incident end face shape of a second rod integrator 321. EX1007, [0038], [0062]-[0064]. The blue laser light from the first rod integrator 308 passes through the collimator lens 309, the dichroic mirror 310, and condensing lenses 311, 312, and converges onto a phosphor 302 on a substrate 301.

EX1007, [0066]-[0071].

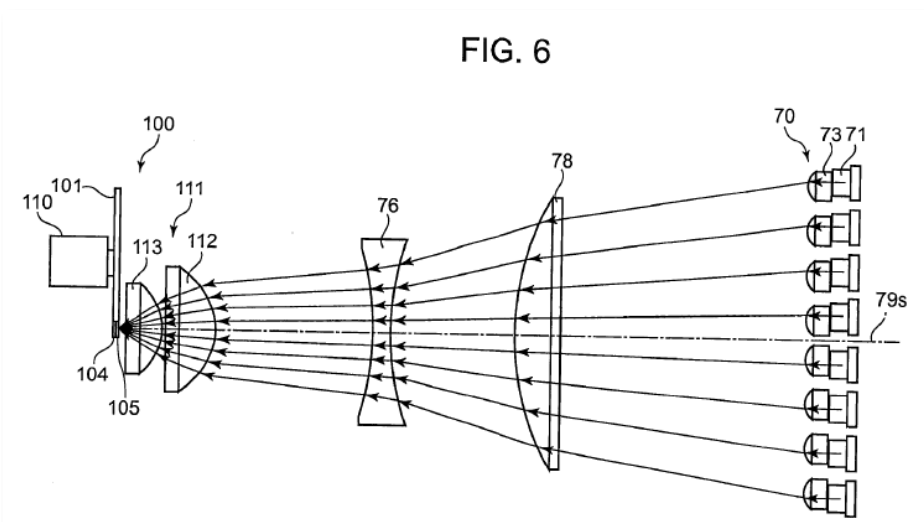
> **[8.12] wherein the optical member is a convex lens and a concave lens, with the convex lens and the concave lens being disposed in this order from the excitation light source toward the dichroic mirror.**

Kitano combined with Kurosaki disclose a light source device having an optical member that is a convex lens and a concave lens, with the convex lens and the concave lens being disposed in this order from the excitation light source toward the dichroic mirror. EX1004, ¶¶ 200-202.

See, Section VIII.A.2.a, Element 8.12, *supra*, and EX1005, FIGS. 3 and 6.



EX1005, FIG 3 (annotated)



b) Dependent Claim 10

[10.0/10.1] The projection-type image display device according to claim 8, wherein at least either one of the convex lens

and the concave lens has a curvature that is set so as to allow the excitation light to be made incident on the fluorescent material at a front side of the fluorescent material as a light-condensing position.

Kitano combine with Kurosaki to disclose that at least either one of the convex lens and the concave lens has a curvature that is set so as to allow the excitation light to be made incident on the fluorescent material at a front side of the fluorescent material as a light-condensing position. EX1004, ¶¶ 203-210.

See, Section VIII.A.2.b, *supra*, for the construction of this element.

Kitano discloses that the excitation light is condensed at a light-condensing position at a front side of the fluorescent material as a light-condensing position, as shown in the annotated figure below. EX1004, ¶ 204.

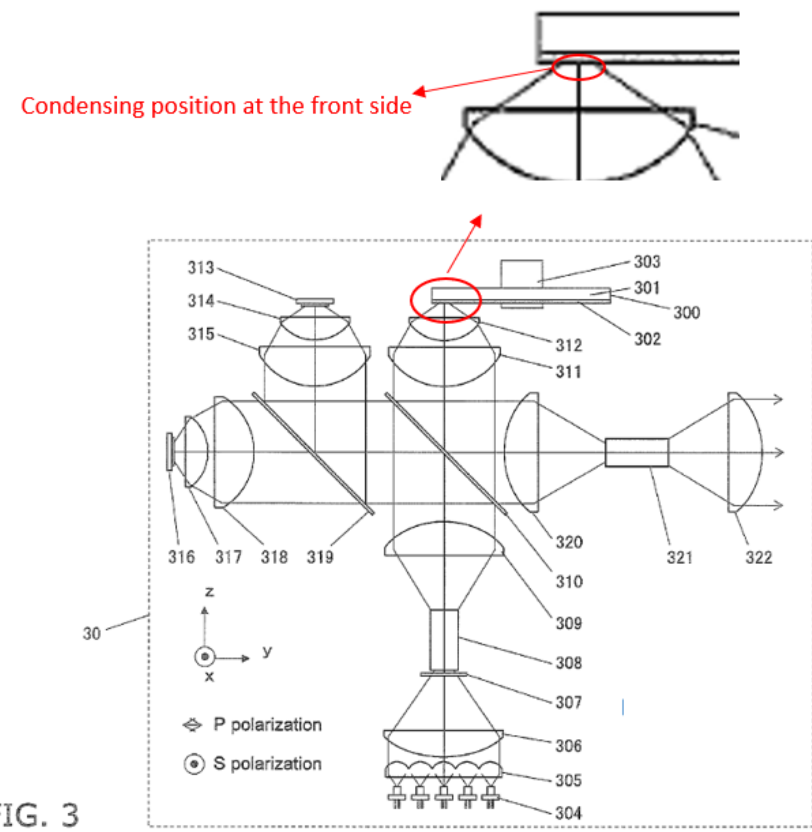


FIG. 3

Specifically, in Kitano, "FIG. 2 shows a specific configuration of the phosphor wheel 100 [in the first embodiment]. The outermost peripheral portion of the substrate 201 is coated with a phosphor 202. The shape of a laser light irradiation spot 204 on the phosphor 202 is indicated by the broken line." *Id.*, [0052].

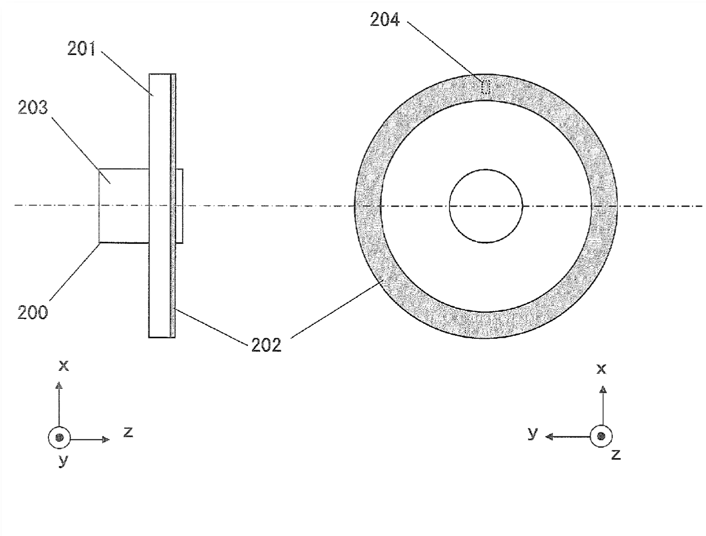


FIG. 2

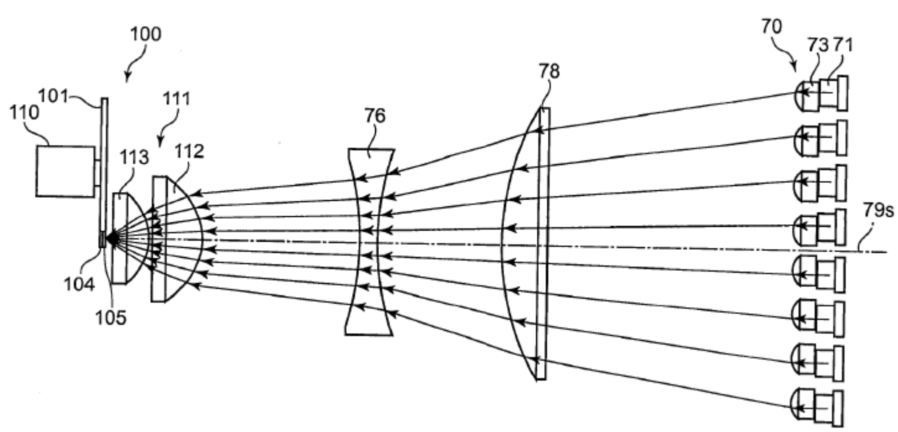
Kitano further discloses that in the second embodiment, "The outermost peripheral portion of the substrate 301 is coated with the phosphor 302." *Id*., [0074].

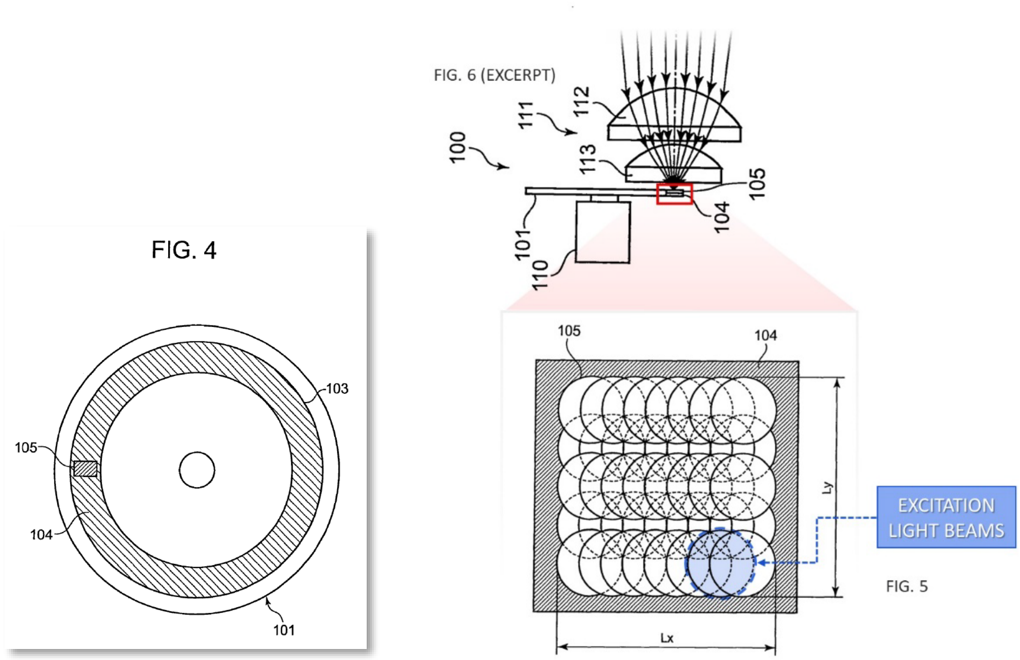
Kitano further discloses that "the flux shape of the green fluorescent light … incident on the second rod integrator is adjusted to be substantially the same as the rod integrator incident end face shape. Therefore, each kind of light can be efficiently coupled to the rod integrator." *Id*., [0087].

Thus, Kitano discloses a light source in which the convergent excitation light irradiates the phosphor layer over a shaped area, and the shape can be substantially the same as the rod integrator incident end face shape. EX1004, ¶ 208. The excitation light is incident on the fluorescent material at a front side of the fluorescent material as a light-condensing position. *Id*. Moreover, the imaginary extensions of the excitation light rays substantially meet at a point on the opposite side of the phosphor layer from the excitation light source, just as shown in the Fig. 1 of the 226 Patent. *Id*.

Alternatively, Kurosaki discloses the optical member having a curvature that is set such that the excitation light to be made incident on the fluorescent material at a front side of the fluorescent material as a light-condensing position. EX1004, ¶ 209. *See*, Section VIII.A.2.a, Element 8.12 and Section VIII.A.2.b, Element 10.0/10.1, *supra*, and EX1005, FIGS. 5 and 6.

FIG. 6





EX1005, FIGS. 4, 5 and 6 (annotated)

c) Dependent Claim 12

[12.0/12.1] The projection-type image display device according to claim 8, wherein the excitation light irradiated onto the fluorescent material has a luminance distribution that is substantially analogous to the image display element.

Kitano discloses that the excitation light irradiated onto the fluorescent material has a luminance distribution that is substantially analogous to the image display element. EX1004, ¶¶ 211-217.

Kitano discloses that "[w]ith an illumination device for an image display device, it is generally necessary to use illumination light having a rectangular spatial intensity distribution that matches the shape of the DMD or liquid crystal display-equivalent element." EX1007, [0014].

Kitano further discloses that "[a] light source device 80 corresponds to the light source device 30 shown in FIG. 3 in the second embodiment. The illuminance of the output light of the light source device 80 is equalized at the emission face of the second rod integrator 321. This output light passes through a relay lens 801, a field lens 802, and a full reflection prism 803, and is incident on a DMD 804, which is an image display element." *Id*., [0119].

Kitano further teaches that "[w]ith this technology, a laser light flux and a fluorescent light flux having a spatially uniform light intensity distribution can be obtained with a simple configuration. More specifically, a rectangular, uniform spatial intensity distribution can be easily formed with respect to the laser light flux and fluorescent light flux." *Id*., [0136].

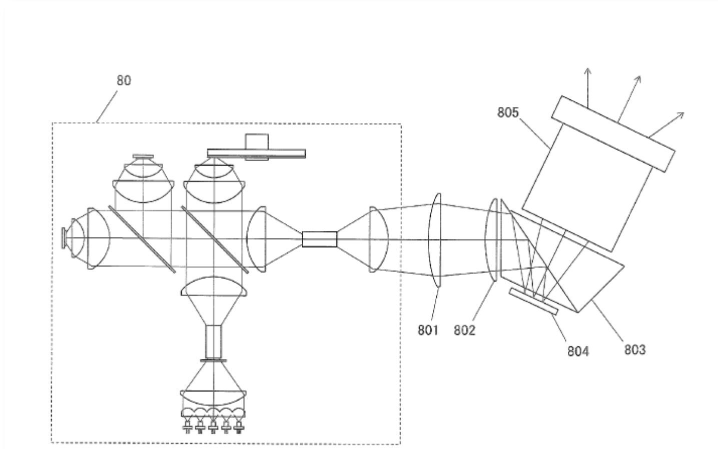
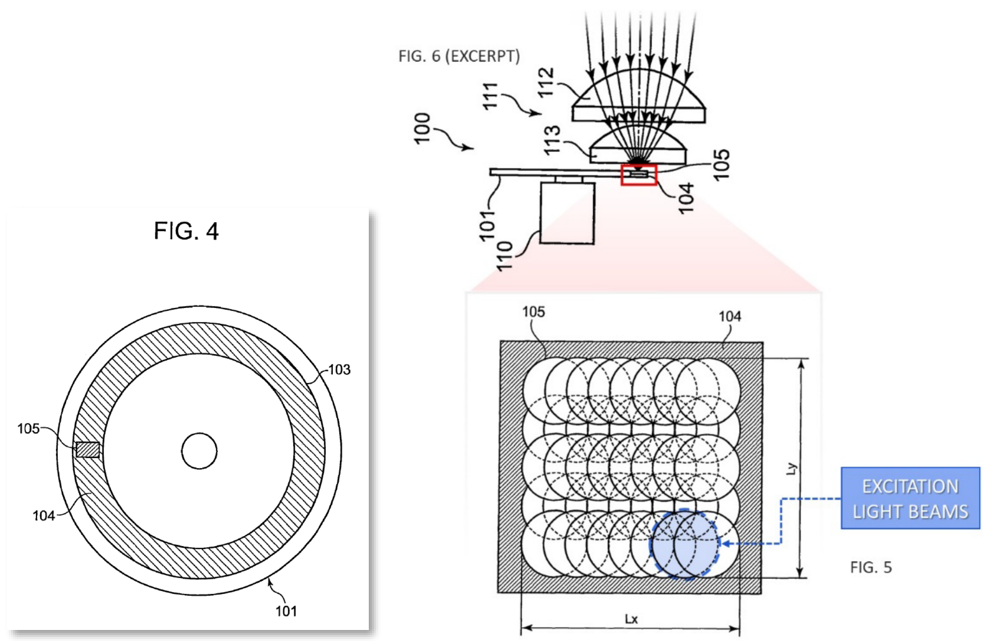


FIG. 9

Kurosaki discloses that the excitation light irradiated onto the fluorescent material has a luminance distribution that is substantially analogous to the image display element.

See, Section VIII.A.2.c, *supra*, and EX1005, FIGS. 4 and 5 for Kurosaki's disclosure of this element and Section VIII.D.2, *supra*, for motivation to combine Kurosaki with Kitano.



EX1005, FIGS. 4, 5 and 6 (annotated)

IX. CONCLUSION

Petitioners respectfully request that a trial be instituted. Claims 8, 10, and 12 should be cancelled.

Respectfully submitted,

Date: January 17, 2025

/Donald R. McPhail/
Donald McPhail
Counsel for Petitioners
Registration No. 35,811

CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. § 42.24, the undersigned attorney for the Petitioners declares that the argument section of this Petition has 12,344 words, according to the word count tool in Microsoft Word™.

/Donald R. McPhail/
Donald R. McPhail
Counsel for Petitioners
Registration No. 35,811

CERTIFICATE OF SERVICE

The undersigned certifies, in accordance with 37 C.F.R. §§ 42.105 and 42.6, that service was made on the Patent Owner as detailed below.

Date of service	January 17, 2025
Manner of service	Electronic Mail and UPS Mail Service
Documents served	Petition for *Inter Partes* Review, including Exhibits and Power of Attorney

Served upon:

Bryan C. Nese (Via Electronic Mail) Mayer Brown 1999 K Street, NW Washington, DC 20006-1101 202-263-3266 bnese@mayerbrown.com Litigation Counsel	Antonelli, Terry, Stout & Kraus, LLP - Arlington, VA (Via UPS) 1300 North Seventeenth Street Suite 1800 Arlington, VA 22209
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Date: January 17, 2025

Respectfully Submitted,

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APPENDIX A – CLAIM LISTING

U.S. Patent No. 9,547,226

Claim or Element #	Claim Language
Claim 8	
[8.0]	A projection-type image display device comprising:
[8.1]	a light source device;
[8.2]	an image display element;
[8.3]	an illumination optical system having a plurality of optical elements for irradiating the image display element with light from the light source device; and
[8.4]	a projection lens for enlarging an optical image formed by the image display element to project the resulting image,
[8.5]	wherein the light source device includes: an excitation light source for emitting excitation light;
[8.6]	a fluorescent material for emitting fluorescent light when excited by the excitation light; and
[8.7]	an optical member for directing the excitation light to the fluorescent material, and

[8.8]	the optical member has a curvature that is set such that a light-condensing position of the excitation light is positioned on an emission side of the excitation light relative to the fluorescent material,
[8.9]	a dichroic mirror disposed between the excitation light source and the fluorescent material; and
[8.10]	a condenser lens for condensing the excitation light disposed between the fluorescent material and the dichroic mirror,
[8.11]	wherein the optical member is disposed between the excitation light source and the dichroic mirror, and
[8.12]	wherein the optical member is a convex lens and a concave lens, with the convex lens and the concave lens being disposed in this order from the excitation light source toward the dichroic mirror.
Claim 10	
[10.0]	The projection-type image display device according to claim 8,
[10.1]	wherein at least either one of the convex lens and the concave lens has a curvature that is set so as to allow the excitation light to be made incident on the fluorescent material at a front side of the fluorescent material as a light-condensing position.
Claim 12	

[12.0]	The projection-type image display device according to claim 8,
[12.1]	wherein the excitation light irradiated onto the fluorescent material has a luminance distribution that is substantially analogous to the image display element.