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(54) **CONNECTOR UNIT AND WIRE HARNESS**

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(57) **ABSTRACT**

A connector unit includes a first connector, a second connector, and a fastener member. The fastener member includes a bolt, a collar supported in such a manner as to be slidable along a fastening direction between a fastened position where the collar has contact with first connection terminal, and a fastening released position where the collar is separated from the first connection terminal, a nut to which a shaft portion of the bolt is fastened in a state in which the nut sandwiches the first connection terminal, the second connection terminal, and the collar between the nut and a head portion of the bolt, and an engagement member that is provided on the bolt and engaged with the collar, moves the collar from the fastening released position to the fastened position in accordance with a fastening operation of the bolt.

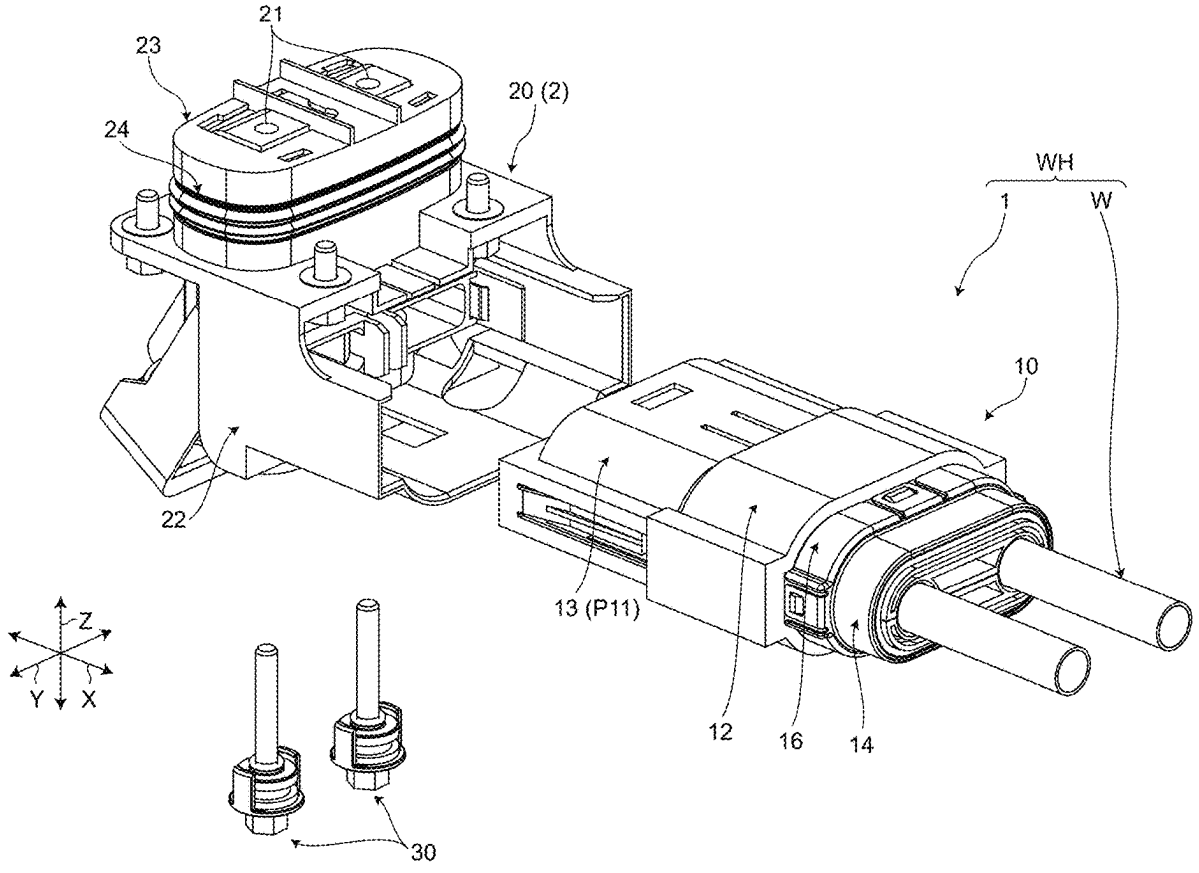


FIG.1

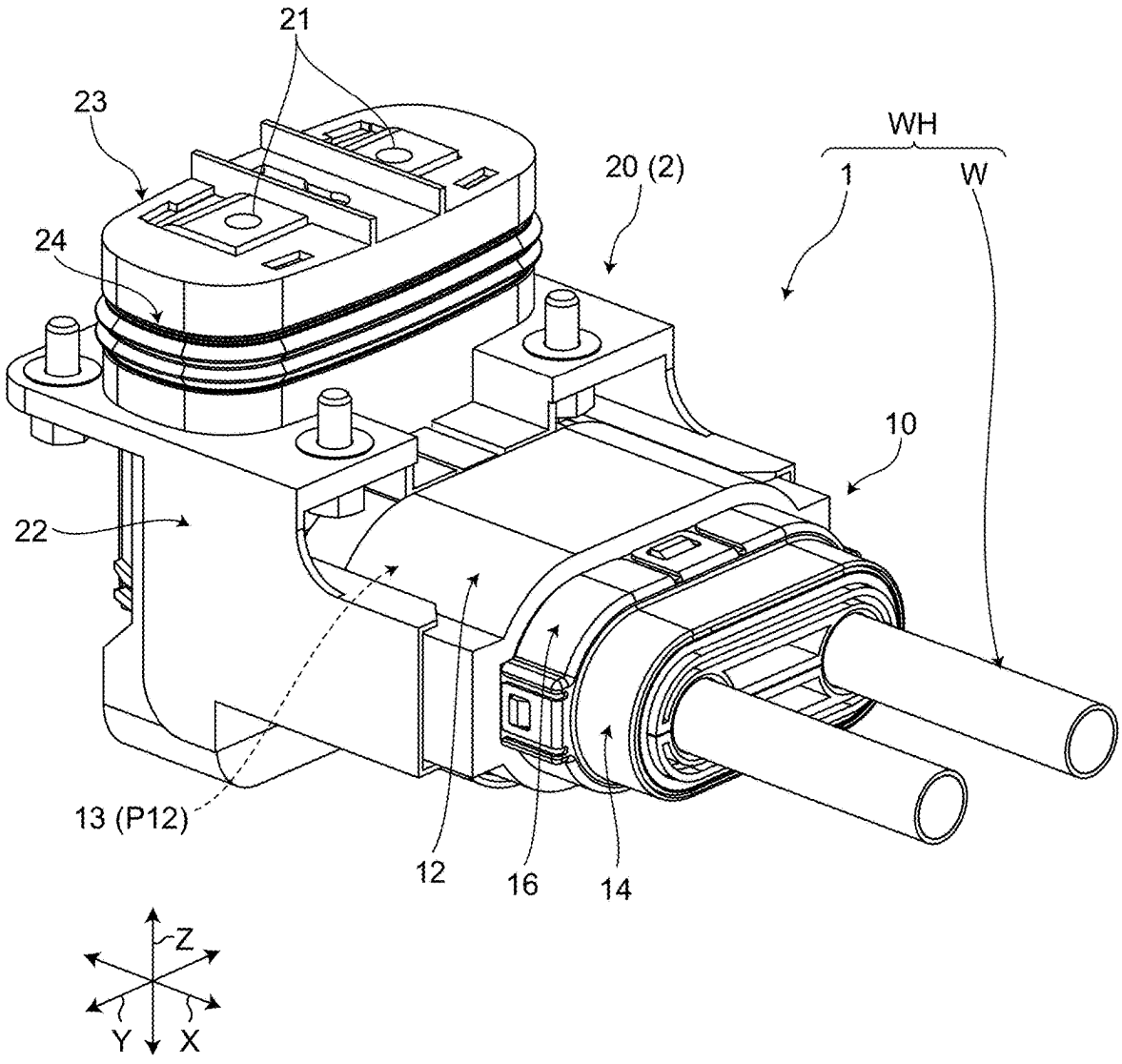


FIG.2

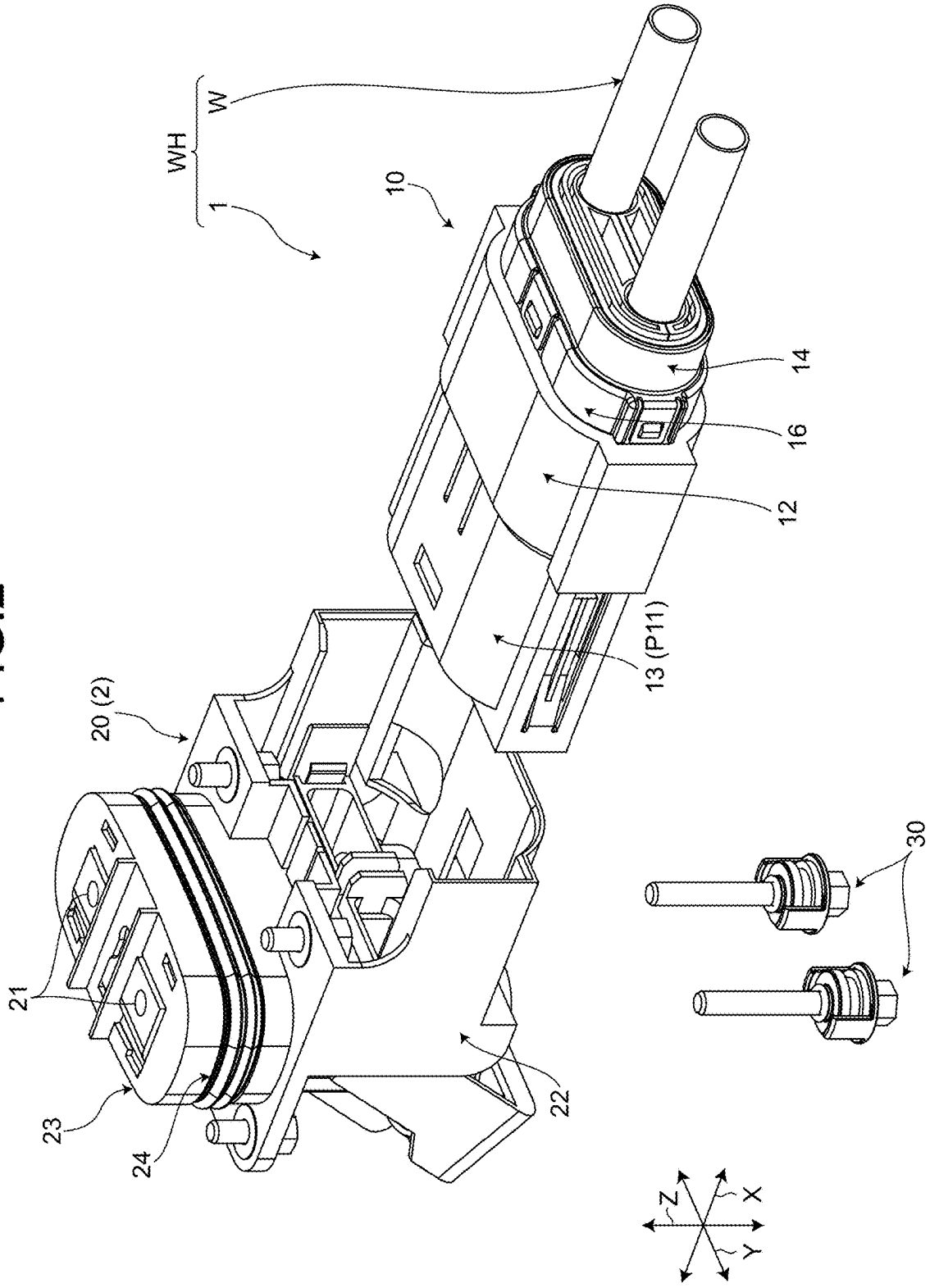


FIG.3

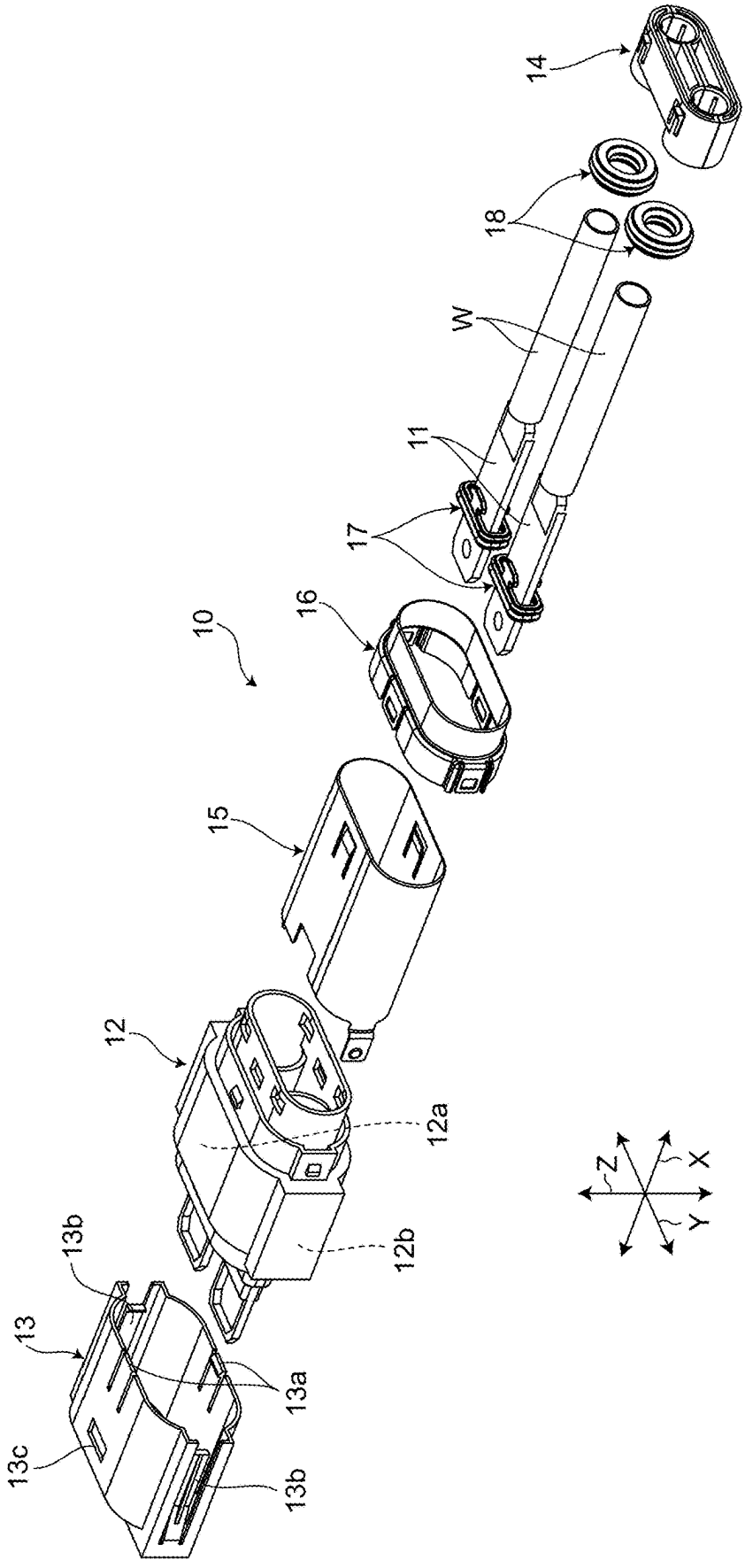


FIG.4

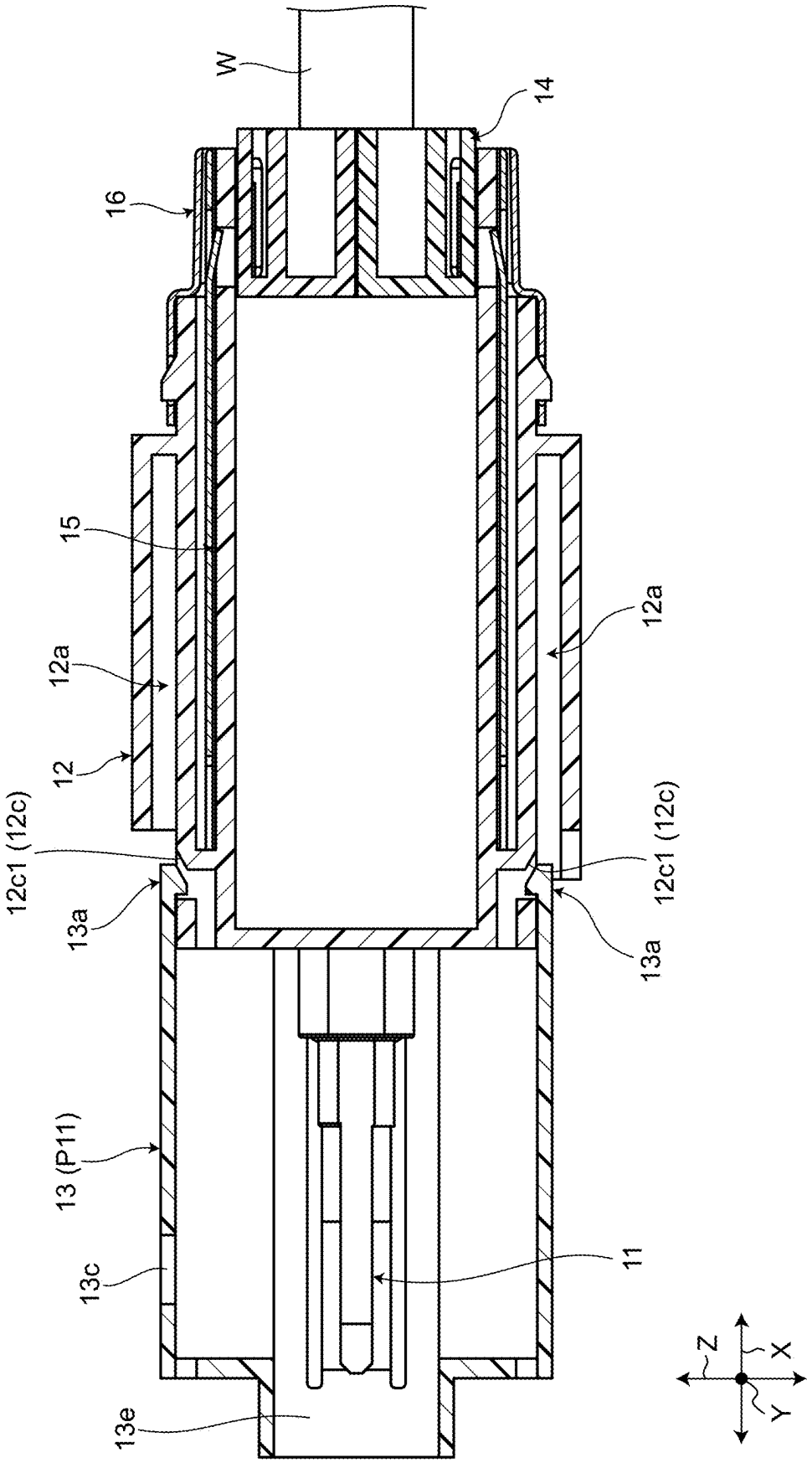

W
14
16
15
12a
12a
12
12c1 (12c)
12c1 (12c)
13a
13a
13 (P11)
13c
11
13e
Z
X
Y

FIG.5

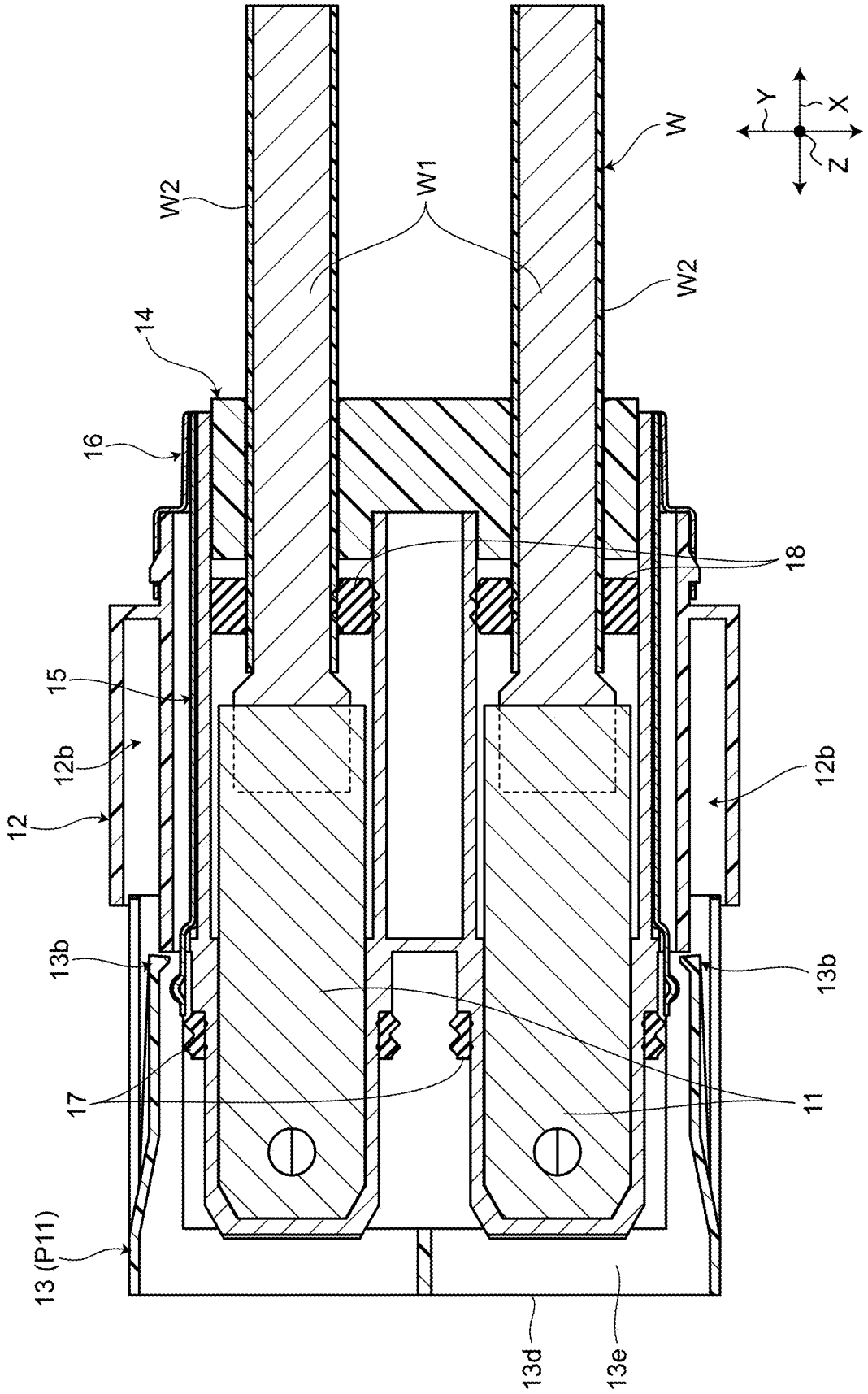


FIG.6

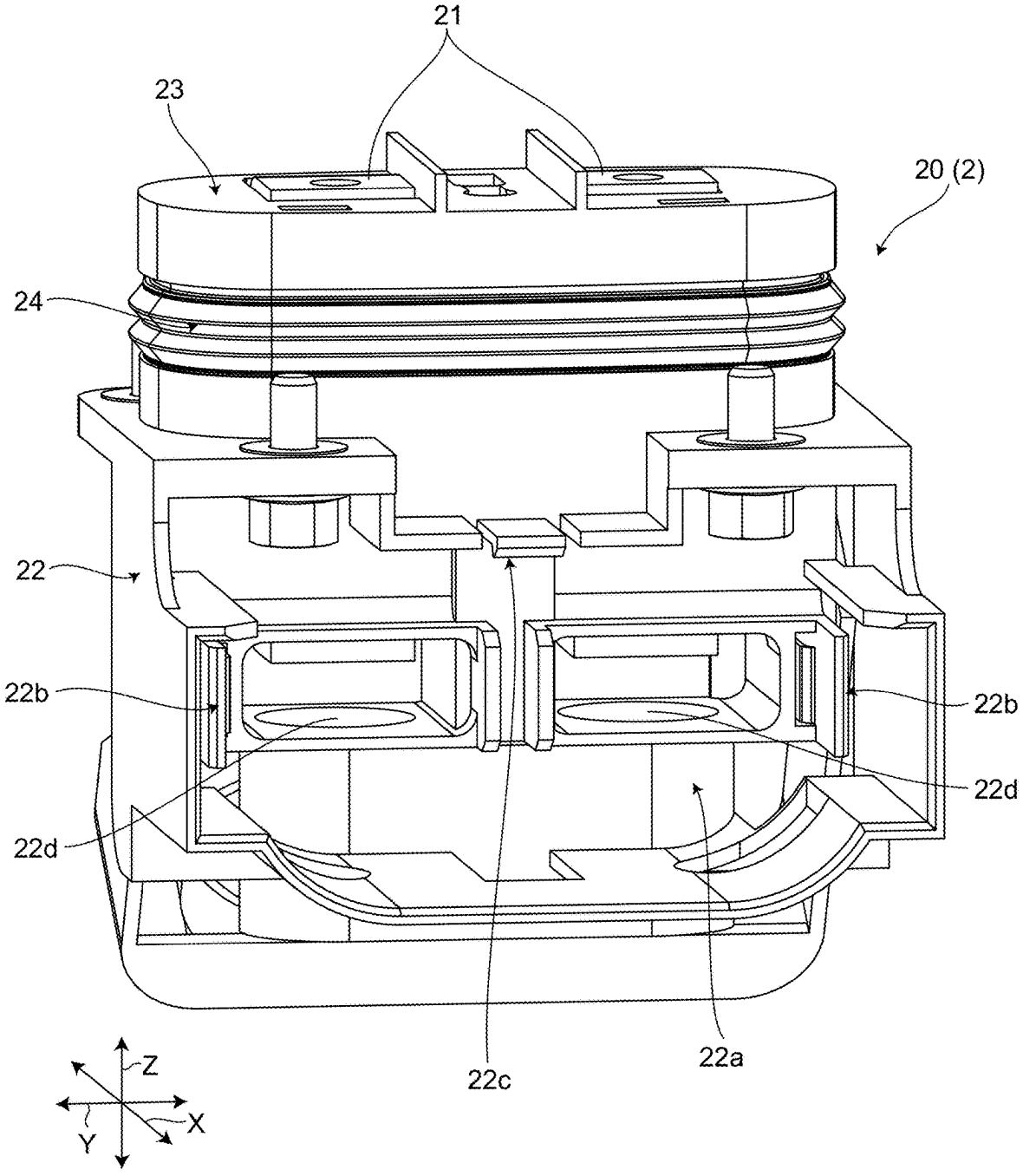


FIG.7

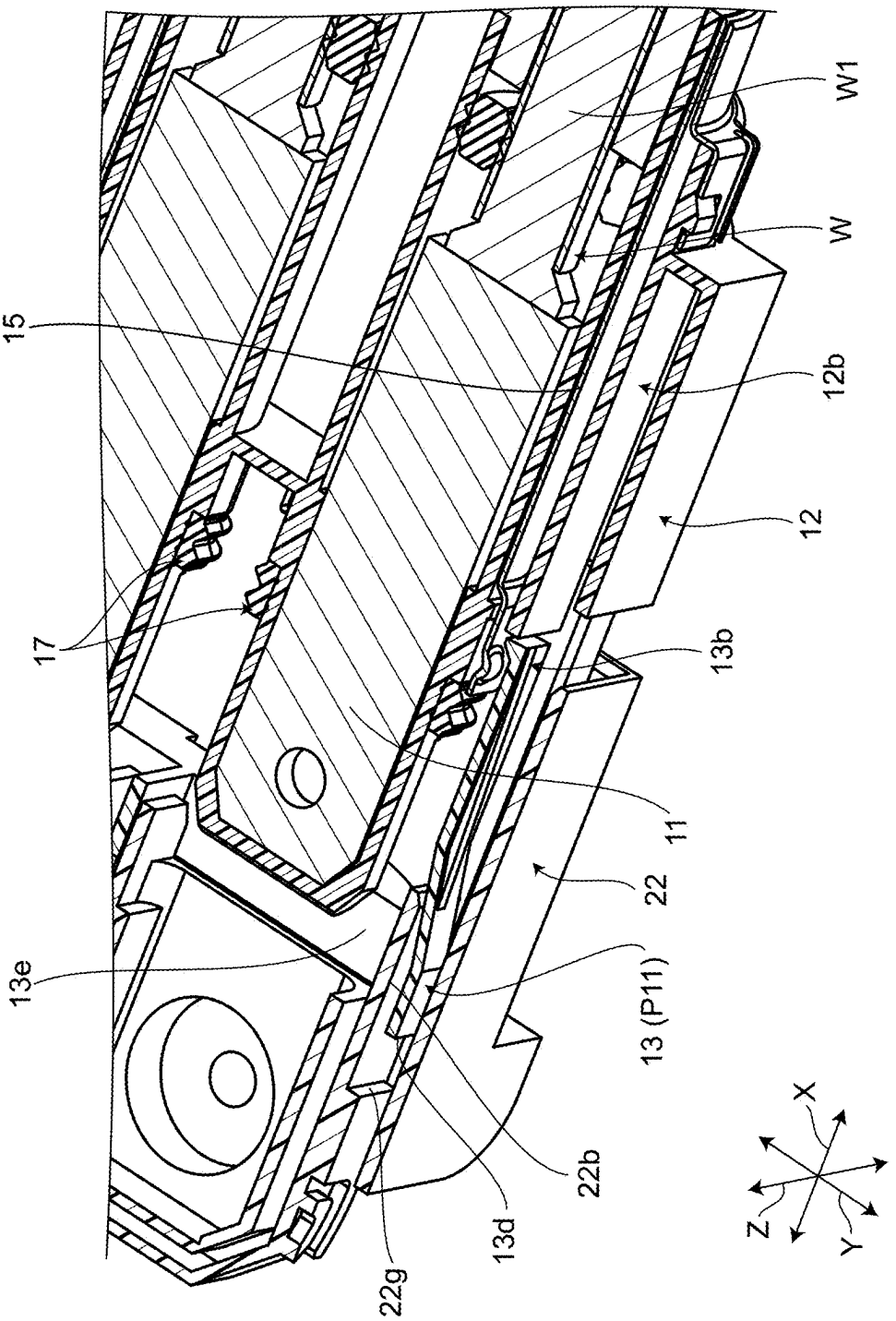


FIG.8

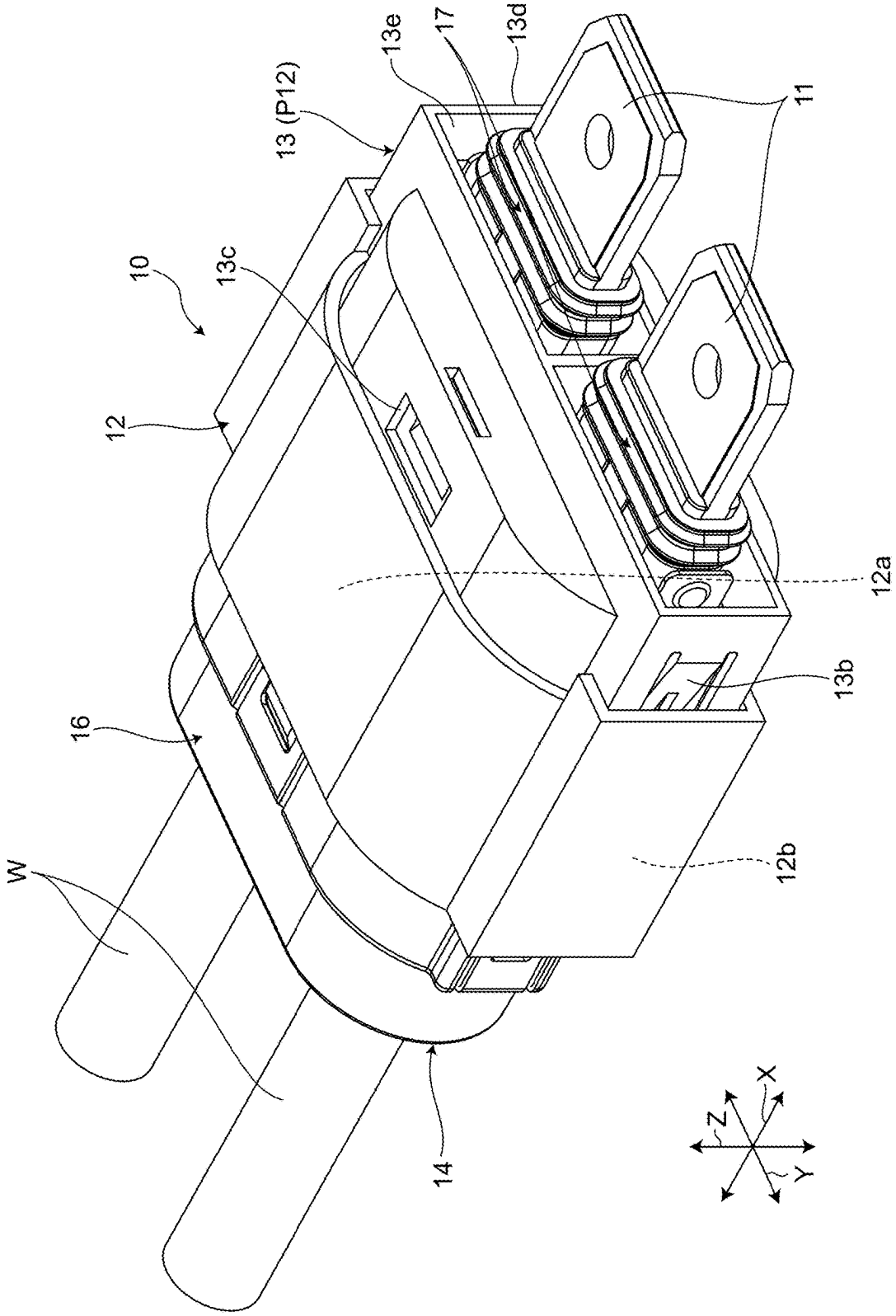


FIG.9

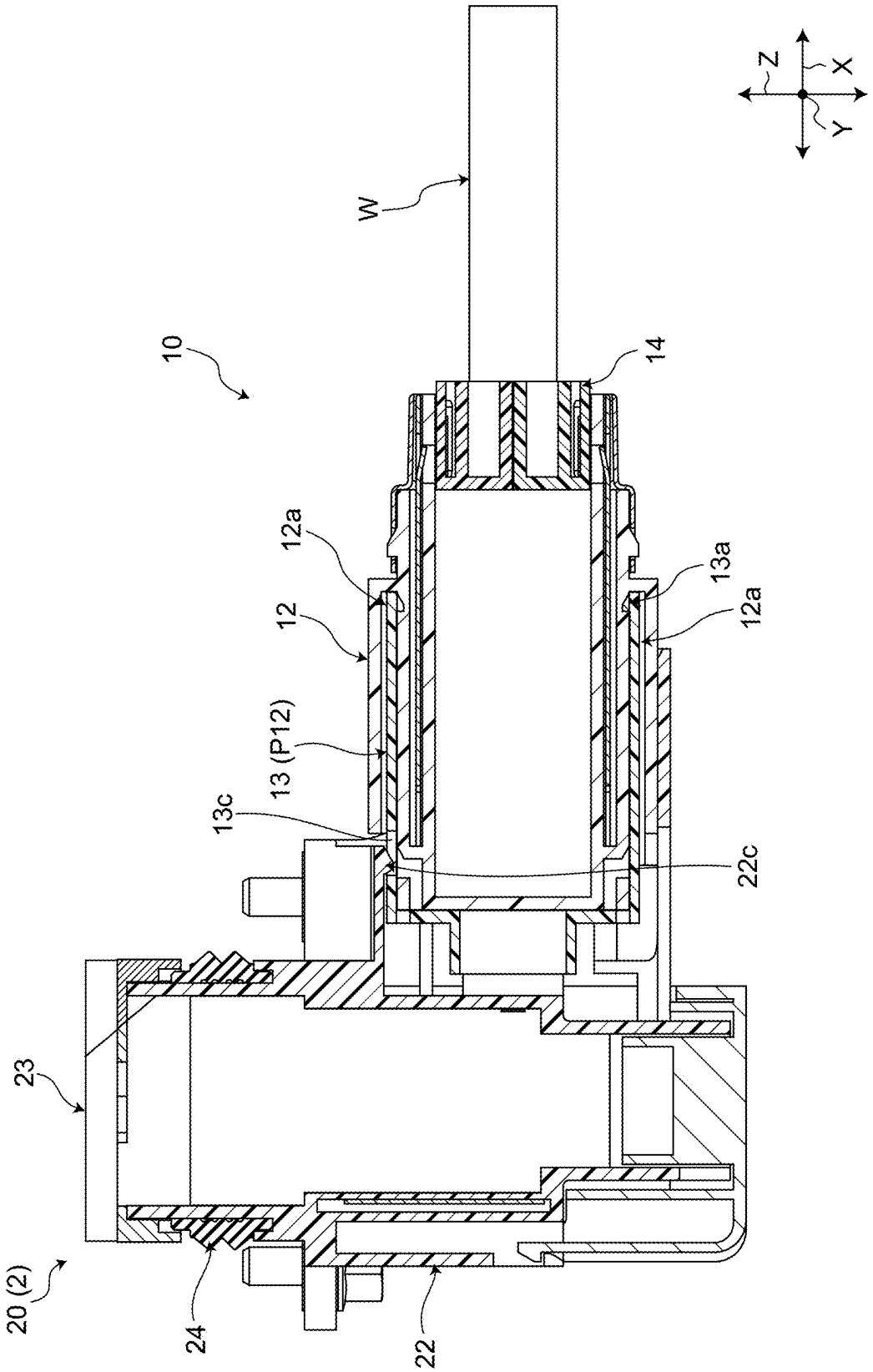


FIG.10

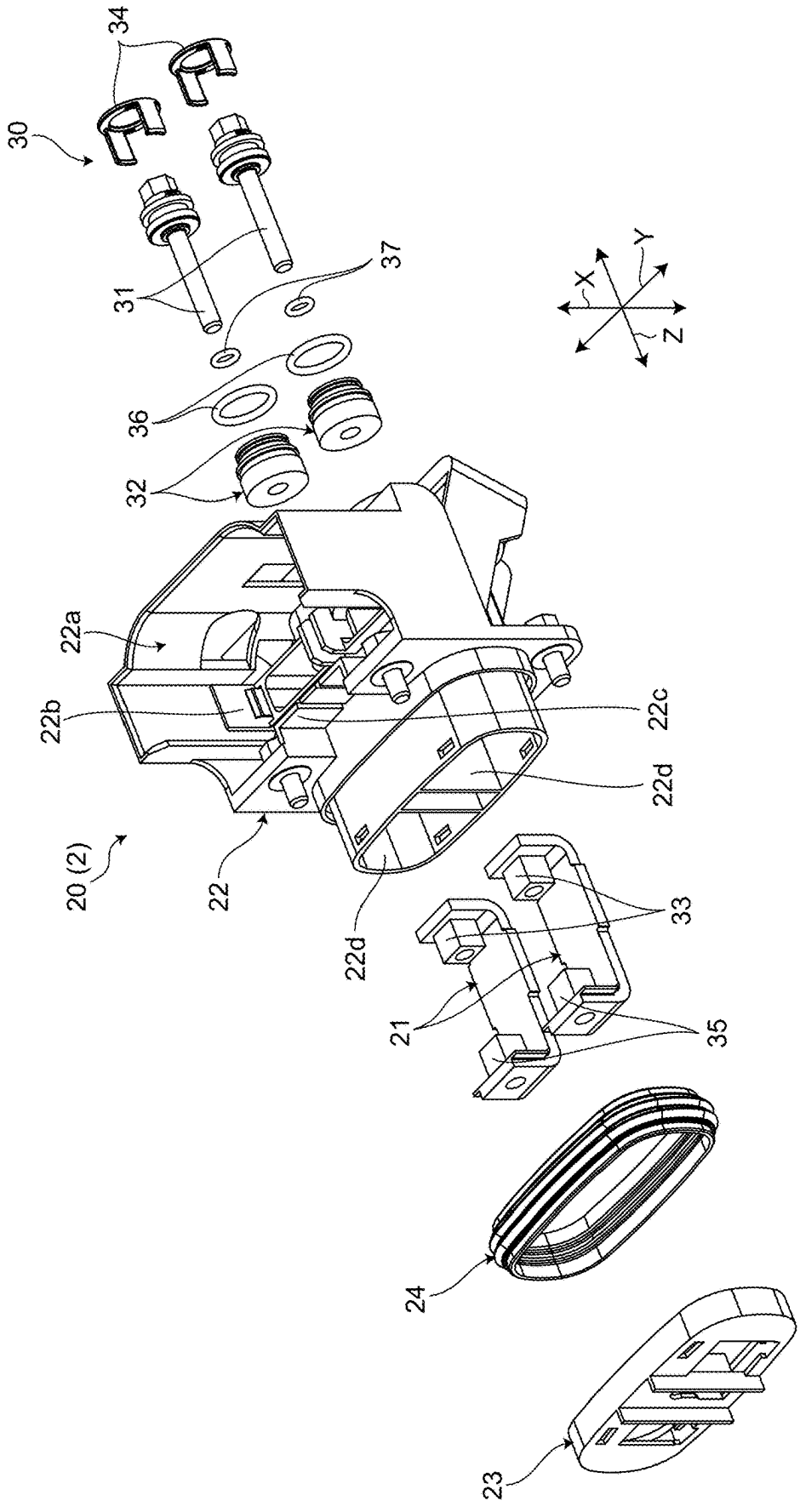


FIG.11

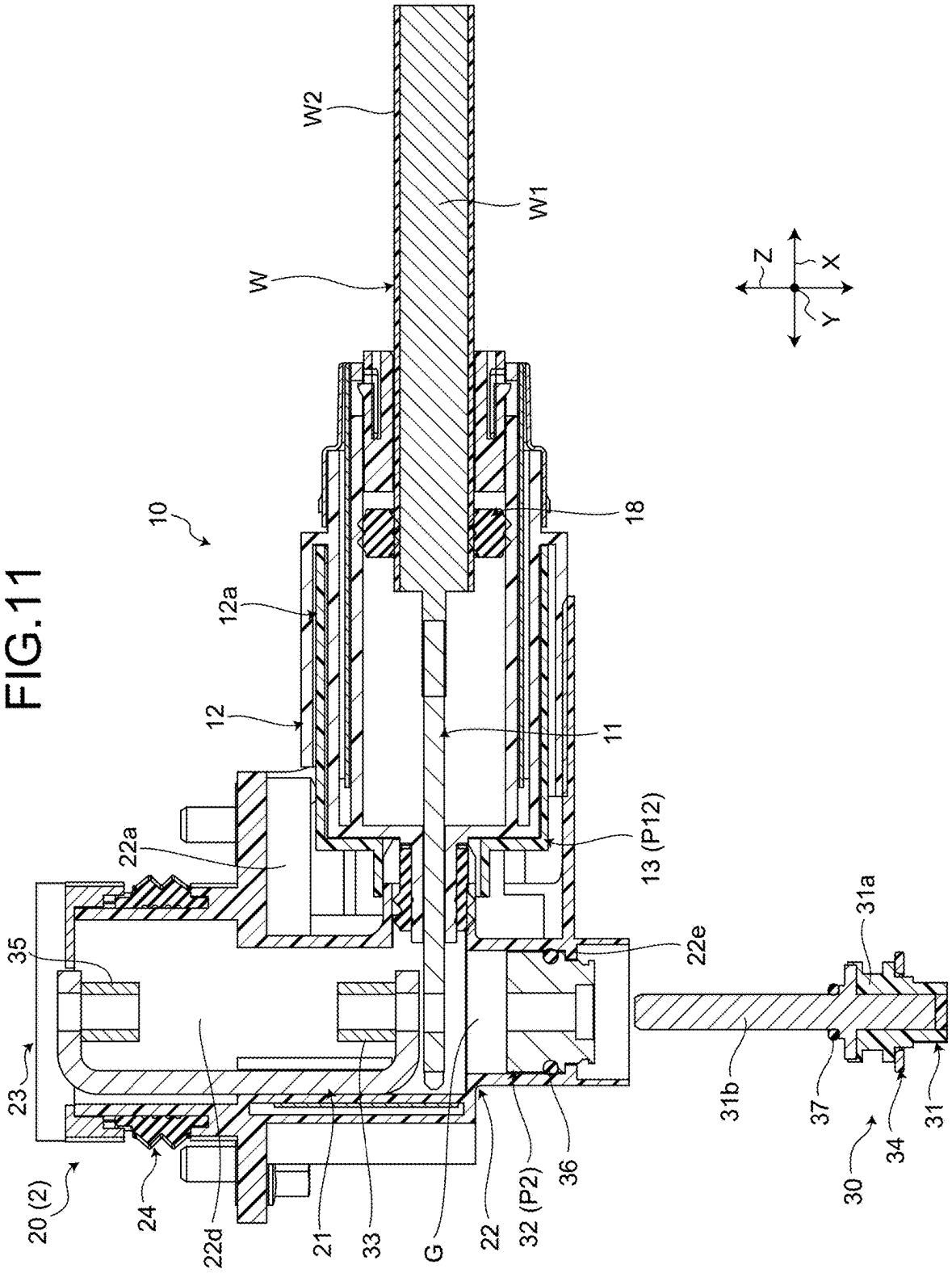

W2
W1
W
Z
X
Y
10
18
12a
12
11
13 (P12)
22a
22e
31a
35
23
31b
37
34
31
30
20 (2)
24
22d
21
33
G
22
32 (P2)
36

FIG.12

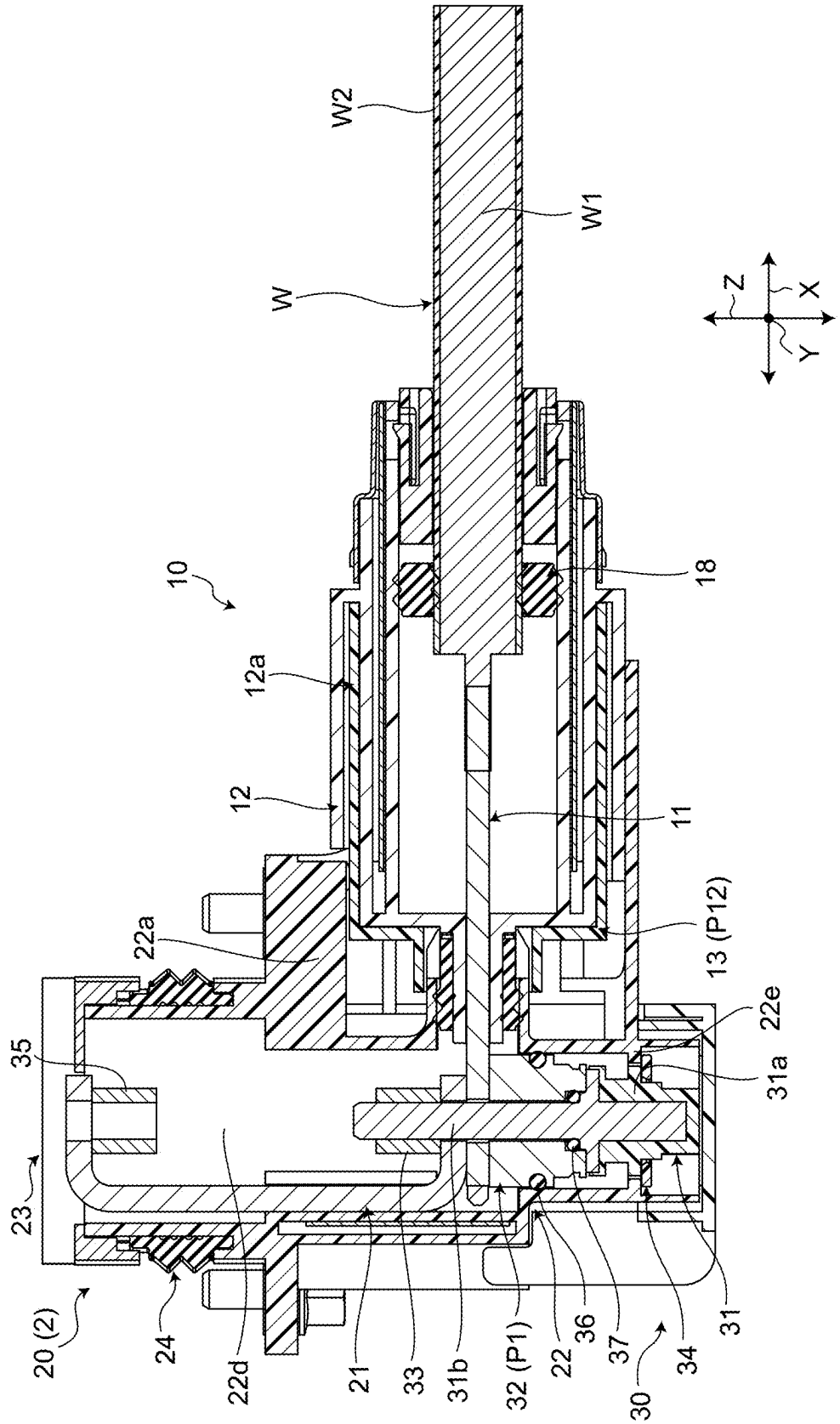

W2
W1
W
Z
X
Y
10
18
12a
12
11
13 (P12)
22a
22e
31a
35
23
20 (2)
24
22d
21
33
31b
32 (P1)
22
36
37
30
34
31

FIG.13

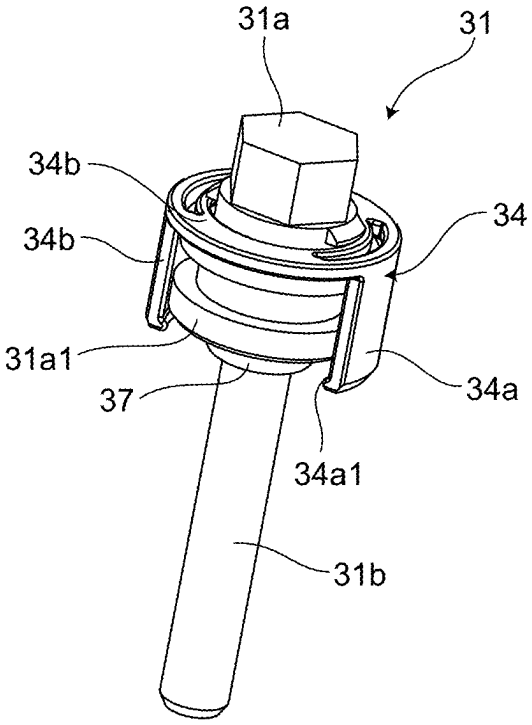


FIG.14

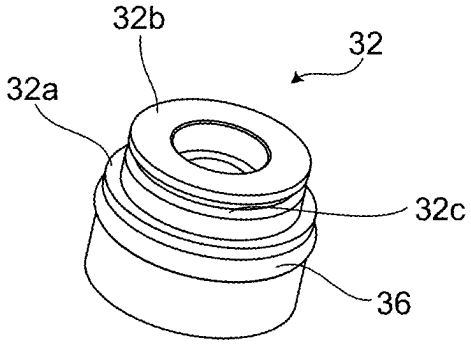


FIG.15

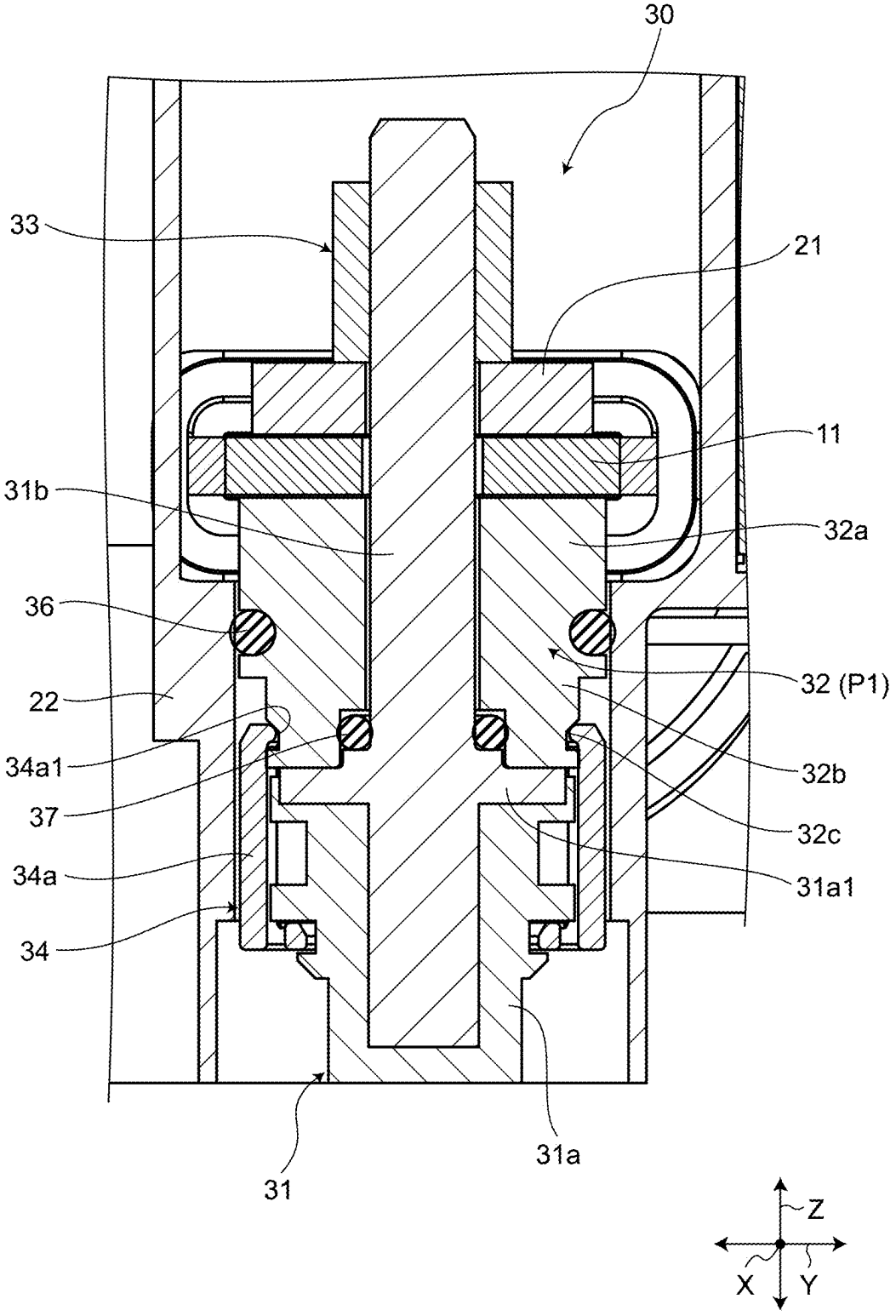
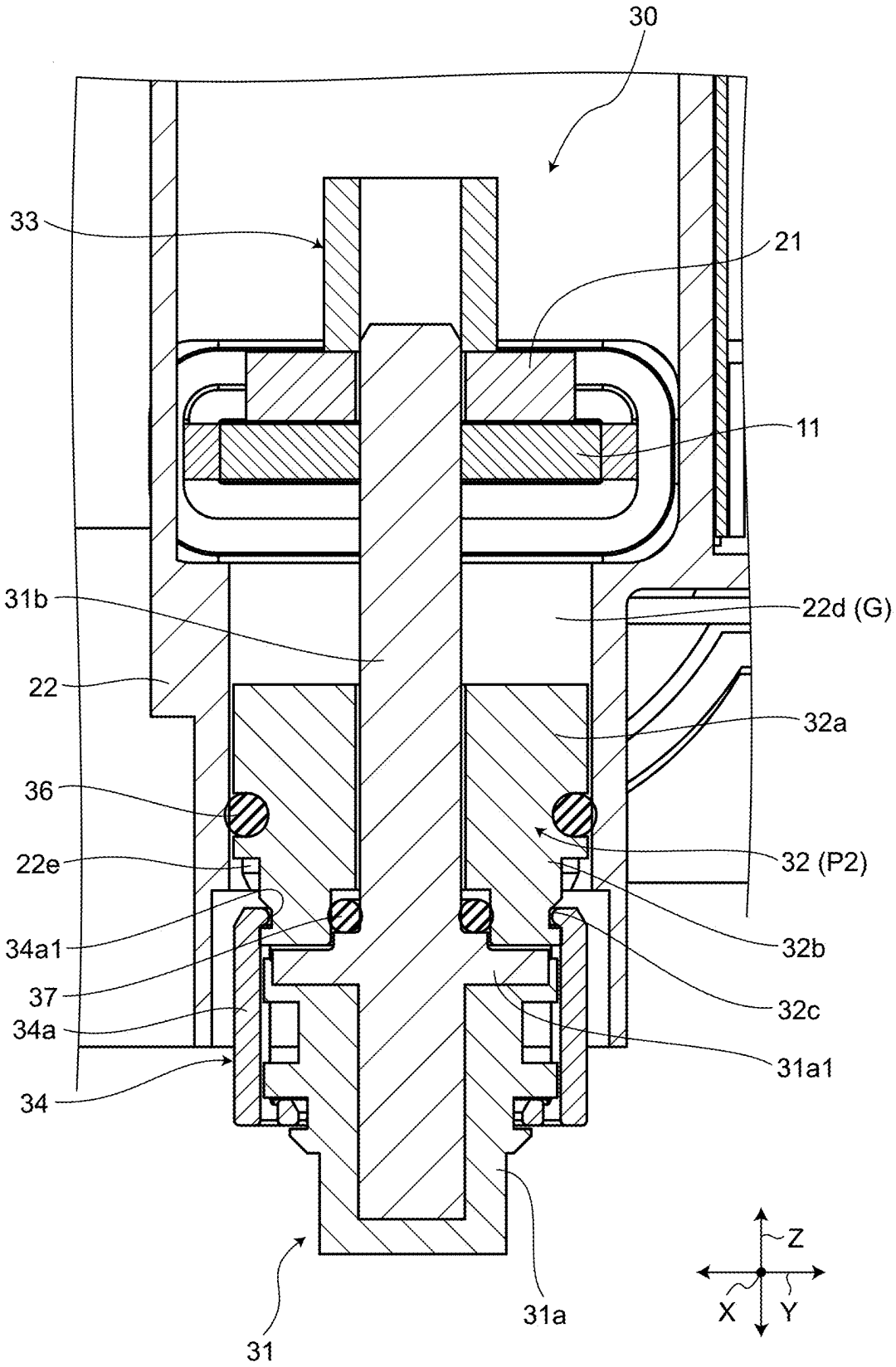

30
33
21
11
31b
32a
36
32 (P1)
22
32b
34a1
37
32c
34a
31a1
34
31
31a
Z
X
Y

FIG.16


30
33
21
11
31b
22d (G)
22
32a
36
22e
32 (P2)
34a1
32b
37
32c
34a
31a1
34
31a
31
Z
X
Y

CONNECTOR UNIT AND WIRE HARNESS

CROSS-REFERENCE TO RELATED APPLICATION(S)

[0001] The present application claims priority to and incorporates by reference the entire contents of Japanese Patent Application No. 2024-017567 filed in Japan on Feb. 8, 2024.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present invention relates to a connector unit and a wire harness.

2. Description of the Related Art

[0003] As a conventional technique related to a connector unit of a wire harness, for example, Japanese Patent Application Laid-open No. 2014-96310 A discloses a connector unit including a first connector having a first connection terminal, a second connector having a second connection terminal, and a fastener member fastening the first connection terminal and the second connection terminal.

[0004] Meanwhile, the above-described connector unit described in Japanese Patent Application Laid-open No. 2014-96310 A, for example, has room for improvement in appropriately performing a fastening work of the first connection terminal and the second connection terminal by the fastener member.

SUMMARY OF THE INVENTION

[0005] The present invention has been devised in view of the above-described circumstances, and the object of the present invention is to provide a connector unit and a wire harness that can appropriately perform a fastening work of terminals.

[0006] In order to achieve the above mentioned object, a connector unit according to one aspect of the present invention includes a first connector including a first connection terminal; a second connector that includes a second connection terminal to be electrically connected with the first connection terminal, and is fitted with the first connector along an axis line direction; and a fastener member configured to fasten the first connection terminal and the second connection terminal, wherein the fastener member includes: a bolt extending along a fastening direction intersecting with the axis line direction; a collar having electrical conductivity that is supported in such a manner as to be slidable along the fastening direction between a fastened position where the collar has contact with one of the first connection terminal and the second connection terminal arranged along the fastening direction, and a fastening released position where the collar is separated from the one; a nut that has contact with another one of the first connection terminal and the second connection terminal, to which a shaft portion of the bolt is fastened in a state in which the nut sandwiches the first connection terminal, the second connection terminal, and the collar between the nut and a head portion of the bolt; and an engagement member that is provided on the bolt and engaged with the collar, moves the collar from the fastening released position to the fastened position together with the bolt in accordance with a fastening operation of the bolt, and moves the collar from the fastened position to the fastening released position together with the bolt in accordance with a fastening release operation of the bolt.

[0007] The above and other objects, features, advantages and technical and industrial significance of this invention will be better understood by reading the following detailed description of presently preferred embodiments of the invention, when considered in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. **1** is an exemplary perspective view of a connector unit to be applied to a wire harness according to an embodiment;

[0009] FIG. **2** is an exemplary exploded perspective view of a connector unit to be applied to a wire harness according to an embodiment;

[0010] FIG. **3** is an exemplary exploded perspective view of a first connector of a connector unit according to an embodiment;

[0011] FIG. **4** is an exemplary cross-sectional view orthogonal to a width direction of a first connector according to an embodiment;

[0012] FIG. **5** is an exemplary cross-sectional view orthogonal to a fastening direction of a first connector according to an embodiment;

[0013] FIG. **6** is an exemplary perspective view of a second connector of a connector unit according to an embodiment;

[0014] FIG. **7** is an exemplary perspective view (partial cross-sectional view) illustrating a vicinity of an engagement piece of a connector unit according to an embodiment;

[0015] FIG. **8** is an exemplary perspective view of a first connector according to an embodiment, and is a diagram illustrating a state in which a slide cover is in an open position;

[0016] FIG. **9** is an exemplary cross-sectional view illustrating a vicinity of a pullback protrusion of a connector unit according to an embodiment;

[0017] FIG. **10** is an exemplary exploded perspective view of a second connector and a fastener member according to an embodiment;

[0018] FIG. **11** is an exemplary cross-sectional view of a connector unit according to an embodiment, and is a diagram illustrating a state before fastening of a fastener member;

[0019] FIG. **12** is an exemplary cross-sectional view of a connector unit according to an embodiment, and is a diagram illustrating a state after fastening of a fastener member;

[0020] FIG. **13** is an exemplary perspective view of a bolt and an engagement member of a fastener member according to an embodiment;

[0021] FIG. **14** is an exemplary perspective view of a collar of fastener member according to an embodiment;

[0022] FIG. **15** is an exemplary cross-sectional view of a fastener member according to an embodiment, and is a diagram illustrating a state in which a collar is in a fastened position; and

[0023] FIG. **16** is an exemplary cross-sectional view of a fastener member according to an embodiment, and is a diagram illustrating a state in which a collar is in a fastening released position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0024] An embodiment according to the present invention will be described in detail below based on the drawings. In addition, the present invention is not limited by the following embodiment. Further, components in the following embodiment include the ones that can be replaced by those skilled in the art, and are easy, or the ones that are substantially identical. In addition, in this specification, ordinal numbers are used only to distinguish parts, members, regions, positions, directions, and the like, and do not indicate order or priority.

Embodiment

[0025] FIG. **1** is a perspective view of a connector unit **1** to be applied to a wire harness WH according to an embodiment, and FIG. **2** is an exploded perspective view of the connector unit **1**. The connector unit **1** of the present embodiment illustrated in FIGS. **1** and **2** is incorporated into the wire harness WH laid in a vehicle such as an automobile. Here, the wire harness WH bundles, as a set of components, wiring materials W to be used for power supply and signal communication, for connection between devices mounted on the vehicle, for example, and connects the wiring materials W to the devices via connectors or the like. The wire harness WH of the present embodiment includes a plurality of wiring materials W having electrical conductivity, and the connector unit **1** provided at the end of the plurality of wiring materials W. The connector unit **1** includes, for example, a first connector **10** provided on the wiring material W side, a second connector **20** provided on a terminal board **2** side, and a fastener member **30** (refer to FIG. **2**) that fastens a first connection terminal **11** of the first connector **10** and a second connection terminal **21** of the second connector **20**, which will be described later. In addition, aside from this, the wire harness WH may further include various component parts such as a grommet and a fixing tool.

[0026] Note that, in the following description, among a first direction, a second direction, and a third direction that intersect with each other, the first direction will be referred to as an "axis line direction X", the second direction will be referred to as a "width direction Y", and the third direction will be referred to as a "fastening direction Z". Here, the axis line direction X, the width direction Y, and the fastening direction Z are approximately orthogonal to each other. Typically, the axis line direction X extends along an extending direction of the plurality of wiring materials W, a fitting direction (insertion direction) of the first connector **10** and the second connector **20** of the connector unit **1**, and the like. Typically, the width direction Y extends along a width direction of the connector unit **1**, and the like. Typically, the fastening direction Z extends along a height direction (up-down direction) of the connector unit **1**, a fastening direction of the fastener member **30** of the connector unit **1**, and the like. Further, each direction to be used in the following description will be described as a direction set in a state in which the connector unit **1** is assembled to a vehicle, unless otherwise stated.

[0027] The wiring materials W each include, for example, a linear conductor portion W**1** (refer to FIG. **5**) having electrical conductivity, and an insulating coating W**2** having an insulating property that covers the external side of the conductor portion W**1**. The wiring material W is an electrical insulated wire in which the conductor portion W**1** is covered with the insulating coating W**2**. The conductor portion W**1** of the present embodiment is a core wire obtained by a bundling a plurality of metal wires having electrical conductivity, but may be a twisted core wire obtained by twisting the plurality of metal wires together. The insulating coating W**2** is a wire covering that covers the outer peripheral side of the conductor portion W**1**. The insulating coating W**2** is formed by extrusion-molding an insulating resin material, or the like, for example.

[0028] The wiring materials W extend linearly along the axis line direction X, and are formed in such a manner as to extend with almost the same diameter in the axis line direction X (extending direction). Further, the wiring material W is formed in such a manner that a cross-sectional shape of the conductor portion W**1** (cross-sectional shape intersecting with the axis line direction X) is an approximately round shape, and a cross-sectional shape of the insulating coating W**2** is an approximately annular shape, for example, and is formed in into an approximately round shape as a whole. In at least one end of the wiring material W, the insulating coating W**2** is stripped off, and the first connection terminal **11** is crimped to the conductor portion W**1** exposed from the insulating coating W**2**.

[0029] FIG. **3** is an exploded perspective view of the first connector **10** of the connector unit **1**. As illustrated in FIG. **3**, the first connector **10** includes, for example, the first connection terminal **11**, a first housing **12**, a slide cover **13**, a rear holder **14**, a shield shell **15**, a shield ring **16**, and a plurality of packings **17** and **18**. In the present embodiment, a pair of first connection terminals **11**, a pair of packings **17**, and a pair of packings **18** are provided in such a manner as to correspond to a pair of wiring materials W.

[0030] The first connection terminal **11** is a terminal fitting made of a metal material having electrical conductivity, and is electrically connected with the second connection terminal **21** of the second connector **20** (refer to FIGS. **11** and **12**). The first connection terminal **11** includes, for example, an electrical connection portion to be electrically connected with the second connection terminal **21**, and a wire crimping portion to be electrically connected with the end of the wiring material W. The first connection terminal **11** will also be referred to as a crimping terminal or the like.

[0031] The first housing **12** holds the first connection terminal **11** thereinside. The first housing **12** is formed into an approximately cylindrical shape in which both sides in the axis line direction X are opened, for example. In a state in which the first connection terminal **11** is attached to the inside of the first housing **12**, while the first connection terminal **11** protrudes from the opening on one side in the axis line direction X, the opening on the other side in the axis line direction X is blocked by the rear holder **14**. The first housing **12** is formed of a resin material having insulation.

[0032] The slide cover **13** is supported in such a manner as to be slidable along the axis line direction X between a close position P**11** (refer to FIG. **2**) where the slide cover **13** covers the first connection terminal **11**, and an open position P**12** (refer to FIG. **8**) where the slide cover **13** exposes the first connection terminal **11**, with respect to the first housing **12**. The slide cover **13** is formed into an approximately rectangular prism shape in which both sides in the axis line direction X are opened, for example. In a state of being located at the close position P**11**, the slide cover **13** covers the periphery of the first connection terminal **11** from both

sides in the width direction Y, and covers it from both sides in the fastening direction Z. The slide cover **13** is formed of a resin material having insulation.

[0033] The rear holder **14** blocks the opening of the first housing **12** from the other side in the axis line direction X. The rear holder **14** includes a pair of dividable members that can be divided along the fastening direction Z, for example. In the pair of dividable members, a plurality of insertion holes into which the wiring materials W are to be inserted along the axis line direction X are formed. In a state in which the pair of dividable members block the openings of the first housing **12**, the rear holder **14** is integrated with an inner circumferential surface of the first housing **12** by so-called snap-fit executed by claw fitting or the like. The rear holder **14** is formed of a resin material having insulation.

[0034] By covering the circumferences of the first connection terminals **11** and the wiring materials W, the shield shell **15** prevents noise generated from the first connection terminals **11** and the wiring materials W, from leaking to the outside of the first connector **10**. The shield ring **16** is crimped with a braided member (not illustrated) of the wiring material W or the like, for example. The shield shell **15** and the shield ring **16** are formed into a cylindrical shape following the outer circumferential surface of the first housing **12**, for example. The shield shell **15** and the shield ring **16** are formed of a metal material having electrical conductivity, for example.

[0035] The packings **17** and **18** prevent a foreign substance such as moisture from entering the first housing **12**. The packings **17** and **18** are formed of elastically-deformable members such as rubber or resin. The packing **17** is formed into an approximately rectangular prism shape following the outer circumferential surface of the first connection terminal **11**, for example, and fitted with the outer circumferential surface of the first connection terminal **11**. The packing **18** is formed into a cylindrical shape following the outer circumferential surface of the wiring material W, for example, and fitted with the outer circumferential surface of the wiring material W. In a state in which the wiring material W is attached to the inside of the first housing **12**, the packing **18** is interposed between the outer circumferential surface of the wiring material W and the inner circumferential surface of the first housing **12** (refer to FIG. **5**).

[0036] FIG. **4** is a cross-sectional view orthogonal to the width direction Y of the first connector **10**. As illustrated in FIG. **4**, a pair of first pocket portions **12***a* are provided at both ends in the fastening direction Z of the first housing **12**. In a case where the slide cover **13** slides and moves from the close position P**11** to the open position P**12** (refer to FIG. **8**), the pair of first pocket portions **12***a* accommodate the top wall and the bottom wall of the slide cover **13**. The pair of first pocket portions **12***a* are provided with opening portions opened toward one side in the axis line direction X (i.e., the side of the slide cover **13** located at the close position P**11**).

[0037] Further, on the top wall and the bottom wall of the slide cover **13**, a pair of engagement claw portions **13***a* to be engaged with engagement hole portions **12***c* of the first housing **12** are provided. The pair of engagement claw portions **13***a* are formed into a claw shape at another end portion in the axis line direction X on the top wall and the bottom wall of the slide cover **13**. The pair of engagement hole portions **12***c* are formed at positions closer to one side in the axis line direction X than the pair of first pocket portions **12***a* on the top wall and the bottom wall of the first housing **12**. The pair of engagement claw portions **13***a* each have an engagement surface that faces one end surface in the axis line direction X of the engagement hole portion **12***c*, and by the engagement surface and the one end surface being engaged in the axis line direction X, the slide cover **13** is locked at the close position P**11** with respect to the first housing **12**.

[0038] Further, another end surface in the axis line direction X of each of the pair of engagement hole portions **12***c* is provided with an inclined surface **12***c***1**. The inclined surfaces **12***c***1** are inclined in such a manner as to head for both end sides in the fastening direction Z of the first housing **12** as getting closer to the other side in the axis line direction X (the pair of first pocket portions **12***a* side). In a case where engagement between a pair of engagement pieces **13***b* (refer to FIG. **5**) of the slide cover **13**, which will be described later, and the first housing **12**, the inclined surfaces **12***c***1** allow the slide cover **13** to move from the close position P**11** toward the open position P**12** side (the pair of first pocket portions **12***a* side).

[0039] FIG. **5** is a cross-sectional view orthogonal to the fastening direction Z of the first connector **10**. As illustrated in FIG. **5**, a pair of second pocket portions **12***b* are provided at both ends in the width direction Y of the first housing **12**. In a case where the slide cover **13** slides and moves from the close position P**11** to the open position P**12** (refer to FIG. **8**), the pair of second pocket portions **12***b* accommodate a pair of side walls of the slide cover **13**. Similarly to the pair of first pocket portions **12***a*, the pair of second pocket portions **12***b* are provided with opening portions opened toward one side in the axis line direction X (i.e., the side of the slide cover **13** located at the close position P**11**).

[0040] Further, the pair of side walls of the slide cover **13** are provided with the pair of engagement pieces **13***b* to be engaged with the first housing **12** along the axis line direction X. The pair of engagement pieces **13***b* are formed on the pair of side walls of the slide cover **13** in a cantilever spring shape. In other words, while one end portions in the axis line direction X of the pair of engagement pieces **13***b* are coupled with the slide cover **13**, another end portions in the axis line direction X are formed as fee ends elastically-deformable along the width direction Y. The pair of engagement pieces **13***b* each have an engagement surface that faces the first housing **12** (i.e., one end surface in the axis line direction X of a corresponding one of the pair of second pocket portions **12***b*), and by the engagement surface and the one end surface being engaged in the axis line direction X, the movement of the slide cover **13** from the close position P**11** toward the open position P**12** side (the pair of second pocket portions **12***b* side) is restricted.

[0041] FIG. **6** is a perspective view of the second connector **20** of the connector unit **1**, and FIG. **7** is a perspective view (partial cross-sectional view) illustrating the vicinity of the engagement piece **13***b* of the connector unit **1**. As illustrated in FIGS. **6** and **7**, the second connector **20** is provided with a fitting opening portion **22***a* into which the above-described slide cover **13** of the first connector **10** fits. The fitting opening portion **22***a* is formed as a recess portion with a size and a shape into which the slide cover **13** can fit, in accordance with the external shape of the slide cover **13**, and in this example, is formed to have an approximately rectangular cross-sectional shape orthogonal to the axis line direction X. In the bottom portion of the fitting opening

portion **22***a*, an opening that the above-described first connection terminal **11** enters, and is communicated with an opening portion **22***d* into which the fastener member **30** to be described later is to be inserted is provided.

[0042] Further, a pair of protruding portions **22***b* that release the engagement between the above-described pair of engagement pieces **13***b* and the first housing **12** is provided at both ends in the width direction Y of the fitting opening portion **22***a*. The pair of protruding portions **22***b* protrude from the bottom portion of the fitting opening portion **22***a* toward the other side in the axis line direction X (the slide cover **13** side). The pair of protruding portions **22***b* are inserted into opening portions **13***e* of the slide cover **13** from leading end portions **13***d* (refer to FIG. **7**) on one side in the axis line direction X of the slide cover **13**. Then, the pair of protruding portions **22***b* come into contact with the pair of engagement pieces **13***b* in accordance with a fitting operation of the first connector **10** and the second connector **20**, and deform the engagement pieces **13***b* toward both sides in the width direction Y. The engagement between the pair of engagement pieces **13***b* and the first housing **12** is thereby released.

[0043] Further, in the bottom portion of the fitting opening portion **22***a*, a contact portion **22***g* that comes into contact with the leading end portion **13***d* of the slide cover **13** is provided. The contact portion **22***g* is an end surface (bottom surface) that faces the leading end portion **13***d* of the slide cover **13** along the axis line direction X. By having contact with the leading end portion **13***d* of the slide cover **13** in a state in which engagement between the above-described pair of engagement pieces **13***b* and the first housing **12** is released in accordance with the fitting operation of the first connector **10** and the second connector **20**, the contact portion **22***g* moves the slide cover **13** from the close position P**11** to the open position P**12** with respect to the first housing **12**. Consequently, the pair of engagement pieces **13***b* are accommodated into the pair of second pocket portions **12***b* (refer to FIG. **8**), and the above-described pair of engagement claw portions **13***a* are accommodated into the pair of first pocket portions **12***a*.

[0044] FIG. **8** is a perspective view of the first connector **10** and is a diagram illustrating a state in which the slide cover **13** is at the open position P**12**, and FIG. **9** is a cross-sectional view illustrating the vicinity of a pullback protrusion **22***c* of the connector unit **1**. As illustrated in FIGS. **8** and **9**, on the top wall of the slide cover **13**, an engagement hole portion **13***c* to be engaged with the pullback protrusion **22***c* of the second connector **20** is provided. The pullback protrusion **22***c* (refer to FIGS. **6** and **9**) is formed into a claw shape at the upper end of the above-described fitting opening portion **22***a*, and the engagement hole portion **13***c* is formed into an engagement hole shape penetrating through the top wall of the slide cover **13** along the fastening direction Z. Further, the engagement hole portion **13***c* is provided at one end portion in the axis line direction X on the top wall of the slide cover **13**, and is configured to be engaged with the pullback protrusion **22***c* in a case where the slide cover **13** moves from the close position P**11** to the open position P**12**.

[0045] As illustrated in FIG. **9**, the pullback protrusion **22***c* has an engagement surface that faces one end surface in the axis line direction X of the engagement hole portion **13***c*. In the case of removing the first connector **10** toward the other side in the axis line direction X with respect to the second connector **20**, by the engagement surface and the one end surface being engaged in the axis line direction X, the pullback protrusion **22***c* moves the slide cover **13** from the open position P**12** to the close position P**11** with respect to the first housing **12**. Consequently, the pair of engagement claw portions **13***a* are pulled back to the outside of the pair of first pocket portions **12***a*, and the above-described pair of engagement pieces **13***b* (refer to FIG. **8**) are pulled back to the outside of the pair of second pocket portions **12***b*.

[0046] FIG. **10** is an exploded perspective view of the second connector **20** and the fastener member **30**. As illustrated in FIG. **10**, the second connector **20** includes, for example, the second connection terminal **21**, a second housing **22**, a front holder **23**, and a unit packing **24**. Further, the fastener member **30** includes, for example, a bolt **31**, a collar **32**, nuts **33** and **35**, an engagement member **34**, and seal members **36** and **37**. In the present embodiment, a pair of second connection terminals **21**, and a pair of fastener members **30** are provided in such a manner as to respectively correspond to the pair of first connection terminals **11** of the first connector **10**.

[0047] The second connection terminal **21** is a terminal fitting made of a metal material having electrical conductivity, and is electrically connected with the first connection terminal **11** of the first connector **10** (refer to FIGS. **11** and **12**). The second connection terminal **21** includes, for example, a first electrical connection portion to be electrically connected with the first connection terminal **11**, a second electrical connection portion to be electrically connected with an external terminal, and a coupling portion that couples the first electrical connection portion and the second electrical connection portion. The second connection terminal **21** has an approximately U-shaped cross-sectional shape opened toward the other side in the axis line direction X, by the first electrical connection portion, the second electrical connection portion, and the coupling portion.

[0048] The second housing **22** holds the second connection terminal **21** thereinside. The second housing **22** is provided with the opening portion **22***d* into which the second connection terminal **21**, the fastener member **30**, and the like are inserted along the fastening direction Z. In the present embodiment, the second housing **22** is provided with a pair of opening portions **22***d* arranged in the width direction Y. In a state in which the second connection terminals **21** are attached to the inside of the pair of opening portions **22***d*, while the fastener member **30** is inserted into the pair of opening portions **22***d* from opening ends on the other side in the fastening direction Z, opening ends on one side in the fastening direction Z are blocked by the front holder **23**. The second housing **22** is formed of a resin material having insulation.

[0049] The front holder **23** blocks the pair of opening portions **22***d* of the second housing **22** from one side in the fastening direction Z. Further, the front holder **23** is a member for holding the unit packing **24** between itself and the second housing **22**, for example. The front holder **23** is formed into a cylindrical shape following an outer circumferential surface of a cylindrical portion of the second housing **22**, and is fitted with the outer circumferential surface of the cylindrical portion. The front holder **23** is integrated with the second housing **22** by claw fitting or the like in a state of sandwiching the unit packing **24** between itself and the second housing **22**.

[0050] The unit packing **24** prevents a foreign substance such as moisture from entering the second housing **22**. The unit packing **24** is formed of an elastically-deformable member such as rubber or resin. The unit packing **24** is formed into, for example, an approximately ellipsoidal cylindrical shape following the outer circumferential surface of the cylindrical portion of the second housing **22**, and is fitted with the outer circumferential surface of the cylindrical portion. In a state in which the terminal board **2** is connected with an external device, the unit packing **24** is interposed between the second housing **22** and the external device, for example.

[0051] FIG. **11** is a cross-sectional view of the connector unit **1** and is a diagram illustrating a state before fastening of the fastener member **30**, and FIG. **12** is a cross-sectional view of the connector unit **1** and is a diagram illustrating a state after fastening of the fastener member **30**. As illustrated in FIGS. **11** and **12**, in the present embodiment, in a state in which the first connector **10** are the second connector **20** fitted, the first connection terminal **11** and the second connection terminal **21** are arranged along the fastening direction Z. The first connection terminal **11** and the second connection terminal **21** are provided with attachment holes into which the bolt **31** of the fastener member **30** are inserted along the fastening direction Z. Further, in the attachment hole of the second connection terminal **21**, a screw hole of the nut **33** is provided on one side in the fastening direction Z with being communicated therewith, and in the attachment hole of the first connection terminal **11**, a central hole of the collar **32** is provided on the other side in the fastening direction Z with being communicated therewith. Then, the first connection terminal **11**, the second connection terminal **21**, and the collar **32** are fastened in such a manner as to be sandwiched between a head portion **31***a* of the bolt **31** and the nut **33**.

[0052] Here, in the present embodiment, the collar **32** is supported in such a manner as to be slidable along the fastening direction Z between a fastened position P**1** (refer to FIG. **12**) where the collar **32** has contact with the first connection terminal **11**, and a fastening released position P**2** (refer to FIG. **11**) where the collar **32** is separated from the first connection terminal **11**. In other words, in a state in which the collar **32** is located at the fastening released position P**2**, a clearance gap G extending along the fastening direction Z is formed between the collar **32** and the first connection terminal **11**, and in a state in which the collar **32** is located at the fastened position P**1**, the clearance gap G is not formed between the collar **32** and the first connection terminal **11**. In this manner, in the present embodiment, by supporting the collar **32** in such a manner as to be slidable along the fastening direction Z with respect to the opening portion **22***d* of the second housing **22**, while electrically connecting the collar **32** and the first connection terminal **11** at the fastened position P**1**, electrical connection between the collar **32** and the first connection terminal **11** is prevented at the fastening released position P**2**.

[0053] Further, in the present embodiment, on the inner surface of the opening portion **22***d*, a flange wall **22***e* supporting the collar **32** at the fastening released position P**2** is provided. The flange wall **22***e* protrudes from the inner surface of the opening portion **22***d* toward the radial direction internal side of the opening portion **22***d*. The collar **32** has an engagement surface that faces the flange wall **22***e* along the fastening direction Z, and by the contact between the engagement surface and the flange wall **22***e*, the movement (removal) of the collar **32** toward the other side in the fastening direction Z with respect to the opening portion **22***d* is prevented. In addition, in the present embodiment, the flange wall **22***e* is provided with an opening portion that allows a pair of engagement pieces **34***a* (refer to FIG. **13**) of the engagement member **34**, which will be described later, to enter. In other words, the flange wall **22***e* is intermittently provided along a circumferential direction of the inner surface of the opening portion **22***d*.

[0054] FIG. **13** is a perspective view of the bolt **31** and the engagement member **34** of the fastener member **30**. As illustrated in FIG. **13**, the bolt **31** includes, for example, the head portion **31***a* and a shaft portion **31***b*, and is obtained by insert molding resin at the head portion **31***a* of the bolt **31**. At one end portion in the fastening direction Z of the head portion **31***a*, a flange **31***a***1** protruding toward a radial direction outer side of the shaft portion **31***b*, and having contact with the collar **32** (refer to FIG. **15**) is provided. On the outer circumferential surface of the shaft portion **31***b*, a male screw portion to be screwed into the screw hole of the above-described nut **33** is provided. Further, a ring-shaped seal member **37** is fitted with another end portion in the fastening direction Z of the shaft portion **31***b*. The seal member **37** is formed of an elastically-deformable member such as rubber or resin, and stops water between itself and the central hole of the collar **32**.

[0055] The engagement member **34** includes, for example, the pair of engagement pieces **34***a*, and a coupling portion **34***b* coupling the pair of engagement pieces **34***a*. The coupling portion **34***b* is formed into an annular shape provided with an opening portion into which the head portion **31***a* of the bolt **31** is to be inserted. The pair of engagement pieces **34***a* are formed with protruding from both ends in the width direction Y of the coupling portion **34***b* along the fastening direction Z. Leading end portions **34***a***1** on one side in the fastening direction Z of the pair of engagement pieces **34***a* are formed into a claw shape, and are engaged with groove portions **32***c* of the collars **32**. The engagement member **34** is attached to the bolt **31**, and used in a state of being integrated with the bolt **31**. In other words, the engagement member **34** is provided on the bolt **31**.

[0056] FIG. **14** is a perspective view of the collar **32** of the fastener member **30**. As illustrated in FIG. **14**, the collar **32** includes, for example, a large diameter portion **32***a* and a small diameter portion **32***b* formed with a diameter smaller than the large diameter portion **32***a*. The large diameter portion **32***a* is a portion located at a position closer to one side in the fastening direction Z than the flange wall **22***e* formed on the inner surface of the opening portion **22***d*, in a state in which the collar **32** is located at the above-described fastening released position P**2** (refer to FIG. **16**). On the outer circumferential surface of the large diameter portion **32***a*, a ring-shaped seal member **36** that comes into contact with the inner surface of the opening portion **22***d* is provided. The seal member **36** is formed of an elastically-deformable member such as rubber or resin, and stops water between itself and the inner surface of the opening portion **22***d*.

[0057] The small diameter portion **32***b* is a portion located at a position closer to the other side in the fastening direction Z than the flange wall **22***e* formed on the inner surface of the opening portion **22***d*, in a state in which the collar **32** is located at the fastening released position P**2** (refer to FIG.

16). The small diameter portion **32***b* is provided with being exposed from an opened end of the opening portion **22***d*, in a state in which the collar **32** is located at the fastening released position P**2**. On the outer circumferential surfaces of the small diameter portions **32***b*, the groove portions **32***c* with which the leading end portions **34***a***1** of the pair of engagement pieces **34***a* of the engagement member **34** are to be engaged are provided. The groove portion **32***c* is formed into an annular shape following the outer circumferential surface of the small diameter portion **32***b*, for example. The collar **32** is formed of a metal material having electrical conductivity, for example.

[0058] FIG. **15** is a cross-sectional view of the fastener member **30** and is a diagram illustrating a state in which the collar **32** is at the fastened position P**1**, and FIG. **16** is a cross-sectional view of the fastener member **30** and is a diagram illustrating a state in which the collar **32** is at the fastening released position P**2**. As illustrated in FIGS. **15** and **16**, in the present embodiment, the engagement member **34** is configured to move the collar **32** from the fastening released position P**2** to the fastened position P**1** together with the bolt **31** in accordance with a fastening operation of the bolt **31**. For example, with respect to the collar **32** located at the fastening released position P**2**, the leading end portions **34***a***1** of the pair of engagement pieces **34***a* of the engagement member **34** are engaged with the groove portions **32***c* from the other side in the fastening direction Z in a state in which the engagement member **34** is integrated with the bolt **31**. The pair of engagement pieces **34***a* make entry toward one side in the fastening direction Z from the opening portion formed on the flange wall **22***e*, when the collar **32** moves from the fastening released position P**2** to the fastened position P**1**.

[0059] Further, in the present embodiment, the engagement member **34** is configured to move the collar **32** from the fastened position P**1** to the fastening released position P**2** together with the bolt **31** in accordance with a fastening release operation of the bolt **31**. The pair of engagement pieces **34***a* move the collar **32** toward the other side in the fastening direction Z with respect to the first connection terminal **11** by the contact between the claw-shaped leading end portion **34***a***1** and the groove portion **32***c*, when moving the collar **32** from the fastened position P**1** to the fastening released position P**2**. Accordingly, the collar **32** and the first connection terminal **11** are separated, and electrical connection of the collar **32** at the fastening released position P**2** with the first connection terminal **11** can be eventually prevented.

[0060] As described above, in the connector unit **1** and the wire harness WH of the present embodiment, the fastener member **30** includes the engagement member **34** that is provided on the bolt **31** and engaged with the collar **32**, moves the collar **32** from the fastening released position P**2** to the fastened position P**1** together with the bolt **31** in accordance with a fastening operation of the bolt **31**, and moves the collar **32** from the fastened position P**1** to the fastening released position P**2** together with the bolt **31** in accordance with a fastening release operation of the bolt **31**. With this configuration, while the connector unit **1** and the wire harness WH can bring the collar **32** and the first connection terminal **11** into contact by moving the collar **32** from the fastening released position P**2** to the fastened position P**1** by the engagement member **34**, for example, the connector unit **1** and the wire harness WH can separate the collar **32** and the first connection terminal **11** by moving the collar **32** from the fastened position P**1** to the fastening released position P**2**. Consequently, the connector unit **1** and the wire harness WH can appropriately perform a fastening work of the first connection terminal **11** and the second connection terminal **21**, and eventually prevent electrical connection of the collar **32** at the fastening released position P**2**.

[0061] Further, in the connector unit **1** and the wire harness WH of the present embodiment, the second connector **20** includes the second housing **22** provided with the opening portion **22***d* into which the bolt **31** and the collar **32** are inserted along the fastening direction Z, and the collar **32** includes the large diameter portion **32***a* including the seal member **36** that is provided on the outer circumferential surface and comes into contact with the inner surface of the opening portion **22***d*, and the small diameter portion **32***b* that is formed to have a smaller diameter than the large diameter portion **32***a*, and includes the groove portion **32***c* into which the leading end portion **34***a***1** of the engagement piece **34***a* of the engagement member **34** is fitted that is provided on the outer circumferential surface. With this configuration, the connector unit **1** and the wire harness WH can slide the collar **32** between the fastened position P**1** and the fastening released position P**2** along the fastening direction Z by the engagement piece **34***a* engaged with the groove portion **32***c* of the small diameter portion **32***b* while being able to stop water to the inner surface of the opening portion **22***d* by the seal member **36** provided on the large diameter portion **32***a* of the collar **32**, for example.

[0062] Further, in the connector unit **1** and the wire harness WH of the present embodiment, the first connector **10** includes the first housing **12** that holds the first connection terminal **11** in a state of protruding along the axis line direction X, and the slide cover **13** supported in such a manner as to be slidable along the axis line direction X between the close position P**11** where the slide cover **13** covers the first connection terminal **11**, and the open position P**12** where the slide cover **13** exposes the first connection terminal **11**, with respect to the first housing **12**. With this configuration, the connector unit **1** and the wire harness WH can cover the periphery of the first connection terminal **11** by the slide cover **13** located at the close position P**11**, for example, and eventually prevent contact between the first connection terminal **11** and hands and fingers of an operator or the like.

[0063] Further, in the connector unit **1** and the wire harness WH of the present embodiment, the slide cover **13** includes the cantilever spring-shaped engagement piece **13***b* to be engaged with the first housing **12** along the axis line direction X at the close position P**11**, and the second connector **20** includes the protruding portion **22***b* that deforms the engagement piece **13***b* along the width direction Y in accordance with a fitting operation with the first connector **10**, and releases engagement between the engagement piece **13***b* and the first housing **12**. With this configuration, the connector unit **1** and the wire harness WH can release engagement between the engagement piece **13***b* and the first housing **12** by the protruding portion **22***b*, for example, in accordance with a fitting operation of the first connector **10** and the second connector **20**, and eventually further prevent contact between the first connection terminal **11** and hands and fingers of an operator or the like in operations.

[0064] Further, in the connector unit **1** and the wire harness WH of the present embodiment, the second connector **20** includes the contact portion **22***g* that moves the slide cover **13** from the close position P**11** to the open position P**12** by having contact with the leading end portion **13***d* of the slide cover **13** in a state in which engagement between the engagement piece **13***b* and the first housing **12** is released in accordance with a fitting operation with the first connector **10**. With this configuration, the connector unit **1** and the wire harness WH can move the slide cover **13** from the close position P**11** to the open position P**12** by the contact portion **22***g*, for example, in accordance with a fitting operation of the first connector **10** and the second connector **20**, and eventually further prevent contact between the first connection terminal **11** and hands and fingers of an operator or the like in operations.

[0065] In addition, in the present embodiment, a case where the collar **32** is provided with being in contact with the first connection terminal **11**, and the nut **33** is provided with being in contact with the second connection terminal **21** has been exemplified, but the configuration is not limited to this example, and for example, the collar **32** may be provided with being in contact with the second connection terminal **21** and the nut **33** may be provided with being in contact with the first connection terminal **11**. Further, in the present embodiment, a case where the slide cover **13** is provided on the first connector **10** has been exemplified, but the configuration is not limited to this example, and the slide cover **13** needs not be provided on the first connector **10**, for example.

[0066] Heretofore, the embodiment of the present invention has been exemplified, but the above-described embodiment is an example, and is not intended to limit the scope of the invention. The above-described embodiment can be implemented in other various configurations, and various omissions, replacements, combinations, and changes can be made without departing from the gist of the invention. Further, the above-described embodiment can be implemented with appropriately changing each configuration and the specification such as shapes (structure, type, direction, format, size, length, width, thickness, height, number, arrangement, position, material, and the like).

[0067] In the connector unit and the wire harness according to the present embodiment, the fastener member includes the engagement member that is provided on the bolt and engaged with the collar, moves the collar from the fastening released position to the fastened position together with the bolt in accordance with a fastening operation of the bolt, and moves the collar from the fastened position to the fastening released position together with the bolt in accordance with a fastening release operation of the bolt. With this configuration, while the connector unit and the wire harness can bring the collar and one of the first connection terminal and the second connection terminal into contact by moving the collar from the fastening released position to the fastened position by the engagement member, for example, the connector unit and the wire harness can separate the collar and one of the first connection terminal and the second connection terminal by moving the collar from the fastened position to the fastening released position. Consequently, the connector unit and the wire harness achieve the effect that a fastening work of terminals can be appropriately performed.

[0068] Although the invention has been described with respect to specific embodiments for a complete and clear disclosure, the appended claims are not to be thus limited but are to be construed as embodying all modifications and alternative constructions that may occur to one skilled in the art that fairly fall within the basic teaching herein set forth.

What is claimed is:

1. A connector unit comprising:

a first connector including a first connection terminal;

a second connector that includes a second connection terminal to be electrically connected with the first connection terminal, and is fitted with the first connector along an axis line direction; and

a fastener member configured to fasten the first connection terminal and the second connection terminal, wherein

the fastener member includes:

a bolt extending along a fastening direction intersecting with the axis line direction;

a collar having electrical conductivity that is supported in such a manner as to be slidable along the fastening direction between a fastened position where the collar has contact with one of the first connection terminal and the second connection terminal arranged along the fastening direction, and a fastening released position where the collar is separated from the one;

a nut that has contact with another one of the first connection terminal and the second connection terminal, to which a shaft portion of the bolt is fastened in a state in which the nut sandwiches the first connection terminal, the second connection terminal, and the collar between the nut and a head portion of the bolt; and

an engagement member that is provided on the bolt and engaged with the collar, moves the collar from the fastening released position to the fastened position together with the bolt in accordance with a fastening operation of the bolt, and moves the collar from the fastened position to the fastening released position together with the bolt in accordance with a fastening release operation of the bolt.

2. The connector unit according to claim **1**, wherein

the second connector includes a second housing provided with an opening portion into which the bolt and the collar are inserted along the fastening direction, and

the collar includes a large diameter portion including a seal member that is provided on an outer circumferential surface and comes into contact with an inner surface of the opening portion, and a small diameter portion that is formed to have a smaller diameter than that of the large diameter portion and includes a groove portion into which an engagement piece of the engagement member is fitted that is provided on an outer circumferential surface.

3. The connector unit according to claim **1**, wherein

the first connector includes a first housing that holds the first connection terminal in a state of protruding along the axis line direction, and a slide cover supported in such a manner as to be slidable along the axis line direction between a close position where the slide cover covers the first connection terminal, and an open position where the slide cover exposes the first connection terminal, with respect to the first housing.

4. The connector unit according to claim **2**, wherein

the first connector includes a first housing that holds the first connection terminal in a state of protruding along the axis line direction, and a slide cover supported in

such a manner as to be slidable along the axis line direction between a close position where the slide cover covers the first connection terminal, and an open position where the slide cover exposes the first connection terminal, with respect to the first housing.

5. The connector unit according to claim **3**, wherein

the slide cover includes a cantilever spring-shaped engagement piece to be engaged with the first housing along the axis line direction at the close position, and

the second connector includes a protruding portion that deforms the engagement piece along a width direction intersecting with the axis line direction and the fastening direction, in accordance with a fitting operation with the first connector, and releases engagement between the engagement piece and the first housing.

6. The connector unit according to claim **4**, wherein

the slide cover includes a cantilever spring-shaped engagement piece to be engaged with the first housing along the axis line direction at the close position, and

the second connector includes a protruding portion that deforms the engagement piece along a width direction intersecting with the axis line direction and the fastening direction, in accordance with a fitting operation with the first connector, and releases engagement between the engagement piece and the first housing.

7. The connector unit according to claim **5**, wherein

the second connector includes a contact portion that moves the slide cover from the close position to the open position by having contact with a leading end portion of the slide cover in a state in which engagement between the engagement piece and the first housing is released in accordance with a fitting operation with the first connector.

8. The connector unit according to claim **6**, wherein

the second connector includes a contact portion that moves the slide cover from the close position to the open position by having contact with a leading end portion of the slide cover in a state in which engagement between the engagement piece and the first housing is released in accordance with a fitting operation with the first connector.

9. A wire harness comprising:

a wiring material having electrical conductivity; and

a connector unit provided at an end of the wiring material, wherein

the connector unit includes:

a first connector including a first connection terminal;

a second connector that includes a second connection terminal to be electrically connected with the first connection terminal, and is fitted with the first connector along an axis line direction; and

a fastener member configured to fasten the first connection terminal and the second connection terminal, and

the fastener member includes:

a bolt extending along a fastening direction intersecting with the axis line direction;

a collar having electrical conductivity that is supported in such a manner as to be slidable along the fastening direction between a fastened position where the collar has contact with one of the first connection terminal and the second connection terminal arranged along the fastening direction, and a fastening released position where the collar is separated from the one;

a nut that has contact with another one of the first connection terminal and the second connection terminal, to which a shaft portion of the bolt is fastened in a state in which the nut sandwiches the first connection terminal, the second connection terminal, and the collar between the nut and a head portion of the bolt; and

an engagement member that is provided on the bolt and engaged with the collar, moves the collar from the fastening released position to the fastened position together with the bolt in accordance with a fastening operation of the bolt, and moves the collar from the fastened position to the fastening released position together with the bolt in accordance with a fastening release operation of the bolt.

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