(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
24 March 2022 (24.03.2022)

WIPO | PCT

(10) International Publication Number
WO 2022/061328 A1

(51) International Patent Classification:
B60R 1/04 (2006.01) *G02F 1/15* (2019.01)
B60R 1/12 (2006.01)

(21) International Application Number:
PCT/US2021/071434

(22) International Filing Date:
13 September 2021 (13.09.2021)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
63/079,636 17 September 2020 (17.09.2020) US

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, IT, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

WO 2022/061328 A1

(54) **Title:** REARVIEW ASSEMBLY

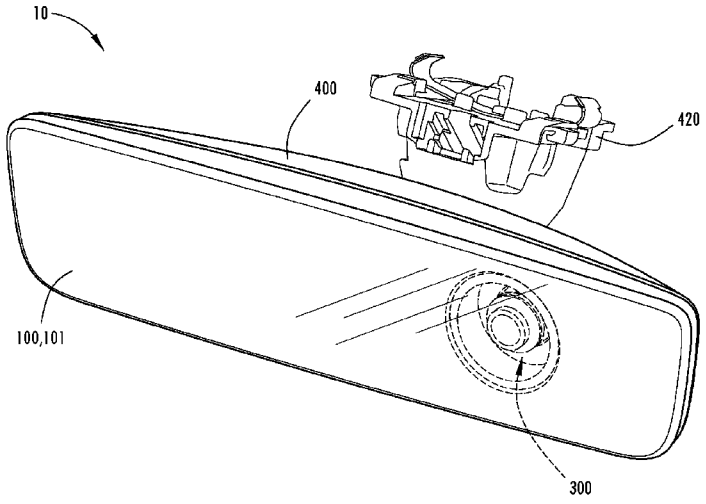

FIG. 1

(57) **Abstract:** A rearview assembly having a transflective element, a carrier plate, and an imager. The transflective element may have a first side and a second side in a first direction relative the first side. The carrier plate has a third side and a fourth side. The third side is adhered to the second side and extends substantially there along. The carrier plate may also have a cavity extending from the third side in the first direction. The cavity may have a first aperture, a second aperture, and an end portion. The first aperture may be at the third side. The second aperture may be disposed in the first direction relative the first aperture. The end portion may circumscribe the second aperture. The imager may extend through the second aperture and comprise a light collection portion, which is disposed proximate the second side.

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(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:

— *with international search report (Art. 21(3))*

REARVIEW ASSEMBLY

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority under 35 U.S.C. § 119(e) to U.S. Provisional Application No. 63/079,636 filed on September 17, 2020, entitled "REARVIEW ASSEMBLY," the disclosure of which is hereby incorporated by reference in its entirety.

FIELD OF INVENTION

[0002] The present disclosure relates in general to rearview assemblies and, more particularly, to rearview assemblies having an imager behind a reflective element.

BACKGROUND OF INVENTION

[0003] Cameras are incorporated into vehicles with increasing regularity. In some instances, cameras are further incorporated into rearview assemblies. Specifically, the cameras may be positioned behind a transflective element of these rearview assemblies, in order to reduce their visibility to a user. However, cameras positioned behind surfaces may experience undesirable artifacts presented in their images. Light that is off-axis with the camera lens may transmit through the transflective element and reflect off various surfaces before collection by the camera lens. This problem is particularly prevalent with wide-angle camera lenses as, due to their wide filed of view, they may collect additional reflections that may otherwise not have been collected by other lenses. However, wide angle camera lenses also provide wider fields of view that may be beneficial or required in some applications, such as cabin monitoring. Accordingly, there is a need for an improved rearview assembly with a camera positioned behind a transflective element.

SUMMARY

[0004] In accordance with the present disclosure, the disadvantages and problems associated with undesirable artifacts as a result of positioning an imager behind a transflective element have been substantially reduced or eliminated.

[0005] In accordance with one aspect of the present disclosure, a rearview assembly is disclosed. The rearview assembly may comprise a transflective element, a carrier plate, and an imager. The transflective element may have a first side and a second side. The second side may be disposed in a first direction relative the first side. The transflective element may be variably reflective. In some embodiments, the transflective element may comprise a first substrate, a second substrate, a first electrode, a second electrode, and an electro-optic medium. The first substrate may have a first surface and a second surface. The second substrate may be substantially parallel the first substate and have a third surface and a fourth surface. The first electrode may be associated with the second surface. The second electrode may be associated with the third surface. The electro-optic medium may be disposed between the first and second electrodes. The carrier plate may, similarly, have a third side and a fourth side. The carrier plate may be disposed in the first direction relative the transflective element. The third side may be adhered to the second side and extend substantially there along. The carrier play may also form a cavity. The cavity may extend in the first direction from the third side and have a first aperture, a second aperture, and an end portion. In some embodiments, the cavity may be substantially cylindrical. Further, surfaces defined by the cavity may be anti-reflective. The first aperture may be at the third side. The second aperture may be disposed in the first direction relative the first aperture. Additionally, the second aperture may be smaller than the first aperture. The end portion may circumscribe the second aperture. The cavity may further have side walls extending between the third aperture and the end portion. Further, these side walls may be substantially perpendicular relative the third side. The imager may be operable to

capture light and produce an image. Further, the imager may extend through the second aperture and comprise a light collecting portion disposed proximate the second side. In some embodiments, the light collecting portion may be disposed less than 5 mm or less than 1 mm from the second side. Additionally, the imager may substantially fill the second aperture.

[0006] In some embodiments, the carrier plate may also have a lip portion. The lip portion may circumscribe the first aperture and comprise an interior edge, an exterior edge, and a connecting surface. The interior edge may be in abutting contact with the second side. Further, the interior edge may define the first aperture. The exterior edge may circumscribe the interior edge. The connecting surface may extend between the interior edge and the exterior edge. The connecting surface may be sloped relative the third side. The lip portion may be raised in a second direction relative the third side. The second direction may be opposite the first direction.

[0007] In some embodiments, the carrier plate may be adhered to the second side via an adhesive foam layer. Additionally, in some further embodiments, the carrier plate does not make direct contact with the transflective element except via the lip portion.

[0008] In accordance with another aspect of the present disclosure, a carrier plate is disclosed. The carrier plate may comprise an elongate member and a cavity. The elongate member may have a first side and a second side. The second side may be disposed in the first direction relative the first side. The cavity may extend in the first direction from the first side. Additionally, the cavity may have a first aperture, a second aperture, and an end portion. The first aperture may be at the first side. The second aperture may be disposed in the first direction relative the first aperture. The end portion may circumscribe the second aperture. Additionally, the elongate member may be operable to support a transflective element of a rearview assembly. Further, the second aperture may be operable to accept a light collecting portion of an imager such that the imager may capture images through the transflective element.

[0009] In some embodiments, the elongate member may further comprise a lip portion. The lip portion may circumscribe the first aperture. Additionally, the lip portion may extend in a second direction relative the first side. The second direction may be defined as a direction opposite the first direction. In some such embodiments, the lip portion comprises an interior edge defining the first aperture. In such an embodiment, the cavity may additionally comprise side walls extending between the first aperture and the end portion.

[0010] The advantages of certain aspects of the present disclosure include reducing or eliminating undesirable artifacts in imaging. Light that is off-axis with the light collecting potion of the imager may have less reflections gathered by the light collecting portion of the imager than in prior rearview assemblies with an imager positioned behind a transflective element. Specifically, off-axis light may travel deeper into the cavity than the light collecting portion. Additionally, light that impinges a side wall may be reflected even deeper into the cavity. Further, light may be substantially absorbed by the anti-reflective surface treatment. Accordingly, by reflecting light away from the light collecting portion as well as absorbing the off-axis light, the cavity may substantially reduce the amount of off-axis light that is captured by the imager. Therefore, artifacts present in images produced by the imager may be substantially reduced or eliminated. Further, embodiments having the lip portion may have the additional advantage of eliminating light reflections from the adhesive foam layer. These advantages may be particularly advantageous for embodiments where the imager has a wide field of view.

[0011] These and other aspects, objects, and features of the present disclosure will be understood and appreciated by those skilled in the art upon studying the following specification, claims, and appended drawings. It will also be understood that features of each embodiment disclosed herein may be used in conjunction with, or as a replacement for, features in other embodiments.

BRIEF DESCRIPTION OF FIGURES

[0012] In the drawings:

[0013] **Figure 1:** Forward perspective view of an embodiment of a rearview assembly.

[0014] **Figure 2A:** Exploded forward perspective view of an embodiment of a rearview assembly.

[0015] **Figure 2B:** Cross-sectional view of an embodiment of a cavity of a carrier plate for a rearview assembly.

[0016] **Figure 3A:** Forward sectional perspective view of an embodiment of a rearview assembly.

[0017] **Figure 3B:** Cross-sectional view of an embodiment of a rearview assembly.

[0018] **Figure 4:** Cross-sectional view of an embodiment of an electro-optic transflective element.

DETAILED DESCRIPTION

[0019] For the purposes of description herein, the specific devices and processes illustrated in the attached drawings and described in this disclosure are simply exemplary embodiments of the inventive concepts defined in the appended claims. Hence, specific characteristics relating the embodiments disclosed herein are not limiting, unless the claims expressly state otherwise.

[0020] **Figures 1–4** illustrate schematic representations of a rearview assembly **10**. Rearview assembly **10** may comprise, a transflective element **100**, a carrier plate **200**, an imager **300**, and/or a housing **400**. Further, rearview assembly **10** may be an interior rearview assembly or an exterior rearview assembly for a vehicle. Accordingly, rearview assembly **10** may be operable to provide a driver with a view rearward relative the vehicle to which it is associated.

[0021] Transflective element **100** has a first side **101** and a second side **102**. First side **101** may be directed toward the driver. Second side **102** may be opposite first side **101**. Thus, second side **102** may be disposed in a first direction relative first side **101**. The first direction may be

defined as a direction substantially perpendicular to a planar extent of first side **101.** Further, transflective element **100** may substantially reflect light impinging first side **101** while simultaneously substantially transmitting light therethrough. In other words, transflective element **100** may transmit light in the first direction while simultaneously reflecting light to a second direction opposite the first direction. In some embodiments, transflective element **100** may have a variable reflectance. In such an embodiment, transflective element **100** may be electro-optic (as shown in **Figure 4**). Accordingly, transflective element **100** may comprise a first substrate **110**, a second substrate **120**, a first electrode **130**, a second electrode **140**, a seal **150**, a chamber **160**, and/or an electro-optic medium **170**.

[0022] First substrate **110** comprises a first surface **111** and a second surface **112**. Second surface **112** may be disposed in the first direction relative first surface **111**. In some embodiments, first surface **111** may correspond to first side **101**. Further, first substrate **110**, may be fabricated from any of a number of materials that are transparent or substantially transparent in the visible region of the electromagnetic spectrum, such as borosilicate glass, soda lime glass, float glass, natural and synthetic polymeric resins, plastics, and/or composites. Substrate materials may be selected from any number of materials so long as the materials are substantially transparent and exhibit appropriate physical properties such as strength and tolerance to conditions of its environment, such as ultra-violet light exposure from the sun and temperature extremes.

[0023] Second substrate **120** is disposed in a substantially parallel, spaced apart relationship relative first substrate **110**. Further, second substrate **120** comprises a third surface **123** and a fourth surface **124**. Fourth surface **124** may be disposed in the first direction relative third surface **123**. In some embodiments, fourth surface **124** may correspond to second side **102**. Additionally, second substrate **110** may be fabricated from the same or similar materials as that of first substrate **110**.

[0024] First electrode **130** is an electrically conductive material associated with second surface **112**. The electrically conductive material of first electrode **130** may be substantially transparent in the visible region of the electromagnetic spectrum and generally resistant to corrosion from materials contained within the electro-optic element. The electrically conductive material may be a transparent conductive oxide (TCO), such as fluorine doped tin oxide (FTO), indium-doped oxide, doped zinc oxide, or other materials known in the art.

[0025] Similarly, second electrode **140** is an is an electrically conductive material associated with third surface **123**. Second electrode **140** may likewise be substantially transparent. Accordingly, the electrically conductive material of second electrode **140** may be fabricated from the same or similar materials as that of first electrode **130**. In some embodiments, second electrode **130** may also be substantially reflective or comprise a substantially reflective layer. Accordingly, second electrode **130** may be transflective. In other embodiments, a reflector may be associated with second electrode **140** between electro-optic medium **170** and second electrode **140**, with third surface **123** between second electrode **140** and second substrate **120**, or with fourth surface **124** of second substrate **120**. Typical reflective materials include chromium, rhodium, ruthenium, silver, aluminum, gold, platinum, palladium, nickel, molybdenum, and combinations thereof.

[0026] Seal **150** may be disposed in a peripheral manner to define chamber **160** between first substrate **110** and second substrate **120**. Chamber **160** may be defined by seal **150** in conjunction with at least two of: first substrate **110**, second substrate **120**, first electrode **130**, and second electrode **140**. In some embodiments, chamber **160** may, more specifically, be defined by seal **150**, first electrode **130**, and second electrode **140**. Seal **150** may comprise any material capable of being adhesively bonded to the at least two of: first substrate **110**, second substrate **120**, first electrode **130**, and second electrode **140**, to in turn seal chamber **160** such that electro-optic medium **170** does not inadvertently leak out.

[0027] Electro-optic medium **170** is disposed in chamber **160**. Additionally, electro-optic medium **170** is electro-active. Therefore, electro-optic medium **170** is operable between activated and un-activated states in response to an electrical potential. Accordingly, electro-optic medium **170** may include, among other materials, electro-active anodic and cathodic materials. In some embodiments, the anodic and/or cathodic materials may be electrochromic. In other words, the electro-optic medium **170** may be electrochromic. Electrochromic means that upon activation, due to the application of an electronic voltage or potential, the electrochromic item may exhibit a change in absorbance at one or more wavelengths of the electromagnetic spectrum. Accordingly, the electro-optic medium **170** may be variably transmissive. The change in absorbance may be in the visible, ultra-violet, infra-red, and/or near infra-red regions. In other embodiments, electro-optic medium **170** may be a liquid crystal medium or a suspended particle medium. Electro-optic medium **170** may be fabricated from any one of a number of materials, including, for example, those disclosed in U.S. Pat. 6,433,914, entitled "Color-Stabilized Electrochromic Devices," which is herein incorporated by reference in its entirety.

[0028] Carrier plate **200** is an elongate member disposed in the first direction relative transflective element **100**. Further, carrier plate **200** comprises a third side **203** and a fourth side **204**. Fourth side **204** may be disposed in the first direction relative third side **203**. Additionally, Carrier plate **200** may substantially extend along second side **102** and be configured to support transflective element **100**. In some embodiments, carrier plate **200** may be in abutting contact with and/or adhered to second side **102**. In some such embodiments, carrier plate **200** may be adhered to second side **102** via an adhesive foam layer **210**. Further, carrier plate **200** may have a polymeric and/or foam construction. Additionally, carrier plate **200** may form a cavity **220**.

[0029] Cavity **220** may be a concave portion formed by a recess extending in the first direction from third side **203**. Further, cavity **220** may be substantially formed in a variety of shapes. For example, cavity **220** may be substantially cylindrical, elliptic–cylindrical, conical, frustum-like, pyramidal, cubic, cuboid-like, hexagonal prismatic, or octagonal prismatic. In some embodiments, surfaces of cavity **220** may be surface treated with an anti-reflectant to reduce or minimize reflections off the surfaces of cavity **220**. Additionally, cavity **200** may comprise a first aperture **221** and a second aperture **222**. First aperture **221** may be substantially along or at third side **203**. Second aperture **222** may be disposed in the first direction relative first aperture **221** and/or may be disposed substantially along or at fourth side **204**. The first and second apertures **221**, **222** may be a formed in a variety of shapes and, in some embodiments, may be formed from the same or different shapes. For example, the first and second apertures may be circular, elliptical, triangular, square, rectangular, hexagonal, or octagonal. In some embodiments, second aperture **222** may be smaller than first aperture **221**. Accordingly, second aperture **222** may have a width less than a width of first aperture **221**. Cavity **220** may also compromise an end portion **224** circumscribing second aperture **222**. End portion **224** may be substantially parallel to and disposed in the first direction relative third side **203**. Additionally, in some embodiments, side walls **225** defined by cavity **220** may be substantially perpendicular to second side **102**, third side **203**, end portion **224**, first aperture **221**, and/or second aperture **222**. Further, side walls **225** may be substantially aligned with first aperture **221**. Thus, side walls **225** may extend between first aperture **221** and end portion **224**.

[0030] In some embodiments, carrier plate **200** may further comprise a lip portion **230**. Lip portion **230** may circumscribe first aperture **221**. Additionally, lip portion **230** may be raised and extend from third side **203** in the second direction. Lip portion **230** may comprise an interior edge **231**, an exterior edge **232**, and a connecting surface **233**. Interior edge **231** may define first aperture **221**. In some embodiments, interior edge **231** may make abutting contact

with second side **102**. Exterior edge **232** is larger than and circumscribes interior edge **231**. In some embodiments, exterior edge **232** may be substantially planar with third side **203**. In other embodiments, exterior edge **232** may be substantially planar with interior edge **231**. Connecting surface **233** may be a surface extending between interior edge **231** and exterior edge **232**. Accordingly, connecting surface **233** may be sloped relative third side **203**. Further, connecting surface **233** may be a flat surface or a curved surface.

[0031] Additionally, in some embodiments, adhesive foam layer **210** may be substantially disposed between second side **102** and third side **203** such that carrier plate **200** does not make direct contact with transflective element **100** except via lip portion **230**. Further, adhesive foam layer **210** may comprise an opening **211** substantially aligned with first aperture **221**, lip portion **230**, interior edge **231**, and/or exterior edge **232**, such that first aperture **221** is substantially un-occluded by adhesive foam layer **210**.

[0032] Imager **300** may be any device operable to capture light and produce an image. The image may be a digital image. For example, imager **300** may be a camera. Imager **300** may be disposed, at least in part, within cavity **220**. Further, imager **300** comprises a light collecting portion **310**, a lens barrel **320**, and a photosensitive array **330**. Furthermore, imager **300** may be disposed such that light collecting portion **310** is disposed within cavity **220**. Light collecting portion **310** may correspond to a front lens or an aperture. Additionally, light collecting portion **310** may be disposed proximate second side **102** and in or proximate first aperture **221**. Light collecting portion **310** may, for example, be less than 5 mm, 4 mm, 3 mm, 2 mm, or 1 mm from second side **102**. Lens barrel **320** may be deposed, at least in part, in cavity **220**. Further, lens barrel **320** may extend through second aperture **222**. Additionally, lens barrel **320** may substantially fill second aperture **222**. Photosensitive array **330** may be disposed in the first direction relative second aperture **220**. Accordingly, photosensitive array **330** may be a Semi-Conductor Charge-Coupled Device (CCD) or pixel sensor of Complementary Metal-Oxide-

Semi-Conductor (CMOS) technology. In some embodiments, imager **300** may have a wide field of view. Accordingly, imager **300** may have wide angle lens.

[0033] Housing **400** may form a second cavity and have an opening. The opening may be disposed in the first direction of the second cavity. Transflective element **100** may be substantially disposed in or proximate the opening. Accordingly, carrier plate **200** and imager **300** may be disposed in the second cavity. In some embodiments, housing **400** may substantially abut second surface **112**. Additionally, housing **400** may support carrier plate **200**. Carrier plate **200** may be secured to housing **400** via a plurality of mechanical fasteners **410**. Housing **400** may further comprise a mount **420**. Mount **420** may operably secure housing **400** to a surface of the vehicle, such as a windshield, a headliner, or a body panel.

[0034] In operation, light may impinge transflective element **100** at first side **101**. Some of the light may be reflected back therefrom. In embodiments where transflective element **100** is a variably transmissive electro-optic element, the first and second electrodes **130**, **140** may apply an electrical potential to the electro-optic medium **170**. The electro-optic medium **170** may accordingly be placed in an activated state and absorb a portion of the light, thereby dimming the reflectance. In addition to reflecting light back, some of the light may be transmitted therethrough. The transmitted light aligning with first aperture **221** may travel therethrough and be collected by imager **300**. Accordingly, imager **300** may provide an image corresponding to a scene exterior and in the second direction relative rearview assembly **10**.

[0035] Some embodiments of rearview assembly **10** may have the advantage of reducing or eliminating artifacts in imaging. Light that is off-axis with light collecting potion **310** of imager **300** may have less reflections gathered by light collecting portion **310** of imager **300** than in prior rearview assemblies with an imager positioned behind a transflective element. Specifically, off-axis light may travel deeper into cavity **220** than light collecting portion **310**. Additionally, light that impinges a side wall **225** may be reflected back even deeper into cavity

220. Further, light may be substantially absorbed due to the anti-reflective surface treatment. Accordingly, by reflecting light away from light collecting portion **310** as well as absorbing the off-axis light, cavity **220** may substantially reduce or eliminate off-axis light captured by imager **300**. Therefore, artifacts present in images produced by imager **300** may be substantially reduced or eliminated. Further, embodiments having lip portion **230** may have the additional advantage of eliminating light reflections from adhesive foam layer **210.** These advantages may be particularly advantageous for embodiments where imager **300** has a wide field of view.

[0036] In this document, relational terms, such as "first," "second," and the like, are used solely to distinguish one entity or action from another entity or action, without necessarily requiring or implying any actual such relationship or order between such entities or actions

[0037] For purposes of this disclosure, the term "associated" generally means the joining of two components (electrical or mechanical) directly or indirectly to one another. Such joining may be stationary in nature or movable in nature. Such joining may be achieved with the two components (electrical or mechanical) and any additional intermediate members being integrally formed as a single unitary body with one another or with the two components. Such joining may be permanent in nature or may be removable or releasable in nature unless otherwise stated.

[0038] As used herein, the term "and/or," when used in a list of two or more items, means that any one of the listed items can be employed by itself, or any combination of the two or more of the listed items can be employed. For example, if a composition is described as containing components A, B, and/or C, the composition can contain A alone; B alone; C alone; A and B in combination; A and C in combination; A and C in combination; B and C in combination; or A, B, and C in combination.

[0039] The term "substantially," and variations thereof, will be understood by persons of ordinary skill in the art as describing a feature that is equal or approximately equal to a value

or description. For example, a "substantially planar" surface is intended to denote a surface that is planar or approximately planar. Moreover, "substantially" is intended to denote that two values are equal or approximately equal. If there are uses of the term which are not clear to persons of ordinary skill in the art, given the context in which it is used, "substantially" may denote values within about 10% of each other, such as within about 5% of each other, or within about 2% of each other.

[0040] The term "transflective" generally refers to an optical configuration that reflects at least a portion of light incident from at least one side and transmits at least a portion of light incident from at least one side. In particular, "transflective" describes an optical element or component that has a non-zero level of transmittance with regard to a wave range of light and also has a non-zero level of reflectance in a region. The applicable wave range of light will vary based on the context. However, in the event the relevant wave range of light is not readily apparent, the wave range in light shall generally refer to visible light.

[0041] The term "transparent" is applied in the relative sense. "Transparent" refers to an optical element or material that is substantially transmissive of at wavelengths in question and thus generally allows light at such wavelengths to pass therethrough. The wavelengths in question will vary based on the context. However, in the event the wavelengths in question is not readily apparent, the wavelengths in question shall generally refer to visible light.

[0042] The terms "comprises," "comprising," or any other variation thereof, are intended to cover a non-exclusive inclusion, such that a process, method, article, or apparatus that comprises a list of elements does not include only those elements but may include other elements not expressly listed or inherent to such process, method, article, or apparatus. An element preceded by "comprises . . . a" does not, without more constraints, preclude the existence of additional identical elements in the process, method, article, or apparatus that comprises the element.

[0043] It is to be understood that although several embodiments are described in the present disclosure, numerous variations, alterations, transformations, and modifications may be understood by one skilled in the art, and the present disclosure is intended to encompass these variations, alterations, transformations, and modifications as within the scope of the appended claims, unless their language expressly states otherwise.

CLAIMS

What is claimed is:

1. A rearview assembly comprising:

   a transflective element having a first side and a second side, the second side in a first direction relative the first side;

   a carrier plate having a third side and a fourth side, the third side adhered to the second side and extending substantially there along, the carrier plate forming a cavity, the cavity extending in the first direction from the third side and having:

   a first aperture at the third side,

   a second aperture disposed in the first direction relative the first aperture, and

   an end portion circumscribing the second aperture; and

   an imager operable to capture light and produce an image, the imager extending though the second aperture and comprising a light collecting portion disposed proximate the second side.

2. The rearview assembly of claim 1, wherein the light collecting portion is disposed less than 5 mm from the second side.

3. The rearview assembly of claim 1, wherein the imager substantially fills the second aperture.

4. The rearview assembly of claim 1, wherein the carrier plate further comprises a lip portion, the lip portion circumscribing the first aperture and comprising:

   an interior edge,

   an exterior edge circumscribing the interior edge, and

   a connecting surface extending between the interior edge and the exterior edge.

5. The rearview assembly of claim 4, wherein the lip portion is raised in a second direction relative the third side, the second direction opposite the first direction.

6. The rearview assembly of claim 4, wherein the interior edge is in substantially abutting contact with the second side.

7. The rearview assembly of claim 4, wherein the interior edge may define the first aperture.

8. The rearview assembly of claim 4, wherein the connecting surface is sloped relative the third side.

9. The rearview assembly of claim 1, wherein the cavity has side walls extending between the first aperture and the end portion.

10. The rearview assembly of claim 9, wherein the side walls are substantially perpendicular relative the third side.

11. The rearview assembly of claim 1, wherein the first aperture is larger than the second aperture.

12. The rearview assembly of claim 1, wherein the cavity is cylindrical.

13. The rearview assembly of claim 1, wherein surfaces of the cavity are anti-reflective.

14. The rearview assembly of claim 1, wherein the transflective element is variably reflective.

15. The rearview assembly of claim 2, wherein the transflective element comprises:

a first substrate having a first surface and a second surface;

a second substrate disposed substantially parallel the first substrate and having a third surface and a fourth surface;

a first electrode associated with the second surface;

a second electrode associated with the third surface; and

an electro-optic medium disposed between the first and second electrodes.

16. The rearview assembly of claim 1, wherein the carrier plate is adhered to the second side via an adhesive foam layer.

17. The rearview assembly of claim 4, wherein:

the carrier plate is adhered to the second side via an adhesive foam layer; and

the carrier plate does not make direct contact with the transflective element except via the lip portion.

18. A carrier plate, comprising:

an elongate member having a first side and a second side disposed in the first direction relative the first side; and

a cavity extending in the first direction from the first side, the cavity having:

a first aperture at the first side,

a second aperture disposed in the first direction relative the first aperture, and

an end portion circumscribing the second aperture;

wherein:

the elongate member is operable to support a transflective element of a rearview assembly; and

the second aperture is operable to accept a light collecting portion of an imager such that the imager may capture images through the transflective element.

19. The carrier plate of claim 18, wherein the elongate member further comprises a lip portion circumscribing the first aperture and extending in a second direction relative the first side, the second direction opposite the first direction.

20. The carrier plate of claim 19, wherein:

the lip portion comprises an interior edge defining the first aperture; and

the cavity further comprises side walls extending between the first aperture and the end portion.

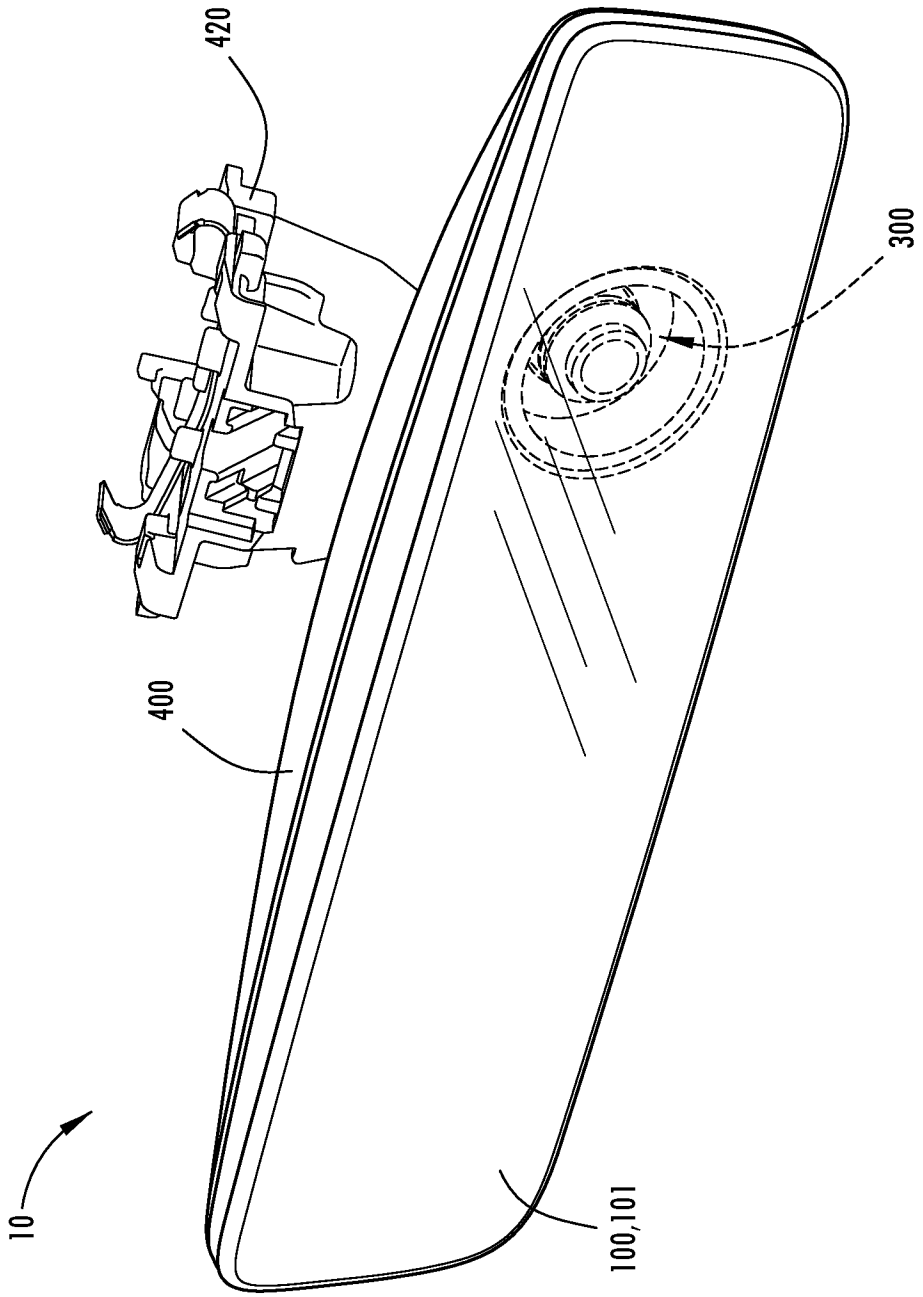

FIG. 1

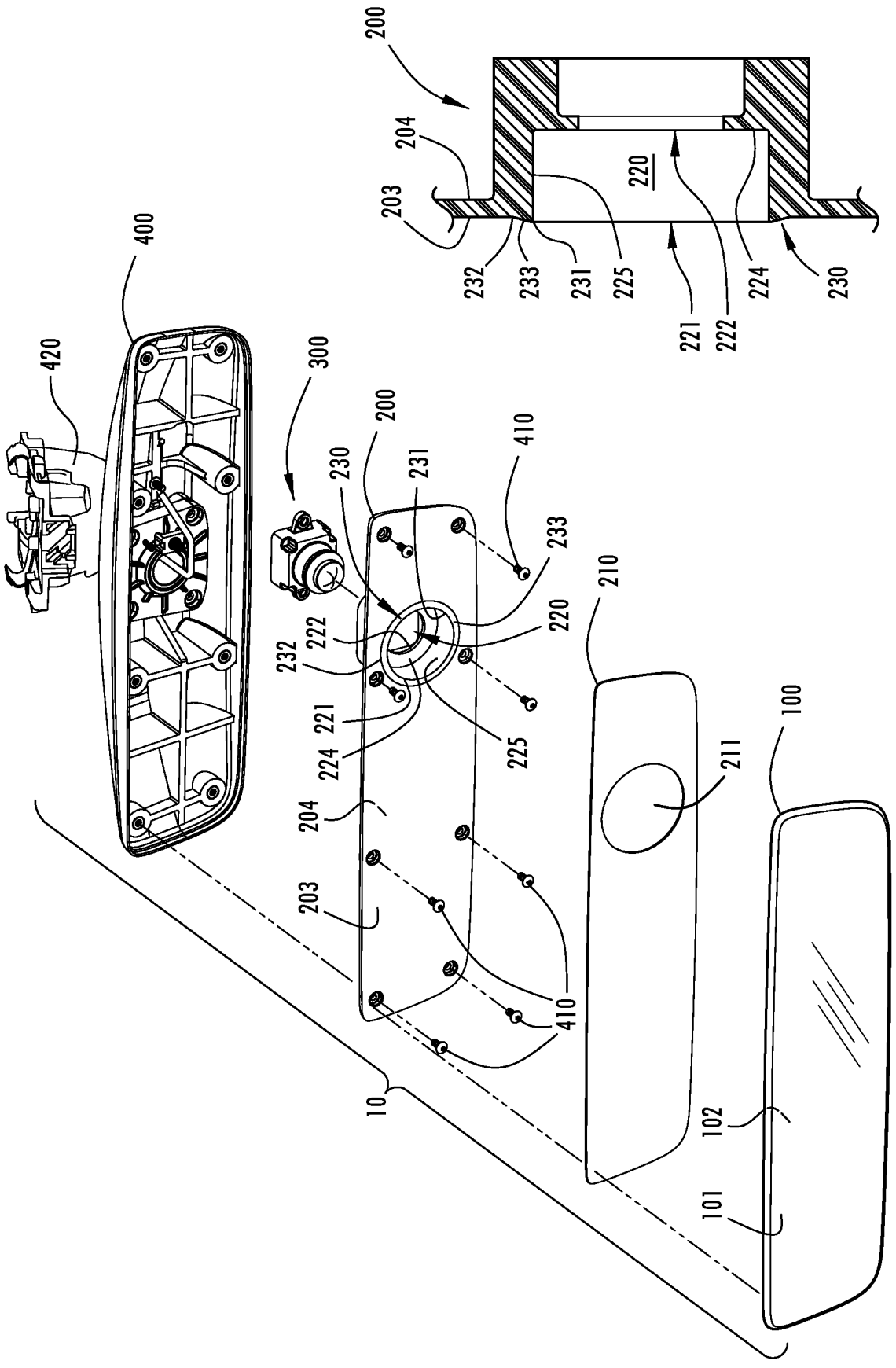
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FIG. 2B

FIG. 2A

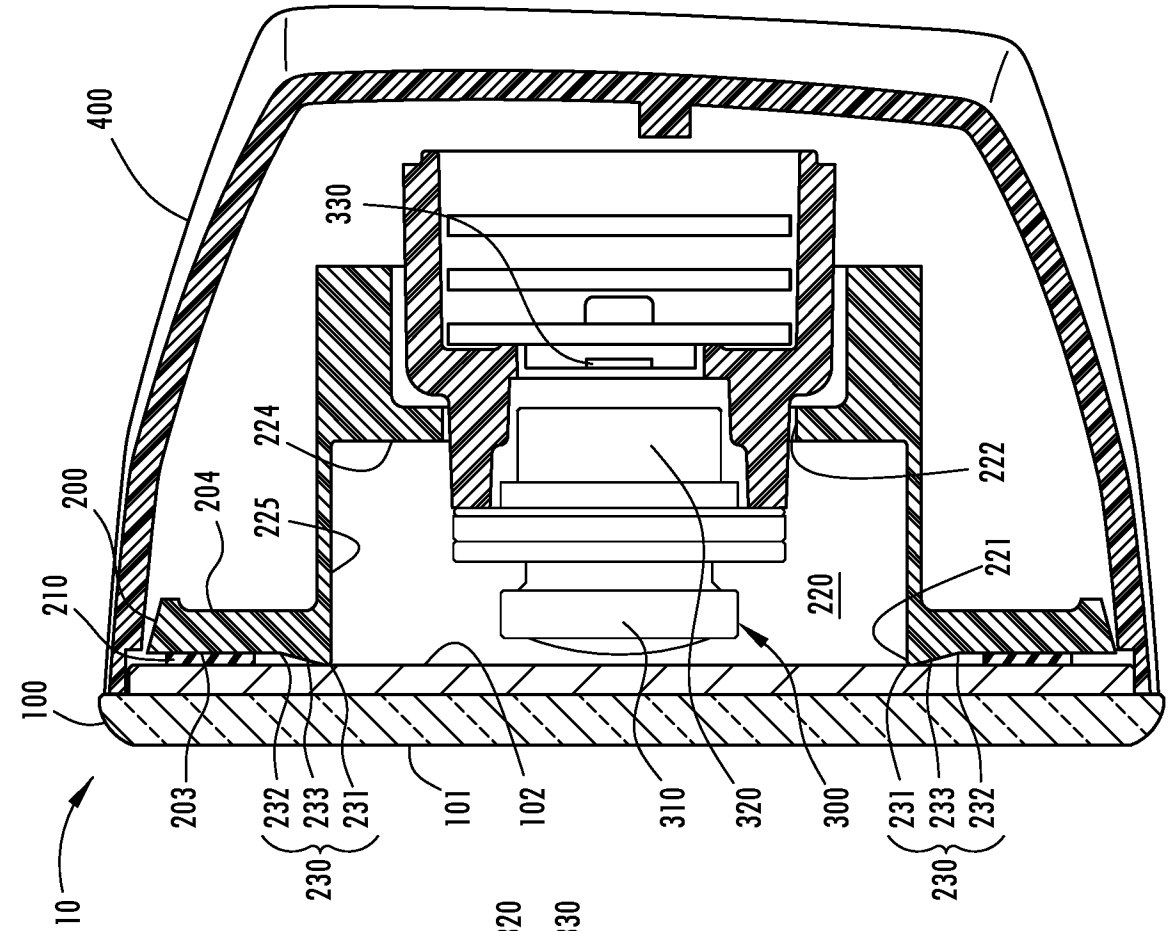
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FIG. 3B

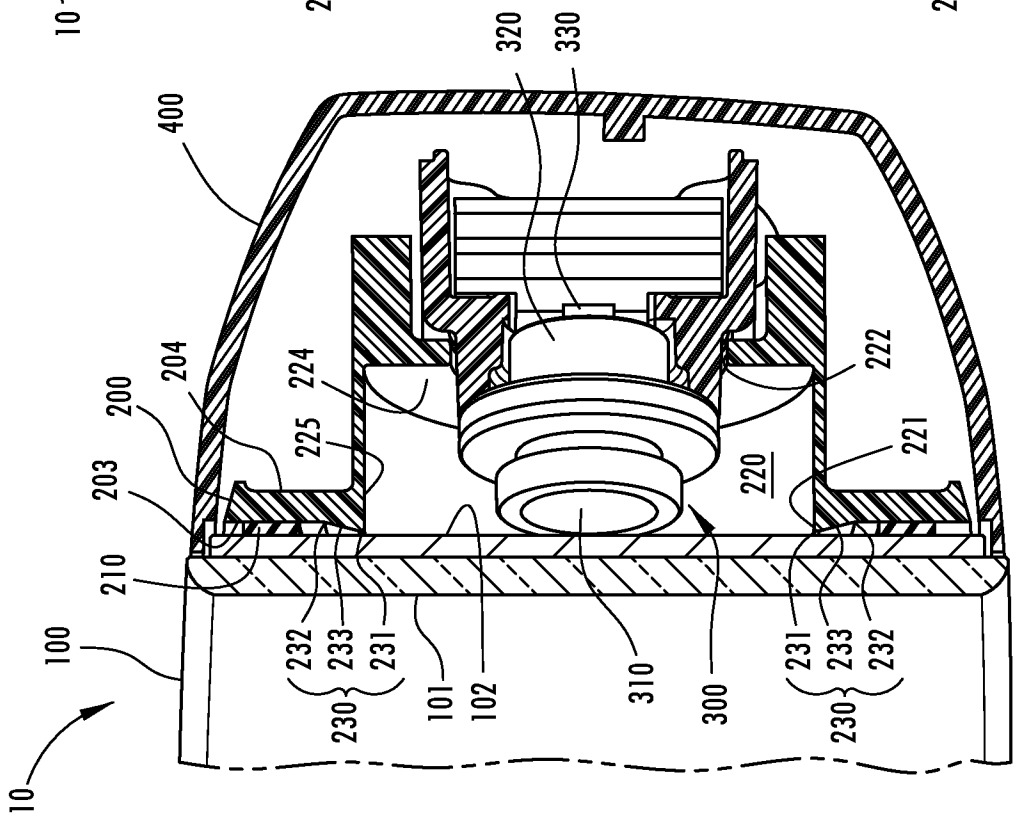
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FIG. 3A

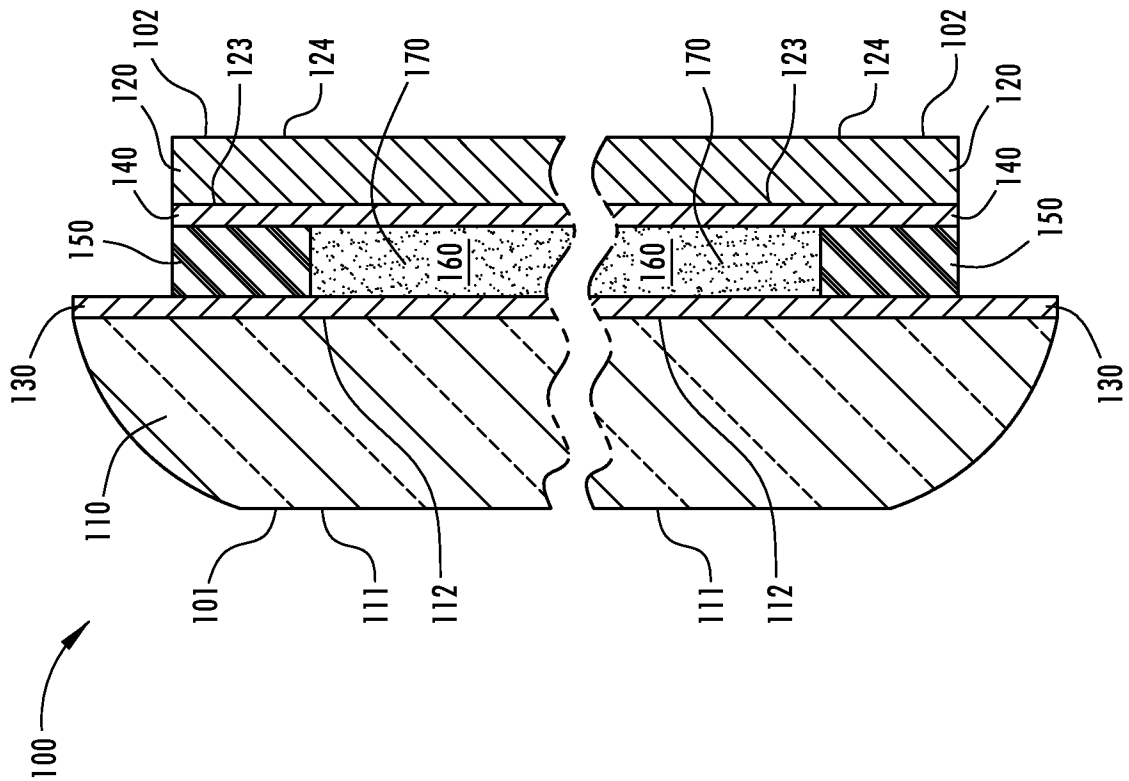

FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 2021/071434

A. CLASSIFICATION OF SUBJECT MATTER

B60R 1/04 *(2006.01)*
B60R 1/12 *(2006.01)*
G02F 1/15 *(2019.01)*

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B32B 17/00-17/10, B60R 1/00-1/12, 11/00-11/06, 21/00-21/08, B60K 35/00, G02B 13/00-13/26, 15/00-15/28, G02B 27/00-27/01, G02F 1/00-1/39, G06F 3/00-3/01, G08G 1/00-1/16, G12B 15/00-15/04, H04N 5/00-5/95, 7/00-7/56, G01H 11/00-11/08, F16F 15/00-15/36

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PatSearch (RUPTO Internal), USPTO, PAJ, Espacenet, Information Retrieval System of FIPS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	US 2003/0227699 A1 (KABUSHIKI KAISHA TOKAI-RIKA-DENKI-SEISAKUSHO) 11.12.2003, paragraphs [0041]-[0077], figures 1-6	1-3, 9-16, 18 4-8, 17, 19-20
Y	US 2003/0016125 A1 (LANG-MEKRA NORTH AMERICA, LLC) 23.01.2003, paragraphs [0041]-[0083], figures 1-5	1-3, 9-16, 18
Y	US 2006/0203323 A1 (WILLIAM L. TONAR et al.) 14.09.2006, paragraphs [0010]-[0014], [0074]-[0077], фиг.1, 3, 5-7	14-15
Y	DE 102017217811 B4 (MAGNA MIRRORS HOLDING GMBH) 29.05.2019, paragraphs [0017]	16

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

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"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 November 2021 (10.11.2021)	25 November 2021 (25.11.2021)
Name and mailing address of the ISA/RU: Federal Institute of Industrial Property, Berezhkovskaya nab., 30-1, Moscow, G-59, GSP-3, Russia, 125993 Facsimile No: (8-495) 531-63-18, (8-499) 243-33-37	Authorized officer N. Bedretdinov Telephone No. 8(495)531-64-81

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