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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 19/120,393 | 04/11/2025 | Kazuya MOTOHASHI | Q308105 | 1485 |

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| EXAMINER | |
|---|---|
| PEERCE, MATTHEW J | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2875 | |

| NOTIFICATION DATE | DELIVERY MODE |
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| 04/17/2026 | ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

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| Office Action Summary | Application No. 19/120,393 | Applicant(s) MOTOHASHI, Kazuya | |
|---|---|---|---|
| | Examiner MATTHEW J PEERCE | Art Unit 2875 | AIA (First Inventor to File) Status Yes |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☑ Responsive to communication(s) filed on 4/3/2026.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☑ This action is **FINAL.** 2b) ☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims***

5) ☑ Claim(s) 1-5 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 1-5 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

**Application Papers**

10)☐ The specification is objected to by the Examiner.

11)☑ The drawing(s) filed on 4/11/2025 is/are: a)☑ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

**Priority under 35 U.S.C. § 119**

12)☑ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

a)☑ All b)☐ Some** c)☐ None of the:

1.☑ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☑ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

## DETAILED ACTION

### *Claim Objections*

Claim 1 objected to because of the following informalities:

Claim 1 recites "a virtual image of the light source… appears to be located rearward of an actual position of the light source". A virtual image is the apparent source of the light source. I.e. the limitation is redundant, the limitation should read "a virtual image of the light source…. is located rearward of the real image of the light source".

Claim 1 recites "a spreading angle larger than that of collimated light". The limitation is comparative to "collimated light", which Applicant has not provided a standard for. I.e. it appears that Applicant is reciting a range of divergence, but Applicant has not disclosed or recited the range for comparison. The Examiner suggests reciting specific angle ranges.

Appropriate correction is required.

### *Claim Rejections - 35 USC § 112*

The following is a quotation of 35 U.S.C. 112(b):
(b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-5 rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor (or for applications subject to pre-AIA 35 U.S.C. 112, the applicant), regards as the invention.

Claim 1 sets forth "the virtual image of the light source that is emitted through the projection lens via the meta-region also appears to be smaller than a virtual image of the light source if the light source were located at the actual position and a convex lens were arranged instead of the meta lens so as…". The limitation is indefinite as it recites a function setting forth

a relationship between the claimed invention and an undefined convex lens. **As the "convex lens" is not defined, the Examiner is unable to interpret such a limitation.**

The Examiner further notes that the limitation recited is the function of the meta-lens. I.e., the limitation is describing an inherent effect of any meta-lens used to reduce the divergence of the light. By reducing divergence, the optic creates a virtual image located farther away and smaller.

The Examiner has interpreted the limitation to read "wherein the virtual image of the light source that is emitted through the projection lens via the metaregion is located rearward of the location of the light source and emits light at a divergence angle from the meta lens".

Claims 2- 5 are rejected for being dependent on a rejected claim.

### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a)(1) the claimed invention was patented, described in a printed publication, or in public use, on sale or otherwise available to the public before the effective filing date of the claimed invention.

Claim(s) 1 is/are rejected under 35 U.S.C. 102(a)(1) as being anticipated by Byrnes (U.S. 9,939,129).

Regarding claim 1, Byrnes teaches a vehicle headlight (see col. 15 lines 15-25, may be used as a headlamp, see fig. 4) comprising:

a light source (light source 402);

a meta-lens (metalens 401) including a meta-region (region with nanostructures) in which a plurality of nanostructures each having a width smaller (see col. 7 lines 24-49, for visible light applications has width less than or equal to 500 nm) than a largest wavelength

(largest wavelength is about 700 nanometers, see col. 6 lines 1-12) of light emitted from the light source is arranged and through which the light emitted from the light source is transmitted; and

a projection lens (optics 423, such as projection optics see col. 13 line 64) through which the light emitted from the meta-lens is transmitted, wherein the meta-lens reduces a divergence angle of the light incident on the meta-region from the light source and emits the light (see fig. 4, reduces divergence from 409 and collimates the light) with a spreading angle larger than that of collimated light (see col. 24 lines 52-55, results in 1.1 degree FWHM, i.e. not fully collimated), and

when the light source is viewed from a side of the projection lens via the meta region, a virtual image of the light source that is emitted through the projection lens via the meta-region appears to be located rearward of an actual position of the light source (see fig. 4, meta lens reduces divergence which moves virtual image backwards, near infinite for collimated light, projection lens projects enlarged image), and

wherein the virtual image of the light source that is emitted through the projection lens via the metaregion is located rearward of the location of the light source and emits light at a divergence angle from the meta lens.

*The Examiner notes that Byrnes teaches that the meta lens emits "collimated light", however Byrnes later notes that the light is not completely collimated, but that it provides a "highly collimated" light, that is still divergent at 1.1 degree FWHM, or that diverges at 27 degrees as noted in col. 26. The claim states "a spreading angle larger than that of collimated light" but does not recite the amount of collimation in the example being compared to.*

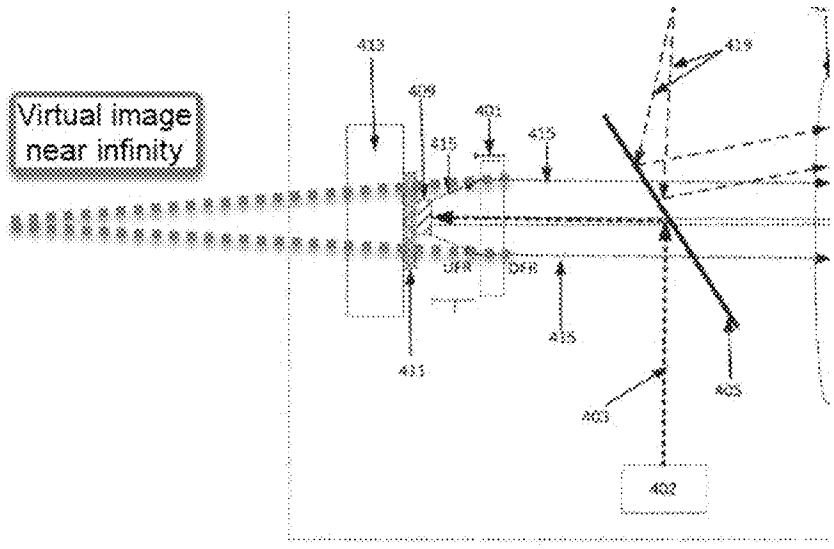


FIG. 4

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 2 is/are rejected under 35 U.S.C. 103 as being unpatentable over Byrnes.

Regarding claim 2, Byrnes does not specifically teach that in the case where the light source is viewed from the side of the projection lens via the meta-region, the image of the light source appears equal in size to the light source at the position farther than the position of the light source.

Byrnes teaches that the image of light source appears farther and of some size larger than the actual light source (as the metalens reduces divergence similarly to Applicant's). It is unclear if the structure of Byrnes teaches that the image of the light source is the same size as the appearance of the light source.

It would have been obvious to a person having ordinary skill in the art at the time that the invention was made to have optimized the image size of the light source. "Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller, 220 F. 2d 454, 456. Optimizing the image size of the light source is an obvious optimization to one of ordinary skill in the art to comply with headlight requirements for vehicles (i.e. emission area standards) and to align with projection optics to properly project a low beam light distribution.

Claim 3 is/are rejected under 35 U.S.C. 103 as being unpatentable over Byrnes in view of Lin (U.S. 11,057,115).

Regarding claim 3, Byrnes does not teach wherein a change in respective heights of the nanostructures an amount of change in a structure of the nanostructure increases from a center side toward an outer peripheral side of the meta-region.

Lin teaches a change in respective heights of the nanostructures an amount of change in a structure of the nanostructure increases from a center side toward an outer peripheral side of the meta-region (see fig. 4, metalenses 414-1 and 404-1).

It would have been obvious to a person having ordinary skill in the art at the time the invention was filed to have used different height nanostructures as taught by Lin for the metalens of Byrnes to enable finetuning of the refraction angles and the resulting beam profile, see col. Line 25-49).

*The Examiner notes that Byrnes specifically teaches that it would be obvious to use different height nanostructures, see col. 8 lines 19-30.*

Claims 4, 5 is/are rejected under 35 U.S.C. 103 as being unpatentable over Byrnes in view of Kanayama (U.S. 2018/0245757).

Regarding claim 4, Byrnes does not teach comprising:

an external casing that surrounds the light source, the meta-lens, and the projection lens; and

an internal casing that surrounds the light source, wherein the meta-lens is a part of the internal casing.

Kanayama teaches an external casing (case 21) that surrounds the light source, the meta-lens, and the projection lens (surrounds all optics); and

an internal casing (fixing member 26) that surrounds the light source, wherein the meta-lens (lens 42) is a part of the internal casing.

It would have been obvious to a person having ordinary skill in the art at the time the invention was filed to have used a two portion casing as taught by Kanayama to mount the structures of Byrnes in a manner that protects the overall optics and enables for the easy installation, repair, and further protection for the inner optics, as is known in the art.

Regarding claim 5, the combination of Byrnes and Kanayama teaches that the nanostructure is formed on an internal space side of the internal casing (nanostructures are formed on the interior side of 401, i.e. facing 409; which when placed in the internal casing of Kanayama is the interior side).

***Response to Arguments***

Applicant's arguments filed 4/3/2026 have been fully considered but they are not persuasive.

Regarding Applicant's argument directed at the 112(b) rejection, that asserts "it is clear that the claimed virtual image of the light source is compared to a theoretical alternative image that is recited only for comparison…", the Examiner notes that such a limitation cannot be interpreted in the claim.

Convex lenses are of varying sizes, shapes, with varying focal points and arrangements in optical systems. The Examiner cannot give weight to a "theoretical convex lens" as there is no "standard" among convex lenses. Additionally, Applicant's recited comparative advantage is

inherent for any metalens as claimed. I.e. the limitation does not further limit the structure beyond requiring a metalens.

Applicant further asserts that Byrnes teaches a collimating optic and therefore does not teach the limitation “a spreading angle larger than that of collimated light”.

The “spreading angle” is not defined by the claim. Byrnes uses the language “collimated”, however the disclosure sets forth a diverging beam. Applicant’s disclosure recites that the goal is to reduce the divergence angle, see p. 0006 but it is unclear how reduced the resulting divergence angle is. I.e. Byrnes teaches a divergence angle of 1.1 degrees FWHM, it is unclear if this is similar or the same as applicant’s divergence angle. The Examiner suggests reciting the divergence angle or range of angles to overcome the interpretation.

## ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any nonprovisional extension fee (37 CFR 1.17(a)) pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MATTHEW J PEERCE whose telephone number is (571)272-6570. The examiner can normally be reached 8-4pm EST.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, James Greece can be reached on (571) 272-3711. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/Matthew J. Peerce/
Primary Examiner, Art Unit 2875