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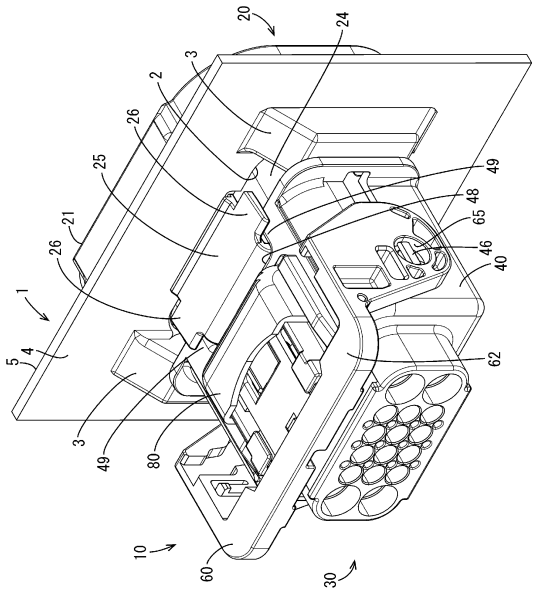
(54) PANEL-MOUNTED CONNECTOR

(57) A panel mount connector 10 of the present disclosure is mounted on a panel 1 including a connector mounting hole 2 and provided with a male connector 20 including an inner receptacle 24 projecting from a base end part toward a tip part and open in the tip part, the male connector 20 being mounted on the panel 1 while passing through the connector mounting hole 2, and a female connector 30 including an outer receptacle 44 to be fit to an outer peripheral surface side of the inner receptacle 24. The inner receptacle 24 includes a panel lock 25 provided at a position closer to the base end part than the tip part, the male connector 20 being held mounted on the panel 1 by locking the panel lock 25 to a peripheral edge part of the connector mounting hole 2.

Fig. 1



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Description

[0001] The present disclosure relates to a panel mount connector.

[Background Art]

[0002] A connector, for example, described in Japanese Unexamined Patent Publication No. 2003-187911 (patent literature 1 below) is known as a panel mount connector to be mounted on a panel such as a body or door of an automotive vehicle. In this connector, a male housing is mounted through a mounting hole open and formed in the panel from a back side of the panel and a female housing is connected to that male housing from a front side of the panel. The male housing includes a receptacle in the form of a tube projecting forward from a terminal accommodating portion. A flange capable of contacting the back surface of the panel as the male housing is mounted on the housing is provided to protrude on the outer peripheral surface of the receptacle at a position somewhat behind a front end. A part of the receptacle projecting further forward than the flange serves as a penetration portion to be fit and passed through the mounting hole and project on the front side of the panel at the time of mounting on the panel. A fixing locking portion and a resilient locking portion are provided to face the flange at the front end of the penetration portion. If the male housing is mounted on the panel, the fixing locking portion and the resilient locking portion can be locked to the front surface of the panel after passing through the mounting hole and sandwich the panel between these and the flange.

[Citation List]

[Patent Literature]

[0003] Patent Literature 1: Japanese Unexamined Patent Publication No. 2003-187911

[Summary of Invention]

[Technical Problem]

[0004] However, since the fixing locking portion and the resilient locking portion described above are both provided on the penetration portion located at the front end of the receptacle, the penetration portion may be deformed, the locking of the fixing locking portion and the resilient locking portion with the panel may be released and the male housing may be detached from the panel if the receptacle receives a strong force.

[Solution to Problem]

[0005] The present disclosure is directed to a panel mount connector to be mounted on a panel including a connector mounting hole, the panel mount connector being provided with a male connector including an inner receptacle projecting from a base end part toward a tip part and open in the tip part, the male connector being mounted on the panel while passing through the connector mounting hole, and a female connector including an outer receptacle to be fit to an outer peripheral surface side of the inner receptacle, the inner receptacle including a panel lock provided at a position closer to the base end part than the tip part, the male connector being held mounted on the panel by locking the panel lock to a peripheral edge part of the connector mounting hole.

[Effect of Invention]

[0006] According to the present disclosure, a male connector can be held not to be detached from a panel.

[Brief Description of Drawings]

[0007]

FIG. 1 is a perspective view of a panel mount connector when viewed obliquely from above,
FIG. 2 is a side view of the panel mount connector,
FIG. 3 is a side view of a male connector,
FIG. 4 is a plan view of the male connector,
FIG. 5 is a side view of a female housing,
FIG. 6 is a plan view of the female housing,
FIG. 7 is a front view of the female housing,
FIG. 8 is a perspective view of a lever when viewed obliquely from above,
FIG. 9 is a perspective view of a panel when viewed obliquely from front,
FIG. 10 is a perspective view of the panel when viewed obliquely from behind,
FIG. 11 is a plan view of a connection detecting member,
FIG. 12 is a plan view of the panel mount connector,
FIG. 13 is a section along A-A of FIG. 12,
FIG. 14 is a section along B-B of FIG. 12,
FIG. 15 is a section along C-C of FIG. 12,
FIG. 16 is a section showing the panel mount connector cut at a cutting position of FIG. 14 when a lever is at a connection start position,
FIG. 17 is a section showing the panel mount connector cut at the cutting position of FIG. 14 while the lever is moving from the connection start position to a connection end position, and
FIG. 18 is a section of the panel mount connector cut at the cutting position of FIG. 14 when the connection detecting member is at a detection position.

[Embodiments of Invention]

[Description of Embodiments of Present Disclosure]

[0008] First, embodiments of the present disclosure

are listed and described.

(1) The panel mount connector of the present disclosure is mounted on a panel including a connector mounting hole and provided with a male connector including an inner receptacle projecting from a base end part toward a tip part and open in the tip part, the male connector being mounted on the panel while passing through the connector mounting hole, and a female connector including an outer receptacle to be fit to an outer peripheral surface side of the inner receptacle, the inner receptacle including a panel lock provided at a position closer to the base end part than the tip part, the male connector being held mounted on the panel by locking the panel lock to a peripheral edge part of the connector mounting hole.

The tip part of the inner receptacle is open and more easily deformed than the base end part having no opening. Thus, if the panel lock is provided on the tip part of the inner receptacle, the locking of the panel lock may be released as the inner receptacle is deformed, and the male connector may be detached from the panel. In that respect, since the panel lock is provided at the position closer to the base end part than the tip part in the inner receptacle in the panel mount connector of the present disclosure, the inner receptacle is not deformed at the position of the panel lock, the locking of the panel is not released and the male connector can be held not to be detached from the panel.

(2) Preferably, the panel lock includes a lock body portion provided displaceably with respect to an outer peripheral surface of the inner receptacle and an expanded portion formed by expanding a part of the lock body portion along the outer peripheral surface of the inner receptacle, and the outer receptacle includes a displacement suppressing portion for suppressing a displacement of the lock body portion by being disposed along a facing surface of the expanded portion facing the inner receptacle with the male connector mounted on the panel.

Since the displacement suppressing portion is disposed along the facing surface of the expanded portion facing the inner receptacle, a displacement of the lock body portion is suppressed by the interference of the expanded portion with the displacement suppressing portion if the lock body portion is displaced toward the inner receptacle. Therefore, the locking of the panel lock is not released and the male connector can be held not to be detached from the panel. That is, the panel lock can be secondarily locked by being locked and held by the displacement suppressing portion in addition to being locked and held by preventing the deformation of the inner receptacle.

(3) Preferably, the outer receptacle is provided with a cutout for avoiding interference with the panel lock with the male connector and the female connector connected, and the displacement suppressing portion is provided on a peripheral edge part of the cutout in the outer receptacle.

If the male connector and the female connector are connected, the panel lock is disposed in the cutout of the outer receptacle and the expanded portion is disposed at a position capable of interfering with the displacement suppressing portion. Since the peripheral edge part of the cutout functions as the displacement suppressing portion by providing the cutout in the outer receptacle in this way, the displacement suppressing portion may not be provided separately from the cutout.

(4) Preferably, the displacement suppressing portion is disposed between the expanded portion and the inner receptacle when connection of the male connector and the female connector is completed.

[0009] The complete connection of the male connector and the female connector can guarantee that detachment from the panel is prevented.

[Details of Embodiment of Present Disclosure]

[0010] A specific example of a panel mount connector 10 according to the present disclosure is described below with reference to the drawings. Note that the present disclosure is not limited to these illustrations, but is represented by claims and intended to include all changes in the scope of claims and in the meaning and scope of equivalents.

[Configuration of Panel Mount Connector]

[0011] As shown in FIG. 1, the panel mount connector 10 of the present disclosure is a connector to be mounted on a panel 1 and provided with a male connector 20 and a female connector 30 connectable to the male connector 20. As shown in FIGS. 9 and 10, the panel 1 is provided with a connector mounting hole 2. The male connector 20 is a standby-side connector mounted on the panel 1 in advance while being inserted through the connector mounting hole 2. Note that a front-rear direction is based on a connecting direction of the male connector 20 and the female connector 30 and connection surface sides thereof are front sides.

[Configuration of Panel]

[0012] As shown in FIG. 9, a pair of bases 3 are provided on both sides of the connector mounting hole 2 of the panel 1. A surface of the panel 1 on the side of the bases 3 is a front surface 4, and a surface of the panel 1 opposite to the bases 3 is a back surface 5. As shown in FIG. 10, a panel receptacle 6 is provided to project rearward on the back surface 5 of the panel 1. The panel receptacle 6 is a receptacle open rearward and having

a rectangular shape long in a lateral direction in a front view. Four corners of the panel receptacle 6 are rounded.

[Configuration of Male Connector]

[0013] As shown in FIG. 15, the male connector 20 is provided with a male housing 21 and a plurality of male terminals (not shown). The male housing 21 is made of synthetic resin and includes a male housing body 23 formed with a plurality of cavities 22 for accommodating the respective male terminals and an inner receptacle 24 provided to project forward from the peripheral edge of the front surface of the male housing body 23. The inner receptacle 24 includes an inner receptacle base end part 24A, which is a base end part of the inner receptacle 24, an inner receptacle tip part 24B, which is a tip part of the inner receptacle 24, and an inner receptacle intermediate part 24C, which is an intermediate part between the inner receptacle base end part 24A and the inner receptacle tip part 24B.

[0014] The inner receptacle 24 is a receptacle projecting from the inner receptacle base end part 24A toward the inner receptacle tip part 24B and open forward in the inner receptacle tip part 24B. As shown in FIG. 13, the inner receptacle 24 has a rectangular shape long in the lateral direction in a front view and four corners thereof are rounded.

[0015] As shown in FIG. 15, a flange 27 is provided on an outer peripheral side of the male housing body 23 in the male housing 21. The flange 27 is provided over an entire periphery to protrude from the outer peripheral surface of the male housing body 23. A fitting recess 28, into which the panel receptacle 6 is fit, is provided on an outer peripheral side of the flange 27. The fitting recess 28 is provided over an entire periphery to protrude from the outer peripheral surface of the flange 27. As shown in FIG. 4, a pair of cam pins 29 are provided on both left and right sides on the outer peripheral surface of the inner receptacle 24.

[0016] As shown in FIG. 3, a pair of panel locks 25 are provided on both upper and lower sides on the outer peripheral surface of the inner receptacle 24. The panel lock 25 includes a lock base end part 25A projecting in a vertical direction from the outer peripheral surface of the inner receptacle 24, a lock body portion 25B cantilevered rearward from the lock base end part 25A toward a lock free end part 25C, and a locking protrusion 25D projecting toward a side opposite to the inner receptacle 24 from the lock free end part 25C.

[0017] The lock base end part 25A is provided near the inner receptacle intermediate part 24C on the outer peripheral surface of the inner receptacle 24. More particularly, the lock base end part 25A is provided at a position closer to the inner receptacle base end part 24A on the inner receptacle intermediate part 24C. Therefore, a length from the lock base end part 25A to the inner receptacle base end part 24A is shorter than a length from the lock base end part 25A to the inner receptacle tip part 24B.

[0018] The lock free end part 25C is provided on an outer peripheral side of the inner receptacle base end part 24A. The lock body portion 25B is provided such that the lock free end part 25C is deflectable in directions toward and away from the outer peripheral surface of the inner receptacle 24 with the lock base end part 25A as a fulcrum. In this way, the locking protrusion 25D is displaceable with respect to the outer peripheral surface of the inner receptacle 24.

[0019] As shown in FIG. 4, a pair of expanded portions 26 are provided on both side edges of the lock body portion 25B. The expanded portions 26 are parts formed by expanding parts of the side edges of the lock body portion 25B laterally along the outer peripheral surface of the inner receptacle 24. Laterally mentioned here means a direction orthogonal to the front-rear direction (connecting direction). The expanded portions 26 are provided in a central part of the lock body portion 25B in the front-rear direction. A length in the front-rear direction of the expanded portion 26 is about half the length in the front-rear direction of the lock body portion 25B.

[0020] A length between the both side edges of the lock body portion 25B (i.e. a width of the lock body portion 25B) is smaller than a length from the side edge of one expanded portion 26 to the side edge of the other expanded portion 26. All of a width of the lock base end part 25A, that of the lock body portion 25B, that of the lock free end part 25C and that of the locking protrusion 25D are the same.

[Configuration of Female Connector]

[0021] As show in FIGS. 14 and 15, the female connector 30 is provided with a female housing 40, a plurality of female terminals (not shown), a side retainer 50, a lever 60, a sealing ring 70 and a connection detecting member 80. The female housing 40 is made of synthetic resin and includes, as shown in FIGS. 5 and 7, a female housing body 43, an outer receptacle 44 disposed on an outer peripheral side of the female housing body 43, a lever lock 45 disposed on an upper side of the outer peripheral surface of the outer receptacle 44, and a pair of lever support shafts 46 disposed on both left and right sides on the outer peripheral surface of the outer receptacle 44.

[0022] The female housing body 43 includes a plurality of cavities 41 for accommodating the respective female terminals and a retainer mounting hole 42, into which the side retainer 50 is mounted. The side retainer 50 is mounted movably between a temporary locking position and a complete locking position in the retainer mounting hole 42. When the side retainer 50 is at the temporary locking position, the respective female terminals are insertable into the respective cavities 41. If the side retainer 50 is moved from the temporary locking position to the complete locking position with the respective female terminals inserted in the respective cavities 41, the respec-

tive female terminals are collectively retained by the side retainer 50.

[0023] As shown in FIG. 15, the outer receptacle 44 is open forward, and a base end part 44A of the outer receptacle 44 is coupled to the outer peripheral surface of the female housing body 43. With the male connector 20 and the female connector 30 connected, the female housing body 43 is fit inside the inner receptacle 24 and the inner receptacle 24 is ft between the outer receptacle 44 and the female housing body 43. That is, the outer receptacle 44 is fit to an outer peripheral side of the inner receptacle 24.

[0024] The lever 60 is rotatably mounted on the pair of lever support shafts 46. The lever 60 is rotatable between a connection start position shown in FIG. 16 and a connection end position shown in FIG. 15. With the lever 60 located at the connection end position, the lever 60 is held at the connection end position by the lever lock 45. On the other hand, the connection detecting member 80 is mounted on the lever lock 45 and movable between an initial position shown in FIG. 14 and a detection position shown in FIG. 18.

[0025] With the lever 60 held at the connection end position by the lever lock 45, the connection detecting member 80 is movable from the initial position to the detection position and it can be guaranteed that a connection completed state is reached if the connection detecting member 80 can be moved to the detection position. The locking by the lever lock 45 cannot be released with the connection detecting member 80 located at the detection position, and the locking by the lever lock 45 can be released with the connection detecting member 80 located at the initial position. Therefore, the lever 60 becomes movable from the connection end position to the connection start position by releasing the locking by the lever lock 45.

[0026] As shown in FIG. 6, a cutout 48 is provided in a front end part of the outer receptacle 44. With the male connector 20 and the female connector 30 connected, the panel locks 25 are accommodated in the cutout 48 as shown in FIG. 1. Parts on both left and right sides, out of a peripheral edge part of the cutout 48, serve as displacement suppressing portions 49, and the displacement suppressing portions 49 are disposed along facing surfaces of the expanded portions 26 facing the inner receptacle 24. That is, the displacement suppressing portions 49 are disposed between the expanded portions 26 and the inner receptacle 24. A dimension of a gap between the expanded portion 26 and the inner receptacle 24 is equal to a plate thickness of the displacement suppressing portion 49. In this way, if the panel lock 25 is deflected toward the inner receptacle 24, the deflection of the panel lock 25 is suppressed since displacements of the expanded portions 26 toward the inner receptacle 24 are suppressed by the displacement suppressing portions 49. Therefore, it is suppressed that the locking by the panel locks 25 is released and the detachment of the male connector 20 from the panel 1 can be suppressed.

[Configuration of Lever]

[0027] The lever 60 is made of synthetic resin and, as shown in FIG. 8, gate-shaped as a whole. The lever 60 includes a pair of lever bodies 61 arranged to face each other and a lever operating portion 62 coupling end parts of the pair of lever bodies 61. A cam groove 63 is formed in the inner surface of the lever body 61. A lever shaft hole 65 is provided to penetrate through an end part of the lever body 61 on a side opposite to the lever operating portion 62.

[0028] As shown in FIG. 1, the lever support shafts 46 of the outer receptacle 44 rotatably support the lever 60 by being fit into the lever shaft holes 65 from inside. Specifically, the lever 60 is rotatable between the connection start position shown in FIG. 18 and the connection end position shown in FIG. 14 by operating the lever operating portion 62. If the lever 60 is rotated from the connection start position to the connection end position, the male connector 20 and the female connector 30 are connected to each other by the cam pins 29 being engaged with the inner walls of cam grooves 63 as shown in FIG. 17. If the lever 60 is rotated from the connection end position to the connection start position, the male connector 20 and the female connector 30 are separated from each other by the cam pins 29 being engaged with the inner walls of cam grooves 63.

[0029] As shown in FIG. 8, the lever operating portion 62 is provided with a pair of lock receiving portions 64. The lever 60 is held at the connection end position by locking the lever lock 45 to the lock receiving portions 64. Conversely, in separating the female connector 30 from the male connector 20, the lever 60 is allowed to rotate from the connection end position to the connection start position after the connection detecting member 80 is moved from the detection position to the initial position and the locking of the lever lock 45 is released.

[Configuration of Sealing Ring]

[0030] The sealing ring 70 is a resilient member made of rubber or the like and configured into an annular shape. As shown in FIG. 15, the sealing ring 70 is mounted on the outer peripheral surface of the female housing body 43. With the male connector 20 and the female connector 30 connected, the sealing ring 70 is sandwiched over an entire periphery by the inner peripheral surface of the inner receptacle tip part 24B of the inner receptacle 24 and the outer peripheral surface of the female housing body 43. In this way, sealing is provided between the male connector 20 and the female connector 30.

[Configuration of Connection Detecting Member]

[0031] The connection detecting member 80 is made of synthetic resin and includes, as shown in FIG. 11, a pressing portion 81 pressable by fingers, a pair of slide portions 82 provided on both sides of the pressing portion

81 and a detecting portion 83 extending in a pressing direction from the pressing portion 81. As shown in FIG. 15, the slide portions 82 are guided in the front-rear direction by rail portions 47 provided on the upper surface of the outer receptacle 44. In this way, the connection detecting member 80 is slidable between the initial position and the detection position.

[0032] The connection detecting member 80 is suppressed from moving to the detection position by an unillustrated projection at the initial position, but the locking by the projection is released and the connection detecting member 80 is allowed to move to the detection position when the lever 60 reaches the connection end position. Further, by a movement of the connection detecting member 80 from the detection position to the initial position, the tip of the lever lock 45 is swung and displaced in a direction separating from the outer receptacle 44 by the detecting portion 83. In this way, the locking by the lever lock 45 is released and the lever 60 is enabled to move from the connection end position to the connection start position.

[Description of Operation of Panel Mount Connector]

[0033] Next, the operation of the panel mount connector 10 is described. As shown in FIG. 18, the male connector 20 is inserted into the connector mounting hole 2 from the side of the back surface 5 of the panel 1. If the locking protrusions 25D of the panel locks 25 are inserted into the connector mounting hole 2, the lock body portions 25B are deflected toward the inner receptacle 24 while tapered surfaces of the locking protrusions 25D slide in contact with a hole edge part of the connector mounting hole 2. If the locking protrusions 25D pass through the panel 1, the lock body portions 25B resiliently return and locking surfaces of the locking protrusions 25D are locked to the front surface 4 of the panel 1. In this way, the male connector 20 is mounted on the panel 1 while passing through the connector mounting hole 2.

[0034] Since the panel 1 is sandwiched between the locking protrusions 25D and the flange 27, the male connector 20 is held mounted on the panel 1. Simultaneously, the panel receptacle 6 is accommodated into the fitting recess 28 and comes into contact with the inner peripheral surface of the fitting recess 28. Thus, the inclination of the male connector 20 with respect to the panel 1 is suppressed. Therefore, it can be avoided that the panel locks 25 are deformed to be unlocked by the inclination of the male connector 20.

[0035] Even if the inner receptacle tip part 24B of the inner receptacle 24 is deflected and deformed due to the application of an excessive force to the male connector 20, the locking by the panel locks 25 is kept since a part of the inner receptacle intermediate part 24C closer to the inner receptacle base end part 24A is higher in rigidity than the inner receptacle tip part 24B and is not deflected and deformed. Therefore, the male connector 20 is not detached from the panel 1 due to the deformation of the inner receptacle tip part 24B.

[0036] Next, a connecting operation of the male connector 20 and the female connector 30 is described. As shown in FIG. 16, the both connectors 20, 30 are lightly fit such that the pair of cam pins 29 of the male connector 20 enter the entrances of the pair of cam grooves 63 of the lever 60 at the start of connection. Subsequently, if the lever 60 is rotated from the connection start position toward the connection end position, the cam pins 29 are engaged with the inner walls of the cam grooves 63 as shown in FIG. 17, whereby the connection of the both connectors 20, 30 proceeds.

[0037] If the lock receiving portions 64 of the lever 60 start to engage the lever lock 45, the displacement suppressing portions 49 of the outer receptacle 44 are arranged in front of the expanded portions 26. That is, the displacement suppressing portions 49 enter between the expanded portions 26 and the inner receptacle 24 after the locking of the lock receiving portions 64 and the lever lock 45 is started. If the male connector 20 and the female connector 30 are connected, the lever lock 45 is locked to the lock receiving portions 64, whereby the lever 60 is held at the connection end position. Simultaneously, the displacement suppressing portions 49 are disposed between the expanded portions 26 and the inner receptacle 24 and the panel locks 25 are secondarily locked to suppress displacements of the locking protrusions 25D of the panel locks 25. Thus, the both connectors 20, 30 in the connected state are not detached from the panel 1.

[0038] Subsequently, the connection detecting member 80 is moved from the initial position to the detection position. If the connection detecting member 80 can be moved to the detection position, it becomes evidence for the complete connection of the both connectors 20, 30. If the both connectors 20, 30 are incompletely connected, the connection detecting member 80 is kept locked by the unillustrated projection. Thus, the connection detecting member 80 cannot be moved from the initial position to the detection position and the both connectors 20, 30 are detected to be in the incompletely connected state.

[0039] With the connection detecting member 80 located at the detection position, the lever lock 45 has already returned to a natural state. Thus, the locking of the lever lock 45 and the lock receiving portions 64 is kept. On the other hand, at the time of separating the both connectors 20, 30, the connection detecting member 80 is moved from the detection position to the initial position, whereby the locking by the lever lock 45 is released and the lever 60 can be moved from the connection end position to the connection start position. If the lever 60 reaches the connection start position, the separation of the both connectors 20, 30 is completed.

[Functions and Effects of Panel Mount Connector]

[0040] The panel mount connector 10 is to be mounted on the panel 1 including the connector mounting hole 2, and provided with the male connector 20 including the

inner receptacle 24 projecting from the inner receptacle base end part 24A toward the edge receptacle tip part 24B and open in the inner receptacle tip part 24B, the male connector 20 being mounted on the panel while passing through the connector mounting hole 2, and the female connector 30 including the outer receptacle 44 to be fit to the outer peripheral surface side of the inner receptacle 24. The inner receptacle 24 includes the lever locks 25 provided at the positions closer to the inner receptacle base end part 24A than the inner receptacle tip part 24B and to be locked to the peripheral edge part of the connector mounting hole 2 from the side of the front surface 4 of the panel 1, whereby the male connector 20 is held in the state mounted on the panel 1.

[0041] The inner receptacle tip part 24B of the inner receptacle 24 is open, and more easily deformed than the inner receptacle base end part 24A having no opening. Thus, if the panel lock is provided on the inner receptacle tip part of the inner receptacle, the locking of the panel lock may be released as the inner receptacle is deformed and the male connector may be detached from the panel 1. In that respect, since the panel locks 25 are provided at the positions closer to the inner receptacle base end part 24A than the inner receptacle tip part 24B in the inner receptacle 24 in the panel mount connector 10 of the present disclosure, the inner receptacle 24 is not deformed at the positions of the panel locks 25, the locking of the panel locks 25 is not released and the male connector 20 can be held not to be detached from the panel 1.

[0042] Preferably, the panel lock 25 includes the lever body portion 25B provided displaceably with respect to the outer peripheral surface of the inner receptacle 24 and the expanded portions 26 formed by expanding the parts of the lever body portion 25B along the outer peripheral surface of the inner receptacle 24, and the outer receptacle 44 includes the displacement suppressing portions 49 for suppressing displacements of the lever body portions 25B by being disposed along the facing surfaces of the expanded portions 26 facing the inner receptacle 24 with the male connector 20 mounted on the panel 1.

[0043] Since the displacement suppressing portions 49 are disposed along the facing surfaces of the expanded portions 26 facing the inner receptacle 24, displacements of the lever body portions 25B are suppressed by the interference of the expanded portions 26 with the displacement suppressing portions 49 if the lever body portions 25B are displaced toward the inner receptacle 24. Therefore, the locking of the panel locks 25 is not released and the male connector 20 can be held not to be detached from the panel 1. That is, the panel locks 25 can be secondarily locked by being locked and held by the displacement suppressing portions 49 in addition to being locked and held by preventing the deformation of the inner receptacle 24.

[0044] Preferably, the outer receptacle 44 is provided with the cutout 48 for avoiding interference with the panel locks 25 with the male connector 20 and the female connector 30 connected, and the displacement suppressing portions 49 are provided on the peripheral edge part of the cutout 48 in the outer receptacle 44.

[0045] If the male connector 20 and the female connector 30 are connected, the panel locks 25 are disposed in the cutout 48 of the outer receptacle 44 and the expanded portions 26 are disposed at positions capable of interfering with the displacement suppressing portions 49. Since the peripheral edge part of the cutout 48 can function as the displacement suppressing portions 49 by providing the outer receptacle 44 with the cutout 48 in this way, the displacement suppressing portions may not be provided separately from the cutout 48.

[0046] The displacement suppressing portions 49 are preferably disposed between the expanded portions 26 and the inner receptacle 24 when the connection of the male connector 20 and the female connector 30 is completed.

[0047] The complete connection of the male connector 20 and the female connector 30 can guarantee that detachment from the panel 1 is prevented.

<Other Embodiments>

[0048]

(1) Although the secondary locking is effected by the displacement suppressing portions 49 in the above embodiment, the displacement suppressing portions may not necessarily be provided.

(2) Although the dimension of the gap between the expanded portion 26 and the inner receptacle 24 is equal to the plate thickness of the displacement suppressing portion 49 in the above embodiment, the plate thickness of the displacement suppressing portion may be smaller than the dimension of the gap between the expanded portion 26 and the inner receptacle 24. That is, it is sufficient to suppress a displacement of the expanded portion 26 by disposing the displacement suppressing portion along the facing surface of the expanded portion 26 facing the inner receptacle 24, and a gap may be present between the displacement suppressing portion and the inner receptacle 24.

(3) Although the cutout 48 is provided in the front end part of the outer receptacle 44 in the above embodiment, the front end of the outer receptacle may be located at a position not to interfere with the panel locks 25 and displacement suppressing portions may be provided to extend downwardly of the expanded portions 26 from the front end of the outer receptacle.

(4) Although the displacement suppressing portions 49 enter between the expanded portions 26 and the inner receptacle 24 after the lever lock 45 is locked to the lock receiving portions 64 in the above embodiment, the displacement suppressing portions 49

may enter between the expanded portions 26 and the inner receptacle 24 before the lever lock 45 is locked to the lock receiving portions 64.

(5) Although the panel locks 25 for holding the male connector 20 mounted on the panel 1 by being locked to the peripheral edge part of the connector mounting hole 2 from the side of the front surface 4 of the panel 1 has been illustrated in the above embodiment, the panel locks may hold the male connector mounted on the panel 1 by being locked to the peripheral edge part of the connector mounting hole 2 from the side of the back surface 5 of the panel 1. In that case, the flange may be disposed on the side of the front surface 4 of the panel 1.

[List of Reference Signs]

[0049]

1: panel, 2: connector mounting hole, 3: base, 4: front surface, 5: back surface, 6: panel receptacle
10: panel mount connector
20: male connector, 21: male housing, 22: cavity, 23: male housing body, 24: inner receptacle, 24A: inner receptacle base end part (base end part), 24B: inner receptacle tip part (tip part), 24C: inner receptacle intermediate part, 25: panel lock, 25A: lock base end part, 25B: lock body portion, 25C: free end part, 25D: locking protrusion, 26: expanded portion, 27: flange, 28: fitting recess, 29: cam pin
30: female connector
40: female housing, 41: cavity, 42: retainer mounting hole, 43: female housing body, 44: outer receptacle, 44A: base end part, 45: lever lock, 46: lever support shaft, 47: rail portion, 48: cutout, 49: displacement suppressing portion,
50: side retainer
60: lever, 61: lever body, 62: lever operating portion, 63: cam groove, 64: lock receiving portion, 65: lever shaft hole
70: sealing ring
80: connection detecting member, 81: pressing portion, 82: slide portion, 83: detecting portion

Claims

1. A panel mount connector to be mounted on a panel including a connector mounting hole, comprising:

a male connector including an inner receptacle projecting from a base end part toward a tip part and open in the tip part, the male connector being mounted on the panel while passing through the connector mounting hole; and
a female connector including an outer receptacle to be fit to an outer peripheral surface side of the inner receptacle,
the inner receptacle including a panel lock provided at a position closer to the base end part than the tip part, the male connector being held mounted on the panel by locking the panel lock to a peripheral edge part of the connector mounting hole.

2. The panel mount connector of claim 1, wherein:

the panel lock includes a lock body portion provided displaceably with respect to an outer peripheral surface of the inner receptacle and an expanded portion formed by expanding a part of the lock body portion along the outer peripheral surface of the inner receptacle, and
the outer receptacle includes a displacement suppressing portion for suppressing a displacement of the lock body portion by being disposed along a facing surface of the expanded portion facing the inner receptacle with the male connector mounted on the panel.

3. The panel mount connector of claim 2, wherein:

the outer receptacle is provided with a cutout for avoiding interference with the panel lock with the male connector and the female connector connected, and
the displacement suppressing portion is provided on a peripheral edge part of the cutout in the outer receptacle.

4. The panel mount connector of claim 2 or 3, wherein the displacement suppressing portion is disposed between the expanded portion and the inner receptacle when connection of the male connector and the female connector is completed.

Fig. 1

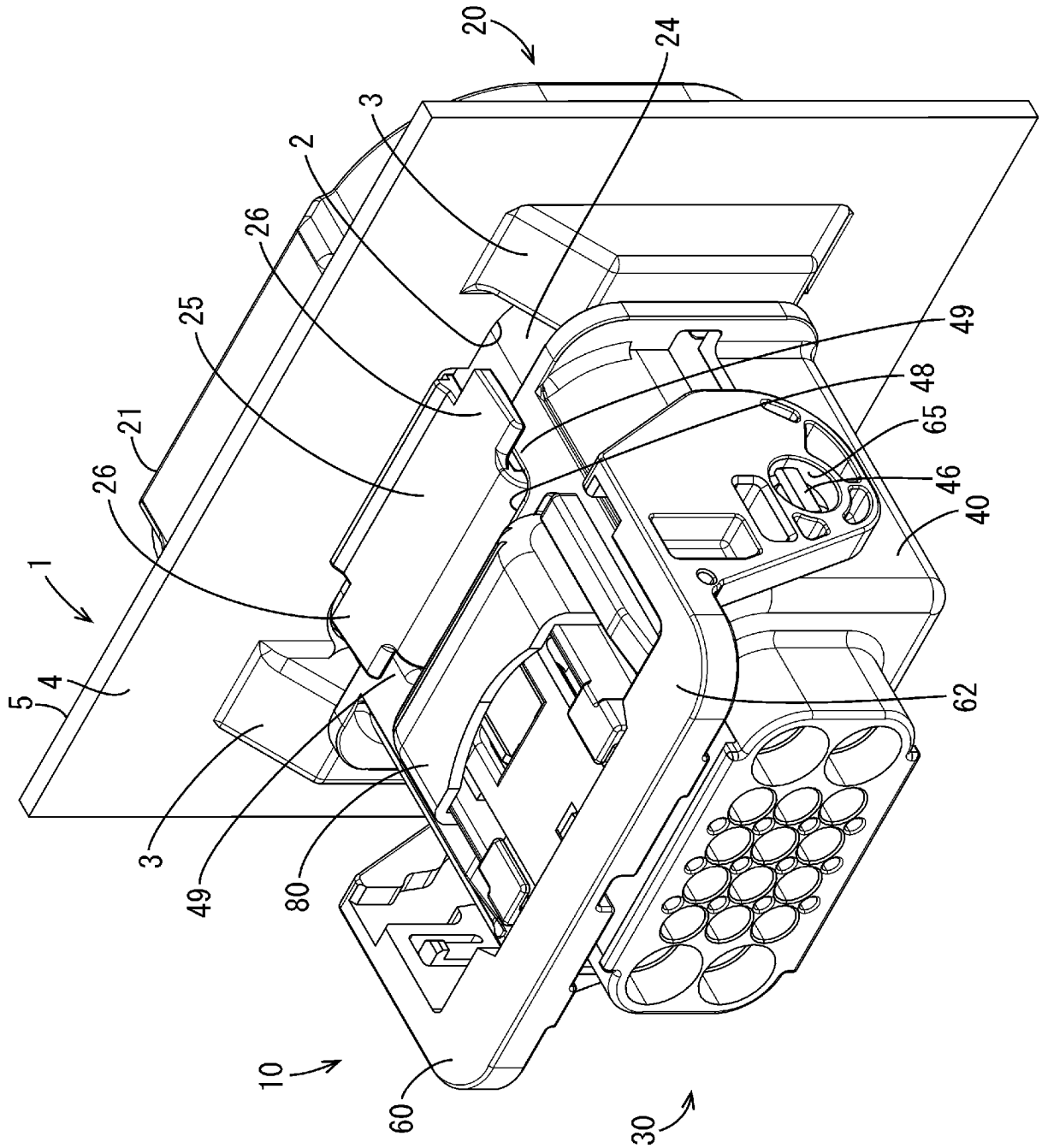


Fig. 2

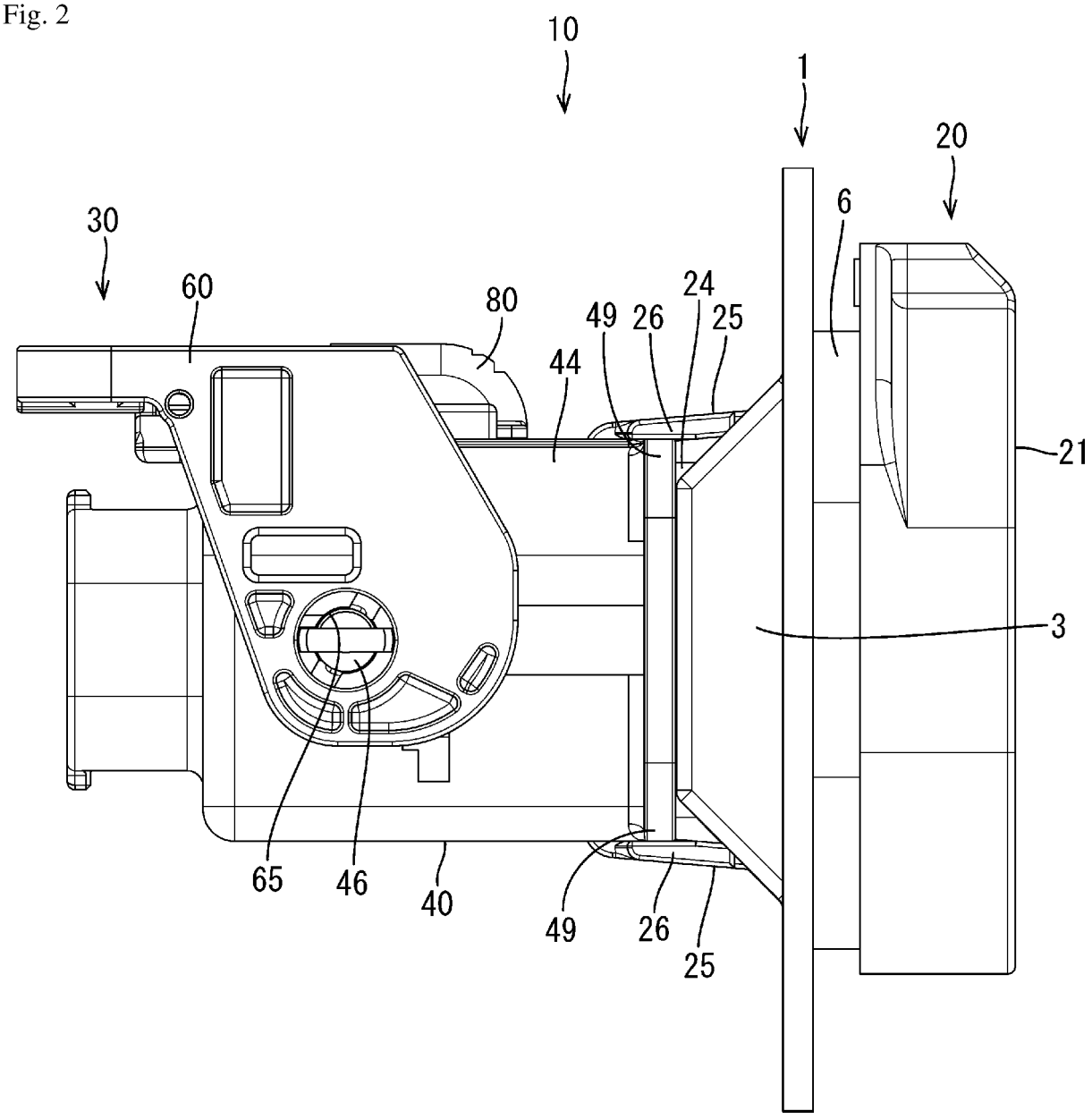
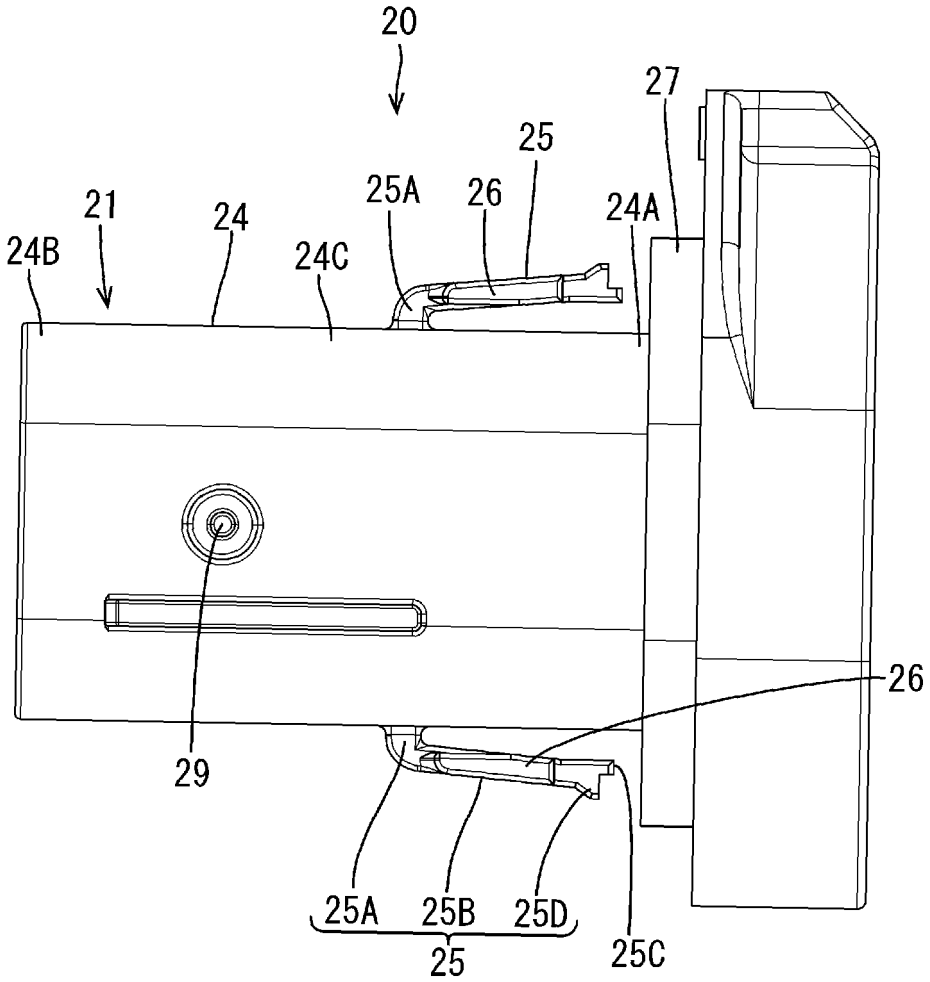


Fig. 3



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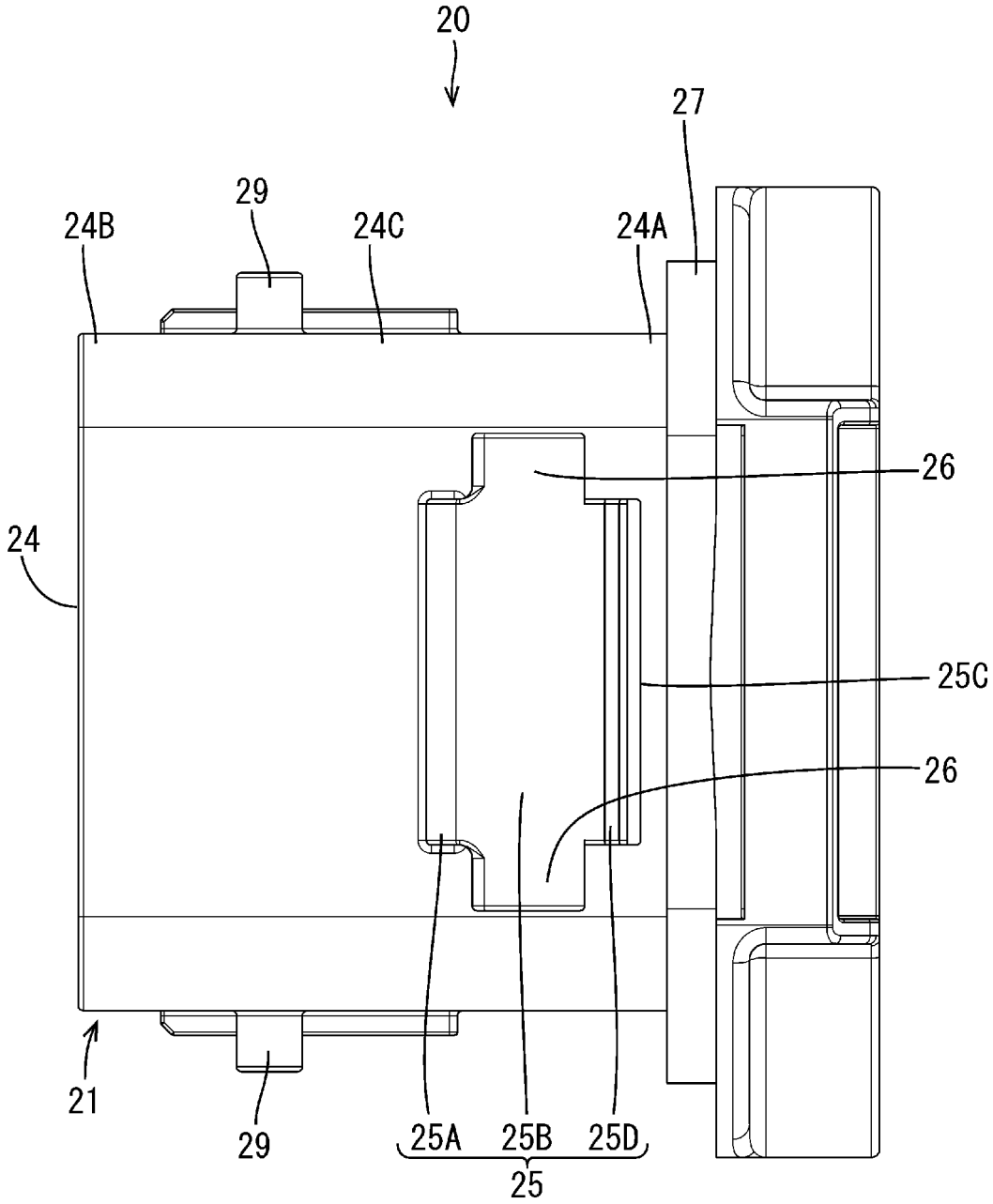

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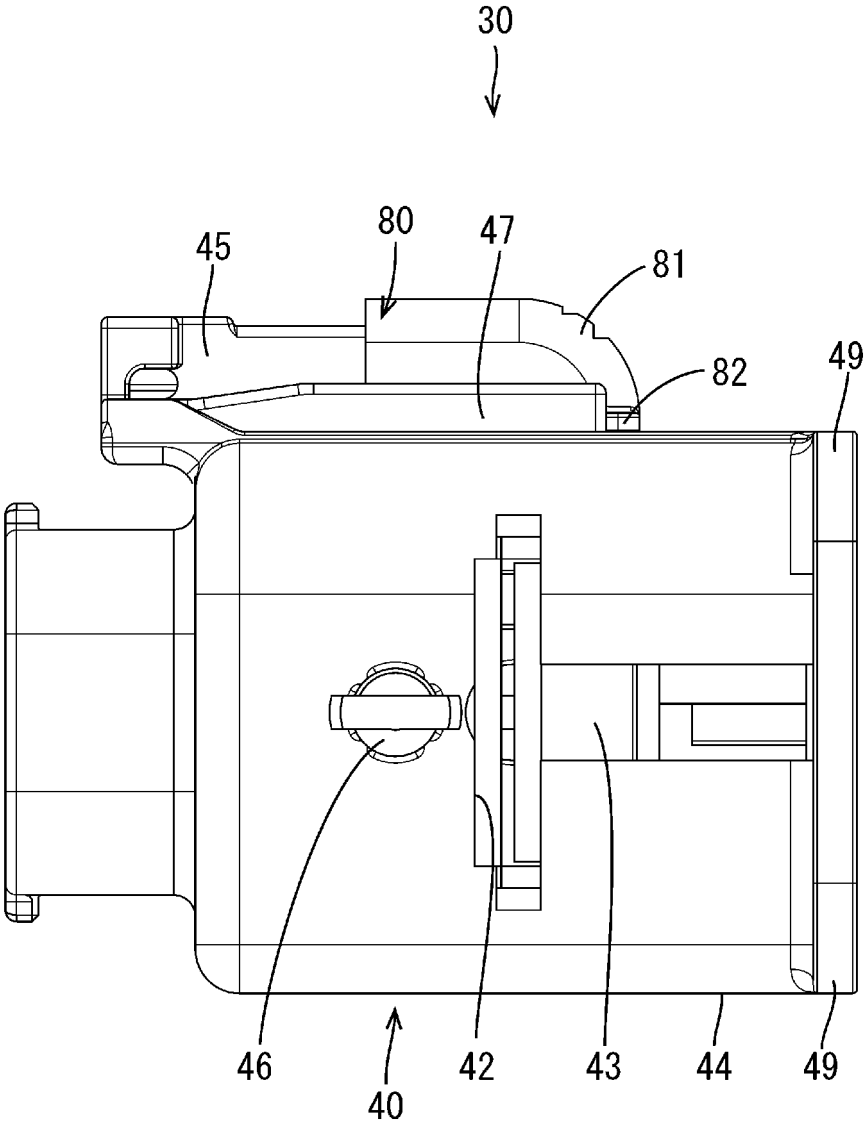

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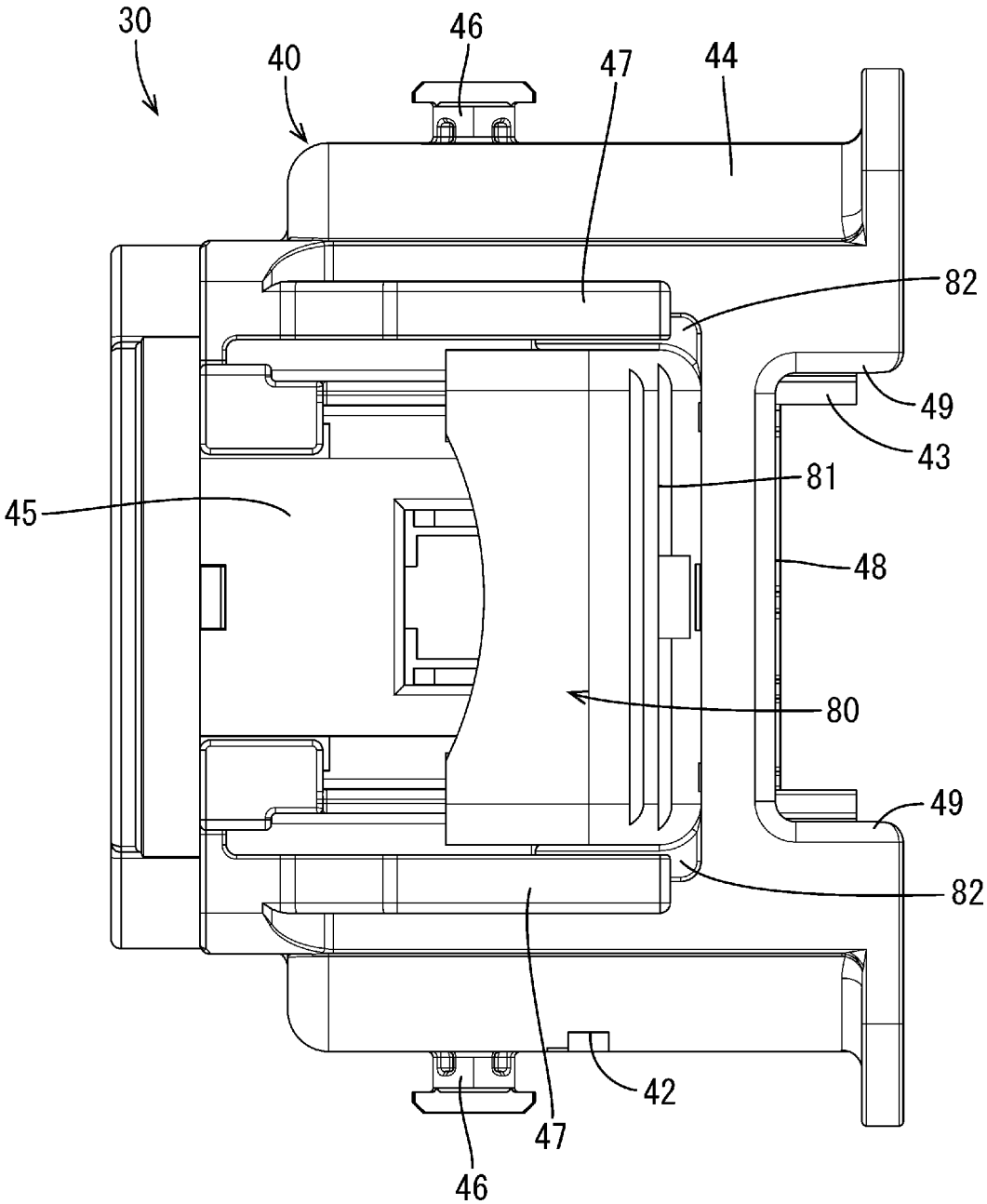

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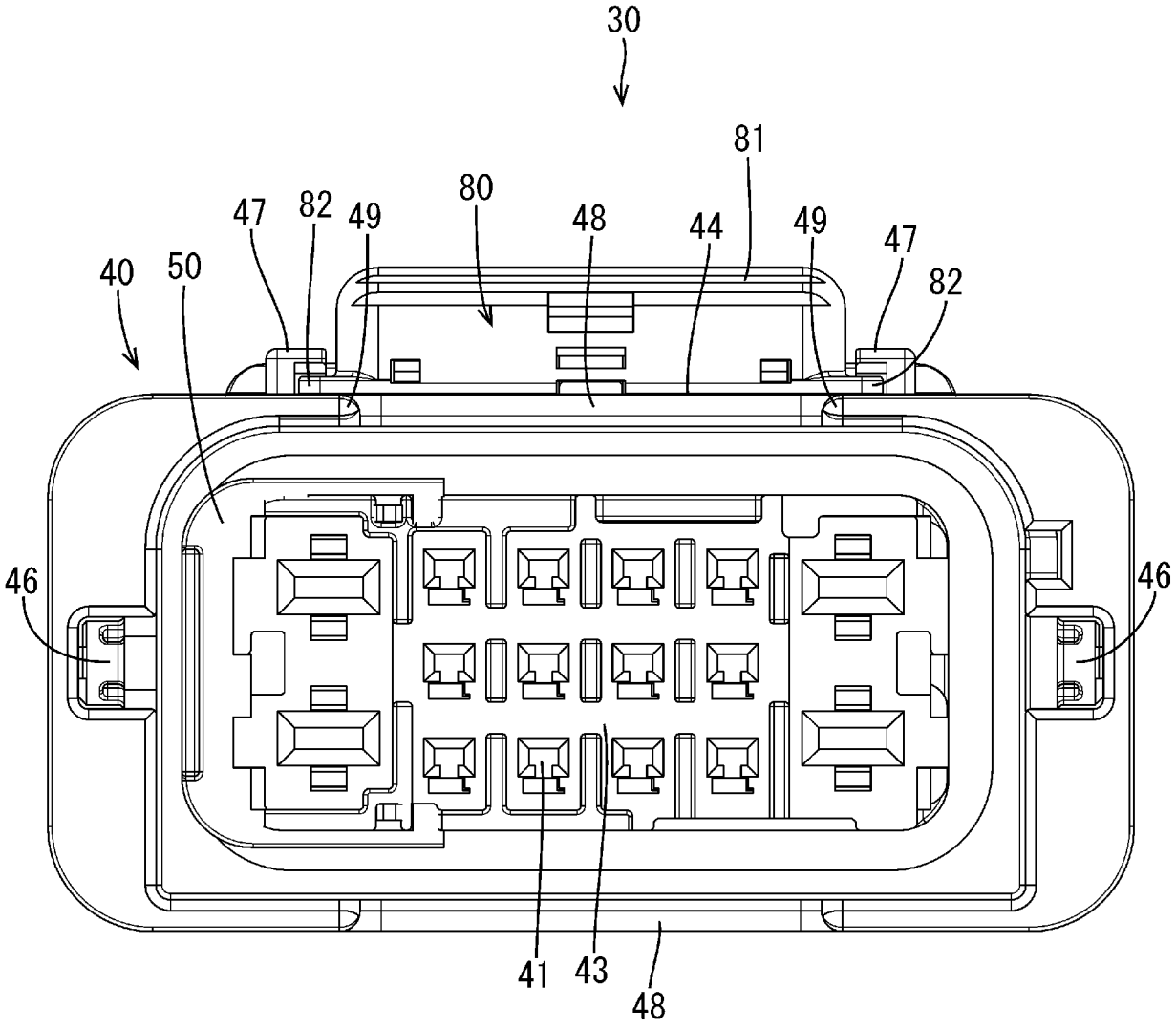

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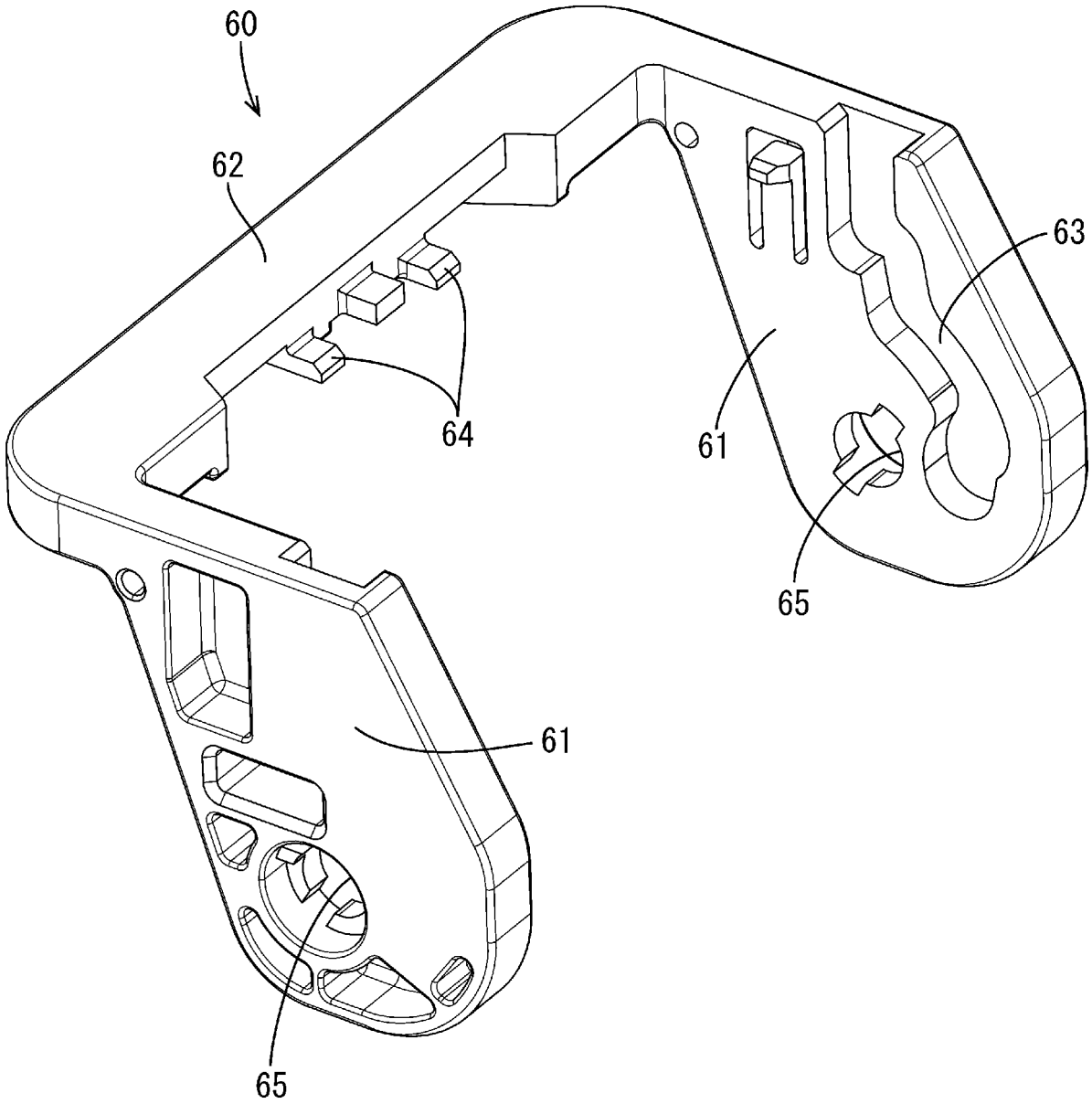

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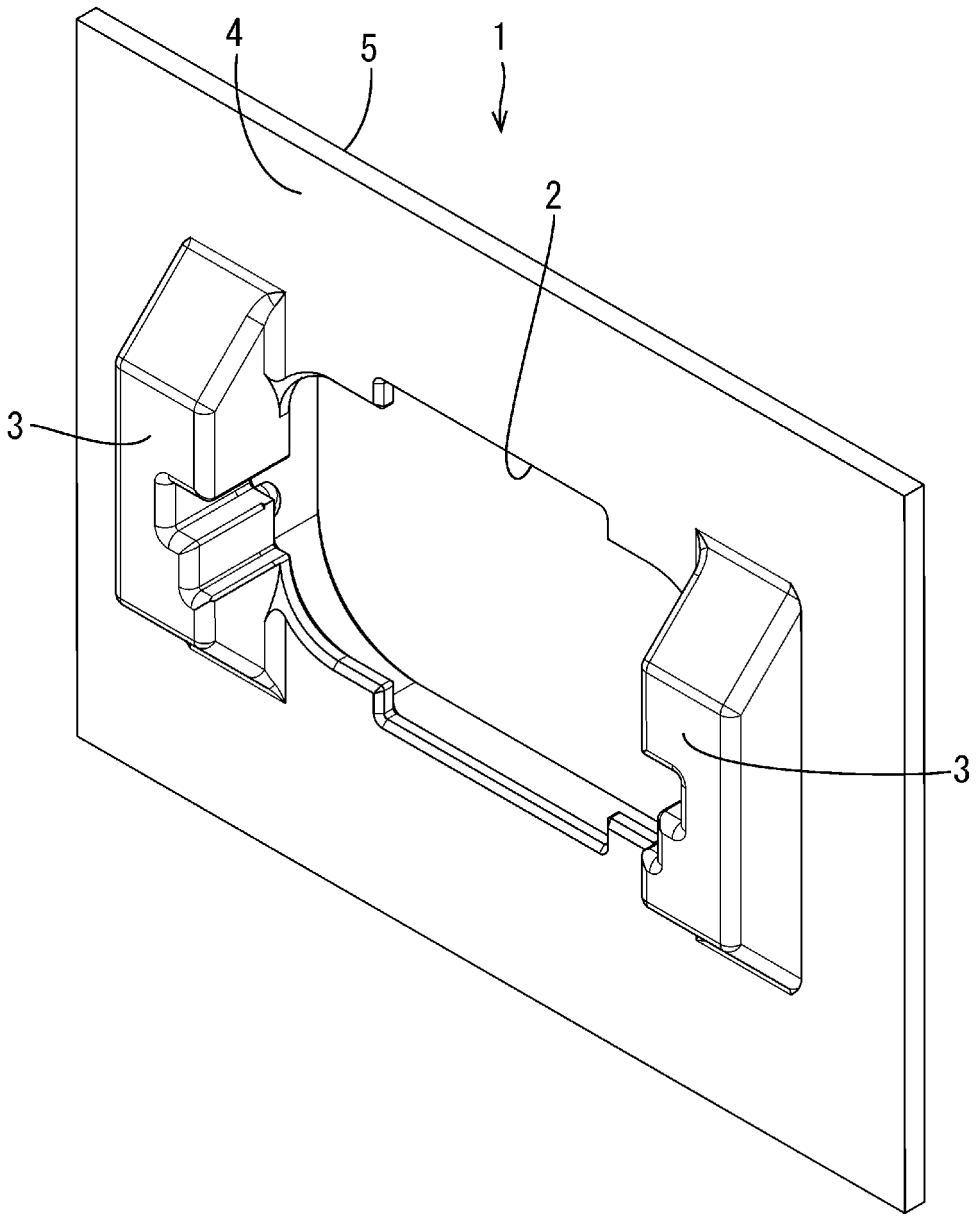
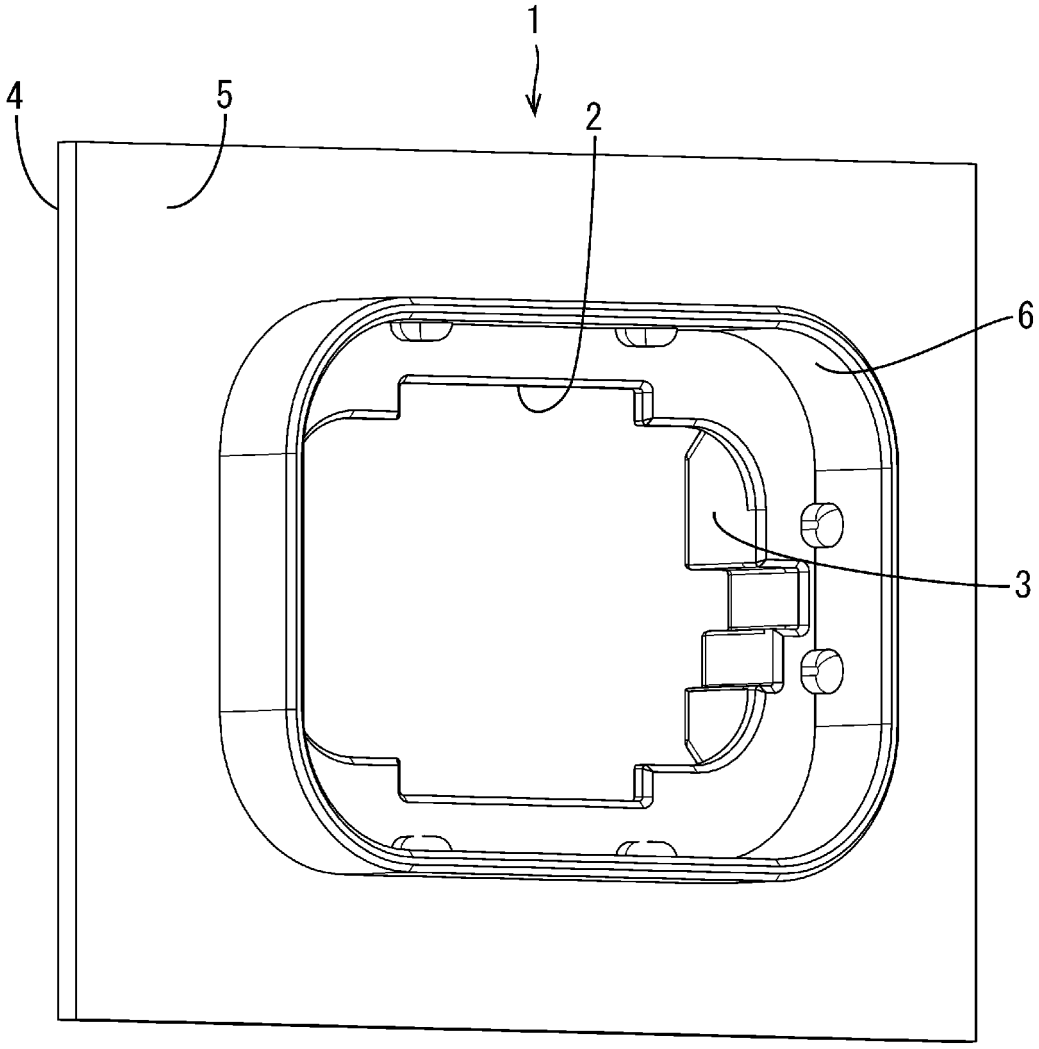


Fig. 10



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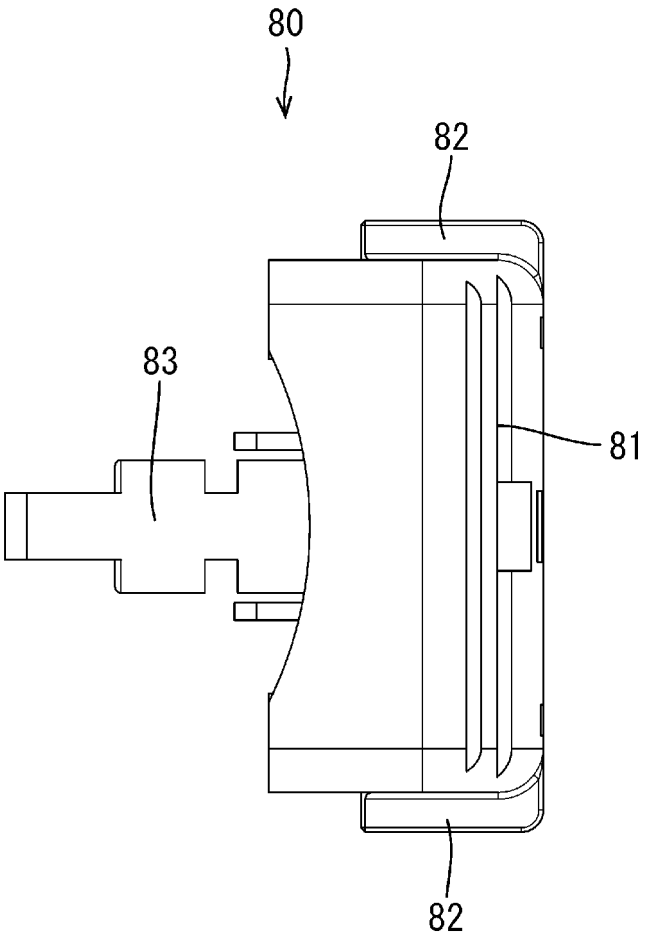

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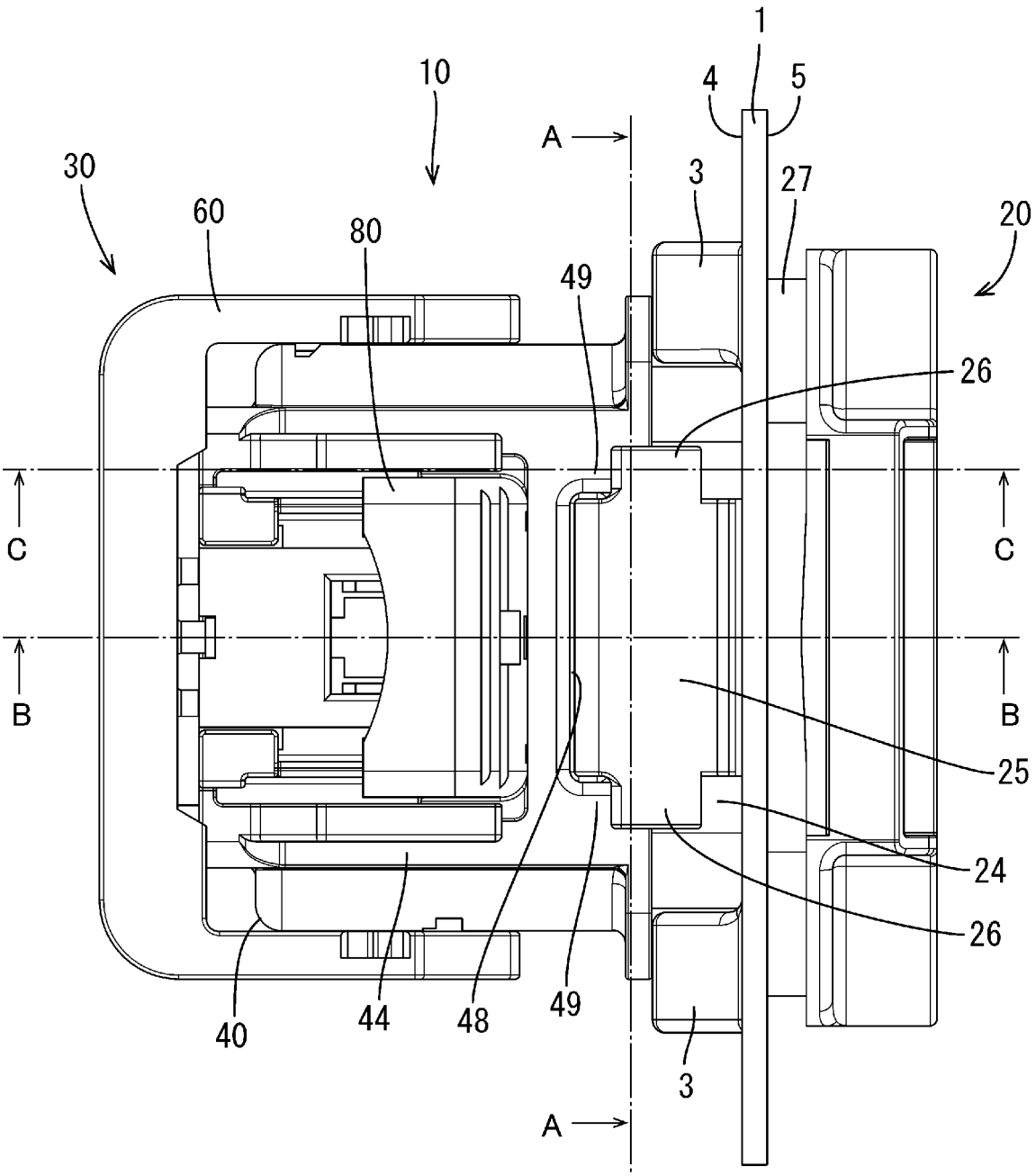

Fig. 13

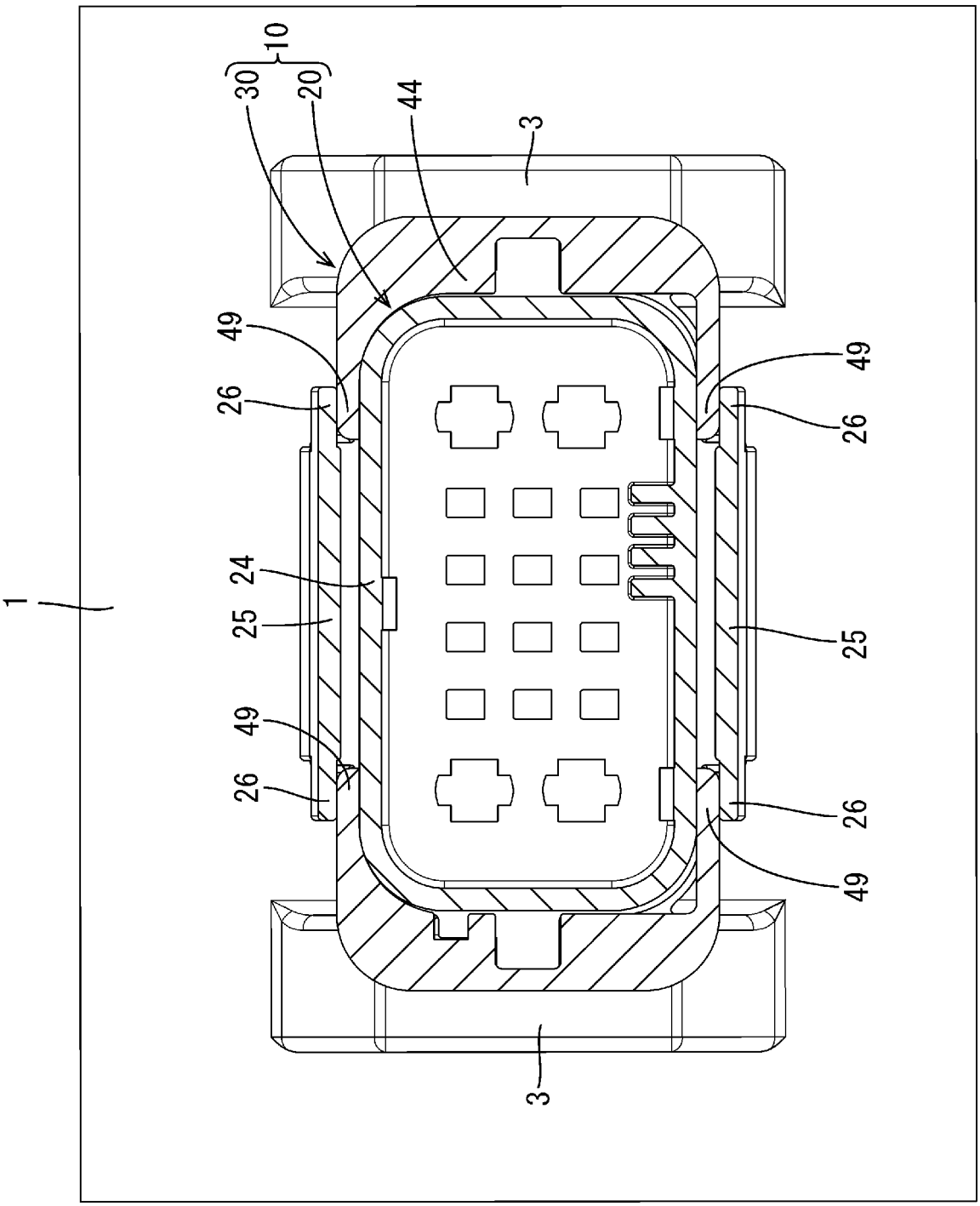

Fig. 14

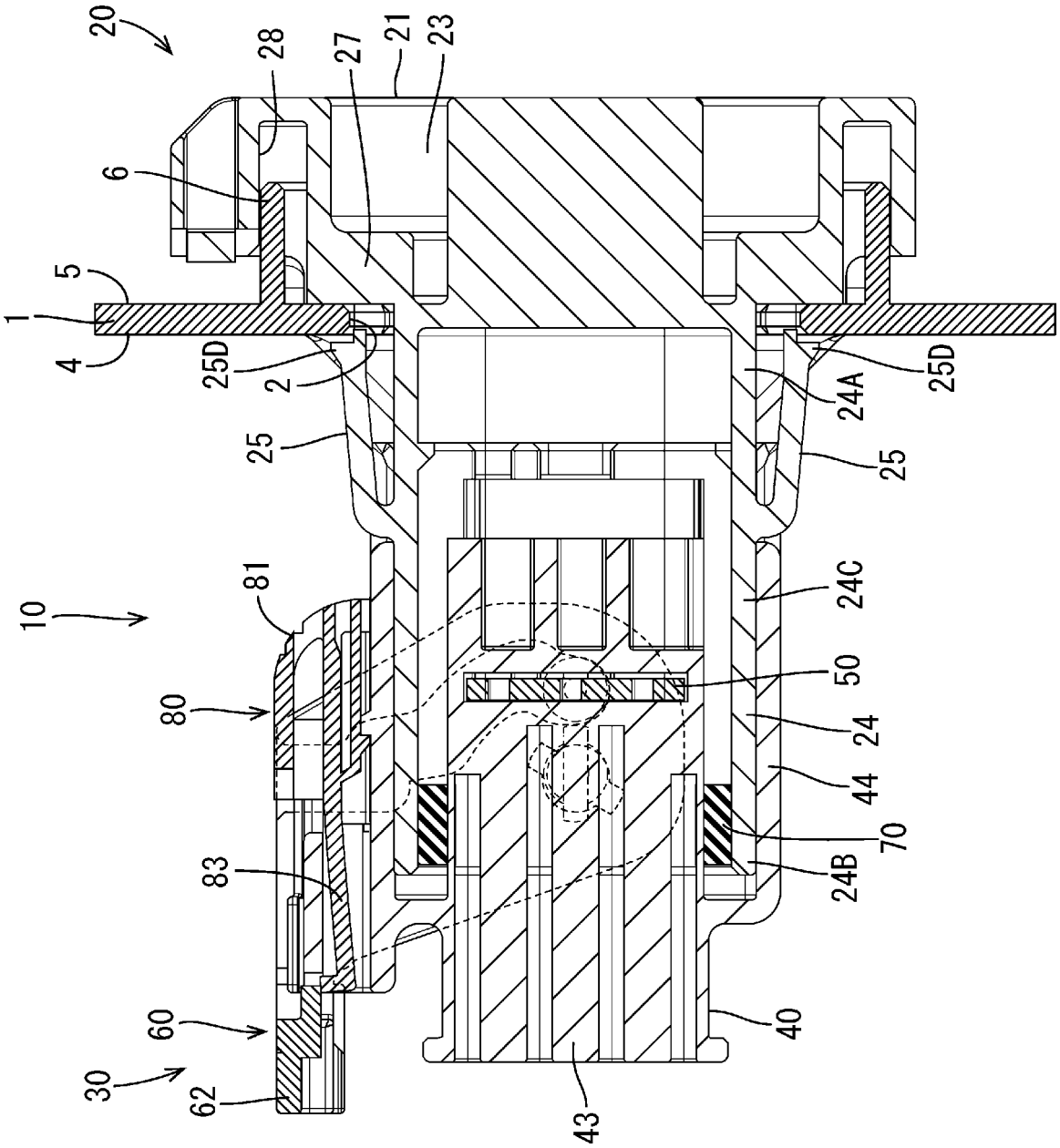
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Fig. 15

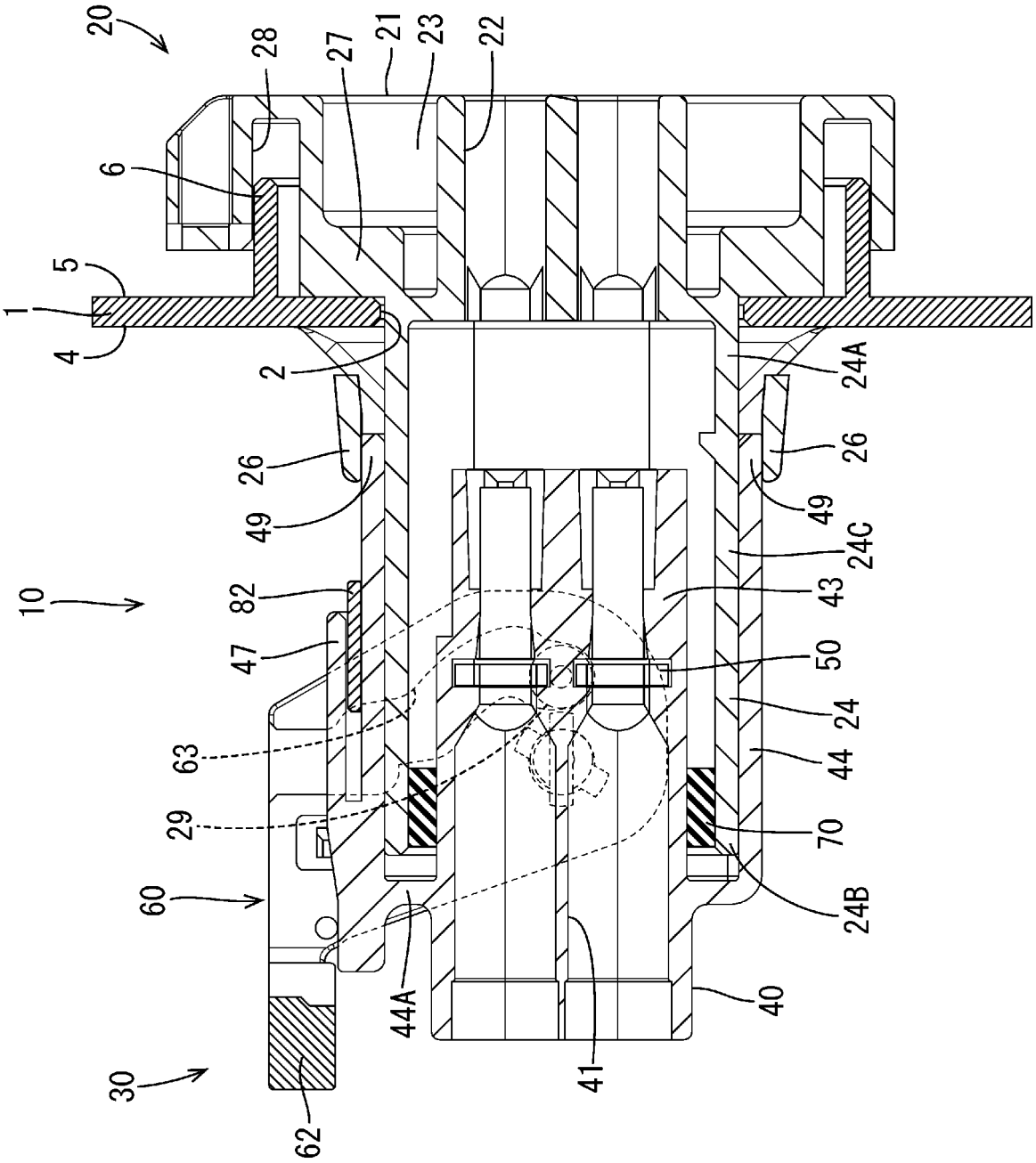
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Fig. 16

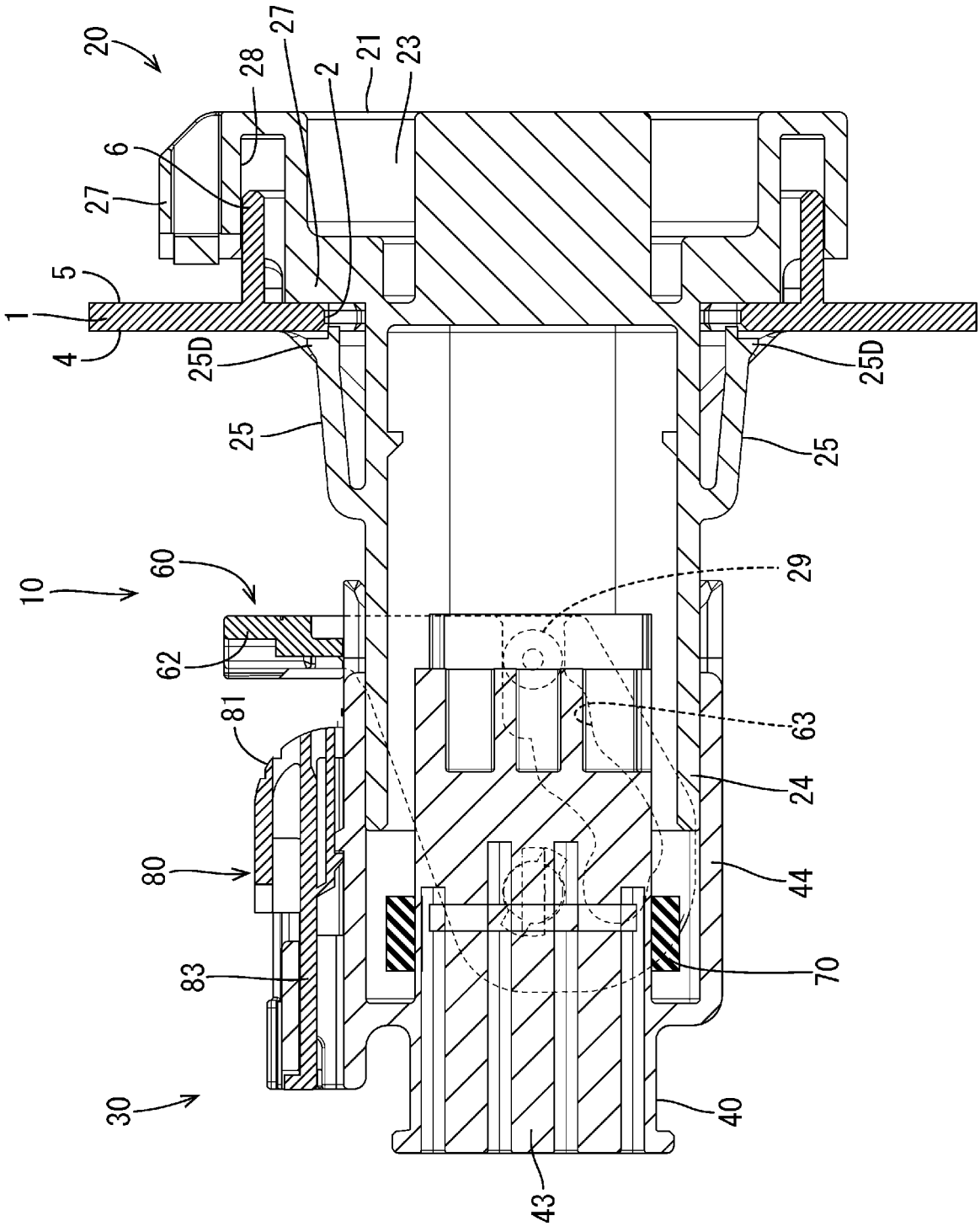
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Fig. 17

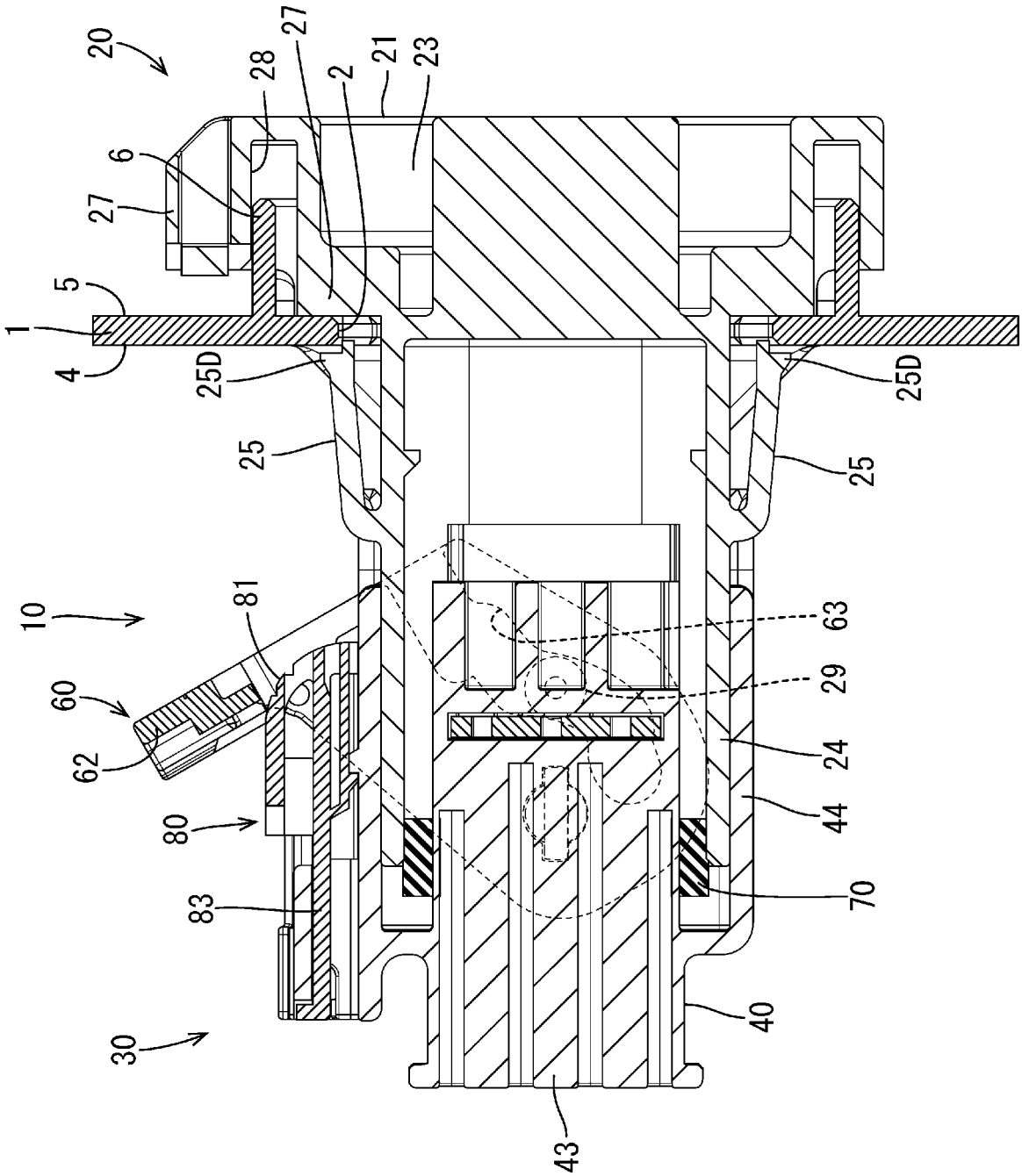
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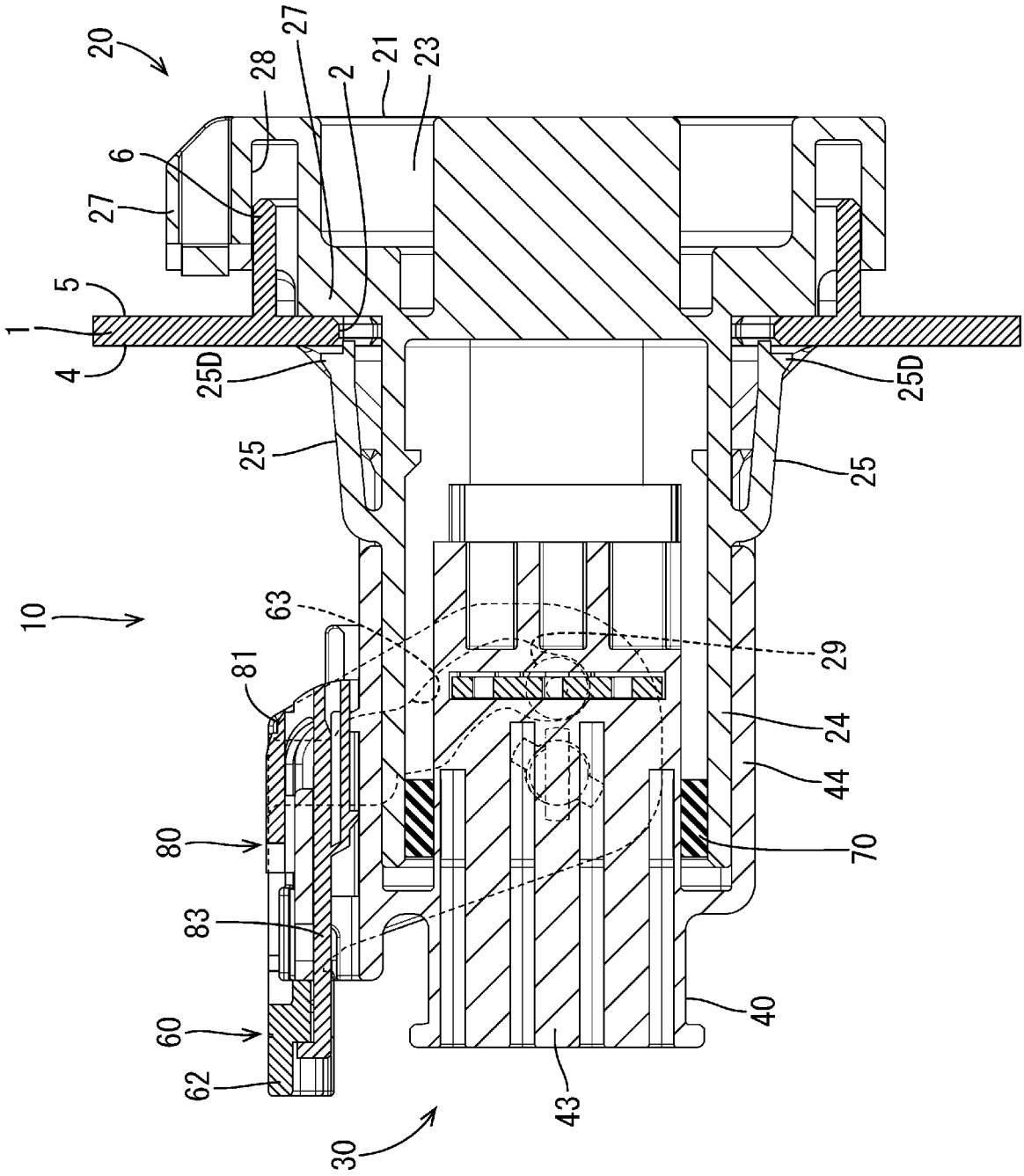
Fig. 18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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2022/006112

A. CLASSIFICATION OF SUBJECT MATTER

H01R 13/46(2006.01)i; ***H01R 13/516***(2006.01)i; ***H01R 13/74***(2006.01)i
FI: H01R13/46 304Z; H01R13/74 Z; H01R13/516

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01R13/46; H01R13/516; H01R13/74

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

Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2022
Registered utility model specifications of Japan 1996-2022
Published registered utility model applications of Japan 1994-2020

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2000-150076 A (SUMITOMO WIRING SYSTEMS, LTD.) 30 May 2000 (2000-05-30) paragraph [0019], fig. 4, 5	1
A		2-4
X	JP 2001-351743 A (SUMITOMO WIRING SYSTEMS, LTD.) 21 December 2001 (2001-12-21) paragraph [0019], fig. 1, 5, 6, 9	1
A		2-4
X	JP 9-45433 A (YAZAKI CORP.) 14 February 1997 (1997-02-14) paragraphs [0008], [0011], fig. 2	1
A		2-4
A	CD-ROM of the specification and drawings annexed to the request of Japanese Utility Model Application No. 28359/1992 (Laid-open No. 87853/1993) (AMP JAPAN KK) 26 November 1993 (1993-11-26), paragraph [0013], fig. 1	2-4

☑ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
09 March 2022	**19 April 2022**
Name and mailing address of the ISA/JP **Japan Patent Office (ISA/JP)** **3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915** **Japan**	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2022/006112

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CD-ROM of the specification and drawings annexed to the request of Japanese Utility Model Application No. 76871/1992 (Laid-open No. 36236/1994) (SUMITOMO WIRING SYSTEMS, LTD.) 13 May 1994 (1994-05-13), paragraph [0021], fig. 9	2-4
A	JP 2007-134292 A (JST MANUFACTURING CO., LTD.) 31 May 2007 (2007-05-31) paragraph [0017], fig. 4	2-4

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2022/006112

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP 2000-150076 A	30 May 2000	(Family: none)	
JP 2001-351743 A	21 December 2001	US 2001/0053623 A1 paragraph [0034], fig. 1, 5, 6, 9 EP 1162700 A2	
JP 9-45433 A	14 February 1997	US 5800208 A column 3, lines 34-51, column 4, lines 15-35, fig. 2	
JP 5-87853 U1	26 November 1993	(Family: none)	
JP 6-36236 U1	13 May 1994	US 5389015 A column 5, line 57 to column 6, line 7, fig. 9A, 9B EP 591972 A2	
JP 2007-134292 A	31 May 2007	(Family: none)	

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Patent documents cited in the description

- JP 2003187911 A **[0002] [0003]**