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

DECLARATION OF DR. JOSE SASIAN

IN SUPPORT OF PETITION FOR INTER PARTES REVIEW

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

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I, Jose Sasian, declare as follows:

I. Introduction

1. I am an independent consultant. I am over eighteen years of age, and I would otherwise be competent to testify as to the matters set forth herein if I am called upon to do so.

2. I have prepared this Declaration for consideration by the Patent Trial and Appeal Board in the *Inter* Partes Review of U.S. Patent No. 9,547,226 ("the '226 Patent").

3. I provide this Declaration at the request of Coretronic Corporation and Optoma Corporation (collectively, "Petitioners") in connection with the above-captioned *Inter Partes* Review. I have been informed and understand that Petitioners contend that claims 8, 10, and 12 of the '226 Patent are unpatentable.

4. I have been asked to provide my opinions regarding whether claims 8, 10, and 12 of the '226 Patent are unpatentable because they were anticipated by the prior art, or would have been obvious to a person of ordinary skill in the art ("POSITA") at the time of the alleged invention, in light of the prior art. After careful analysis it is my opinion that the subject matter of claims 8, 10, and 12 were anticipated by the prior art and would have been obvious to a POSITA.

5. I am being compensated at my standard hourly rate of $650 per hour. My compensation is not dependent on the outcome of, or any issue in relation to, the above-captioned *Inter Partes* Review. I have no interest in any of the parties.

6. In forming my opinions, I relied on my knowledge and experience in the field and on documents and information referenced in this Declaration.

7. My complete qualifications and professional experience are described in my *Curriculum Vitae*, a copy of which can be found in EX1003. The following is a brief summary of my relevant qualifications and professional experience.

8. I am not an attorney. As shown in my *Curriculum Vitae*, I have extensive academic and industry experience with optical engineering. Specifically, I have over thirty years of academic and industry experience in the field of optical sciences and optical engineering in general, including optical instrumentation, optical design, and optical fabrication and testing.

9. I am currently a full-time, tenured Professor of Optical Sciences at the Wyant College of Optical Sciences at the University of Arizona in Tucson, Arizona, a position I have held since 2002. As a professor, I teach and perform research in the field of optical design. For example, I teach my students how to design lenses and mirrors and how to think about light so that they can design useful optical systems. As part of my academic and research responsibilities I am frequently involved with the design, fabrication, and testing of optical devices.

10. From 1995 to 2001, prior to receiving tenure, I was an Associate Professor of Optical Sciences at the University of Arizona. Prior to joining the University of Arizona faculty, I was a member of the technical staff of AT&T Bell Laboratories from 1990 to 1995. From 1984 to 1987, I was a Research Assistant, and from 1988 to 1990, I was a Research Associate, in the Optical Sciences Center at the University of Arizona. From 1976 to 1984, I was an optician at the Institute of Astronomy at the University of Mexico.

11. I received a Bachelor of Science degree in Physics from the University of Mexico in 1982, a Master of Science degree in Optical Sciences from the University of Arizona in 1987, and a Ph.D. in Optical Sciences from the University of Arizona in 1988. My research areas include optical design, fabrication, and testing of optical instruments, astronomical optics, diffractive optics, opto-mechanical design, light in gemstones, lithography optics, and light propagation.

12. At the University of Arizona, I have taught the courses Lens Design OPTI 517 (1997-present), Introduction to Aberrations OPTI 518 (2005-present), Advanced Lens Design OPTI 696A (2008, 2012, 2017, 2021), Illumination Optics Seminar (1997-2000), Introduction to Opto-mechanics OPTI 690 (1998, 2001, 2003, 2004, 2005), Optical Shop Practices OPTI 597A (1996-present), and Optical Specification, Fabrication and Testing OPTI 415 (2023-present). In these classes, among other things, I teach students how to design optical systems for imaging and

for uniform illumination, how to mount optical elements properly so that their physical integrity is preserved, and properly align and test optical systems.

13. I have directed several student reports, theses, and dissertations in the area of optical design. I have lectured regarding my work, and have published, along with students and colleagues, over one hundred scientific papers in the area of optics. These include technical papers, student reports and theses done under my direction, related to photographic optics and illumination. For example:

a. Efficient EUV collector designs, USP 7,405,871, 2009

b. Sukmock Lee, Byongoh Kim, Jiyeon Lee, and Jose Sasian, "Accurate determination of distortion for smart phone cameras," Applied Optics, Vol. 53, Issue 29, pp. H1-H6 (2014).

c. D. Reshidko and J. Sasian, "Role of aberrations in the relative illumination of a lens system," - Opt. Eng. 55(11), 115105 (Nov 29, 2016). doi:10.1117/1.OE.55.11.115105.

d. Jose Sasian, Dmitry Reshidko, and Chia-Ling Li, "Aspheric/freeform optical surface description for controlling illumination from point-like light sources," Opt. Eng. 55(11), 115104 (Nov 25, 2016). doi:10.1117/1.OE.55.11.115104

e. Jieun Ryu, Jose Sasian, "Tolerancing a lens for LED uniform illumination," Proc. SPIE 10377, Optical System Alignment, Tolerancing, and Verification XI, 1037703 (22 August 2017); doi: 10.1117/12.2276864

f. Lerner, S.A. and J. M. Sasian, "Optical Design Using Novel Aspheric Surfaces", SPIE Annual Meeting, San Diego, Proc. SPIE 4092, 17-25, August 2000.

g. Lenny Laughlin and Jose M. Sasian, "Source modeling and calculation of mask illumination during extreme ultraviolet lithography condenser design," SPIE Proceedings Vol. 4832, 283-292, 2002.

14. Since 1995, I have been a consultant. My consulting has included designing lens or mirror systems for cell-phones, microscopes, projectors, telescopes, medical devices, optical displays, and high speed photography, as well as designing optical systems for uniform illumination. I hold patents and patent applications related to lens systems. I am familiar with electronic circuit boards and electronic test instruments. I also have worked with or designed with LEDs and other types of light sources, including light diffusers, for uniform illumination.

15. I have been a topical editor and reviewer for the peer-reviewed journals Applied Optics and Optical Engineering. I am a fellow of the International Society for Optics and Photonics (SPIE), a fellow of OPTICA (formerly the Optical Society of America), and a lifetime member of the Optical Society of India.

16. I have served as a co-chair for the conferences "Novel Optical Systems: Design and Optimization" (1997-2006), "Optical systems alignment, tolerancing,

and verification" (2007-2021), and "International Optical Design Conference," (2002). I have taught the course: Advanced Lens Design: Art and Science in Japan (2014, 2016, and 2017). I teach the short course Mirror System Design with Freeform Surfaces at the SPIE Symposium: https://spie.org/education/courses/coursedetail/SC1272.

17. I have been a co-editor of approximately 28 published conference proceedings from SPIE. I am the author of the book, "Introduction to Aberrations in Optical Imaging Systems," by Cambridge University Press, 2013; and of the book "Introduction to Lens Design," by Cambridge University Press, 2019. I am named as an inventor on approximately 18 U.S. patents, and on 3 U.S. patent applications.

18. A more detailed summary of my background, experience, and publications is contained in my CV attached hereto as Exhibit 1003.

II. Information Considered

19. I have considered the following documents:

a. The '226 Patent (EX1001);

b. The prosecution history of the '226 Patent (EX1002);

c. U.S. Patent No. 8,721,087 B2 ("Kurosaki") (EX1005);

d. Japanese Patent Publication 2012-199075 ("Miyamae") (EX1006);

e. U.S. Patent Application Publication No. 2013/0088471 A1 ("Kitano") (EX1007).

20. In addition to the documents above, in forming the opinions expressed below, I have also considered:

a. My own knowledge and experience, as described above and in my CV; and

b. The level of skill of a POSITA at the time of the alleged invention of the '226 Patent.

III. Anticipation and Obviousness

21. I have been informed and understand that a claim is "anticipated" if each and every element of a claim is disclosed, either expressly or inherently, in a single prior art reference.

22. I have been informed and understand that a claim is "obvious" in light of the prior art if the difference or differences between the claimed subject matter and the prior art are such that the subject matter as a whole would have been obvious, at the time the invention was made, to a person having ordinary skill in the art. I have been informed and understand that the Supreme Court provided an outline for analyzing obviousness in which it rejected an earlier test in favor of an "expansive and flexible approach" using "common sense." I have also been informed and understand that the Supreme Court explained that under the correct analysis, any

need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed. I have also been informed and understand that the Supreme Court explained that "[t]he combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." I further have been informed and understand that the Court pointed to other factors that may show obviousness. These factors include the following principles:

a. combination that unites old elements with no change in their respective functions is unpatentable. As a result, the combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results,
b. a predictable variation of a work in the same or a different field of endeavor is likely obvious if a person of ordinary skill would be able to implement the variation,
c. an invention is obvious if it is the use of a known technique to improve a similar device in the same way, unless the actual application of the technique would have been beyond the skill of the person of ordinary skill in the art. In this case, a key inquiry is whether the improvement is more than the predictable use of prior art elements according to their established functions,

d. an invention is obvious if there existed at the time of invention a known problem for which there was an obvious solution encompassed by the patent's claims,

e. inventions that were "obvious to try" — chosen from a finite number of identified, predictable solutions, with a reasonable expectation of success — are likely obvious,

f. known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations would have been predictable to one of ordinary skill in the art, and

g. an explicit teaching, suggestion, or motivation in the art to combine references, while not a requirement for a finding of obviousness, remains "a helpful insight" upon which a finding of obviousness may be based.

IV. Claim Construction

23. I have been informed and understand that, in an *inter partes* review, claim terms are construed according to their ordinary and customary meaning as understood by one of ordinary skill in the art in view of the specification and the prosecution history of the patent. Independent claim 8 of the '226 Patent reads:

8. A projection-type image display device comprising:

a light source device;

an image display element;

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

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

wherein the light source device includes:

an excitation light source for emitting excitation light;

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

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

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,

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

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

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

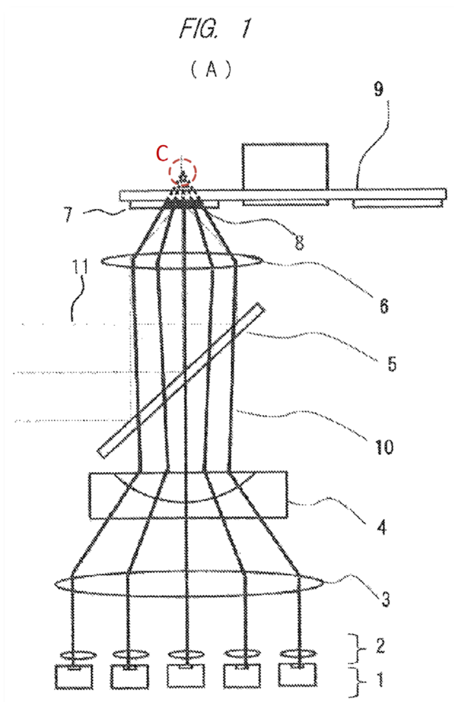
wherein the optical member is a convex lens and a concave lens, with the convex lens and the concave lens being disposed in this order from the excitation light source toward the dichroic mirror.

24. Claims 10 and 12 both depend directly from claim 1. Claim 10 adds the limitation "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 adds the limitation "wherein the excitation light irradiated onto the fluorescent material has a luminance distribution that is substantially analogous to the image display element."

25. In my opinion, the claims of the '226 Patent use terms that have ordinary and customary meanings in the art, and do not use these terms inconsistently with those ordinary and customary meanings, except "a light condensing position" recited in claims 1 and 10, and "an emission side of the excitation light relative to the fluorescent material" in claim 1. Therefore, it is my opinion that no terms other than these two terms need an explicit construction.

26. In my opinion, the term "a light condensing position" means "an illumination region formed by converging light rays."

27. "A light-condensing position" does not, by itself, has an ordinary and customary meaning to a POSITA. Furthermore, this term is ambiguous in the context of the specification and the prosecution history of the patent: On the one hand, "a light-condensing position could mean a location where light rays come to a point, as indicated by the annotation "C" in Fig. 1, reproduced below, of the '226 Patent.



EX1001, FIG. 1 (annotated)

28. On the other hand, the '226 Patent appears to also suggest that the "light-condensing position" is a region (irradiation region 8) illuminated by converging light rays on the side of the fluorescent material (7) facing the excitation light source (1):

> the excitation light 10 that has passed through the condenser lens 6 is made 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, 3:45-51 (emphases added). Because converging light rays results in a more concentrated, or condensed, illumination, it is my opinion that, to the extent that the term "a light-condensing position" can be interpreted, in light of the specification, it should mean "an illumination region formed by converging light rays."

29. Regarding "an emission side of the excitation light relative to the fluorescent material," this term is ambiguous because it is unclear what a "side of the excitation light" is. It is my opinion that, because the passage quoted above in paragraph 28 appears to suggest that "front side" and "emission side" refer to the same side of the fluorescent material, to the extent that the term "an emission side of the excitation light relative to the fluorescent material" can be interpreted, in light of the specification, as meaning "the surface of the fluorescent material on the side facing the excitation light source."

V. Level of Skill in the Art

30. I have been informed that obviousness is considered from the perspective of a person of ordinary skill in the art at the time of the invention. I understand that several factors are considered in determining the level of ordinary skill in the art, including the educational level of active workers in the field, the types

of problems encountered in the art, the nature of the prior art solutions to those problems, prior art patents and publications, the activities of others, the sophistication of the technology involved, and the rapidity of innovations in the field. I have been informed that the filing date of the Japanese application to which the ’226 Patent claims priority is June 15, 2006.

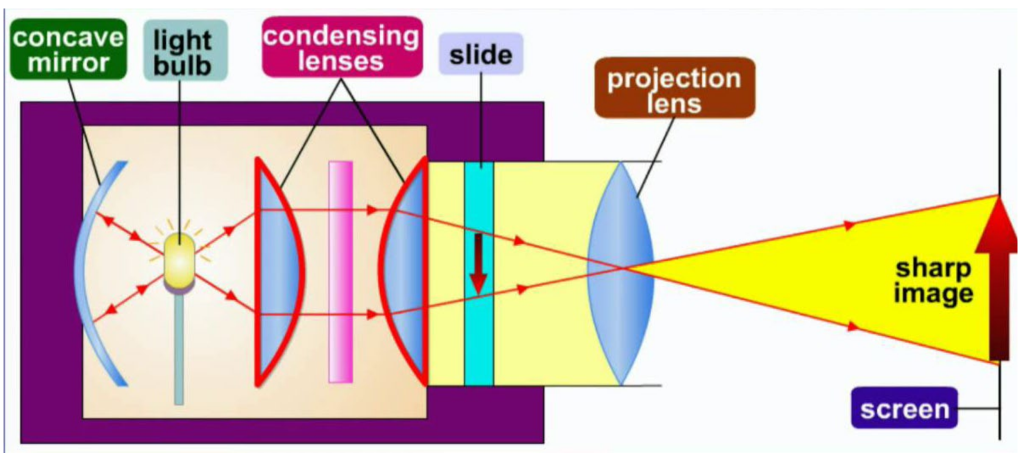
31. In my opinion, a POSITA at the time of the invention of the ’226 Patent would have had a Ph.D. in electrical engineering, physics, optical sciences, optical engineering, or a related scientific or engineering field, and at least one to two years of work or research experience in optical engineering,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

32. I met and exceeded the above qualifications for a POSITA as of at least June 15, 2006 (and thereafter) and consider myself to be a person with at least ordinary skill in the art of the ’226 Patent. My experience working with undergraduate students, graduate students, postdoctoral fellows, industry professionals, and others in the relevant field provides me with significant insight on the knowledge of a POSITA.

VI. Background on Relevant Technology

33. I provide the following background information on technology relevant to the ’226 Patent based on my general knowledge and experience in the fields of optical engineering and optical science.

34. The development of optical projectors goes back to the Magic Lantern, which evolved into slide projectors, overhead projectors, and movie film projectors. With the advent of micro-photolithography, optical projectors further evolved as digital projectors, and complex projectors for the fabrication of micro-electronic circuits.

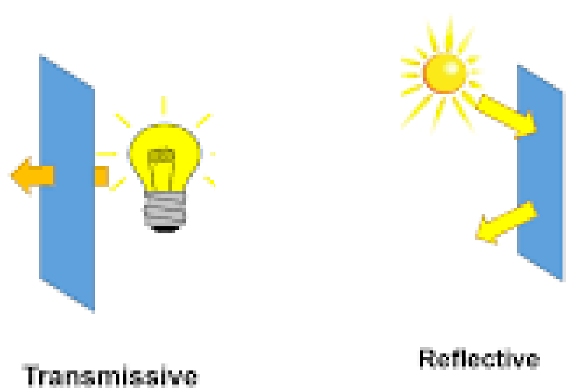


35. The main block components of an optical projector are a light source, a light condenser, a transparency or subject to be projected, a projection lens, and a screen. In all projectors, the efficient use of the available light is important. Much effort is put into minimizing light loss and minimizing loss of energy in the form of heat. Often a fan is included to remove heat from the projector components.

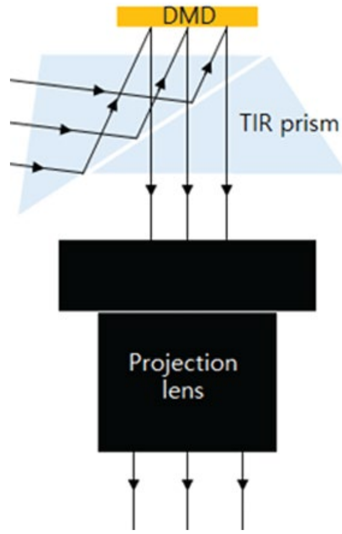
36. The condenser optics' function is to transmit as much light as possible from the light source to the slide or image display; the condenser must illuminate the slide, or image display, in a uniform manner.

37. The projection lens's function is to form an image of the slide, or image display such as a liquid crystal display (LCD) or digital micro-mirror display (DMD), on the screen. The image formed on the screen must be sharp, free of distortions, and have high contrast.

38. Early projectors used a transparency, film, or slide as the subject to be projected onto the screen. Modern digital projectors use a light valve instead. The light valve can be an LCD or a DMD. A light valve can, in addition, transmit or reflect light cast by the condenser optics.



39. Projectors that use a DMD image display work on reflecting light and may require a prism to input the light from the condenser optics.



40. Because of the need to improve the light efficiency of projectors, reduce environmental impact, and reduce cost, optical projectors have further evolved. The use of LEDs or lasers as the light sources has permitted this progress.

41. The projection lens is often a multi-lens element so that sharp images can be cast at high contrast.

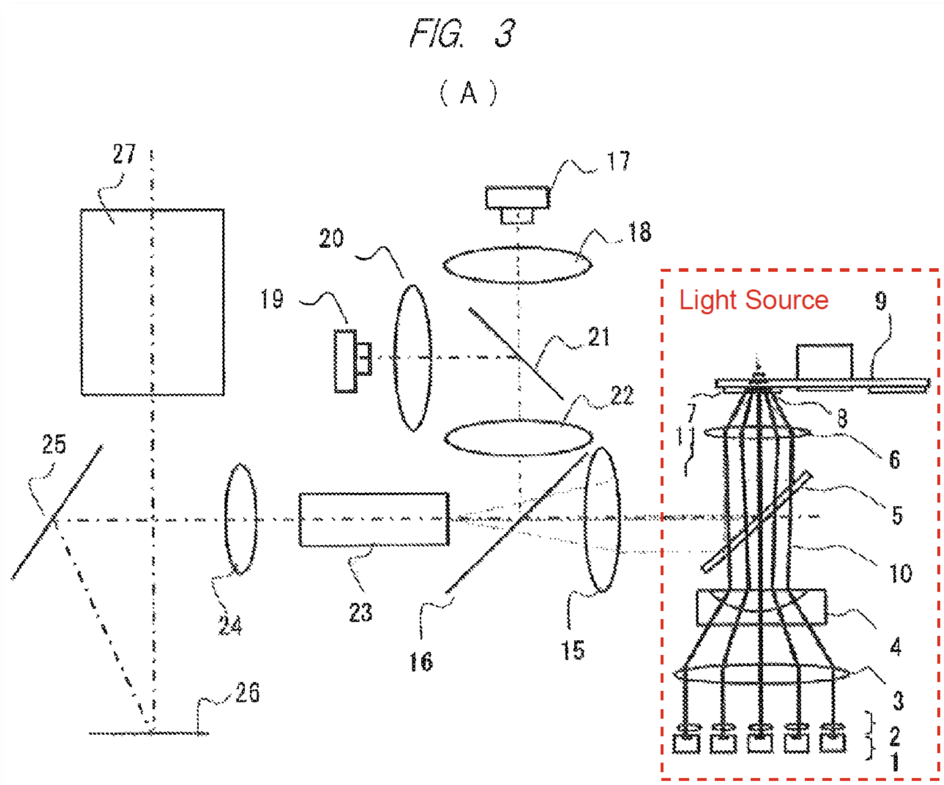
VII. U.S. Patent No. 9,547,226 (the "'226 Patent")

42. I have been informed and understand that the earliest priority date to which the Patent Owner may claim the '226 Patent is entitled is November 1, 2012. For purposes of my analysis herein, I am assuming that the '226 Patent is entitled to this priority date. All of the references discussed below qualify as prior art based on this assumed priority date of November 1, 2012.

43. 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.

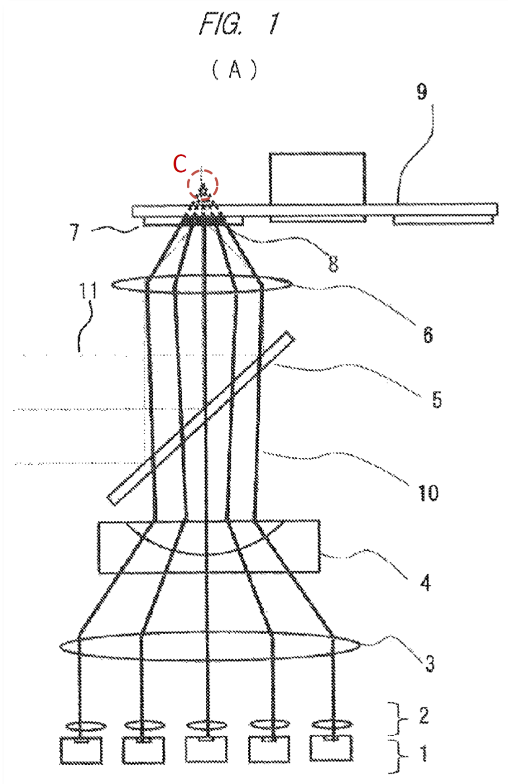
44. Fig. 3(A) shows an optical system of a projection-type image display device (color annotations added):



EX1001, FIG. 3 (annotated)

45. 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.

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



EX1001, FIG. 1 (annotated)

47. 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.

48. 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. 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. 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.

49. 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.

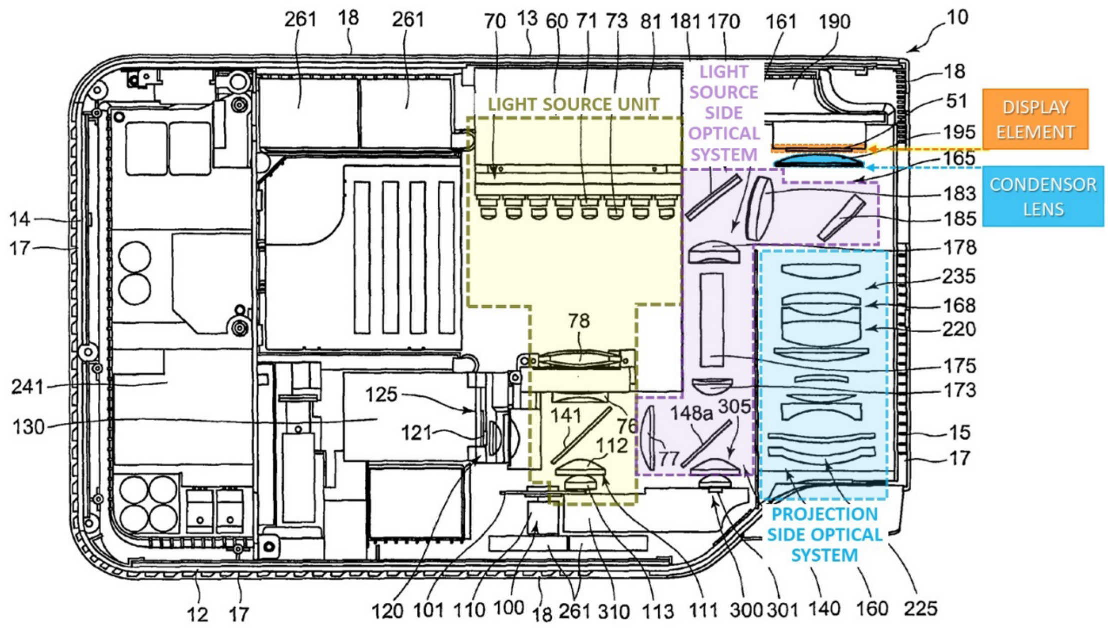
50. As relevant to the claims challenged in the Petition, claim 9 was amended to incorporate the limitations of claims 11 and 12, which are also found in the rejected claim 19, and was issued as the challenged claim 8 ; claim 13 that was issued as the challenged claim 10 has the limitations that are 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.

VIII. Prior Art

A. Kurosaki (EX1005)

51. 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. I understand that Kurosaki qualifies as prior art and that Kurosaki was neither cited nor considered by the Examiner during prosecution of the '226 Patent. Id.

52. Kurosaki describes a projector 10:

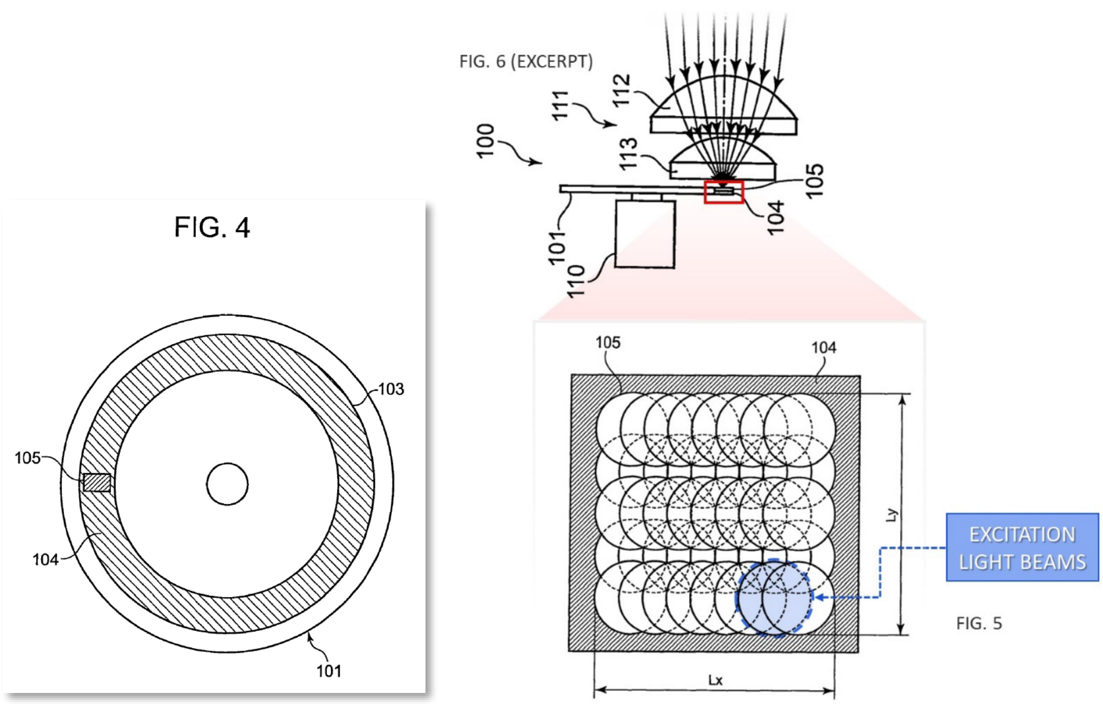


EX1005, FIG 3 (annotated)

53. 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.

54. 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)

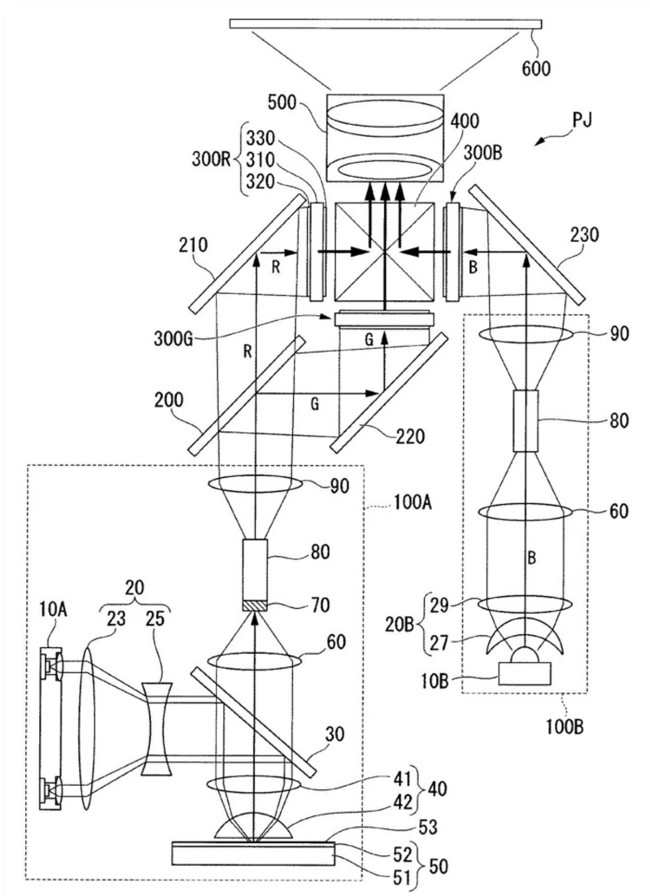
55. Excitation light beams emitted from the respective excitation light sources 71 fall on region 105 of the phosphor layer 104, such that excitation light beams have an approximately uniform illumination intensity distribution in the rectangular region 105 having a width Lx in the right-left direction 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.

B. Miyamae (EX1006)

56. 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. I understand that Miyamae qualifies as prior art and that Miyamae was neither cited nor considered by the Examiner during prosecution of the '226 Patent. Id.

57. 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].

58. 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].



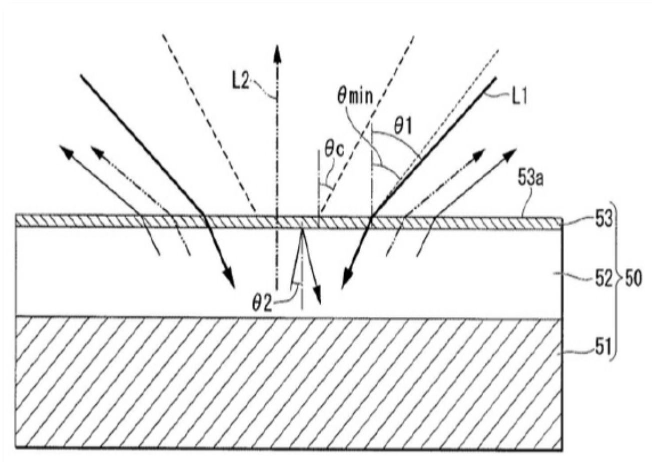
EX1006, FIG. 1

59. 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].

60. 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].

61. 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].

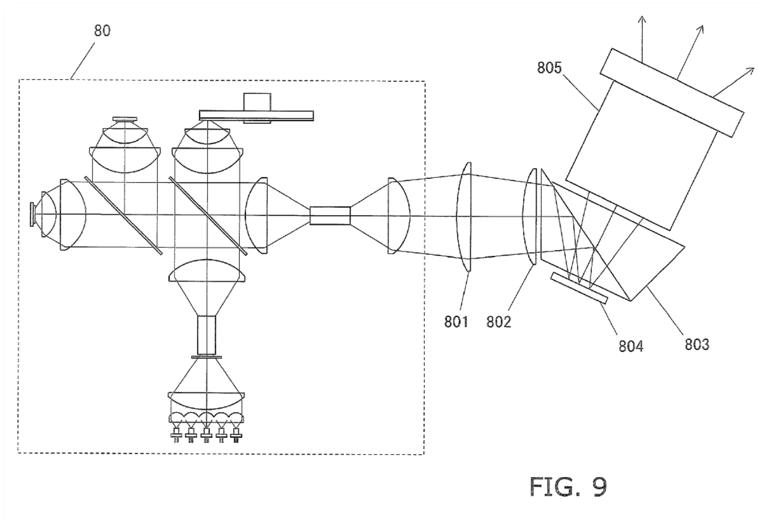


EX1006, FIG. 5

C. Kitano (EX1007)

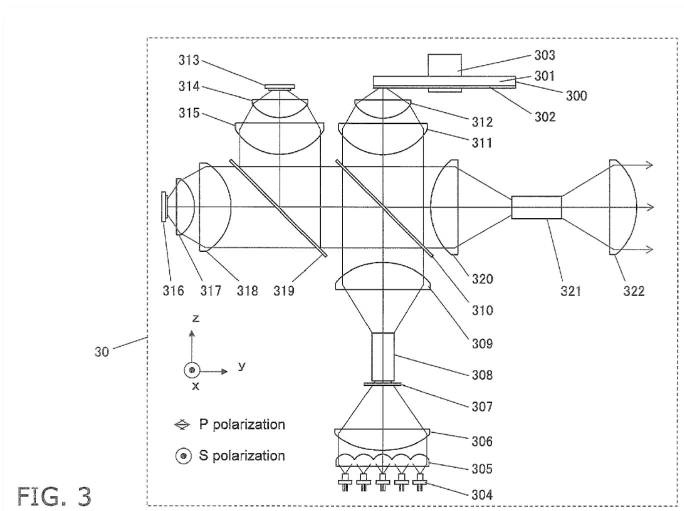
62. Kitano was filed as a U.S. Patent Application No. 13/645,474 on October 4, 2012, and published as U.S. Patent Application Publication No. 2013/0088471 on April 11, 2013. EX1007. Accordingly, Kitano qualifies as prior art under 35 U.S.C. § 102(e)(1) (pre-AIA) at least because it was filed before the 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.

63. 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:



EX1007, FIG. 9

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



EX1007, FIG. 3

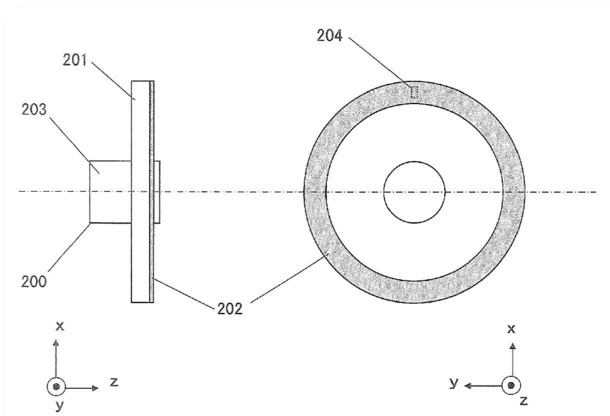
65. The output light of the light source device 80 passes through the second rod integrator 321, relay lens 801, field lens 802, and full reflection prism 803, and is incident on a DMD 804, which is an image display element. The optical systems 801, 802, and 803 are configured so that the emission face shape of the second rod

integrator 321 will be efficiently and uniformly condensed or focused on the DMD 804. EX1007, [0119].

66. 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]

67. 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].

68. 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

IX. Analysis And Identification Of How The Claims Are Unpatentable

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

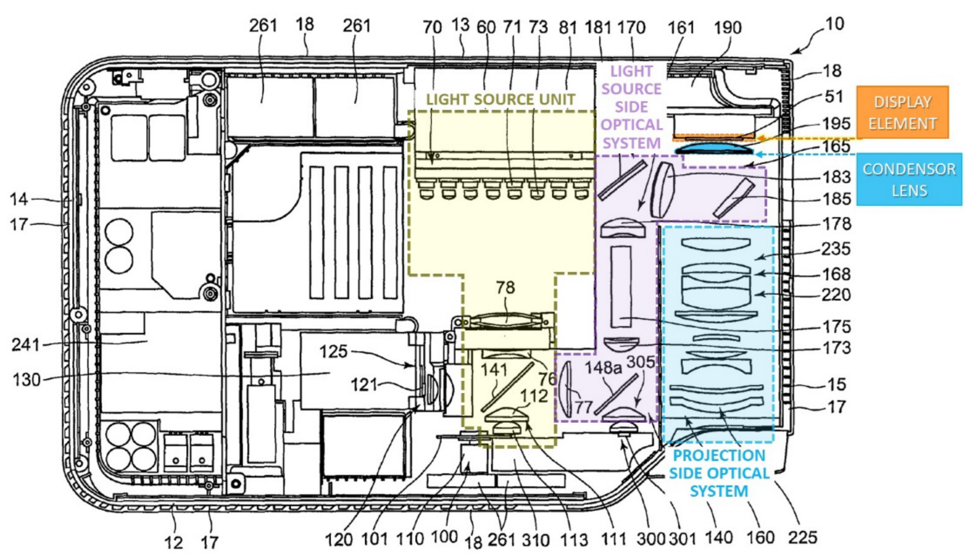
69. In my opinion, and for the reasons explained below, Kurosaki anticipates the subject matter recited by claims 8, 10, and 12 of the '226 Patent.

1. Independent Claim 8

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

70. Kurosaki discloses a projection-type image display device.

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;

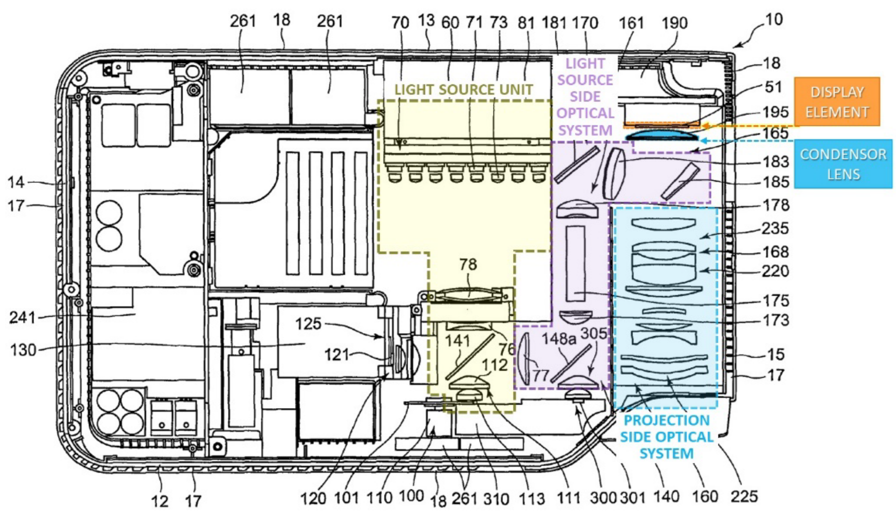
72. Kurosaki discloses a light source device.

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

[8.2] an image display element;

74. Kurosaki discloses an image display element.

75. Kurosaki discloses that "[t]he image generation block 165 is also provided with the display element 51 which is a DMD." EX1005, 8:8-10.

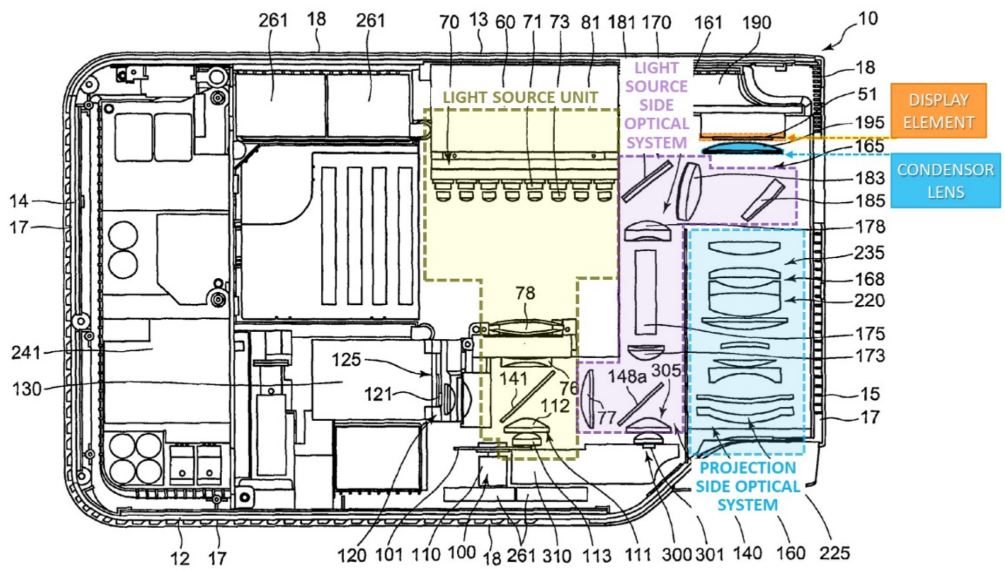


EX1005, FIG. 3 (annotated)

[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

76. 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.

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, 3:52-56.



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,

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

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;

80. Kurosaki discloses an excitation light source for emitting excitation light.

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.

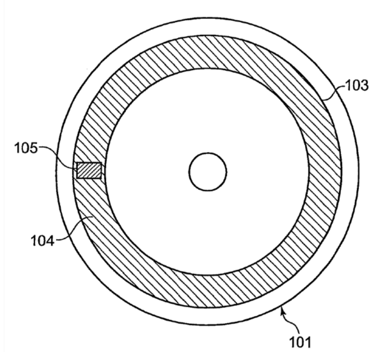
[8.6] a fluorescent material for emitting fluorescent light when excited by the excitation light; and

82. Kurosaki discloses a fluorescent material for emitting fluorescent light when excited by the excitation light.

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

84. 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

85. Kurosaki discloses an optical member for directing the excitation light to the fluorescent material.

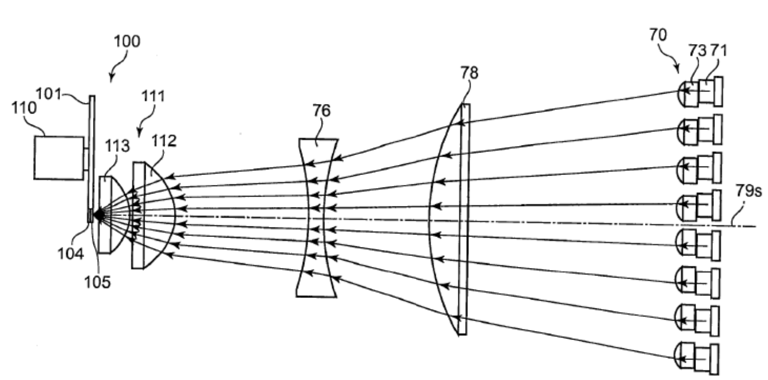
86. Kurosaki discloses: "As shown in FIG. 3, light beams that are emitted from the excitation light sources 71 and applied to the green phosphor layer 104 of the phosphor wheel 101 via the collimator lenses 73, the condenser lens 78, the concave lens 76, and a dichroic mirror 141 excite the green phosphor 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. Thus at least an optical member is disclosed, i.e. lenses 78 and 76.

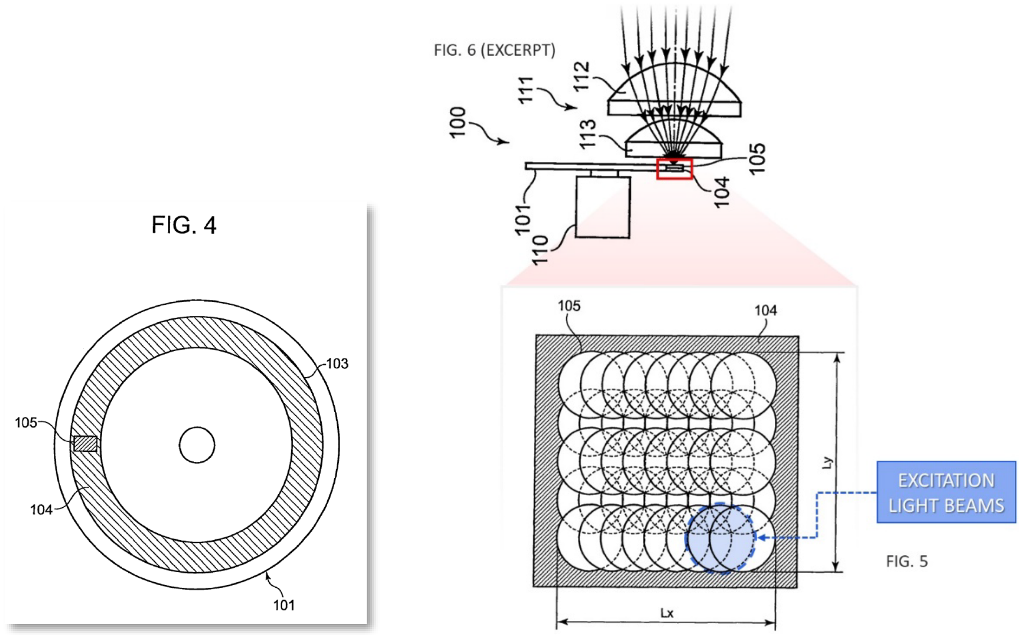
[8.8] the optical member has a curvature that is set such that a light-condensing position of the excitation light is positioned on

an emission side of the excitation light relative to the fluorescent material,

87. 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. 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.

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

88. Kurosaki discloses a dichroic mirror disposed between the excitation light source and the fluorescent material.

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,

90. Kurosaki discloses a condenser lens for condensing the excitation light disposed between the fluorescent material and the dichroic mirror.

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

92. Kurosaki discloses the optical member being disposed between the excitation light source and the dichroic mirror.

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.

94. 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.

95. 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.

96. In summary, claim 8 is anticipated by Kurosaki.

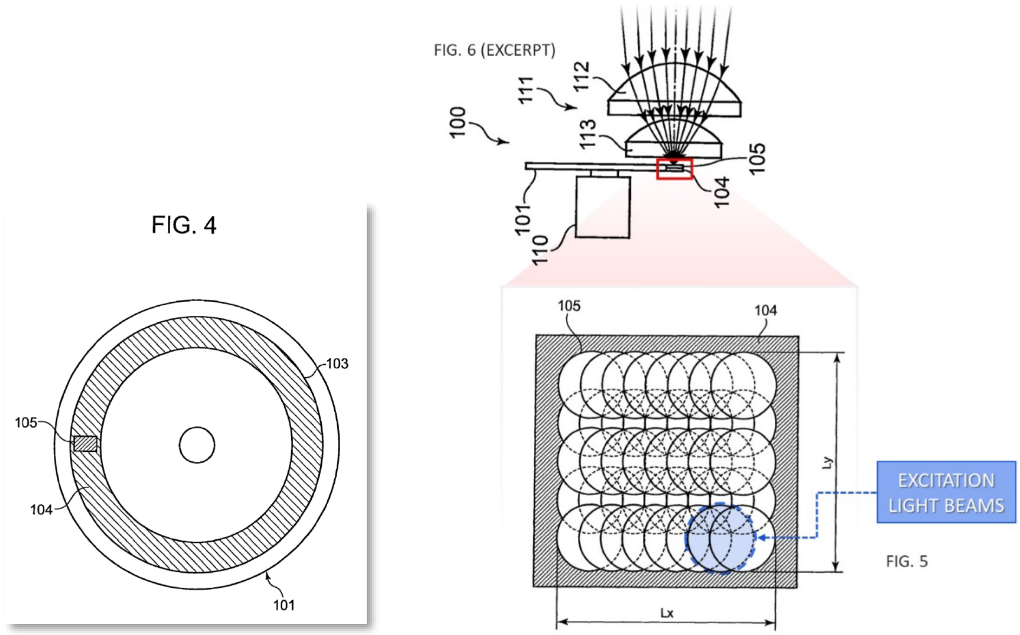
2. Dependent Claim 10

[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.

97. 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.

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

99. 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)

100. 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 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.

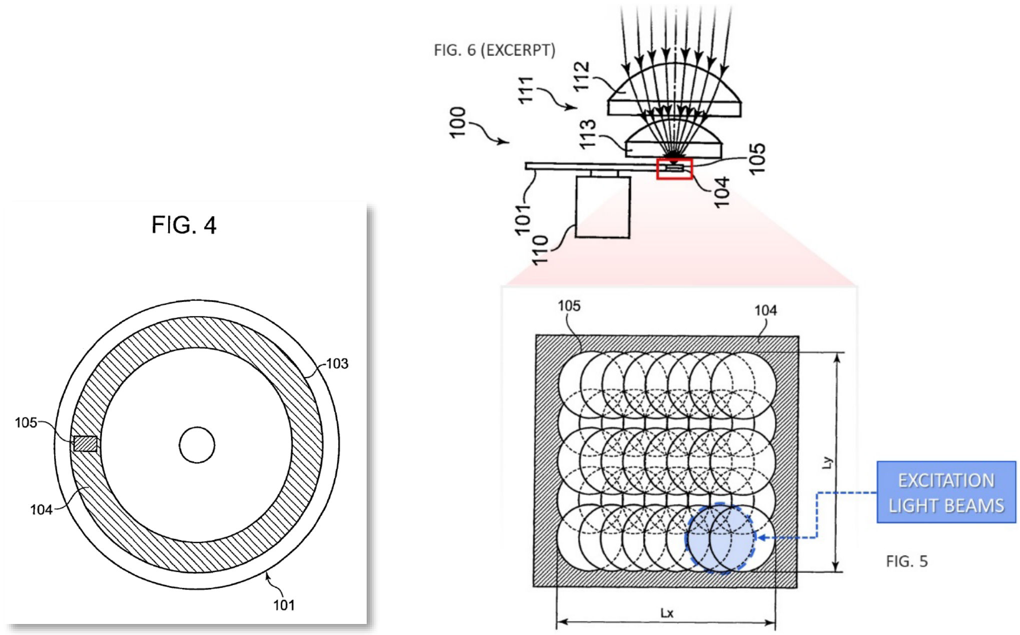
101. In summary, claim 10 is anticipated by Kurosaki.

3. 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.

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

103. 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)

104. In summary, claim 12 is anticipated by Kurosaki.

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

105. In my opinion, and for the reasons explained below, Miyamae anticipates the subject matter recited by claims 8 and 10 of the ’226 Patent.

1. Independent Claim 8

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

106. Miyamae discloses a projection-type image display device.

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].

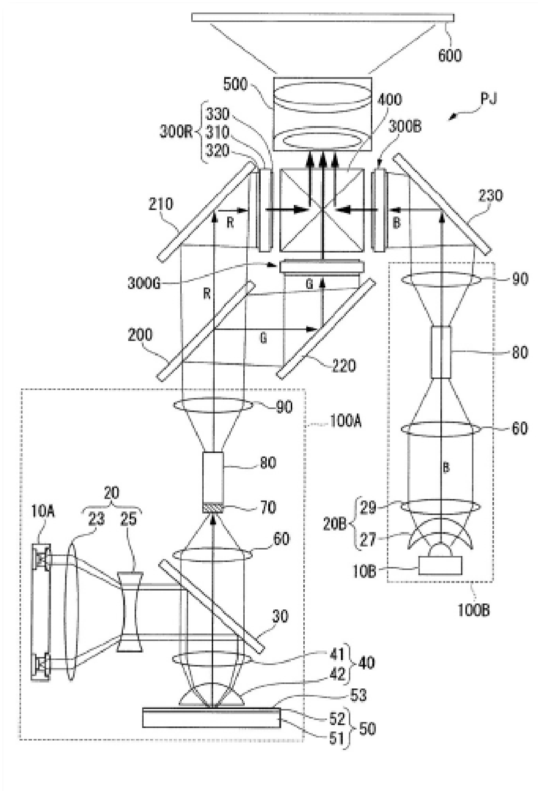


FIG. 1

[8.1] a light source device;

108. Miyamae discloses a light source device.

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].

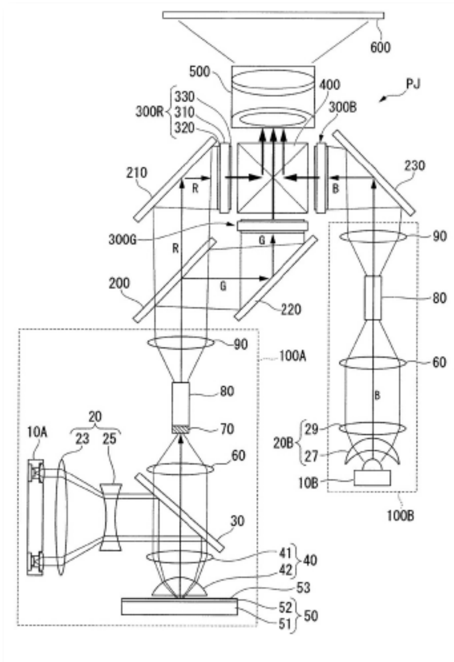


FIG. 1

[8.2] an image display element;

110. Miyamae discloses an image display element.

111. 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.

112. 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

113. 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.

114. 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].

115. 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,

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

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;

118. Miyamae discloses a light source device that includes an excitation light source for emitting excitation light.

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

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

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

122. 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.

123. 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]. Thus, at least an optical member is disclosed, i.e. lenses 23 and 25.

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

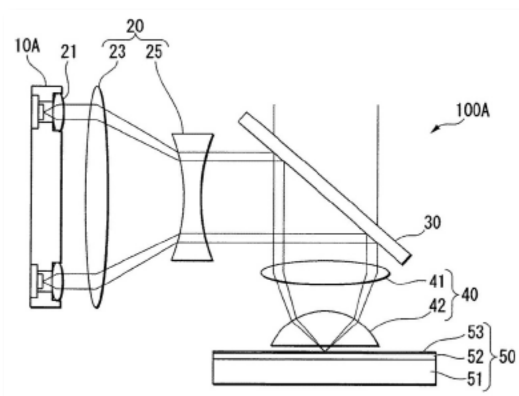
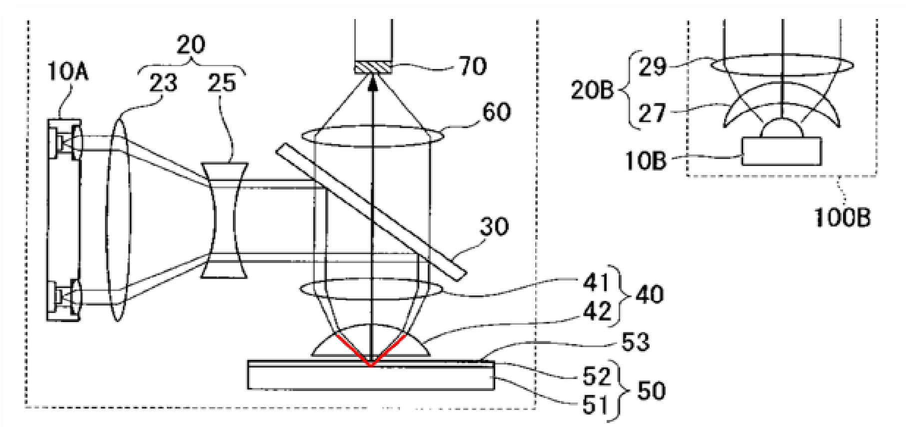


FIG. 3

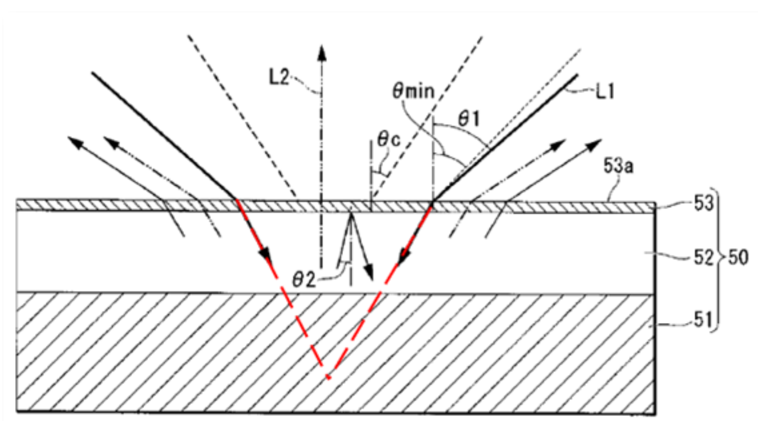
[8.8] the optical member has a curvature that is set such that a light-condensing position of the excitation light is positioned on an emission side of the excitation light relative to the fluorescent material,

125. Miyamae discloses a light source device that includes an optical member, *e.g.* lenses 23 and 25, 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.

126. See annotated FIG. 1 and FIG. 5.



EX1006, FIG. 1 (excerpt; annotated)



EX1006, FIG. 5 (annotated)

127. 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].

128. 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. 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.

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

129. Miyamae discloses a light source device that includes a dichroic mirror disposed between the excitation light source and the phosphor (fluorescent material).

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

131. 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,

132. 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.

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

134. 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.

135. 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].

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

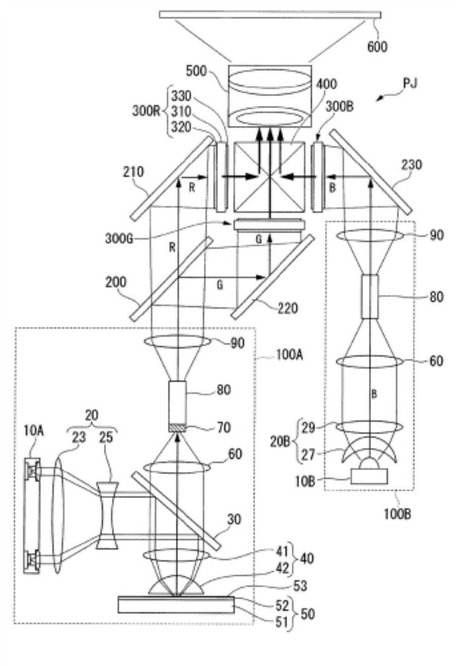


FIG. 1

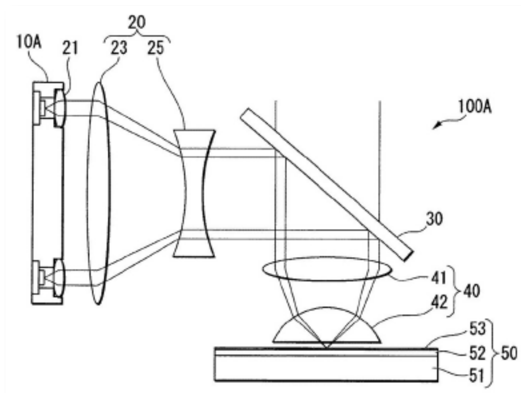


FIG. 3

[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.

137. 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.

138. 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, which is a convex lens, then transmitted through collimating lens 25, which is a concave lens, to narrow the

overall excitation light beam. The condenser lens 23 is a convex lens, and the collimating lens 25 is concave and are disposed in this order from the excitation light source 10A toward the dichroic mirror 30.

139. Further, Excitation light is focused onto the wavelength-selecting reflective layer 53 at a relatively large incident angle." EX1006 [0041].

140. 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].

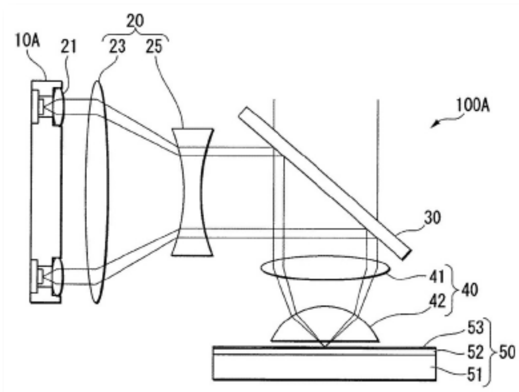


FIG. 3

141. In summary, claim 8 is anticipated by Kurosaki.

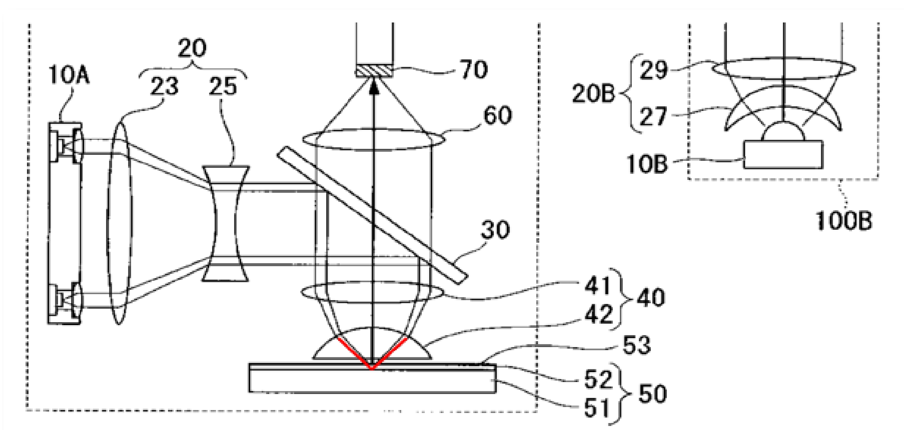
2. Dependent Claim 10

[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.

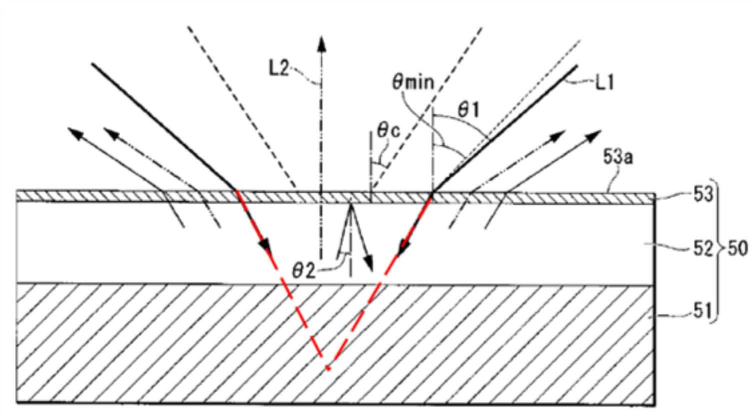
142. Miyamae discloses that at least either one of the convex lens and the concave lens has a curvature that is set so as to allow the excitation light to be made incident on the fluorescent material at a front side of the fluorescent material as a light-condensing position.

143. 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 41 and 42) as shown in the annotated figure below.

144. See annotated FIG. 1 and FIG. 5.



EX1006, FIG. 1 (excerpt, annotated)



EX1006, FIG. 5 (annotated)

145. 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].

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

147. In summary, claim 10 is anticipated by Kurosaki.

C. Miyamae in view of Kurosaki renders Claim 12 obvious.

148. In my opinion and for the reasons explained below, Miyamae, in view of Kurosaki, renders obvious the subject matter recited by claim 12 of the '226 Patent.

149. As an initial matter, a POSITA would have been motivated to combine the teachings of Miyamae with the teachings of Kurosaki.

150. 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. 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.

151. 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.

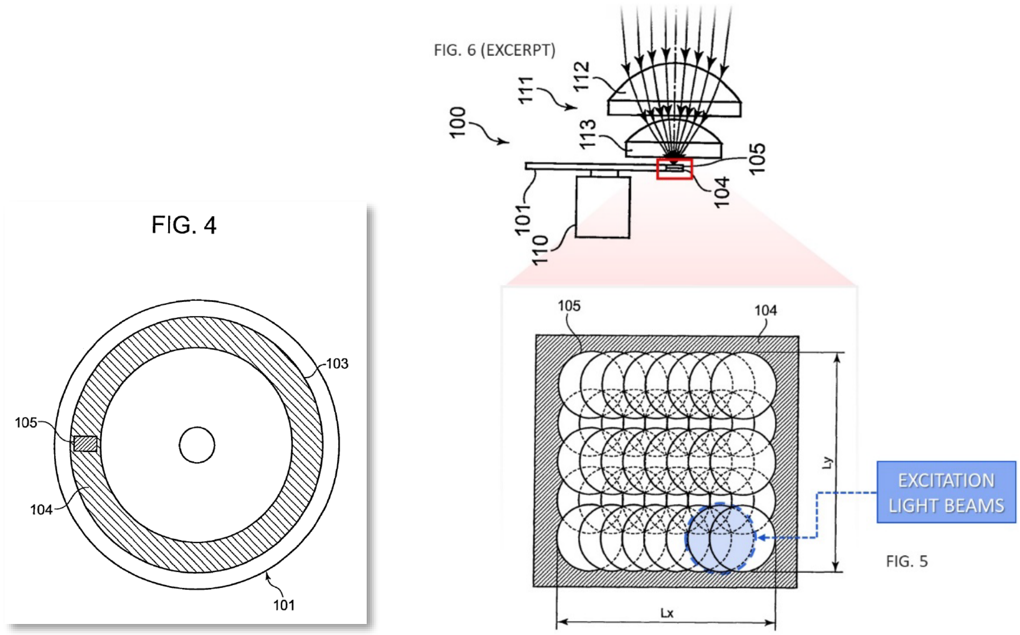
EX1007, [0014] (emphases added). A POSITA would therefore have had a motivation to combine Miyamae and Kurosaki to obtain an efficient light source for projectors.

1. 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.

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

153. *See*, Section IX.A.3, *supra*, and EX1005, FIGS. 4 and 5 for Kurosaki's disclosure of this element.



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

154. A POSITA would have been motivated to combine the teachings of Miyamae with the teachings of Kurosaki for the following reasons.

155. Both references 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. EX1006, [0032]. Kurosaki, as explained in Section VIII.A.2, *Supra*, 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. 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.

156. 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.

157. In summary, claim 12 is obvious over Miyamae in view of Kurosaki.

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

158. In my opinion and for the reasons explained below, Kitano, in view of Kurosaki, renders obvious the subject matter recited by claims 8, 10, and 12 of the '226 Patent.

159. As an initial matter, a POSITA would have been motivated to combine the teachings of Kitano with the teachings of Kurosaki.

160. 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].

161. 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. 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.

162. Furthermore, a POSITA would have recognized that substituting certain components by those disclosed in Kurosaki offer certain advantages. For example, Kurosaki discloses combination of convex lens 78 and concave lens 76, as discussed above, and notes certain benefits of this combination:

> More specifically, since the concave lens 76 causes excitation light beams pass through the first dichroic mirror 141 in a state that they are as close to parallel light beams as possible, the degree of undesirable reflection of those excitation light beams can be lowered.
>
> In the embodiments, the condenser lens 78 is disposed between the excitation light source 71 which emit excitation light beams and the concave lens 76. Therefore, the distance between the excitation light illumination device 70 and the phosphor wheel 101 is shorter than in a configuration without the condenser lens 78. As a result, a relatively small projector 10 can be provided.

EX1006, 14:8-20. A POSITA would therefore have had a motivation to use this combination to exploit those benefits.

163. Further, a POSITA would have known that such arrangement of lenses, 78 and 76, permits adjusting the width of the light source to the width of the lenses downstream, and also allows the control of light collimation.

164. Thus, a POSITA would have been motivated to combine the teachings of Kitano with those of Kurosaki and would have recognized that combining these teachings would have produced predictable and operable results.

1. Independent Claim 8

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

165. Kitano discloses a projection-type image display device.

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].

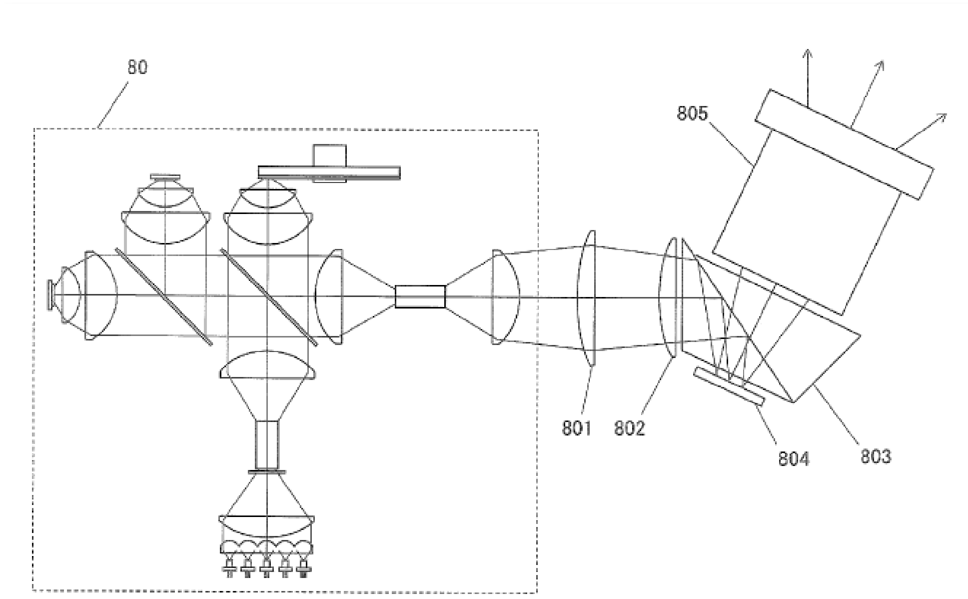


FIG. 9

[8.1] a light source device;

167. Kitano discloses a light source device.

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]

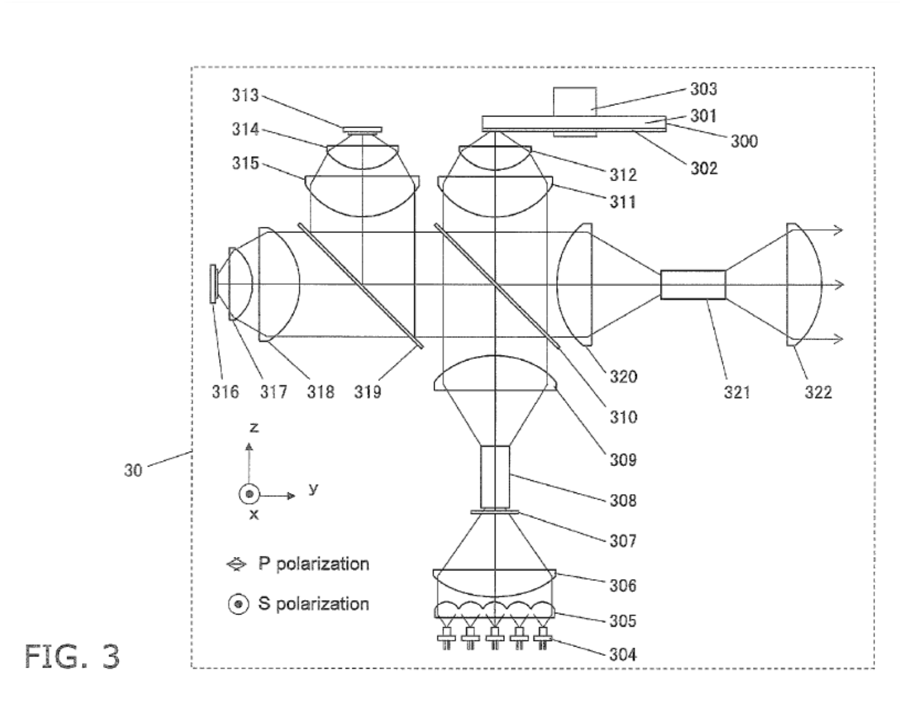


FIG. 3

169. 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].

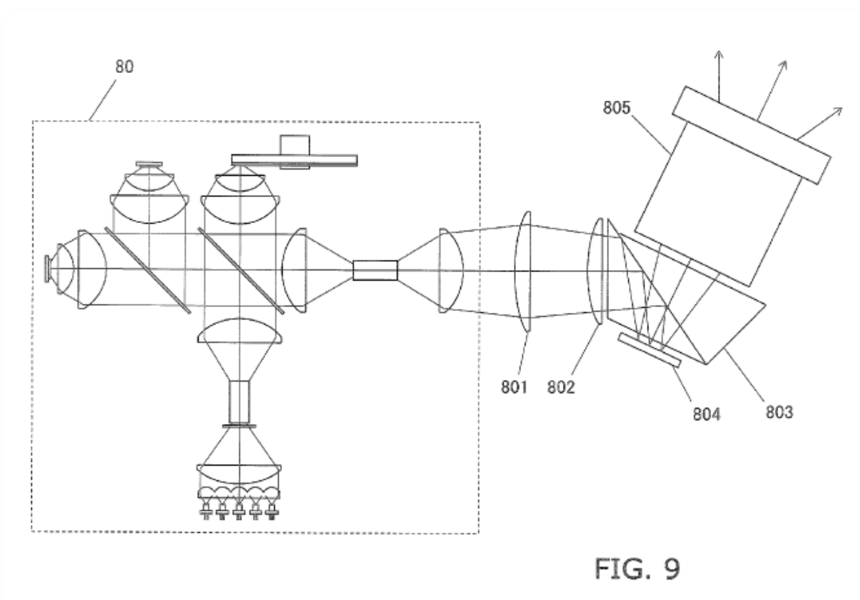


FIG. 9

[8.2] an image display element;

170. Kitano discloses an image display element.

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

172. 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.

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

174. 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,

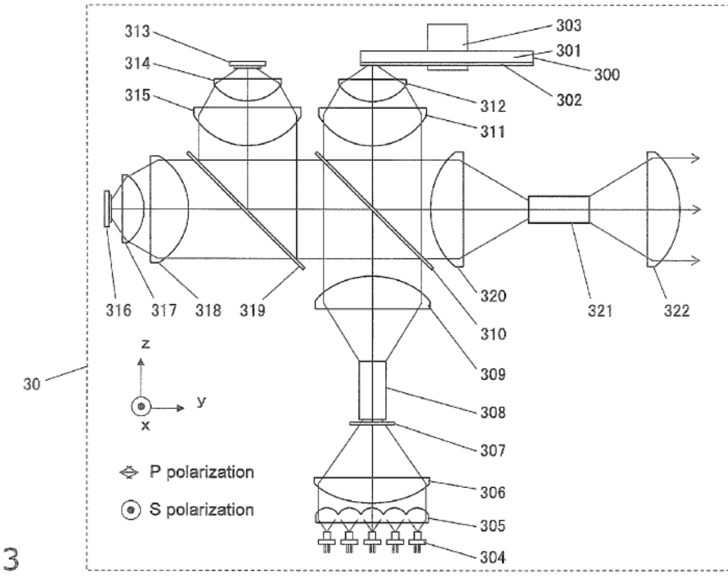
175. Kitano discloses a projection lens for enlarging an optical image formed by the image display element to project the resulting image.

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;

177. Kitano discloses a light source device that includes an excitation light source for emitting excitation light.

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]. Kitano further explains that "[w]ith this technology, the laser light sources 104, 304, 405, and 604 are used as excitation light sources for exciting the phosphors 102,302, 402, and 602." *Id*., [0128].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S polarization

FIG. 3

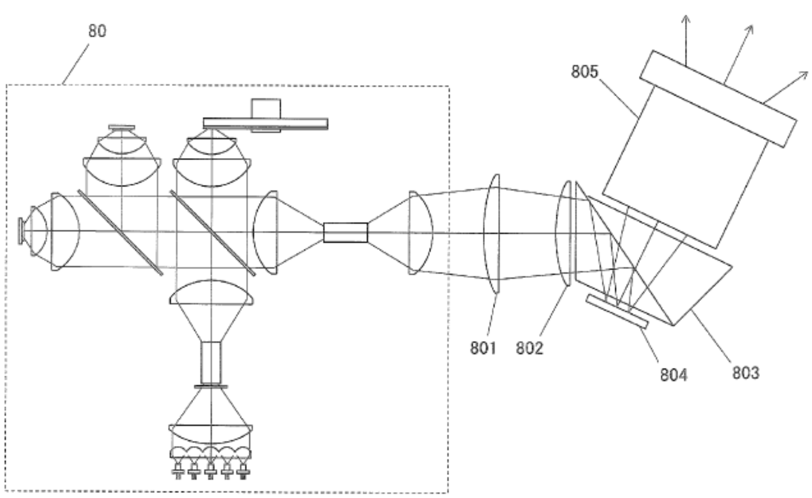

80
805
801
802
804
803

FIG. 9

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

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

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

181. 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.

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

183. Kitano discloses "[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].

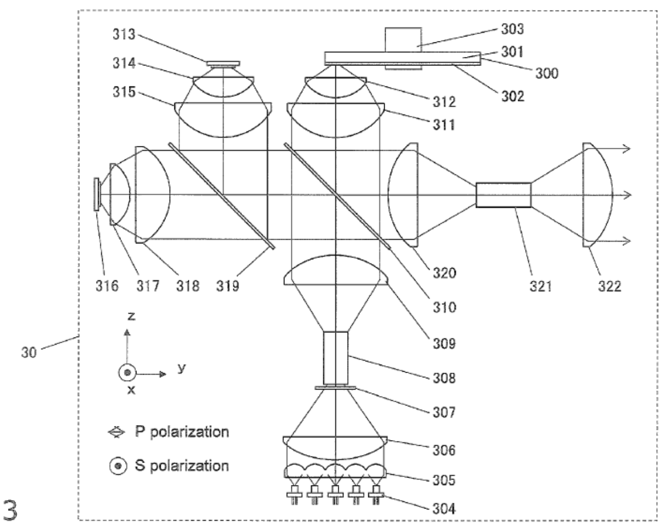
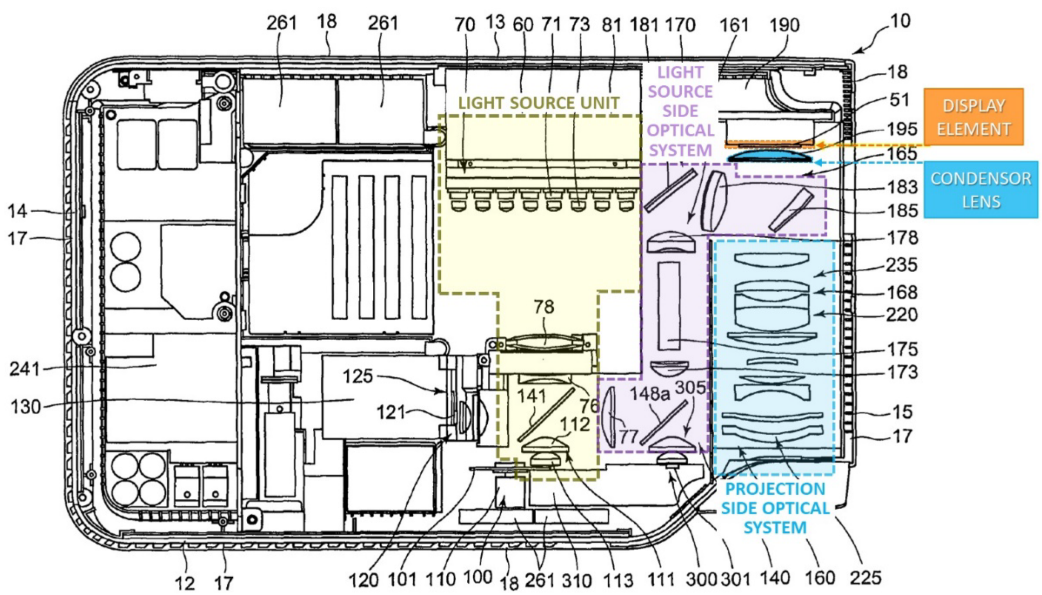


FIG. 3

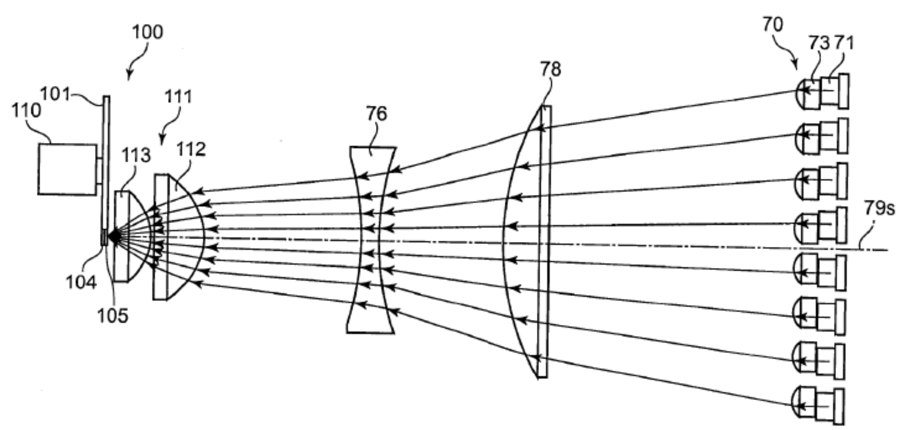
184. Kurosaki discloses that an optical member, *e.g.,* the convex lens (condenser lens 78) and the concave lens 76, directs the excitation light to the fluorescent material (green phosphor layer).

185. 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



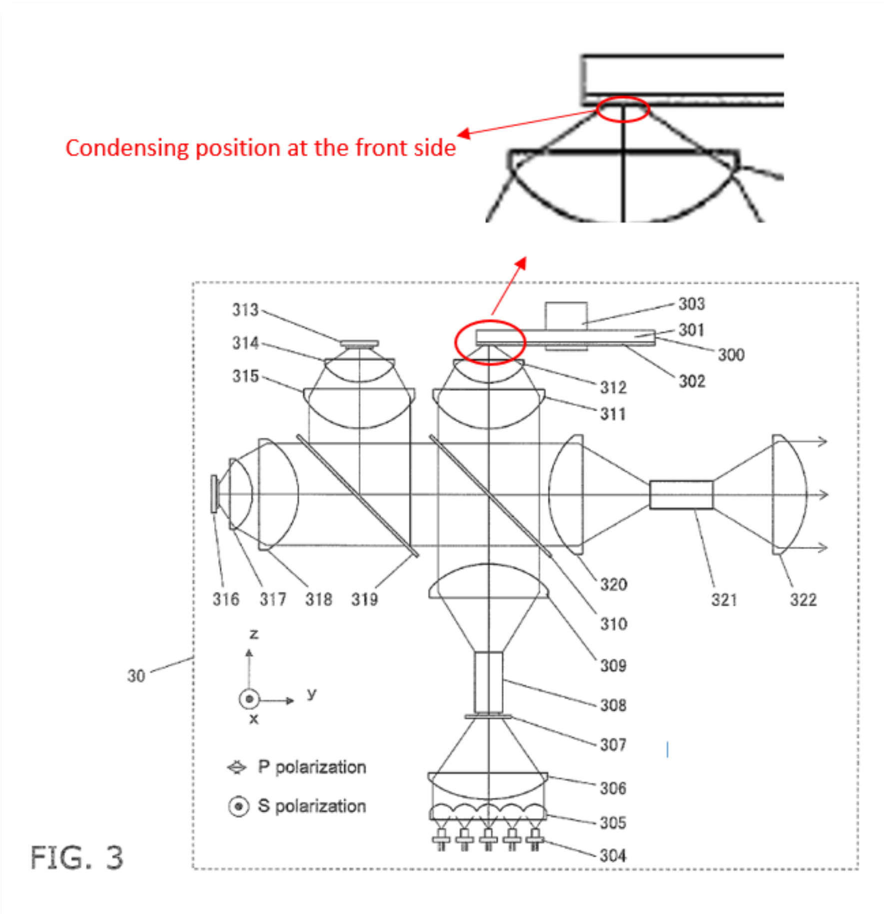
186. As discussed in Section VIII.A.2, *supra*, Kurosaki identifies certain benefits of using a combination of convex and concave lenses disposed in the specified order between the excitation light source and fluorescent material. A

POSITA would therefore have been motivated to combine the teaching of Kitano 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,

187. 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.

188. 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.



EX1007, FIG. 3 (annotated)

189. 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].

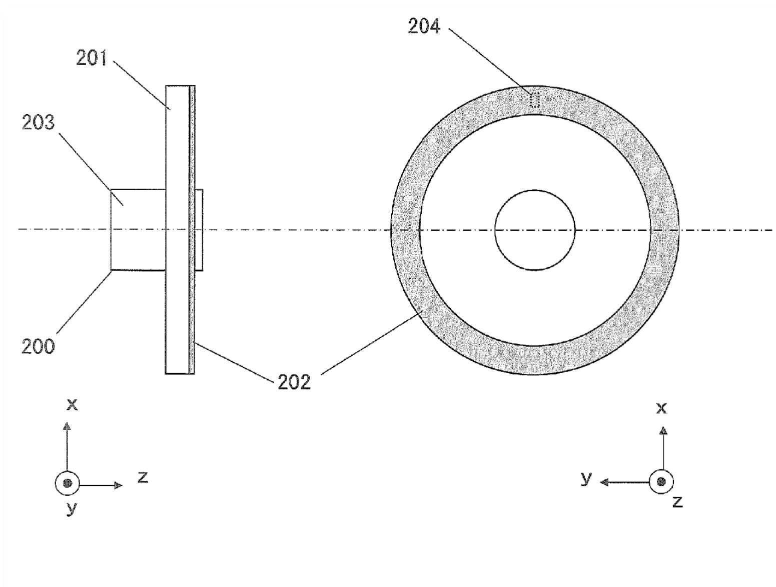


FIG. 2

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

191. 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].

192. 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. 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*. See annotated Fig. 3 above, where rays are shown not to meet at the phosphorous layer, but beyond the phosphorous layer.

193. 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. *See*, Section IX.A.1, 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

194. Kitano discloses a light source device that includes a dichroic mirror disposed between the excitation light source and the phosphor (fluorescent material).

195. 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,

196. 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.

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

198. Kitano discloses a light source device that includes at least an optical member disposed between the excitation light source and the dichroic mirror.

> 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.

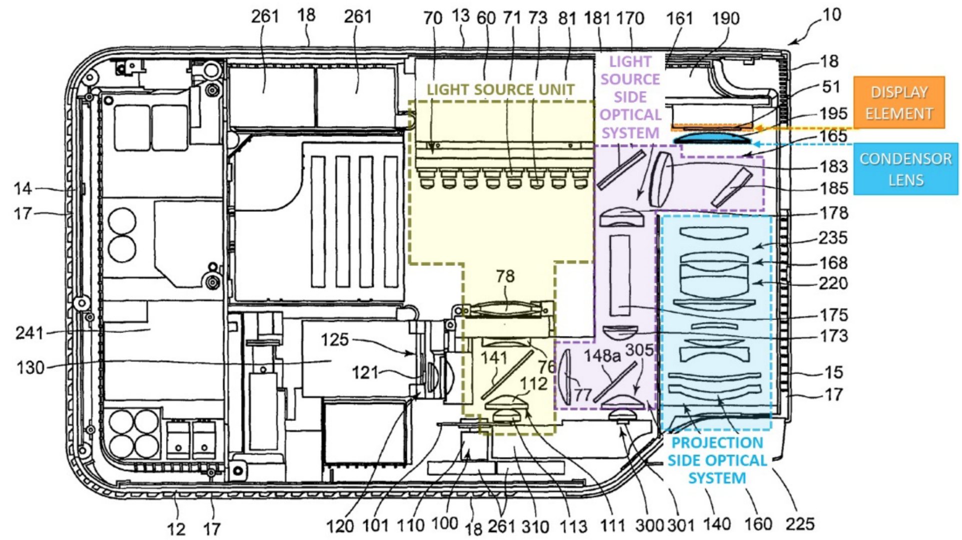
EX1007, [0066]-[0071].

199. Alternatively, Kurosaki discloses a light source device that includes at least an optical member disposed between the excitation light source and the dichroic mirror. The condenser lens 78 and the concave lens 76 are disposed between the excitation light sources 71 and the dichroic mirror 141. See, EX1005, Figs. 3 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.

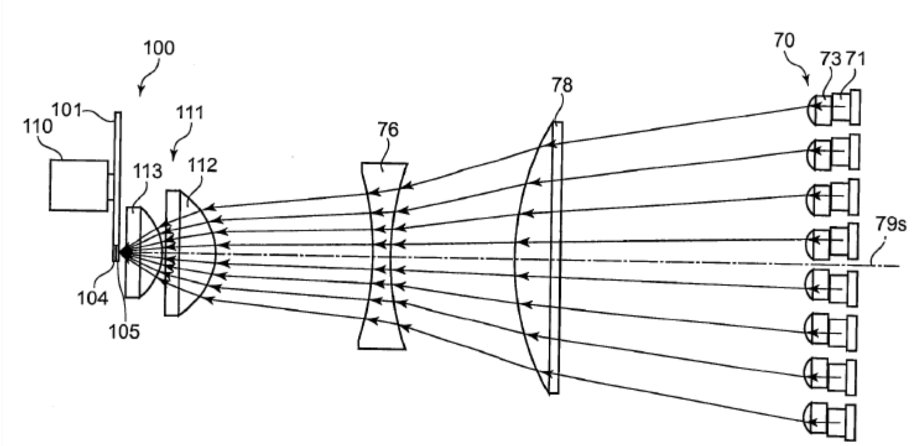
200. Kitano combined with Kurosaki disclose a light source device having an optical member that is a convex lens and a concave lens, with the convex lens and the concave lens being disposed in this order from the excitation light source toward the dichroic mirror.

201. *See*, Section IX.A.1, Element 8.12, *supra*, and EX1005, FIGS. 3 and 6.



EX1005, FIG 3 (annotated)

FIG. 6



202. In summary, claim 8 is obvious over Kitano in view of Kurosaki.

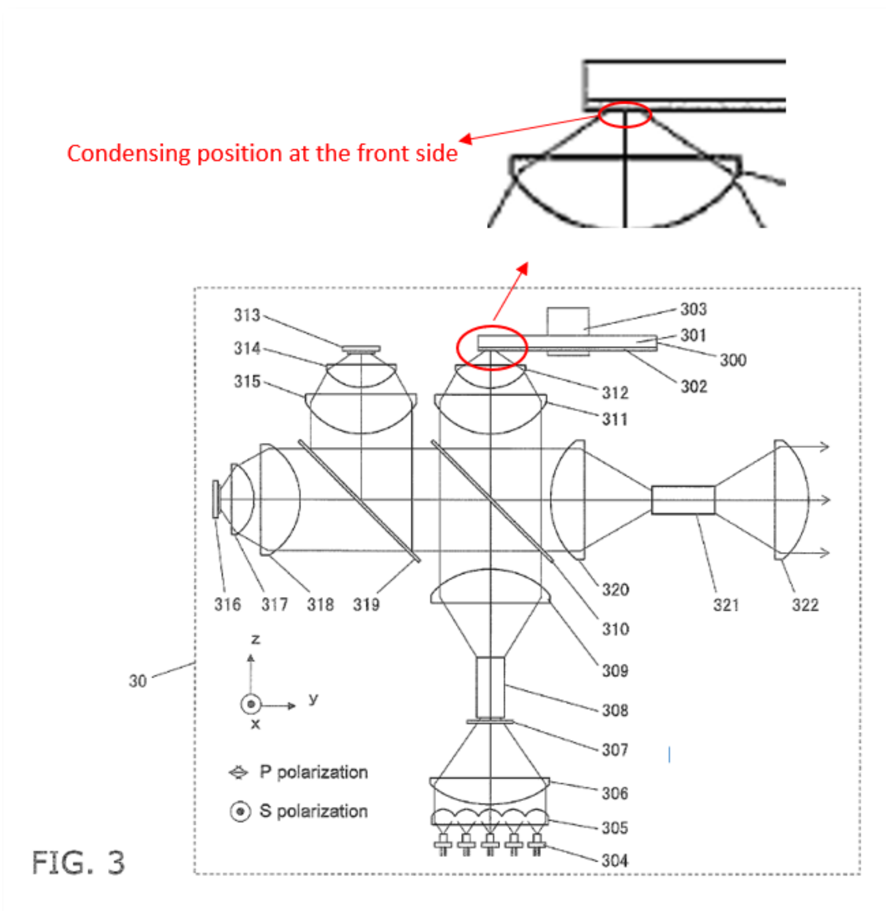
2. Dependent Claim 10

[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.

203. 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.

204. 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.



EX1007, FIG. 3 (annotated)

205. 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].

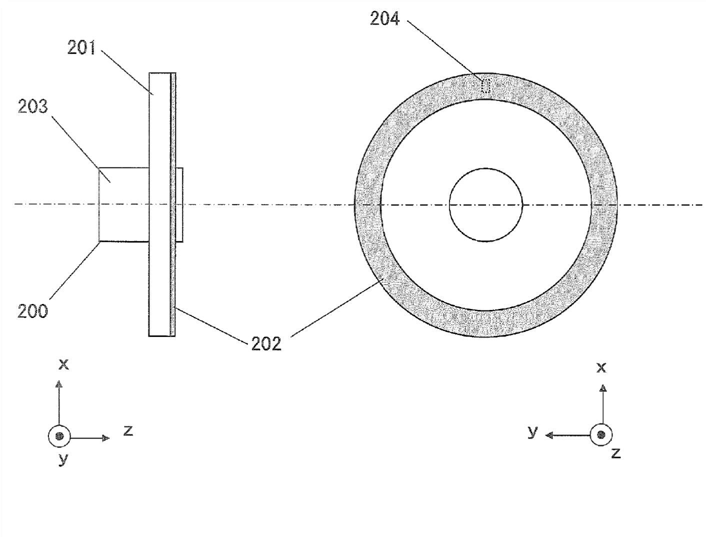


FIG. 2

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

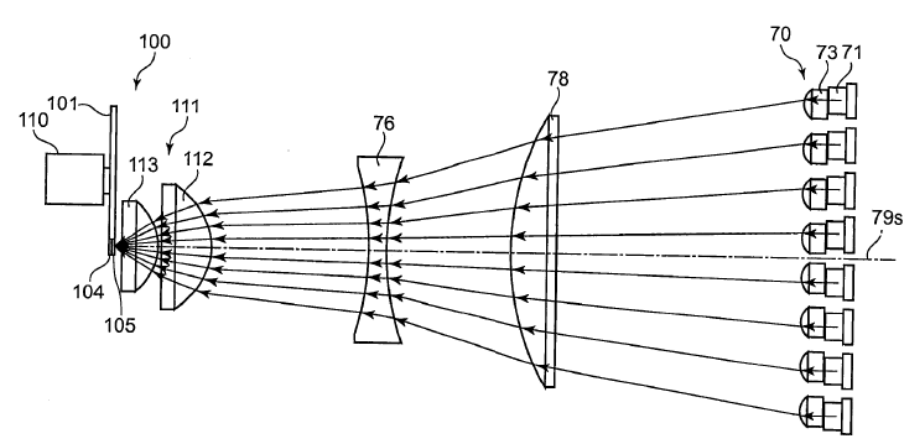
207. Kitano further discloses that "the flux shape of the green fluorescent light … incident on the second rod integrator is adjusted to be substantially the same as the rod integrator incident end face shape. Therefore, each kind of light can be efficiently coupled to the rod integrator." *Id.*, [0087].

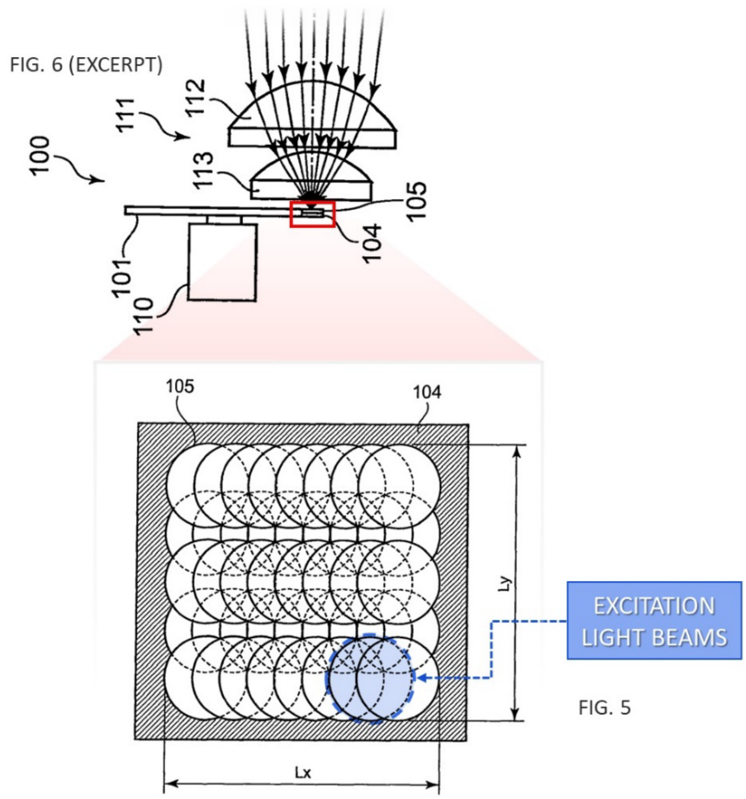
208. Thus, Kitano discloses a light source in which the convergent excitation light irradiates the phosphor layer over a shaped area, and the shape can be substantially the same as the rod integrator incident end face shape. The excitation

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*.

209. 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. *See*, Section IX.A.1, Element [8.8] and Section IX.A.2, Element [10.0/10.1], *supra*, and EX1005, FIGS. 5 and 6.

FIG. 6





EX1005, FIGS. 5 and 6 (annotated)

210. In summary, claim 10 is obvious over Kitano in view of Kurosaki.

3. 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.

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

212. 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].

213. 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].

214. 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].

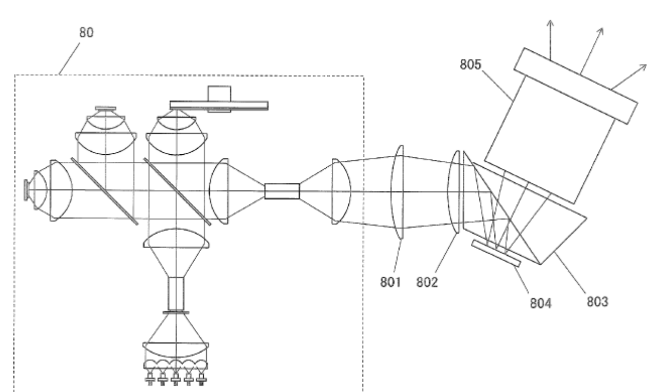
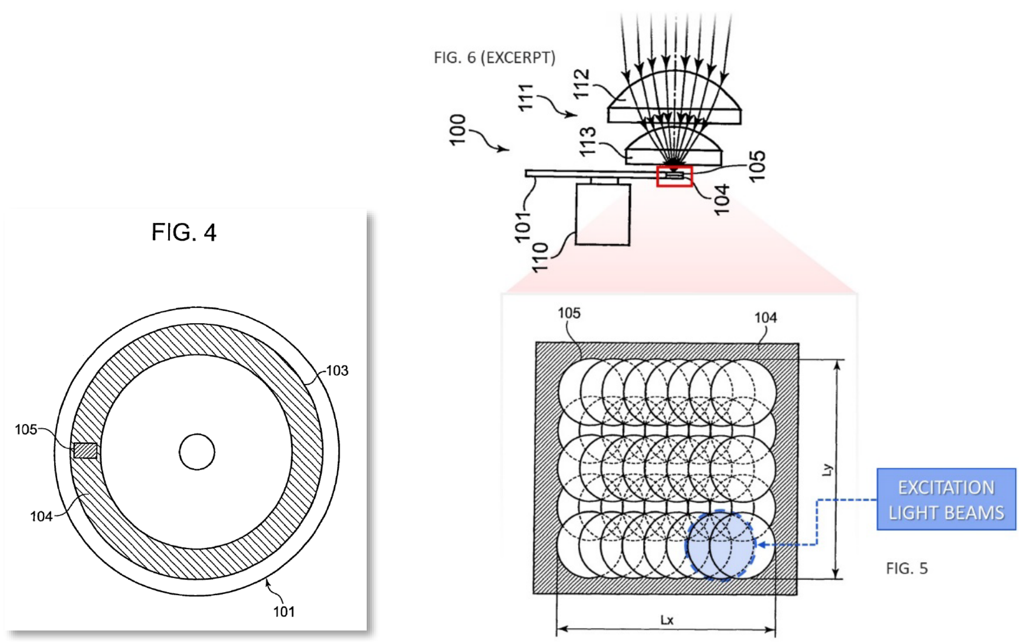


FIG. 9

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

216. *See*, Section IX.A.3, *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)

217. In summary, claim 12 is obvious over Kitano in view of Kurosaki.

X. Secondary Considerations

218. I am not aware of any secondary considerations that would make claims 8, 10, and 12 of the '226 Patent nonobvious over the prior art considered herein. Regardless, any possible secondary considerations would not overcome the above-

cited prior art, which clearly demonstrates that the subject matter of claims 8, 10, and 12 of the ’226 Patent would have been obvious to a POSITA as of November 1, 2012.

I hereby declare that statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true. Should further information become available to me as this matter proceeds, I may revise my opinions accordingly as necessary. I declare under penalty of perjury that the foregoing Declaration is true and correct. Executed on 01-17, 2025.

By: /s/ José Sasián