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Imaizumi et al.

(54) OPTICAL MEASUREMENT DEVICE

(71) Applicant: MITUTOYO CORPORATION, Kawasaki (JP)

(72) Inventors: Ryoichi Imaizumi, Tokyo (JP); Takumi Hayashi, Kanagawa (JP); Kohei Narumiya, Kanagawa (JP)

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(57) ABSTRACT

An optical measurement device includes: a measurement region in which a measurement object is disposed; a light beam scanning unit that irradiates the measurement region with light beam and scans the light beam in a scanning direction intersecting with an irradiation direction of the light beam; a light receiving unit that receives the light beam that has passed through the measurement region and outputs a light receiving signal; a signal processing unit that outputs data indicative of a dimension in the scanning direction of the measurement object based on the light receiving signal; and an optical path cover that is configured to be removably attachable to a housing of the light beam scanning unit and covers an optical path of the light beam in a range from the housing to the measurement object.

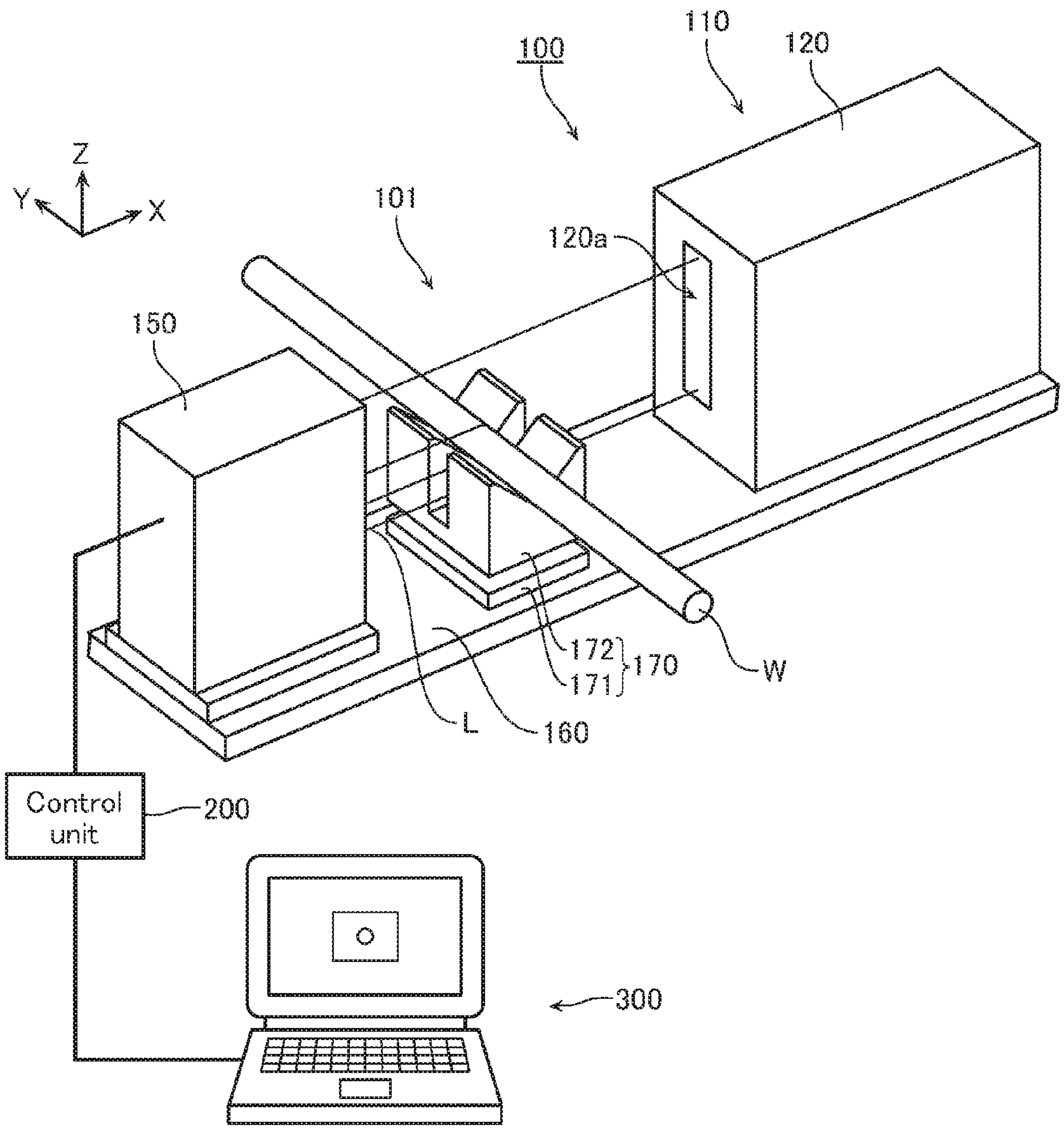
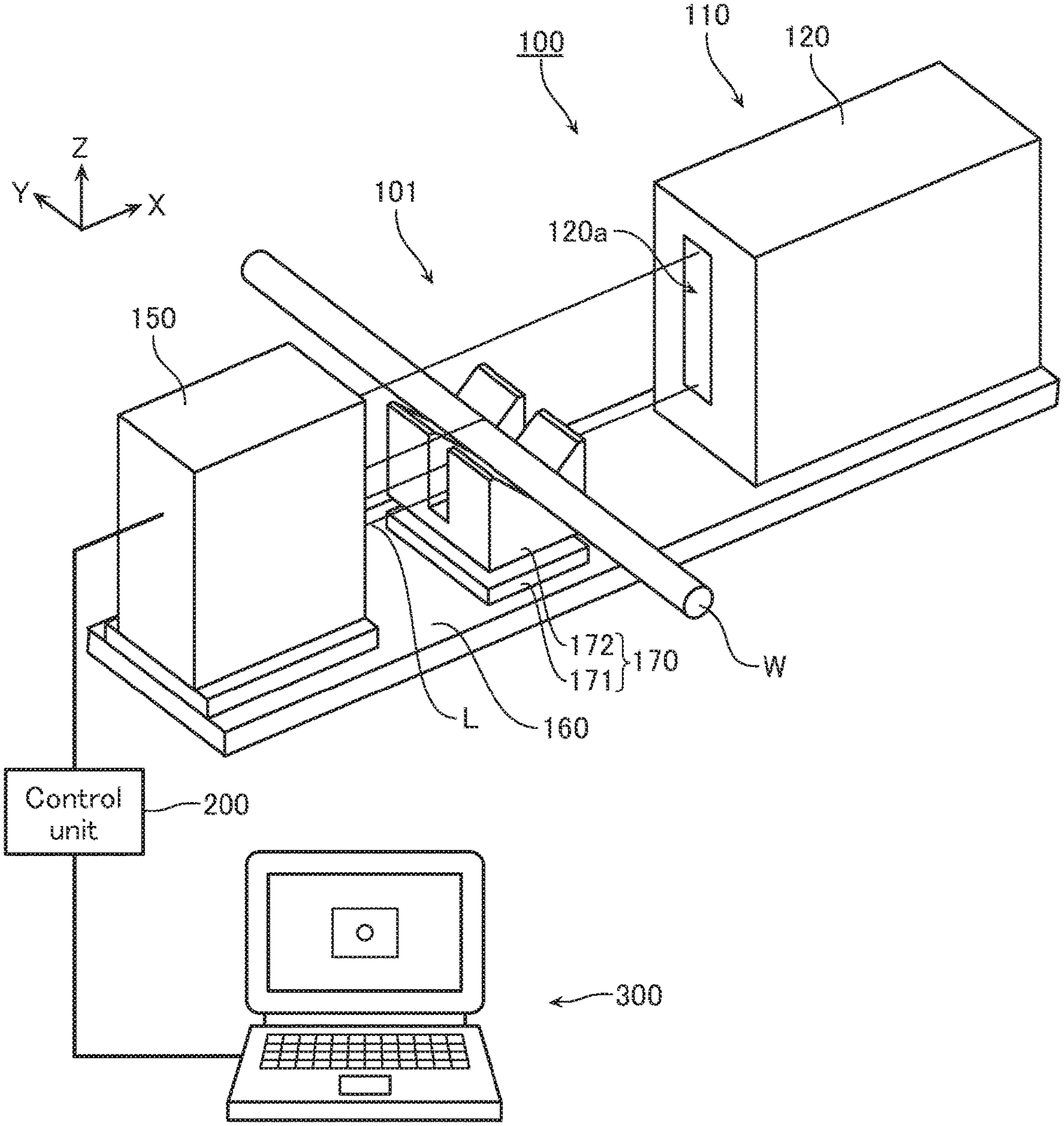


FIG. 1


100
110
120
Z
Y
X
101
120a
150
172
171
170
W
L
160
Control unit
200
300

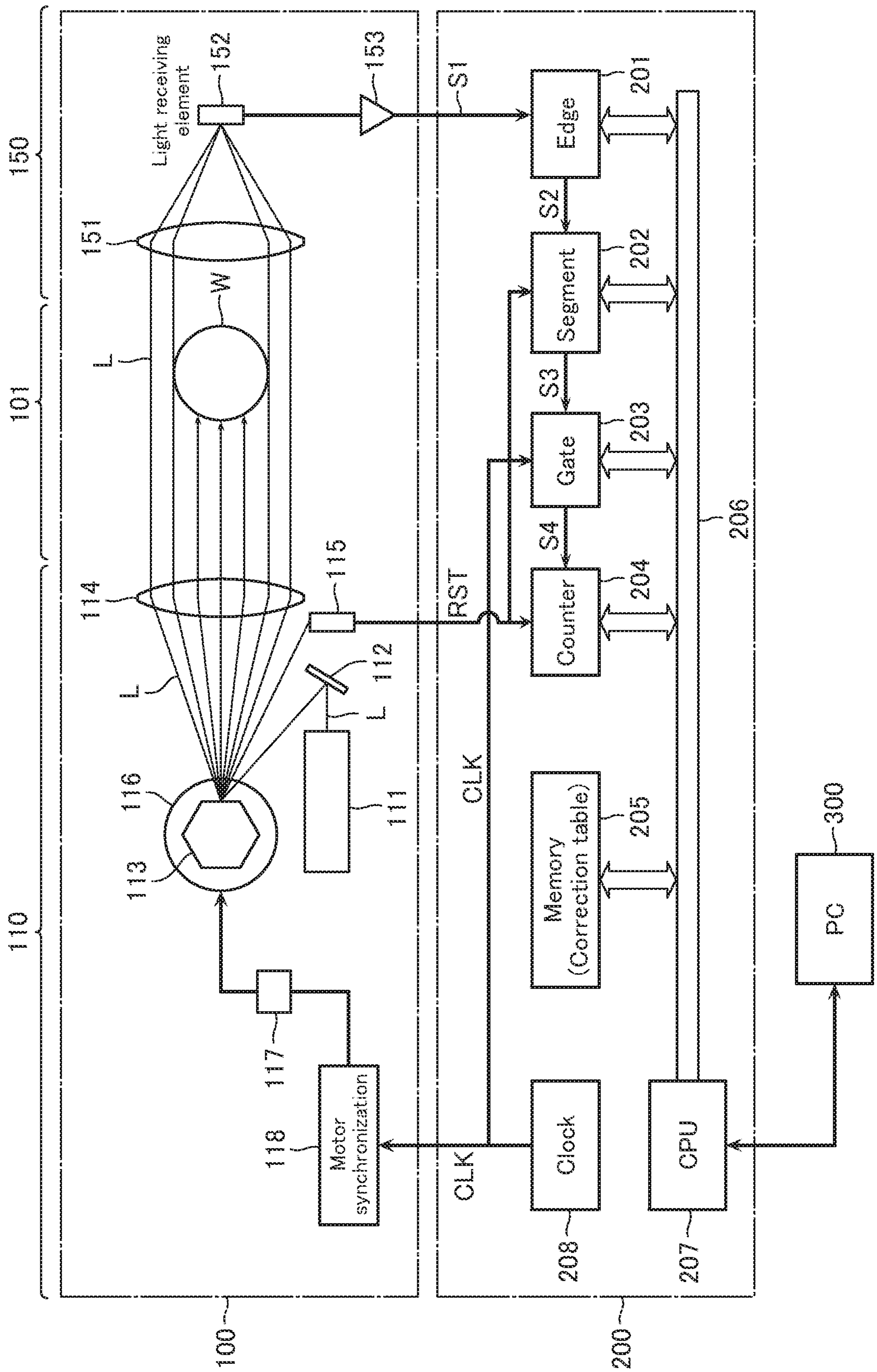

150
101
110
Light receiving element
152
153
S1
Edge
201
151
W
L
S2
Segment
202
S3
Gate
203
206
114
115
RST
S4
Counter
204
L
112
L
116
113
111
CLK
Memory
(Correction table)
205
300
PC
117
118
Motor synchronization
CLK
Clock
208
CPU
207
100
200

FIG. 2

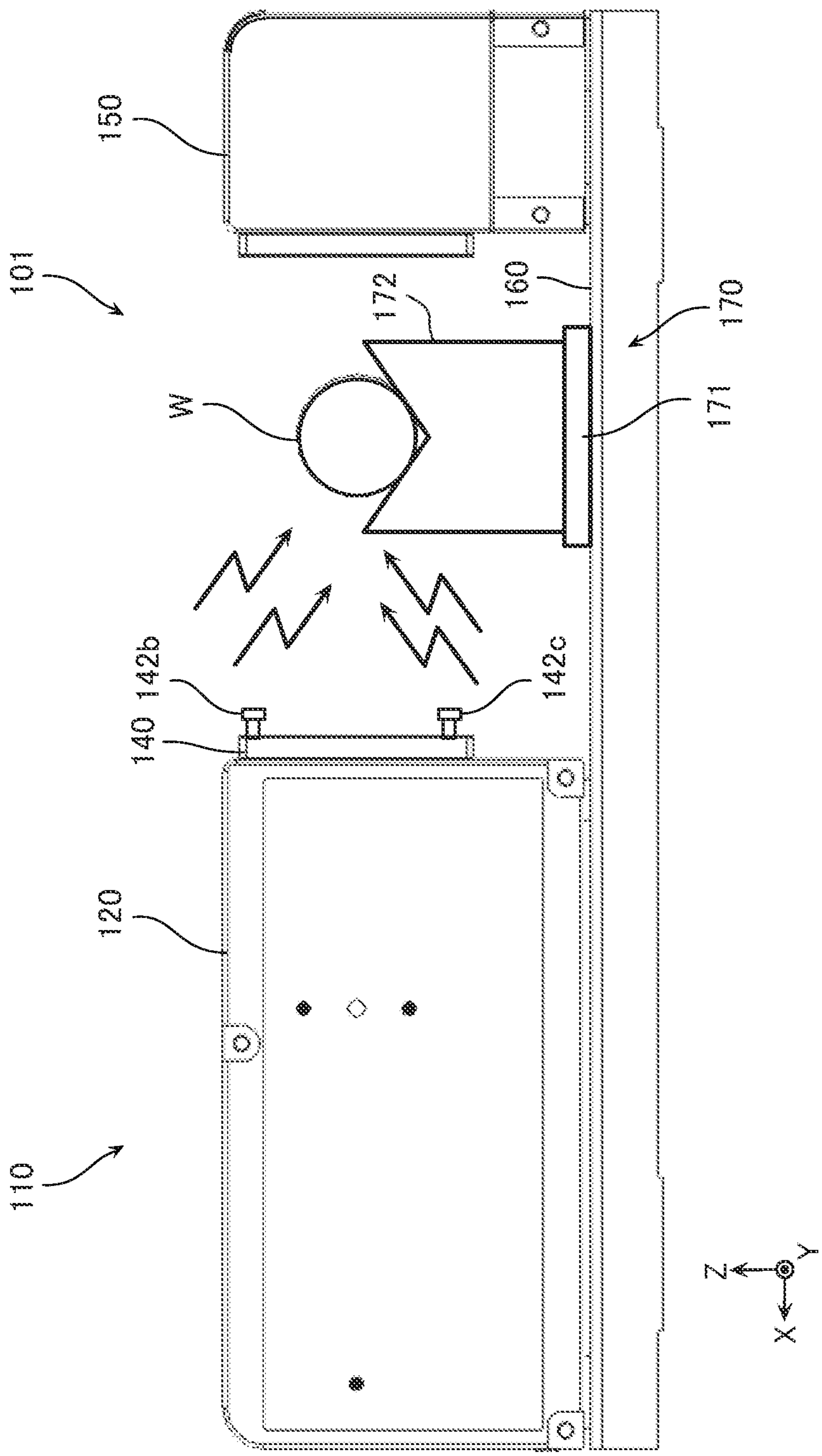


FIG. 3

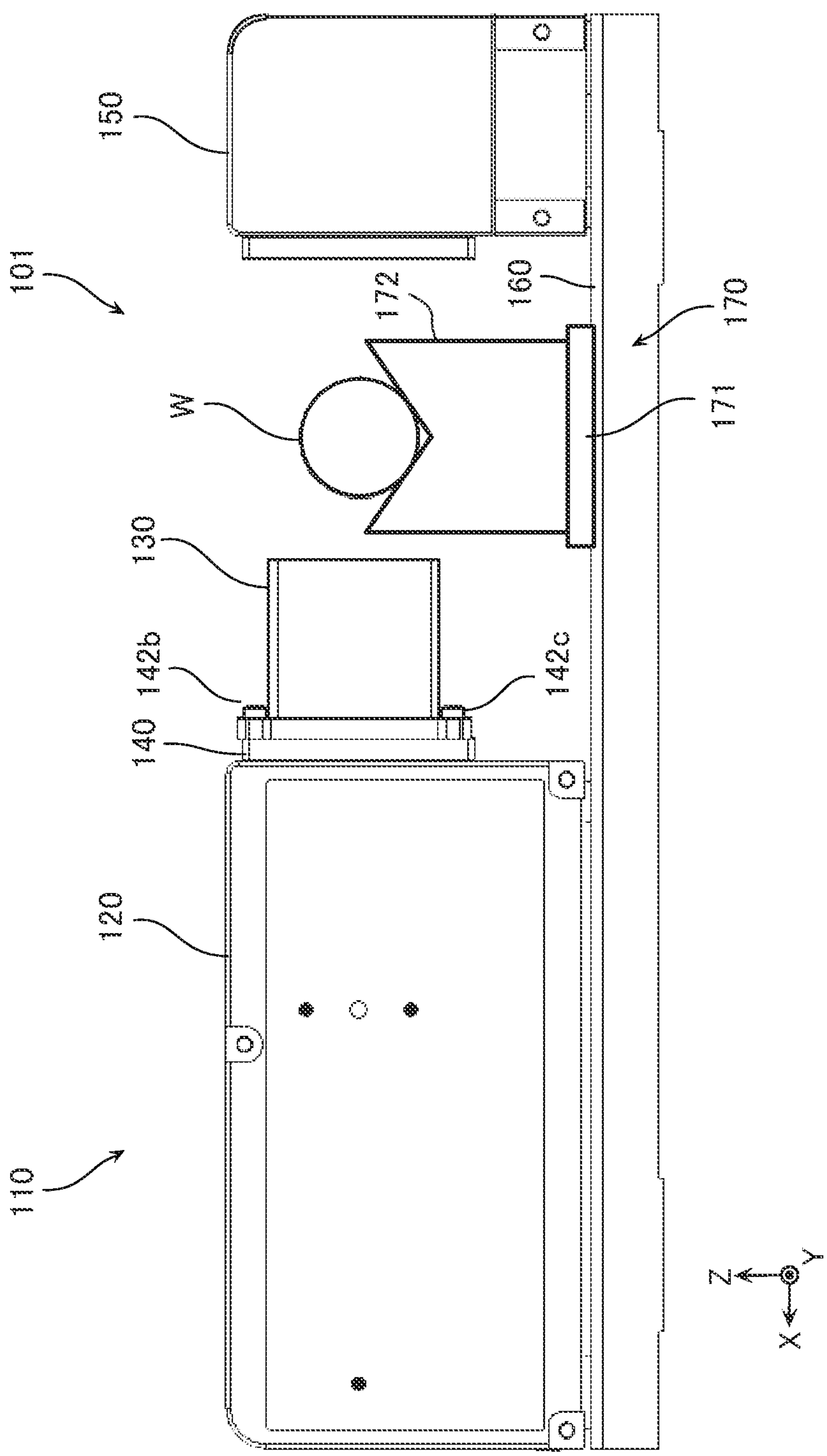


FIG. 4

FIG. 5

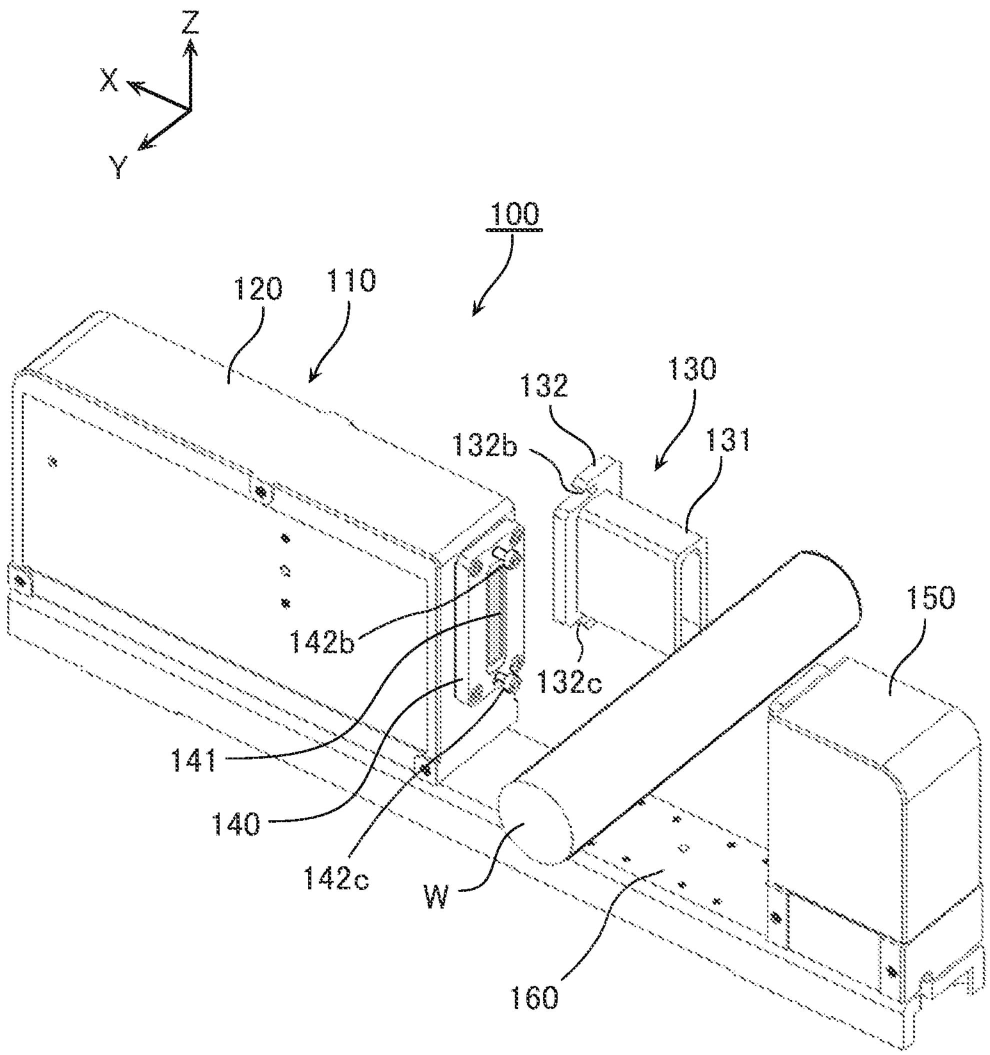

Z
X
Y
100
120
110
132
130
132b
131
150
142b
132c
141
140
142c
W
160

FIG. 6

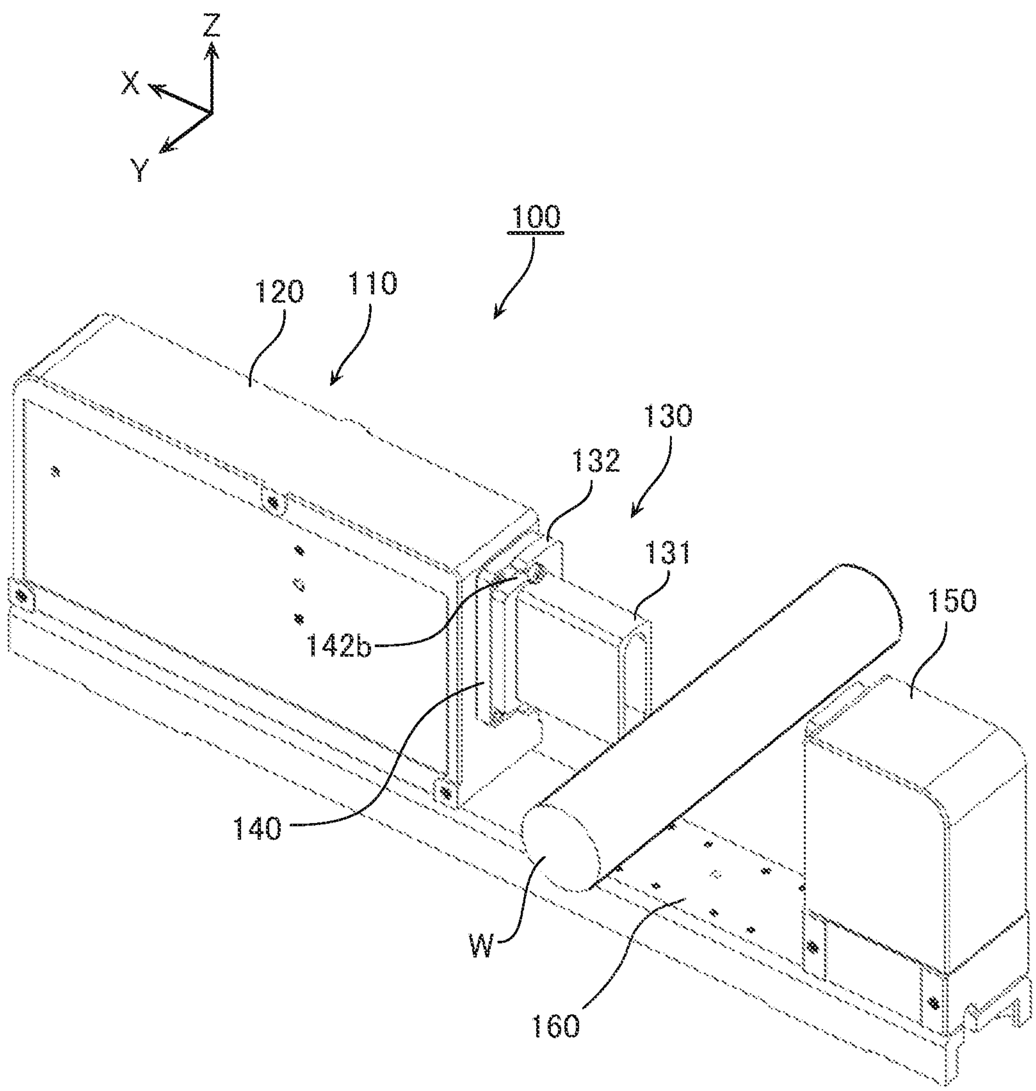


FIG. 7

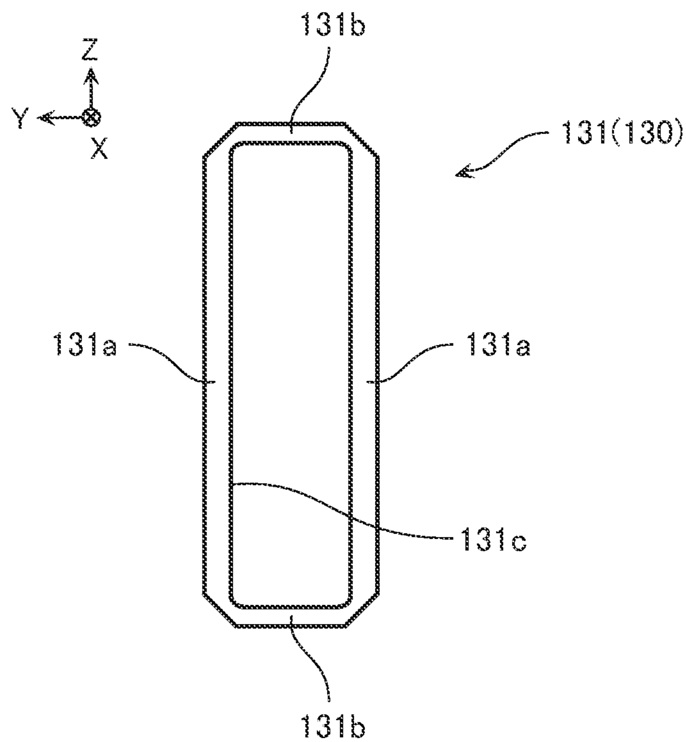


FIG. 8

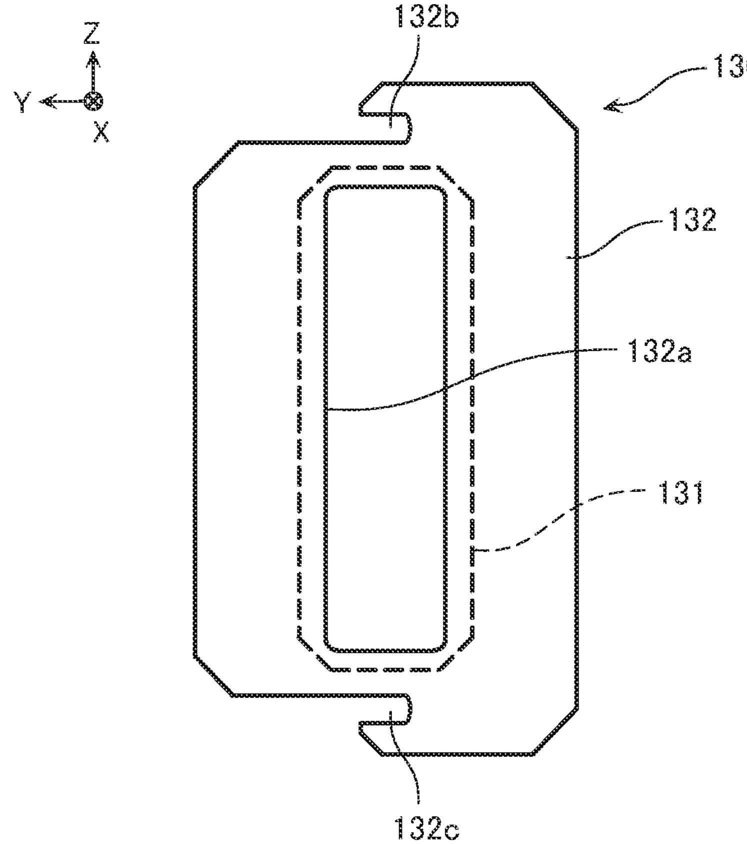


FIG. 9

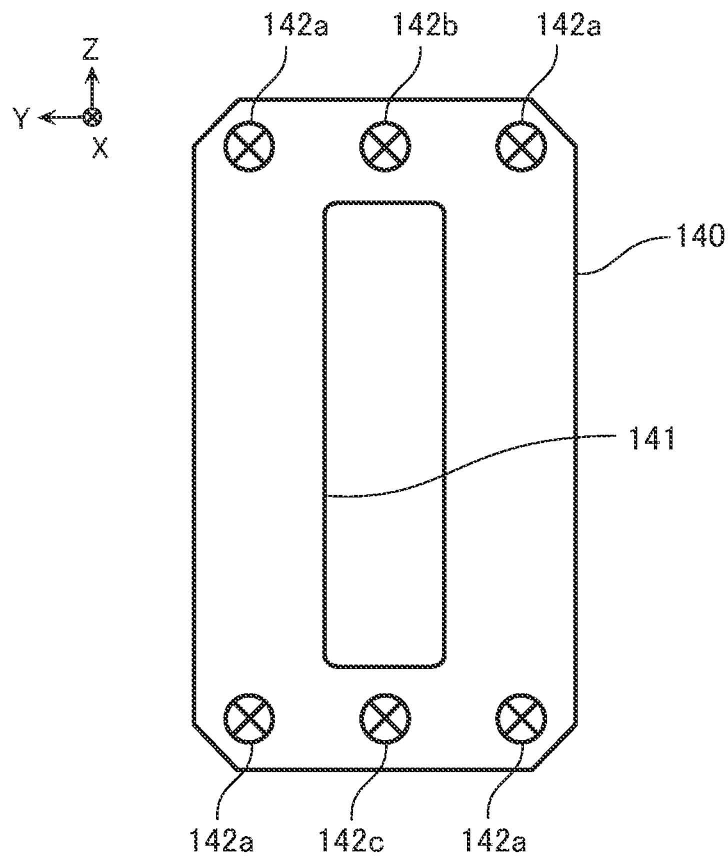


FIG. 10

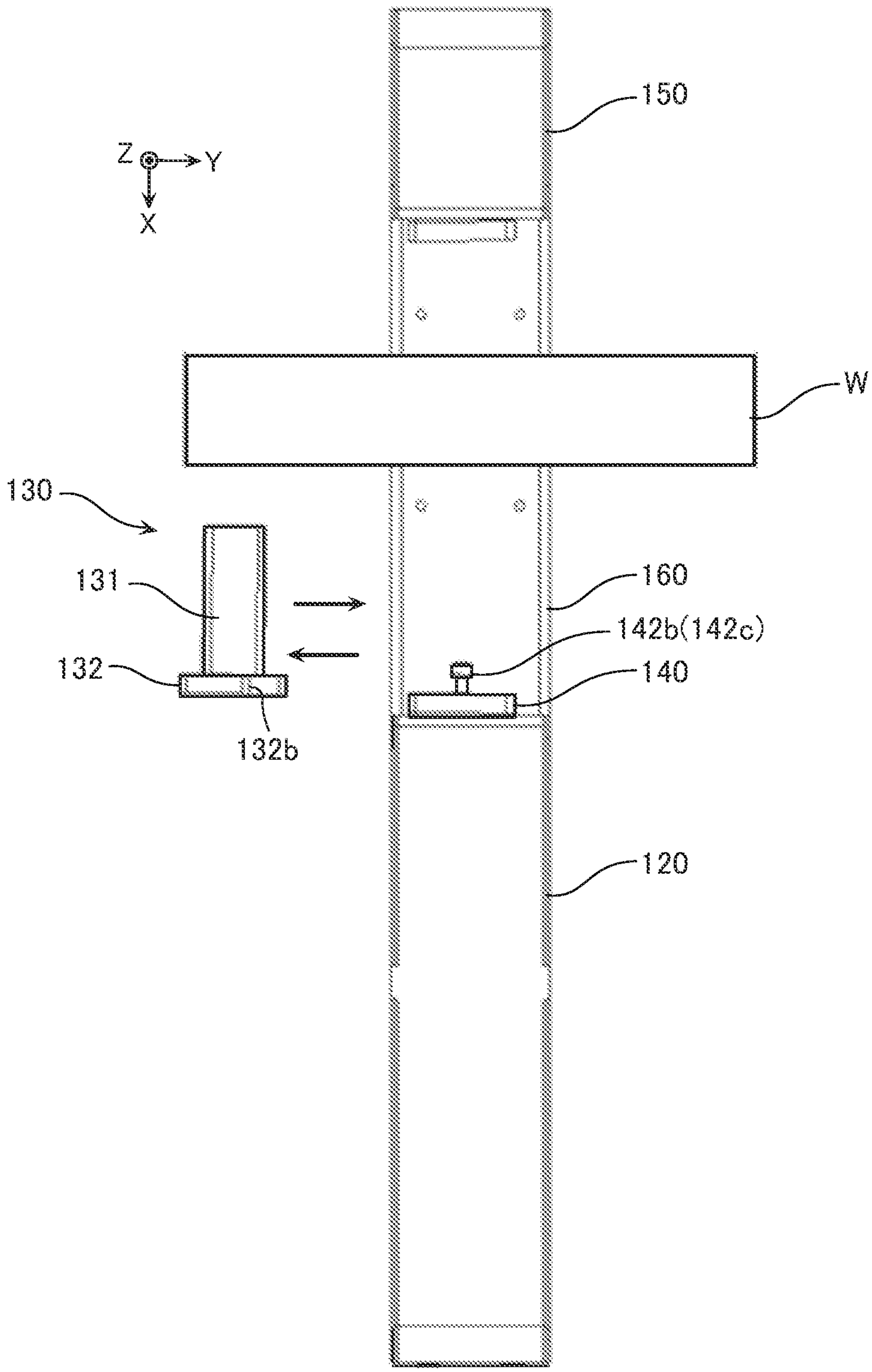


FIG. 11

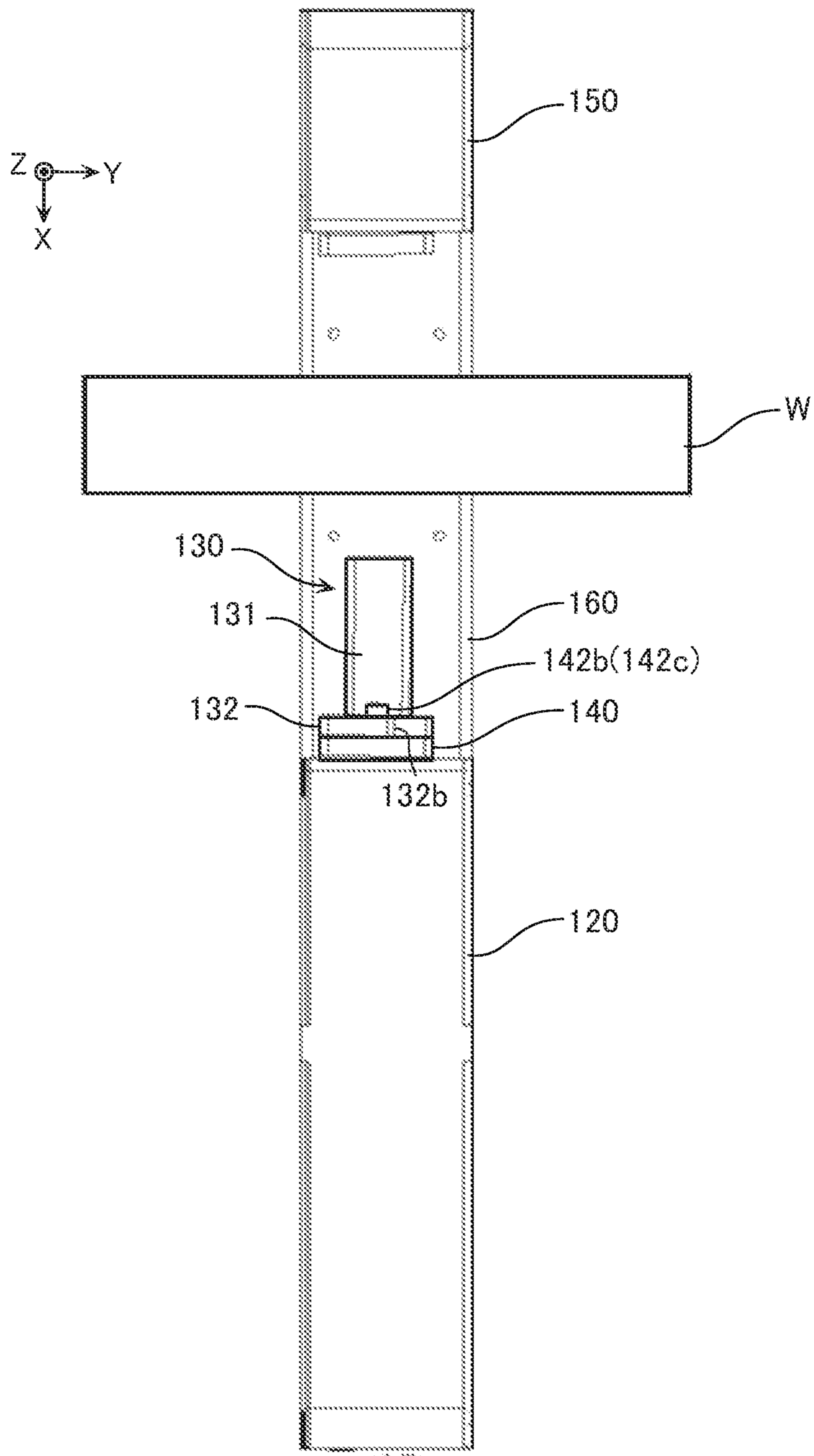


FIG. 12

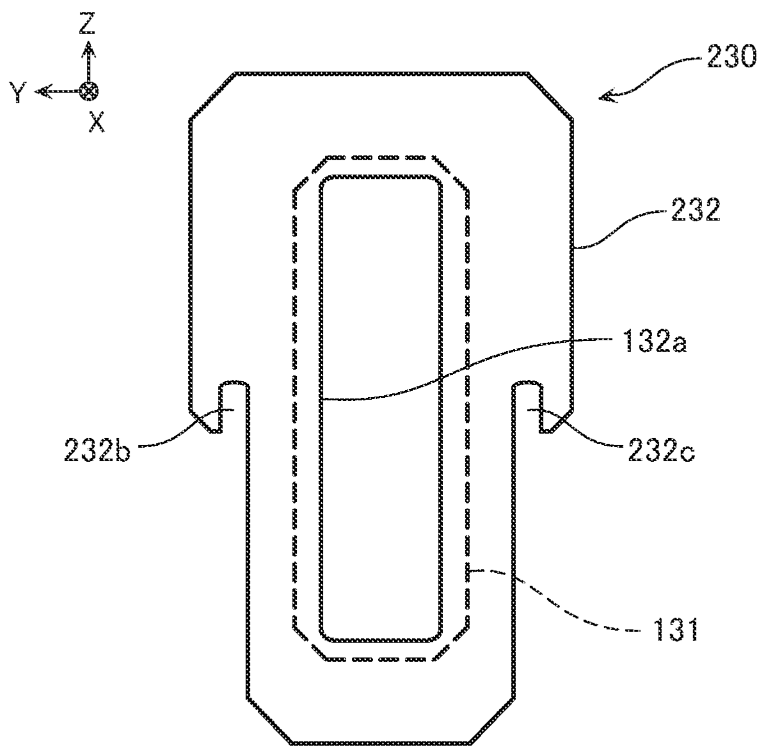
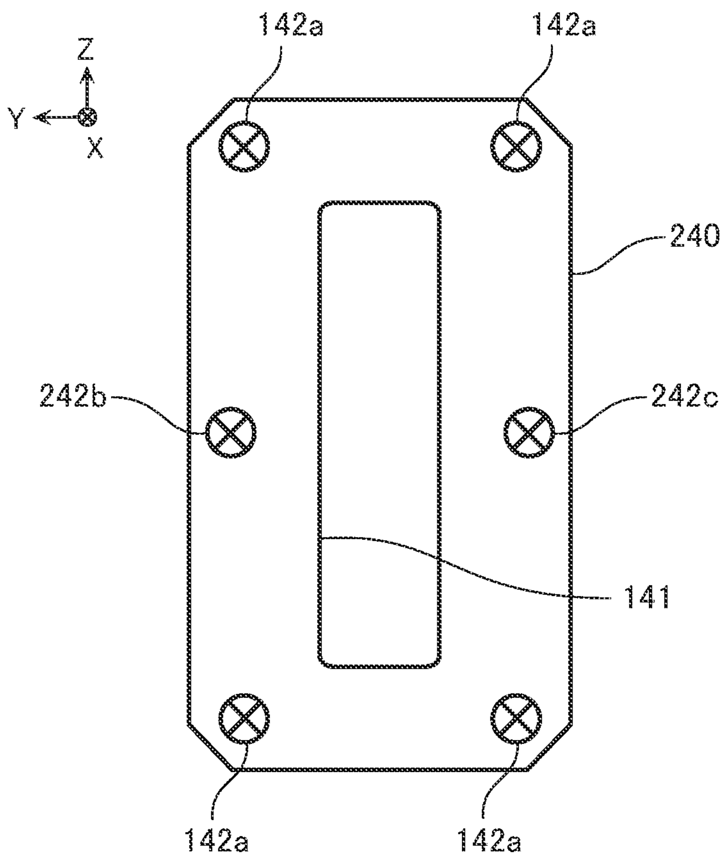


FIG. 13



OPTICAL MEASUREMENT DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is based upon and claims the benefit of Japanese Patent Application No. 2022-205610, filed on Dec. 22, 2022, the entire contents of which are incorporated herein by reference.

BACKGROUND

Field

[0002] The present invention relates to an optical measurement device that includes a measurement region in which a measurement object is disposed, irradiates this measurement region with light beam, scans this light beam in a scanning direction, and measures a dimension and the like in this scanning direction of the measurement object.

Description of the Related Art

[0003] There has been known an optical measurement device that includes a measurement region in which a measurement object is disposed, a light beam scanning unit that irradiates this measurement region with light beam and scans the light beam in a scanning direction intersecting with an irradiation direction of the light beam, a light receiving unit that receives the light beam that has passed through the measurement region and outputs a light receiving signal, and a signal processing unit that outputs data indicating a dimension in the scanning direction of the measurement object based on the light receiving signal.

[0004] With this configuration, due to influence of heat from a light source unit of the light beam, faint wind from a mechanism that scans the light beam, and the like, air fluctuation in an optical path of the light beam occurs at an inside of a housing of the light beam scanning unit, and this possibly results in a decrease in measurement accuracy.

[0005] Therefore, in Japanese Patent Application Publication No. 2018-179837 and Japanese Patent Application Publication No. 58-48805, an optical path cover that covers an optical path of light beam is disposed inside a housing of a light beam scanning unit. This configuration allows inhibiting air fluctuation in the optical path of the light beam at the inside of the housing of the light beam scanning unit and inhibiting the decrease in measurement accuracy.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] FIG. **1** is a perspective view illustrating a configuration of an optical measurement device according to a first embodiment of the present invention;

[0007] FIG. **2** is a block diagram illustrating a configuration of a measurement unit **100** and a control unit **200**;

[0008] FIG. **3** is a side view illustrating a configuration of the measurement unit **100** in a state of an optical path cover **130** being removed;

[0009] FIG. **4** is a side view illustrating a configuration of the measurement unit **100** in a state of the optical path cover **130** being mounted;

[0010] FIG. **5** is a perspective view illustrating the configuration of the measurement unit **100** in a state of the optical path cover **130** being removed;

[0011] FIG. **6** is a perspective view illustrating a configuration of the measurement unit **100** in a state of the optical path cover **130** being mounted;

[0012] FIG. **7** is a front view illustrating a configuration of a cover portion **131** of the optical path cover **130**;

[0013] FIG. **8** is a front view illustrating a configuration of a mounting portion **132** of the optical path cover **130**;

[0014] FIG. **9** is a front view illustrating a configuration of a member **140**;

[0015] FIG. **10** is a top view illustrating a configuration of the measurement unit **100** in a state of the optical path cover **130** being removed;

[0016] FIG. **11** is a top view illustrating a configuration of the measurement unit **100** in a state of the optical path cover **130** being mounted;

[0017] FIG. **12** is a front view illustrating a configuration of a mounting portion **232** of an optical path cover **230** according to a second embodiment of the present invention; and

[0018] FIG. **13** is a front view illustrating a configuration of a member **240** according to the second embodiment of the present invention.

DETAILED DESCRIPTION

[0019] An optical measurement device according to one embodiment of the present invention comprises: a measurement region in which a measurement object is disposed; a light beam scanning unit that irradiates the measurement region with light beam and scans the light beam in a scanning direction intersecting with an irradiation direction of the light beam; a light receiving unit that receives the light beam that has passed through the measurement region and outputs a light receiving signal; a signal processing unit that outputs data indicative of a dimension in the scanning direction of the measurement object based on the light receiving signal; and an optical path cover that is configured to be removably attachable to a housing of the light beam scanning unit and covers an optical path of the light beam in a range from the housing to the measurement object.

[0020] With this configuration, when the measurement object and a brace are disposed, the optical path cover can be removed from the housing of the light beam scanning unit and after the measurement object and the brace are disposed, the optical path cover can be mounted to the housing. Thus, a decrease in measurement accuracy can be inhibited without a decrease in workability.

[0021] The optical path cover may be configured to be removably attachable to the housing from an attachment/removal direction intersecting with the irradiation direction. Movement in the irradiation direction of the optical path cover relative to the housing may be restrictable when the optical path cover is attached to or removed from the housing.

[0022] With this configuration, when the optical path cover is attached to or removed from the housing, a contact of the optical path cover with the measurement object and the brace can be prevented. Therefore, the optical path cover according to the embodiment is easily mountable to the housing even after the measurement object and the brace are disposed.

[0023] The attachment/removal direction may intersect with the scanning direction. A position in the attachment/removal direction of the optical path cover to/from the housing may be adjustable. The optical path cover may be fixable to the housing in a state of the position in the attachment/removal direction being adjusted.

[0024] With this configuration, even when the position of the light beam differs from design, by adjusting the position in the attachment/removal direction of the optical path cover, the light beam can be preferably emitted to the measurement region. Therefore, the optical measurement device in which a width of the optical path cover is decreased, influence of air fluctuation is small, and environmental resistance is high can be provided.

[0025] The optical measurement device may further include: a member disposed at an emission port of the light beam of the housing; and male threads that are screwed with the member in the irradiation direction and can sandwich a part of the optical path cover with the member. The member may be slidable with the optical path cover when the optical path cover is attached or removed.

[0026] The optical path cover: may be configured to be removably attachable to the housing in an attachment/removal direction intersecting with the irradiation direction, and may include: a cover portion that covers the optical path of the light beam; and a mounting portion slidable with the member when the optical path cover is attached to or removed from the housing. The mounting portion may include groove portions disposed at positions corresponding to the male threads and extending in the attachment/removal direction.

[0027] According to the present invention, the optical measurement device in which, when the measurement object is disposed, the decrease in measurement accuracy can be inhibited without the decrease in workability can be provided.

First Embodiment

[0028] Hereinafter, an optical measurement device according to the first embodiment of the present invention will be described with reference to the drawings.

[Schematic Configuration]

[0029] FIG. **1** is a perspective view illustrating a configuration of the optical measurement device according to the first embodiment of the present invention.

[0030] As illustrated in FIG. **1**, the optical measurement device according to the embodiment includes a measurement unit **100**, a control unit **200** (signal processing unit) that controls the measurement unit **100**, and a PC **300** connected to the control unit **200**. The measurement unit **100** includes a measurement region **101** in which a measurement object W is disposed, a light beam scanning unit **110** that irradiates the measurement region **101** with light beam (laser light L) and scans this light beam in a scanning direction (−Z-direction), a light receiving unit **150** that receives the light beam that has passed through the measurement region **101**, and a connecting portion **160** that connects the light beam scanning unit **110** and the light receiving unit **150**.

[0031] Note that in the example of FIG. **1**, the light beam scanning unit **110** and the light receiving unit **150** are separated in an X-direction, and a space between the light beam scanning unit **110** and the light receiving unit **150** becomes the measurement region **101**. Additionally, in the measurement region **101**, the cylindrical measurement object W extending in a Y-direction and a brace **170** that supports this measurement object W are disposed. The brace **170** includes a pedestal portion **171** placed on an upper surface of the connecting portion **160**, a supporting portion **172** that supports the measurement object W, and an adjustment mechanism (not illustrated) that can adjust a positional relation between these pedestal portion **171** and supporting portion **172** in the X-direction and the Z-direction. The light beam scanning unit **110** emits the laser light L that progresses in the −X-direction via an emission port **120***a* disposed in a housing **120** of the light beam scanning unit **110** and scans it in the −Z-direction.

[0032] FIG. **2** is a block diagram illustrating configurations of the measurement unit **100** and the control unit **200**.

[0033] The light beam scanning unit **110** includes a laser light source unit **111** that emits the laser light L, a mirror **112** by which the emitted laser light L is reflected, a polygon mirror **113** by which the laser light L reflected by the mirror **112** is further reflected, an fθ lens **114** that guides the laser light L reflected by the polygon mirror **113** to the measurement region **101**, and a light receiving element **115**, such as a photodiode, that outputs a reset signal RST at termination of scanning the laser light L. Additionally, the light beam scanning unit **110** includes a motor **116** that rotates the polygon mirror **113**, a motor drive circuit **117** that drives the motor **116**, and a motor synchronization circuit **118** that inputs a synchronous signal to the motor drive circuit **117** according to a clock signal CLK.

[0034] The light receiving unit **150** includes a condenser lens **151** that condenses the laser light L that has passed through the measurement region **101**, a light receiving element **152**, such as a photodiode, that receives the condensed laser light L, and an amplifier **153** that amplifies an output signal of the light receiving element **152** and outputs it as a light receiving signal S**1**.

[0035] The control unit **200** includes an edge detection circuit **201** that binarizes the light receiving signal S**1** and outputs an edge detection signal S**2**, a segment selection circuit **202** that rises an edge selection signal S**3** according to rising and falling of the edge detection signal S**2**, a gate circuit **203** that outputs an AND signal of the edge selection signal S**3** and a clock signal CLK as one or a plurality of gate signals S**4**, a count circuit **204** that counts the number of clock pulses included in one or the plurality of gate signals S**4**, and a memory **205** that stores a correction table. Additionally, the control unit **200** includes a CPU **207** connected to these configurations via a bus **206** and a clock signal output circuit **208** that outputs the clock signal CLK to these configurations.

[Operation During Dimension Measurement]

[0036] In dimension measurement, for example, the brace **170** and the measurement object W are disposed in the measurement region **101**. The measurement object W is, for example, disposed at a focal point of the fθ lens **114**.

[0037] Next, the laser light L is emitted from the laser light source unit **111** and rotate the polygon mirror **113**. For example, when the polygon mirror **113** has a regular 16-sided prism shape and has 16 reflective surfaces, the laser light L is scanned by 16 times each time the polygon mirror **113** is rotated by one.

[0038] When the operation of the laser light L starts, the laser light L passes through the measurement region **101** and is received by the light receiving unit **150**. Additionally, the light receiving signal S**1** becomes a value larger than a threshold, and the edge detection signal S**2** rises. Additionally, the count circuit **204** starts counting the clock pulse corresponding to an upper region of the measurement object W.

[0039] When the laser light L reaches the measurement object W, the laser light L is shielded by the measurement object W and does not pass through the measurement region **101**. Additionally, the light receiving signal S**1** becomes a value smaller than the threshold, and the edge detection signal S**2** falls. The count circuit **204** starts counting the clock pulse corresponding to the measurement object W.

[0040] When the laser light L passes through the measurement object W, the laser light L passes through the measurement region **101** and is received by the light receiving unit **150**. Additionally, the light receiving signal S**1** becomes a value larger than a threshold, and the edge detection signal S**2** rises. Additionally, the count circuit **204** starts counting the clock pulse corresponding to a lower region of the measurement object W.

[0041] When the laser light L is received by the light receiving element **115**, the reset signal RST rises. The count circuit **204** receives the reset signal RST and outputs a counting result of the clock pulse to the CPU **207** as an edge count value. Further, the count circuit **204** resets the latched edge count value. The CPU **207**, for example, refers to the correction table stored in the memory **205**, corrects the edge count value, and acquires the edge count value after the correction. Afterwards, for example, among the edge count values after the correction, the edge count value corresponding to the lower region of the measurement object W is subtracted from the edge count value corresponding to the measurement object W to acquire a difference value. Moreover, this difference value is multiplied by a distance of the laser light L being scanned in the −Z-direction in one clock and outputs the result to the PC **300** as dimension data indicative of an outside diameter of the measurement object W. The PC **300** stores the output dimension data and displays the outside diameter indicated by the dimension data on a display.

[Optical Path Cover **130**]

[0042] Next, with reference to FIG. **3** and FIG. **4**, the optical path cover **130** will be described. FIG. **3** is a side view illustrating a configuration of the measurement unit **100** in a state of the optical path cover **130** being removed. FIG. **4** is a side view illustrating a configuration of the measurement unit **100** in a state of the optical path cover **130** being mounted.

[0043] In the optical measurement device described with reference to FIG. **1** and FIG. **2**, when airflow, heat gradient, or the like is present in a range from the light beam scanning unit **110** to the measurement object W, as illustrated in FIG. **3**, air fluctuation occurs in the optical path of the light beam. When air fluctuation occurs, a refractive index in the air changes according to a state of a density of the air, and a decrease in measurement accuracy possibly occurs. To inhibit this, for example, as illustrated in FIG. **4**, it is considered to dispose the optical path cover **130** that covers the optical path of the laser light L in the range from the light beam scanning unit **110** to the measurement object W.

[0044] Here, to preferably inhibit air fluctuation, the optical path cover **130** preferably covers the optical path of the laser light L in the range from the light beam scanning unit **110** to the proximity of the measurement object W. However, when the optical path cover **130** approaches the measurement object W, the optical path cover **130** becomes an obstacle when the brace **170** is disposed in the measurement region **101** and the measurement object W is disposed on the brace **170**, possibly causing a decrease in workability.

[0045] Therefore, the optical measurement device according to the embodiment includes the optical path cover **130** (FIG. **5** to FIG. **9**) that is easily removably attachable to the housing **120** of the light beam scanning unit **110**. With such a configuration, as illustrated in FIG. **3**, the optical path cover **130** can be removed from the housing **120** when the brace **170** and the measurement object W are disposed, and as illustrated in FIG. **4**, the optical path cover **130** can be mounted to the housing **120** after the brace **170** and the measurement object W are disposed. Accordingly, the decrease in measurement accuracy can be inhibited without the decrease in workability when the brace **170** and the measurement object W are disposed.

[Configuration of Optical Path Cover **130** or the Like]

[0046] Next, with reference to FIG. **5** to FIG. **9**, the configuration of the optical path cover **130** or the like will be described. FIG. **5** is a perspective view illustrating the configuration of the measurement unit **100** in a state of the optical path cover **130** being removed. FIG. **6** is a perspective view illustrating a configuration of the measurement unit **100** in a state of the optical path cover **130** being mounted. FIG. **7** is a front view illustrating a configuration of a cover portion **131** of the optical path cover **130**. FIG. **8** is a front view illustrating a configuration of a mounting portion **132** of the optical path cover **130**. FIG. **9** is a front view illustrating a configuration of a member **140**.

[0047] As illustrated in FIG. **5**, the optical measurement device according to the embodiment includes the optical path cover **130** and the member **140** configured to allow the optical path cover **130** to be removably attachable to the housing **120**.

[0048] The optical path cover **130** includes the cover portion **131** that covers the optical path of the laser light L in the range from the light beam scanning unit **110** to the measurement object W and the mounting portion **132** configured to be removably attachable to the member **140**.

[0049] The cover portion **131** includes an approximately square tube shape extending in an irradiation direction (−X-direction) and the scanning direction (−Z-direction) of the laser light L. As illustrated in FIG. **7**, the cover portion **131** includes a pair of wall portions **131***a* that separate in the Y-direction and a pair of wall portions **131***b* that separate in the Z-direction. The pair of wall portions **131***a* each extend in the X-direction and the Z-direction. The pair of wall portions **131***b* each extend in the X-direction and the Y-direction. A region **131***c* surrounded by these pair of wall portions **131***a* and pair of wall portions **131***b* is a region through which the laser light L passes.

[0050] The mounting portion **132** has an approximately rectangular shape extending in the Y-direction and the Z-direction. As illustrated in FIG. **8**, at a center of the mounting portion **132**, a through-hole **132***a* extending in the Z-direction is provided. The through-hole **132***a* is a region through which the laser light L passes. Groove portions **132***b*, **132***c* are disposed at respective upper end and lower end of the mounting portion **132**. The groove portions **132***b*, **132***c* extend in the Y-direction from positions corresponding to male threads **142***b*, **142***c* (FIG. **9**) described later, respectively, to end portions (end portions at a positive side in the

Y-direction in the illustrated example) at one side in the Y-direction of the mounting portion **132**, and end portions of the groove portions **132***b*, **132***c* at one side are open.

[0051] As illustrated in FIG. **9**, the member **140** has an approximately rectangular shape extending in the Y-direction and the Z-direction. At a center of the member **140**, a through-hole **141** extending in the Z-direction is provided. The through-hole **141** is a region through which the laser light L passes. A width in the X-direction of the through-hole **141** may be equal to a width in the X-direction of the region **131***c* (FIG. **7**) and a width in the X-direction of the through-hole **132***a* (FIG. **8**) or may be larger than these widths. At four corners of the member **140**, respective male threads **142***a* that fix the member **140** to the housing **120** are disposed. Additionally, in respective upper and lower regions of the through-hole **141**, the male threads **142***b*, **142***c* screwed with the member **140** from a negative side in the X-direction are disposed.

[Attachment and Removal of Optical Path Cover **130**]

[0052] Next, with reference to FIG. **10** and FIG. **11**, the attachment and removal of the optical path cover **130** will be described. FIG. **10** is a top view illustrating a configuration of the measurement unit **100** in a state of the optical path cover **130** being removed. FIG. **11** is a top view illustrating a configuration of the measurement unit **100** in a state of the optical path cover **130** being mounted.

[0053] When the optical path cover **130** is mounted, as illustrated in FIG. **10**, the male threads **142***b*, **142***c* are set to be in a state of projecting to the negative side in the X-direction. Next, the mounting portion **132** of the optical path cover **130** is inserted into a region between the member **140** and heads of the male threads **142***b*, **142***c* in the positive side in the Y-direction. In this respect, the mounting portion **132** slides to the member **140**.

[0054] Additionally, screw portions of the male threads **142***b*, **142***c* are inserted into the groove portions **132***b*, **132***c*. Next, as illustrated in FIG. **11**, a position in the Y-direction of the optical path cover **130** relative to the housing **120** is adjusted. Next, the male threads **142***b*, **142***c* are fastened and the mounting portion **132** is sandwiched by the member **140** and the heads of the male threads **142***b*, **142***c* to fix the optical path cover **130** to the housing **120**.

[0055] When the optical path cover **130** is removed, the male threads **142***b*, **142***c* are loosened. Next, as illustrated in FIG. **10**, the mounting portion **132** of the optical path cover **130** is pulled out to a negative side in the Y-direction from the region between the member **140** and the heads of the male threads **142***b*, **142***c*.

[0056] That is, in the embodiment, the optical path cover **130** is configured to be removably attachable to the housing **120** in an attachment/removal direction (the Y-direction in the embodiment) intersecting with the irradiation direction of the laser light L (−X-direction). Additionally, when the optical path cover **130** is attached to or removed from the housing **120**, movement in the irradiation direction (−X-direction) of the optical path cover **130** relative to the housing **120** can be restricted.

[0057] With this configuration, when the optical path cover **130** is attached to or removed from the housing **120**, a contact of the optical path cover **130** with the brace **170** (FIG. **1**) and the measurement object W can be prevented. Therefore, the optical path cover **130** according to the embodiment is easily mountable to the housing **120** even after the brace **170** (FIG. **1**) and the measurement object W are disposed.

[0058] With this configuration, for example, in a case where measurement is performed while the optical path cover **130** is removed and a variation in the measurement result is large, the optical path cover **130** can be mounted for high accuracy. In this case, since the optical path cover **130** does not contact the brace **170** (FIG. **1**) or the measurement object W, measurement can be performed with the same conditions.

[0059] Additionally, in the embodiment, the position in the Y-direction of the optical path cover **130** relative to the housing **120** is adjustable, and the optical path cover **130** can be fixed to the housing **120** with the position in the attachment/removal direction adjusted.

[0060] Here, the optical measurement device as described above allows reducing influence of air fluctuation as the widths in the X-direction of the region **131***c* (FIG. **7**) and the through-hole **132***a* (FIG. **8**) become small. Additionally, an invasion of a foreign matter or the like from the outside can be inhibited.

[0061] On the other hand, in the optical measurement device as described above, there may be a case where the position in the Y-direction of the laser light L differs from design due to a manufacturing error of the polygon mirror **113** (FIG. **2**), an assembly error of each of the configurations, and the like. Therefore, unless the widths in the X-direction of the region **131***c* (FIG. **7**) and the through-hole **132***a* (FIG. **8**) are increased to some extent, the optical path cover **130** obstructs the laser light L and preferred measurement possibly cannot be performed.

[0062] However, in the embodiment, even when the position in the Y-direction of the laser light L differs from the design, by adjusting the position of the optical path cover **130** in the Y-direction, the laser light L can be preferably emitted to the measurement region **101**. Therefore, the optical measurement device in which the width of the region **131***c* (FIG. **7**) in the X-direction and the width of the through-hole **132***a* (FIG. **8**) in the X-direction are decreased, the influence of air fluctuation is small, and environment resistance is high can be provided.

Second Embodiment

[0063] Next, an optical measurement device according to the second embodiment of the present invention will be described. In the following description, same reference numerals are given to parts similar to those of the first embodiment to omit the description.

[0064] The optical measurement device according to the second embodiment is basically configured similarly to the optical measurement device according to the first embodiment. However, the optical measurement device according to the second embodiment includes an optical path cover **230** and a member **240** instead of the optical path cover **130** and the member **140**.

[0065] FIG. **12** is a front view illustrating a configuration of a mounting portion **232** of the optical path cover **230**. The optical path cover **230** is basically configured similarly to the optical path cover **130**. However, the optical path cover **230** includes the mounting portion **232** instead of the mounting portion **132**. The mounting portion **232** is basically configured similarly to the mounting portion **132**. However, the mounting portion **232** does not include the groove portion **132***b*, **132***c*. Additionally, at respective one end and the other end in the Y-direction of the mounting portion **232**, groove portions **232***b*, **232***c* are disposed. The groove portions **232***b*, **232***c* extend in the Z-direction from positions corresponding to male threads **242***b*, **242***c* (FIG. **13**) described later, respectively, to end portions (end portions at a negative side in the Z-direction in the illustrated example) at one side in the Z-direction of the mounting portion **232**, and end portions at one side are open.

[0066] FIG. **13** is a front view illustrating a configuration of the member **240**. The member **240** is basically configured similarly to the member **140**. However, the member **240** does not include the male thread **142***b*, **142***c*. Additionally, in regions at the positive side in the Y-direction and the negative side in the Y-direction with respect to the through-hole **141**, the male threads **242***b*, **242***c* screwed with the member **240** from the negative side in the X-direction are disposed, respectively.

[0067] The optical path cover **230** according to the second embodiment is basically removably attachable to the housing **120** by the method similar to that of the optical path cover **130** according to the first embodiment. However, in the first embodiment, the attachment/removal direction of attaching or removing the optical path cover **130** to/from the housing **120** is the Y-direction. On the other hand, in the second embodiment, the attachment/removal direction of attaching or removing the optical path cover **230** to/from the housing **120** is the Z-direction.

OTHER EMBODIMENTS

[0068] In the first embodiment, the example in which the optical path cover **130** is attached to or removed from the housing **120** via the member **140** has been described. However, the optical path cover **130** may be directly removably attachable to the housing **120**. In such a case, the housing **120** may have a surface slidable with the mounting portion **132** when the optical path cover **130** is attached or removed. Additionally, the male threads **142***b*, **142***c* may be screwed with the housing **120**.

What is claimed is:

1. An optical measurement device comprising:

a measurement region in which a measurement object is disposed;

a light beam scanning unit that irradiates the measurement region with light beam and scans the light beam in a scanning direction intersecting with an irradiation direction of the light beam;

a light receiving unit that receives the light beam that has passed through the measurement region and outputs a light receiving signal;

a signal processing unit that outputs data indicative of a dimension in the scanning direction of the measurement object based on the light receiving signal; and

an optical path cover that is configured to be removably attachable to a housing of the light beam scanning unit and covers an optical path of the light beam in a range from the housing to the measurement object.

2. The optical measurement device according to claim **1**, wherein

the optical path cover is configured to be removably attachable to the housing from an attachment/removal direction intersecting with the irradiation direction.

3. The optical measurement device according to claim **2**, wherein

movement in the irradiation direction of the optical path cover relative to the housing is restrictable when the optical path cover is attached to or removed from the housing.

4. The optical measurement device according to claim **3**, wherein

the attachment/removal direction intersects with the scanning direction,

a position in the attachment/removal direction of the optical path cover to/from the housing is adjustable, and

the optical path cover is fixable to the housing in a state of the position in the attachment/removal direction being adjusted.

5. The optical measurement device according to claim **1**, further comprising:

a member disposed at an emission port of the light beam of the housing; and

male threads that are screwed with the member in the irradiation direction and are able to sandwich a part of the optical path cover with the member, wherein

the member is slidable with the optical path cover when the optical path cover is attached or removed.

6. The optical measurement device according to claim **5**, wherein

the optical path cover:

is configured to be removably attachable to the housing in an attachment/removal direction intersecting with the irradiation direction; and

includes:

a cover portion that covers the optical path of the light beam; and

a mounting portion slidable with the member when the optical path cover is attached to or removed from the housing, and

the mounting portion includes groove portions disposed at positions corresponding to the male threads and extending in the attachment/removal direction.

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