

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CORETRONIC CORPORATION and
OPTOMA CORPORATION,

Petitioners,

- vs. -

MAXELL, LTD.,

Patent Owner

IPR2025-00476

PETITION FOR INTER PARTES REVIEW

OF U.S. PATENT NO. 8,593,580

**DECLARATION OF DR. JOSE SASIAN
IN SUPPORT OF PETITION FOR INTER PARTES REVIEW
OF U.S. PATENT NO. 8,593,580**

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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. 8,593,580 (“the ’580 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 1, 3-11, 17, 18, and 32-38 of the ’580 Patent are unpatentable.

4. I have been asked to provide my opinions regarding whether claims 1, 3-11, 17, 18, and 32-38 of the ’580 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 1, 3-11, 17, 18, and 32-38 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:

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

15. 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).

16. 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.

17. 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.

18. 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

19. 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.

20. 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.

21. 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.

22. 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.

23. 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>.

24. 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.

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

II. INFORMATION CONSIDERED

26. I have considered the following documents:

- a. U.S. Patent No. 8,593,580 (the '580 Patent) (EX1001);
- b. Prosecution History of the '580 Patent (EX1002);
- c. U.S. Patent Application Publication 2003/0189693A1 (“Ishino”) (EX1005);

- d. U.S. Patent No. 7,196,354 (“Erchak”) (EX1006);
- e. Chinese Patent Publication 101498415A (“Li ’415”) (EX1007);
- f. U.S. Patent Application Publication 2007/0182932A1 (“Bakker”) (EX1008);
- g. U.S. Patent Application Publication 2006/0203202A1 (“Uchiyama”) (EX1009);
- h. U.S. Patent Application Publication 2009/0262308A1 (EX1011);
and
- i. U.S. Patent Application Publication 2003/0039036A1 (EX1012).

27. 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 ’580 Patent.

III. OBVIOUSNESS

28. 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.

29. I have been further informed and understand that certain factors may support or rebut the obviousness of a claim. I understand that such secondary considerations include, among other things, commercial success of the patented invention, skepticism of those having ordinary skill in the art at the time of the

invention, unexpected results of the invention, any long-felt but unsolved need in the art that was satisfied by the alleged invention, the failure of others to make the alleged invention, praise of the alleged invention by those having ordinary skill in the art, and copying of the alleged invention by others in the field. I understand that there must be a connection between any such secondary considerations and the alleged invention. I also understand that contemporaneous and independent invention by others is a secondary consideration tending to show obviousness.

IV. CLAIM CONSTRUCTION

30. 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.

31. I have also been informed and understand that the U.S. patent law allows a patentee to claim an invention in functional rather than structural language. I understand that this form of claim drafting is referred to as “means-plus-function” claiming. I understand that means-plus-function claiming applies to functional claim elements that do not provide sufficient corresponding structure for performing the claimed function.

32. I have been informed and understand that the interpretation of claim language as a means-plus-function limitation is based on the following underlying factual questions: (1) whether the words of the claim are understood by POSITA to have a sufficiently definite meaning as the name for structure, and (2) what structure is disclosed in the specification for performing the claimed function. I understand the PTAB will determine whether a term or phrase is a means-plus-function claim element. I am not providing an opinion on the legal question of whether any phrases are means-plus-function element; however, I have provided my opinions on the underlying factual determinations as to what a POSITA would have understood about specific claim terms and the content of the specification.

33. I have been informed and understand that the presence of the word “means” in a claim creates the presumption that the claim term is a means-plus-function claim term. Likewise, I understand that the absence of the word “means” in a claim creates the presumption that the claim term is not a means-plus-function claim term. I understand that the key inquiry for determining whether a claim term is a means-plus-function term is whether the words of the claim are understood by persons of ordinary skill in the art (POSITA) to have a sufficiently definite meaning as the name for structure.

34. I have been informed and understand that once a claim term is determined to be a means-plus-function term, then the function recited in the claim

must be determined. I understand that the function of a means-plus-function claim term is defined by the words of the claim language. I also understand that a means-plus-function claim term may recite multiple functions, in which case, the corresponding structure in the specification must perform all the functions recited in the claim.

35. I have been informed and understand that, once the function of a claim is determined, the structure, if any, in the specification corresponding to the claimed function must be determined, and that the means-plus-function element covers the corresponding structure.

A. Independent Claims 1, 10, and 32

36. Claims 1, 10, and 32 are independent claims. Claim 1 reads:

A projection-type display apparatus, comprising:

- a light source, including a solid-state light emitting element for emitting an excitation light therein, configured to emit white lights including a light emitting from a fluorescent substance, which is excited by said excitation light;
- a light separation optic system, configured to separate the white lights from said light source into red-color (R), green-color (G) and blue-color (B);

a light modulation means, configured to make light-modulation
on a respective one of the lights of the R, G and B separated,
depending on a video signal; and
a projection means, configured to enlargedly project a respective
one of optical images, which are formed by said light
modulation means, wherein
said fluorescent substance has plural numbers of concave
portions on a surface, upon which said excitation light is
incident.

37. Claim 10 is otherwise the same as claim 1, except that the last limitation
of claim 1 is replaced by:

a separation mirror, being disposed between said solid-state light
emitting element and said fluorescent substance and configured to
pass said excitation light therethrough, as well as, to reflect the light
from said fluorescent substance thereon.

38. Claim 32 is otherwise the same as claim 1, except that the last limitation
of claim 1 is replaced by:

said fluorescent substance has a concave portion, an excitation
light incident side opening is larger than a bottom surface

portion thereof, on a surface, upon which said excitation light is incident.

B. Dependent Claims 3-9, 11, 17, 18, and 33-38

39. Claims 3-9 are dependent ultimately from claim 1. Claim 3 refers to claim 1 and adds the limitation, “wherein the emitting light are the lights in a wavelength region having a complementary color relationship with said excitation light with respect to a white color.” Claim 4 refers to claim 3 and adds the limitation, “wherein said solid-state light emitting element is a semiconductor laser element.” Claim 5 refers to claim 4 and adds the limitation, “wherein said excitation light is the B-color light, and said emitting light is a yellow-color (Y) light.” Claim 6 refers to claim 5 and adds the limitation, “wherein said white lights are lights, which are produced by switching said B-color light and said Y-color light, sequentially, to be combined with, in a time-division manner.” Claim 7 refers to claim 6 and adds the limitation, “wherein said white lights are lights, which are captured by a light flux capturing means made up with a reflection surface having a focus point.” Claim 8 refers to claim 1 and adds the limitation, “wherein said white lights are lights, which are almost in parallel.” Claim 9 refers to claim 1 and adds the limitation, “wherein each of said light modulation means is any one of a transmission-type liquid crystal panel, a reflection-type liquid crystal panel and a digital mirror device (DMD) made by aligning plural numbers of micro-mirrors.”

40. Claims 33-38 dependent claims referring to claims 32-36 and 32, respectively, and add the limitations identical to those of claims 3-8, respectively.

41. Claims 11, 17, and 18 are dependent ultimately from claim 10. Claim 11 refers to claim 10 and adds the limitation, “wherein said separation mirror almost reflect a light of a S-wave component, among the G-color light, the R-color light and the B-color light, while almost passing a light of a P-wave component therethrough, among the B-color light.” Claim 17 refers to claim 11 and adds the limitation, “wherein said white lights are lights, which are almost in parallel.” Claim 18 refers to claim 10 and adds the limitation, “wherein each of said light modulation means is any one of a transmission-type liquid crystal panel, a reflection-type liquid crystal panel and a digital mirror device (DMD) made by aligning plural numbers of micro-mirrors.”

C. Interpretation of Claim Elements

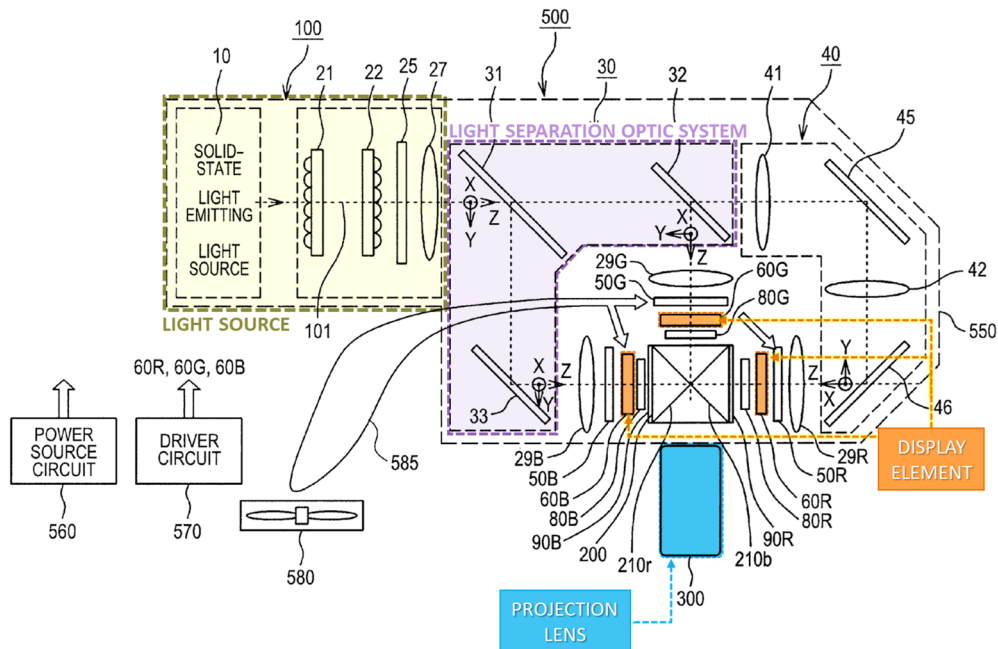
42. In my opinion, the claims of the '580 Patent use terms that have ordinary and customary meanings in the art, and do not use these terms inconsistently with those ordinary and customary meanings, except the following:

- a. “a light separation optic system” recited in claims 1, 10, and 32;
- b. “a light modulation means” recited in claims 1, 10, and 32;
- c. “a projection means” recited in claims 1, 10, and 32;
- d. “a light flux capturing means” recited in claims 7 and 37;

- e. “the emitting light” in claims 3-7 and 33-37;
- f. “separation mirror” in claim 10;
- g. “almost reflect[s]” and “almost passing” in claim 11.

43. Regarding “a light separation optic system,” even though the element does not contain the word “means,” the term by itself does not have a sufficiently definite meaning as the name for structure. I therefore believe that this term meets the definition of a means-plus-function element and base my invalidity opinions on this understanding.

44. The only structure described in the specification is the light separation optic system 30, which includes dichroic mirrors 31, 32, and reflection mirror 33, statically oriented and positioned relative to each other as shown in Fig. 1, with the dichroic mirror 31 reflecting blue light and transmitting green light and red light, and the dichroic mirror 32 receiving the light transmitted through the dichroic mirror 31 and reflecting the green light and transmitting the red light, and the reflection mirror 33 reflecting the blue light reflected by the dichroic mirror 31. EX1001, Fig.1, 5:31-34, 6:2-32. In my opinion, therefore, this claim element covers the light separation optic system 30 and its equivalents.

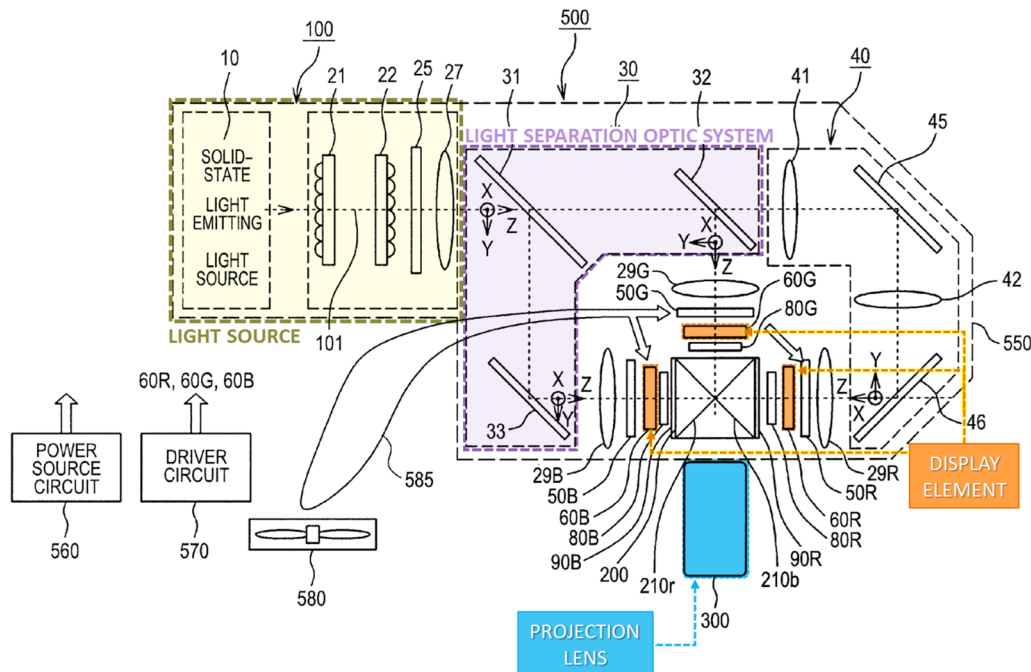


EX1001, FIG. 1 (annotated)

45. Regarding “a light modulation means,” because the element contains the word “means,” and the term by itself does not have a sufficiently definite meaning as the name for structure, I believe that this term meets the definition of a means-plus-function element and base my invalidity opinions on this understanding.

46. The specification of the ’580 Patent describes three structures for light intensity modulators: transmission-type liquid crystal panels, reflection-type liquid crystal panels, or digital mirror devices (DMD’s), each panel (light intensity modulator) being used to modulate the corresponding color light separately from other panels. EX1001, Fig. 1, 3:1-10, 3:42-50, 7:41-48. The specification of the ’580 Patent discloses three (3) sets of transmission-type liquid crystal panels to perform the function of modulation of the blue light, green light and red light respectively and separately. *Id.*, 5: 4-5, 6:10-32. In my opinion, therefore, “light modulation

means” covers a set of three panels, one for each separated color light, each panel having one of these three types, and equivalents thereof.



EX1001, FIG. 1 (annotated)

47. Regarding “a projection means,” because the element contains the word “means,” and the term by itself does not have a sufficiently definite meaning as the name for structure, I believe that this term meets the definition of a means-plus-function element and base my invalidity opinions on this understanding.

48. The specification of the ’580 Patent discloses “and a projection lens 300 as a projecting means.” EX1005, 5:1-12. In my opinion, therefore, this element covers a projection lens or its equivalents.

49. Regarding “a light flux capturing means” recited in claims 7 and 37, because the element contains the word “means,” and the term by itself does not have

a sufficiently definite meaning as the name for structure, I believe that this term meets the definition of a means-plus-function element and base my invalidity opinions on this understanding.

50. The term, “a light flux capturing means,” is ambiguous. Claims 7 and 37 state that “white lights [] are captured by a light flux capturing means,” but it is unclear whether the “light flux capturing means” is part of the claimed “projection-type display apparatus.” For the purpose of this declaration, however, I assume “a light flux capturing means” is part of the claimed “projection-type display apparatus.”

51. I further consider “a light flux capturing means” a means-plus-function element based on the use of the word, “means,” the function being to direct the white light emitted from the light source. A structure disclosed in the ’580 Patent that performs this function is the reflection mirror 130, which is a parabolic mirror. EX1001, 8:51-65. In forming my opinion, therefore, I assume that this element covers a reflection surface, such as a mirror, having a focus point, or equivalents thereof.

52. Regarding “the emitting light,” this term is ambiguous because claim 1, to which claim 3 refers, recites three lights being emitted: (1) excitation light emitted from the solid-state light emitting element, (2) white lights, and (3) light emitting from a fluorescent substance, which is excited by said excitation light. It is unclear

which one “*the* emitting light” (emphasis added) refers to. A similar ambiguity arises for claim 33. However, for the purpose of this Declaration, I assume “the emitting light” means the fluorescent light emitting from the fluorescent substance.

53. Regarding “separation mirror,” this term would not have been understood by a POSITA to have a sufficiently definite meaning as the name for structure. Therefore, I believe that the element reciting this term is a means-plus-function element. The specification of the ’580 patent describe “separation mirror” only in terms of its function, not structure. *See, e.g.*, EX1001, 8:37-50. For the purpose of this Declaration, I assume “separation mirror” is construed to encompass a dichroic mirror.

54. Regarding “almost reflect[s]” and “almost passing,” these terms are ambiguous, as it is unclear whether they mean “not quite reflects” and “not quite passing,” respectively, or “reflects nearly all” and “passing nearly all,” respectively. For the purpose of this declaration, my analysis of relevant claim(s) is based on the interpretation that these terms mean “reflects nearly all” and “passing nearly all,” respectively.

V. LEVEL OF SKILL IN THE ART

55. 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 '580 Patent claims foreign priority is February 5, 2010.

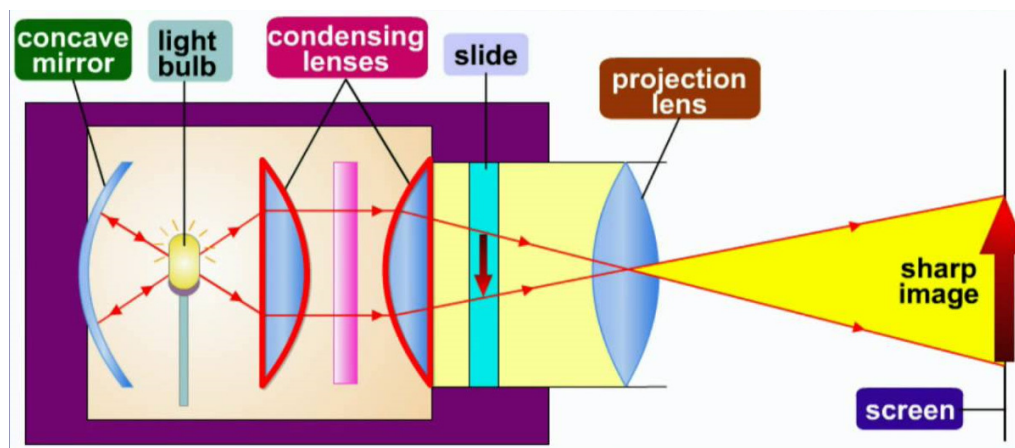
56. In my opinion, a POSITA at the time of the invention of the '580 Patent would have had a Ph.D. in electrical engineering, physics, optical sciences, optical engineering, or a related scientific or engineering field, and at least one to two years of work or research experience in optical engineering, 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.

57. I met and exceeded the above qualifications for a POSITA as of at least February 5, 2010 (and thereafter) and consider myself to be a person with at least ordinary skill in the art of the '580 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

58. I provide the following background information on technology relevant to the '580 Patent based on my general knowledge and experience in the fields of optical engineering and optical science.

59. 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.

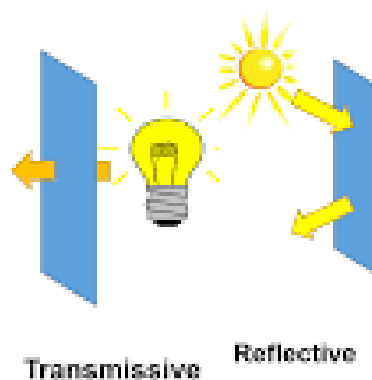


60. The main block components of an optical projector are a light source, a light condenser, a transparency or subject to be projected, a projection lens, and a screen. In all projectors, the efficient use of the available light is important. Much effort is put into minimizing light loss and minimizing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

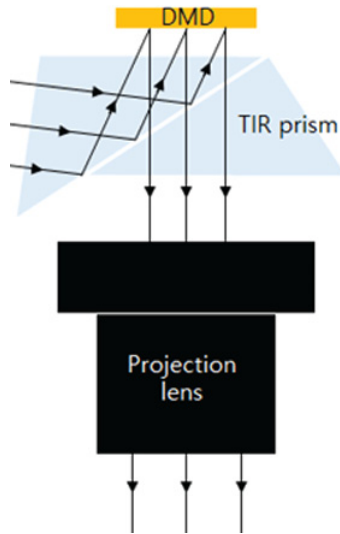
61. The condenser optics' function is to transmit as much light as possible from the light source to the slide or image display; the condenser must illuminate the slide, or image display, in a uniform manner.

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

63. 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.



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



65. 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.

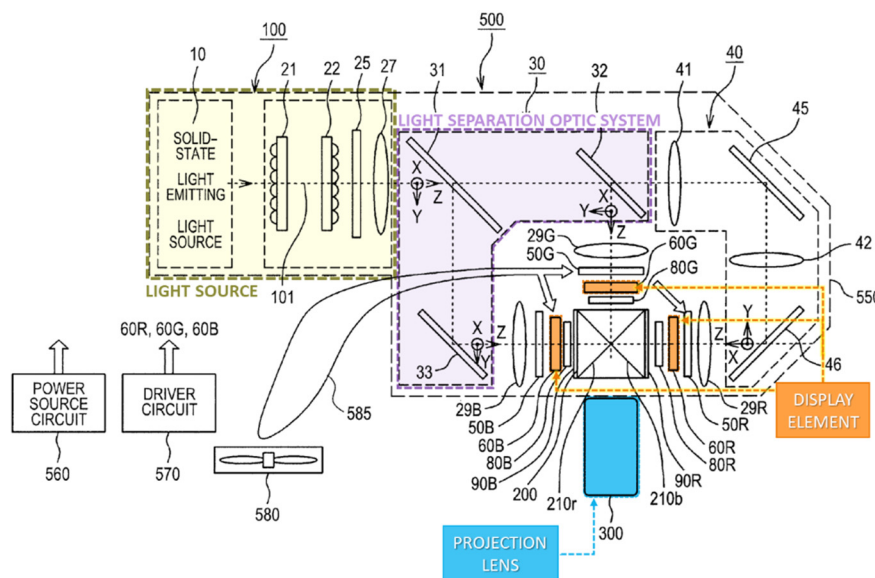
VII. U.S. PATENT NO. 8,593,580 (THE “’580 PATENT”)

66. I have been informed and understand that the earliest priority date to which the Patent Owner may claim the ’580 Patent is entitled is February 5, 2010. For purposes of my analysis herein, I am assuming that the ’580 Patent is entitled to this priority date. I understand that all of the references discussed below qualify as prior art based on this assumed priority date of February 5, 2010, and because they were published before October 6, 2009, one year before the earliest U.S. filing date.

67. The ’580 Patent describes a projection-type display apparatus with a solid-state light source configured to emit white light. EX1001, Abstract. The ’580 Patent “relates to a projection-type display apparatus of projecting an optical image,

which is formed by modulating light intensity of lights from a light source depending on a video signal, by means of a transmission-type or a reflection-type liquid crystal panel, or a digital mirror device (DMD) aligning plural numbers of micro mirrors, etc.” *Id.* 1:11-16.

68. The '580 Patent describes a projector-type display apparatus shown in Fig. 1, reproduced below:

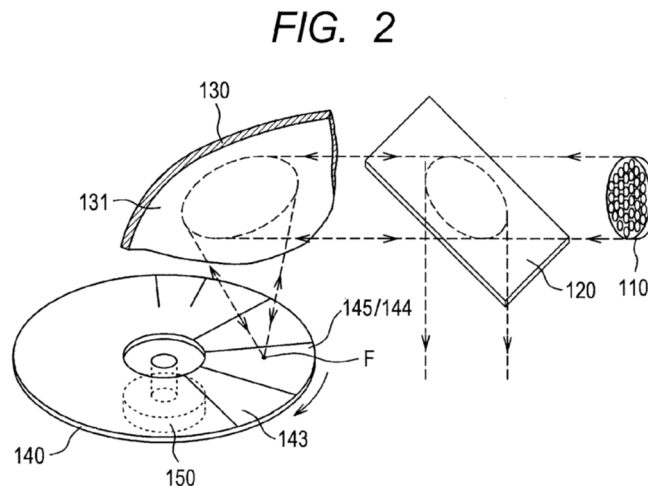


EX1001, FIG. 1 (annotated)

69. The projector-type display apparatus includes an optical system 100, a light separation optic system 30, a relay optic system 40, three sets of field lenses 29 (29R, 29G and 29B), three sets of transmission-type liquid crystal panels 60 (60R, 60G and 60B), a light composing prism 200, and a projection lens 300 as a projecting means. *Id.*, 5:22-30.

70. The optical image of each color light is incident upon the light composing prism 200. The composed light emitting from the light composing prism 200 mentioned above is projected on a screen through a projection lens 300, such as a zoom lens, as an enlarged picture. *Id.*, 7:25-30.

71. Fig. 2, reproduced below, shows the principle of the light source unit 10. *Id.*, 7:57-58:



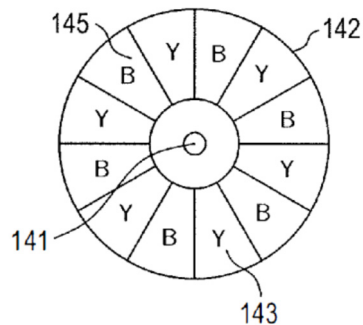
EX1001, FIG. 2

72. The unit 10 includes a semiconductor laser element group 110, which emits B-light, a separation mirror 120, a reflection mirror 130 having a parabolic surface, for example, disposed at a position facing to that laser beam emitting surface of the semiconductor laser element 110, a disc (or wheel) member 140 rotating round in the vicinity of a focus point (F) of the reflection mirror. *Id.*, 7:59-8:8. The separation mirror 120 passes the blue color laser beams emitting from the semiconductor laser element group to the reflection mirror 130; the separation mirror

120 also receives light from the reflection mirror. The mirror reflects the lights emitting from the vicinity of that focus point and directs the light to the separation mirror 120. *Id.*, 8:37-65.

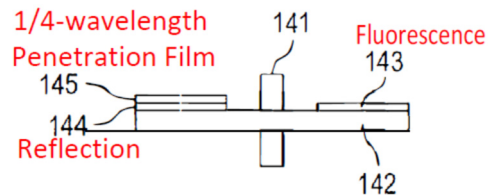
73. As shown in FIGS. 5A and 5B below, the surface of the disc-like base member 142 are divided into alternating “Y” regions, which are provided a fluorescence surface 143, and “B” regions, which are provided with a reflection surface 144 and a penetration film 145 on top of the reflection surface 144 for shifting the phase of the excitation light by $1/4$ wavelength ($1/4\lambda$). The fluorescent surface 143 receives an excitation light and emits a yellow light (shown by “Y” in FIG. 5B). With rotation of the base 142, the excitation light is condensed at the vicinity of the focus point “F” and is incident on the fluorescence surface 143 (Y) and the reflection surface 144 alternately. As a result, from the disc member 140 emits the fluorescent light and the reflected excitation in a time-sharing manner. *Id.*, 8:66-9:32.

FIG. 5B



EX1001, FIG. 5B

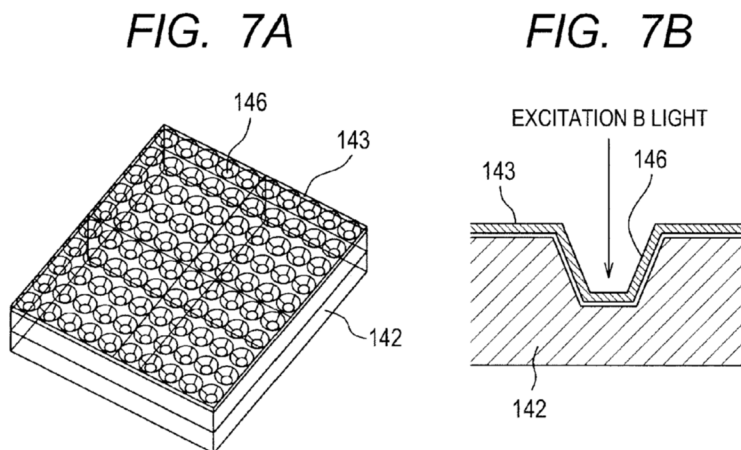
FIG. 5A



EX1001, FIG. 5A (annotated)

74. As a result, the B-color excitation light and the yellow color fluorescent light are mixed to become a white light. *Id.*, 10:41-47.

75. In some embodiments, as shown in Fig. 7a and 7b, reproduced below, recess portions 146 are formed on the surface of the base member 142, in particular, on the surface in the vicinity of the focus point “F”, upon which the excitation light is incident. The fluorescence surface 143 covers over the recess portions 146, e.g., the cone-shaped dents or pits formed on the surface. In comparison with the case where no such cone-shaped dents or pits is formed on an incident surface of the excitation light, the fluorescence lights emitting from the surface have a narrower scattering direction distribution and may increase the efficiency of utilizing the lights. *Id.* 12:1-25.



EX1001, Fig. 7a and 7b

76. The '580 Patent issued on November 26, 2013, from U.S. Patent Application No. 13/891,267, filed on May 10, 2013. EX1001, Cover. The '580 Patent claims priority as a continuation of application No. 12/898,763, filed on October 6, 2010 and which became U.S. Patent No. 8,462,296. EX1002. It further claims foreign priority to Japanese Application No. 2010-023911, filed on February 5, 2010. *Id.* The claims of the '580 Patent were allowed without any rejections or amendments via a Notice of Allowance issued on July 22, 2013. EX1002 at 158-65. A Corrected Notice of Allowability was issued on September 3, 2013, after an Information Disclosure Statement was considered by the Examiner. EX1002 at 42-44.

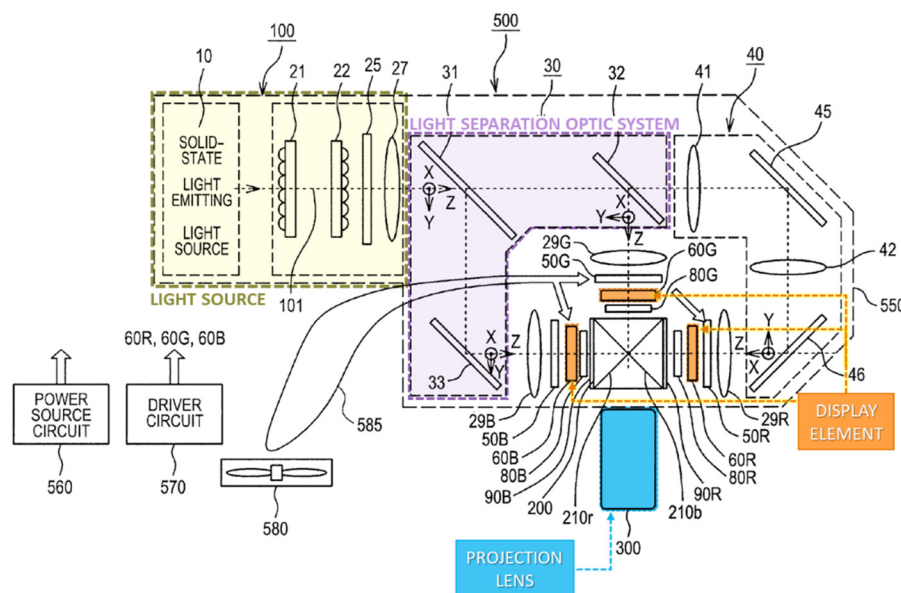
VIII. PRIOR ART

A. Ishino

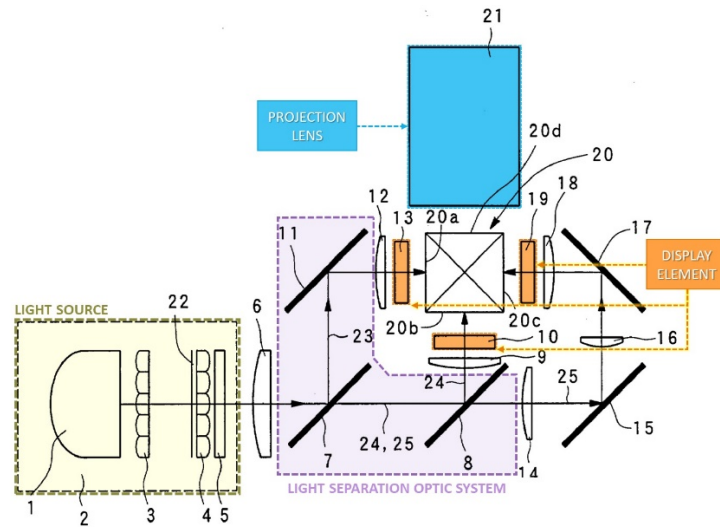
77. Ishino was filed as U.S. Application No. 10/343,883 on June 10, 2002, and published as U.S. Publication No. 2003/0189693 on October 9, 2003. EX1005. Ishino was neither cited nor considered by the Examiner during prosecution of the '580 Patent. *Id.*

78. Ishino generally discloses a lighting device and projection type image display device. EX1005, title.

79. Ishino discloses a similar image display device as disclosed in the '580 Patent, as shown by Fig. 1 of the '580 Patent and Fig. 1 of Ishino:



EX1001, Fig. 1(annotated)



EX1005, FIG. 1 (annotated)

80. Ishino discloses a projection-type image display that, as shown in Fig. 1, reproduced below, “includes an illuminator 2[,] which emits illumination light including components having three primary colors, respectively, and an optical system[,] which includes a main condenser lens 6, dichroic mirrors 7 and 8, mirrors 11, 15 and 17, channel condenser lenses 9, 12 and 18, relay lenses 14 and 16, cross prism 20 and a projection lens 21 EX1005, [0054].

81. Ishino further describes that the illuminator emits white light: “The lamp 1 emits an illumination light including components having three primary colors: R, G and B, respectively. The lamp 1 includes a light emitter, [which] is an ultra-high voltage mercury lamp, halogen lamp, metal halide lamp or a xenon lamp, for example.” *Id.*, [0056]-[0057]. Ishino further describes that lamp 1 “emits generally parallel light.” *Id.*, [0123], [0126].

82. Ishino explains that “[t]he dichroic mirror 7 is provided to split the illumination light ... into blue light 23 ... and light components having wavelengths corresponding to other primary colors. [The] projector has provided therein the mirror 11, channel condenser lens 12 and the liquid crystal panel 13 in this order along the optical path of the blue light 23 The liquid crystal panel 13 spatially modulates the blue light 23 ... according to a video signal corresponding to the blue.” *Id.* [0061]-[0066]. Ishino further discloses that “[t]he dichroic mirror 8 splits the incident light components ... into a green light 24 ... and a red light 25 The liquid crystal panel 10 spatially modulates the green light 24 incident thereupon ... according to a video signal corresponding to green. *Id.*, [0067]-[0071]. “The liquid crystal panel 19 will spatially modulate the red light 25 according to a video signal corresponding to the red.” *Id.*, [0072]-[0074].

83. Ishino further discloses that “[t]he dichroic mirror 8 splits the incident light components ... into a green light 24 ... and a red light 25 The liquid crystal panel 10 spatially modulates the green light 24 incident thereupon ... according to a video signal corresponding to green. *Id.*, [0067]-[0071].

84. Ishino further describes that “[t]he liquid crystal panel 19 will spatially modulate the red light 25 according to a video signal corresponding to the red.” *Id.*, [0072]-[0074].

85. Ishino further describes that “the liquid crystal projector has the cross prism 20 and projection lens 21 provided therein in a position where the optical paths of the blue, green and red light components 23, 24 and 25 cross each other. The cross prism 20 combines the blue, green and red light components 23, 24 and 25 together and the projection lens 21 projects the combined light components coming from the cross prism 20 toward a screen (not shown).” *Id.* [0076].

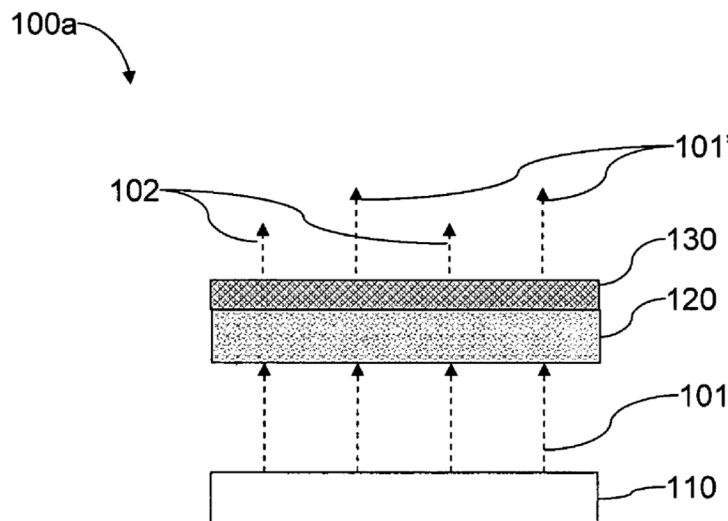
B. Erchak

86. Erchak was filed as U.S. Application No. 11/238,667 on September 29, 2005 and issued as U.S. Patent No. 7,196,354 on March 27, 2007. EX1006. Erchak was neither cited nor considered by the Examiner during prosecution of the '580 Patent. *Id.*

87. Erchak discloses a wavelength-converting light-emitting device. EX1006, title.

88. Erchak discloses, as shown in FIG. 1a, reproduced below, “a light-emitting device 100a including a light-generating region 110, a wavelength-converting region 120, and a thermally conductive region 130 [T]he light-generating region may be an LED that includes an active region (e.g., a quantum well structure). Region 110 may be operated to generate light 101 that enters the wavelength-converting region 120, where at least some of the light is converted to light 102 having one or more wavelengths different than the wavelength of generated

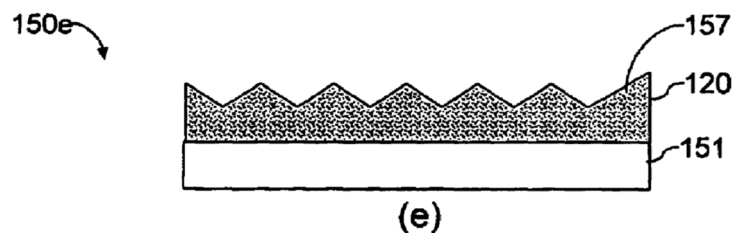
light 101. As shown, a portion of light 101, namely light 101', may pass through the wavelength-converting region without being converted to light having a different wavelength (i.e., light 102). ... [T]he emission of light from the light-emitting device includes the combination of light 101' and light 102. For example, if light 101' has a wavelength characteristic of blue light and light 102 has a wavelength characteristic of yellow light, then *the combined emission (i.e., light 101' and 102) may appear white*. EX1006, 3:55-4:11 (emphasis added).



EX1006, Fig. 1a

89. Erchak further discloses that “[w]avelength-converting region 120 is a region that can include one or more wavelength-converting materials that can convert the wavelength of absorbed light. The wavelength-converting materials can function by absorbing light having a first wavelength and emitting light having a second wavelength (e.g., longer wavelengths). In some embodiments, the wavelength-converting region includes a phosphor material.” EX1006, 7:13-20.

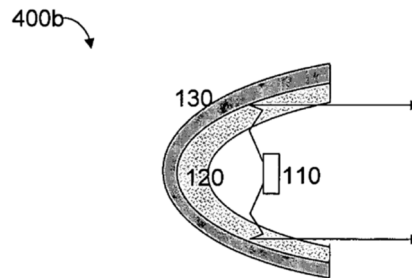
90. Erchak discloses additional configurations for the light-emitting device. For example, Erchak discloses that, as shown in Fig. 3e, reproduced below, the wavelength-converting region 120 is supported on a substrate (e.g., glass) (*Id.*, 13:31-35) and has a patterned surface. *Id.*, 14:29-36. Erchak explains that [p]atterning one or more surfaces is one method of increasing the surface area and thereby increasing the heat extraction from the wavelength-converting region, as shown in FIG. 3e. Without wishing to be bound by theory, it is believed that in some embodiments, a patterned emission surface on the window can also increase light extraction out of the package window. *Id.*, 14:29-39.



EX1006, Fig. 3e

91. Erchak further discloses that in another embodiment, shown in FIG. 4b, reproduced below, “the wavelength-converting region ... may be shaped such that emitted light is collimated and/or focused. For example, ... the assembly of the wavelength-converting region and the thermally conductive region has a parabolic shape, ... The light-generating region 110 may be configured so as to generate light that is projected onto the wavelength-converting region. Some of the light can be converted by the wavelength-converting region, and both converted light

propagating towards the reflecting thermally conductive region and any unconverted light can be reflected and directed away from the light-emitting device 400b.”



EX1006, Fig. 4b

C. Li '415

92. Li '415 was filed as Chinese Application No. 200810065260.1 on January 30, 2008 and published as Chinese Publication No. 101498415 on August 5, 2009. EX1007. Li '415 was neither cited nor considered by the Examiner during prosecution of the '580 Patent. *Id.*

93. Li '415 discloses a light source and method for enhancing the emission efficiency of mixed light based on fluorescent powder. EX1007, Abstract. As shown in Fig. 1, reproduced below, the dichroic filter 2 is positioned between the excitation light source 1 and the excitation material/excitation material layer 3, receives the oblique radiation of the excitation light from the excitation light source 1, and transmits part of the excitation light to the excitation material/excitation material layer 3, while also reflecting the other part of the excitation light to the second reflection surface 5. The dichroic filter 2 also reflects the excited light of the

excitation material 3 to the light emission surface of the light source and transmits part of the excitation light reflected from the second reflection surface 5 to the light emission surface of the light source. *Id.*, p. 12, lines 9-17. “The embodiment of Figure 3 illustrates the selection of the characteristics of the dichroic filter 2 in the light source structure of Figures 1 and 2. Curve a2 represents the spectrum of the excitation light, which is blue light; curve a3 represents the spectrum of the excited light, for example, yellow light...” *Id.*, p. 12, line 25-p. 13, line 7.

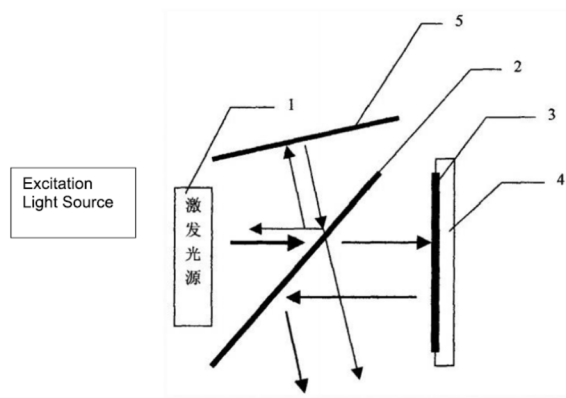


图 1

Figure 1

EX1007, Fig. 1

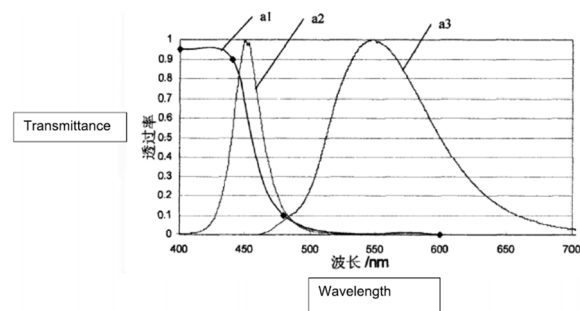


图 3

Figure 3

EX1007, Fig. 3

94. Li '415 further discloses using appropriate combination of blue excitation light and yellow excited light to generate white light. *Id.*, p. 12, line 25-p. 13, line 7.

95. Li '415 further discloses that “the fluorescence conversion solution is to use the emission light from alternative light sources (such as, but not limited to, LED chips) to excite fluorescent powder, resulting in light with a longer

wavelength. *Id.*, p. 12, lines 11-16. A POSITA would have known that an LED is a solid-state source made of semiconductor materials.

D. Bakker

96. Bakker was filed as U.S. Application No. 10/598,607 on March 3, 2005, and published as U.S. Publication No. 2007/0182932 on August 9, 2007. EX1008. Bakker was neither cited nor considered by the Examiner during prosecution of the '580 Patent. *Id.*

97. Bakker discloses an LCD projecting system having dichroic mirrors for polarization conversion. EX1008, Title.

98. Bakker discloses that certain prior-art projection systems using light sources that emit blue, green, and red lights use beam splitters, which are expensive, and that alternative approaches for conversion of polarization are required reducing the number of beam splitters required in the projection system. EX1008, [0002]. Bakker discloses in one embodiment, shown in Fig. 5, dichroic mirrors 212 and 220 used to split blue, green, and red light based on the polarization of the light. For example, dichroic mirror 212 transmits a major part of p-polarized blue light in the blue spectral range (B_p) and reflects s-polarized blue (B_s) light together with the green light (both polarizations) and red light (both polarizations). *Id.*, [0055], [0058].

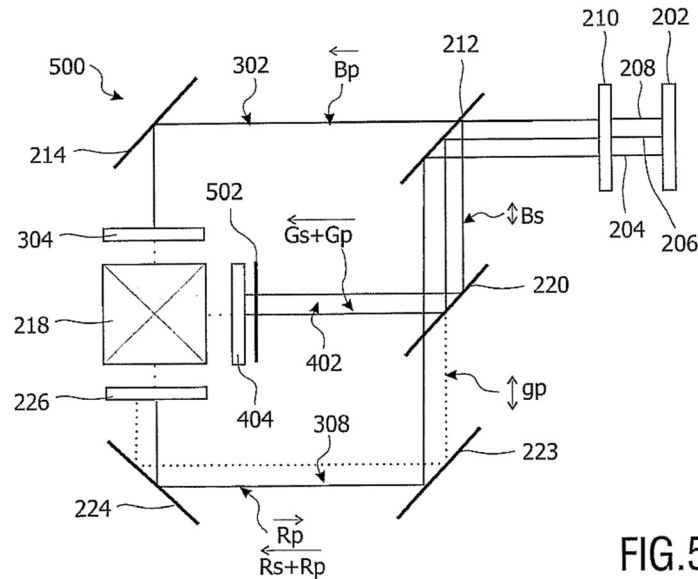


FIG.5

EX1008, Fig. 5

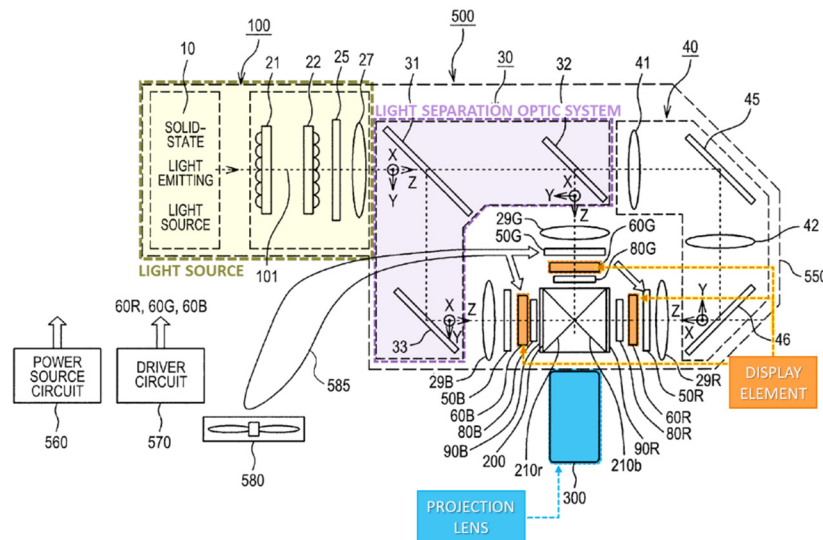
99. Choosing dichroic mirrors based on their polarization characteristics resulted in a reduction in the number of polarization conversions needed. *Id.*, [0052].

E. Uchiyama

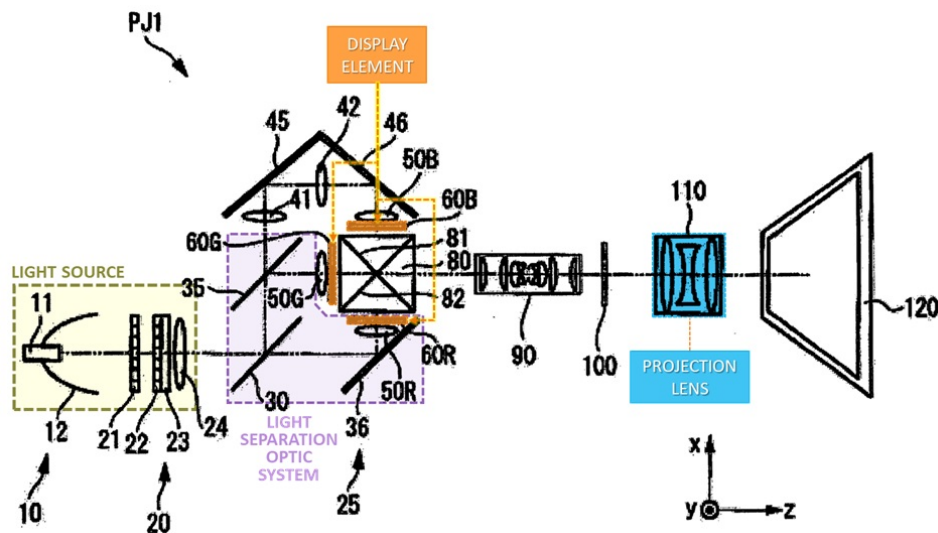
100. Uchiyama was filed as U.S. Application No. 11/363,181 on February 28, 2006, and published as U.S. Publication No. 2006/0203202 on September 14, 2006. EX1009. Uchiyama was neither cited nor considered by the Examiner during prosecution of the '580 Patent. *Id.*

101. Uchiyama generally discloses an image display device and projector. EX1009, title.

102. Uchiyama discloses a similar image display device as disclosed in the '580 Patent, as shown by Fig. 1 of the '580 Patent and Fig. 1 of Uchiyama:



EX1001, Fig. 1 (annotated)



EX1009, Fig. 1 (annotated)

103. Uchiyama discloses that, as shown in Fig. 1, reproduced below, “[t]he projector PJ1 comprises an image display device including: a light source 10; a uniform illumination system 20 that makes a luminance distribution of a light coming incident thereon from the light source 10 uniform; a color modulation portion 25 that modulates luminance of three primary colors, RGB, among the wavelength regions of a light coming incident thereon from the uniform illumination

system 20 (including three transmissive liquid crystal light valves as a first modulation element, that is, a transmissive liquid crystal light valve 60B for a blue light, a transmissive liquid crystal light valve 60G for a green light, and a transmissive liquid crystal light valve 60R for a red light); a relay lens 90 that relays a light coming incident thereon from the color modulation portion 25; and a transmissive liquid crystal light valve 100 serving as a second modulation portion that modulates luminance of a light coming incident thereon from the relay lens 90 in all the wavelength regions, and a projection lens (projection system) 110 that projects a light coming incident thereon from the liquid crystal light valve 100 onto a screen 120.” EX1009, [0043].

104. Uchiyama further discloses that “[t]he light source 10 includes a lamp 11 comprising an extra-high pressure mercury vapor lamp or a xenon lamp, and a reflector 12 that reflects or collects a light emitted from the lamp 11.” *Id.* [0044]. Uchiyama further discloses that “The color modulation portion 25 comprises two dichroic mirrors 30 and 35 serving as light separation portions, three mirrors (reflection mirrors 36, 45, and 46), five field lenses (a lens 41, a relay lens 42, parallelizing lenses 50B, 50G, and 50R), three liquid crystal light valves 60B, 60G, and 60R, and a cross dichroic prism 80.” *Id.*, [0047]. “The dichroic mirrors 30 and 35 separate (isolate) a light (a white light) from the light source 10 to lights of three primary colors, RGB representing red (R), green (G), and blue (B).” *Id.*, [0048].

IX. Analysis And Identification Of How The Claims Are Unpatentable

A. Ishino in view of Erchak renders Claims 1, 3-5, 8-9, 32-35, and 38 obvious

105. In my opinion, and for the reasons explained below, Ishino, in view of Erchak, renders claims 1, 3-5, 8-9, 32-35, and 38 obvious.

106. As initial matter, POSITA would have been motivated to combine the teachings of Ishino with the teachings of Erchak.

107. Ishino is directed to a lighting device and projection type image display device. EX1005, title. The lamp disclosed in Ishino includes a light emitter, which can be an ultra-high voltage mercury lamp.” EX1005, [0056]-[0057]. At the time of the invention of the '580 Patent, a POSITA would have recognized the drawback of such lamps for projection-type image display devices and looked to solid-state light sources as replacements. For example, the '580 Patent admits, in the “Background of the Invention” section,

[W]hen applying a discharge lamp, generating a white light therefrom, it is necessary to provide a high-voltage power source, causing a difficulty in handling thereof, and also since it is short in the lifetime thereof and low in the shock-resistance thereof, therefore, *in the place thereof*, ideas or proposals are made, variously, of **applying the solid-stake light source**, such as, the light emitting diode and/or the laser diode, etc., as the light source of the projection-type display apparatus.

Id., 1:34-42 (emphases added). *See, also*, EX1011¹, [0006] (“In recent years, there have been developments in projectors employing, as light sources, ... light emitting diodes or solid-state light emitting devices such as organic electroluminescence light emitting devices and laser, ... Compared with discharge lamps, light emitting diodes are advantageous in that they consume less power and highly reliable.” *Id.*, [0006]-[0007].) A POSITA, having been aware of Ishino, would therefore have looked in the field of solid-state light sources for replacement for the lamp disclosed in Ishino.

108. Erchak, as discussed above, discloses a solid-state light source configured to emit white light. EX1006, 3:55-4:11. A POSITA would thus have had a motivation to combine the teachings of Ishino and Erchak to replace the light source of Ishino with the light source of Erchak, and would have recognized that combining these teachings would have produced predictable and operable results.

1. Independent Claim 1

[1.0] A projection-type display apparatus, comprising:

109. Ishino discloses a projection-type display apparatus.

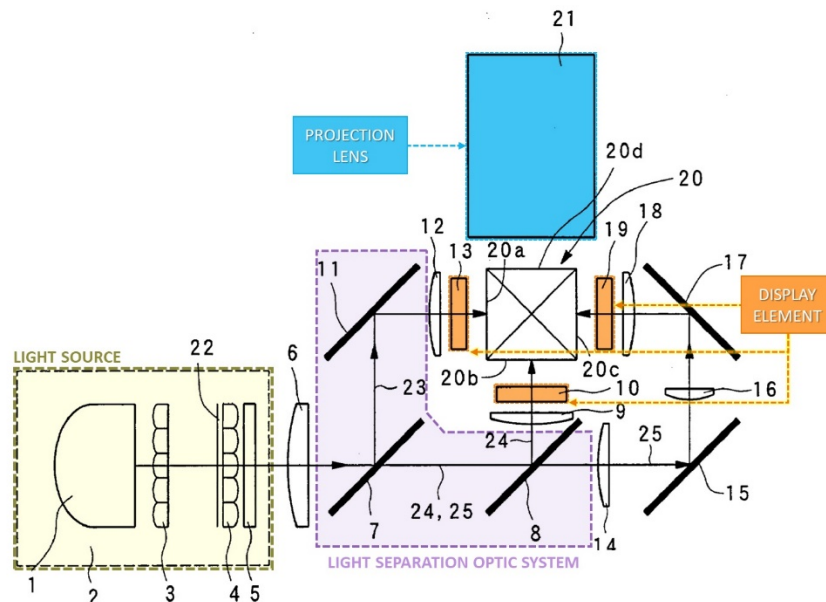
¹ U.S. Patent Application Publication No. 2009/0262308, published October 22, 2009.

110. Ishino states that “[t]he present invention relates to an illuminator ... and a projector type image display apparatus which projects the trichromatic light emitted from the illuminator to display a color image.”

[1.1] a light source, including a solid-state light emitting element for emitting an excitation light therein, configured to emit white lights including a light emitting from a fluorescent substance, which is excited by said excitation light;

111. Ishino discloses a light source configured to emit white lights.

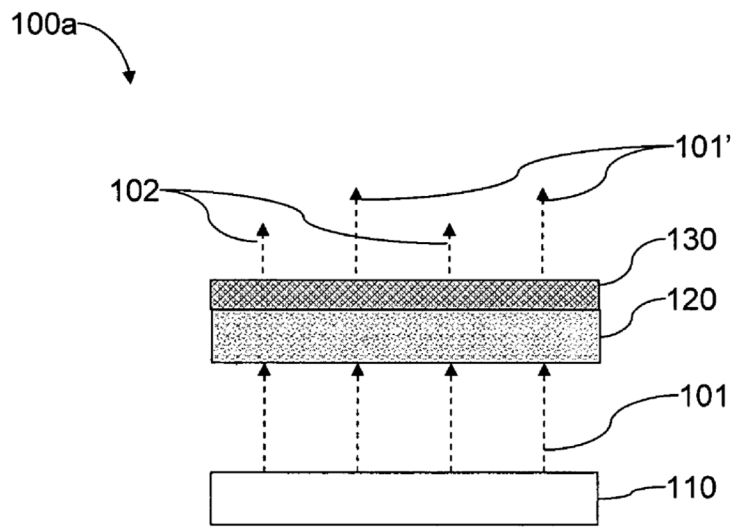
112. Ishino describes that “[t]he illuminator 2 includes a lamp 1 to emit trichromatic light The lamp 1 emits an illumination light including components having three primary colors: R, G and B, respectively....” EX1005, [0056]-[0057].



EX1005, FIG. 1

113. Erchak discloses a solid-state light emitting element for emitting an excitation light therein, configured to emit white lights including a light emitting from a fluorescent substance, which is excited by said excitation light.

114. Erchak discloses, as shown in FIG. 1a, reproduced below, and as discussed in Section VIII.B, *supra*, that the light-emitting device 100a includes a light-generating region 110 that may be an LED, a wavelength-converting region 120 that may be a phosphor material. Erchak further discloses that the emission of light from the light-emitting device includes the combination of blue light 101' and yellow light 102 and that the combined emission (i.e., light 101' and 102) may appear white. EX1006, 3:55-4:11.



EX1006, Fig. 1a

115. As explained in ¶¶ 106-107, *supra*, a POSITA would have been motivated to combine the teaching of Ishino and Erchak and the claim element is then disclosed by the combination.

[1.2] a light separation optic system, configured to separate the white lights from said light source into red-color (R), green-color (G) and blue-color (B);

116. Ishino discloses a projection-type display apparatus that includes a light separation optic system, configured to separate the white lights from said light source into red color, green color, and blue color. Fig. 1 of Ishino has the substantially the same arrangement of the optical elements as that in Fig. 1 of ‘580 patent.

117. Ishino explains that “[t]he dichroic mirror 7 is provided to split the illumination light ... into blue light 23 ... and light components having wavelengths corresponding to other primary colors. EX1005, [0062]. Ishino further discloses that the dichroic mirror 8 splits the incident light components having the wavelengths corresponding to the other primary colors into a green light 24 ... and a red light 25. *Id.*, [0068].

[1.3] a light modulation means, configured to make light-modulation on a respective one of the lights of the R, G and B separated, depending on a video signal; and

118. Ishino discloses a light modulation means, configured to make light-modulation on a respective one of the lights of the R, G and B separated, depending on a video signal.

119. Ishino discloses that “[t]he liquid crystal panel 13 spatially modulates the blue light 23 ... according to a video signal corresponding to the blue.” EX1005, [0066]. Ishino further discloses that “[t]he liquid crystal panel 10 spatially modulates the green light 24 ... according to a video signal corresponding to green. *Id.*, [0071].

Ishino further discloses that “[t]he liquid crystal panel 19 will spatially modulate the red light 25 ... according to a video signal corresponding to the red. *Id.*, [0074].

[1.4] a projection means, configured to enlargedly project a respective one of optical images, which are formed by said light modulation means, wherein

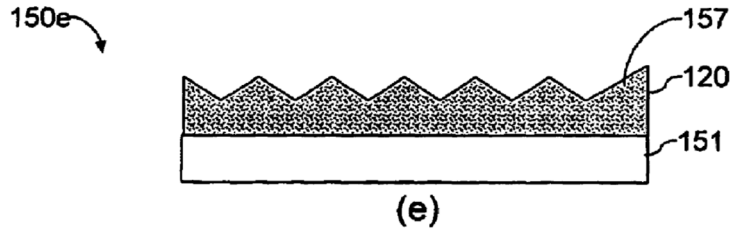
120. Ishino discloses a projection means, configured to enlargedly project a respective one of optical images, which are formed by said light modulation means.

121. Ishino discloses that “the liquid crystal projector has the cross prism 20 and projection lens 21 provided therein in a position where the optical paths of the blue, green and red light components 23, 24 and 25 cross each other. The cross prism 20 combines the blue, green and red light components 23, 24 and 25 together and the projection lens 21 projects the combined light components coming from the cross prism 20 toward a screen (not shown). EX1005, [0076].

[1.5] said fluorescent substance has plural numbers of concave portions on a surface, upon which said excitation light is incident.

122. Erchak discloses said fluorescent substance has plural numbers of concave portions on a surface, upon which said excitation light is incident.

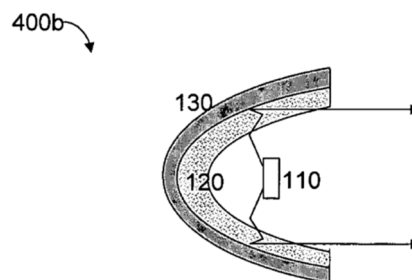
123. Erchak discloses that “FIG. 3e illustrates [] a package window 150e of a light-emitting device where an increased surface area on the package window increases heat extraction,” where the layer labeled “120” is a wavelength-converting region 120, which may be a phosphor material. EX1006, 3:55-4:11.



EX1006, Fig. 3e

124. Erchak further describes advantages such a phosphor surface has: “Increasing the surface area of the window can provide increased cooling. Patterning one or more surfaces is one method of increasing the surface area and thereby increasing the heat extraction from the wavelength-converting region, as shown in FIG. 3e. Without wishing to be bound by theory, it is believed that in some embodiments, a patterned emission surface on the window can also increase light extraction out of the package window.” *Id.*, 14:29-39.

125. Erchak further discloses, with reference to FIG. 4b, that the assembly of the wavelength-converting region and the thermally conductive region has a parabolic shape, ... The light-generating region 110 may be configured so as to generate light that is projected onto the wavelength-converting region. [15:52-58]



EX1006, Fig. 4b

126. A POSITA would therefore have had a motivation to incorporate Erchak's concave features/portions into the phosphor.

127. In summary, claim 1 is obvious over Ishino in view of Erchak.

2. Dependent Claim 3

[3.0/3.1] The projection-type display apparatus, as described in the claim 1, wherein the emitting light are the lights in a wavelength region having a complementary color relationship with said excitation light with respect to a white color.

128. Erchak discloses that the emitting light are the lights in a wavelength region having a complementary color relationship with said excitation light with respect to a white color.

129. Erchak discloses that “[i]n some embodiments, it may be desirable for the light emitting device to emit light that is substantially white. In such embodiments, the wavelength-converting region can emit yellow light, for example, a (Y,Gd)(Al,Ga)G:Ce³⁺ phosphor. ... A viewer of the total light spectrum emerging from light-emitting device 100a or 100b sees the yellow broad emission spectrum from the wavelength-converting region and the blue narrow emission spectrum from the light-generating region (e.g., from the GaN LED) and typically mixes the two spectra to perceive white. *Id.*, [8:36-50].

130. Further, Erchak teaches that “the emission of light from the light-emitting device includes the combination of light 101' and light 102. For example, if light 101' has a wavelength characteristic of blue light and light 102 has a

wavelength characteristic of yellow light, then *the combined emission (i.e., light 101' and 102) may appear white*. EX1006, 3:55-4:11 (emphasis added). Thus, Blue light and yellow light complement each other to form white light.

131. In summary, claim 3 is obvious over Ishino in view of Erchak.

3. Dependent Claim 4

[4.0/4.1] The projection-type display apparatus, as described in the claim 3, wherein said solid-state light emitting element is a semiconductor laser element.

132. Erchak discloses that said solid-state light emitting element is a semiconductor laser element.

133. Erchak discloses that “the light-generating region may be other types of light-emitting devices including lasers, or portions thereof. EX1006, [4:53-57]. Erchak further discloses that “the light-emitting devices and structures described in the above embodiments can be fabricated using a combination of any suitable processing techniques ... for depositing various materials, including semiconductors, insulators, and metals.” *Id.*, 20:4-10.

134. In summary, claim 4 is obvious over Ishino in view of Erchak.

4. Dependent Claim 5

[5.0/5.1] The projection-type display apparatus, as described in the claim 4, wherein said excitation light is the B-color light, and said emitting light is a yellow-color (Y) light.

135. Erchak discloses said excitation light is the B-color light, and said emitting light is a yellow-color (Y) light.

136. Same analysis as for claim 3, *supra*.

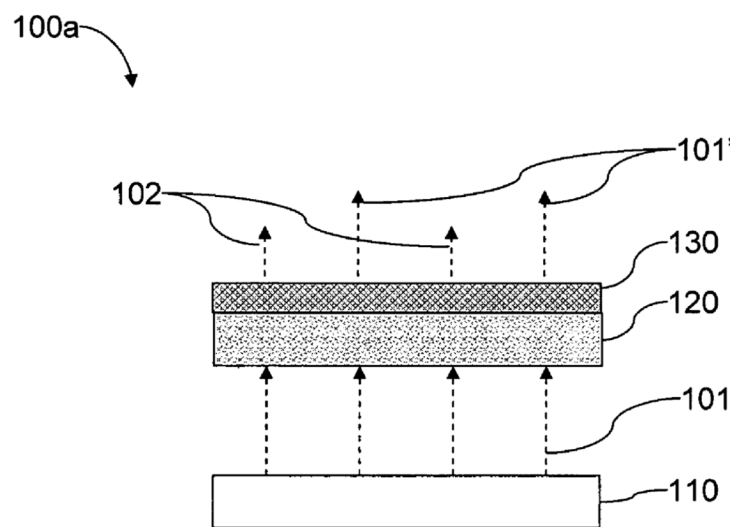
137. In summary, claim 5 is obvious over Ishino in view of Erchak.

5. Dependent Claim 8

[8.0/8.1] The projection-type display apparatus, as described in the claim 1, wherein said white lights are lights, which are almost in parallel.

138. Erchak discloses that said white lights are lights, which are almost in parallel.

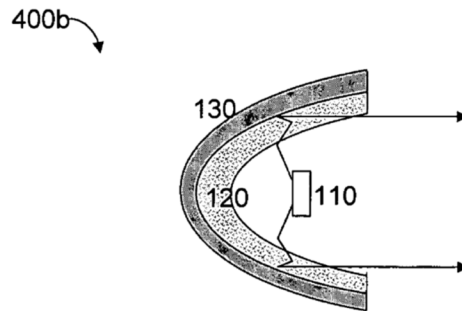
139. As shown in Fig. 1a, the white lights resulting from lights 101', 102 are substantially parallel.



EX1006, Fig. 1a

140. Erchak further disclose, with reference to FIG. 4b, that “the wavelength-converting region and the thermally conductive region may be shaped such that emitted light is collimated and/or focused. ... [T]he assembly of the wavelength converting region and the thermally conductive region has a parabolic

shape [B]oth converted light propagating towards the reflecting thermally conductive region and any unconverted light can be reflected and directed away from the light-emitting device 400b. EX1006, [15:46-63].



EX1006, Fig. 4b

141. In summary, claim 8 is obvious over Ishino in view of Erchak.

6. Dependent Claim 9

[9.0/9.1] The projection-type display apparatus, as described in the claim 1, wherein each of said light modulation means is any one of a transmission-type liquid crystal panel, a reflection-type liquid crystal panel and a digital mirror device (DMD) made by aligning plural numbers of micro-mirrors.

142. Ishino discloses that each of said light modulation means is any one of a transmission-type liquid crystal panel, a reflection-type liquid crystal panel and a digital mirror device (DMD) made by aligning plural numbers of micro-mirrors.

143. Ishino discloses that “the liquid crystal projectors according to the present invention have been described concerning the optical system using the transmission type liquid crystal panels. However, the present invention ... may include an optical system using reflection type liquid crystal panels.” EX1005, [0171]. Ishino further discloses that “a digital micro mirror device (DMD) [may be

used] in place of each of the aforementioned reflection type liquid crystal panels.”
EX1005, [0195].

144. In summary, claim 9 is obvious over Ishino in view of Erchak.

7. Independent Claim 32

[32.0] A projection-type display apparatus, comprising:

145. This preamble is met by Ishino, as analyzed for claim 1 in Section IX.A.1, *supra*.

[32.1] a light source, including a solid-state light emitting element for emitting an excitation light therein, configured to emit white lights including a light emitting from a fluorescent substance, which is excited by said excitation light;

146. This element is met by Ishino in combination with Erchak, as analyzed for claim 1 in Section IX.A.1, *supra*.

[32.2] a light separation optic system, configured to separate the white lights from said light source into red-color (R), green-color (G) and blue-color (B);

147. This element is met by Ishino, as analyzed for claim 1 in Section IX.A.1, *supra*.

[32.3] a light modulation means, configured to make light-modulation on a respective one of the lights of the R, G and B separated, depending on a video signal; and

148. This element is met by Ishino, as analyzed for claim 1 in Section IX.A.1, *supra*.

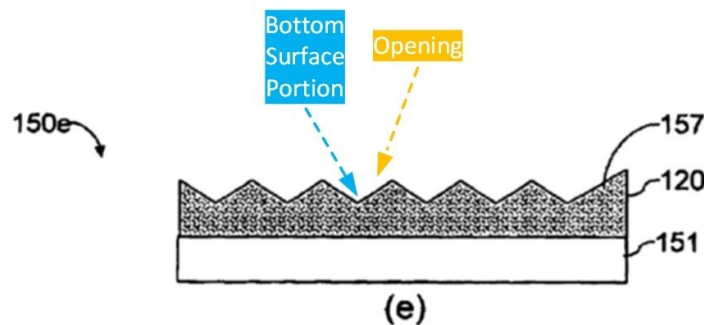
[32.4] a projection means, configured to enlargedly project a respective one of optical images, which are formed by said light modulation means, wherein

149. This element is met by Ishino, as analyzed for claim 1 in Section IX.A.1, *supra*.

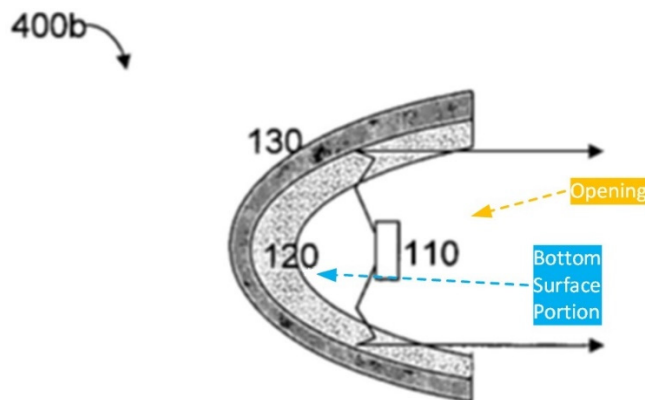
[32.5] said fluorescent substance has a concave portion, an excitation light incident side opening is larger than a bottom surface portion thereof, on a surface, upon which said excitation light is incident.

150. Erchak discloses said fluorescent substance has a concave portion, an excitation light incident side opening is larger than a bottom surface portion thereof, on a surface, upon which said excitation light is incident.

151. *See*, Figs. 3e, 1a, 4a, 4b, and 5 of Erchak and analysis of Element [1.5] in Section IX.A.1, *supra*, for description of the disclosure of this element by Erchak.



EX1006, Fig. 3e (annotated)



EX1006, Fig. 4b (annotated)

152. In summary, claim 32 is obvious over Ishino in view of Erchak.

8. Dependent Claim 33

[33.0/33.1] The projection-type display apparatus, as described in the claim 32, wherein the emitting light are the lights in a wavelength region having a complementary color relationship with said excitation light with respect to a white color.

153. This element is met by Erchak, as analyzed for claim 3 in Section IX.A.2, *supra*.

154. In summary, claim 33 is obvious over Ishino in view of Erchak.

9. Dependent Claim 34

[34.0/34.1] The projection-type display apparatus, as described in the claim 33, wherein said solid-state light emitting element is a semiconductor laser element.

155. This element is met by Erchak, as analyzed for claim 4 in Section IX.A.3, *supra*.

156. In summary, claim 34 is obvious over Ishino in view of Erchak.

10. Dependent Claim 35

[35.0/35.1] The projection-type display apparatus, as described in the claim 34, wherein said excitation light is the B-color light, and said emitting light is a yellow-color (Y) light.

157. This element is met by Erchak, as analyzed for claim 5 in Section IX.A.4, *supra*.

158. In summary, claim 35 is obvious over Ishino in view of Erchak.

11. Dependent Claim 38

[38.0/38.1] The projection-type display apparatus, as described in the claim 32, wherein said white light are lights, which are almost in parallel.

159. This element is met by Erchak, as analyzed for claim 8 in Section IX.A.5, *supra*.

160. In summary, claim 38 is obvious over Ishino in view of Erchak.

B. Ishino in view of Li '415 and Erchak renders claims 1, 3-9, and 32-38 obvious.

161. In my opinion, and for the reasons explained below, Ishino, in view of Li '415 and Erchak, renders claims 1, 3-9, and 32-38 obvious.

162. As an initial matter, a POSITA would have been motivated to combine the teachings of Ishino with the teachings of Erchak and Li '415.

163. *See*, Section IX.A. for motivation to combine Ishino with Erchak.

164. Like Erchak, Li '415 discloses a solid-state light source configured to emit white light. EX1007, p. 12, line 25-p. 13, line 7. A POSITA would thus have been motivated to combine the teachings of Ishino and Li '415 for similar reasons as for the motivation to combine the teachings of Ishino and Erchak.

165. A POSITA would thus have been motivated to combine the teachings of Ishino, Erchak, and Li '415, and would have recognized that combining these teachings would have produced predictable and operable results.

1. Independent Claim 1

[1.0] A projection-type display apparatus, comprising:

166. This preamble is met by Ishino, as analyzed for claim 1 in Section IX.A.1, *supra*.

[1.1] a light source, including a solid-state light emitting element for emitting an excitation light therein, configured to emit white lights including a light emitting from a fluorescent substance, which is excited by said excitation light;

167. This element is met by Ishino in combination with Erchak, as analyzed for claim 1 in Section IX.A.1, *supra*.

168. As an alternative to Erchak, Li '415 discloses a solid-state light emitting element for emitting an excitation light therein, configured to emit white lights including a light emitting from a fluorescent substance, which is excited by said excitation light.

169. Li '415 discloses that “technical solutions that can be used to obtain various color light sources (especially white light sources) include ... fluorescence conversion. Fluorescence conversion solution is to use the emission light from alternative light sources (such as, but not limited to, LED chips) to excite fluorescent powder, resulting in light with a longer wavelength. For instance, the white light LED patent of Nichia Corporation of Japan discloses using a 470 nanometer blue light LED chip to excite yellow YAG fluorescent powder for white light emission.

The scheme has a simple structure, low manufacturing cost, and the product has strong practicality. EX1007, p. 21, lines 15-18.

170. Li '415 further discloses, with reference to Fig. 1, that “[t]he dichroic filter 2 is positioned between the excitation light source 1 and the excitation material/excitation material layer 3, receives the oblique radiation of the excitation light from the excitation light source 1, and guides part of the excitation light to the excitation material/excitation material layer 3.” *Id.*, p. 12, lines 9-17. *See, also, Id.*, p. 12, line 25-p. 13, line 7.

171. Li '415 further provides an example of using blue excitation light and yellow excited light to produce white light. *Id.*, p. 12, line 25-p. 13, line 7.

[1.2] a light separation optic system, configured to separate the white lights from said light source into red-color (R), green-color (G) and blue-color (B);

172. This element is met by Ishino, as analyzed for claim 1 in Section IX.A.1, *supra*.

[1.3] a light modulation means, configured to make light-modulation on a respective one of the lights of the R, G and B separated, depending on a video signal; and

173. This element is met by Ishino, as analyzed for claim 1 in Section IX.A.1, *supra*.

[1.4] a projection means, configured to enlargedly project a respective one of optical images, which are formed by said light modulation means, wherein

174. This element is met by Ishino, as analyzed for claim 1 in Section IX.A.1, *supra*.

[1.5] said fluorescent substance has plural numbers of concave portions on a surface, upon which said excitation light is incident.

175. This element is met by Erchak, as analyzed for claim 1 in Section IX.A.1, *supra*. In addition, it would have been obvious to add the concave portions of Erchak to the phosphorus of Li '415.

176. In summary, claim 1 is obvious over Ishino in view of Li '415 and Erchak.

2. Dependent Claim 3

[3.0/3.1] The projection-type display apparatus, as described in the claim 1, wherein the emitting light are the lights in a wavelength region having a complementary color relationship with said excitation light with respect to a white color.

177. This element is met by Erchak, as analyzed for claim 3 in Section IX.A.2, *supra*.

178. Alternatively, this element is met by Li '415, as analyzed for Element [1.1] of claim 1 in Section IX.B.1, *supra*.

179. In summary, claim 3 is obvious over Ishino in view of Li '415 and Erchak.

3. Dependent Claim 4

[4.0/4.1] The projection-type display apparatus, as described in the claim 3, wherein said solid-state light emitting element is a semiconductor laser element.

180. This element is met by Erchak, as analyzed for claim 4 in Section IX.A.3, *supra*. In addition, the combination of Erchak and Li disclose using a semiconductor laser element.

181. In summary, claim 4 is obvious over Ishino in view of Li '415 and Erchak.

4. Dependent Claim 5

[5.0/5.1] The projection-type display apparatus, as described in the claim 4, wherein said excitation light is the B-color light, and said emitting light is a yellow-color (Y) light.

182. This element is met by Erchak, as analyzed for claim 5 in Section IX.A.4, *supra*.

183. As an alternative to Erchak, Li '415 discloses producing white light by using blue excitation light and yellow emitting light, as analyzed for Element [1.1] of claim 1 in Section IX.B.1, *supra*.

184. In summary, claim 5 is obvious over Ishino in view of Li '415 and Erchak.

5. Dependent Claim 6

[6.0/6.1] The projection-type display apparatus, as described in the claim 5, wherein said white lights are lights, which are produced by switching said B-color light and said Y-color light, sequentially, to be combined with, in a time-division manner.

185. Li '415 discloses said white lights are lights, which are produced by switching said B-color light and said Y-color light, sequentially, to be combined with, in a time-division manner.

186. Li '415 discloses, with reference to Figure 7, that “a turntable is used to carry two or more excitation materials 3 and 3'. In particular, these excitation materials can be arranged in the excitation material layer in various regions along the circumference of a turntable with a rotating axis 7 as the center. ... [A]s the turntable rotates, when the excitation light excites different excitation materials, excited lights of various colors can be achieved. By selecting a suitable dichroic filter 2 that can simultaneously reflect or transmit the two types of excited light, the colors of the excited light emitted to the same position of the dichroic filter 2 alternate continuously at different times. This enables uniform color mixing among the emitted excited lights, which then mixes with part of the excitation light guided to the light emission surface. An embodiment of using this enhanced structure to obtain a white light source can be: the excitation light is set to blue light; In this embodiment, a third excited material, such as yellow fluorescent powder, can also be added to obtain a mixed white light composed of red, blue, green and yellow.” EX1007, p. 15, lines 1-26. “The enhanced structure can also be implemented based on Figure 1 and 2, only the characteristics of the dichroic filter 2 for the two excited lights need to be changed accordingly, which will not be described in detail here.” *Id.*, p. 15, lines 27-29. Because producing white light by mixing colors by generating color in a timesharing manner (i.e., alternating them continuously) was

known, it would have been obvious for a POSITA to choose appropriate colors, such as yellow and blue, to produce white light.

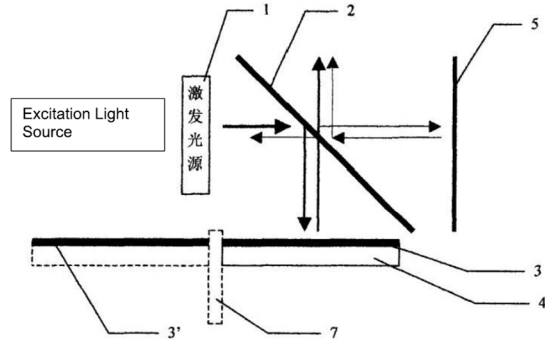


图7

Figure 7

EX1007, Fig. 7

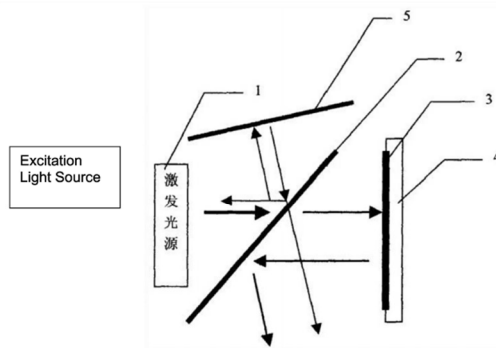


图1

Figure 1

EX1007, Fig. 1

187. In summary, claim 6 is obvious over Ishino in view of Li '415 and Erchak.

6. Dependent Claim 7

[7.0/7.1] The projection-type display apparatus, as described in the claim 6, wherein said white lights are lights, which are captured by a light flux capturing means made up with a reflection surface having a focus point.

188. Erchak discloses that wherein said white lights are lights, which are captured by a light flux capturing means made up with a reflection surface having a focus point.

189. Erchak discloses, with reference to FIG. 4b, “the wavelength-converting region and the thermally conductive region may be shaped such that emitted light is collimated and/or focused. ... For example, ... the assembly of the wavelength converting region and the thermally conductive region has a parabolic

shape, ...” EX1006, [15:46-16: 4]. A POSITA would have known that a parabolic shape has a focus point.

190. In summary, claim 7 is obvious over Ishino in view of Li ’415 and Erchak.

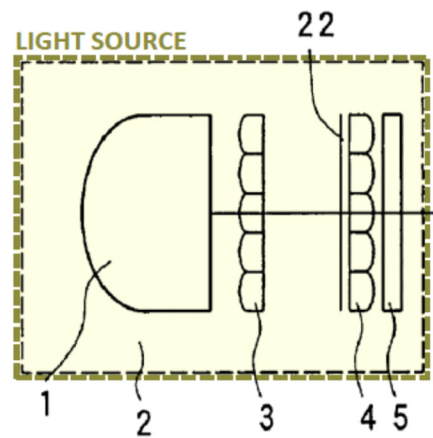
7. Dependent Claim 8

[8.0/8.1] The projection-type display apparatus, as described in the claim 1, wherein said white lights are lights, which are almost in parallel.

191. This element is met by Erchak, as analyzed for claim 8 in Section IX.A.5, *supra*.

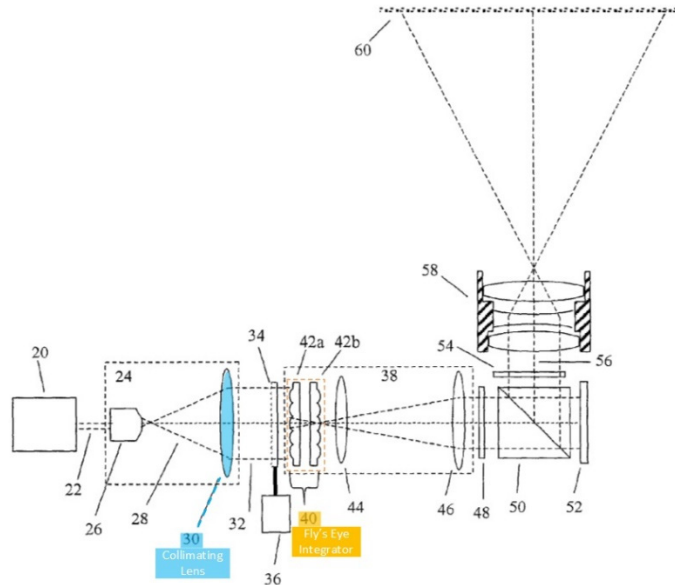
192. Alternatively, as described in Sections VIII.C and ¶ 164, *supra*, Li ’415 discloses a solid-state light source configured to emit white light. Additionally, Ishino discloses a light emitter and a parabolic reflector to emit substantially parallel light. EX1005, [0057], [0123], [0126]. Ishino further discloses fly-eye lenses 3 and 4 for equalizing the illumination distribution of the light components emitted from the light emitter. EX1005, [0058]. A POSITA, in replacing the Ishino lamp (emitter and reflector), would have known that substantially collimated (parallel) rays are needed for the fly-eye lens arrays to work, and a POSITA would thus have used a collimator, such as a parabolic reflector or collimator lens (*see, e.g.*, EX1012, Fig. 1

(reproduced below) and [0022]-[0024]]², to provide parallel light to be transmitted to the fly-eye lenses 3 and 4. To the extent that Li '415 does not expressly disclose parallel rays, it would have been obvious to include a collimator to provide parallel lights to properly illuminate the fly-eye lenses 3 and 4 and make the projector work as intended by Ishino after replacing lamp 1 with Li '415's light source. This element is therefore met by Li '415 and Ishino.



EX1005, Fig. 1 (excerpt; annotated)

² U.S. Patent Application Publication 2003/0039036A1, published February 27, 2003.



EX1012, Fig. 1 (annotated)

193. In summary, claim 8 is obvious over Ishino in view of Li '415 and Erchak.

8. Dependent Claim 9

[9.0/9.1] The projection-type display apparatus, as described in the claim 1, wherein each of said light modulation means is any one of a transmission-type liquid crystal panel, a reflection-type liquid crystal panel and a digital mirror device (DMD) made by aligning plural numbers of micro-mirrors.

194. This element is met by Ishino, as analyzed for claim 9 in Section IX.A.6, *supra*.

195. In summary, claim 9 is obvious over Ishino in view of Li '415 and Erchak.

9. Independent Claim 32

[32.0] A projection-type display apparatus, comprising:

196. This preamble is met by Ishino, as analyzed for claim 1 in Section IX.B.1, *supra*.

[32.1] a light source, including a solid-state light emitting element for emitting an excitation light therein, configured to emit white lights including a light emitting from a fluorescent substance, which is excited by said excitation light;

197. This element is met by Ishino in combination with Erchak or Li '415, as analyzed for claim 1 in Section IX.B.1, *supra*.

[32.2] a light separation optic system, configured to separate the white lights from said light source into red-color (R), green-color (G) and blue-color (B);

198. This element is met by Ishino, as analyzed for claim 1 in Section IX.B.1, *supra*.

[32.3] a light modulation means, configured to make light-modulation on a respective one of the lights of the R, G and B separated, depending on a video signal; and

199. This element is met by Ishino, as analyzed for claim 1 in Section IX.B.1, *supra*.

[32.4] a projection means, configured to enlargedly project a respective one of optical images, which are formed by said light modulation means, wherein

200. This element is met by Ishino, as analyzed for claim 1 in Section IX.B.1, *supra*.

[32.5] said fluorescent substance has a concave portion, an excitation light incident side opening is larger than a bottom surface portion thereof, on a surface, upon which said excitation light is incident.

201. This element is met by Erchak, as analyzed for claim 32 in Section IX.A.7, *supra*.

202. In summary, claim 32 is obvious over Ishino in view of Li '415 and Erchak.

10. Dependent Claim 33

[33.0/33.1] The projection-type display apparatus, as described in the claim 32, wherein the emitting light are the lights in a wavelength region having a complementary color relationship with said excitation light with respect to a white color.

203. This element is met by Li '415 or Erchak, as analyzed for claim 3 in Section IX.B.2, *supra*.

204. In summary, claim 33 is obvious over Ishino in view of Li '415 and Erchak.

11. Dependent Claim 34

[34.0/34.1] The projection-type display apparatus, as described in the claim 33, wherein said solid-state light emitting element is a semiconductor laser element.

205. This element is met by Erchak, as analyzed for claim 4 in Section IX.B.3, *supra*.

206. In summary, claim 34 is obvious over Ishino in view of Li '415 and Erchak.

12. Dependent Claim 35

[35.0/35.1] The projection-type display apparatus, as described in the claim 34, wherein said excitation light is the B-color light, and said emitting light is a yellow-color (Y) light.

207. This element is met by Li '415 or Erchak, as analyzed for claim 5 in Section IX.B.4, *supra*.

208. In summary, claim 35 is obvious over Ishino in view of Li '415 and Erchak.

13. Dependent Claim 36

[36.0/36.1] The projection-type display apparatus, as described in the claim 35, wherein said white lights are lights, which are produced by switching said B-color light and said Y-color light, sequentially, to be combined with, in a time-division manner.

209. This element is met by Li '415, as analyzed for claim 6 in Section IX.B.5, *supra*.

210. In summary, claim 36 is obvious over Ishino in view of Li '415 and Erchak.

14. Dependent Claim 37

[37.0/37.1] The projection-type display apparatus, as described in the claim 36, wherein said white lights are lights, which are captured by a light flux capturing means made up with a reflection surface having a focus point.

211. This element is met by Erchak, as analyzed for claim 7 in Section IX.B.6, *supra*.

212. In summary, claim 37 is obvious over Ishino in view of Li '415 and Erchak.

15. Dependent Claim 38

[38.0/38.1] The projection-type display apparatus, as described in the claim 32, wherein said white light are lights, which are almost in parallel.

213. This element is met Erchak, as analyzed for claim 8 in Section IX.B.7, *supra*.

214. In summary, claim 38 is obvious over Ishino in view of Li '415 and Erchak.

C. Ishino in view of Li '415 renders claims 10 and 18 obvious.

215. In my opinion, and for the reasons explained below, Ishino, in view of Li '415, renders claims 10 and 18 obvious.

216. As an initial matter, a POSITA would have been motivated to combine the teachings of Ishino with the teachings of Li '415. *See*, Section IX.B, *supra*.

1. Independent Claim 10

[10.0] A projection-type display apparatus, comprising:

217. This preamble is met by Ishino, as analyzed for claim 1 in Section IX.B.1, *supra*.

[10.1] a light source, including a solid-state light emitting element for emitting an excitation light therein, configured to emit white lights including a light emitting from a fluorescent substance, which is excited by said excitation light;

218. This element is met by Ishino combined with Li '415, as analyzed for claim 1 in Section IX.B.1, *supra*. Further, and as discussed above, Li '415 teaches LED's as the excitation source, which is a solid-state light source.

[10.2] a light separation optic system, configured to separate the white lights from said light source into red-color (R), green-color (G) and blue-color (B);

219. This element is met by Ishino, as analyzed for claim 1 in Section IX.B.1, *supra*.

[10.3] a light modulation means, configured to make light-modulation on a respective one of the lights of the R, G and B separated, depending on a video signal;

220. This element is met by Ishino, as analyzed for claim 1 in Section IX.B.1, *supra*.

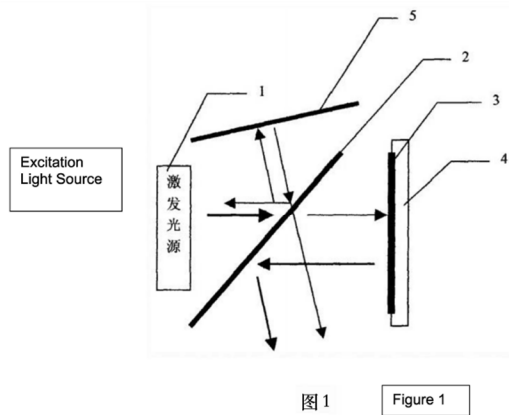
[10.4] a projection means, configured to enlargedly project a respective one of the optical images, which are formed by said light modulation means; and

221. This element is met by Ishino, as analyzed for claim 1 in Section IX.B.1, *supra*.

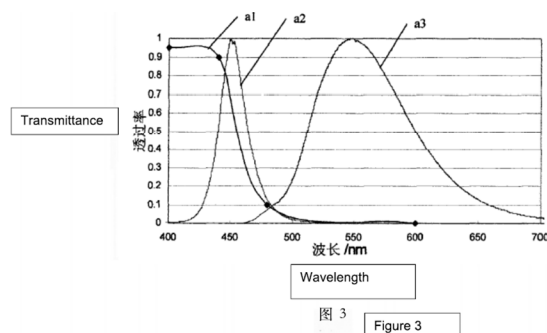
[10.5] a separation mirror, being disposed between said solid-state light emitting element and said fluorescent substance and configured to pass said excitation light therethrough, as well as, to reflect the light from said fluorescent substance thereon.

222. Li '415 discloses a separation mirror, being disposed between said solid-state light emitting element and said fluorescent substance and configured to pass said excitation light therethrough, as well as, to reflect the light from said fluorescent substance thereon.

223. Li '415 discloses, with reference to Fig. 1, that “[t]he dichroic filter 2 is positioned between the excitation light source 1 and the excitation material/ excitation material layer 3, receives the oblique radiation of the excitation light from the excitation light source 1, and guides part of the excitation light to the excitation material/ excitation material layer 3 in a transmissive manner, while also guiding the other part of the excitation light to the second reflection surface 5 in a reflective manner.” EX1007, p. 12, lines 9-14. *See, also, Id.*, p. 12, line 25-p. 13, line 7.



EX1007, Fig. 1



EX1007, Fig. 3

224. In summary, claim 10 is obvious over Ishino in view of Li '415.

2. Dependent Claim 18

[18.0/18.1] The projection-type display apparatus, as described in the claim 10, wherein each of said light modulation means is any one of a transmission-type liquid crystal panel, a reflection-type liquid crystal panel and a digital mirror device (DMD) made by aligning plural numbers of micro-mirrors.

225. This element is met by Ishino, as analyzed for claim 9 in Section IX.A.6, *supra*.

226. In summary, claim 18 is obvious over Ishino in view of Li '415.

D. Ishino in view of Li '415 and Bakker renders claims 11 and 17 obvious.

227. In my opinion, and for the reasons explained below, Ishino, in view of Li '415 and Bakker, renders claims 11 and 17 obvious.

228. As an initial matter, a POSITA would have been motivated to combine the teachings of Ishino with the teaching of Li '415 and Bakker.

229. *See* Section IX.B, *supra.*, for motivation to combine Ishino and Li '415.

230. Furthermore, Bakker is in the same field of endeavor as the invention of the '580 Patent. Both are directed to projection-type image display apparatus. The invention in the '580 Patent “relates to a projection-type display apparatus of projecting an optical image, which is formed by modulating light intensity of lights from a light source depending on a video signal, by means of a transmission-type or a reflection-type liquid crystal panel, or a digital mirror device (DMD) aligning plural numbers of micro mirrors, etc.” EX1001, 1:11-16. Similarly, the invention in Bakker “relates to a system for projecting images on a screen. In particular, this invention relates to a transmissive projection system comprising dichroic mirrors used as polarizers for polarization conversion in a liquid crystal display (LCD) projector.” EX1008, [0001]. A POSITA would thus have considered the teachings of Bakker at the time of the invention of the '580 Patent.

231. Moreover, Bakker provides a dichroic mirror suitable for implementing certain embodiments disclosed in Li '415. For example, in the embodiment shown

in Fig. 1 of Li '415, the dichroic filter 2 partially transmits and partially reflects blue light from the light source 1 but substantially reflects the excited light (yellow) from the excitation material 3. EX1007, p. 21, lines 9-17. A POSITA would have recognized that the dichroic mirror 212 described in connection with Fig. 5 in Bakker has such optical characteristics and is suitable implementation of dichroic filter 2.

232. Additionally, a POSITA would have recognized that Bakker describes details of dichroic mirror characteristics and the benefits of using dichroic mirrors with those characteristics.

233. Therefore, a POSITA would have been motivated to combine the teachings of Ishino with those of Li '415 Patent and Bakker, and would have recognized that combining these teachings would have produced predictable and operable results.

1. Dependent Claim 11

[11.0/11.1] The projection-type display apparatus, as described in the claim 10, wherein said separation mirror almost reflect a light of a S-wave component, among the G-color light, the R-color light and the B-color light, while almost passing a light of a P-wave component therethrough, among the B-color light.

234. Bakker discloses a separation mirror almost reflect a light of a S-wave component, among the G-color light, the R-color light and the B-color light, while almost passing a light of a P-wave component therethrough, among the B-color light, and it would have been obvious to use such a separation mirror for the dichroic filter in Li '415.

235. Bakker discloses, with reference to Fig. 5, that “[t]he first dichroic mirror 212 [] transmits a major part of p-polarized blue light in the blue spectral range, indicated by (Bp) in FIG. 5, and reflects s-polarized blue (Bs) light together with the green light (Gs+Gp) and red light (Rs+Rp).” EX1008, [0055]. Bakker further provides an advantage of using such a dichroic mirror – reducing the number of optical components required: “As described with reference to FIGS. 3 and 4, hence no polarization conversion is required in the blue channel 302 and, consequently, only the first polarizer 304 transmitting p-polarized blue light (Bp) to the recombination prism 218 is required. *Id.*”

236. A POSITA would have had a motivation to combine the teachings of Bakker with those of Ishino and Li ’415 to arrive at the invention of claim 11.

237. In summary, claim 11 is obvious over Ishino in view of Li ’415 and Bakker.

2. Dependent Claim 17

[17.0/17.1] The projection-type display apparatus, as described in the claim 11, wherein said white lights are lights, which are almost in parallel.

238. This element is met by Li ’415 in combination with Ishino, as analyzed for claim 8 in Section IX.B.7, *supra*.

239. In summary, claim 11 is obvious over Ishino in view of Li ’415 and Bakker.

E. Uchiyama in view of Erchak renders claims 1, 3-5, 8-9, 32-35, and 38 obvious.

240. In my opinion, and for the reasons explained below, Uchiyama in view of Erchak renders claims 1, 3-5, 8-9, 32-35, and 38 obvious.

241. As an initial matter, a POSITA would have been motivated to combine the teachings of Uchiyama and Erchak for similar reasons for the motivation to combine the teachings of Ishino and Erchak. *See*, Section IX.A.

1. Independent Claim 1

[1.0] A projection-type display apparatus, comprising:

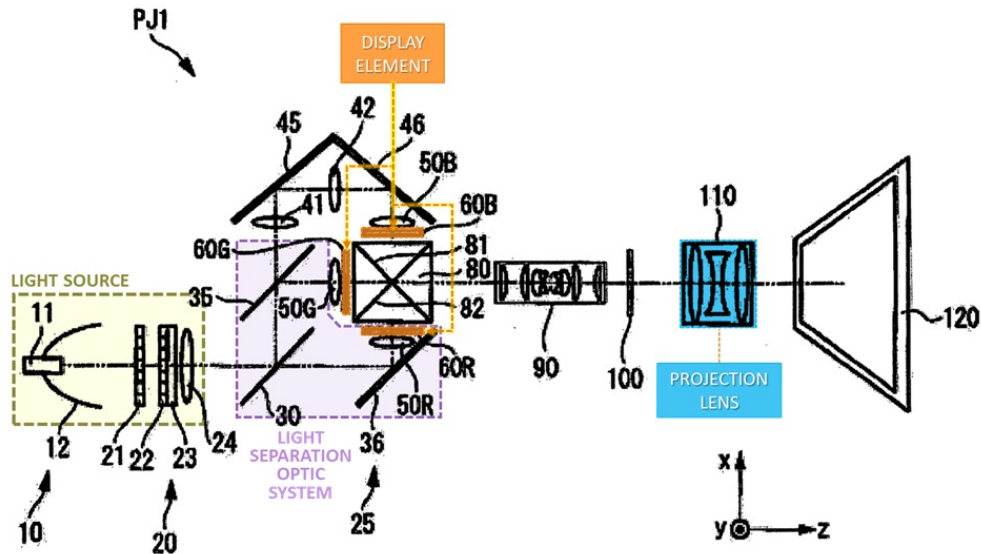
242. Uchiyama discloses a projection-type display apparatus.

243. Uchiyama states that “[t]he present invention relates to a device that displays an image by modulating a light from a light source via plural light modulation elements...” EX1009, [0002].

[1.1] a light source, including a solid-state light emitting element for emitting an excitation light therein, configured to emit white lights including a light emitting from a fluorescent substance, which is excited by said excitation light;

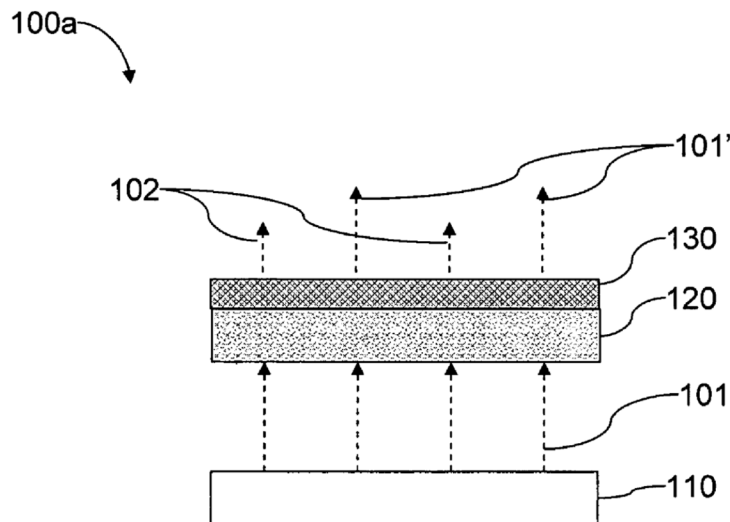
244. Uchiyama discloses a light source configured to emit white lights.

245. Uchiyama describes that “[t]he light source 10 includes a lamp 11 comprising an extra-high pressure mercury vapor lamp or a xenon lamp, and a reflector 12 that reflects or collects a light emitted from the lamp 11.” EX1009, [0044]. Uchiyama describes that “[t]he dichroic mirrors 30 and 35 separate (isolate) a light (a white light) from the light source 10....” EX1009, [0048].



EX1009, Fig. 1

246. See, Section VIII.B, *supra* for disclosure by Erchak.



EX1006, Fig. 1a

247. As explained above, a POSITA would have been motivated to combine the teaching of Uchiyama and Erchak. To remove the Uchiyama lamp and include the solid-state light source of Erchak; this combination discloses this claim element.

[1.2] a light separation optic system, configured to separate the white lights from said light source into red-color (R), green-color (G) and blue-color (B);

248. Uchiyama discloses a projection-type display apparatus that includes a light separation optic system, configured to separate the white lights from said light source into red color, green color, and blue color.

249. Uchiyama discloses that “[t]he color modulation portion 25 comprises two dichroic mirrors 30 and 35 serving as light separation portions, three mirrors (reflection mirrors 36, 45, and 46), five field lenses (a lens 41, a relay lens 42, parallelizing lenses 50B, 50G, and 50R), three liquid crystal light valves 60B, 60G, and 60R, and a cross dichroic prism 80.” *Id.*, [0047].

[1.3] a light modulation means, configured to make light-modulation on a respective one of the lights of the R, G and B separated, depending on a video signal; and

250. Uchiyama discloses a light modulation means, configured to make light-modulation on a respective one of the lights of the R, G and B separated, depending on a video signal.

251. Uchiyama discloses that “a color modulation portion 25 that modulates luminance of three primary colors, RGB, among the wavelength regions of a light coming incident thereon from the uniform illumination system 20 (including three transmissive liquid crystal light valves as a first modulation element, that is, a transmissive liquid crystal light valve 60B for a blue light, a transmissive liquid crystal light valve 60G for a green light, and a transmissive liquid crystal light valve

60R for a red light).” EX1009, [0043]. Uchiyama further discloses that the modulation is dependent on a video signal. *Id.* [0081].

[1.4] a projection means, configured to enlargedly project a respective one of optical images, which are formed by said light modulation means, wherein

252. Uchiyama discloses a projection means, configured to enlargedly project a respective one of optical images, which are formed by said light modulation means.

253. Uchiyama discloses “a transmissive liquid crystal light valve 100 serving as a second modulation portion that modulates luminance of a light coming incident thereon from the relay lens 90 in all the wavelength regions, and a projection lens (projection system) 110 that projects a light coming incident thereon from the liquid crystal light valve 100 onto a screen 120.” EX1009, Fig. 1, [0043].

[1.5] said fluorescent substance has plural numbers of concave portions on a surface, upon which said excitation light is incident.

254. This element is met by Erchak, as analyzed for claim 1 in Section IX.A.1, *supra*.

255. In summary, claim 1 is obvious over Uchiyama in view of Erchak.

2. Dependent Claim 3

[3.0/3.1] The projection-type display apparatus, as described in the claim 1, wherein the emitting light are the lights in a wavelength region having a complementary color relationship with said excitation light with respect to a white color.

256. This element is met by Erchak, as analyzed for claim 3 in Section IX.A.2, *supra*.

257. In summary, claim 3 is obvious over Uchiyama in view of Erchak.

3. Dependent Claim 4

[4.0/4.1] The projection-type display apparatus, as described in the claim 3, wherein said solid-state light emitting element is a semiconductor laser element.

258. This element is met by Erchak, as analyzed for claim 4 in Section IX.A.3, *supra*.

259. In summary, claim 4 is obvious over Uchiyama in view of Erchak.

4. Dependent Claim 5

[5.0/5.1] The projection-type display apparatus, as described in the claim 4, wherein said excitation light is the B-color light, and said emitting light is a yellow-color (Y) light.

260. This element is met by Erchak, as analyzed for claim 5 in Section IX.A.4, *supra*.

261. In summary, claim 5 is obvious over Uchiyama in view of Erchak.

5. Dependent Claim 8

[8.0/8.1] The projection-type display apparatus, as described in the claim 1, wherein said white lights are lights, which are almost in parallel.

262. This element is met by Erchak, as analyzed for claim 8 in Section IX.A.5, *supra*.

263. In summary, claim 8 is obvious over Uchiyama in view of Erchak.

6. Dependent Claim 9

[9.0/9.1] The projection-type display apparatus, as described in the claim 1, wherein each of said light modulation means is any one of a transmission-type liquid crystal panel, a reflection-type liquid crystal panel and a digital mirror device (DMD) made by aligning plural numbers of micro-mirrors.

264. Uchiyama discloses that each of said light modulation means is any one of a transmission-type liquid crystal panel, a reflection-type liquid crystal panel and a digital mirror device (DMD) made by aligning plural numbers of micro-mirrors.

265. Uchiyama discloses that “the transmissive modulation element may be replaced with a reflective modulation element. A good example in this case is a DMD (Digital Micromirror Device).” EX1009 [0008].

266. *See also*, analysis for Element [1.3] of claim 1 in Section IX.E.1, *supra*.

267. In summary, claim 9 is obvious over Uchiyama in view of Erchak.

7. Independent Claim 32

[32.0] A projection-type display apparatus, comprising:

268. This preamble is met by Uchiyama, as analyzed for claim 1 in Section IX.E.1, *supra*.

[32.1] a light source, including a solid-state light emitting element for emitting an excitation light therein, configured to emit white lights including a light emitting from a fluorescent substance, which is excited by said excitation light;

269. This element is met by Uchiyama in combination with Erchak, as analyzed for claim 1 in Section IX.E.1, *supra*.

[32.2] a light separation optic system, configured to separate the white lights from said light source into red-color (R), green-color (G) and blue-color (B);

270. This element is met by Uchiyama, as analyzed for claim 1 in Section IX.E.1, *supra*.

[32.3] a light modulation means, configured to make light-modulation on a respective one of the lights of the R, G and B separated, depending on a video signal; and

271. This element is met by Uchiyama, as analyzed for claim 1 in Section IX.E.1, *supra*.

[32.4] a projection means, configured to enlargedly project a respective one of optical images, which are formed by said light modulation means, wherein

272. This element is met by Uchiyama, as analyzed for claim 1 in Section IX.E.1, *supra*.

[32.5] said fluorescent substance has a concave portion, an excitation light incident side opening is larger than a bottom surface portion thereof, on a surface, upon which said excitation light is incident.

273. This element is met by Erchak, as analyzed for claim 32 in Section IX.A.7, *supra*.

274. In summary, claim 32 is obvious over Uchiyama in view of Erchak.

8. Dependent Claim 33

[33.0/33.1] The projection-type display apparatus, as described in the claim 32, wherein the emitting light are the lights in a wavelength region having a complementary color relationship with said excitation light with respect to a white color.

275. This element is met by Erchak, as analyzed for claim 3 in Section IX.E.2, *supra*.

276. In summary, claim 33 is obvious over Uchiyama in view of Erchak.

9. Dependent Claim 34

[34.0/34.1] The projection-type display apparatus, as described in the claim 33, wherein said solid-state light emitting element is a semiconductor laser element.

277. This element is met by Erchak, as analyzed for claim 4 in Section IX.E.3, *supra*.

278. In summary, claim 34 is obvious over Uchiyama in view of Erchak.

10. Dependent Claim 35

[35.0/35.1] The projection-type display apparatus, as described in the claim 34, wherein said excitation light is the B-color light, and said emitting light is a yellow-color (Y) light.

279. This element is met by Erchak, as analyzed for claim 5 in Section IX.E.4, *supra*.

280. In summary, claim 35 is obvious over Uchiyama in view of Erchak.

11. Dependent Claim 38

[38.0/38.1] The projection-type display apparatus, as described in the claim 32, wherein said white light are lights, which are almost in parallel.

281. This element is met by Erchak, as analyzed for claim 8 in Section IX.E.5, *supra*.

282. In summary, claim 38 is obvious over Uchiyama in view of Erchak.

F. Uchiyama in view of Li '415 and Erchak renders claims 1, 3-9, and 32-38 obvious.

283. In my opinion, and for the reasons explained below, Uchiyama in view of Li '415 and Erchak renders claims 1, 3-9, and 32-38 obvious.

284. As an initial matter, a POSITA would have been motivated to combine the teachings of Uchiyama, Erchak, and Li '415 for similar reasons for the motivation to combine the teachings of Ishino, Erchak, and Li '415. *See*, Section IX.B.

1. Independent Claim 1

[1.0] A projection-type display apparatus, comprising:

285. This preamble is met by Uchiyama, as analyzed for claim 1 in Section IX.E.1, *supra*.

[1.1] a light source, including a solid-state light emitting element for emitting an excitation light therein, configured to emit white lights including a light emitting from a fluorescent substance, which is excited by said excitation light;

286. This element is met by Uchiyama in combination with Erchak, as analyzed for claim 1 in Section IX.E.1, *supra*.

287. As an alternative to Erchak, Li '415 discloses a solid-state light emitting element for emitting an excitation light therein, configured to emit white lights including a light emitting from a fluorescent substance, which is excited by said excitation light.

288. See, description of the disclosure of this element by Li '415 in the analysis of Element [1.1] of claim 1 in Section IX.B.1.

[1.2] a light separation optic system, configured to separate the white lights from said light source into red-color (R), green-color (G) and blue-color (B);

289. This element is met by Uchiyama, as analyzed for claim 1 in Section IX.E.1, *supra*.

[1.3] a light modulation means, configured to make light-modulation on a respective one of the lights of the R, G and B separated, depending on a video signal; and

290. This element is met by Uchiyama, as analyzed for claim 1 in Section IX.E.1, *supra*.

[1.4] a projection means, configured to enlargedly project a respective one of optical images, which are formed by said light modulation means, wherein

291. This element is met by Uchiyama, as analyzed for claim 1 in Section IX.E.1, *supra*.

[1.5] said fluorescent substance has plural numbers of concave portions on a surface, upon which said excitation light is incident.

292. This element is met by Erchak, as analyzed for claim 1 in Section IX.E.1, *supra*.

293. In summary, claim 1 is obvious over Uchiyama in view of Li '415 and Erchak.

2. Dependent Claim 3

[3.0/3.1] The projection-type display apparatus, as described in the claim 1, wherein the emitting light are the lights in a wavelength region having a complementary color relationship with said excitation light with respect to a white color.

294. This element is met by Erchak, as analyzed for claim 1 in Section IX.E.2, *supra*.

295. Alternatively, this element is met by Li '415, as analyzed for Element [1.1] of claim 1 in Section IX.B.1, *supra*.

296. In summary, claim 3 is obvious over Uchiyama in view of Li '415 and Erchak.

3. Dependent Claim 4

[4.0/4.1] The projection-type display apparatus, as described in the claim 3, wherein said solid-state light emitting element is a semiconductor laser element.

297. This element is met by Erchak, as analyzed for claim 1 in Section IX.E.3, *supra*.

298. In summary, claim 3 is obvious over Uchiyama in view of Li '415 and Erchak.

4. Dependent Claim 5

[5.0/5.1] The projection-type display apparatus, as described in the claim 4, wherein said excitation light is the B-color light, and said emitting light is a yellow-color (Y) light.

299. This element is met by Erchak, as analyzed for claim 1 in Section IX.E.4, *supra*.

300. As an alternative to Erchak, Li '415 discloses producing white light by using blue excitation light and yellow emitting light, as analyzed for Element [1.1] of claim 1 in Section IX.B.1, *supra*.

301. In summary, claim 5 is obvious over Uchiyama in view of Li '415 and Erchak.

5. Dependent Claim 6

[6.0/6.1] The projection-type display apparatus, as described in the claim 5, wherein said white lights are lights, which are produced by switching said B-color light and said Y-color light, sequentially, to be combined with, in a time-division manner.

302. This element would have been obvious to a POSITA in view of Li '415, as analyzed for claim 6 in Section IX.B.5, *supra*.

303. In summary, claim 6 is obvious over Uchiyama in view of Li '415 and Erchak.

6. Dependent Claim 7

[7.0/7.1] The projection-type display apparatus, as described in the claim 6, wherein said white lights are lights, which are captured by a light flux capturing means made up with a reflection surface having a focus point.

304. This element is met by Erchak, as analyzed for claim 7 in Section IX.B.6, *supra*.

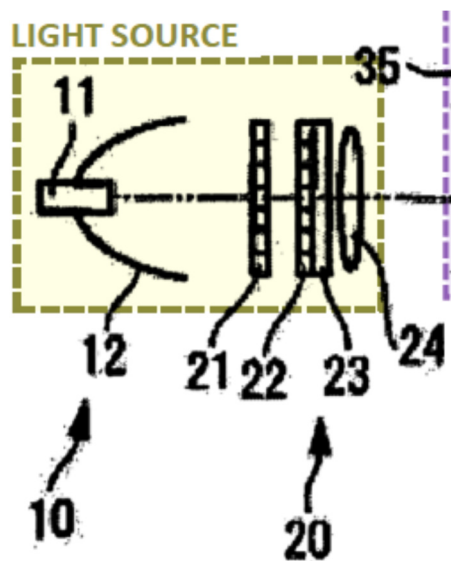
305. In summary, claim 7 is obvious over Uchiyama in view of Li '415 and Erchak.

7. Dependent Claim 8

[8.0/8.1] The projection-type display apparatus, as described in the claim 1, wherein said white lights are lights, which are almost in parallel.

306. This element is met by Erchak as analyzed for claim 8 in Section IX.B.7, *supra*.

307. Alternatively, this element is met by Li '415 and Uchiyama. Like Ishino (EX1005), Uchiyama discloses a lamp 11 and reflector 12 that “reflects or collect a light emitted from the lamp 11. EX1009, [0044]. A POSITA would have known that the reflector 12 substantially collimates rays, i.e. makes them substantially parallel. Like Ishino, Uchiyama further discloses lens arrays 21 and 22 formed of fly-eye lenses or the like. Therefore, a POSITA would have known that lamp 11, together with the reflector 12, would emit substantially parallel light for lens arrays 21 and 22. Thus, for similar reasons set forth in Section IX.B.7, *supra*, a POSITA would have combined Li '415 and Uchiyama, to produce white lights that are substantially parallel.



EX1009, Fig. 1 (excerpt; annotated)

308. In summary, claim 7 is obvious over Uchiyama in view of Erchak.

8. Dependent Claim 9

[9.0/9.1] The projection-type display apparatus, as described in the claim 1, wherein each of said light modulation means is any one of a transmission-type liquid crystal panel, a reflection-type liquid crystal panel and a digital mirror device (DMD) made by aligning plural numbers of micro-mirrors.

309. This element is met by Uchiyama, as analyzed for claim 9 in Section IX.E.6, *supra*.

310. In summary, claim 9 is obvious over Uchiyama in view of Li '415 and Erchak.

9. Independent Claim 32

[32.0] A projection-type display apparatus, comprising:

311. This preamble is met by Uchiyama, as analyzed for claim 1 in Section IX.F.1, *supra*.

[32.1] a light source, including a solid-state light emitting element for emitting an excitation light therein, configured to emit white lights including a light emitting from a fluorescent substance, which is excited by said excitation light;

312. This element is met by Uchiyama in combination with Erchak or Li '415, as analyzed for claim 1 in Section IX.F.1, *supra*.

[32.2] a light separation optic system, configured to separate the white lights from said light source into red-color (R), green-color (G) and blue-color (B);

313. This element is met by Uchiyama, as analyzed for claim 1 in Section IX.F.1, *supra*.

[32.3] a light modulation means, configured to make light-modulation on a respective one of the lights of the R, G and B separated, depending on a video signal; and

314. This element is met by Uchiyama, as analyzed for claim 1 in Section IX.F.1, *supra*.

[32.4] a projection means, configured to enlargedly project a respective one of optical images, which are formed by said light modulation means, wherein

315. This element is met by Uchiyama, as analyzed for claim 1 in Section IX.F.1, *supra*.

[32.5] said fluorescent substance has a concave portion, an excitation light incident side opening is larger than a bottom surface portion thereof, on a surface, upon which said excitation light is incident.

316. This element is met by Erchak, as analyzed for claim 1 in Section IX.F.1, *supra*.

317. In summary, claim 32 is obvious over Uchiyama in view of Li '415 and Erchak.

10. Dependent Claim 33

[33.0/33.1] The projection-type display apparatus, as described in the claim 32, wherein the emitting light are the lights in a wavelength region having a complementary color relationship with said excitation light with respect to a white color.

318. This element is met by Erchak or Li '415, as analyzed for claim 3 in Section IX.F.2, *supra*.

319. In summary, claim 33 is obvious over Uchiyama in view of Li '415 and Erchak.

11. Dependent Claim 34

[34.0/34.1] The projection-type display apparatus, as described in the claim 33, wherein said solid-state light emitting element is a semiconductor laser element.

320. This element is met by Erchak, as analyzed for claim 4 in Section IX.F.3, *supra*.

321. In summary, claim 34 is obvious over Uchiyama in view of Li '415 and Erchak.

12. Dependent Claim 35

[35.0/35.1] The projection-type display apparatus, as described in the claim 34, wherein said excitation light is the B-color light, and said emitting light is a yellow-color (Y) light.

322. This element is met by Erchak or Li '415, as analyzed for claim 5 in Section IX.F.4, *supra*.

323. In summary, claim 35 is obvious over Uchiyama in view of Li '415 and Erchak.

13. Dependent Claim 36

[36.0/36.1] The projection-type display apparatus, as described in the claim 35, wherein said white lights are lights, which are produced by switching said B-color light and said Y-color light, sequentially, to be combined with, in a time-division manner.

324. This element would have been obvious to a POSITA, as analyzed for claim 6 in Section IX.F.5, *supra*.

325. In summary, claim 36 is obvious over Uchiyama in view of Li '415 and Erchak.

14. Dependent Claim 37

[37.0/37.1] The projection-type display apparatus, as described in the claim 36, wherein said white lights are lights, which are captured by a light flux capturing means made up with a reflection surface having a focus point.

326. This element is met by Erchak, as analyzed for claim 7 in Section IX.F.6, *supra*.

327. In summary, claim 37 is obvious over Uchiyama in view of Li '415 and Erchak.

15. Dependent Claim 38

[38.0/38.1] The projection-type display apparatus, as described in the claim 32, wherein said white light are lights, which are almost in parallel.

328. This element is met by Erchak as analyzed for claim 8 in Section IX.F.7, *supra*.

329. In summary, claim 38 is obvious over Uchiyama in view of Li '415 and Erchak.

G. Uchiyama in view of Li '415 renders claims 10 and 18 obvious.

330. In my opinion, and for the reasons explained below, Uchiyama in view of Li '415 renders claims 10 and 18 obvious.

331. As an initial matter, POSITA would have been motivated to combine the teachings of Uchiyama and Li '415 for similar reasons for the motivation to combine the teachings of Ishino and Li '415. *See*, Section IX.C.

1. Independent Claim 10

[10.0] A projection-type display apparatus, comprising:

332. This preamble is met by Uchiyama, as analyzed for claim 1 in Section IX.E.1, *supra*.

[10.1] a light source, including a solid-state light emitting element for emitting an excitation light therein, configured to emit white lights including a light emitting from a fluorescent substance, which is excited by said excitation light;

333. This element is met by Uchiyama combined with Li '415, as analyzed for claim 1 in Section IX.F.1, *supra*.

[10.2] a light separation optic system, configured to separate the white lights from said light source into red-color (R), green-color (G) and blue-color (B);

334. This element is met by Uchiyama, as analyzed for claim 1 in Section IX.F.1, *supra*.

[10.3] a light modulation means, configured to make light-modulation on a respective one of the lights of the R, G and B separated, depending on a video signal;

335. This element is met by Uchiyama, as analyzed for Element [1.3] of claim 1 at ¶ 251 in Section IX.E.1, *supra*.

[10.4] a projection means, configured to enlargedly project a respective one of the optical images, which are formed by said light modulation means; and

336. This element is met by Uchiyama, as analyzed for claim 1 in Section IX.F.1, *supra*.

[10.5] a separation mirror, being disposed between said solid-state light emitting element and said fluorescent substance and configured to pass said excitation light therethrough, as well as, to reflect the light from said fluorescent substance thereon.

337. This element is met by Li '415, as analyzed for claim 10 in Section IX.C.1, *supra*.

338. In summary, claim 10 is obvious over Uchiyama in view of Li '415.

2. Dependent Claim 18

[18.0/18.1] The projection-type display apparatus, as described in the claim 10, wherein each of said light modulation

means is any one of a transmission-type liquid crystal panel, a reflection-type liquid crystal panel and a digital mirror device (DMD) made by aligning plural numbers of micro-mirrors.

339. This element is met by Uchiyama, as analyzed for claim 9 in Section IX.E.6, *supra*.

340. In summary, claim 18 is obvious over Uchiyama in view of Li '415.

H. Uchiyama in view of Li '415 and Bakker renders claims 11 and 17 obvious.

341. In my opinion, and for the reasons explained below, Uchiyama in view of Li '415 and Bakker renders claims 11 and 17 obvious.

342. As an initial matter, a POSITA would have been motivated to combine the teachings of Uchiyama, Li '415 and Bakker for similar reasons for the motivation to combine the teachings of Ishino, Li '415 and Bakker. *See*, Section IX.D.

1. Dependent Claim 11

[11.0/11.1] The projection-type display apparatus, as described in the claim 10, wherein said separation mirror almost reflect a light of a S-wave component, among the G-color light, the R-color light and the B-color light, while almost passing a light of a P-wave component therethrough, among the B-color light.

343. *See*, Section IX.D.1 for the analysis of claim 11 over Ishino in view of Li '415 and Bakker. For similar reasons set forth therein, a POSITA would have had a motivation to combine the teachings of Bakker with those of Uchiyama and Li '415 to arrive at the invention of claim 11.

344. In summary, claim 11 is obvious over Uchiyama in view of Li '415 and Bakker.

2. Dependent Claim 17

[17.0/17.1] The projection-type display apparatus, as described in the claim 11, wherein said white lights are lights, which are almost in parallel.

345. This element is met by Li '415 in combination of Uchiyama as analyzed for claim 8 in Section IX.F.7, *supra*.

346. In summary, claim 17 is obvious over Uchiyama in view of Li '415 and Bakker.

X. SECONDARY CONSIDERATIONS

347. I am not aware of any secondary considerations that would make claims 1, 3-11, 17, 18, and 32-38 of the '580 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 1, 3-11, 17, 18, and 32-38 of the '580 Patent would have been obvious to a POSITA as of February 6, 2010.

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 01/28, 2025.

By: / José Sasiam /