

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CORTRONIC CORPORATION AND
OPTOMA CORPORATION,

Petitioners,

v.

MAXELL, LTD.,

Patent Owner.

IPR2025-00475

PETITION FOR INTER PARTES REVIEW

OF U.S. PATENT NO. 9,322,530

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PETITIONERS' EXHIBIT LIST

EX1001	U.S. Patent No. 9,322,530 (the “’530 Patent”)
EX1002	Prosecution History of the ’530 Patent
EX1003	Declaration of Dr. Jose Sasian, dated February 7, 2025
EX1004	U.S. Patent Publication 2011/0187999 to Hirata <i>et al.</i> (“Hirata”)
EX1005	U.S. Patent Publication 2009/0308852 to Alpay <i>et al.</i> (“Alpay”)
EX1006	U.S. Patent Publication 2012/0008098 to Akiyama (“Akiyama”)
EX1007	U.S. Patent Publication 2011/0044046 to Abu-Ageel (“Abu-Ageel”)
EX1008	U.S. Patent Publication 2011/0292349 to Kitano <i>et al.</i> (“Kitano”)
EX1009	U.S. Patent No. 8,783,886 to Huang (“Huang”)
EX1010	First Amended Docket Control Order, <i>Maxell, Ltd. v. Coretronic Corp. et al.</i> , Case No. 5:24-cv-00088 (E.D. Tex. Jan. 7, 2025)
EX1011	CV of Dr. Jose Sasian
EX1012	U.S. Patent Publication 2011/0234998 to Kurosaki (“Kurosaki”)
EX1013	U.K. Patent Publication GB2462805 to Cai <i>et al.</i>
EX1014	U.S. Patent No. 7,433,558 to Booth <i>et al.</i>

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

A. Real Party-in-Interest

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

B. Related Matters

Patent Owner Maxell, Ltd. (“Maxell”) has asserted U.S. Patent No. 9,322,530 (the “530 Patent”) against Petitioners in *Maxell, Ltd. v. Coretronic Corp, et al.*, No. 5:24-cv-00088 (E.D. Tex.). That case is currently pending.

Petitioners are not aware of any other related matters.

C. Lead and Back-up Counsel and Service Information

Lead Counsel

Donald McPhail
MERCHANT & GOULD P.C.
1900 Duke Street
Suite 600
Alexandria, VA 22314

Phone: 703-518-2500
Fax: 612-332-9081
dmcphail@merchantgould.com
USPTO Reg. No. 35,8111

Back-up Counsel

John S. Kern
MERCHANT & GOULD P.C.
1900 Duke Street
Suite 600
Alexandria, Virginia 22314

Phone: 703-684-2500
Fax: 612-332-9081
jkern@merchantgould.com
USPTO Reg. No.: 42,719

Please address correspondence to lead and back-up counsel at coretronic530ipr@merchantgould.com. Petitioners consent to electronic service.

II. GROUNDS FOR STANDING

Petitioners certify that the '530 Patent is available for *inter partes* review and that Petitioners are not barred or estopped from requesting *inter partes* review challenging the patent claims on the grounds identified in this Petition.

III. REQUESTED RELIEF

Petitioners ask that the Board review the accompanying prior art and analysis, institute a trial for an *inter partes* review of Claims 1, 3, 4, 7, and 9 of the '530 Patent (the "Challenged Claims") and cancel those claims as unpatentable.

IV. REASONS FOR THE REQUESTED RELIEF

The Challenged Claims of the '530 Patent would have been anticipated and/or obvious to a person of ordinary skill in the art ("POSITA") as of their priority date and are therefore unpatentable. The claims of the '530 Patent were known or recite nothing more than an obvious combination of optical elements that had been used by POSITAs for many years prior to the filing of the '530 Patent.

This Petition's showing that the cited art renders the Challenged Claims unpatentable is fully supported by the Declaration of Dr. Jose Sasian (EX1003), a Professor of Optical Sciences for over 20 years at the University of Arizona. EX1003, ¶5; EX1011. Professor Sasian is familiar with the state of the art before the

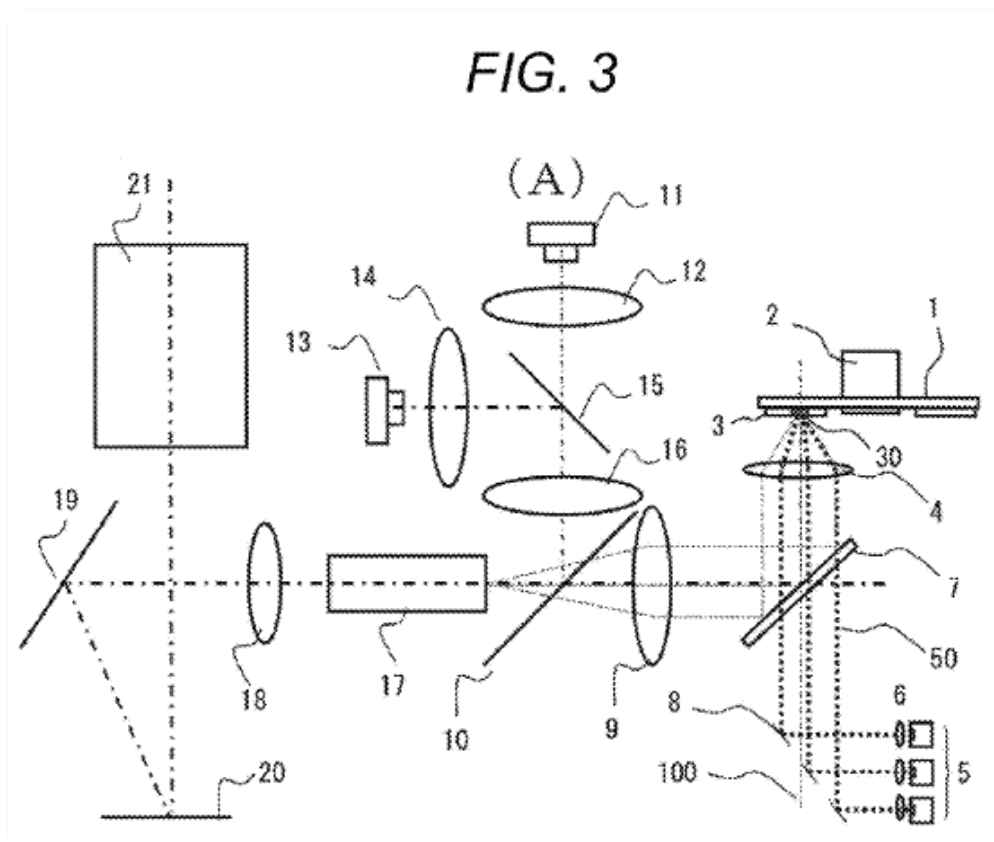
'530 Patent was filed, and fully agrees with and supports the showing herein that the claims at issue merely recite long-known optical elements arranged in a known or an obvious fashion. EX1003, ¶¶76-196.

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

A. Summary of the '530 Patent

The '530 Patent describes a light source device. EX1001, abstract. EX1003, ¶45. The light source device is provided with a plurality of excitation light sources emitting excitation light and a phosphor changing excitation light to fluorescent light, and the excitation light sources are arranged so that each excitation light emitted from each of the excitation light sources asymmetrically enters an excitation light irradiation region on a phosphor. *Id.* A mirror is installed on an optical path of unconverted excitation light reflected from the phosphor and returns the unconverted excitation light to the phosphor side, whereby the unconverted excitation light can be utilized as excitation light again. *Id.*

Figure 3(A) of the '530 Patent, reproduced below, depicts a schematic configuration diagram of an embodiment of the claimed light source device and components working with that light source device as part of a projection type video display device.

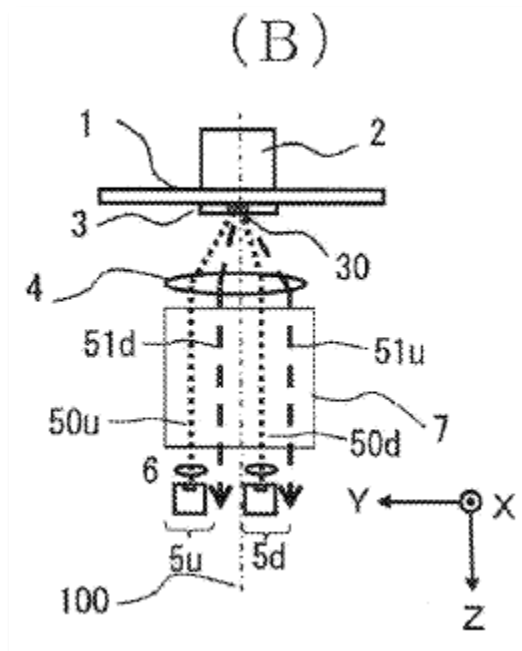


The figure shows an excitation light source group 5 that emits blue excitation light. EX1001, 18:5-8. The dichroic mirror 7 transmits blue light and reflects green light, meaning that the blue excitation light transmits through the dichroic mirror to be condensed by a condensing lens 4 onto a disk 1. *Id.*, 18:8-11.

Disk 1 is a rotation-controllable circular base material, coated with a green phosphor 3, with a rotation element 2 as a center axis. *Id.*, 18:15-18. Green light generated by excitation of the green phosphor 3 that has been transmitted through the condensing lens 4 is reflected by the dichroic mirror 7 to transmit through another condensing lens 9 and thus enter another dichroic mirror 10. *Id.*, 18:18-23. This

green light then travels through a number of optical elements, ultimately reaching video display element 20 and entering through a projection lens 21. *Id.* 18:59-19:15.

Figure 2(B) reproduced below, depicts an alternative embodiment of the claimed light source device.



The figure shows a configuration where the excitation light sources 5u, 5d are arranged asymmetrically to the optical axis 100. *Id.*, 5:29-36. In this arrangement, excitation light 50u, 50d not converted by the phosphor 3 (labeled 51d and 51u) does not return along the same path as excitation light 50u and 50d. *Id.*, 5:46-57. According to the '530 Patent, ensuring that this unconverted light does not travel along the reverse path as the excitation light improves the output and life of the excitation light sources. *Id.*, 6:4-9.

B. The Prosecution History of the '530 Patent

The '530 Patent issued on April 26, 2016, originally from PCT Application No. PCT/JP2012/074617, filed on September 26, 2012. That application entered the national stage in the United States as U.S. Patent Application No. 14/240,799, on February 25, 2014. EX1001, cover.

In an Office Action dated September 4, 2015, the Examiner rejected pending claims 1, 2, 5-9, and 12 and objected to claims 3, 4, 10, and 11. EX1002, 065. Claims 1, 6, and 7 were rejected under pre-AIA 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 8,783,886 to Huang, Claims 2 and 8 were rejected under 35 U.S.C. § 102(e) as being anticipated by Patent Pub. No. US2011/0292349 to Kitano et al., and Claims 9 and 12 were rejected under pre-AIA 35 U.S.C. § 103(a) as being obvious over Huang in view of Komatsu. *Id.*, 067-72. Claim 5 was rejected under 35 U.S.C. § 112. *Id.*, 066-67. In addressing, Claims 3, 4, 10, and 11, the Examiner indicated that these claims were objected to as being dependent upon a rejected independent claim but that the claims were written in independent form, they would be allowable. *Id.*, 072-73. Regarding Claim 4 in particular, the Examiner stated that the prior art does not teach “when the excitation light irradiation region of any excitation light of each of the excitation lights is an elevation angle theta, and the condition theta is not equal to zero is satisfied.” *Id.*, 072.

Related to the Challenged Claims in this petition, the Applicant Amended its Claims on November 9, 2015, to incorporate “when the excitation light irradiation region of any excitation light of each of the excitation lights is an elevation angle θ , and the condition θ is not equal to zero is satisfied[,]” which the Examiner had indicated were not present in the prior art, into the independent claims 1 and 7. *Id.*, 046-53. The Examiner issued a Notice of Allowance on January 13, 2016, in which claims 1 and 7 became the Challenged Claims 1 and 9. *Id.*, 029-33.

C. Priority Date

The '530 Patent claims priority to a PCT application filed on September 26, 2011. EX1001, Cover. That date is the assumed priority date for purposes of this Petition. All of the references cited in the instant Petition qualify as prior art based on that priority date.

D. Challenged Claims

Claims 1, 3, 4, 7, and 9 of the '530 Patent are challenged.

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

Petitioners have not been involved in any previous review of the '530 Patent. Additionally, the Office has not considered the combinations of references forming the grounds for this Petition, and the combinations are not redundant to any combination of references considered during prosecution. Additionally, the instant

Petition provides the analysis of Dr. Sasian, which has likewise not been presented to the Office before. As the same or similar arguments have not been previously considered by the Office, discretionary denial under § 325(d) is not warranted here.

Likewise, denial under § 314(a) is not warranted. The discretionary factors set out in *Apple v. Fintiv, Inc.*, IPR2020-00019, Paper 11, at 6 (PTAB Mar. 20, 2020) (precedential), do not favor denying institution.

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

Fintiv factor two is neutral. Although the trial date in the Texas litigation is currently March 23, 2026, that date could get pushed back. EX1010. In this regard, the USPTO’s Interim *Fintiv* Guidance recognizes that “[a] court’s scheduled trial date . . . is not by itself a good indicator of whether the district court trial will occur before the statutory deadline for a final written decision” and allows parties to “present evidence regarding the most recent statistics on median time-to-trial for civil actions” in the applicable district court. Interim *Fintiv* Guidance at 8-9 (June

21, 2022). The most recent statistics on median time-to-trial for civil actions in the Eastern District of Texas is 21.9 months.¹ Here, the complaint in the Texas litigation was filed on July 9, 2024, making the calculated trial date based on the median statistics in May 2026. The Board’s final written decision (FWD) in this case is expected in approximately July 2026—meaning that the district court trial could easily occur after the FWD if the trial gets pushed back only slightly more than a median trial in the Texas district court.

Fintiv factor three weighs against discretionary denial. The court proceeding is at an early stage, with relatively little investment from the Court and Parties. The court has not yet issued any substantive orders relating to the ’530 Patent. Expert reports have not been prepared on any issues in the Texas litigation. And Petitioners have been diligent—Petitioners filed this Petition less than three and a half months after receiving Patent Owner’s infringement contentions, less than two and a half months after Patent Owner supplemented those contentions, and over five months before Petitioners’ bar date. Petitioners have not delayed filing for any strategic advantage.

Fintiv factor four weighs against discretionary denial. If this Petition is instituted, Petitioners stipulate that they will not pursue the grounds identified in this

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

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

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

Regarding *Fintiv* factor six, the strong merits of this Petition weigh heavily against discretionary denial. Petitioners raise compelling, meritorious challenges that the Patent Owner cannot meaningfully rebut, which underscores the conclusion that one or more claims of the '530 Patent are unpatentable by a preponderance of the evidence.

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

F. Secondary Considerations

Neither Petitioners nor Dr. Sasian are aware of any secondary considerations of nonobviousness that support patentability of the Challenged Claims. EX1003, ¶196.

V. Claim Construction

Terms not construed in the discussion below have their plain and ordinary meaning consistent with the claim construction standards set forth under *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005). EX1003, ¶¶24-29.

VI. STATUTORY GROUNDS FOR CHALLENGES AND REFERENCES USED

Ground #1: Claims 1, 4, and 7 are anticipated under pre-AIA 35 U.S.C. § 102 by Hirata and/or are obvious under pre-AIA 35 U.S.C. § 103 over Hirata.

Hirata is based on an application filed October 25, 2010, and published on August 4, 2011. Hirata is prior art under at least pre-AIA 35 U.S.C. §102(a), (b), and (e)(1).

Ground #2: Claims 1, 3, 4, 7 and 9 are obvious under pre-AIA 35 U.S.C. § 103 over Kurosaki in view of Alpay.

Kurosaki is based on an application filed March 24, 2011, and published on September 29, 2011. Kurosaki is prior art under at least pre-AIA 35 U.S.C. (e)(1).

Alpay is based on an application filed September 12, 2008, and published on December 17, 2009. Alpay is prior art under at least pre-AIA 35 U.S.C. § 102(a), (b), and (e)(1).

Ground #3: Claim 9 is obvious under pre-AIA 35 U.S.C. § 103 over Kurosaki in view of Abu-Ageel.

Abu-Ageel is based on an application filed April 21, 2010, and published on February 24, 2011. Abu-Ageel is prior art under at least pre-AIA 35 U.S.C. § 102(a), (b), and (e)(1).

Ground #4: Claims 1, 3, 4 and 9 are obvious under pre-AIA 35 U.S.C. § 103 over Huang in view of Alpay.

Huang is based on an application filed on June 27, 2011, published on July 19, 2012, and issued on July 22, 2014. Huang is prior art under at least pre-AIA 35 U.S.C. § 102(e)(2).

Ground #4a: Claim 7 is obvious under pre-AIA 35 U.S.C. § 103 over Huang in view of Alpay and Akiyama.

Akiyama is based on an application filed June 28, 2011, and published on January 12, 2012. Akiyama is prior art under at least pre-AIA 35 U.S.C. § 102(e)(1).

Ground #5: Claim 9 is obvious under pre-AIA 35 U.S.C. § 103 over Huang in view of Abu-Ageel and Alpay.

VII. LEVEL OF ORDINARY SKILL IN THE ART

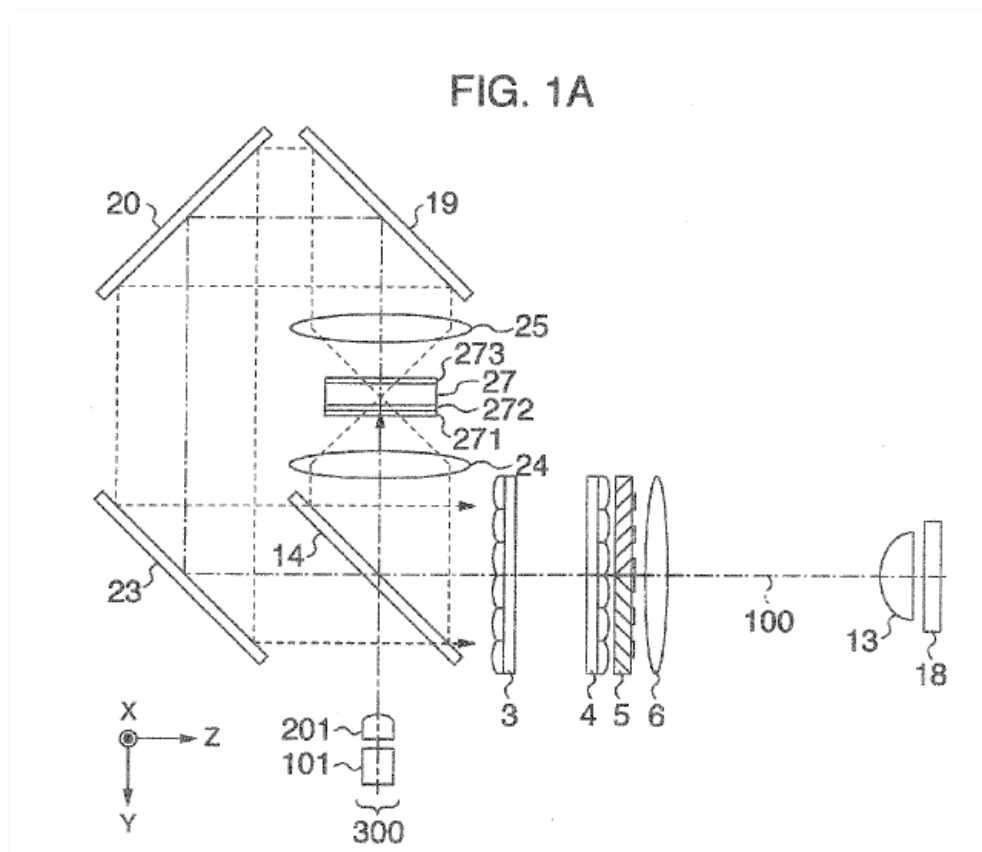
As of September 26, 2011, a POSITA would have had a Ph.D. in electrical engineering, physics, optical sciences, optical engineering, or a related scientific or engineering field, and at least one to two years of work or research experience in optical engineering, optical design, or a related field. EX1003, ¶31. Alternatively, a POSITA could have a Bachelor's degree in one of the foregoing areas and at least three to four years of work or research experience in optical engineering, optical design, optoelectronics, or a related field. *Id.* Additional education could substitute for some of the work experience. *Id.*

VIII. CLAIMS 1, 3, 4, 7, AND 9 ARE UNPATENTABLE.

A. Ground 1: Claims 1, 4, and 7 are invalid under pre-AIA 35 USC § 102 as anticipated by Hirata and/or are invalid under pre-AIA 35 U.S.C. § 103 as obvious over Hirata

1. Overview of Hirata

Hirata discloses a projection type display apparatus that incorporates a light source device. EX1004, abstract; EX1003, ¶56. Figure 1A depicts an embodiment of the invention described therein.



EX1004, Fig. 1A; EX1003, ¶56.

As shown in Figure 1A, Hirata discloses an excitation light source device 300 that includes a blue excitation light source 101 for phosphor excitation. EX1004, [0090]; EX1003, ¶57. Though only one excitation light source is shown in Figure 1A, Hirata makes clear that the invention described therein can comprise a plurality of excitation light sources that each emit excitation light. EX1004, Fig. 1B, [0094]; EX1003, ¶57. Excitation light from the excitation light source 101 excites a yellow phosphor 271, which then emits yellow light. EX1004, [0088], [0091]; EX1003, ¶57.

Also as shown in Figure 1A of Hirata is a dichroic mirror 14 that transmits blue excitation light from excitation light source 101 and reflects yellow light from yellow phosphor 271. EX1004, [0090]; EX1003, ¶58. After transmission through the dichroic mirror 14, the blue excitation light is focused by a focusing lens 24 onto the yellow phosphor 271. EX1004, [0090], [0094]; EX1003, ¶58. Yellow light emitted from the yellow phosphor is reflected or transmitted by various other elements depicted in Figure 1A, ultimately reaching a liquid-crystal display element 18. EX1004, [0020]; EX1003, ¶58.

2. Claim 1

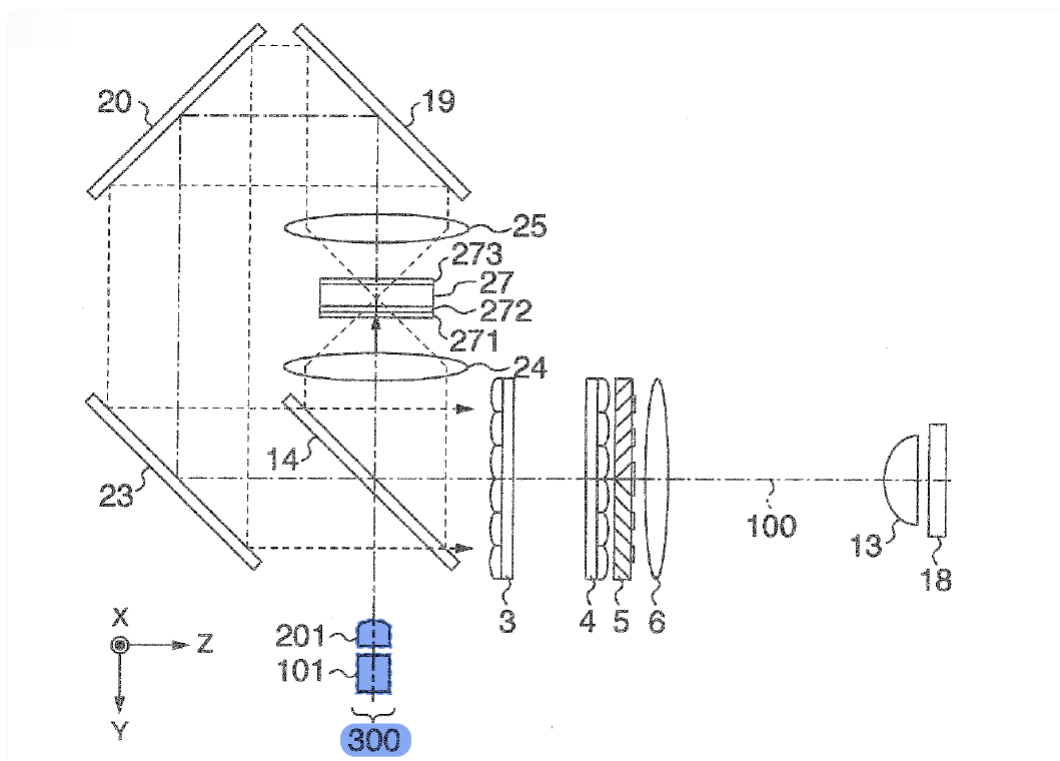
Claim 1 is anticipated or rendered obvious by Hirata. EX1003, ¶¶76-84.

a. Claim Element 1p

A light source device, comprising:

It is Petitioners' position that the preamble of Claim 1 is not limiting and need not be analyzed for the purposes of determining Claim 1's validity. Should the Board determine the preamble is limiting, however, Hirata discloses a light source device. EX1003, ¶77.

Figure 1A depicts "an excitation *light source device* 300 [that] includes the blue excitation light source 101[.]" EX1004, [0090] (emphasis added); EX1003, ¶77.

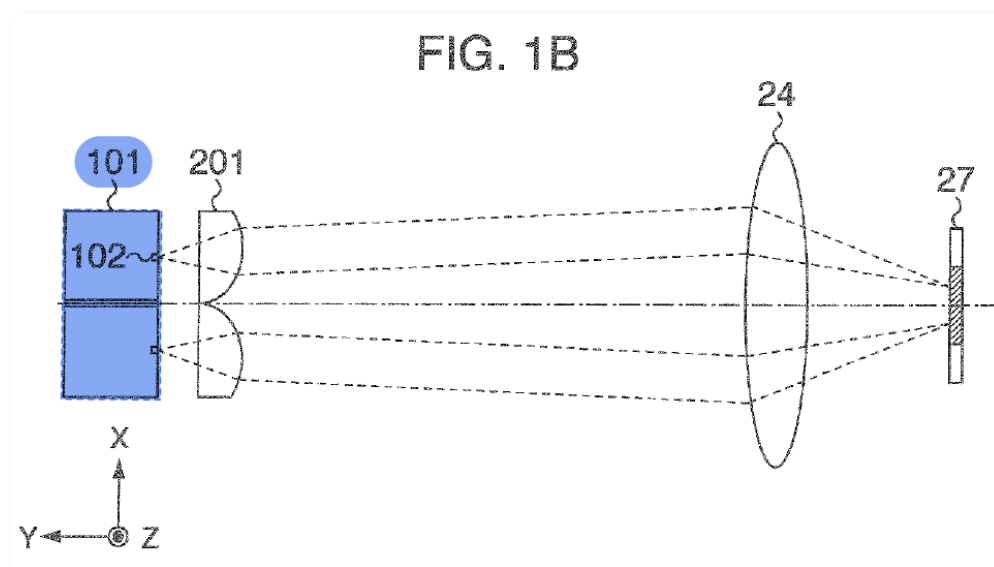


EX1004, Fig. 1A (annotated); *see also* EX1003, ¶77.

b. Claim Element 1a

a plurality of excitation light sources which emit excitation light;

Figure 1B depicts “two blue excitation light sources 101[.]” EX1004, [0094]; EX1003, ¶78. “The blue excitation light rays [are] emitted from the blue excitation light source 101[.]” EX1004, [0094]; EX1003, ¶78.



EX1004, Fig. 1B (annotated); EX1003, ¶78.

c. Claim Element 1b

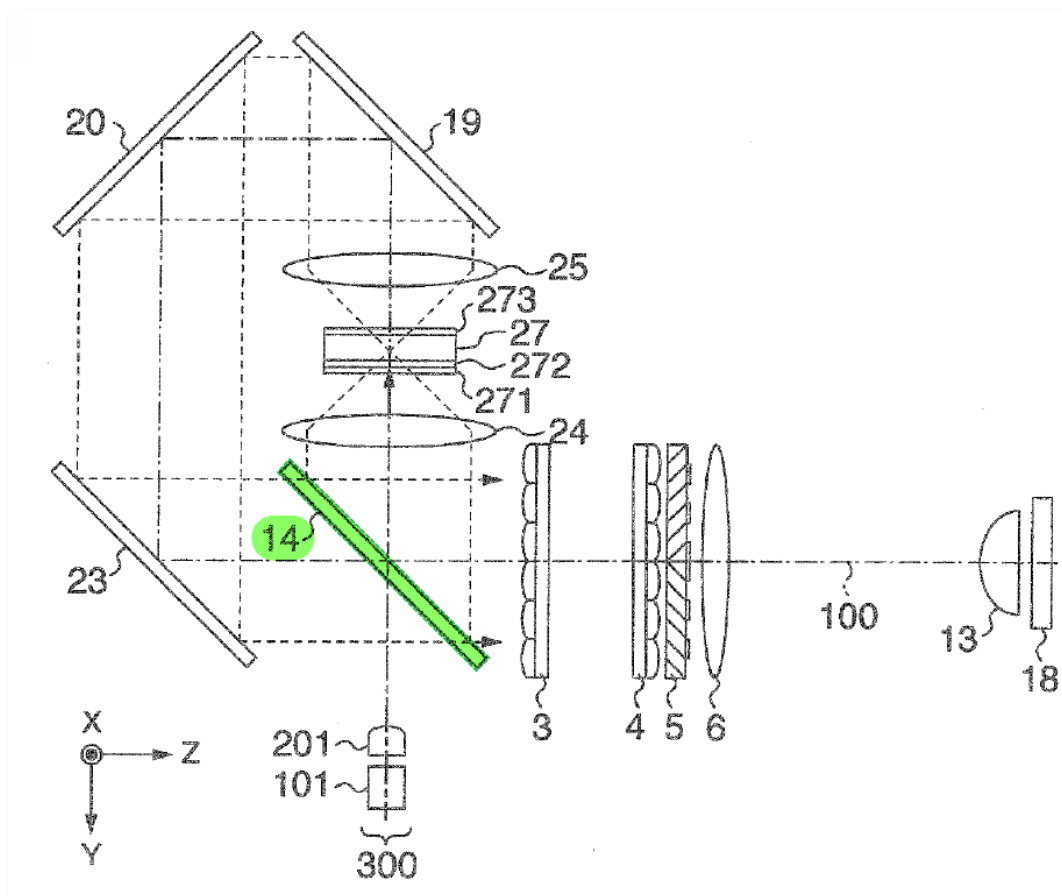
a phosphor which changes the excitation light to fluorescent light;

Hirata discloses “a light source in which a yellow phosphor is excited by blue excitation light to emit yellow light.” EX1004, [0088]; *see also id.*, [0091]; EX1003, ¶79. The yellow light emitted by the yellow phosphor in response to the blue excitation light is fluorescent light. EX1003, ¶79.

d. Claim Element 1c

a dichroic mirror which transmits the excitation light and reflects the fluorescent light; and

Hirata discloses that “[t]he blue excitation light rays . . . from the excitation light source device 300 pass through a dichroic mirror 14, which transmits blue light and which reflects yellow light[.]” EX1004, [0090]; EX1003, ¶80.



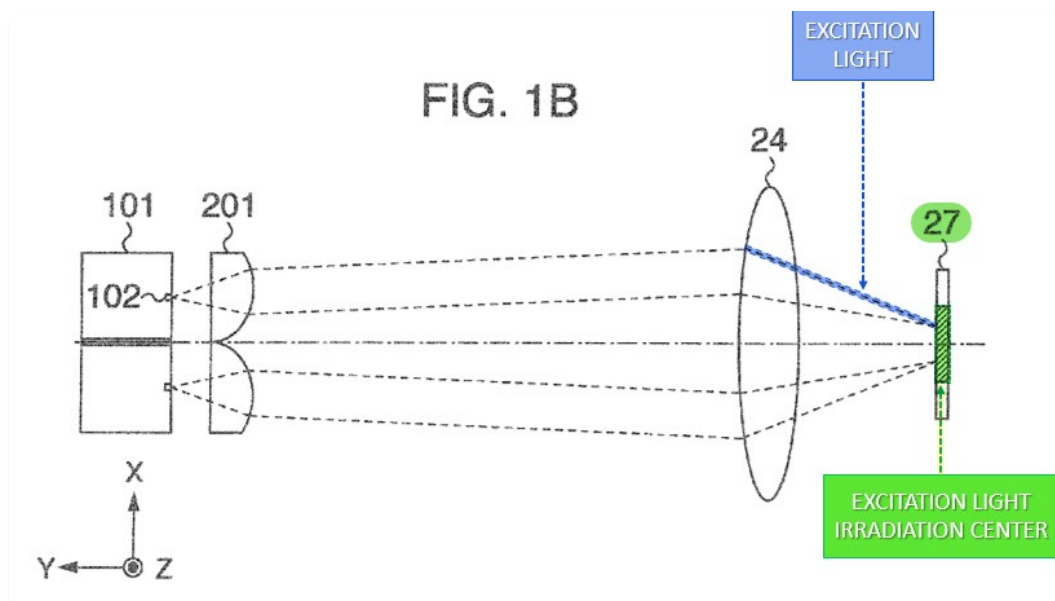
EX1004, Fig. 1A (annotated); EX1003, ¶80.

e. Claim Element 1d

a condensing lens which condenses the excitation light transmitted through the dichroic mirror in an excitation light irradiation region on the phosphor,

Hirata discloses that the blue excitation light rays from the excitation light source that pass through the dichroic mirror “are focused [*i.e.*, “condensed”] through a focusing lens 24 [*i.e.*, a “condensing lens”] onto a light incidence side of a transparent substrate 27 [*i.e.*, a “excitation light irradiation region”].” EX1004, [0090]; EX1003, ¶81. “[T]he transparent substrate 27 ***includ[es] a yellow***

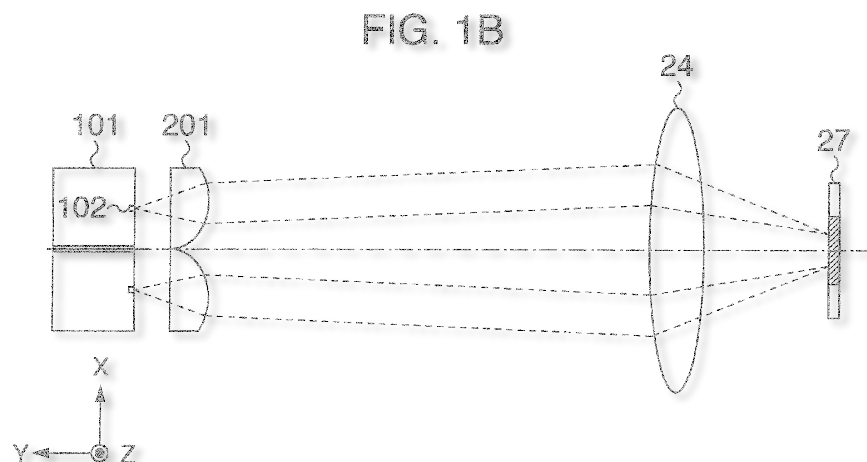
phosphor[.]” EX1004, [0094] (emphasis added); EX1003, ¶81.



f. Claim Element 1e

wherein the plurality of light sources are arranged so that each excitation light emitted from each of the plurality of light sources enters asymmetrically to a center of the condensing lens; and

As depicted in Figure 1B, there are “*two blue excitation light sources 101* each including a light emitting plane 102”. The blue excitation light rays emitted by each excitation light source 101 enters offset and tilted from the optical axis of the focusing lens 24. EX1003, ¶82. Therefore, each excitation light emitted from each excitation light source 101 enters asymmetrically to the center of Hirata’s condensing lens (*i.e.*, focusing lens 24):



EX1004, Fig. 1B; *see also id.*, [0094]; EX1003, ¶82. A POSITA would have found that, because the light beams are offset and tilted, they are asymmetrically entering the condensing lens. EX1003, ¶83.

To the extent this is disputed, it would also have been obvious to offset the light source 101 and collimator lens 201 in a perpendicular direction to the plane of the figure (Z-axis) or along the X-axis of the Fig. 1B to avoid back reflections from reflected or scattered excitation light. *Id.*

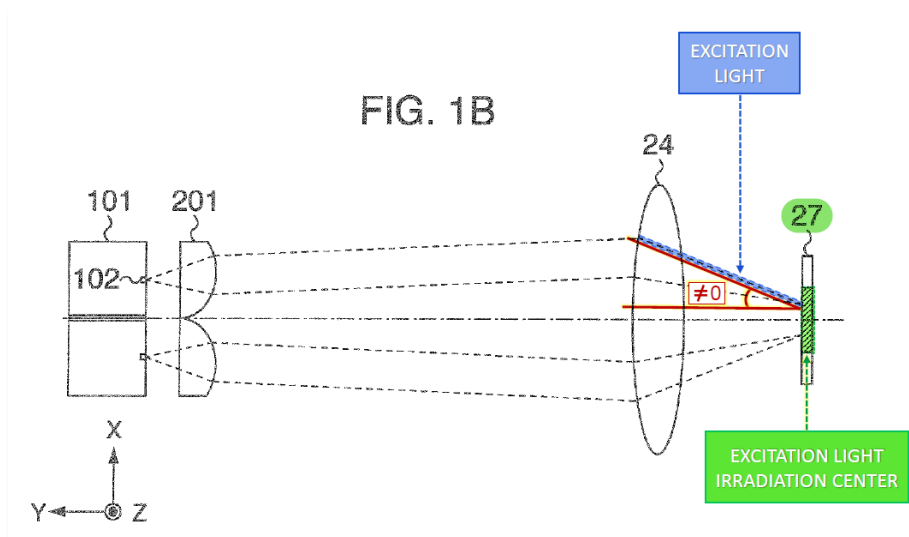
g. Claim Element 1f

wherein when the excitation light irradiation region is a center and an incident angle to the excitation light irradiation region of any excitation light of each of the excitation light is an elevation angle θ , $\theta \neq 0$ is satisfied².

Figure 1B depicts an arrangement where the excitation light enters obliquely to the excitation light irradiation region (transparent substrate 27, which includes

² The recitation “ $\theta \neq 0$ ” was amended to read “ $\theta \neq 0$ ” by Certificate of Correction.

yellow phosphor 271). EX1004, [0090], [0094]; EX1003, ¶84. As a result, the incident angle to the excitation light irradiation region of any excitation light of each of the excitation light sources is not equal to zero.



EX1004, Fig. 1B (annotated); EX1003, ¶84.

3. Claim 4

The light source device according to claim 1, wherein the excitation light source is a solid light-emitting element.

Claim 4 is anticipated or rendered obvious by Hirata. EX1003, ¶¶76, 85.

Hirata discloses that the excitation light sources disclosed therein can be “***solid light emitting elements*** such as light emitting diodes, lasers, and organic electroluminescence elements.” EX1004, [0044]; *see also id.*, [0088]; EX1003, ¶85.

4. Claim 7

Claim 7 is anticipated or rendered obvious by Hirata. EX1003, ¶¶76, 86-91.

a. Claim Element 7a

A projection type video display device, comprising:

It is Petitioners' position that the preamble of Claim 7 is not limiting and need not be analyzed for the purposes of determining Claim 7's validity. Should the Board determine the preamble is limiting, however, Hirata discloses a projection type video display device. EX1003, ¶86.

Specifically, Hirata discloses "[a] projection type display apparatus[.]" EX1004, Abstract, [0064]; EX1003, ¶86.

b. Claim Element 7a

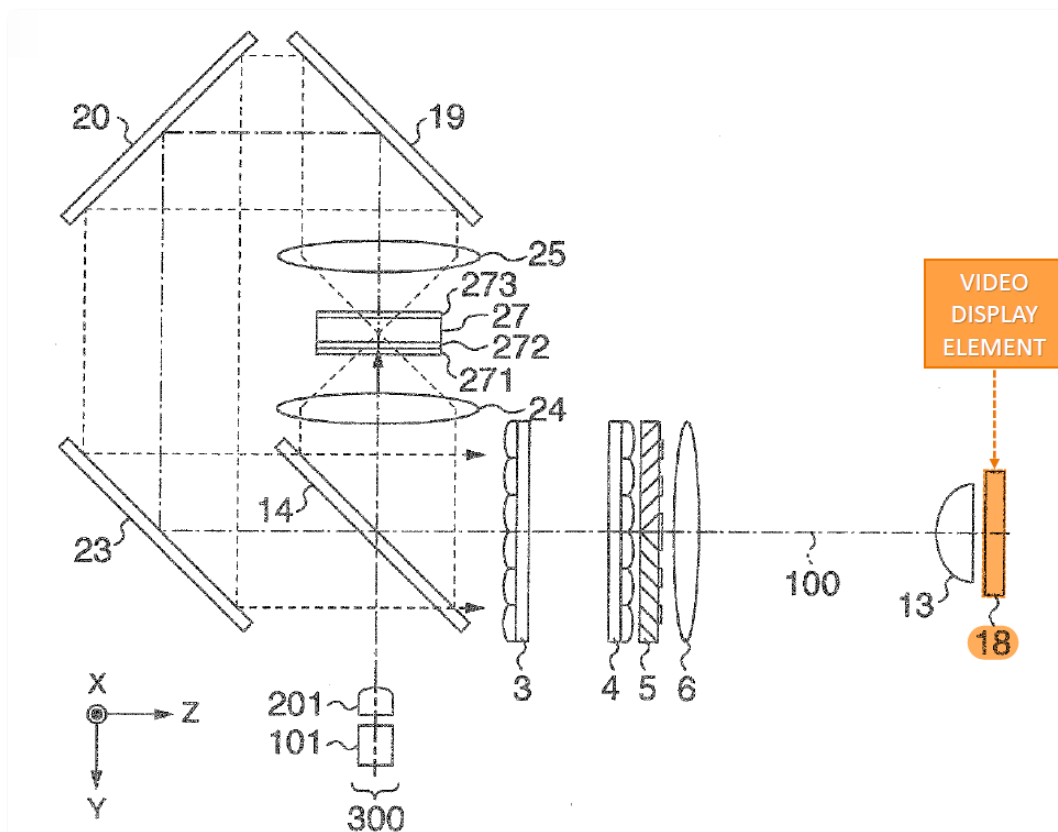
the light source device according to claim 1;

Hirata discloses a light source device according to Claim 1. *See supra* Ground 1, Claim 1; EX1003, ¶¶77-84, 87.

c. Claim Element 7b

a video display element;

Hirata discloses a "liquid crystal display element 18" as depicted in Figure 1A. EX1003, ¶88. A POSITA would understand this element to be a video display element. EX1003, ¶88.

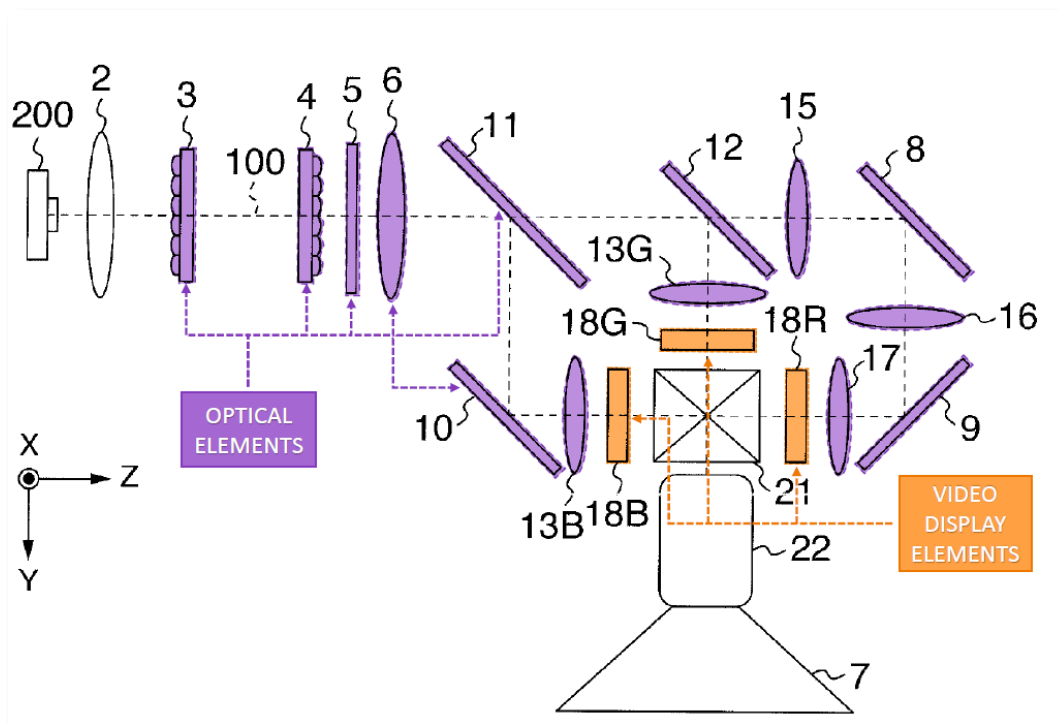


EX1004, Fig. 1A (annotated); *see also id.*, [0064]; EX1003, ¶88.

d. Claim Element 7c

an illumination optical system which has a plurality of optical elements applying light from the light source device to the video display element; and

Hirata discloses an “optical system of a projection type display apparatus” that includes a plurality of optical elements that apply light from the light source device to the video display element. EX1004, [0064]; EX1003, ¶89. These optical elements include array lenses with “a plurality of lens cells arranged in a matrix[,] . . . and each lens cell[] projects or maps the contour of the lens cell of the first array lens 3 corresponding thereto onto a liquid-crystal display element 18.”

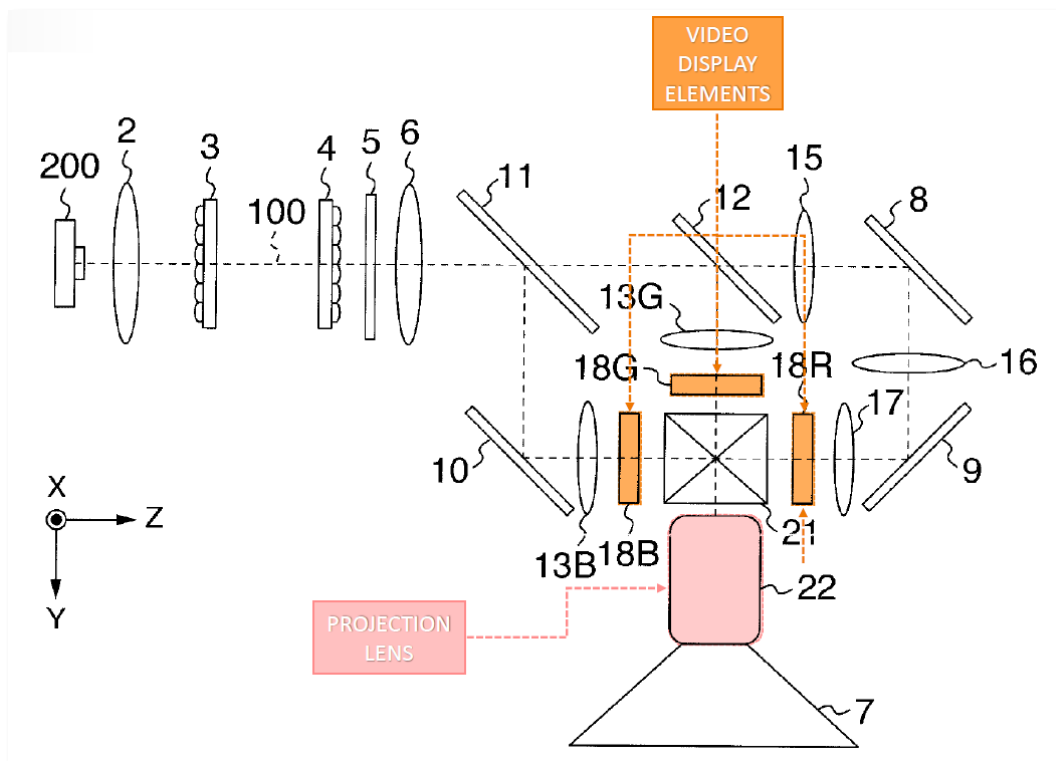


EX1004, Fig. 4A (annotated); *see also id.*, [0068]-[0074]; EX1003, ¶89.

e. Claim Element 7d

a projection lens which enlarges and projects an optical image formed by the video display element.

Hirata discloses a projection lens that enlarges and projects an optical image formed by the video display element: “An optical image formed on each liquid-crystal display element through an optical intensity modulation is *projected* by the *projection lens 22* as a *magnified* image onto the screen 7[.]”

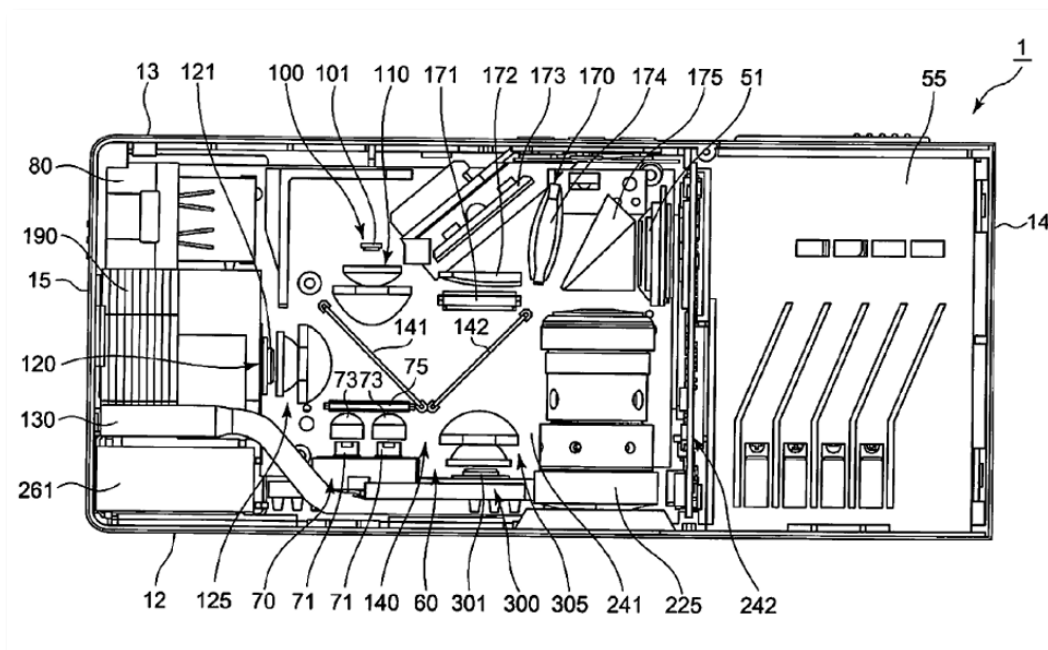


EX1004, Fig. 4A (annotated); EX1003, ¶90.

B. Ground 2: Claims 1, 3, 4, 7, and 9 are invalid under pre-AIA 35 U.S.C § 103 as obvious over Kurosaki in view of Alpay.

1. Overview of Kurosaki

Kurosaki discloses a projection type video display device in the form of projector 1 as depicted in Kurosaki's Figure 3:



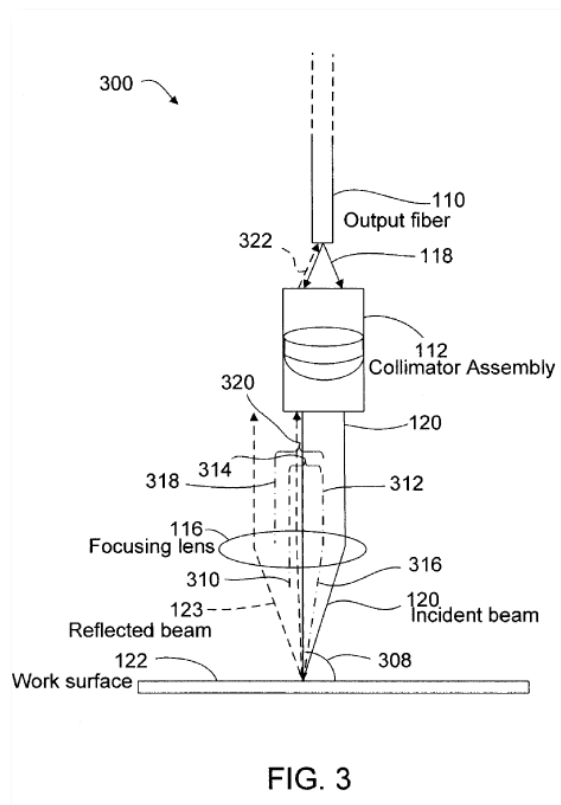
EX1012, Fig. 3; *see also id.*, [0022]; EX1003, ¶60. Projector 1 includes a light source device in the form of light source unit 60, which further includes an excitation light shining unit 70 that includes two excitation light sources 71. EX1012, [0023], [0041]; EX1003, ¶60. Each excitation light source 71 is a blue laser that emits a laser beam as excitation light. EX1012, [0041]-[0042]; EX1003, ¶60.

Projector 1 also includes a luminescent plate 101 that “generates green luminescent light by use of a laser beam emitted from excitation light source 71 as excitation light and emits this green luminescent light[.]” EX1012, [0041]-[0042]; EX1003, ¶61. “A front surface of the luminescent plate 101 is formed into a reflecting plane, and a rectangular luminescent material layer is laid on the reflecting plane.” EX1012, [0024]; *see also Id.*, [0042]. A POSITA would understand that the luminescent material layer could be a phosphor. EX1003, ¶61. Projector 1 also

includes a dichroic mirror 141 that transmits excitation light and reflects fluorescent light and a condensing lens (collective lens 110) that condenses excitation light transmitted through the dichroic mirror to an excitation light irradiation region on luminescent plate 101. EX1012, [0025], [0044]; EX1003, ¶61. In this arrangement, light from the luminescent plate 101 is reflected or transmitted by various other elements depicted in Figure 3, ultimately reaching a display device 51, which may comprise a Digital Mirror Device (DMD). EX1012, [0038]; EX1003, ¶61.

2. Overview of Alpay

Alpay discloses systems and methods for reducing back-reflections in laser processing systems. EX1005, abstract; EX1003, ¶63. Figure 3 depicts an embodiment of the invention described therein.



EX1005, Fig. 3, EX1003, ¶63.

Alpay teaches an arrangement where excitation light emitted from a light source in the form of incident laser beam 120 enters asymmetrically to a center of a focusing lens 116. EX1005, [0028]; EX1003, ¶64. Alpay discusses the importance of this arrangement:

Generally, certain lasers may be sensitive to optical feedback such as a laser beam reflected back to the laser from a work surface. If such reflections are not properly blocked, e.g., if there is a return path for such reflections to couple back into an output fiber, it is possible that both the output fiber and gain fibers may be damaged.

EX1005, [0003]; EX1003, ¶¶64-65. The arrangement of Figure 3 prevents this unwanted feedback by providing an asymmetric arrangement provided by offset 314

between a first axis of propagation 312 of an incident laser beam 120 and the primary axis 310 of focusing lens 116 to reduce or prevent overlap between the reflected laser beam 123 and the incident laser beam 120. EX1005, [0027]-[0028]; EX1003, ¶65. “Thus, all or at least a substantial portion of the reflected laser beam 123 does not return through the collimator assembly 118 of output fiber 110.” EX1005, [0029]; EX1003, ¶65. Alpay further teaches other additional solutions to prevent the remaining portion of the reflected laser beam from returning to the light source. EX1005, [0029]-[0031].

3. Motivation to combine Alpay with Kurosaki

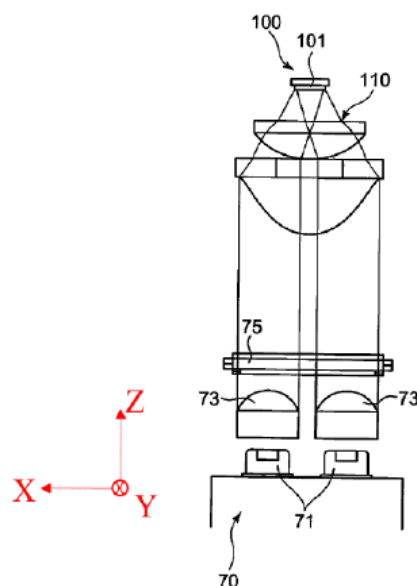
As an initial matter, a POSITA would have been motivated to combine Kurosaki and Alpay, and would have had a reasonable expectation of success in making the combination. Kurosaki and Alpay both employ lasers, and a POSITA would have looked at Alpay while considering the reliability of the Kurosaki projector. Kurosaki and Alpay are analogous and/or complimentary art. EX1003, ¶93. Kurosaki describes a projection type display apparatus including a light source device, such as lasers. *Id.* Prior to the '530 Patent, it was well known that back reflections affected, degraded, or impaired the performance of laser diodes. EX1005, [0003] (“[C]ertain lasers may be sensitive to optical feedback such as a laser beam reflected back to the laser from a work surface. . . . [I]t is therefore desirable to prevent such back-reflections from finding a path back into the output fiber.”); *see*

also EX1013, 1:11-17 (“For many applications back-reflection of the light emitted by a laser diode into the laser active region has a significant, negative, impact on the performance of the laser.”); EX1014, 1:19-22 (“In high power fiber-optic systems, optical isolators are used to protect low-power components from damage that may be caused by back-reflected light from amplifiers or other components.”); EX1003, ¶93. By the time of the priority date of the ’530 Patent, not only was this problem known, but tools had been developed to combat this problem, such as optical isolators. EX1005, [0004]-[0005]; EX1013; EX1014; EX1003, ¶93. Optical isolators, however, “are usually quite bulky (especially when configured for use with high-power beams) and expensive.” EX1005, [0006]; EX1003, ¶93. A POSITA would have known this and would have at least considered protecting the laser diodes of Kurosaki by the means taught by Alpay, which discloses a different method to prevent unwanted, destabilizing feedback, or by the use of optical isolators that were well known and used in front of laser diodes in applications such as telecommunications and high power lasers. EX1003, ¶93. In other words, by the time of the priority date of the ’530 Patent, it was well known that back reflections can adversely affect the performance of a laser. Therefore, a POSITA looking at Kurosaki would have considered the teaching of Alpay.

A POSITA would have understood as of the ’530 Patent’s priority date that some portion of excitation light emitted by Kurosaki’s excitation light sources 71

would not be converted by Kurosaki's luminescent plate 101 and would be reflected back in the direction of excitation light sources 71. *See, e.g.*, EX1008, [0048]; EX1001, 1:28-31; EX1003, ¶94. With this understanding, such a POSITA would have recognized the advantage of implementing the asymmetric arrangement of Alpay into the light source device of Kurosaki by further offsetting Kurosaki's excitation light sources 71 from the optical axis of Kurosaki's collective lens 110 to prevent unconverted excitation light from either excitation light source 71 from entering either the same light source 71 it originated from or its partner light source 71. EX1003, ¶94. Implementing Alpay's offset into the device disclosed by Kurosaki will provide further protection against reflected excitation light from reaching Kurosaki's excitation light sources 71, which will in turn, prevent potential damage to Kurosaki's light sources 71. EX1005, [0003]; *see also* EX1013, 1:11-17; EX1014, 1:19-22; EX1003, ¶94. This would have been nothing but following known methods with predictable results and desirable to improve projector reliability. EX1003, ¶94.

Kurosaki's Figure 5 depicts an arrangement where excitation light sources 71 are offset from the optical axis of collective lens 110 and offset in the X-axis direction of Figure 5.



EX1012, Fig. 5 (annotated); EX1003, ¶95. Though this arrangement would prevent unconverted light from the lefthand excitation light source 71 from feeding back to the same lefthand excitation light source 71, it would not prevent unconverted light from the lefthand excitation light source 71 from feeding back to the righthand excitation light source. EX1003, ¶96. A POSITA, upon review of Alpay, would be motivated to also offset both light sources 71 (with collimator lenses 73 and microlens array 75) from the optical axis of collective lens 110 in Figure 5's Y-axis, out of the plane of Figure 5, or by shifting the righthand excitation light source 71 (with collimator lenses 73 and microlens array 75) in X-axis direction to make the incident angles of the excitation lights of the two excitation light sources 71 to the luminescent material layer of luminescent plate 101 differently from each other. *Id.*

This arrangement in view of Alpay would prevent unwanted feedback of unconverted excitation light from either excitation light source *Id.*

A POSITA thus would have naturally looked to the teachings of Alpay and its asymmetrical arrangement as a means of achieving these benefits by modifying the arrangement of the light source in Kurosaki to avoid the light source from being disposed at the light path of the reflected excitation light so as to reduce or prevent overlap between the reflected laser beam and the incident laser beam. EX1005, [0010] (“The lens includes a primary axis that is substantially parallel to, and offset from, the first axis of propagation.”); EX1003, ¶97.

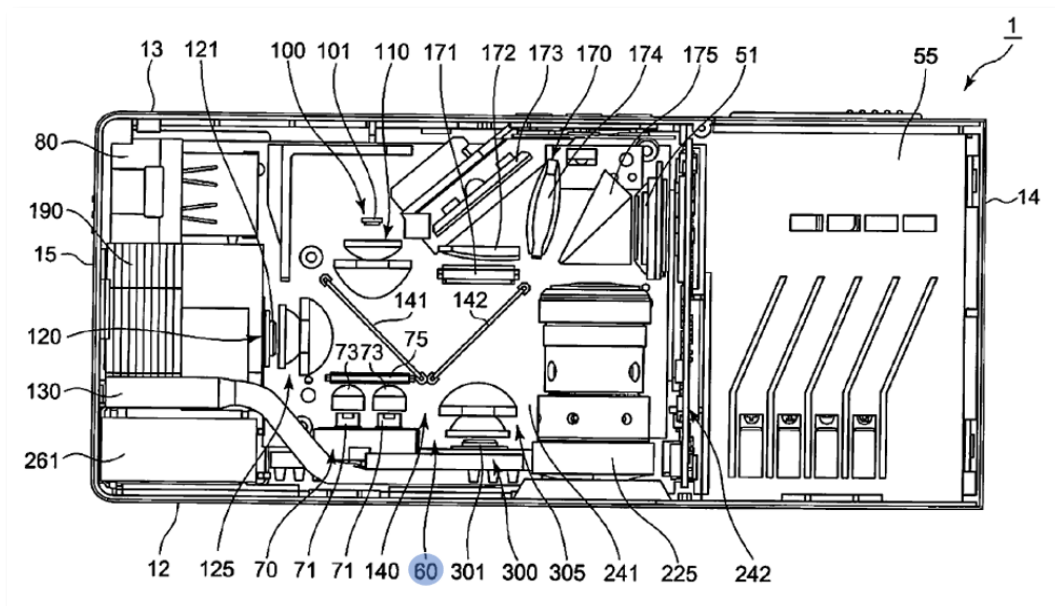
4. Claim 1

Claim 1 is obvious over Kurosaki in view of Alpay. EX1003, ¶¶92-112.

a. Claim Element 1p

A light source device, comprising:

It is Petitioners’ position that the preamble of Claim 1 is not limiting and need not be analyzed for the purposes of determining Claim 1’s validity. Should the Board determine the preamble is limiting, however, Kurosaki discloses a light source device, identified as a “light source unit 60[.]” EX1012, [0023]; EX1003, ¶98.

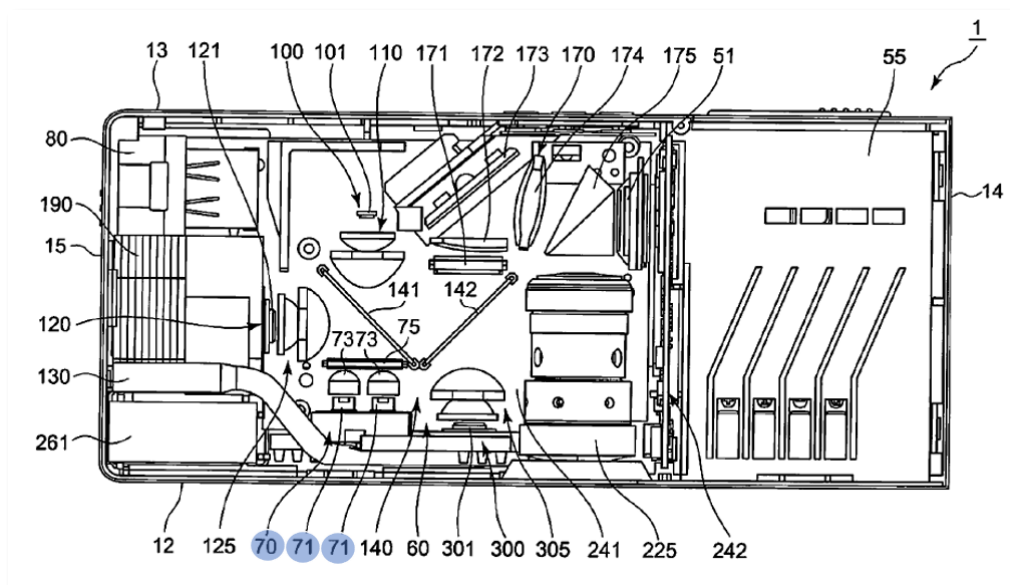


EX1012, Fig. 3 (annotated). EX1003, ¶98.

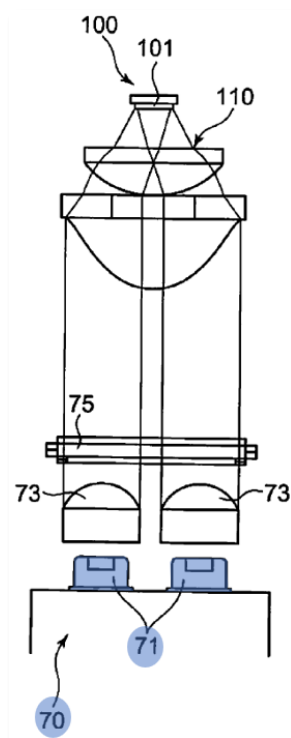
b. Claim Element 1a

a plurality of excitation light sources which emit excitation light;

Kurosaki discloses that its light source device (light source unit 60) comprises an “excitation light shining unit 70” that includes two (*i.e.*, a plurality of) “excitation light sources 71[.]” EX1012, [0041]; EX1003, ¶99.



EX1012, Fig. 3 (annotated).

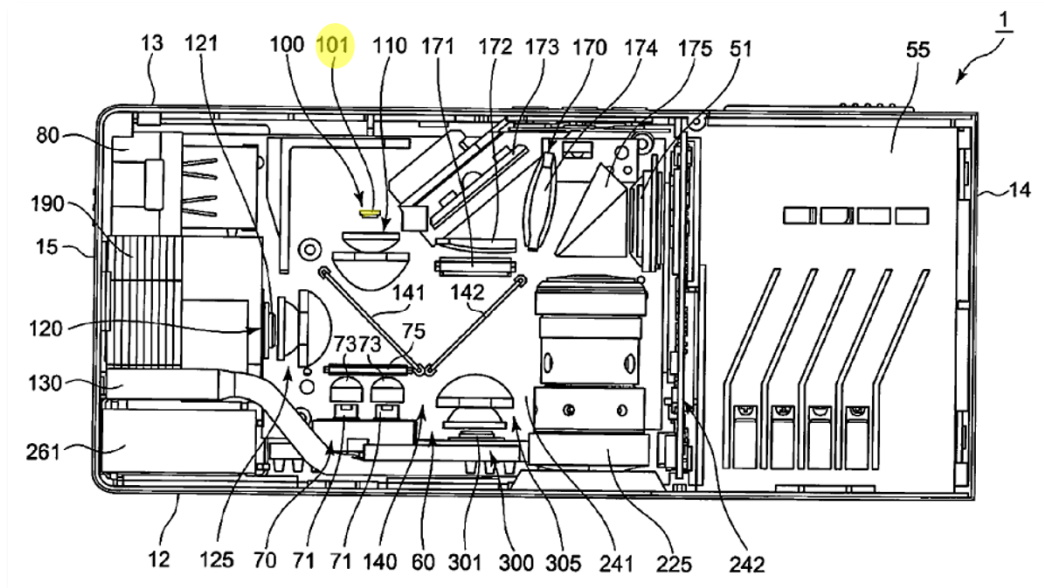


Id., Fig. 5 (annotated). Each excitation light source is a blue laser that emits a laser beam as excitation light. EX1012, [0041]-[0042]; EX1003, ¶99.

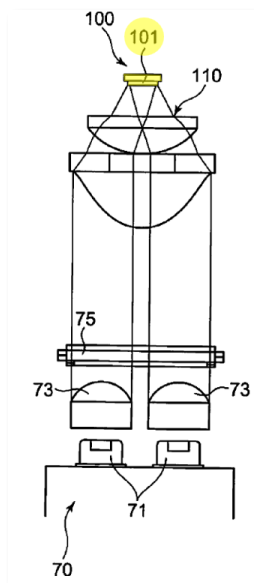
c. Claim Element 1b

a phosphor which changes the excitation light to fluorescent light;

Kurosaki discloses a luminescent plate 101 has a rectangular green luminescent material layer that “generates green luminescent light by use of a laser beam emitted from excitation light source 71 as excitation light and emits this green luminescent light[.]” EX1012, [0041]-[0042]; EX1003, ¶100. A POSITA would understand that the luminescent material layer of luminescent plate 101 is typically a phosphor and luminescent light is the fluorescent light. EX1003, ¶100.



EX1012, Fig. 3 (annotated).



Id., Fig. 5 (annotated); EX1003, ¶100.

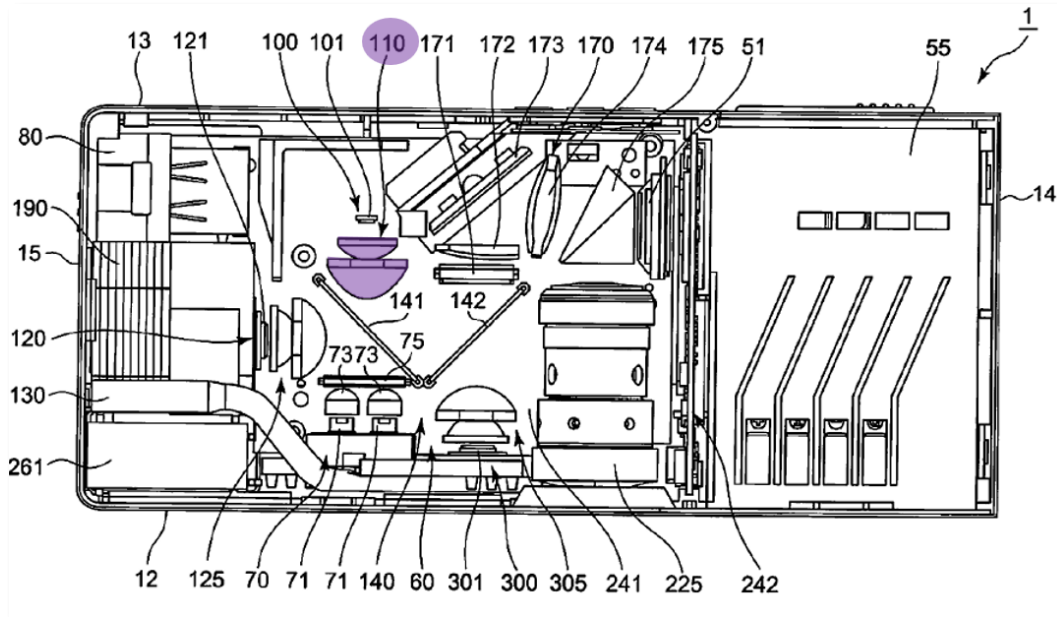
d. Claim Element 1c

a dichroic mirror which transmits the excitation light and reflects the fluorescent light; and

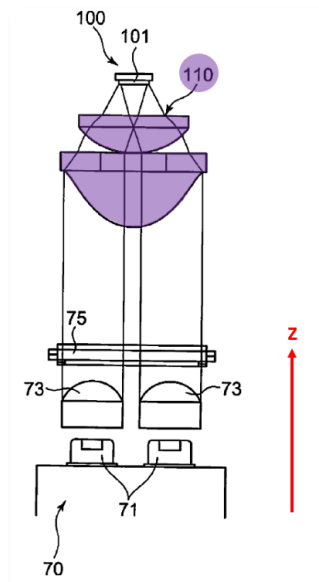
Kurosaki discloses a “dichroic mirror 141 which transmits excitation light from the excitation light shining unit 70 . . . and reflects luminescent light emitted from the luminescent plate 101[.]” EX1012, [0044]; EX1003, ¶101.

a condensing lens which condenses the excitation light transmitted through the dichroic mirror in an excitation light irradiation region on the phosphor,

Kurosaki discloses a condensing lens (collective lens 110) that condenses excitation light transmitted through the dichroic mirror “on to the luminescent material layer [of luminescent plate 101] . . . so that the center positions thereof [*i.e.*, an excitation light irradiation region] are superposed one on another on the luminescent material layer.” EX1012, [0025]; EX1003, ¶102.



EX1012, Fig. 3 (annotated).



Id., Fig. 5 (annotated); EX1003, ¶102.

f. Claim Element 1e

wherein the plurality of light sources are arranged so that each excitation light emitted from each of the plurality of light sources enters asymmetrically to a center of the condensing lens; and

Kurosaki discloses that, there are “two excitation light sources 71”, “[t]his excitation light source 71 is a blue laser emitter and emits a laser beam[.]” EX1012, [0041]; EX1003, ¶103. As shown in Figure 5, the laser beam emitted by each excitation light source 71 enters offset from the optical axis of the condensing lens (collective lens 110). EX1012, Fig. 5; EX1003, ¶103. Therefore, each excitation light emitted from each excitation light source 71 enters asymmetrically to the center of Kurosaki’s condensing lens (i.e., collective lens 110). EX1003, ¶103.

Moreover, Alpay teaches a light source arranged so that excitation light emitted from the light source enters asymmetrically to a center of the condensing lens. *Id.*, ¶104.

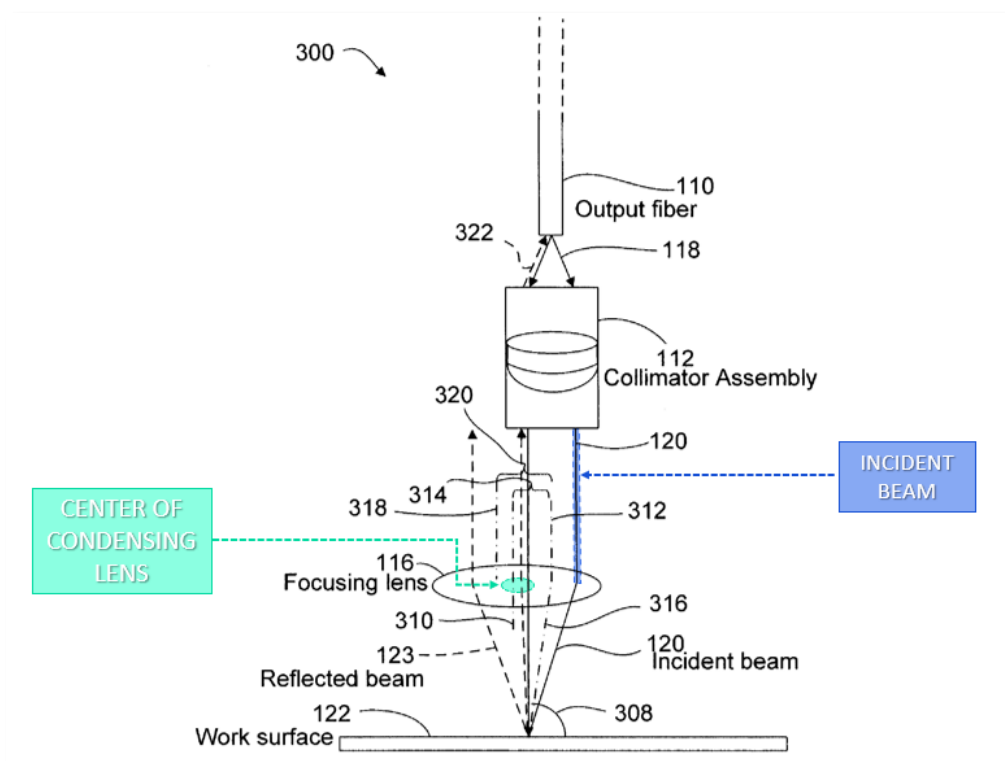
Specifically, Alpay teaches that light must be prevented from reflecting back to damage the light source:

Generally, certain lasers may be sensitive to optical feedback such as a laser beam reflected back to the laser from a work surface. ***If such reflections are not properly blocked, e.g., if there is a return path for such reflections to couple back into an output fiber, it is possible that both the output fiber and gain fibers may be damaged.***

EX1005, [0003] (emphasis added); *see also id.*, [007]; EX1003, ¶104. Alpay teaches that one method to prevent such damage is to “reduce or avoid back-reflections” by

“‘tilt[ing]’ the entire beam delivery system with respect to the work surface 122 so that ***the angle of incidence of the beam hitting the work surface is not 90 degrees.***”

EX1005, [0007] (emphasis added); “[A]n offset 314 between the first axis of propagation 312 of the incident laser beam 120 and the primary axis 310 of the focusing lens 116. In other words, the (collimated) incident laser beam 120 does not hit the focusing lens 116 at the center of the lens 116 (as in the standard layouts shown in FIGS. 1 and 2). Rather, the incident laser beam 120 hits the focusing lens 116 at an offset 314 from the center of the lens 116.” EX1005, [0027]; *see also id.*, [0028]-[0029]; EX1003, ¶105. Alpay further teaches that an asymmetric arrangement is preferred because the “asymmetric arrangement provided by the offset 314 between the first axis of propagation 312 of the incident laser beam 120 and the primary axis 310 of the focusing lens 116, the focusing lens 116 ‘tilts’ the incident laser beam 120 toward the primary axis of the focusing lens 116.” EX1005, [0028]; EX1003, ¶105. “[***T***]he path of the reflected laser beam 123 is angularly separated from the path of the incident laser beam 120. . . such that the reflected laser beam 123 does not overlap with the incident laser beam 120. Thus, all or at least a substantial portion of the reflected laser beam 123 does not return through the collimator assembly 118 to the output fiber 110.” EX1005, [0029] (emphasis added); EX1003, ¶105. This arrangement is depicted in Figure 3.



EX1005, Fig. 3 (annotated); EX1003, ¶105.

As explained above, a POSITA, in view of Alpay, would be motivated to also offset one or both light sources 71 (together with collimator lenses 73 and microlens array 75) from the optical axis of collective lens 110 in Figure 5's Y-axis; this is out of the plane of Figure 5. EX1003, ¶106. Such a source arrangement would prevent unwanted feedback of unconverted excitation light from either excitation light source. *Id.*

Further, in view of Alpay, a PHOSITA would have displaced laterally the light sources 71 (together with collimator lenses 73 and microlens array 75) of Kurosaki in either x, or y, or both directions to avoid back reflections. *Id.*, ¶107. This

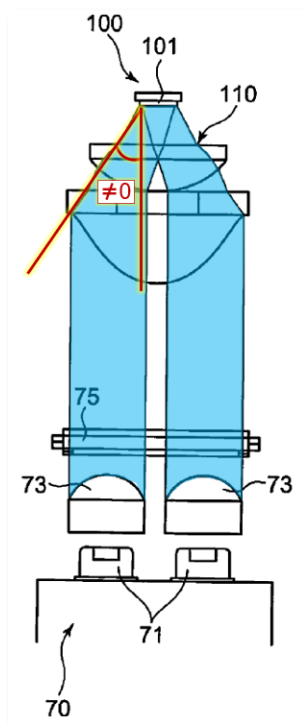
would result in an asymmetric arrangement of the light beams. *Id.*

A POSITA would have recognized the advantage of implementing the asymmetric arrangement of Alpay into the light source device of Kurosaki to reduce or avoid the back reflections to the light sources so as to protect and improve the reliability of the light source device described by Kurosaki as explained above. *Id.*, ¶108.

g. Claim Element 1f

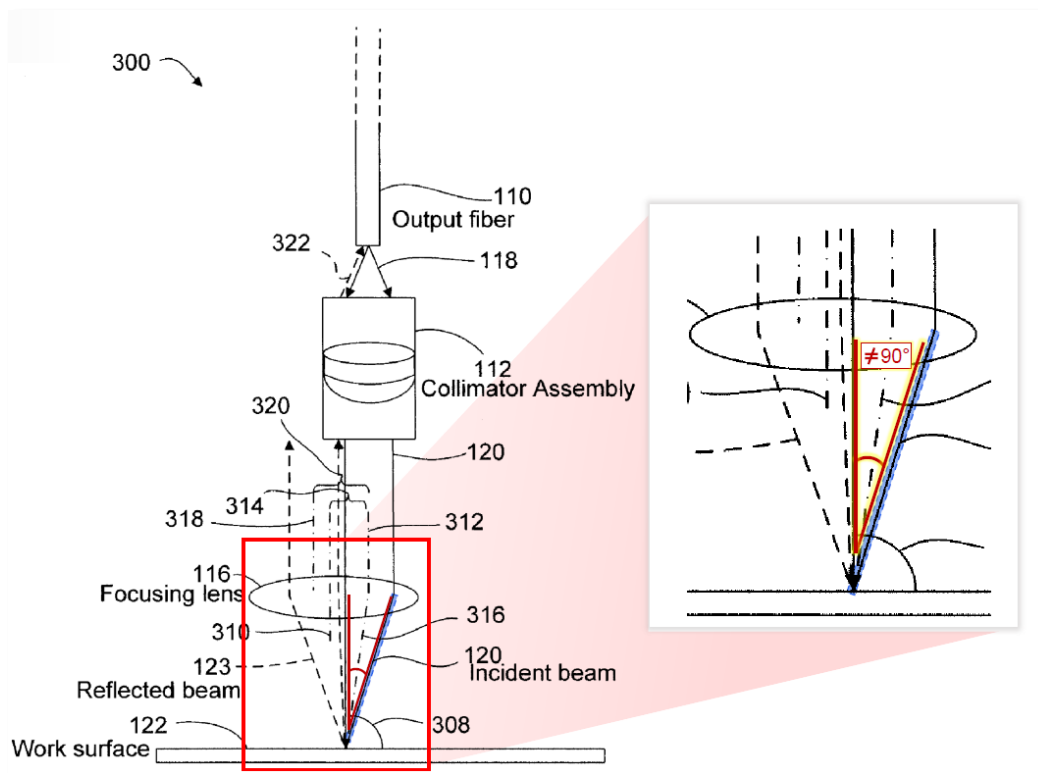
wherein when the excitation light irradiation region is a center and an incident angle to the excitation light irradiation region of any excitation light of each of the excitation light is an elevation angle θ , $\theta \neq 0$ is satisfied.

Kurosaki's Figure 5 discloses an arrangement where excitation light enters obliquely to the luminescent plate 101 from the left- and right-hand sides of the central axis of luminescent plate 101:



EX1012, Fig. 5 (annotated); EX1003, ¶109. Figure 5 thus discloses “an incident angle to the excitation light irradiation region of any excitation light of each of the excitation light is an elevation angle θ , $\theta \neq 0$ is satisfied.” EX1003, ¶110.

Moreover, Alpay discloses an arrangement where an excitation light delivery subsystem is “tilt[ed]” with respect to an excitation light irradiation system (work surface 122 in Alpay) “so that the angle of incidence of the beam hitting the work surface is not 90 degrees” as shown in Figure 3, which means that the incident angle (elevation angle) θ is not equal to 0. *Id.*, ¶111.



EX1005, Fig. 3 (annotated); EX1003, ¶111. As discussed above, a POSITA would have been motivated to combine the teachings of Alpay with those of Kurosaki to protect and improve the output of the light source of Kurosaki. EX1003, ¶112.

5. Claim 3

The light source device according to claim 1, wherein when the excitation light irradiation region is a center, in an incident angle to the excitation light irradiation region of first excitation light of each of the excitation lights, an elevation angle is θ_m and an azimuth angle is ϕ_m , and in an incident angle to the excitation light irradiation region of second excitation light different from the first excitation light, an elevation angle is θ_n and an azimuth angle is ϕ_n , there is no pair of the excitation lights in which $\theta_m - 2^\circ \leq \theta_n \leq \theta_m + 2^\circ$, and $\phi_m + 178^\circ \leq \phi_n \leq \phi_m + 182^\circ$ are established.

Claim 3 is obvious over Kurosaki in view of Alpay. EX1003, ¶¶92, 113-125.

As an initial matter, the term “azimuth angle” is ambiguous. However—and

without waiving any indefiniteness position for purposes of the related litigation—in this petition, Petitioners will proceed to map this claim element to the prior art notwithstanding its ambiguity. Specifically, Petitioners believe that, to the extent this term is amenable to construction, the most reasonable interpretation of “azimuth angle” is “the angle between the orthogonal projection of the light beam on the xy-plane and, for example, the x-axis” as shown in Figure 2E of the ’530 Patent. EX1001, Fig. 2E.

As the ’530 Patent makes clear, the purpose of this limitation is to avoid light of an excitation light source from overlapping with unconverted light when entering or exiting the light irradiation region, thus preventing unconverted light from entering any light source and potentially damaging or degrading that light source. EX1001, 6:37-7:5; EX1003, ¶113.

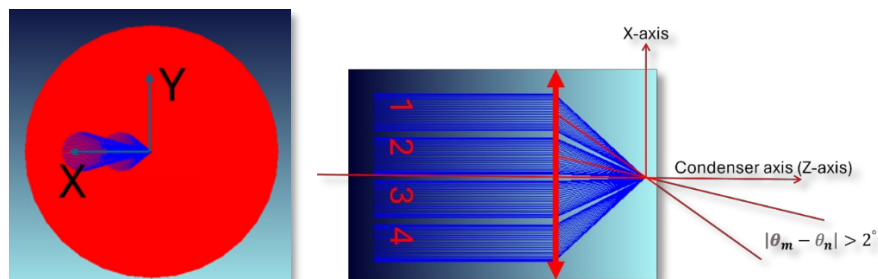
The disclosure of Alpay, when combined with the light source device of Kurosaki, makes the limitations of Claim 3 obvious. EX1003, ¶114. Alpay discloses the use of an arrangement in which a light source is off-axis from the optical path of a condensing lens to avoid back reflections. *See* EX1005, [0007] (“Another approach to reduce or avoid back-reflections is to ‘tilt’ the entire beam delivery subsystem with respect to the work surface 122 so that the angle of incidence of the beam hitting the work surface is not 90 degrees.”), [0027] (“[T]he (collimated) incident laser beam 120 does not hit the focusing lens 116 at the center of the lens 116 Rather,

the incident laser beam 120 hits the focusing lens 116 at an offset 314 from the center of the lens 116.”), [0028] (“[T]he focusing lens 116 changes the incident laser beam's path from the first axis of propagation 312 to a second axis of propagation 316 that intersects the work surface 122 at a non-perpendicular angle of attack 308.”), [0029] (“***[T]he path of the reflected laser beam 123 is angularly separated from the path of the incident laser beam 120 . . . such that the reflected laser beam 123 does not overlap with the incident laser beam 120.***” (emphasis added)).

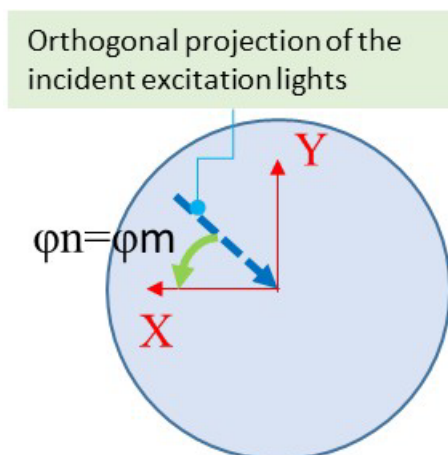
Though the specific mathematical conditions recited in Claim 3 are not explicitly disclosed by Alpay, these conditions would have been obvious to a POSITA in view of Alpay and/or through routine experimentation. EX1003, ¶115. A POSITA intending to avoid potentially damaging feedback of unconverted excitation light would be motivated to stay well clear of arrangements where the reflected beams would return to any laser source. *Id.* The combination of Kurosaki and Alpay, as explained below, would have resulted in ensuring that the specific mathematical conditions recited in Claim 3 were not established, which would have been nothing more than applying known methods to produced expected results. *Id.*

The figures below illustrates that the application of Alpay’s teachings to Kurosaki would have resulted in the specific mathematical conditions of $-2^{\circ} \leq \theta_n - \theta_m \leq 2^{\circ}$ and $178^{\circ} \leq \phi_n - \phi_m \leq 182^{\circ}$ not being met, which is what Claim 3 requires. *Id.*, ¶116. For example, a POSITA having reviewed Alpay could have moved one or both

of the excitation light sources (together with collimator lenses 73 and microlens array 75) of Kurosaki along the X-axis such that both excitation light sources, and thus the excitation light beams coming from each excitation light source, sat on one side of the Z-axis (*i.e.*, the optical path of the condensing lens of Kurosaki). *Id.*, ¶117.

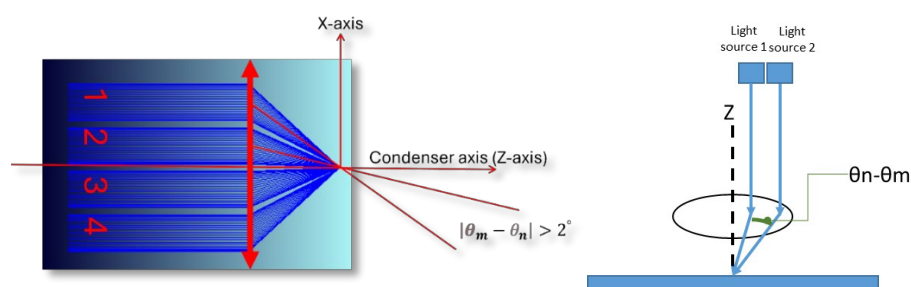


The lefthand figure above, viewed along the Z-axis (the optical axis of the condenser lens), shows the two light sources (together with collimator lenses 73 and microlens array 75) of Kurosaki being shifted leftward along the X-axis offset from the optical axis of the condenser lens based on the teachings from Alpay. *Id.*, ¶118. The righthand figure shows this same arrangement but viewed along the Y-axis. As shown in the righthand figure, the incident excitation light beams (labeled 1 and 2) would have elevation angles θ that are different by more than 2° , thus failing to meet the mathematical condition $\theta_m - 2^\circ \leq \theta_n \leq \theta_m + 2^\circ$ as Claim 3 requires. *Id.*, ¶119. The righthand figure also shows the beams of reflected, unconverted excitation light (labeled 3 and 4), are not on the same path as the incident excitation light path. *Id.*, ¶120.



Moreover, based on the same arrangement described above, the resulting azimuth angles ϕ_n and ϕ_m of the excitation light beams, which are the angle between the x-axis and the orthogonal projection of the incident excitation lights on the x-y plane respectively, would be the same ($\phi_n = \phi_m$). As such, it would fail to meet the mathematical condition $\phi_m + 178^\circ \leq \phi_n \leq \phi_m + 182^\circ$ as Claim 3 requires. *Id.*, ¶121.

A POSITA, with an understanding of the disclosure of Alpay, would have understood that the arrangement of the light sources of Kurosaki disposed on one side of the optical axis of the condenser lens would have or obviously have the differences in elevation angles larger than 2 degrees as shown below. *Id.*, ¶122.



Furthermore, this is not the only potential arrangement. *Id.*, ¶123. Working

from the arrangement of Kurosaki in view of Alpay, a POSITA would have understood that any arrangement in which the difference in the elevation angle of each excitation light source was sufficiently large (*i.e.*, more than 2°) would prevent undesirable back reflections as taught by Alpay. *Id.* A POSITA, with an understanding of the disclosure of Alpay, would also have understood that differences in elevation angles that were too small (*i.e.*, less than 2°) may not prevent unwanted back reflections when the light sources are not on the same side of the optical axis of the condenser lens and would thus have selected any arrangement where the difference in elevation angles was larger than 2° , necessarily resulting in the mathematical conditions of Claim 3 not being met as Claim 3 requires. *Id.*, ¶124.

6. Claim 4

The light source device according to claim 1, wherein the excitation light source is a solid light-emitting element.

Claim 4 is obvious over Kurosaki in view of Alpay. EX1003, ¶¶92, 126.

Kurosaki discloses that its excitation light source is a blue laser emitter that emits a laser beam. EX1012, [0041]. A POSITA would understand that a laser emitter could be a solid light-emitting element. EX1003, ¶126. In addition, a POSITA would have understood that the laser in Kurosaki would have been a solid light-emitting element such a laser diode as shown in Figures 3 and 5 of Kurosaki. *Id.*

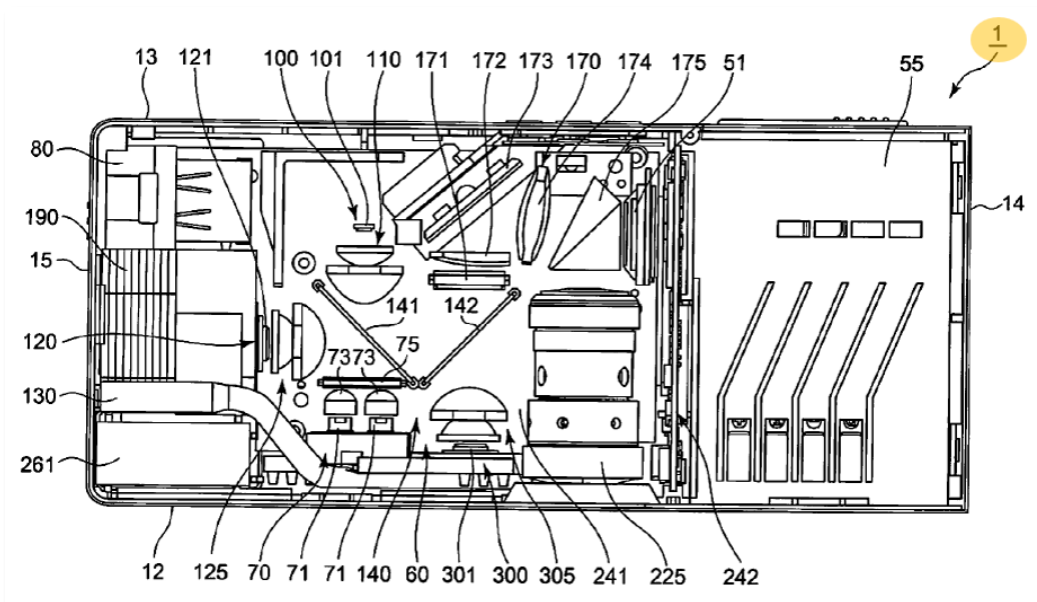
7. Claim 7

Claim 7 is obvious over Kurosaki in view of Alpay. EX1003, ¶¶92, 127-131.

a. Claim Element 7p

A projection type video display device, comprising:

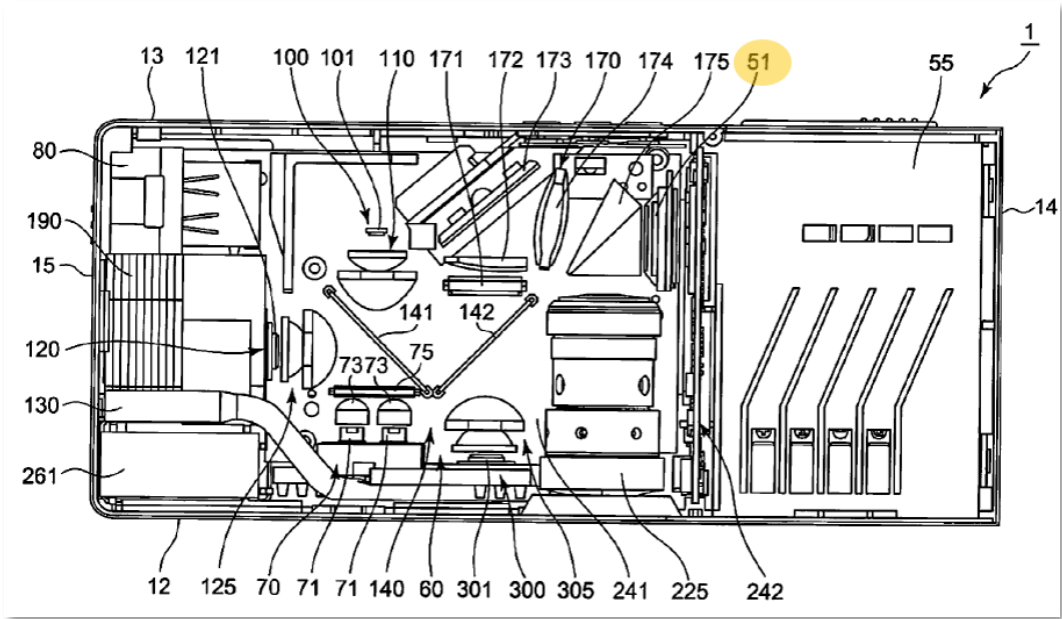
It is Petitioners' position that the preamble of Claim 1 is not limiting and need not be analyzed for the purposes of determining Claim 1's validity. Should the Board determine the preamble is limiting, however, Kurosaki discloses a projection type video display device in the form of projector 1 as depicted in Figure 3:



EX1012, Fig. 3 (annotated); *see also id.*, [0022]; EX1003, ¶127.

the light source device according to claim 1;

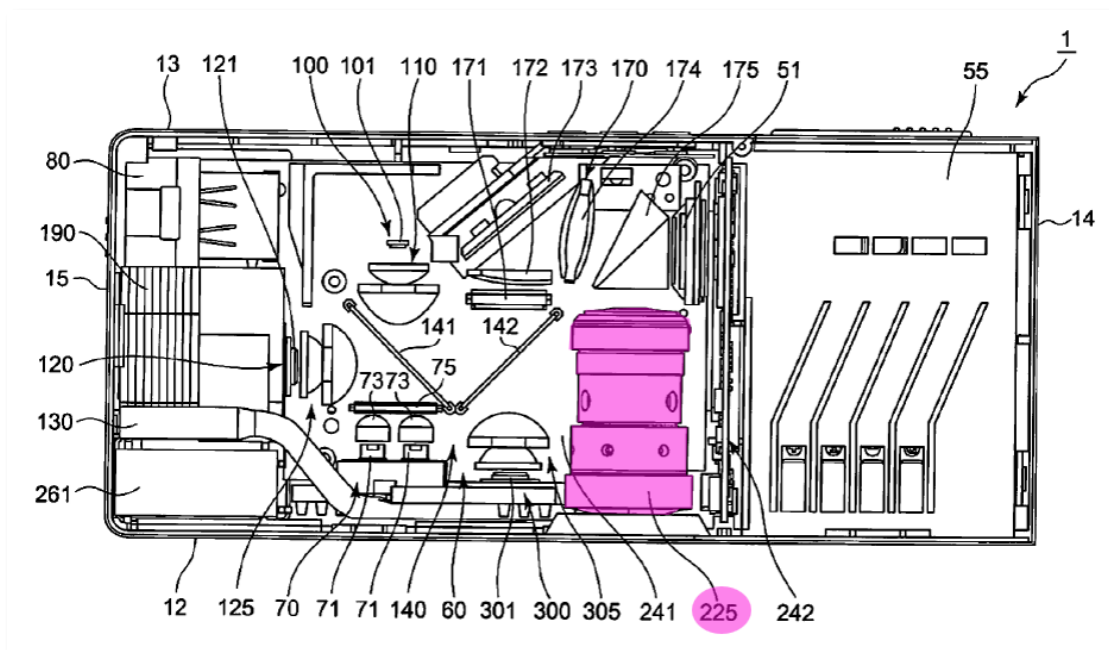
a video display element;



e. Claim Element 7d

a projection lens which enlarges and projects an optical image formed by the video display element.

Kurosaki discloses a “projection-side optical system” that is incorporated in a lens barrel 225. EX1012, [0033], [0052]. The projection-side optical system includes “a fixed lens group and a movable lens group[.]” *Id.*, [0052]; EX1003, ¶131.



EX1012, Fig. 3 (annotated); EX1003, ¶131. A POSITA would understand that any of the lens included in the fixed lens group or the movable lens group would meet the limitations of this Claim Element. EX1003, ¶131.

8. Claim 9

Claim 9 is obvious over Kurosaki in view of Alpay. EX1003, ¶¶92, 132-139.

a. Claim Element 9p

A light source device, comprising:

It is Petitioners' position that the preamble of Claim 9 is not limiting and need not be analyzed for the purposes of determining Claim 9's validity. Should the Board determine the preamble is limiting, however, Kurosaki discloses a light source device. EX1003, ¶132.

Claim Element 9p is identical to Claim Element 1p. *Compare* EX1001, 20:17 *with id.*, 21:55; *see also* EX1003, ¶132. For the same reasons that Kurosaki discloses the limitations of Claim Element 1p, Kurosaki discloses the limitations of Claim Element 9p. *See supra* Ground 2, Claim 1, Claim Element 1p; *see also* EX1003, ¶132.

b. Claim Element 9a

an excitation light source which emits excitation light;

Claim Element 9a is substantially similar to Claim Element 1a, with the only difference being that Claim Element 9a requires "an" excitation light source while Claim Element 1a requires a plurality of excitation light sources. *Compare* EX1001, 20:18-19 *with id.*, 21:56. For the same reasons that Kurosaki teaches a plurality of excitation light sources which emit excitation light, it discloses "an" excitation light source which emits excitation light. *See supra* Ground 2, Claim 1, Claim Element 1a; *see also* EX1003, ¶133.

c. Claim Element 9b

a phosphor which changes the excitation light to fluorescent light;

Claim Element 9b is identical to Claim Element 1b. *Compare* EX1001, 20:20-21 *with id.*, 21:57-58. For the same reasons Kurosaki teaches every limitation of Claim Element 1b, it discloses every limitation of Claim Element 9b. *See supra* Ground 2, Claim 1, Claim Element 1b; *see also* EX1003, ¶134.

d. Claim Element 9c

a dichroic mirror which transmits the excitation light and reflects the fluorescent light; and

Claim Element 9c is identical to Claim Element 1c. *Compare* EX1001, 20:22-23 *with id.*, 21:59-60. For the same reasons Kurosaki discloses every limitation of Claim Element 1c, it discloses every limitation of Claim Element 9c. *See supra* Ground 2, Claim 1, Claim Element 1c; *see also* EX1003, ¶135.

e. Claim Element 9d

a condensing lens which condenses the excitation light transmitted through the dichroic mirror in an excitation light irradiation region on the phosphor,

Claim Element 9d is identical to Claim Element 1d. *Compare* EX1001, 20:24-26 *with id.*, 21:61-63. For the same reasons Kurosaki discloses every limitation of Claim Element 1d, it discloses every limitation of Claim Element 9d. *See supra* Ground 2, Claim 1, Claim Element 1d; *see also* EX1003, ¶136.

f. Claim Element 9e

wherein the excitation light sources are arranged so that when excitation light emitted from the excitation light source enters the excitation light irradiation region and is reflected without being converted into fluorescent light, the unconverted excitation light is prevented from entering the excitation light source; and

As explained above, Alpay teaches an arrangement where excitation light enters asymmetrically to a center of the condensing lens. *See supra* Ground 2, Claim 1, Claim Element 1e; *see also* EX1003, ¶137. Alpay further teaches that an asymmetric arrangement is preferred because the “asymmetric arrangement provided by the offset 314 between the first axis of propagation 312 of the incident laser beam 120 and the primary axis 310 of the focusing lens 116, the focusing lens 116 ‘tilts’ the incident laser beam 120 toward the primary axis of the focusing lens 116.” EX1005, [0028]; EX1003, ¶137; *see also supra* Ground 2, Claim 1, Claim Element 1e.

A POSITA would have recognized the advantage of implementing the asymmetric arrangement of Alpay into the light source device of Kurosaki to protect and improve the output of the excitation light of the light source device described by Kurosaki and improved its reliability as explained above. EX1003, ¶138.

g. Claim Element 9f

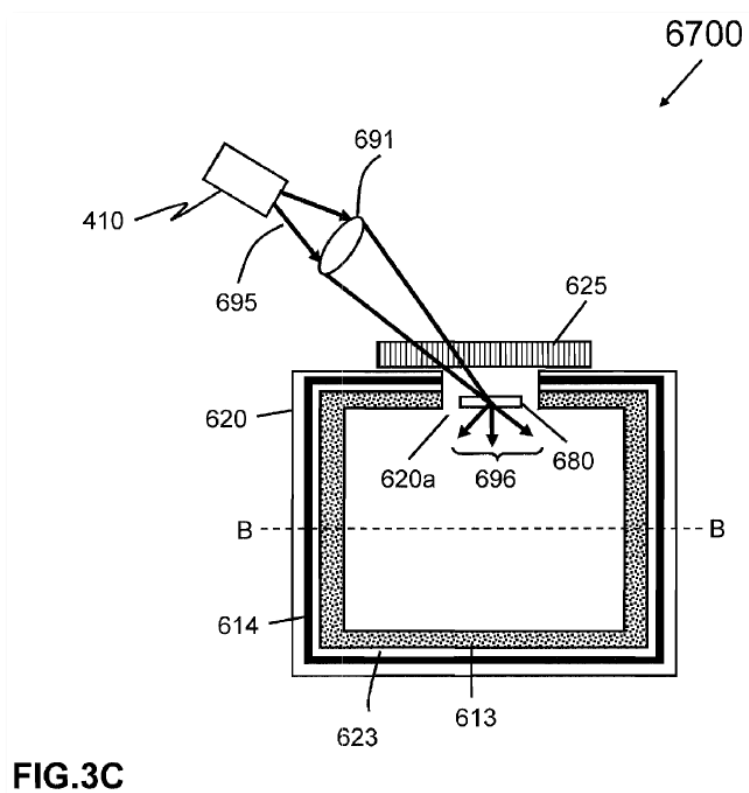
wherein when the excitation light irradiation region is a center and an incident angle to the excitation light irradiation region of any excitation light of each of the excitation light is an elevation angle θ , $\theta \neq 0$ is satisfied.

Claim Element 9f is identical to Claim Element 1f. *Compare* EX1001, 20:31-37 *with id.*, 22:3-9. For the same reasons both Kurosaki and Alpay teach every limitation of Claim Element 1f, they disclose every limitation of Claim Element 9f. *See supra* Ground 2, Claim 1, Claim Element 1f; *see also* EX1003, ¶139.

C. Ground 3: Claim 9 is invalid under pre-AIA 35 U.S.C. § 103 as obvious over Kurosaki in view of Abu-Ageel.

1. Overview of Abu-Ageel

Abu-Ageel discloses a high brightness light source and illumination system using that light source. EX1007, cover; EX1003, ¶69. Figure 3C depicts one embodiment of an illumination system as described by Abu-Ageel.



EX1007, Fig. 3C; EX1003, ¶70.

Figure 3C depicts an illumination assembly 6700, which includes of a violet laser 410,³ a lens 691, an optical element 625, and a light envelope 620. EX1007, [0087]; EX1003, ¶71. The light envelope 620 further comprises an aperture 620a, a wavelength conversion layer (such as a phosphor) 613, a reflective coating 614, and a low-refractive index layer 623. EX1007, [0005], [0087]; EX1003, ¶71. Disposed just outside of aperture 620a is an optical element 625, which is preferable a coating

³ In the portion of the specification of Abu-Ageel describe Figure 3C, this violet laser is mistakenly associated with label 411, which is not included in Figure 3C. Compare EX1007, Fig. 3 with *id.*, [0087].

that reflects non-converted light back into the light envelope. EX1007, [0087]; EX1003, ¶71.

In operation, light 695 from violet laser 410 is focused by lens 691 through aperture 620a into light envelope 620. EX1007, [0087]; EX1003, ¶72. This light is converted by the wavelength conversion layer 613. EX1007, [0087]; EX1003, ¶72. Unconverted light is reflected back into light envelope 620 by optical element 625, which prevents unconverted light from reflecting back to violet laser 410. EX1007, [0087]; EX1003, ¶72.

2. Motivation to combine Abu-Ageel with Kurosaki

A POSITA would have been motivated to combine Kurosaki with Abu-Ageel, and would have had a reasonable expectation of success in making the combination. EX1003, ¶141. Kurosaki and Abu-Ageel are analogous and/or complimentary art because they disclose laser light sources. *Id.* Kurosaki describes a projection type display apparatus including a light source device using lasers. *Id.* Abu-Ageel describes a high-brightness light source using lasers. *Id.*

Prior to the '530 Patent, it was well known that back reflections affected, degraded, or impaired the performance of laser diodes. EX1005, [0003]; *see also* EX1013, 1:11-17; EX1014, 1:19-22; EX1003, ¶142. By the time of the priority date of the '530 Patent, not only was this problem known, but tools had been developed to combat this problem, such as optical isolators. EX1005, [0004]-[0005]; EX1013;

EX1014; EX1003, ¶142. Optical isolators, however, “are usually quite bulky (especially when configured for use with high-power beams) and expensive.” EX1005, [0006]; EX1003, ¶142. A POSITA would have known this and would have at least considered protecting the laser diodes of Kurosaki by the means taught by Abu-Ageel, which discloses a different method to prevent unwanted, destabilizing feedback, or by the use of optical isolators that were well known and used in front of laser diodes in applications such as telecommunications and high power lasers. *Id.* In other words, by the time of the priority date of the ’530 patent it was well known that back reflections can affect adversely the performance of a laser. *Id.* Therefore, a POSITA looking at Kurosaki would have considered the teaching of Abu-Ageel. *Id.*

A POSITA designing a light source device like that of Kurosaki would have been aware of this problem and would have understood that arrangements like that of Abu-Ageel addressed the issue. *Id.*, ¶143. Interested in preventing potential damage to excitation light sources within such a device, a POSITA would have looked to Abu-Ageel and similar art to accomplish this goal. *Id.* This would have been nothing but following known methods with predictable results to improve the reliability of the Kurosaki projector. *Id.*

3. Claim 9

Claim 9 is obvious over Kurosaki in view of Abu-Ageel. EX1003, ¶¶140, 144-152.

a. Claim Element 9p

A light source device, comprising:

It is Petitioners' position that the preamble of Claim 9 is not limiting and need not be analyzed for the purposes of determining Claim 9's validity. Should the Board determine the preamble is limiting, however, Kurosaki discloses a light source device. EX1003, ¶144; *see also supra* Ground 2, Claim 9, Claim Element 9p.

b. Claim Element 9a

an excitation light source which emits excitation light;

As explained above, Kurosaki teaches Claim Element 9a. EX1003, ¶145; *see also supra* Ground 2, Claim 9, Claim Element 9a.

c. Claim Element 9b

a phosphor which changes the excitation light to fluorescent light;

As explained above, Kurosaki teaches Claim Element 9b. EX1003, ¶146; *see also supra* Ground 2, Claim 9, Claim Element 9b.

d. Claim Element 9c

a dichroic mirror which transmits the excitation light and reflects the fluorescent light; and

As explained above, Kurosaki discloses Claim Element 9c. EX1003, ¶147;
see also supra Ground 2, Claim 9, Claim Element 9c.

e. Claim Element 9d

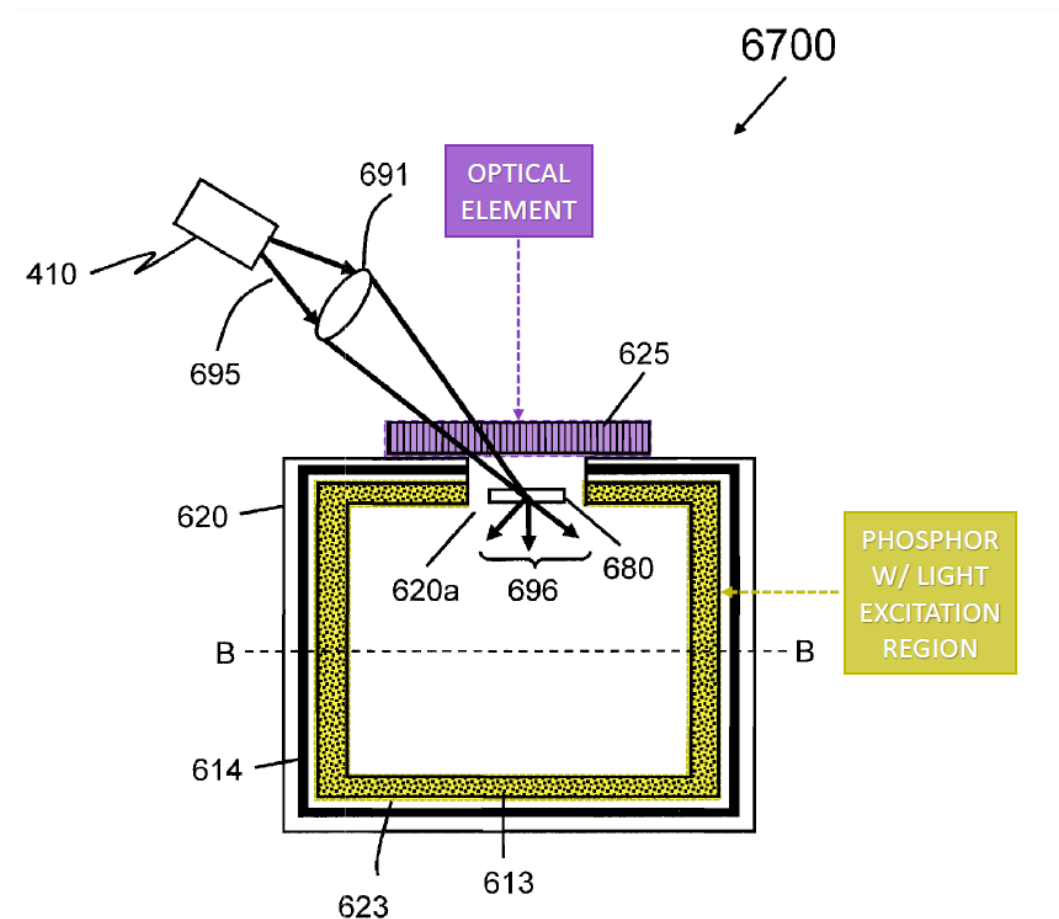
a condensing lens which condenses the excitation light transmitted through the dichroic mirror in an excitation light irradiation region on the phosphor,

As explained above, Kurosaki discloses Claim Element 9d. EX1003, ¶148;
see also supra Ground 2, Claim 9, Claim Element 9d.

f. Claim Element 9e

wherein the excitation light sources are arranged so that when excitation light emitted from the excitation light source enters the excitation light irradiation region and is reflected without being converted into fluorescent light, the unconverted excitation light is prevented from entering the excitation light source; and

Abu-Ageel teaches an arrangement where excitation light sources are arranged so that when excitation light emitted from the excitation light source enters the excitation light irradiation region and is reflected without being converted into fluorescent light, the unconverted excitation light is prevented from entering the excitation light source. EX1003, ¶149.



EX1007, Fig. 3C (annotated); EX1003, ¶149.

Figure 3C depicts a light envelope 620 into which excitation light 695 is directed (or focused) through aperture 620a. EX1007, [0087]; EX1003, ¶150. Upon entry, such light is converted by an excitation light region of a phosphor (wavelength conversion layer 613). EX1007, [0087]; *see also id.* at [0005] (identifying a “wavelength conversion layer” as a phosphor); EX1003, ¶150. An optical element 625 is preferably a coating that reflects non-converted light back into the light envelope, thus preventing it from reaching the light source 411 (incorrectly

designated 410 in Figure 3C). EX1007, Fig. 3C, [0087]; EX1003, ¶150. A POSITA would have considered the teachings of Abu-Ageel and would have included an optical element like 625 in the excitation light to block or prevent back reflections of excitation light. EX1003, ¶150. In addition, it would have been obvious to also insert an optical isolator in view of Abu-Ageel. *Id.*

g. Claim Element 9f

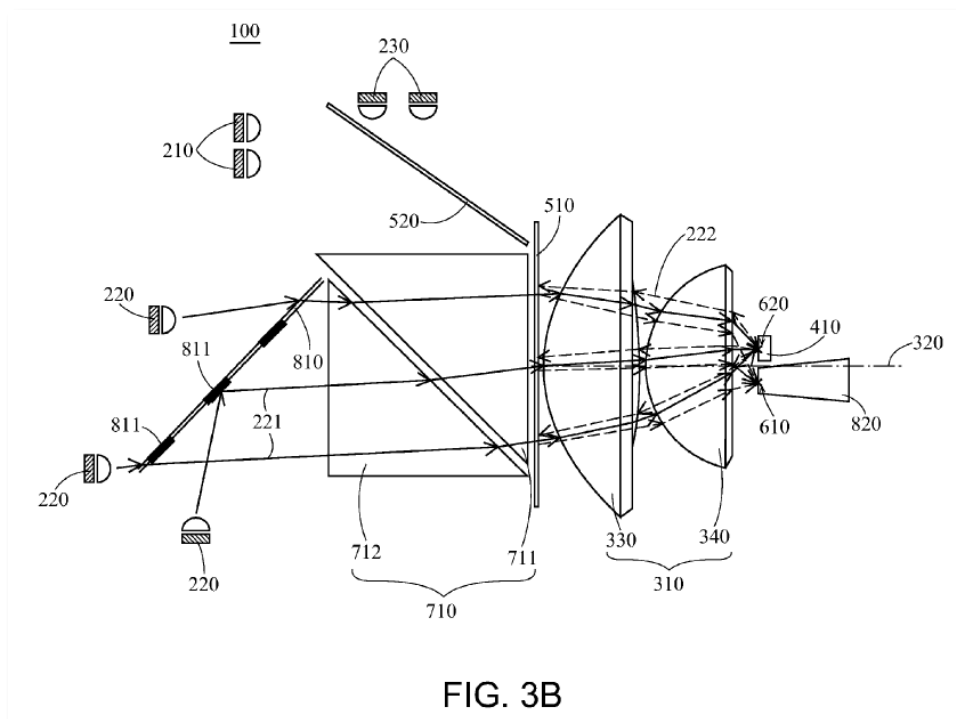
wherein when the excitation light irradiation region is a center and an incident angle to the excitation light irradiation region of any excitation light of each of the excitation light is an elevation angle θ , $\theta \neq 0$ is satisfied.

As explained above, Kurosaki teaches Claim Element 9f. EX1003, ¶152; *see also supra* Ground 2, Claim 9, Claim Element 9f.

D. Ground 4: Claims 1, 3, 4, and 9 are invalid under pre-AIA 35 U.S.C. § 103 as obvious over Huang in view of Alpay.

1. Overview of Huang

Huang discloses an illumination system for use in a projection device. EX1009, abstract; EX1003, ¶74. Figure 3B depicts an embodiment of the invention described therein.



EX1009, Fig. 3B; EX1003, ¶74.

Figure 3B depicts an illumination system with light sources 210, 220. EX1009, 2:38-42; EX1003, ¶75. Light sources 220 emit light ultimately received by a wavelength transformer 410, which Huang explains could be a phosphor. EX1009, 2:61-64, 4:36-38; EX1003, ¶75. Figure 3B also depicts a dichroic mirror 510 that is adapted to allow light 221 from light sources 220 to travel through and to reflect light converted by the wavelength transformer. EX1009, 2:38-45, 2:61-3:10; EX1003, ¶75. Figure 3B also depicts an optical device 310 comprising a first lens 330 and second lens 340 that focuses light 221 passing through the dichroic mirror onto the wavelength transformer 410 that is disposed at a focal point. EX1009, 3:5, 4:38-40; EX1003, ¶75.

2. Motivation to combine Alpay with Huang

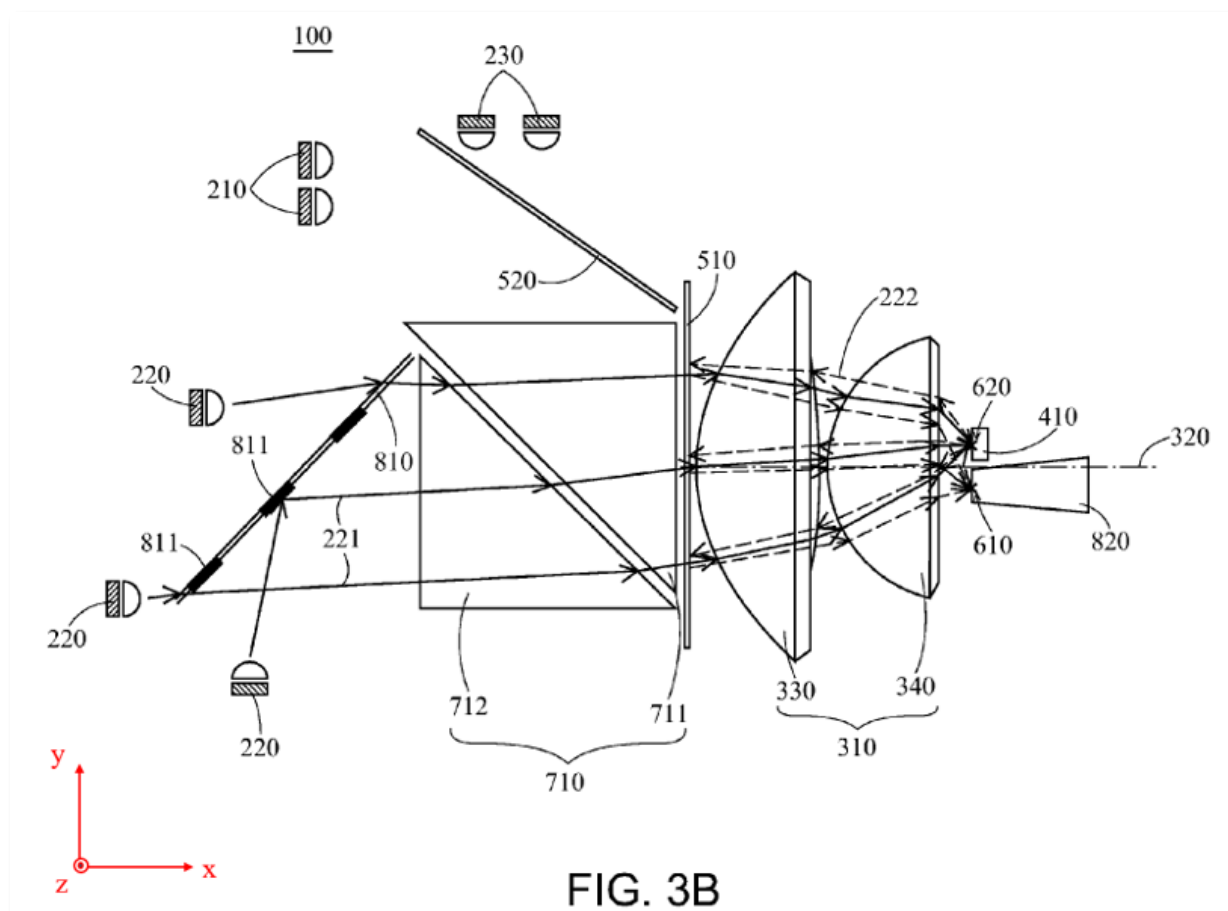
As a threshold matter, a POSITA would have been motivated to combine Huang with Alpay, and would have had a reasonable expectation of success in making the combination. EX1003, ¶154. Huang and Alpay both employ lasers, and a POSITA would have looked at Alpay while considering the reliability of the lasers in Huang. Huang describes a light source device with a plurality of light sources, such as lasers. Prior to the '530 Patent, it was well known that back reflections affected, degraded, or impaired the performance of laser diodes. EX1005, [0003]; *see also* EX1013, 1:11-17; EX1014, 1:19-22; EX1003, ¶154. By the time of the priority date of the '530 Patent, not only was this problem known, but tools had been developed to combat this problem, such as optical isolators. EX1005, [0004]-[0005]; EX1013; EX1014; EX1003, ¶154. Optical isolators, however, “are usually quite bulky (especially when configured for use with high-power beams) and expensive.” EX1005, [0006]; EX1003, ¶154. A POSITA would have known this and would have at least considered protecting the laser diodes of Huang by the means taught by Alpay, which discloses a different method to prevent unwanted, destabilizing feedback, or by the use of optical isolators that were well known and used in the front of laser diodes in applications such as telecommunications and high power lasers. EX1003, ¶¶154. In other words, by the time of the priority date of the '530 patent it was well known that back reflections can affect adversely the performance

of a laser. *Id.* Therefore, a POSITA looking at Huang would have considered or implemented the teaching of Alpay. *Id.*

A POSITA would have understood as of the '530 Patent's priority date that some portion of excitation light emitted by Huang's light sources 220 would not be converted by Huang's wavelength transformer 410 and would be reflected back in the direction of light sources 220. *See, e.g.,* EX1008, [0048]; EX1001, 1:28-31; EX1003, ¶155. Though, as discussed below, Huang depicts an asymmetrical arrangement of light sources, Huang does not explicitly identify protecting the light sources described therein as the rationale for this asymmetrical arrangement. EX1003, ¶155. Moreover, it is uncertain that Huang's arrangement prevents the issue of damaging back reflections. *Id.* With the disclosure of Alpay and his or her own prior knowledge as a skilled artisan, a POSITA would have recognized the advantage of implementing the asymmetric arrangement of Alpay into the light source device of Huang by further offsetting Huang's light sources 220 from the optical axis of Huang's optical device 310 to ensure that unconverted excitation light from any light source 220 does not enter either the same light source 220 it originated from or any other light source 220. *Id.* Implementing Alpay's teachings into the device disclosed by Huang would have provided further protection against reflected excitation light from reaching Huang's light sources. EX1005, [0003]; *see also* EX1013, 1:11-17; EX1014, 1:19-22; EX1003, ¶155. This would have been nothing more than

following known methods to achieve predictable results and desirable to improve the projector reliability. EX1003, ¶155.

Huang's Figure 3B depicts an arrangement where light sources 220 are offset from the optical axis of optical device 310 in the X- and Y-axes of Figure 3B.



EX1009, Fig. 3B (annotated); EX1003, ¶156.

Though this arrangement would prevent unconverted light from the any light source 220 from feeding back to the *same* light source 220, it may not prevent unconverted light from feeding back to other light sources 220. EX1003, ¶157. A

POSITA, in view of Alpay, would be motivated to also offset all light sources 220 from the optical axis of collective lens 110 in Figure 3B's Z-axis, or by shifting certain excitation light source 220 in X-axis or Y-axis direction to make incident angles of the excitation lights 221 to the wavelength transformer differently from each other. *Id.* As illustrated above this arrangement in view of Alpay would prevent unwanted feedback of unconverted excitation light from either excitation light source. *Id.*

A POSITA would thus have naturally looked to the teachings of Alpay and its asymmetrical arrangement as a means of achieving these benefits by modifying the arrangement of the light source in Huang to avoid the light source from being disposed at the light path of the reflected excitation light so as to reduce or prevent overlap between the reflected laser beam and the incident laser beam. EX1005, [0010] ("The lens includes a primary axis that is substantially parallel to, and offset from, the first axis of propagation."); EX1003, ¶158.

3. Claim 1

Claim 1 is obvious over Huang in view of Alpay. EX1003, ¶¶153, 159-167.

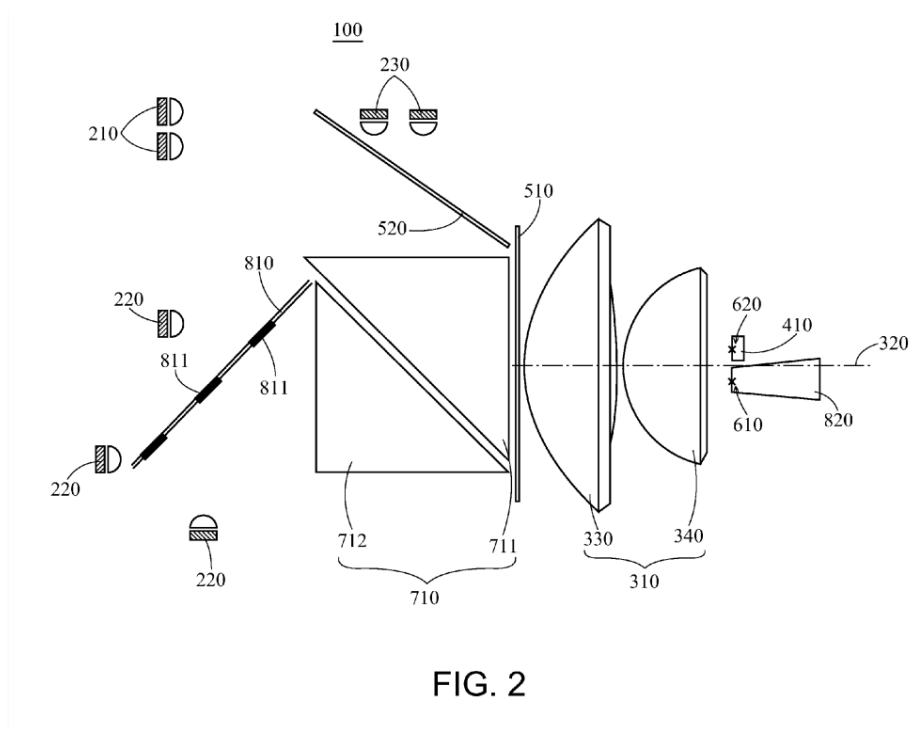
a. Claim Element 1p

A light source device, comprising:

It is Petitioners' position that the preamble of Claim 1 is not limiting and need not be analyzed for the purposes of determining Claim 1's validity. Should the Board

determine the preamble is limiting, however, Huang teaches a light source device. EX1003, ¶159.

Huang discloses projecting devices comprising “a first light source 210[and] a second light source 220.” EX1009, 2:38-42; EX1003, ¶159.

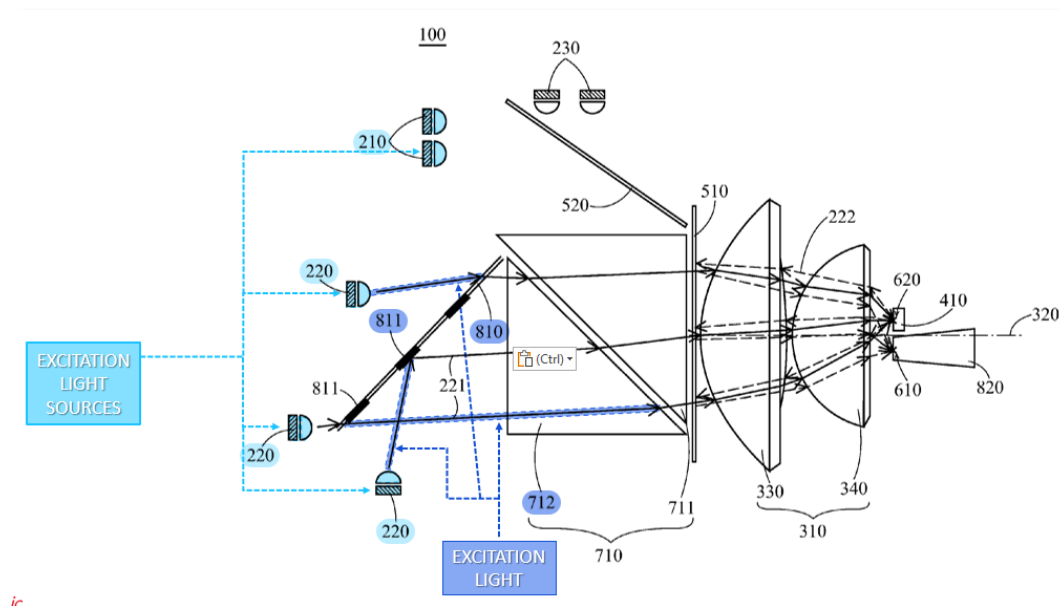


EX1009, Fig. 2; EX1003, ¶159.

b. Claim Element 1a

a plurality of excitation light sources which emit excitation light;

Huang teaches a plurality of excitation light sources which emit excitation light. EX1003, ¶160.

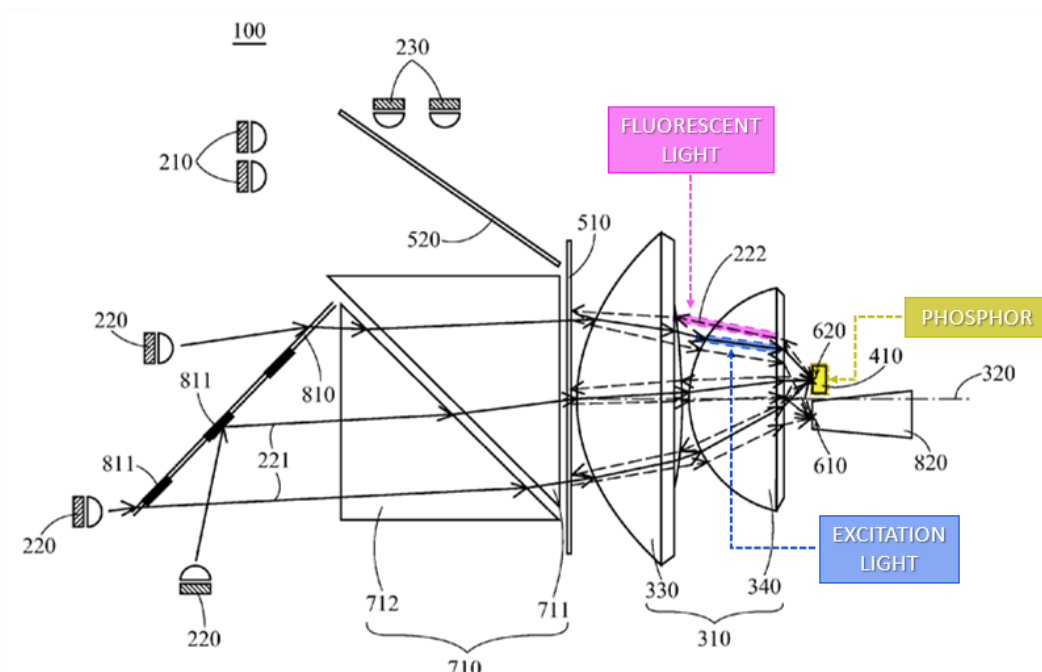


EX1009, Fig. 3B (annotated); EX1003, ¶160. As shown in Figure 3B, Huang comprises a plurality of light sources 220. EX1009, 2:38-42, 4:16-19; 4:29-34; EX1003, ¶161. These light sources 220 emit light 221 that is ultimately received by a wavelength transformer 410, which could be a phosphor. EX1009, 2:61-64, 4:36-38; EX1003, ¶161. A POSITA would understand that the wavelength transformer, as a phosphor, would transform the excitation light to fluorescent light and that the light emitted by light source 220 comprised of a plurality of blue laser light sources is thus excitation light. EX1003, ¶161.

c. Claim Element 1b

a phosphor which changes the excitation light to fluorescent light;

Huang teaches a phosphor (wavelength transformer 410) that transforms excitation light from excitation light sources (second light source 220) to fluorescent light. See *supra* Ground 4, Claim 1, Claim Element 1a; see also EX1003, ¶162.



EX1009, Fig. 3B (annotated); EX1003, ¶162.

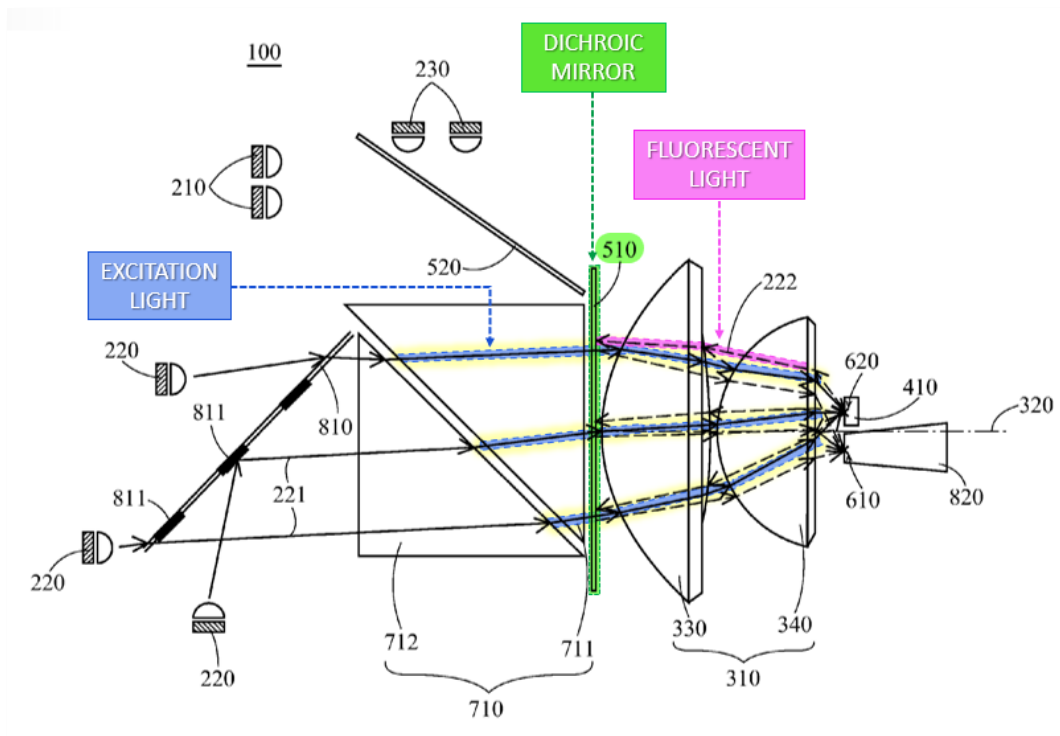
d. Claim Element 1c

a dichroic mirror which transmits the excitation light and reflects the fluorescent light; and

Huang discloses a dichroic mirror 510, which “is adapted to allow the first light beam 211 and the second light beam 221” (*i.e.*, the excitation light) “to travel

therethrough and reflect the third light beam 222” (i.e., the fluorescent light).

EX1009, 2:38-45, 2:61-3:10; EX1003, ¶163.



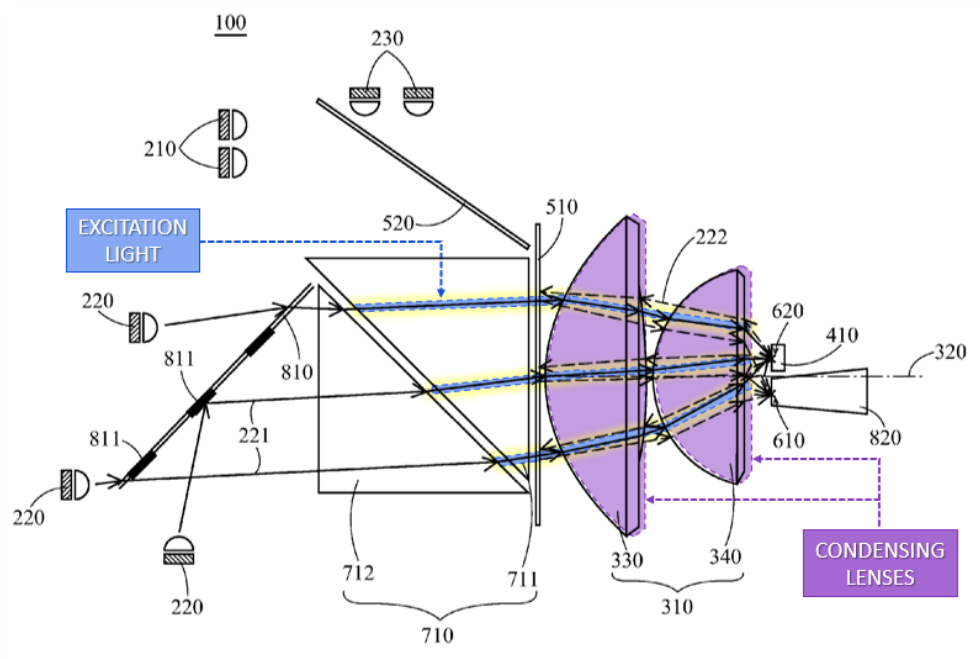
EX1009, Fig. 3B (annotated); EX1003, ¶163.

e. Claim Element 1d

a condensing lens which condenses the excitation light transmitted through the dichroic mirror in an excitation light irradiation region on the phosphor,

Huang teaches that excitation light transmitted through the dichroic mirror is “focused by the optical device 310 onto the wavelength transformer 410 [(i.e., a phosphor)] that is disposed at the second focal point 620[(i.e., “an excitation light irradiation region”).]” EX1009, 3:3-5; EX1003, ¶164. Huang teaches that the optical device 310 “may comprise a **first lens** 330 and a **second lens** 340[,]” either one of

which satisfies the “condensing lens” limitation of Claim Element 1e. EX1009, 4:38-40; EX1003, ¶164. This arrangement is shown in Figure 3B:

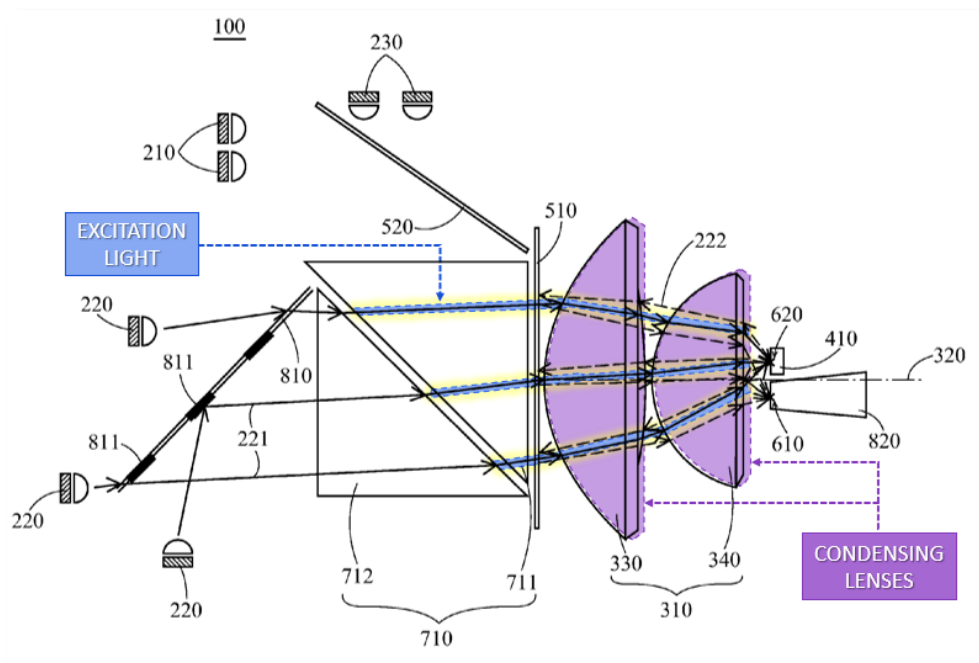


EX1009, Fig. 3B (annotated); EX1003, ¶164.

f. Claim Element 1e

wherein the plurality of light sources are arranged so that each excitation light emitted from each of the plurality of light sources enters asymmetrically to a center of the condensing lens; and

Huang teaches a plurality of light sources arranged so that each excitation light (e.g., light beams 221) emitted from the plurality of light sources 220 enters asymmetrically to a center of the condensing lens (e.g., lens 330, lens 340). EX1003, ¶165. This is shown in Figure 3B.



EX1009, Fig. 3B (annotated). Figure 3B demonstrates that the excitation light enters the condensing lens(es) asymmetrically. EX1003, ¶165. The excitation beams are tilted with respect to the condenser lens optical axis (320), yielding an off-axis spot (620) where the phosphor is located. *Id.* Further, offsetting the excitation beams out of plane of the drawing or shifting certain light source 220 in the Y-axis direction in view of Alpay would make the excitation light further asymmetrical to the center of the condensing lens. *Id.*

As explained above in the context of Ground 2, Alpay makes obvious the limitations of Claim Element 1e. *See supra* Ground 2, Claim 1, Claim Element 1e; EX1003, ¶166.

g. Claim Element 1f

wherein when the excitation light irradiation region is a center and an incident angle to the excitation light irradiation region of any excitation light of each of the excitation light is an elevation angle θ , $\theta \neq 0$ is satisfied.

As explained above in the context of Ground 2, Alpay teaches the limitations of Claim Element 1f. *See supra* Ground 2, Claim 1, Claim Element 1f; EX1003, ¶167. As discussed above in the context of Claim Element 1e, a POSITA would have been motivated to combine the teachings of Alpay with those of Huang to avoid retroreflections. *See supra* Ground 2, Claim 1, Claim Element 1e; *see also* EX1003, ¶167. Further, the excitation light from sources 220 arrives to the condenser lens at an angle and focuses at the phosphor (620) that is located off of the lens axis (320); each of the light beams is shown in Figure 3B incident on the phosphor at an elevation angle different from zero. EX1003, ¶167.

4. Claim 3

The light source device according to claim 1, wherein when the excitation light irradiation region is a center, in an incident angle to the excitation light irradiation region of first excitation light of each of the excitation lights, an elevation angle is θ_m and an azimuth angle is ϕ_m , and in an incident angle to the excitation light irradiation region of second excitation light different from the first excitation light, an elevation angle is θ_n and an azimuth angle is ϕ_n , there is no pair of the excitation lights in which $\theta_m - 2^\circ \leq \theta_n \leq \theta_m + 2^\circ$, and $\phi_m + 178^\circ \leq \phi_n \leq \phi_m + 182^\circ$ are established.

Claim 3 is obvious over Huang in view of Alpay. EX1003, ¶¶153, 168. As explained above, Alpay teaches the limitations of Claim 3. *See supra* Ground 2, Claim 3; EX1003, ¶168. As discussed above, a POSITA would have been motivated

to combine the teachings of Alpay with those of Huang to protect the light source and improve the reliability of Huang's source, which would result in the limitations of Claim 3 being obvious. EX1003, ¶168.

5. Claim 4

The light source device according to claim 1, wherein the excitation light source is a solid light-emitting element.

Claim 4 is obvious over Huang in view of Alpay. EX1003, ¶¶153, 169.

Specifically, Huang discloses that the excitation light sources disclosed therein can be “***solid light sources*** with both a high luminance and a long service life[.]” EX1009, Col. 4:47-50; EX1003, ¶169.

6. Claim 9

Claim 9 is obvious over Huang in view of Alpay. EX1003, ¶¶153, 170-176.

a. Claim Element 9p

A light source device, comprising:

It is Petitioners' position that the preamble of Claim 9 is not limiting and need not be analyzed for the purposes of determining Claim 9's validity. Should the Board determine the preamble is limiting, however, Huang teaches a light source device. EX1003, ¶170.

Claim Element 9p is identical to Claim Element 1p. *Compare* EX1001, Col. 20:17 *with id.* Col. 21:55; *see also* EX1003, ¶170. Thus, for the same reasons that Huang teaches any limitations of Claim Element 1p, it also teaches any limitations

of Claim Element 9p. *See supra* Ground 4, Claim 1, Claim Element 1p; *see also* EX1003, ¶170.

b. Claim Element 9a

an excitation light source which emits excitation light;

Claim Element 9a is substantially similar to Claim Element 1a, with the only difference being that Claim Element 9a requires “an” excitation light source while Claim Element 1a requires a plurality of excitation light sources. *Compare* EX1001, Col. 20:18-19 *with id.* at Col. 21:56. Thus, for the same reasons that Huang teaches a plurality of excitation light sources which emit excitation light, it also teaches “an” excitation light source which emits excitation light. *See supra* Ground 4, Claim 1, Claim Element 1a; *see also* EX1003, ¶171.

c. Claim Element 9b

a phosphor which changes the excitation light to fluorescent light;

Claim Element 9b is identical to Claim Element 1b. *Compare* EX1001, Col. 20:20-21 *with id.* at Col. 21:57-58. Thus, for the same reasons Huang teaches every limitation of Claim Element 1b, it also teaches every limitation of Claim Element 9b. *See supra* Ground 4, Claim 1, Claim Element 1b; *see also* EX1003, ¶172.

d. Claim Element 9c

a dichroic mirror which transmits the excitation light and reflects the fluorescent light; and

Claim Element 9c is identical to Claim Element 1c. *Compare* EX1001, Col. 20:22-23 *with id.* at Col. 21:59-60. Thus, for the same reasons Huang teaches every limitation of Claim Element 1c, it also teaches every limitation of Claim Element 9c. *See supra* Ground 4, Claim 1, Claim Element 1c; *see also* EX1003, ¶173.

e. Claim Element 9d

a condensing lens which condenses the excitation light transmitted through the dichroic mirror in an excitation light irradiation region on the phosphor,

Claim Element 9d is identical to Claim Element 1d. *Compare* EX1001, Col. 20:24-26 *with id.* at Col. 21:61-63. Thus, for the same reasons Huang teaches every limitation of Claim Element 1d, it also teaches every limitation of Claim Element 9d. *See supra* Ground 4, Claim 1, Claim Element 1d; *see also* EX1003, ¶174.

f. Claim Element 9e

wherein the excitation light sources are arranged so that when excitation light emitted from the excitation light source enters the excitation light irradiation region and is reflected without being converted into fluorescent light, the unconverted excitation light is prevented from entering the excitation light source; and

As explained above, Huang teaches a plurality of light sources arranged so that each excitation light (*e.g.*, light beams 221) emitted from the plurality of light sources 220 enters asymmetrically to a center of the condensing lens (*e.g.*, lens 330,

lens 340). EX1003, ¶175. As explained above in the context of Ground 2, Alpay teaches that an asymmetrical arrangement prevents back reflections from reaching excitation light sources and potentially damaging them. *See supra* Ground 2; *see also* EX1003, ¶175. A POSITA would thus have understood that the asymmetrical arrangement of the light sources in Huang prevents unconverted excitation light from entering any excitation light source and would have used the teaching of Alpay to ensure that an asymmetrical arrangement was maintained to prevent back reflections. EX1003, ¶175.

g. Claim Element 9f

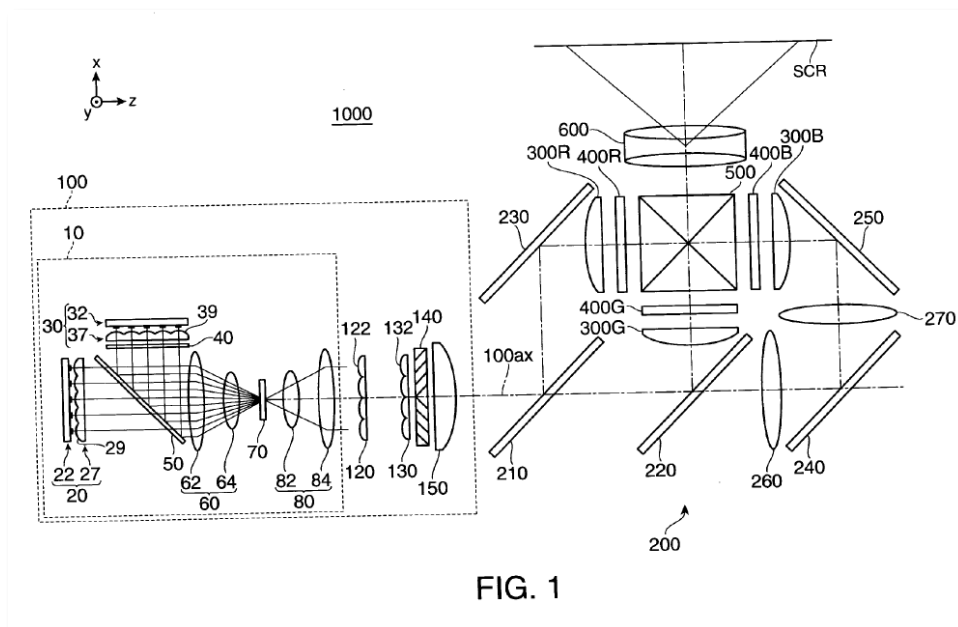
wherein when the excitation light irradiation region is a center and an incident angle to the excitation light irradiation region of any excitation light of each of the excitation light is an elevation angle θ , $\theta \neq 0$ is satisfied.

Claim Element 9f is identical to Claim Element 1f. *Compare* EX1001, Col. 20:31-37 *with id.* at Cols. 22:3-9. Thus, for the same reasons Alpay teaches every limitation of Claim Element 1f, it also teaches every limitation of Claim Element 9f. *See supra* Ground 4, Claim 1, Claim Element 1f; *see also* EX1003, ¶176.

E. Ground 4a: Claim 7 is invalid under pre-AIA 35 U.S.C. § 103 as obvious over Huang in view of Alpay and Akiyama.

1. Overview of Akiyama

Akiyama discloses a light source device and projector. EX1006, cover. Akiyama's Figure 1 depicts an embodiment of the invention described therein.



EX1006, Fig. 1.

Akiyama discloses a light source device and projector including an optical system 200, which comprises a plurality of optical elements, including dichroic mirrors 210, 220, reflecting mirrors 230, 240, 250, and relay lenses 260, 270. EX1006, [0089]. These optical elements apply light for a light source (illumination device 100) to video display elements (liquid crystal modulation devices 400R, 400G, 440B). EX1006, [0089].

2. Motivation to combine Akiyama with Huang/Alpay

As a threshold matter, a POSITA would have been motivated to combine Akiyama with the combination of Huang and Alpay, and would have had a reasonable expectation of success in making the combination. EX1003, ¶178. The combination of Huang and Alpay teaches a light source device for use in a projection

device (Huang) with Alpay's asymmetrical arrangement of light sources to prevent back reflections. EX1003, ¶178. Akiyama teaches a complete projection device. EX1006, [0003] ("The present invention relates to a light source device and a projector."); EX1003, ¶178. A POSITA, looking to employ the light source device of Huang, as improved by Alpay, for use in a projector device in combination with Alpay would naturally look to Akiyama and similar references in which to employ that light source device. *Id.*

3. Claim 7

Claim 7 is obvious over Huang in view of Alpay and further in view of Akiyama. EX1003, ¶¶177, 179-184.

a. Claim Element 7p

A projection type video display device, comprising:

It is Petitioners' position that the preamble of Claim 7 is not limiting and need not be analyzed for the purposes of determining Claim 7's validity. Should the Board determine the preamble is limiting, however, both Akiyama and Huang teach a projection type video display device. EX1003, ¶179.

Specifically, Akiyama teaches "a projector" that contains the light source device described therein. EX1006, [0003]; EX1003, ¶179. Huang also teaches "a projection device" employing the illumination system of Huang. EX1009, 2:38-42; EX1003, ¶179.

b. Claim Element 7a

the light source device according to claim 1;

The combination of Huang and Alpay teaches a light source device according to Claim 1. *See supra* Ground 4, Claim 1; EX1003, ¶¶159-167, 180.

c. Claim Element 7b

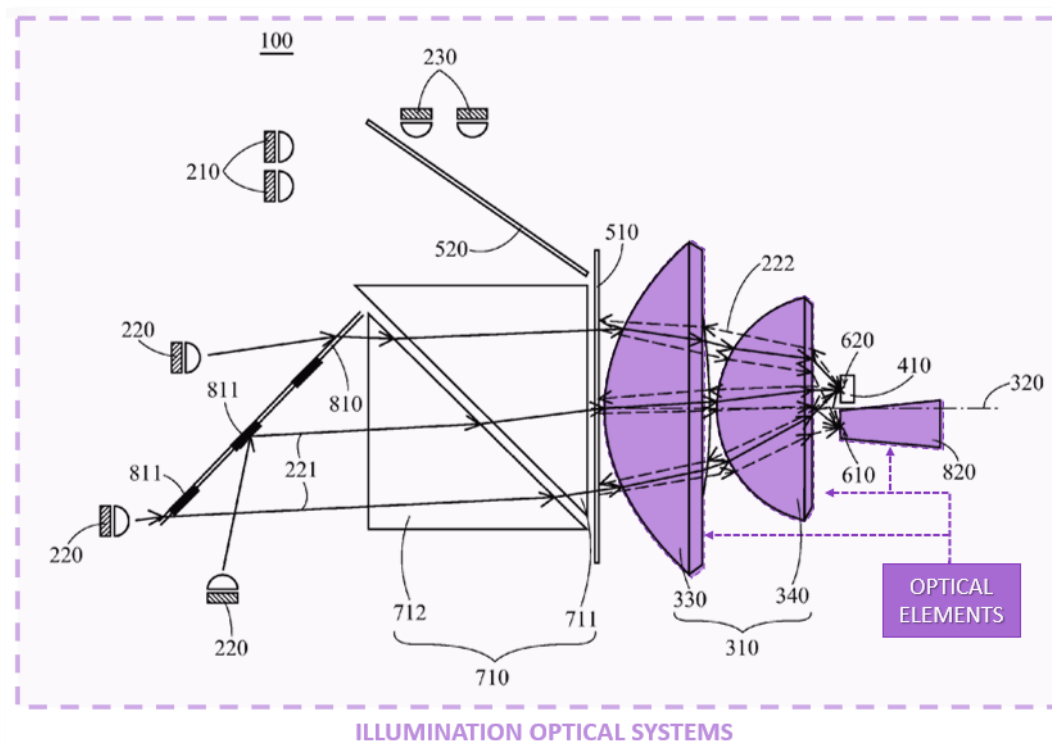
a video display element;

Akiyama teaches video display elements in the form of liquid crystal modulation devices. EX1006, [0089]; EX1003, ¶181. Huang teaches a “micro-display” of the projection device disclosed by Huang, which a POSITA would understand to be a “video display element.” EX1009, 2:56-60; EX1003, ¶181.

d. Claim Element 7c

an illumination optical system which has a plurality of optical elements applying light from the light source device to the video display element; and

Akiyama discloses an optical illumination system that discloses the limitations of Claim Element 7c. EX1003, ¶182. Akiyama discloses an illumination optical system (optical system 200), which comprises a plurality of optical elements, including dichroic mirrors 210, 220, reflecting mirrors 230, 240, 250, and relay lenses 260, 270. EX1006, [0089], EX1003, ¶182. These optical elements apply light for a light source (illumination device 100) to video display elements (liquid crystal modulation devices 400R, 400G, 440B). EX1006, [0089], EX1003, ¶182.



EX1009, Fig. 3B (annotated); EX1003, ¶183.

e. Claim Element 7d

a projection lens which enlarges and projects an optical image formed by the video display element.

Akiyama teaches that the images formed by the video display elements of Claim Element 7d (liquid crystal modulation devices 400R, 400G, 440B) are enlarged by a projection optical system 600, which a POSITA would understand comprises one or more lenses. EX1006, [0057], [0103]; EX1003, ¶184.

F. Ground 5: Claim 9 is invalid under pre-AIA 35 U.S.C. § 103 as obvious over Huang in view of Abu-Ageel and Alpay.

1. Motivation to combine Abu-Ageel with Huang/Alpay

As a threshold matter, a POSITA would have been motivated to combine Huang with Abu-Ageel and Alpay, and would have had a reasonable expectation of success in making the combination. EX1003, ¶186. Huang, Alpay, and Abu-Ageel are analogous and/or complimentary art because they disclose light sources as explained above. *Id.*

Prior to the '530 Patent, it was well known that back reflections affected, degraded, or impaired the performance of laser diodes. EX1005, [0003]; *see also* EX1013, 1:11-17; EX1014, 1:19-22; EX1003, ¶187. By the time of the priority date of the '530 Patent, not only was this problem known, but tools had been developed to combat this problem, such as optical isolators. EX1005, [0004]-[0005]; EX1013; EX1014; EX1003, ¶187. Optical isolators, however, “are usually quite bulky (especially when configured for use with high-power beams) and expensive.” EX1005, [0006]; EX1003, ¶187. A POSITA would have known this and would have at least considered protecting the laser diodes of Huang and Alpay by the means taught by Abu-Ageel, which discloses a different method to prevent unwanted, destabilizing feedback, or by the use of optical isolators that were well known and used in front of laser diodes in applications such as telecommunications and high power lasers. EX1003, ¶187. In other words, by the time of the priority date of the

'530 patent it was well known that back reflections can affect adversely the performance of a laser. *Id.* Therefore, a POSITA looking at Huang and Alpay would have also considered the teaching of Abu-Ageel. *Id.*

A POSITA designing a light source device like that of Huang would have been aware of the back reflection problem and would have understood that arrangements like that of Abu-Ageel could also be used to further avoid back reflections. *Id.*, ¶188. Interested in protecting the excitation light sources, a POSITA would have looked to Abu-Ageel and similar art to accomplish to suppress back reflections to the excitation light sources. *Id.* This would have been nothing but following known methods with predictable results. *Id.*

2. Claim 9

Claim 9 is obvious over Huang in view of Abu-Ageel and Alpay. EX1003, ¶¶185, 189-195.

a. Claim Element 9p

A light source device, comprising:

It is Petitioners' position that the preamble of Claim 9 is not limiting and need not be analyzed for the purposes of determining Claim 9's validity. Should the Board determine the preamble is limiting, however, Huang teaches a light source device. EX1003, ¶189; *see also supra* Ground 4, Claim 9, Claim Element 9p.

b. Claim Element 9a

an excitation light source which emits excitation light;

As explained above, Huang teaches Claim Element 9a. EX1003, ¶190; *see also supra* Ground 4, Claim 9, Claim Element 9a.

c. Claim Element 9b

a phosphor which changes the excitation light to fluorescent light;

As explained above, Huang teaches Claim Element 9b. EX1003, ¶191; *see also supra* Ground 4, Claim 9, Claim Element 9b.

d. Claim Element 9c

a dichroic mirror which transmits the excitation light and reflects the fluorescent light; and

As explained above, Huang teaches Claim Element 9c. EX1003, ¶192; *see also supra* Ground 4, Claim 9, Claim Element 9c.

e. Claim Element 9d

a condensing lens which condenses the excitation light transmitted through the dichroic mirror in an excitation light irradiation region on the phosphor,

As explained above, Huang teaches Claim Element 9d. EX1003, ¶193; *see also supra* Ground 4, Claim 9, Claim Element 9d.

f. Claim Element 9e

wherein the excitation light sources are arranged so that when excitation light emitted from the excitation light source enters the excitation light irradiation region and is reflected without being converted into fluorescent light, the unconverted excitation light is prevented from entering the excitation light source; and

As explained above, Abu-Ageel teaches Claim Element 9e. EX1003, ¶194; *see also supra* Ground 3, Claim 9, Claim Element 9e.

g. Claim Element 9f

wherein when the excitation light irradiation region is a center and an incident angle to the excitation light irradiation region of any excitation light of each of the excitation light is an elevation angle θ , $\theta \neq 0$ is satisfied.

As explained above, Alpay teaches Claim Element 9f. EX1003, ¶195; *see also supra* Ground 4, Claim 9, Claim Element 9f.

IX. CONCLUSION

Petitioners respectfully request that a trial be instituted. Claims 1, 3, 4, 7, and 9 should be cancelled.

Respectfully submitted,

Date: February 7, 2025

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

CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. § 42.24, the undersigned attorney for the Petitioners declares that the argument section of this Petition has 13,891 words, according to the word count tool in Microsoft Word™.

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

APPENDIX A – CLAIM LISTING

U.S. Patent No. 9,322,530

Claim or Element #	Claim Language
<i>1</i>	
1p	A light source device, comprising:
1a	a plurality of excitation light sources which emit excitation light;
1b	a phosphor which changes the excitation light to fluorescent light;
1c	a dichroic mirror which transmits the excitation light and reflects the fluorescent light; and
1d	a condensing lens which condenses the excitation light transmitted through the dichroic mirror in an excitation light irradiation region on the phosphor,
1e	wherein the plurality of light sources are arranged so that each excitation light emitted from each of the plurality of light sources enters asymmetrically to a center of the condensing lens; and
1f	wherein when the excitation light irradiation region is a center and an incident angle to the excitation light irradiation region of any

	excitation light of each of the excitation light is an elevation angle θ , $\theta \neq 0$ is satisfied.
3	The light source device according to claim 1, wherein when the excitation light irradiation region is a center, in an incident angle to the excitation light irradiation region of first excitation light of each of the excitation lights, an elevation angle is θ_m and an azimuth angle is ϕ_m , and in an incident angle to the excitation light irradiation region of second excitation light different from the first excitation light, an elevation angle is θ_n and an azimuth angle is ϕ_n , there is no pair of the excitation lights in which $\theta_m - 2^\circ \leq \theta_n \leq \theta_m + 2^\circ$, and $\phi_m + 178^\circ \leq \phi_n \leq \phi_m + 182^\circ$ are established.
4	The light source device according to claim 1, wherein the excitation light source is a solid light-emitting element.
7	
7p	A projection type video display device, comprising:
7a	the light source device according to claim 1;

7b	a video display element;
7c	an illumination optical system which has a plurality of optical elements applying light from the light source device to the video display element; and
7d	a projection lens which enlarges and projects an optical image formed by the video display element.
9	
9p	A light source device, comprising:
9a	an excitation light source which emits excitation light;
9b	a phosphor which changes the excitation light to fluorescent light;
9c	a dichroic mirror which transmits the excitation light and reflects the fluorescent light; and
9d	a condensing lens which condenses the excitation light transmitted through the dichroic mirror in an excitation light irradiation region on the phosphor,
9e	wherein the plurality of light sources wherein the excitation light sources are arranged so that when excitation light emitted from the excitation light source enters the excitation light irradiation region

	and is reflected without being converted into fluorescent light, the unconverted excitation light is prevented from entering the excitation light source; and
9f	wherein when the excitation light irradiation region is a center and an incident angle to the excitation light irradiation region of any excitation light of each of the excitation light is an elevation angle θ , $\theta \neq 0$ is satisfied.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF SERVICE

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

Date of service February 7, 2025

Manner of service Electronic Mail and UPS Mail Service

Documents served Petition for *Inter Partes* Review, including Exhibits and Power of Attorney

Served upon:

Bryan C. Nese (Via Electronic Mail) Mayer Brown 1999 K Street, NW Washington, DC 20006-1101 202-263-3266 bnese@mayerbrown.com Litigation Counsel	Antonelli, Terry, Stout & Kraus, LLP - Arlington, VA (Via UPS) 1300 North Seventeenth Street Suite 1800 Arlington, VA 22209
AMANDA STREFF BONNER (Via UPS) 71 S. Wacker Drive Chicago, IL 60606	

Please address all correspondence to lead and back-up counsel at
coretronic530ipr@merchantgould.com. Petitioners consent to electronic service.

Date: February 7, 2025

Respectfully Submitted,

/Donald R. McPhail/
Donald R. McPhail
Counsel for Petitioners
Registration No. 35,811
Merchant and Gould PC

1900 Duke Street, Suite 600
Alexandria, VA 22314
Telephone: (703) 518-4509
E-Mail: dmcphail@merchantgould.com