US 20210124146A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2021/0124146 A1**

(43) **Pub. Date: Apr. 29, 2021**

Jin et al.

(54) **LOW WAVEFRONT DISTORTION OPTICAL MOUNT FOR THIN OPTICAL COMPONENTS**

(71) Applicant: **Newport Corporation**, Irvine, CA (US)

(72) Inventors: **Wen Xu Jin**, Laguna Hills, CA (US); **Warren Booth**, Laguna Hills, CA (US)

(73) Assignee: **Newport Corporation**, Irvine, CA (US)

(21) Appl. No.: **17/070,039**

(22) Filed: **Oct. 14, 2020**

Related U.S. Application Data

(60) Provisional application No. 62/926,701, filed on Oct. 28, 2019.

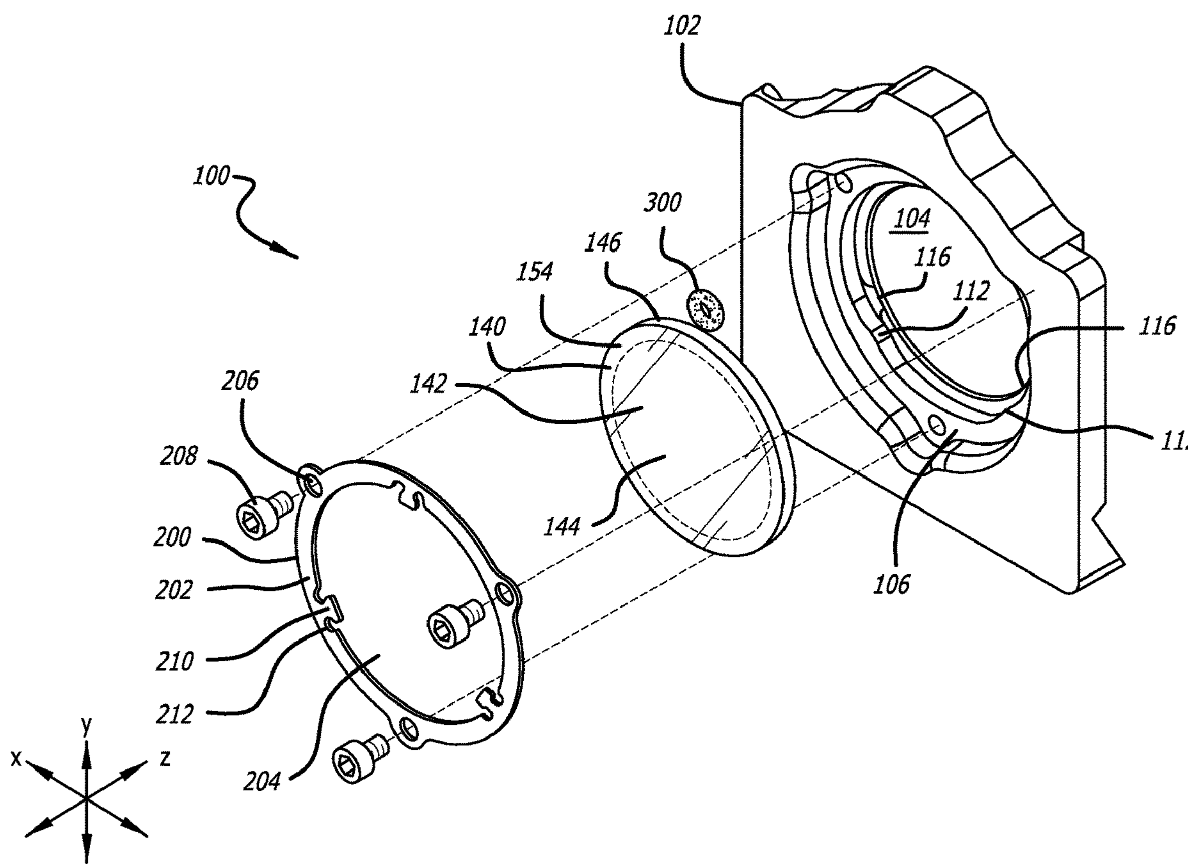
Publication Classification

(51) **Int. Cl.**
G02B 7/182 (2006.01)

(52) **U.S. Cl.**
CPC *G02B 7/182* (2013.01)

(57) **ABSTRACT**

The present application discloses embodiments of a mount for optical components configured to secure thin optical components while minimizing wavefront distortion effects. The optical mount may include at least one mount body with at least one optical component receiving recess formed therein, the at least one optical component receiving recess configured to receive at least one optical component therein, the optical component having at least one edge. The mount may include one or more elastomeric retention members configured to exert at least one compliant retention force to the edge of the optical component, thereby securely retaining the optical component within the optical component receiving recess.



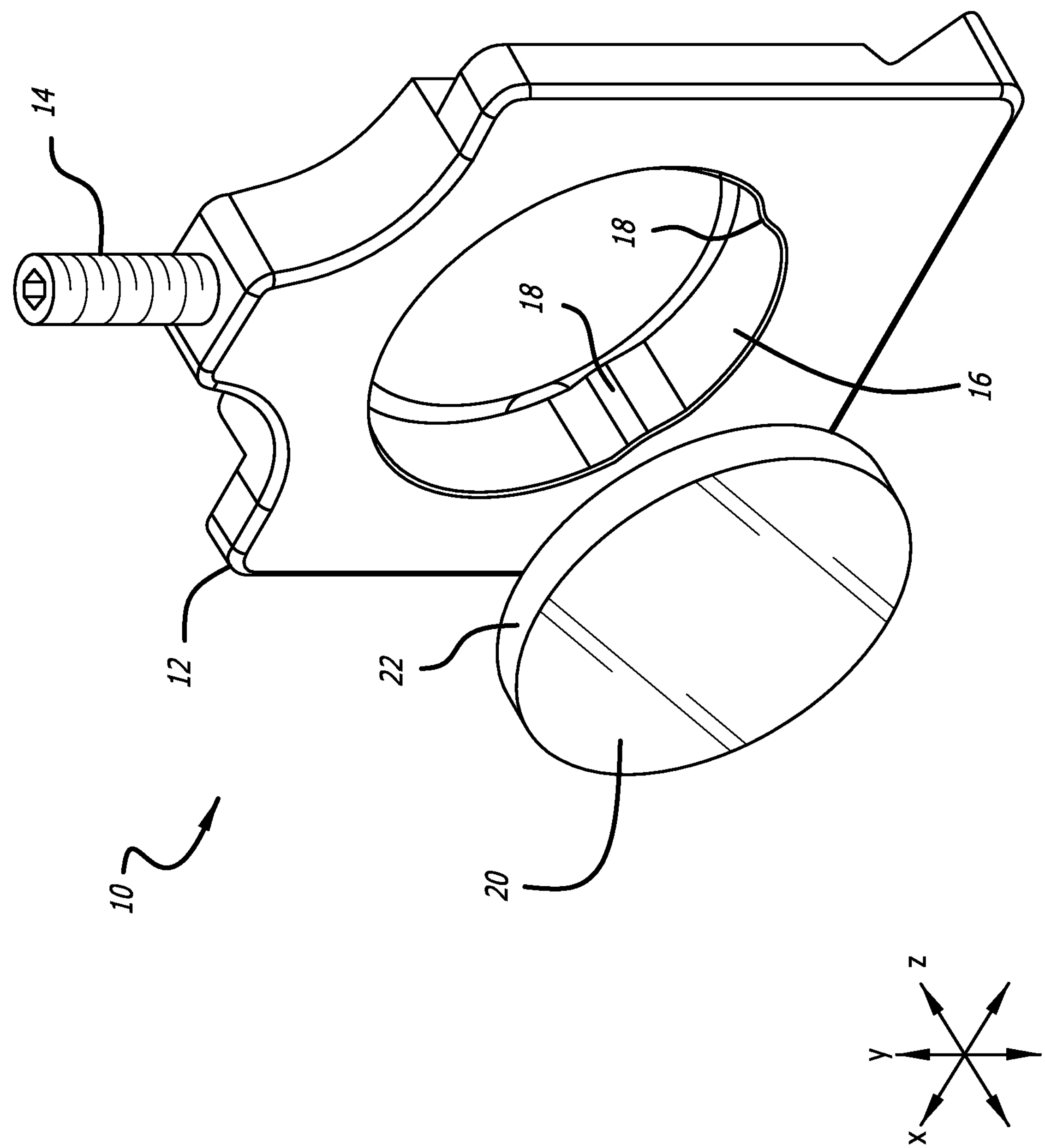


FIG. 1
(Prior Art)

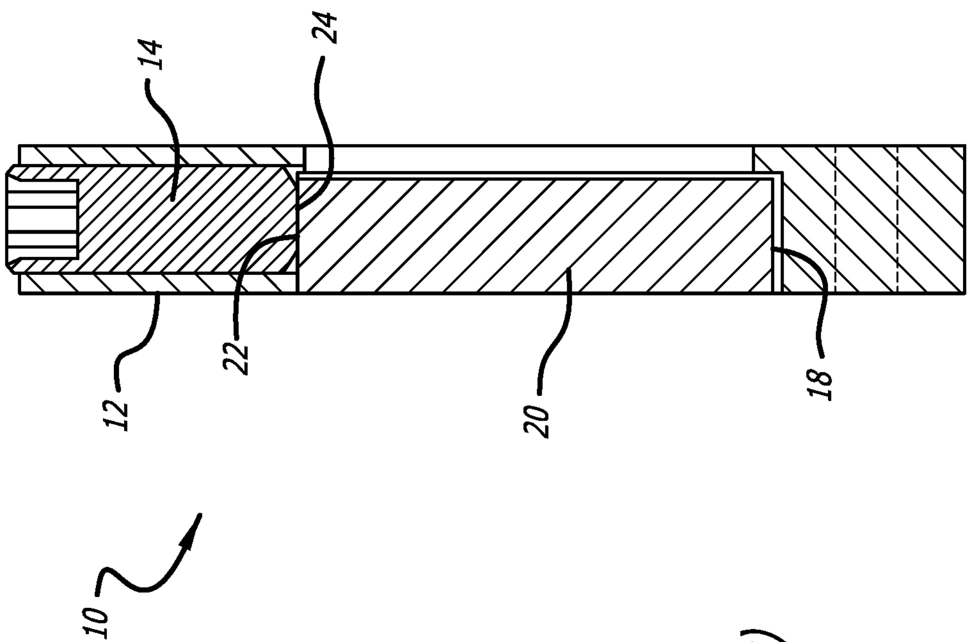


FIG. 2
(Prior Art)

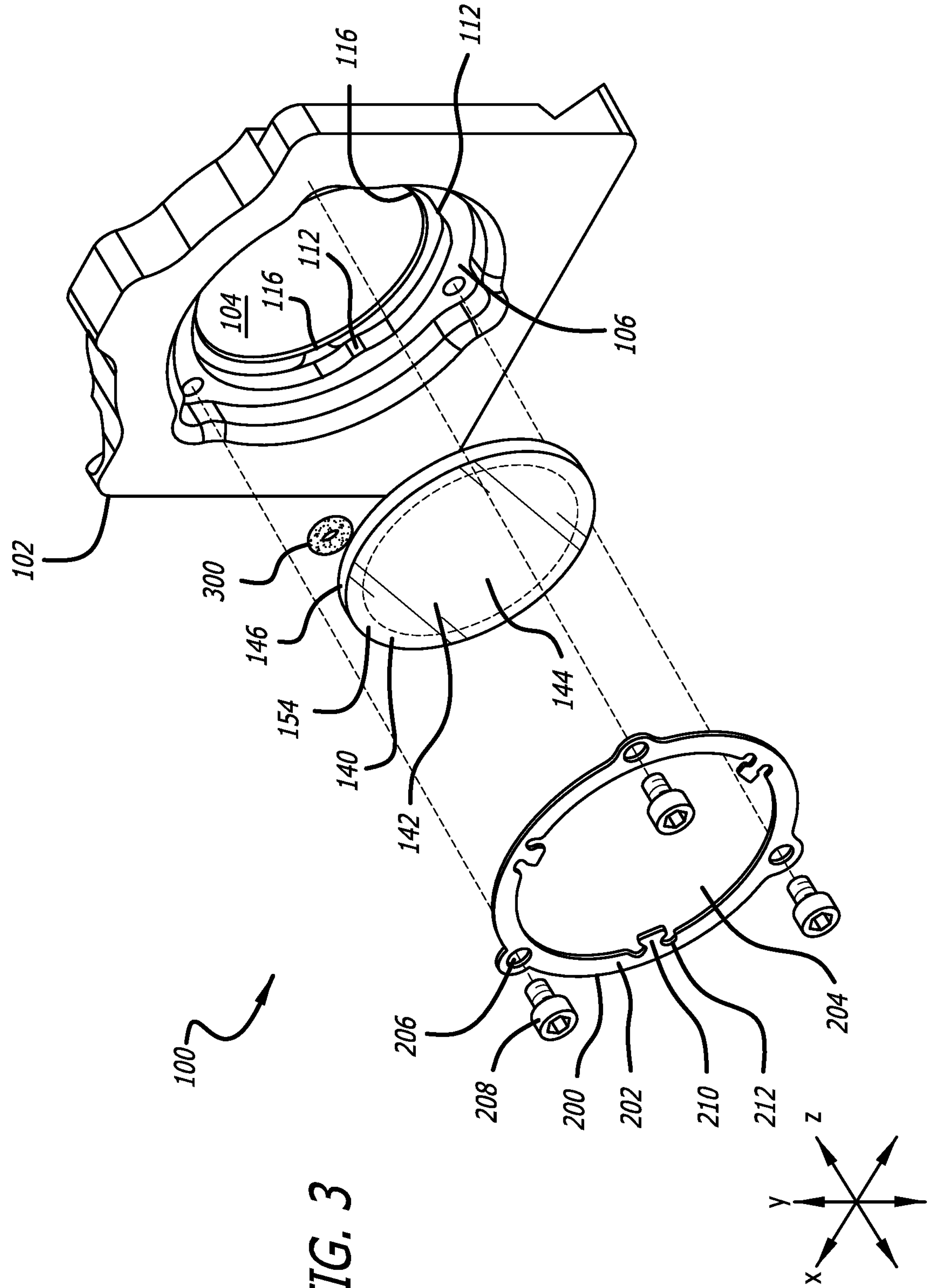

100
102
104
106
112
116
140
142
144
146
154
200
202
204
206
208
210
212
300
x
y
z

FIG. 3

FIG. 4

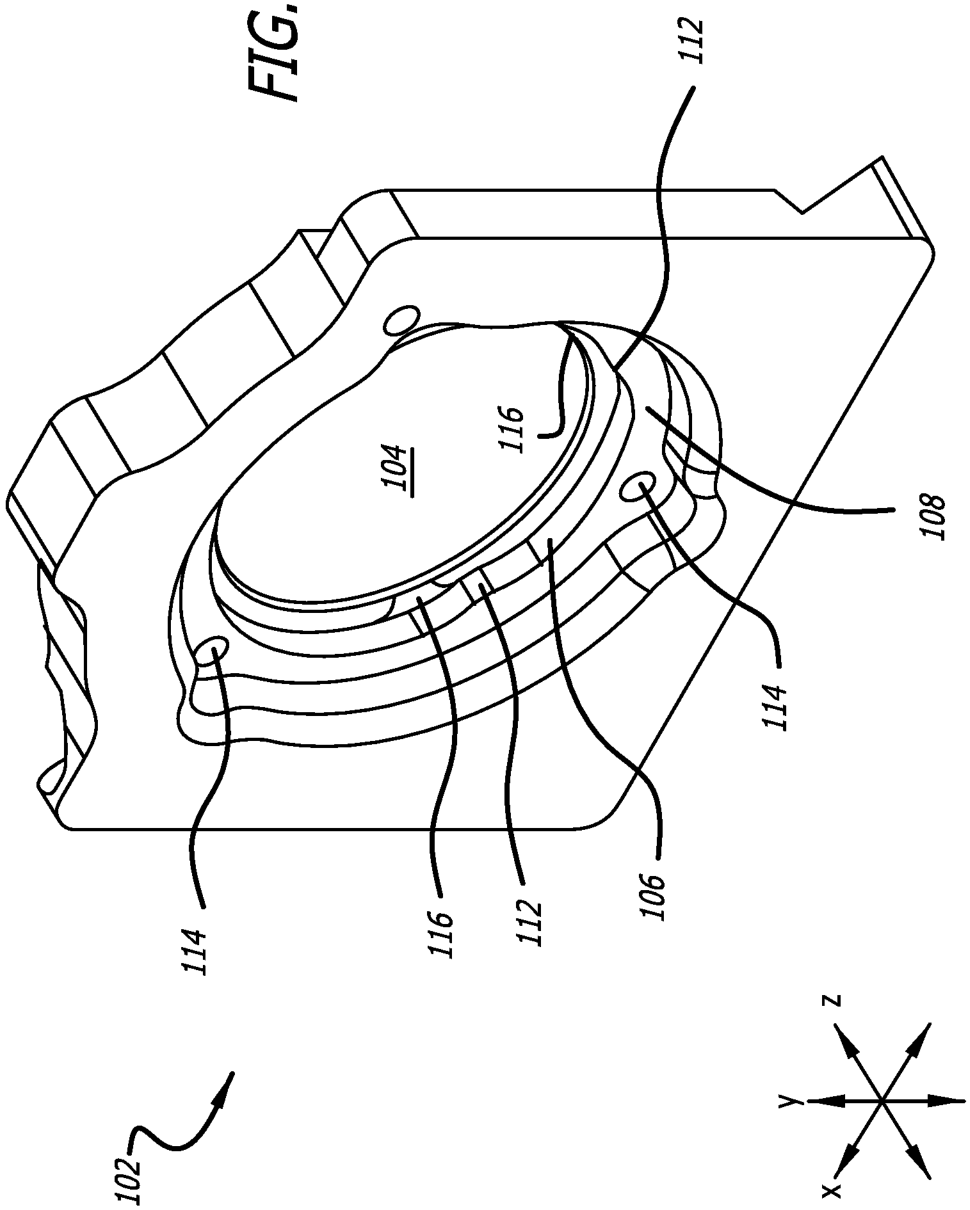
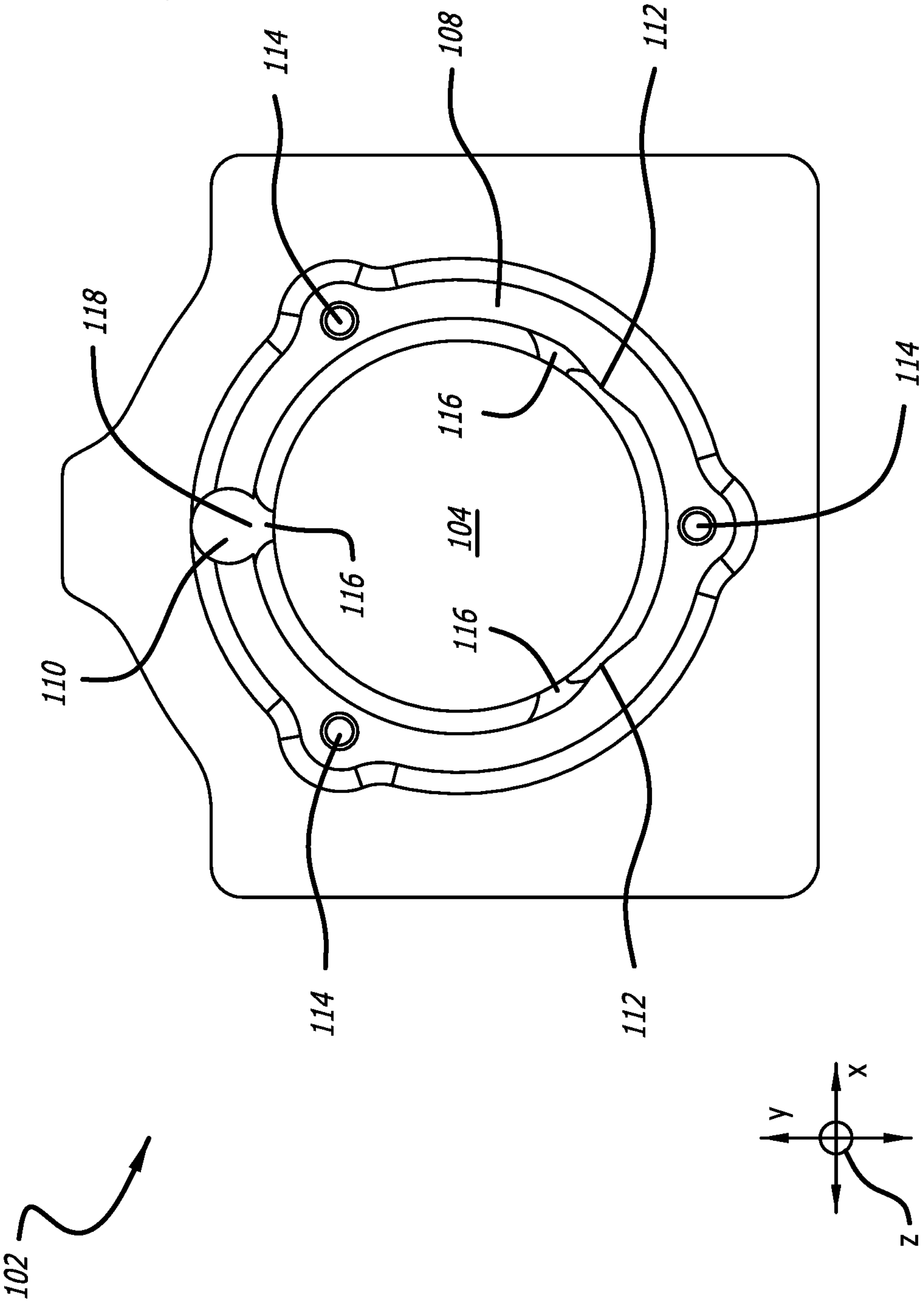


FIG. 5



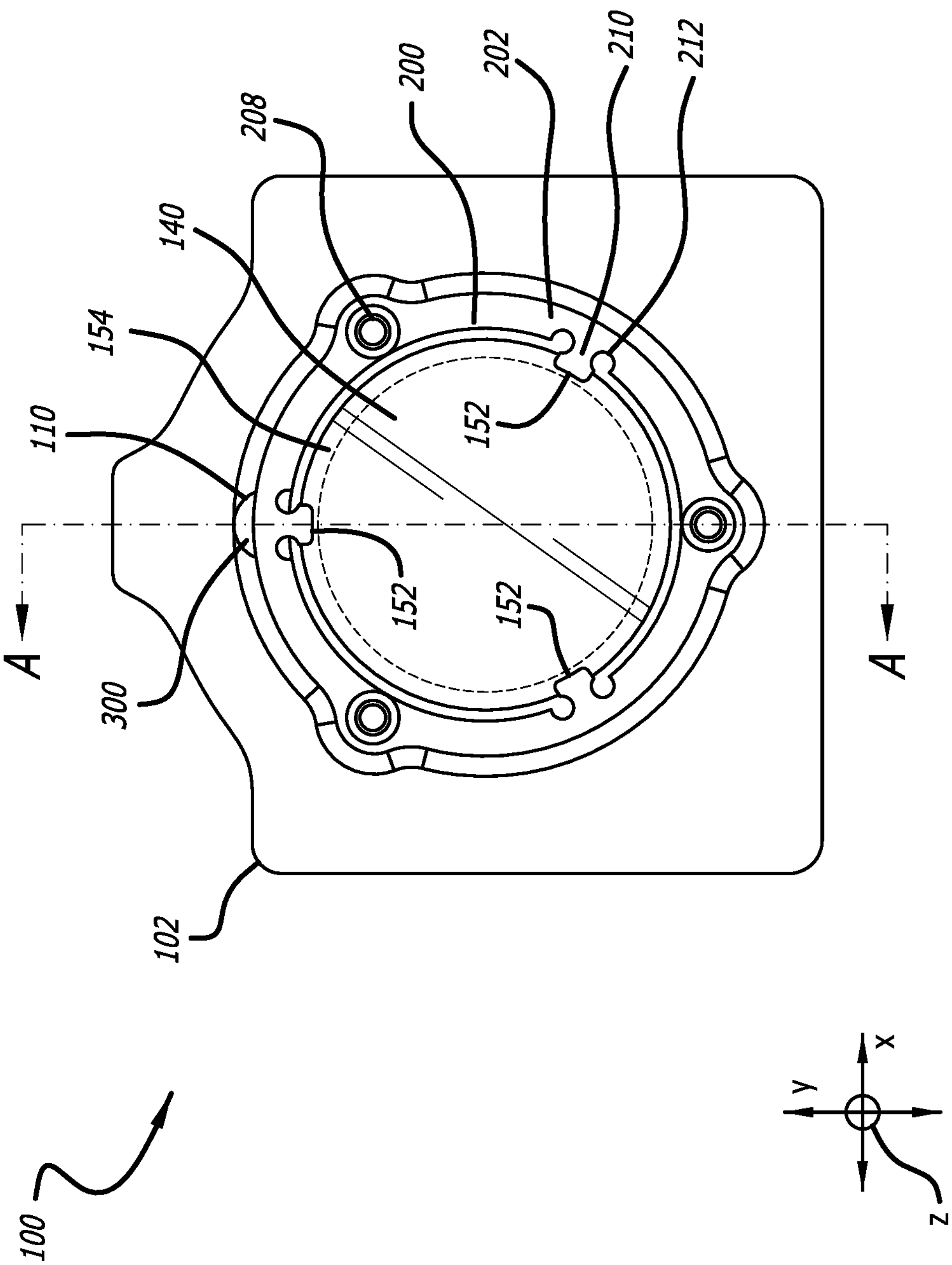


FIG. 6

FIG. 7

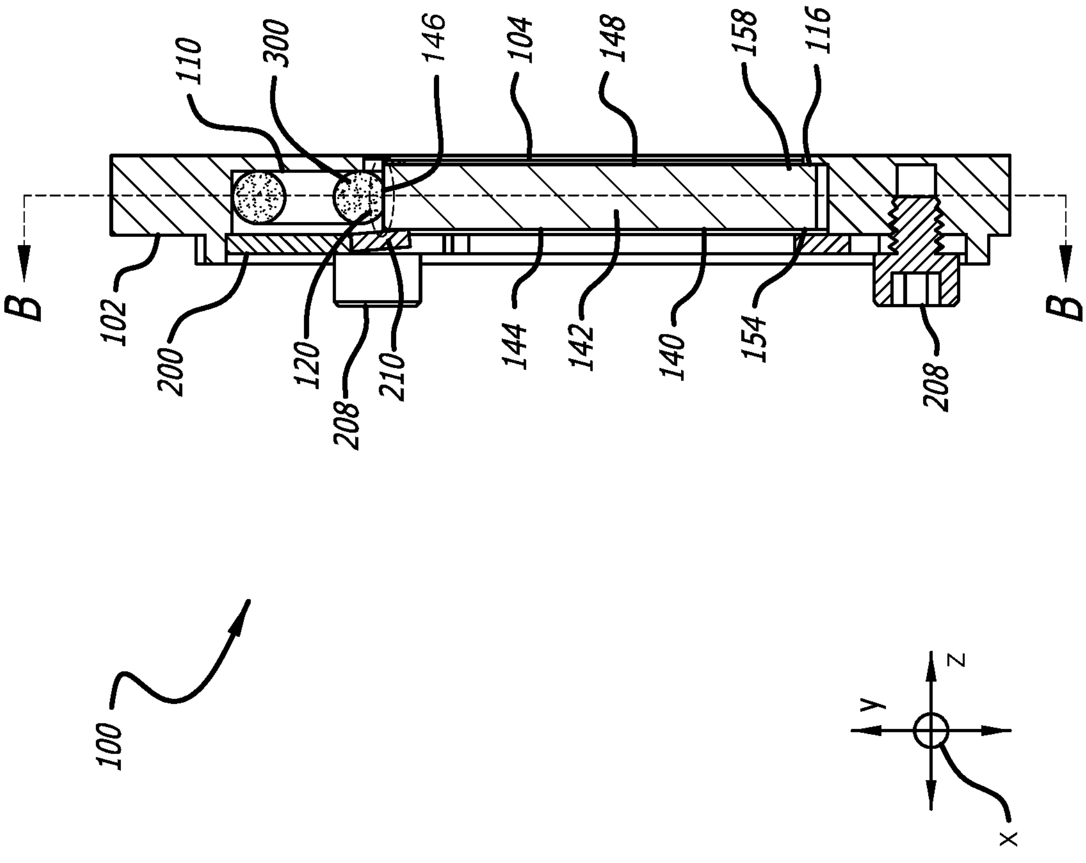
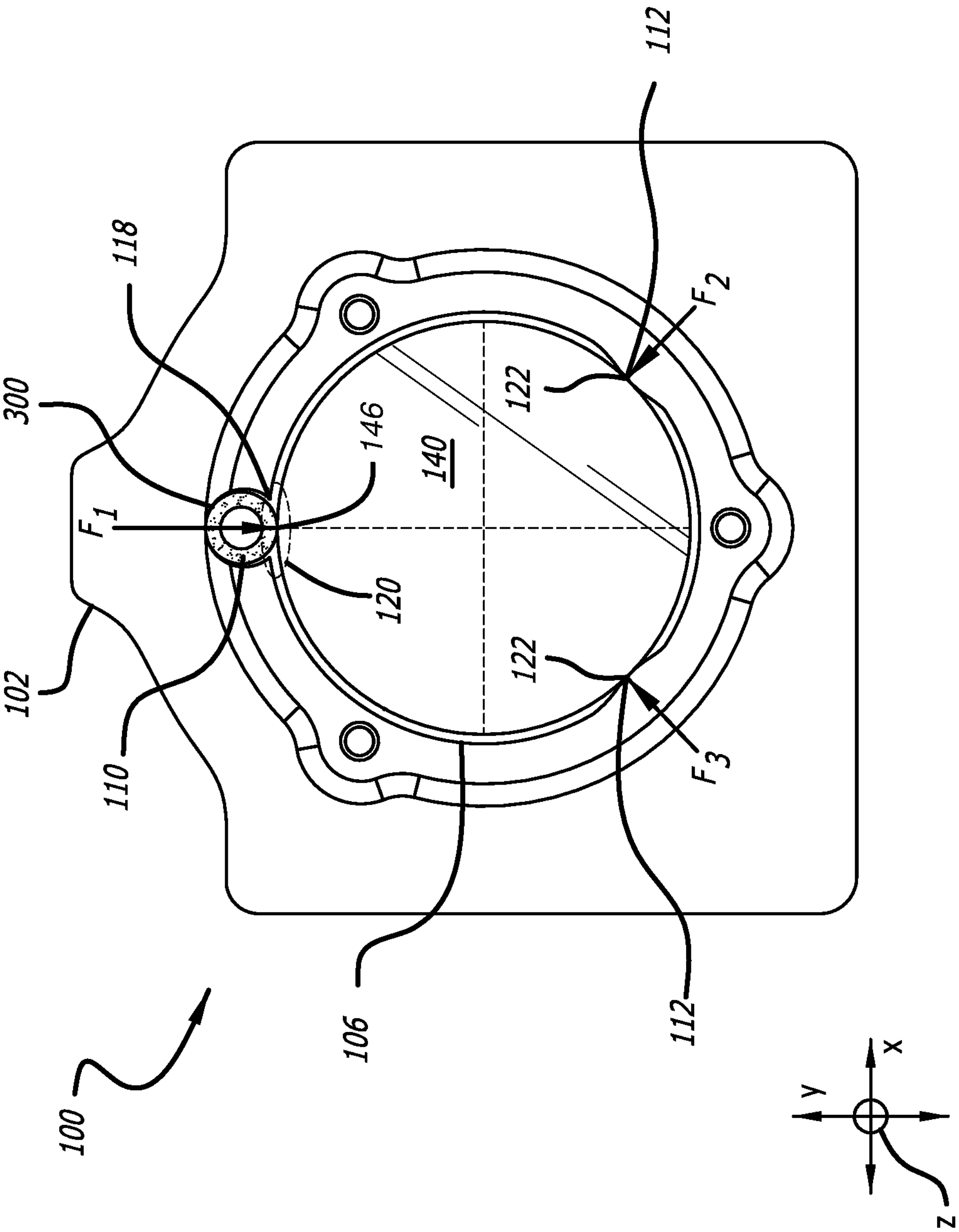

110
300
146
104
148
158
116
B
102
200
120
208
210
144
142
140
154
208
B
100
y
z
x

FIG. 8



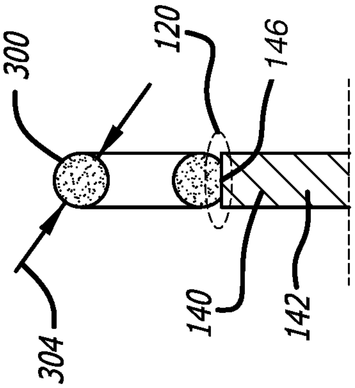


FIG. 9B

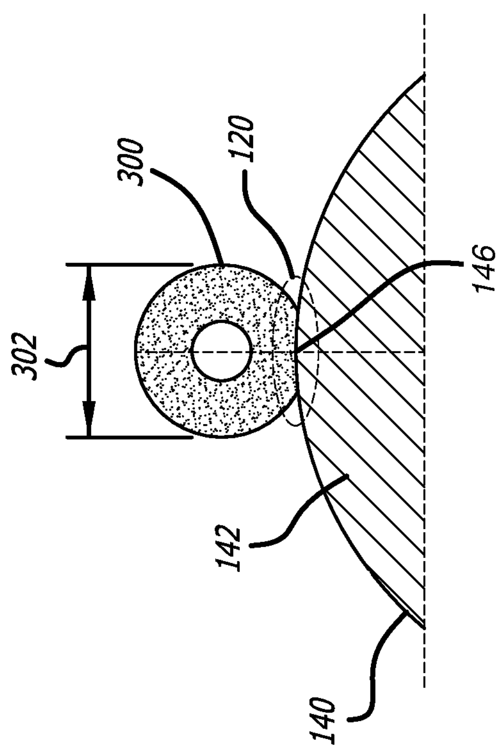


FIG. 9A

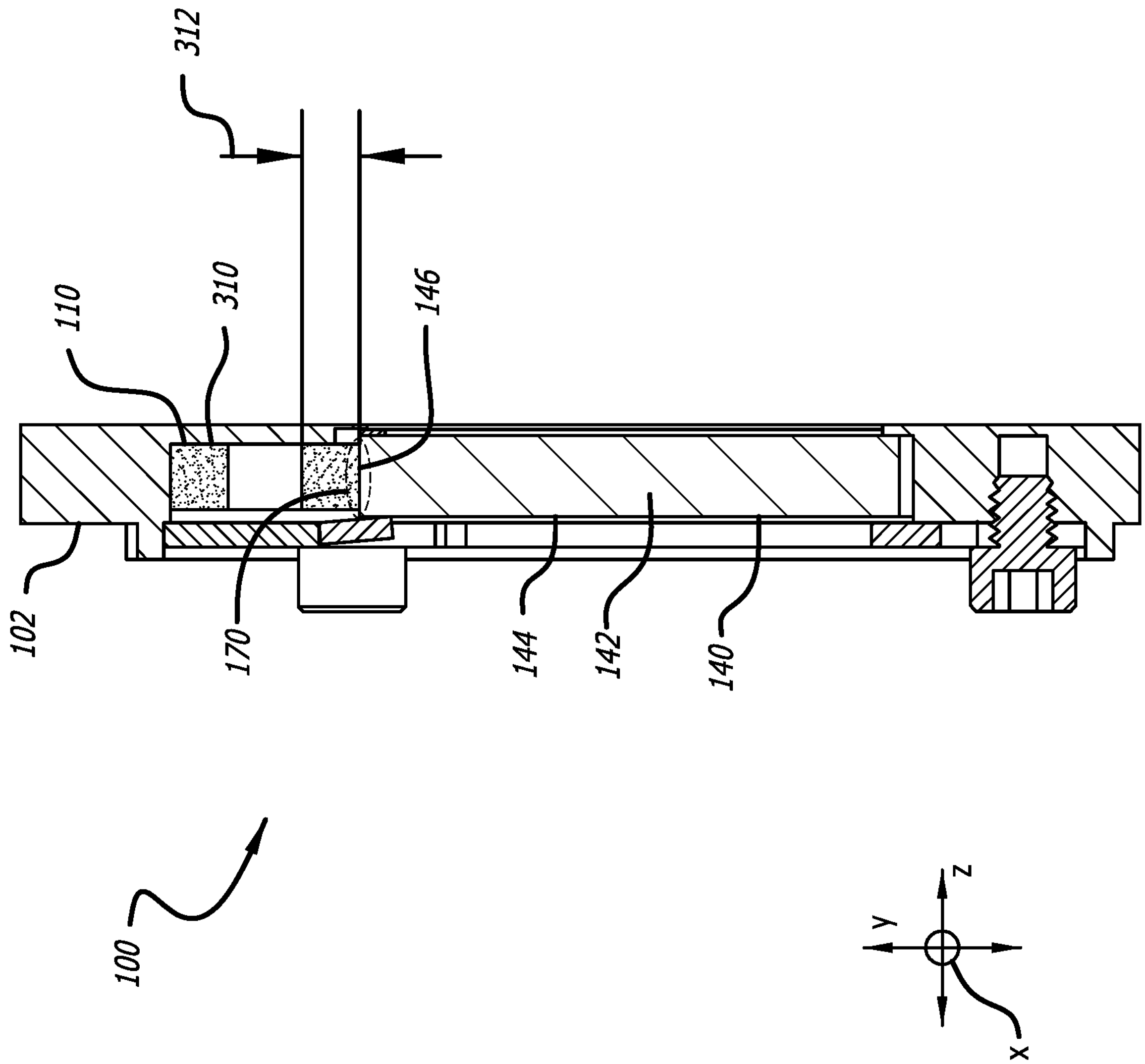


FIG. 10

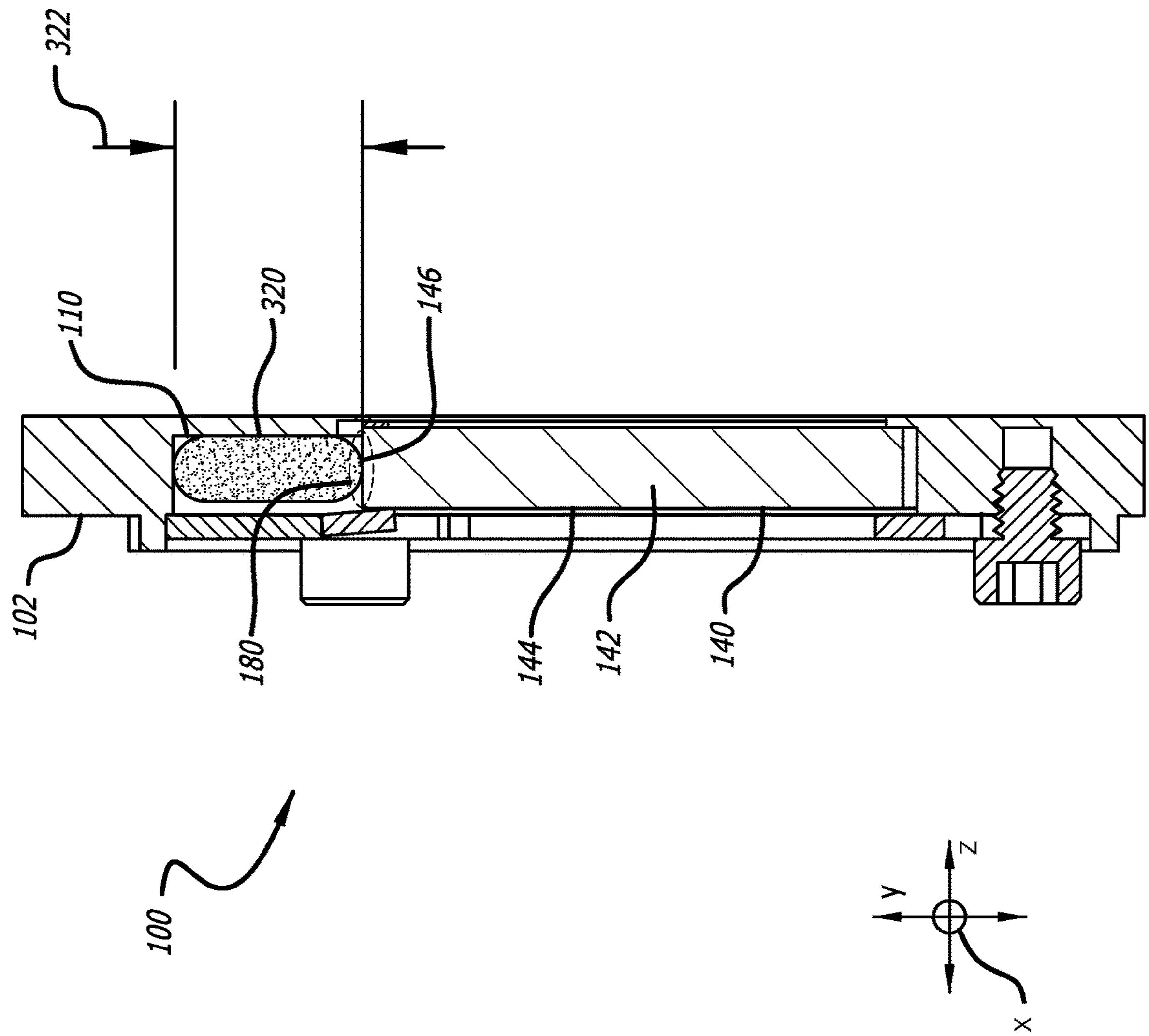


FIG. 11

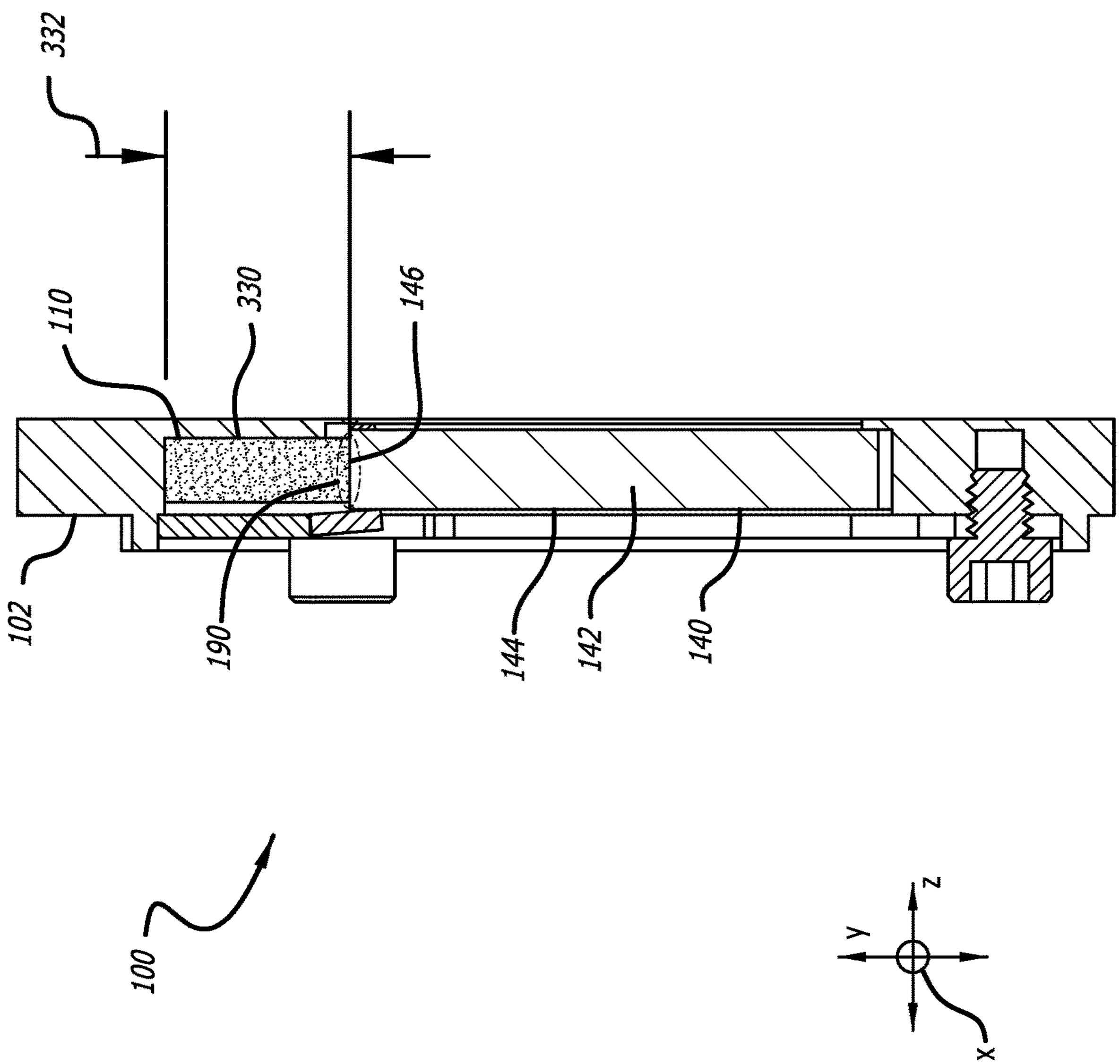


FIG. 12

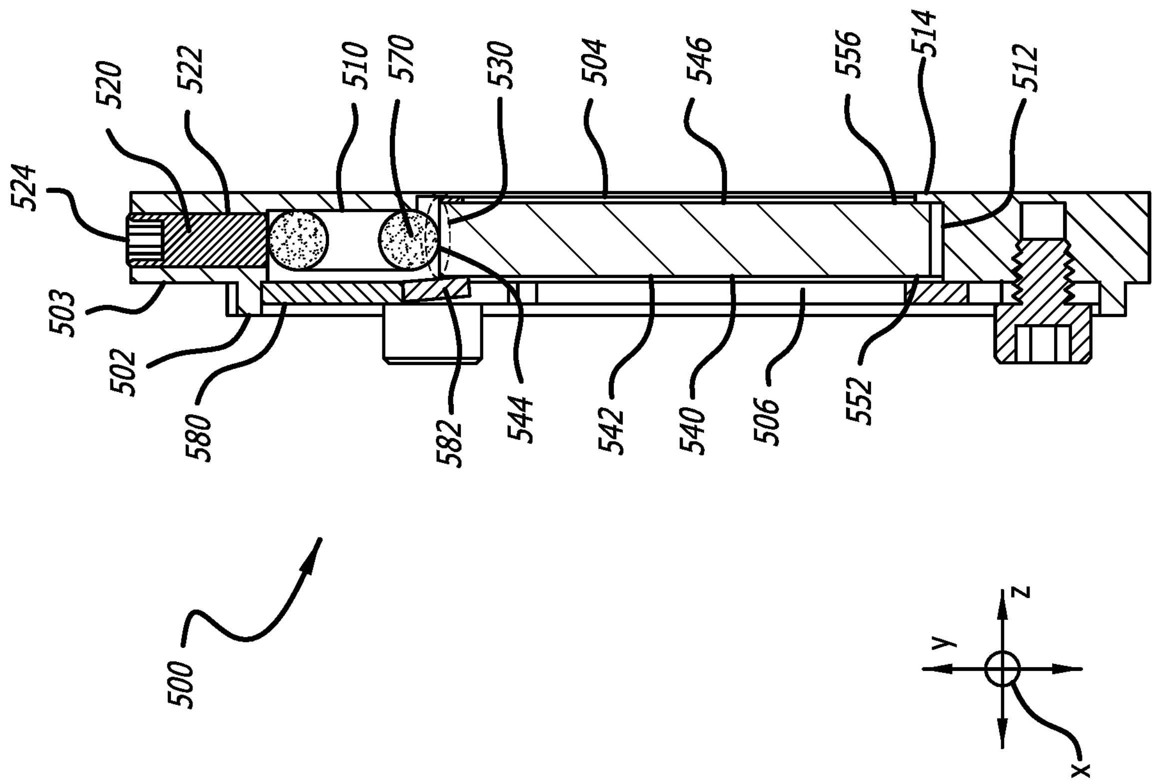

524
520
522
510
570
530
504
546
556
514
512
503
502
580
582
544
542
540
506
552
500
y
z
x

FIG. 13

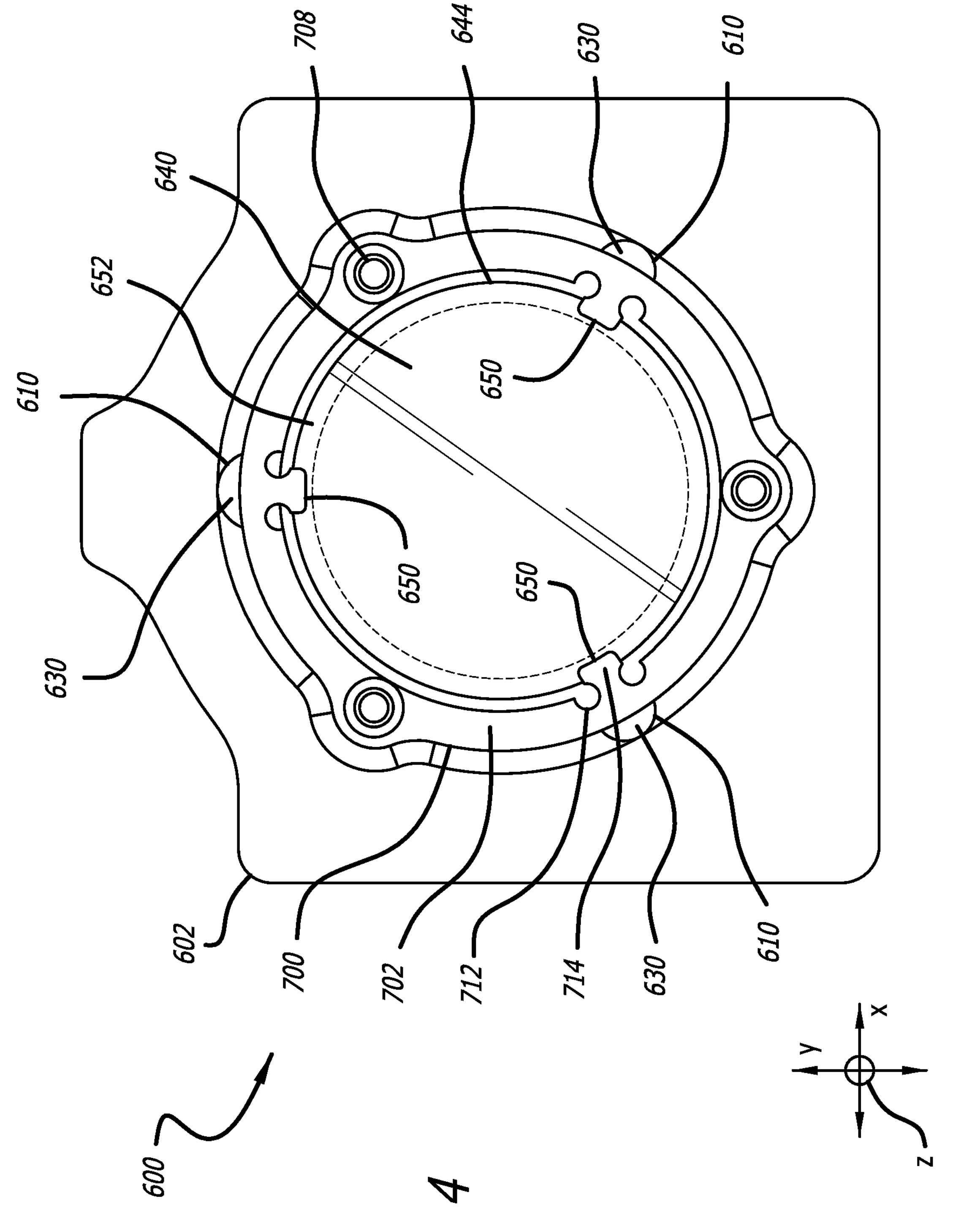

708
644
630
610
640
652
610
650
650
650
630
602
700
702
712
714
630
610
600
x
y
z

FIG. 14

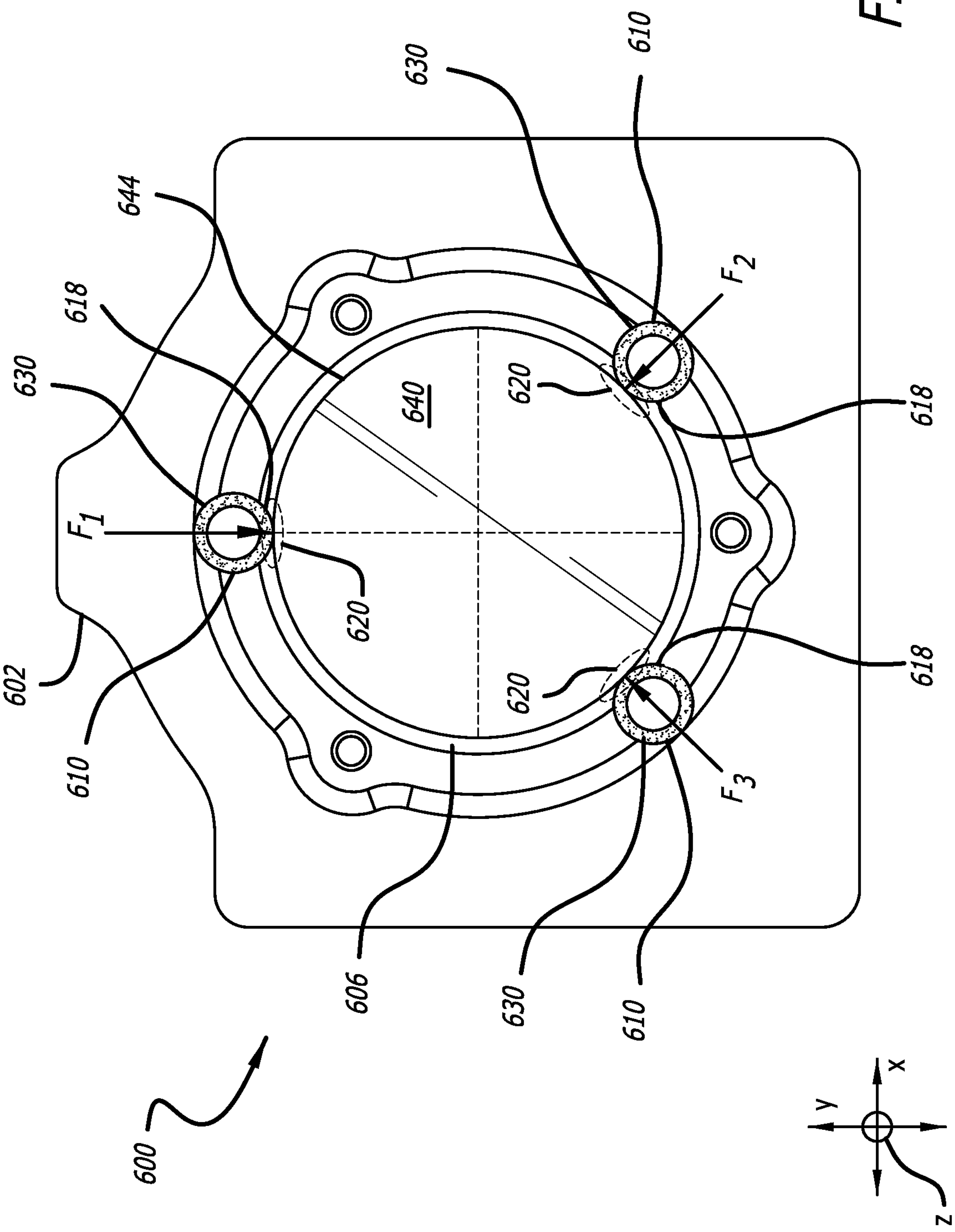


FIG. 15

LOW WAVEFRONT DISTORTION OPTICAL MOUNT FOR THIN OPTICAL COMPONENTS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority to U.S. Provisional Patent Application Ser. No. 62/926,701—entitled "Low Wavefront Distortion Optical Mount for Thin Optical Components", filed on Oct. 28, 2019, the contents of which are incorporated by reference herein.

BACKGROUND

[0002] Optical component mounts used in a wide variety of applications. Presently, they are used to hold various optical components such as lenses and mirrors that are used in optical and laser experiments, as components in laser systems, and in biomedical instrumentation. Some applications are very sensitive to wavefront distortions caused by stresses or distortions in the optical components induced by the retention devices used to hold the optical components in place in the optical component mount. While some optical component mount designs have reduced wavefront distortion, some shortcomings have been identified. For example, thin optical components are especially susceptible to stress and distortion, and retention devices may cause an unacceptable amount of stress in and distortion of the optical component, affecting the results of sensitive laser experiments or affecting the performance of laser systems or instruments that use such optical component mounts.

[0003] Thus, there is an ongoing need for an optical component mount that reduces or eliminates the wavefront distortion of thin optical components.

SUMMARY

[0004] The present application is directed to a novel mount for an optical component. In one embodiment, the optical component mount may include at least one mount body with at least one optical component receiving recess formed therein, the at least one optical component receiving recess configured to receive at least one optical component therein, the at least one optical component having at least one edge. The optical component mount may further include at least one elastomeric retention member configured to exert at least one compliant retention force to at least one edge of the optical component and securely retain the optical component within the optical component receiving recess in at least one first direction. In one embodiment, the elastomeric retention member has an annular shape with substantially circular cross-section. In another embodiment, the elastomeric retention member may have an annular shape with a rectangular cross-section. In another embodiment, the elastomeric retention member may have a solid oval cross-section. In another embodiment, the elastomeric retention member may have a rectangular cross-section. The elastomeric retention member may be formed from a material selected from a group consisting of butyl, nitrile (Buna-N), silicone, fluorocarbon, fluorosilicone, fluoroelastomer, urethane, polyurethane, perfluoroelastomer (FFKM), polytetrafluoroethylene (PTFE), tetrafluoroethylene propylene (TFE/P), ethylene-propylene (EPDM), neoprene, and chloroprene.

[0005] In another embodiment, the optical component mount may further include at least one adjustment member configured to exert at least one adjustable biasing force to the elastomeric retention member, thereby adjusting the compliant retention force applied to the edge of the optical component by the elastomeric retention member.

[0006] In another embodiment, the optical component mount may include at least one mount body with at least one optical component receiving recess formed therein, the at least one optical component receiving recess configured to receive at least one optical component therein, the at least one optical component having at least one edge. The optical component mount may further include at least one first elastomeric retention member configured to exert at least one compliant retention force to at least one edge of the optical component in at least one first direction, and at least one second elastomeric retention member configured to exert at least one compliant retention force to the edge of the optical component in at least one second direction, thereby securely retaining the optical component within the optical component receiving recess in at least one first direction and at least one second direction.

[0007] In another embodiment, the optical component mount may further include at least one third elastomeric retention member configured to exert at least one compliant retention force to the edge of the optical component at at least one contact area and securely retain the optical component in at least one third direction.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Various embodiments of a low-wavefront-distortion optical mount for thin optical components will be explained in more detail by the accompanying drawings, wherein:

[0009] FIG. **1** shows an exploded perspective view of a prior art optical component mount;

[0010] FIG. **2** shows a cross-sectional view of the prior art optical component mount shown in FIG. **1**;

[0011] FIG. **3** shows an exploded perspective view of an embodiment of a low-wavefront-distortion optical component mount for thin optical components;

[0012] FIG. **4** shows a perspective view of the embodiment of the mount body of the optical component mount shown in FIG. **3**;

[0013] FIG. **5** shows a front view of the embodiment of the mount body of the optical component mount shown in FIGS. **3** and **4**;

[0014] FIG. **6** shows a front view of the embodiment of the optical mount shown in FIG. **3**;

[0015] FIG. **7** shows a cross-sectional view of the embodiment of the optical component mount shown in FIGS. **3**-**6**;

[0016] FIG. **8** shows a front view of the embodiment of the optical component mount shown in FIGS. **6** and **7**;

[0017] FIGS. **9**A and **9**B show detailed views of the retention member and the optical component of the embodiment of the optical component mount shown in FIGS. **3**-**8**;

[0018] FIG. **10** shows a cross-sectional view of an alternate embodiment of a low-wavefront-distortion optical component mount for thin optical components;

[0019] FIG. **11** shows a cross-sectional view of an alternate embodiment of a low-wavefront-distortion optical component mount for thin optical components;

[0020] FIG. **12** shows a cross-sectional view of an alternate embodiment of a low-wavefront-distortion optical component mount for thin optical components;

[0021] FIG. **13** shows a cross-sectional view of an alternate embodiment of a low-wavefront-distortion optical component mount for thin optical components;

[0022] FIG. **14** shows a front view of an alternate embodiment of a low-wavefront-distortion optical component mount for thin optical components; and

[0023] FIG. **15** shows a front view of the embodiment of the optical component mount shown in FIG. **14**.

DETAILED DESCRIPTION

[0024] The present application is directed to an optical component mount and related devices that are configured to provide retention of thin optical components with reduced stresses on the optical component. The various embodiments described herein are directed to optical component mounts and similar devices, those skilled in the art will appreciate that the components and retention devices described herein may be used in any variety of applications to prevent undesirable stresses of the optical component.

[0025] Example embodiments are described herein with reference to the accompanying drawings. Unless otherwise expressly stated, in the drawings the sizes, positions, etc., of components, features, elements, etc., as well as any distances therebetween, are not necessarily to scale, but are exaggerated for clarity. In the drawings, like numbers refer to like elements throughout. Thus, the same or similar numbers may be described with reference to other drawings even if they are neither mentioned nor described in the corresponding drawing. Also, even elements that are not denoted by reference numbers may be described with reference to other drawings.

[0026] The terminology used herein is for the purpose of describing particular exemplary embodiments only and is not intended to be limiting. Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art. As used herein, the singular forms "a," "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It should be recognized that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. Unless indicated otherwise, terms such as "first," "second," etc., are only used to distinguish one element from another. For example, one coupler could be termed a "first coupler" and similarly, another node could be termed a "second coupler", or vice versa.

[0027] Unless indicated otherwise, spatially relative terms, such as "below," "beneath," "lower," "above," and "upper," "opposing," and the like, may be used herein for ease of description to describe one element or feature's relationship to another element or feature, as illustrated in the FIGS. It should be recognized that the spatially relative terms are intended to encompass different orientations in addition to the orientation depicted in the FIGS. For example, if an object in the FIGS. is turned over, elements described as "below" or "beneath" other elements or features would then be oriented "above" the other elements or features. Thus, the exemplary term "below" can encompass both an orientation of above and below. An object may be otherwise oriented (e.g., rotated 90 degrees or at other orientations) and the spatially relative descriptors used herein may be interpreted accordingly.

[0028] An XYZ reference coordinate system graphic is shown in the bottom left corner of some of the FIGS., laying out the basic orientation of various axes, directions, and degrees of freedom used in the present disclosure. This graphic is intended only to orient the reader of the patent for ease of understanding and to provide clarity and contrast between the location and relative movement of the various elements, components and systems described herein. This graphic is not intended to mean that any of the axes, directions of motion, degrees of freedom, or angular orientations of any of the disclosed components overlap each other or are orthogonal to each other.

[0029] The paragraph numbers used herein are for organizational purposes only and, unless explicitly stated otherwise, are not to be construed as limiting the subject matter described. It will be appreciated that many different forms, embodiments and combinations are possible without deviating from the spirit and teachings of this disclosure and so this disclosure should not be construed as limited to the example embodiments set forth herein. Rather, these examples and embodiments are provided so that this disclosure will be thorough and complete, and will convey the scope of the disclosure to those skilled in the art.

[0030] FIGS. **1** and **2** show views of a prior art optical component mount **10**. As shown, the optical component mount **10** includes a mount body **12** with a recess **16**. The optical component **20** may be retained in the recess **16** by a set screw **14** that applies a biasing force to an edge **22** of the optical component **20** to urge the edge **22** against two support surfaces **18**. Generally, the mount body **12** and the set screw **14** are made of metal. As such, when the set screw **14** contacts the edge **22** at a contact region **24**, localized compressive stresses and stress-induced birefringence (a change in the refractive index of an optical material due to stress gradients) may be created within the optical component **20**, resulting in optical wavefront distortions in the surfaces and body of the optical component **20**. In addition, the force exerted by the set screw **14** may warp the optical component **20**, also causing optical wavefront distortions in the surfaces of the optical component **20**. If changes in ambient temperature cause thermal expansion or contraction of the mount body **12**, the set screw **14** and the optical component **20**, the stresses in the optical component **20** may change, causing changes in the optical performance of the optical component **20**.

[0031] FIG. **3** shows an exploded perspective view of an exemplary embodiment of an improved optical component mount **100** configured to reduce stresses in thin optical components. As shown, the optical component mount **100** (also referred to herein as the "optical mount **100**") may include at least one mount body **102**. Exemplary materials for the mount body **102** include, without limitation, aluminum, stainless steel, plastics, alloys, or composite materials. The mount body **102** may also be formed from a variety of materials having low coefficients of thermal expansion, such as Kovar, Invar, Zerodur, or the like or any combination thereof. Those skilled in the art will appreciate that the mount body **102** may be formed of any variety of materials. As shown, the mount body **102** may include at least one optical component receiving recess **106** and at least one aperture **104** formed therein, the optical component receiving recess **106** configured to receive at least one optical component **140** therein. Optionally, the mount body **102** may not have an aperture. In the illustrated embodiment, the optical component receiving recess **106** may be configured to accept a single optical component, though those skilled in the art will appreciate that the optical component receiving recess **106** may be configured to hold any number of optical components **140**. Further, as shown in FIGS. **3-5**, one or more support surfaces **112** configured to support the optical component **140** thereon may be formed on the mount body **102**. In the illustrated embodiment, the mount body **102** includes two support surfaces **112** sufficient to support the optical component **140** in the X- and Y-axes. In the illustrated embodiment, the support surfaces **112** are two rounded raised protrusions extending radially inward into the optical component receiving recess **106**. Those skilled in the art will appreciate that the mount body **102** may have any number of support surfaces **112** formed thereon. In another embodiment, the support surfaces **112** may be made of materials such as plastics or elastomers that are mounted on the mount body **102**. In another embodiment, the mount body **102** may have no support surfaces **112** formed thereon, and the optical component **140** may be supported by the wall of the optical component receiving recess **106**.

[0032] In the illustrated embodiment, as shown in FIGS. **3**, **4** and **7**, the optical component **140** is a circular mirror including at least one body **142**, at least one edge **146**, at least one first surface **144** with at least one first periphery **154**, and at least one second surface **148** with at least one second periphery **158**. Optionally, the optical component **140** may be a lens, waveplate, polarizes, grating, filter or the like or any combination thereof. Also, the shape of the optical component **140** may be rectangular, square, or any variety of shapes. Those skilled in the art will appreciate that the optical mount **100** may be configured to accept and retain any variety of optical components. The optical mount **100** may further include at least one elastomeric retention member **300** (also referred to herein as the "retention member **300**) located within at least one retention member recess **110** formed in the mount body **102** (see FIGS. **5** and **6**). In the illustrated embodiment, the elastomeric retention member **300** is configured to engage the edge **146** of the optical component **140** with a complaint retention force that is proportional to its durometer and the amount of deflection of the retention member **300** to urge the edge **146** against the support surfaces **112**, thereby securely retaining the optical component **140** in the X- and Y-directions. Optionally, the elastomeric retention member **300** may be configured to engage the first periphery **154**, second periphery **158** of the optical component **140**, or both.

[0033] As shown in FIGS. **3-5**, one or more raised regions **116** may be formed on the mount body **102**, the raised regions **116** being configured to contact the second periphery **158** of the second surface **148** of the optical component **140** and retain the optical component **140** within the optical component receiving recess **106** in the Z-direction. In the illustrated embodiment, the mount body **102** includes three raised regions **116**, although those skilled in the art will appreciate that any number of raised regions may be formed on the mount body **102**. As shown in FIG. **5**, one or more recess opening **118** may be formed in the mount body **102** between the retention member recess **110** and the optical component receiving recess **106**, the recess openings being configured to allow contact between the retention member **300** and the optical component **140** along the edge **146**, the first periphery **154**, the second periphery **158**, or any combination thereof.

[0034] As shown in FIGS. **3**, **6** and **7**, the mount **100** may include at least one retention device **200** configured to contact the first periphery **154** of the first surface **144** of the optical component **140** at contact points **152**, thereby securely retaining the optical component **140** within the optical component receiving recess **106** in the Z-direction. The retention device **200** may also be configured to securely retain the retention member **300** within the retention member recess **110**. As shown in FIG. **3**, the retention device **200** may include a body **202** with at least one aperture **204** formed therein. One or more flexure members **210** may extend from the body **202** into the aperture **204**. One or more reliefs **212** may be formed in the body **202** on either side of the flexure members **210**, the reliefs **212** configured to reduce localized stress in the body **202** and flexure members **210** at the point where the flexure member **210** meets the body **202**. The reliefs **212** may also be operative to reduce the stiffness of the flexure member **210** at the contact points **152** on the first periphery **154** of the optical component **140**. In the illustrated embodiment, three flexure members **210** are formed on the body **202**, though those skilled in the art will appreciate that any number of flexure members **210** may be formed on the body **202**. One or more fastener passages **206** may be formed in the body **202**, the fastener passages **206** configured to accept one or more fasteners **208** to traverse therethrough and engage one or more fastener passages **114** formed in the mount body **102** so that the retention device **200** may be securely retained against the surface **108** formed in the mount body **102**. In the illustrated embodiment, the flexure members **210** are configured to be opposite of the raised regions **116** in the Z-direction so that the biasing force retaining the optical component **140** in the Z-direction does not created bending stress in or deflection of the optical component **140**. As shown in FIG. **7**, in the illustrated embodiment, the flexure member **210** is configured to be oriented slightly out of the plane of the body **200** so that the flexure members **210** contact the first periphery **154** of the optical component **140**. Optionally, the flexure members **210** may lie within the same plane as the body **202**. In the illustrated embodiment, the retention device **200** is formed from stainless steel. Those skilled in the art will appreciate that the retention device **200** may be formed from any variety of materials.

[0035] FIGS. **7-9** show various views of the optical component mount **100**. As shown, the retention member **300** engages the edge **146** of the optical component **140**. When the retention member **300** engages the edge **146**, it deforms, resulting in a compliant retention force exerted over the contact area **120** where the retention member **300** is in contact with the optical component **140**. As shown in FIGS. **9**A and **9**B, in the illustrated embodiment, the retention member **300** has an annular shape with an outer diameter **302** and a circular cross-section **304** (also known in the art as an "O-ring"). In the illustrated embodiment, the cross-section **304** of the retention member **300** is about the same as the thickness of the optical component **140**. Those skilled in the art will appreciate that the cross section **304** of the retention member **300** may be either smaller than or larger than the thickness of the optical component **140**. Exemplary elastomeric materials include, without limitation, butyl, nitrile (Buna-N), silicone, fluorocarbon, fluorosilicone, fluoroelastomer, perfluoroelastomer (FFKM), polytetrafluoroethylene (PTFE), tetrafluoroethylene propylene (TFE/P), fluorosilicone, urethane, polyurethane, ethylene-propylene (EPDM), neoprene, chloroprene, and the like. Those skilled in the art will appreciate that the retention member **300** may be made from any variety of materials. The retention member **300** material may also be selected to be compatible with cleanroom or vacuum environments. The retention member **300** material may also be selected based on its durometer, a measure of the resistance to deflection of polymers, elastomers and rubbers. For example, in the illustrated embodiment, as shown in FIG. **8**, the retention member **300** exerts a compliant retention force F_1 on the optical component **140** that is proportional to its durometer and the amount of deflection of the retention member **300**. Because the durometer of the retention member **300** may change with temperature, material of the retention member may be selected so that the retention force F_1 is maintained at an acceptable level to retain the optical component **140** securely, while avoiding distortion of the optical component **140**. For example, high-temperature applications may require that the retention member **300** be made from a material with a higher durometer, and low-temperature applications may require that the retention member **300** be made from a material with a lower durometer. In one embodiment, the retention member **300** may be made of a material whose durometer changes little with temperature. In another embodiment, the retention member **300** may be made of a material whose durometer changes significantly with temperature. The stress created in the optical component **140** is the retention force F_1 exerted by the retention member **300** divided by the contact area **120**. The details of the design of the optical component mount **100** would be selected to minimize the stress on the optical component **140** while providing a sufficient compliant retention force to prevent the optical component **140** from shifting within the optical component receiving recess **106** during use.

[0036] FIG. **8** shows a view of the mount body **102** showing the contact area **120** where the edge **146** of the optical component **140** engages the retention member **300**, and the contact points **122** where the edge **146** contacts the support surfaces **112**. As shown, the optical component **140** is placed in the optical component receiving recess **106** and the retention member **300** is placed in the retention member recess **110**. A portion of the retention member **300** protrudes through the recess opening **118** and engages the edge **146** of the optical component **140** at the contact area **120** with a retention force F_1. As described above, in the illustrated embodiment, the retention force F_1 may be proportional to the diameter **302** of the retention member **300**, the cross-section **304** of the retention member **300**, the durometer of the retention member **300**, the deflection or compression of the retention member **300**, and the ambient temperature. Those skilled in the art will appreciate that any variety of factors may affect the magnitude of the retention force F_1. Opposing or reaction forces F_2 and F_3 are exerted at the two contact points **122** on the support surfaces **112**, thereby securely retaining the optical component **140** in the X- and Y-directions within the optical component receiving recess **106**. Those skilled in the art will appreciate that the optical component **140** may be supported at any number of contact points **122**.

[0037] FIGS. **10-13** show cross-sectional views of various alternate embodiments of the optical component mount **100**, each alternate embodiment having a different configuration of the retention member. FIG. **10** shows an embodiment of the optical component mount **100** having a retention member **310** positioned in the retention member recess **110** of the mount body **102**. In the illustrated embodiment, in similar fashion to the retention member **300**, the retention member **310** may be formed from an elastomeric material. Exemplary materials for the retention member **310** are similar to those listed above with respect to the retention member **300**. In the illustrated embodiment, the retention member **310** has an annular shape with a square cross-section **312** and is configured to exert a compliant retention force at a contact area **170** where the retention member **310** meets the edge **146** of the optical component **140**. Because the cross-section **312** of the retention member **310** is square, the contact area **170** may be larger than the contact area **120** shown in FIGS. **9**A and **9**B. As such, the resulting stress created within the body **142** of the optical component **140** may be lower than where the retention member **300** contacts the optical component **140**. Likewise, warping of the surface **144** of the optical component **140** may minimized. Optionally, the cross-section **312** of the retention member **310** may be rectangular. Those skilled in the art will appreciate that the retention member **310** may have any variety of cross-sections.

[0038] FIG. **11** shows an embodiment of the optical component mount **100** having a retention member **320** positioned in the retention member recess **110** of the mount body **102**. In the illustrated embodiment, in similar fashion to the retention member **300**, the retention member **320** may be formed from an elastomeric material. Exemplary materials for the retention member **320** are similar to those listed above with respect to the retention member **300**. In the illustrated embodiment, the retention member **320** has a solid, oval cross-section with a diameter **322** and is configured to exert a compliant retention force at a contact area **180** where the retention member **320** engages the edge **146** of the optical component **140**. Those skilled in the art will appreciate that the retention member **320** may have any variety of cross-sections. Due to the solid cross section of the retention member **320**, the retention member **320** may exert a higher compliant retention force on the optical component **140**, resulting in higher stresses within the body **142** and at the surface **144** of the optical component **140** relative to those exerted on the optical component by the retention member **300** or **310**.

[0039] FIG. **12** shows an embodiment of the optical component mount **100** having a retention member **330** positioned in the retention member recess **110** of the mount body **102**. In the illustrated embodiment, in similar fashion to the retention member **300**, **310** and **320**, the retention member **330** may be formed from an elastomeric material. Exemplary materials for the retention member **330** are similar to those listed above with respect to the retention member **300**. In the illustrated embodiment, the retention member **330** has a solid, rectangular cross-section with a diameter **332** and is configured to exert a compliant retention force at a contact area **180** where the retention member **330** engages the edge **146** of the optical component **140**. Those skilled in the art will appreciate that the retention member **330** may have any variety of cross-sections. Though the solid cross section of the retention member **330** may exert a higher compliant retention force on the optical component **140** relative to the compliant retention forces exerted by the retention members **300**, **310** and **320**, the contact area **180** may be larger than the respective contact areas **120**, **170**, and **180** described above, the stresses within the body **142** and at the surface **144** of the optical component **140** may be acceptable for some applications where the optical mount **100** is used.

[0040] The design of the optical mount **100** as described above allows for significant design flexibility so that the end user of the optical mount **100** may choose from a number of design parameters so that the optical mount **100** is ideally suited for the user's experiment, system or application. For example, to hold very thin optics that are sensitive to stress-induced birefringence, the user may specify the configuration of the retention member **300** made from a material with a low durometer, such as fluorosilicone. As another example, for a high-temperature application using relatively thicker optics, the user may specify the configuration of the retention member **310**, made from a high durometer, such as fluorocarbon, so that the compliant retention force on the optical component **140** does not become too low at high temperatures. In this example, the contact area **170** at the edge of the optical component **140** retention member may be high enough so that any stresses in the optical component **140** are acceptable for the end-use application. Those skilled in the art will appreciate that that the end user may select, specify or adjust the design parameters when choosing any particular configuration of the optical component **100**.

[0041] FIG. **13** shows a section view of an embodiment of an optical component mount **500** (also referred to herein as the "optical mount **500**"). In many respects, the optical mount **500** is similar to the optical mount **100** described above. The optical mount **500** may include at least one body **502** having at least one aperture **504** and at least one optical component receiving recess **506** formed therein, the optical component receiving recess **506** configured to accept at least one optical component **540** therein. At least one retention member recess **510** configured to receive at least one retention member **570** therein may be formed in the mount body **502**. The mount body **502** may include at least one extended region **503** formed thereon. At least one adjustment member passage **522** may be formed in the extended region **503** of the mount body **502**, with the adjustment member passage **522** configured to accept at least one adjustment member **520** configured to exert an adjustable biasing force operative to deflect the retention member **570**, so that the retention member **570** exerts an adjustable compliant retention force over at least one contact area **530** on the edge **544** of the optical component **540**, thereby securely retaining it within the optical component receiving recess **506**. In the illustrated embodiment, the adjustment member **520** is a set screw, similar to the set screw **14** described above with respect to the optical component mount **10**. The adjustment member **520** may be actuated by placing a tool such as an Allen wrench into an adjustment port **524** formed in the adjustment member **520**. Those skilled in the art will appreciate that the retention member **570** may also have the same or similar alternative cross-sections described above with respect to retention members **300**, **310**, **320** and **330**. Likewise, the retention member **570** may be made of any of the elastomeric materials listed above with respect to the retention member **300**. The optical component mount **500** may include at least one retention device **580** configured to retain the optical component **540** within the optical component receiving recess **506** and to retain the retention member **570** within the retention member recess **510** in the Z-direction. The retention device **580** may include at least one flexure member **582** formed thereon, the flexure member **582** being configured to engage at least one first periphery **552** of at least one first surface **542** of the optical component **540** and exert a biasing force to urge at least one second periphery **556** of at least one second surface **546** against one or more raised regions **514** formed on the mount body **502** to securely retain the optical component **540** in the optical component receiving recess **506** in the Z-direction. The optical component mount **500** further includes one or more fasteners **588** configured to engage one or more fastener passages **514** to securely retain the retention device **580** against the mount body **502**.

[0042] FIGS. **14** and **15** show views of an embodiment of an optical component mount **600**. As shown, the optical component mount **600** (also referred to herein as the optical mount **600**") may include at least one mount body **602**, with at least one optical component receiving recess **606** formed therein, the optical component receiving recess **606** configured to receive at least one optical component **640** therein. The optical mount **600** may further include at least one retention device **700** with a body **702** that may include one or more flexure members **714** configured to contact a periphery **652** of the optical component **640** at one or more contact points **650**, thereby securely retaining the optical component **640** within the optical component receiving recess **606** in the Z-direction. One or more reliefs **712** may be formed in the body **702** adjacent to the flexure members **714**, the reliefs **712** configured to reduce or otherwise control the force exerted by the flexure members **714** on the periphery **652** of the optical component **640**. The mount body **602** may further include one or more retention member recesses **610** configured to accept one or more retention members **630**, the retention members **630** being configured to contact at least one edge **644** of the optical component **640** over a contact area **620**. In the illustrated embodiment, the optical mount **600** includes three retention members **630**, though those skilled in the art will appreciate that the optical mount **600** may use any number of retention members **630**. In similar fashion to the retention member **300**, the retention members **630** may be formed from an elastomeric material. Exemplary materials for the retention member **630** are similar to those listed above with respect to the retention member **300**. As shown in FIG. **15**, one or more recess openings **618** configured to allow the retention members **630** to protrude therethrough to contact the optical component **640** may be formed in the mount body **602** at the interface between the retention member recesses **610** and the optical component receiving recess **606**. The retention device **700** may be detachably mounted to the mount body **602** by one or more fasteners **708**. The retention device **700** may be further configured to retain the retention devices **630** within the respective retention member recesses **610**.

[0043] FIG. **15** shows a view of the optical mount **600** showing compliant retention forces F_1, F_2 and F_3 exerted by the retention members **630** to securely retain the optical component **640** within the optical component receiving recess **606** in the X- and Y-directions. For the purpose of illustration, the retention device **700** is not shown in FIG. **15**. As shown, the forces F_{1-3} contact the optical component **640** at contact areas **620**. In the illustrated embodiment, the retention members **630** are similar in configuration to the retention member **300** described above with respect to the optical mount **100**. In contrast to the optical mount **100** described above, because multiple retention members **630** are used, each having an annular configuration, the localized stresses in the optical component **640** caused by forces F_2 and F_3 may be lower than the corresponding localized stresses created in the optical component **140** caused by contact between the optical component **140** and the support surfaces **112** at the contact points **122** as shown in FIG. **8**. Those skilled in the art will appreciate that the retention members **630** may also have the same or similar alternative cross-sections described above with respect to retention members **310**, **320**, **330**, and **570**.

[0044] While an optical component mount is disclosed by reference to the various embodiments and examples described above, it should be understood that these examples are intended in an illustrative rather than limiting sense, as it is contemplated that modifications will readily occur to those skilled in the art which are intended to fall within the scope of the present invention.

What is claimed is:

1. An optical component mount, comprising:

at least one mount body with at least one optical component receiving recess formed therein, the at least one optical component receiving recess configured to receive at least one optical component therein, the at least one optical component having at least one edge; and

at least one elastomeric retention member configured to exert at least one compliant retention force on the at least one edge of the at least one optical component and securely retain the at least one optical component within the at least one optical component receiving recess in at least one first direction.

2. The optical component mount of claim **1**, wherein the at least one elastomeric retention member has an annular shape with a substantially circular cross-section.

3. The optical component mount of claim **1**, wherein the at least one elastomeric retention member has an annular shape with a rectangular cross-section.

4. The optical component mount of claim **1**, wherein the at least one elastomeric retention member has an oval cross-section.

5. The optical component mount of claim **1**, wherein the at least one elastomeric retention member has a rectangular cross-section.

6. The optical component mount of claim **1**, wherein the at least one elastomeric retention member is formed from a material selected from a group consisting of butyl, nitrile (Buna-N), silicone, fluorocarbon, fluorosilicone, fluoroelastomer, urethane, polyurethane, perfluoroelastomer (FFKM), polytetrafluoroethylene (PTFE), tetrafluoroethylene propylene (TFE/P), ethylene-propylene (EPDM), neoprene, and chloroprene.

7. The optical component mount of claim **1**, further comprising at least one adjustment member configured to exert at least one adjustable force on the at least one elastomeric retention member, thereby adjusting the compliant retention force applied to the at least one edge of the at least one optical component by the elastomeric retention member.

8. The optical component mount of claim **1**, further comprising at least one retention device configured to contact the at least one optical component on at least one first periphery and securely retain the at least one optical component in at least one second direction.

9. An optical component mount, comprising:

at least one mount body with at least one optical component receiving recess formed therein, the at least one optical component receiving recess configured to receive at least one optical component therein, the at least one optical component having at least one contact area and at least one first periphery;

at least one first elastomeric retention member configured to contact the at least one optical component at at least one contact area and securely retain the at least one optical component in at least one first direction; and

at least one second elastomeric retention member configured to contact the at least one optical component at at least one contact area and securely retain the at least one optical component in at least one second direction.

10. The optical component mount of claim **9**, further comprising at least one third elastomeric retention member configured to contact the at least one optical component at at least one contact area and securely retain the at least one optical component in at least one third direction.

11. The optical component mount of claim **9**, wherein the at least one elastomeric retention member has a substantially circular cross-section.

12. The optical component mount of claim **9**, wherein the at least one elastomeric retention member has an annular shape with a rectangular cross-section.

13. The optical component mount of claim **9**, wherein the at least one elastomeric retention member has an oval cross-section.

14. The optical component mount of claim **9**, wherein the at least one elastomeric retention member has a rectangular cross-section.

15. The optical component mount of claim **9**, wherein the at least one elastomeric retention member for from a material selected from a group consisting of butyl, nitrile (Buna-N), silicone, fluorocarbon, fluorosilicone, fluoroelastomer, urethane, polyurethane, perfluoroelastomer (FFKM), polytetrafluoroethylene (PTFE), tetrafluoroethylene propylene (TFE/P), ethylene-propylene (EPDM), neoprene, and chloroprene.

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