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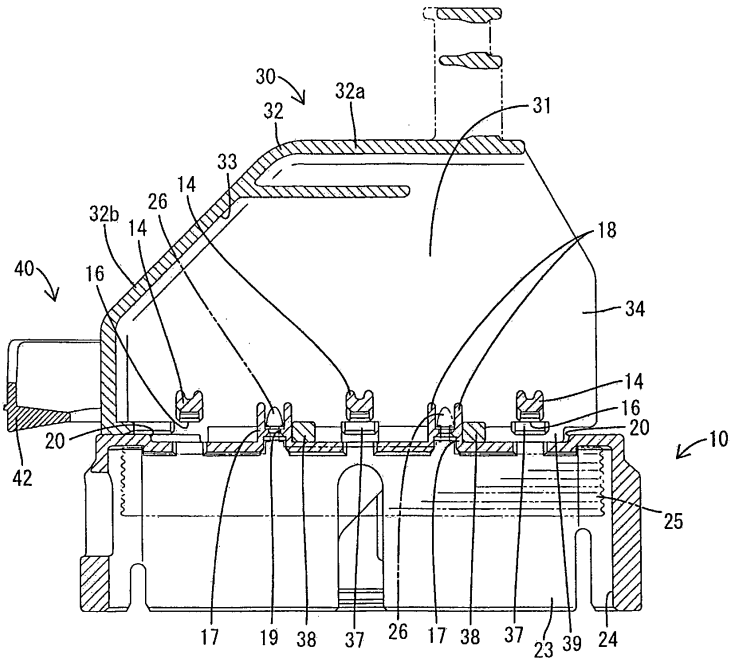
(54) A lever-type connector and an assembling method therefor

(57) An object of the present invention is to prevent an inadvertent movement of a wire cover resulting from the operation of a lever.

A wire cover 30 and a housing 10 are provided with contact means (projection-shaped receiving portions 17, projection-shaped contact portions 38, step-shaped receiving portions 20 and step-shaped contact portions 39) capable of preventing the wire cover 30 from moving relative to the housing 10 in directions substantially parallel to a displacing direction of the operation 42 according to the rotation of a lever 40. In the process of assembling the wire cover 30 in a direction substantially orthogonal to the rear surface (wire draw-out surface 12, mounting surface 13) of the housing 10, lock means (lock portions 14, hooking portions 37) are engaged with each other while resiliently deforming the wire cover 30 and, by this engaging action, the wire cover 30 is prevented from being separated from the housing 10 in a direction substantially orthogonal to the rear surface of the housing 10.

FIG. 4



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Description

[0001] The present invention relates to a lever-type connector and to an assembling method therefor.

[0002] Japanese Unexamined Patent Publication No. 2004-199990 discloses such a connector that a rotary lever engageable with cam followers of a mating connector is supported on a wire cover mounted on a housing. Since the wire cover is for bending wires drawn out from the rear surface of the housing and turning the wires sideways, it is formed to cover the rear surface of the housing. The lever is so mounted as to be rotationally displaced by a specified angle substantially along the rear surface of the wire cover.

[0003] In the above connector, the wire cover is assembled with the housing while being slid in parallel with the rear surface of the housing. Resilient locking pieces formed in the wire cover are resiliently deformed in the assembling process, and are resiliently restored and engaged with locking portions of the housing when the wire cover reaches a proper assembled position. By this engaging action, the wire cover is locked in its assembled state while having a returning movement thereof prevented.

[0004] Thus, the direction of an operation force given from the lever to the wire cover when the lever is rotated along the rear surface of the wire cover is the same as the separating direction of the wire cover from the housing. In this case, if the operation force given to the wire cover exceeds the locking force of the resilient locking pieces, the resilient locking pieces may be resiliently deformed to be disengaged from the locking portions, with the result that the wire cover may be moved from the proper assembled position.

[0005] The present invention was developed in view of the above situation and an object thereof is to prevent an inadvertent movement of a wire cover resulting from the operation of a lever.

[0006] This object is solved according to the invention by the features of the independent claims. Preferred embodiments of the invention are subject of the dependent claims.

[0007] According to the invention, there is provided a lever-type or movable-member type connector, comprising:

a housing, from which one or more wires can be drawn out through a wire draw-out surface thereof,
a wire cover to be assembled with the housing to at least partly cover the wire draw-out surface of the housing, and
a lever or movable member movably supported on the wire cover and including an operable portion displaceable substantially along a portion of the wire cover,
wherein the wire cover and the housing include:

contact means capable of preventing the wire cover from being displaced relative to the housing in a direction substantially parallel to a displacing direction of the operable portion according to the movement of the lever by being engaged with each other, and
lock means engaged with each other while resiliently deforming the wire cover in the process of assembling the wire cover in a direction at an angle different from 0° or 180°, preferably substantially substantially orthogonal to the wire draw-out surface of the housing and capable of preventing the wire cover from being separated from the housing in a direction at an angle different from 0° or 180°, preferably substantially substantially orthogonal to the wire draw-out surface of the housing by the engaging action thereof.

[0008] Since the movement of the wire cover substantially along the wire draw-out surface of the housing is prevented by the contact action of the contact means, the function of preventing the movement of the wire cover has higher reliability as compared to a construction for preventing the movement of the wire cover by the engaging action of resilient locking pieces. In the case of providing the contact means as described above, the assembling direction of the wire cover with the housing is or can be at an angle different from 0° or 180°, preferably substantially orthogonal to the wire draw-out surface of the housing. However, since the wire cover is assembled taking advantage of the resilient deformation of the wire cover, there is no hindrance to the assembling operation.

[0009] According to a preferred embodiment of the invention, the wire cover is to be assembled with the wire draw-out surface of the housing to thereby turn the drawn-out wires.

[0010] According to a further preferred embodiment of the invention, there is provided a lever-type connector, comprising:

a housing, from which wires are drawn out through the rear surface thereof,
a wire cover to be assembled with the housing to cover the rear surface of the housing, thereby turning the drawn-out wires, and
a lever rotatably supported on the wire cover and including an operable portion displaceable along the rear surface of the wire cover,
wherein the wire cover and the housing include:

contact means capable of preventing the wire cover from being displaced relative to the housing in a direction substantially parallel to a displacing direction of the operable portion according to the rotation of the lever by being engaged with each other, and
lock means engaged with each other while resiliently deforming the wire cover in the process

of assembling the wire cover in a direction substantially orthogonal to the rear surface of the housing and capable of preventing the wire cover from being separated from the housing in a direction substantially orthogonal to the rear surface of the housing by the engaging action thereof. Since the movement of the wire cover along the rear surface of the housing is prevented by the contact action of the contact means, the function of preventing the movement of the wire cover has higher reliability as compared to a construction for preventing the movement of the wire cover by the engaging action of resilient locking pieces. In the case of providing the contact means as described above, the assembling direction of the wire cover with the housing is substantially orthogonal to the rear surface of the housing. However, since the wire cover is assembled taking advantage of the resilient deformation of the wire cover, there is no hindrance to the assembling operation.

[0011] Preferably, the housing is formed with a plurality of lock portions forming at least part of, preferably constituting the lock means.

[0012] Further preferably, the plurality of lock portions are arranged along an imaginary line parallel to the wire draw-out surface of the housing.

[0013] Most preferably, the housing is formed with a plurality of lock portions constituting the lock means, and the plurality of lock portions are arranged along an imaginary line parallel to the rear surface of the housing.

[0014] The plurality of lock portions constituting the lock means of the housing can fulfill the function of guiding an assembling operation of a cover-shaped member for turning wires, which member can be assembled with the housing while being slid in parallel with the rear surface of the housing.

[0015] Preferably, a seal ring formed with at least one positioning locking portion is to be mounted in the housing.

[0016] Further preferably, the housing, preferably the contact means of the housing, is formed with at least one positioning receiving portion capable of preventing the seal ring from being circumferentially displaced by being engaged with the positioning locking portion.

[0017] Most preferably, a seal ring formed with a positioning locking portion is mounted in the housing, and the contact means of the housing is formed with a positioning receiving portion capable of preventing the seal ring from being circumferentially displaced by being engaged with the positioning locking portion.

[0018] The lock means of the housing also functions to prevent the circumferential displacement of the seal ring.

[0019] According to a further preferred embodiment of the invention, the contact means of the housing and the lock means of the housing are in point symmetry with respect to an axis orthogonal to the wire draw-out surface (preferably the rear surface) of the housing.

[0020] Since the contact means and the lock means are in point symmetry with respect to the axis orthogonal to the rear surface of the housing, the wire cover can be assembled with the housing in two orientations inverted from each other by 80°. Therefore, the wires can be turned in two opposite directions.

[0021] Preferably, the lever is displaceable between a stand-by position and a connection position to assist or perform the connection of the lever-type connector with a mating connector.

[0022] Further preferably, when the lever approaches the connection position, an operation force given to the operable portion acts as a force from the lever for pushing the wire cover toward a wire draw-out opening, wherein the contact portions preferably come substantially into contact with receiving portions substantially at this time.

[0023] Most preferably, upon separating the lever-type connector connected with the mating connector, an operation force given to the operable portion at an initial stage of the operation acts as a force from the lever for pushing the wire cover toward a substantially side opposite to a wire draw-out opening, wherein the contact portions preferably come substantially into contact with the receiving portions substantially at this time.

[0024] According to the invention, there is further provided an assembling or mounting method for assembling a lever-type connector, in particular according to the invention or a preferred embodiment thereof, comprising the following steps:

providing a housing, from which one or more wires can be drawn out through a wire draw-out surface thereof,

assembling a wire cover with the housing to at least partly cover the wire draw-out surface of the housing, movably supporting a lever on the wire cover, the lever including an operable portion displaceable substantially along a portion of the wire cover,

preventing the wire cover from being displaced relative to the housing in a direction substantially parallel to a displacing direction of the operable portion according to the movement of the lever by engaged contact means of the wire cover and the housing with each other, and

preventing the wire cover from being separated from the housing in a direction at an angle different from 0° or 180°, preferably substantially substantially orthogonal to the wire draw-out surface of the housing by an engaging action of lock means of the wire cover and the housing engaged with each other while resiliently deforming the wire cover in the process of assembling the wire cover in a direction at an angle different from 0° or 180°, preferably substantially substantially orthogonal to the wire draw-out surface of the housing.

[0025] According to a preferred embodiment of the invention, the wire cover is assembled with the wire draw-out surface of the housing to thereby turn the drawn-out wires.

[0026] Preferably, the housing is formed with a plurality of lock portions forming at least part of, preferably constituting the lock means.

[0027] Further preferably, the plurality of lock portions are arranged along an imaginary line parallel to the wire draw-out surface of the housing.

[0028] Most preferably, the assembling method further comprises a step of mounting a seal ring formed with at least one positioning locking portion in the housing.

[0029] These and other objects, features and advantages of the present invention will become more apparent upon reading of the following detailed description of preferred embodiments and accompanying drawings. It should be understood that even though embodiments are separately described, single features thereof may be combined to additional embodiments.

FIG. 1 is a perspective view of one embodiment,
FIG. 2 is a plan view of the embodiment,
FIG. 3 is a horizontal section of the embodiment,
FIG. 4 is a vertical section of the embodiment,
FIG. 5 is a perspective view of a housing,
FIG. 6 is a plan view of the housing,
FIG. 7 is a side view of the housing,
FIG. 8 is a perspective view of a wire cover,
FIG. 9 is a bottom view of the wire cover, and
FIG. 10 is a vertical section of the wire cover.

[0030] One preferred embodiment of the present invention is described with reference to FIGS. 1 to 10. A connector of this embodiment is provided with a housing 10 and at least one wire cover 30. A connecting side of the connector with an unillustrated matig connector will be referred to as front or front side.

[0031] The housing 10 is made e.g. of synthetic resin and preferably substantially in the form of a laterally long block as a whole. At least one projecting portion 11 is formed to project from an area of the rear surface of the housing 10 except a peripheral edge portion. In the rear surface of the housing 10, the rear surface of the projecting portion 11 serves as a wire draw-out surface 12 and a peripheral area at least partly surrounding the projecting portion 11 serves as a mounting surface 13. One or more terminal fittings (not shown) are or can be at least partly inserted into the housing 10 through the rear surface, and one or more wires (not shown) connected with (preferably the rear ends of) the terminal fittings are or can be drawn out at one or more angles different from 0° or 180°, preferably substantially at right angles from the wire draw-out surface 12.

[0032] One or more, e.g. three projection-shaped lock portions 14 (as preferred lock means) preferably spaced at substantially equal intervals in transverse direction TD (longitudinal direction) are formed on (preferably each of) the longer side(s) of the outer circumferential surface of the projecting portion 11. Each lock portion 14 preferably is formed with a guiding portion 15 inclined with respect to the wire draw-out surface 12 and to be brought substantially into sliding contact with a hooking portion 37 (as preferred lock means) to be described later, and a surface of the lock portion 14 facing the mounting surface 13 preferably serves as a locking surface 16 to be engaged with the hooking portion 37. The (e.g. six) lock portion(s) 14 formed on this projecting portion 11 is/are shaped and preferably arranged in point symmetry with respect to an axis orthogonal to the rear surface (wire draw-out surface 12 and/or mounting surface 13) of the housing 10. The locking surfaces 16 of the plurality of (e.g. three) lock portions 14 juxtaposed on each longer side are arranged along an imaginary line in parallel with the rear surface of the housing 10.

[0033] In each of two longer side areas of the mounting surface 13, two or more projection-shaped receiving portions 17 (as preferred contact means) preferably substantially continuous with the outer circumferential surface of the projecting portion 11 are formed while being spaced part in longitudinal direction. Each projection-shaped receiving portion 17 preferably includes one or more, preferably a pair of protecting pieces 18 in the form of plates at an angle different from 0° or 180°, preferably substantially at right angles to the wire draw-out surface 12 and/or the mounting surface 13, and at least one positioning hole 19 (as a preferred positioning receiving portion) at an angle different from 0° or 180°, preferably substantially at right angles to the mounting surface 13 and communicating with a connection space 24 to be described later is formed to penetrate adjacent to the protecting piece 18 or substantially between the paired protecting pieces 18. One or more, preferably a pair of step-shaped receiving portions 20 (as preferred contact means) are formed at the (preferably substantially opposite) end(s) of the one or more (preferably each) longer side area of the mounting surface 13 by being elevated or by projecting. The (four) projection-shaped receiving portion(s) 17 and the one or more (four) step-shaped receiving portion(s) 20 formed on the mounting surface 13 are shaped and arranged in point symmetry with respect to the axis orthogonal to the rear surface (wire draw-out surface 12 and/or mounting surface 13) of the housing 10. The respective projection-shaped receiving portions 17 are arranged between the adjacent lock portions 14.

[0034] One or more, preferably a pair of accommodation spaces 21 (preferably substantially in the form of slits extending substantially along the longer side edges) are formed in the housing 10. The accommodation spaces 21 are for at least partly accommodating a part of a lever 40 to be described later, and are open toward the mounting surface 13. The housing 10 includes a (preferably substantially block-shaped) terminal accommodating portion 22 for at least partly accommodating one or more terminal fittings, and a tubular fitting portion 23 surround-

ing the terminal accommodating portion 22 over at least part of, preferably over the substantially entire circumference, and a space between the terminal accommodating portion 22 and the tubular fitting portion 23 serves as the connection space 24 making an opening in the front surface of the housing 10. A seal ring 25 made of resilient material such as rubber is so to be mounted near or at the back end (rear end of the housing 10) of the connection space 24 as to be held substantially in close contact with (preferably the outer circumferential surface of) the terminal accommodating portion 22. When a receptacle (not shown) of a mating connector is at least partly fitted or inserted into the connection space 24, one or more lips on the outer surface of the seal ring 25 come to be held in close contact with the inner circumferential surface of the receptacle to provide sealing. One or more, preferably a plurality of positioning projections 26 (as preferred positioning locking portion) are formed on the seal ring 25, preferably near or at an end edge of the rear surface of the seal ring 25, while preferably being circumferentially spaced apart. Each positioning projection 26 has a constricted portion where the diameter is locally narrowed. Out of the plurality of positioning projections 26, a specific number (preferably four) positioning projections 26 are passed through positioning holes 19 to engage the constricted portions with the positioning holes 19 and retained by the engaging action of the constricted portions with the hole edges of the positioning holes 19. By this engagement of the positioning hole 19 and the positioning projections 26, the seal ring 25 is prevented from being circumferentially displaced relative to the housing 10.

[0035] The wire cover 30 is made e.g. of synthetic resin, and assembled with the housing 10 to at least partly cover the rear surface of the housing 10. The wire cover 30 includes one or more, preferably a pair of side walls 31 and/or a rear wall 32 (preferably connecting the both side walls 31), and a space enclosed or defined by these walls serves as a turning space 33 which is open at the front side and at (preferably only) one lateral side. The lateral opening of the turning space 33 serves as a wire draw-out opening 34. With the wire cover 30 mounted on the housing 10, the side walls 31 extend along the outer edges of the longer sides of the mounting surface 13 and are at an angle different from 0° or 180°, preferably substantially at right angles to the mounting surface 13. The rear wall 32 includes a parallel portion 32a substantially parallel to the mounting surface 13 and an inclined portion 32b inclined with respect to the mounting surface 13 with the wire cover 30 mounted on the housing 10. Preferably, one or more supporting shafts 35 for rotatably or pivotably supporting the lever 40 project from the outer surfaces of the side walls 31, and at least one lock projection 36 for locking the lever 40 at a connection position is formed on the outer surface of the parallel portion 32a.

[0036] One or more, preferably two hooking portions 37 in the form of projections and one or more, preferably two projection-shaped contact portions 38 (as preferred contact means) are formed on the inner surface of each side wall 31. The hooking portion(s) 37 and the projection-shaped contact portion(s) 38 are arranged substantially along an edge of each side wall 31 opposite to the parallel portion 32a (side closer to the mounting surface 13). The hooking portions 37 more distant from the wire draw-out opening 34 are arranged on the back sides of the supporting shafts 35 with the side walls 31 at least partly located therebetween. Further, one or more edges of the side walls 31 substantially facing the mounting surface 13 near the wire draw-out opening 34 serve as one or more step-shaped contact portions 39 (as preferred contact means).

[0037] The lever 40 is made e.g. of synthetic resin and preferably has such a form that a pair of plate-like arm portions 41 are connected by an operable portion 42. Each arm portion 41 is formed with a bearing hole 43 and an arcuate or spiral-like cam groove (not shown), and the lever 40 is mounted on the wire cover 30 rotatably or pivotably between a standby position and the connection position by engaging the bearing holes 43 with the supporting shafts 35. With the lever 40 located at the standby position, the operable portion 42 is located at a side opposite to the wire draw-out opening 34. With the lever 40 located at the connection position, the operable portion 42 is located substantially along the outer surface of the parallel portion 32a and engaged with the lock projection 36 and the lever 40 is positioned or held or locked at the connection position by this engaging action. Since lines connecting the operable portion 42 and the supporting shafts 35 are at an angle different from 0° or 180°, preferably substantially at right angles to the mounting surface 13 with the lever 40 located at the connection position, the operable portion 42 is or can be displaced substantially in parallel with the parallel portion 32a (i.e. the wire draw-out surface 13 and the mounting surface 13) immediately before the lever 40 rotated or pivoted in a connecting direction from the standby position reaches the connection position. Similarly, when the rotation of the lever 40 at the connection position toward the standby position is started, the operable portion 42 is displaced substantially in parallel with the parallel portion 32a (i.e. the wire draw-out surface 12 and the mounting surface 13).

[0038] Next, functions of this embodiment are described.

[0039] Upon assembling the connector, the one or more terminal fittings are first at least partly inserted into the housing and, on the other hand, the wire cover 30 is assembled with the lever 40. The wire cover 30 (preferably having the lever 40 assembled therewith) is brought toward the housing 10 substantially in a direction at an angle different from 0° or 180°, preferably substantially orthogonal to the rear surface of the housing 10 (preferably substantially from behind) and assembled by being fitted on the outer circumferential surface of the projecting portion 11. In the assembling process, the one or more (e.g. four) hooking portions 37 of the wire cover 30 come

substantially into sliding contact with the one or more guiding portions 15 of the one or more (e.g. four) lock portions 14 preferably located closer to the wire draw-out opening 34 out of the plurality of (e.g. six) lock portions 14 of the housing 10, whereby the side walls 31 are resiliently deformed outwardly. When the wire cover 30 comes into contact with the mounting surface 13 to reach the proper assembled position, the (four) hooking portions 37 pass the corresponding (four) lock portions 14 and the side walls 31 are resiliently at least partly restored to engage the one or more hooking portions 37 with the locking surfaces 16 of the lock portions 14. By this engaging action, the wire cover 30 is prevented from being separated from the housing 10 in a direction at an angle different from 0° or 180°, preferably substantially orthogonal to the rear surface of the housing 10 and locked in the assembled state.

[0040] With the wire cover 30 assembled, the one or more (e.g. four) projection-shaped contact portions 38 of the wire cover 30 are held in contact with the one or more (e.g. four) projection-shaped receiving portions 17 of the housing 10 form the side of the wire draw-out opening 34 and, by this contact, the wire cover 30 is prevented from moving relative to the housing 10 in a direction substantially parallel to the rear surface of the housing 10 (i.e. substantially the same direction as the moving direction of the operable portion 42 when the lever 40 at the connection position is rotated or pivoted or displaced toward the standby position). The two step-shaped contact portions 39 of the wire cover 30 come into contact with the two step-shaped receiving portions 20 of the housing 10 from the side substantially opposite to the wire draw-out opening 34 and, by this contact action, the wire cover 30 is prevented from moving relative to the housing 10 in a direction substantially parallel to the rear surface of the housing 10 (i.e. substantially the same direction as the moving direction of the operable portion 42 when the lever 40 at the standby position is rotated or pivoted or displaced toward the connection position).

[0041] With the wire cover 30 assembled with the housing 10, the one or more wires drawn out from the wire draw-out surface 12 of the housing 10 are bent sideways in the turning space 33 and drawn out sideways (or at an angle different from 0° or 180°, preferably substantially orthogonal to the longitudinal extension of the terminal fittings) to the outside of the wire cover 30 through the wire draw-out opening 34.

[0042] Upon the connection with the mating connector (not shown), the receptacle of the mating connector is lightly fitted or inserted into the tubular fitting portion 23 and the one or more cam followers (not shown) of the mating connector are at least partly inserted into the entrances of the one or more respective cam grooves with the lever 40 held or positioned at the standby position and, in this state, the lever 40 is operated or displaced (preferably rotated or pivoted) toward the connection position. When the lever 40 approaches the connection position, an operation force given to the operable portion 42 preferably acts as a force from the lever 40 for pushing the wire cover 30 toward the wire draw-out opening 34. Since the step-shaped contact portions 39 come substantially into contact with the step-shaped receiving portions 20 at this time, there is no likelihood that the wire cover 30 is displaced relative to the housing 10 in the direction toward the wire draw-out opening 34 in parallel with the rear surface of the housing 10.

[0043] Upon separating the connector connected with the mating connector, an operation force given to the operable portion 42 at an initial stage of the operation acts as a force from the lever 40 for pushing the wire cover 30 toward the side opposite to the wire draw-out opening 34. Since the projection-shaped contact portions 38 come substantially into contact with the projection-shaped receiving portions 17 at this time, there is no likelihood that the wire cover 30 is displaced relative to the housing 10 in the direction toward the side opposite to the wire draw-out opening 34 in parallel with the rear surface of the housing 10.

[0044] As described above, in this embodiment, the operable portion 42 is displaced along the rear surface of the wire cover 30 when the lever 40 supported on the wire cover 30 is operated or displaced (preferably rotated or pivoted). Since the wire cover 30 and the housing 10 are provided with contact means (projection-shaped contact portions 38, projection-shaped receiving portions 17, step-shaped contact portions 39 and/or step-shaped receiving portions 20) capable of preventing the wire cover 30 from substantially moving relative to the housing 10 in the directions substantially parallel to the displacing direction of the operable portion 42 according to the rotation of the lever 40, the function of preventing the movements of the wire cover 30 has higher reliability as compared with a construction for preventing the movements of the wire cover, for example, by the locking action of resilient locking pieces.

[0045] In the case of providing the above contact means, the assembling direction of the wire cover 30 with the housing 10 is at an angle different from 0° or 180°, preferably substantially substantially orthogonal to the rear surface of the housing 10. However, the wire cover 30 and the housing 10 are provided with the lock means (lock portions 14, hooking portions 37) that are engaged with each other while resiliently deforming the wire cover 30 in the process of assembling the wire cover 30 with the housing 10 and, by this engaging action, capable of preventing the wire cover 30 from being separated from the housing 10 in the direction at an angle different from 0° or 180°, preferably substantially substantially orthogonal to the rear surface of the housing 10, and the wire cover 30 is assembled taking advantage of the resilient deformation of the wire cover 30. Therefore, there is no hindrance to the assembling operation.

[0046] The one or more, preferably the plurality of lock portions 14 forming at least part of the lock means of the housing 10 preferably are arranged substantially along the imaginary line parallel to the rear surface of the hous-

ing 10 and fulfill the function of guiding an assembling operation of a cover-shaped member (not shown) for turning wires, which member can be assembled with the housing 10 while being slid substantially in parallel with the rear surface of the housing 10.

[0047] The housing 10 is formed with the one or more positioning holes 19 for preventing circumferential movements of the seal ring 25 by being engaged or engageable with the one or more positioning projections 26 of the seal ring 25. Since the positioning holes 19 preferably are formed in the projection-shaped receiving portions 17 as the contact means of the housing 10, the projection-shaped receiving portions 17 also function to prevent circumferential displacements of the seal ring 25.

[0048] The contact means (preferably the projection-shaped receiving portion(s) 17 and/or step-shaped receiving portion(s) 20) of the housing 10 preferably substantially are in point symmetry with respect to the axis orthogonal to the rear surface of the housing 10 and the lock means (preferably the lock portion(s) 14) of the housing 10 are similarly in point symmetry with respect to the axis orthogonal to the rear surface of the housing 10. Thus, the wire cover 30 can be assembled with the housing 10 in two orientations inverted from each other by 180°. Therefore, the wires can be turned in two opposite directions.

[0049] Accordingly, to prevent an inadvertent movement of a wire cover resulting from the operation of a lever, a wire cover 30 and a housing 10 are provided with one or more contact means (projection-shaped receiving portions 17, projection-shaped contact portions 38, step-shaped receiving portions 20 and/or step-shaped contact portions 39) capable of preventing the wire cover 30 from moving relative to the housing 10 in directions substantially parallel to a displacing direction of the operation 42 according to the displacement (preferably the rotation or pivotal movement) of a lever 40. In the process of assembling the wire cover 30 in a direction at an angle different from 0° or 180°, preferably at an angle of more than about 45°, more preferably of more than about 60°, most preferably substantially substantially orthogonal to the rear surface (wire draw-out surface 12, mounting surface 13) of the housing 10, lock means (lock portions 14 and/or hooking portions 37) are engaged with each other while resiliently deforming the wire cover 30 and, by this engaging action, the wire cover 30 is prevented from being separated from the housing 10 in a direction at an angle different from 0° or 180°, preferably substantially substantially orthogonal to the rear surface of the housing 10.

<Other Embodiments>

[0050] The present invention is not limited to the above described and illustrated embodiment. For example, the following embodiments are also embraced by the technical scope of the present invention as defined by the claims.

(1) The contact means and the lock means may not be in point symmetry with respect to the axis orthogonal to the rear surface of the housing.

(2) Although the operable portion is displaced along the rear surface of the wire cover upon rotating the lever in the separating direction in the above embodiment, the present invention is also applicable to connectors in which an operable portion is displaced along the rear surface of a wire cover upon rotating lever in a connecting direction. Furthermore, the lever may be displaced along a path different from a rotational path such as a substantially linear path.

LIST OF REFERENCE NUMERALS

[0051]

10 ...	housing
12 ...	wire draw-out surface (rear surface of the housing)
13 ...	mounting surface (rear surface of the housing)
14 ...	lock portion (lock means)
17 ...	projection-shaped receiving portion (contact means)
19 ...	positioning hole (positioning receiving portion)
20 ...	step-shaped receiving portion (contact means)
25 ...	seal ring
26 ...	positioning projection (positioning locking portion)
30 ...	wire cover
32 ...	rear wall
37 ...	hooking portion (lock means)
38 ...	projection-shaped contact portion (contact means)
39 ...	step-shaped contact portion (contact means)
40 ...	lever
42 ...	operable portion

Claims

1. A lever-type connector, comprising:

a housing (10), from which one or more wires can be drawn out through a wire draw-out surface (12) thereof,
a wire cover (30) to be assembled with the housing (10) to at least partly cover the wire draw-out surface (12) of the housing (10), and
a lever (40) movably supported on the wire cover (30) and including an operable portion (42) displaceable substantially along a portion (32) of the wire cover (30),

wherein the wire cover (30) and the housing (10) include:

contact means (17, 38; 20, 39) capable of pre-

venting the wire cover (30) from being displaced relative to the housing (10) in a direction substantially parallel to a displacing direction of the operable portion (42) according to the movement of the lever (40) by being engaged with each other, and
lock means (14, 37) engaged with each other while resiliently deforming the wire cover (30) in the process of assembling the wire cover (30) in a direction at an angle different from 0° or 180°, preferably substantially substantially orthogonal to the wire draw-out surface (12) of the housing (10) and capable of preventing the wire cover (30) from being separated from the housing (10) in a direction at an angle different from 0° or 180°, preferably substantially substantially orthogonal to the wire draw-out surface (12) of the housing (10) by the engaging action thereof.

2. A lever-type connector according to claim 1, wherein the wire cover (30) is to be assembled with the wire draw-out surface (12) of the housing (10) to thereby turn the drawn-out wires.

3. A lever-type connector according to one or more of the preceding claims, wherein the housing (10) is formed with a plurality of lock portions (14) forming at least part of, preferably constituting the lock means (14).

4. A lever-type connector according to claim 3, wherein the plurality of lock portions (14) are arranged along an imaginary line parallel to the wire draw-out surface (12) of the housing (10).

5. A lever-type connector according to one or more of the preceding claims, wherein a seal ring (25) formed with at least one positioning locking portion (26) is to be mounted in the housing (10).

6. A lever-type connector according to claim 5, wherein the housing (10), preferably the contact means (17) of the housing (10), is formed with at least one positioning receiving portion (19) capable of preventing the seal ring (25) from being circumferentially displaced by being engaged with the positioning locking portion (26).

7. A lever-type connector according to one or more of the preceding claims, wherein the contact means (17, 38; 20, 39) of the housing (10) and the lock means (14, 37) of the housing (10) substantially are in point symmetry with respect to an axis orthogonal to the wire draw-out surface (12) of the housing (10).

8. A lever-type connector according to one or more of the preceding claims, wherein the lever (40) is displaceable between a stand-by position and a connection position to assist or perform the connection of the lever-type connector with a mating connector.

9. A lever-type connector according to claim 8, wherein when the lever (40) approaches the connection position, an operation force given to the operable portion (42) acts as a force from the lever (40) for pushing the wire cover (30) toward a wire draw-out opening (34), wherein the contact portions (39) preferably come substantially into contact with receiving portions (20) substantially at this time.

10. A lever-type connector according to claim 8 or 9, wherein upon separating the lever-type connector connected with the mating connector, an operation force given to the operable portion (42) at an initial stage of the operation acts as a force from the lever (40) for pushing the wire cover (30) toward a substantially side opposite to a wire draw-out opening (34), wherein the contact portions (38) preferably come substantially into contact with the receiving portions (17) substantially at this time.

11. An assembling method for assembling a lever-type connector, comprising the following steps:

providing a housing (10), from which one or more wires can be drawn out through a wire draw-out surface (12) thereof,
assembling a wire cover (30) with the housing (10) to at least partly cover the wire draw-out surface (12) of the housing (10),
movably supporting a lever (40) on the wire cover (30), the lever (40) including an operable portion (42) displaceable substantially along a portion (32) of the wire cover (30),
preventing the wire cover (30) from being displaced relative to the housing (10) in a direction substantially parallel to a displacing direction of the operable portion (42) according to the movement of the lever (40) by engaged contact means (17, 38; 20, 39) of the wire cover (30) and the housing (10) with each other, and
preventing the wire cover (30) from being separated from the housing (10) in a direction at an angle different from 0° or 180°, preferably substantially substantially orthogonal to the wire draw-out surface (12) of the housing (10) by an engaging action of lock means (14, 37) of the wire cover (30) and the housing (10) engaged with each other while resiliently deforming the wire cover (30) in the process of assembling the wire cover (30) in a direction at an angle different from 0° or 180°, preferably substantially substantially orthogonal to the wire draw-out surface (12) of the housing (10).

12. An assembling method according to claim 11, where-

in the wire cover (30) is assembled with the wire draw-out surface (12) of the housing (10) to thereby turn the drawn-out wires.

13. An assembling method according to claim 11 or 12, wherein the housing (10) is formed with a plurality of lock portions (14) forming at least part of, preferably constituting the lock means (14).

14. An assembling method according to claim 13, wherein the plurality of lock portions (14) are arranged along an imaginary line parallel to the wire draw-out surface (12) of the housing (10).

15. An assembling method according to one or more of the preceding claims 11 to 14, further comprising a step of mounting a seal ring (25) formed with at least one positioning locking portion (26) in the housing (10).

FIG. 1

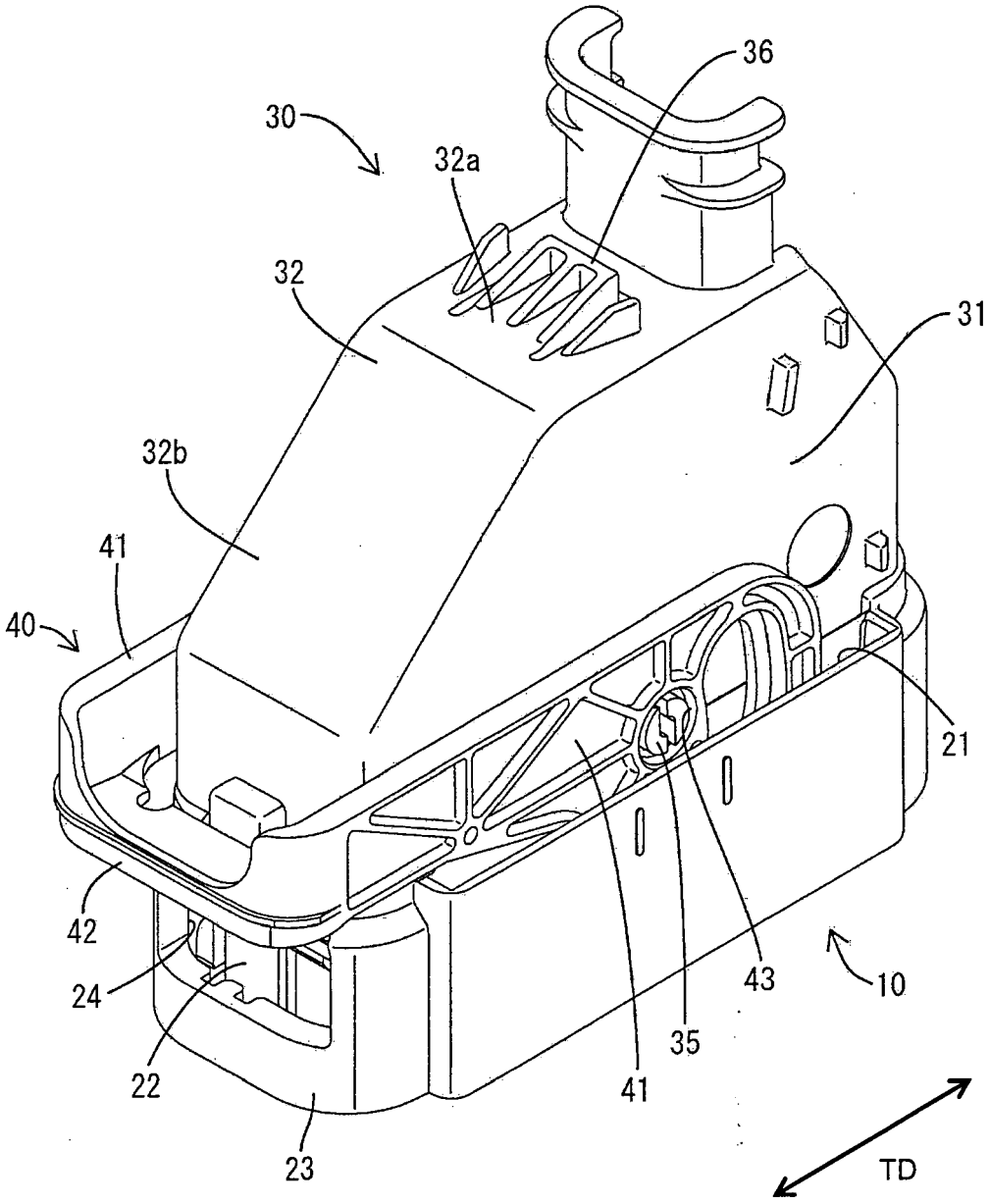


FIG. 2

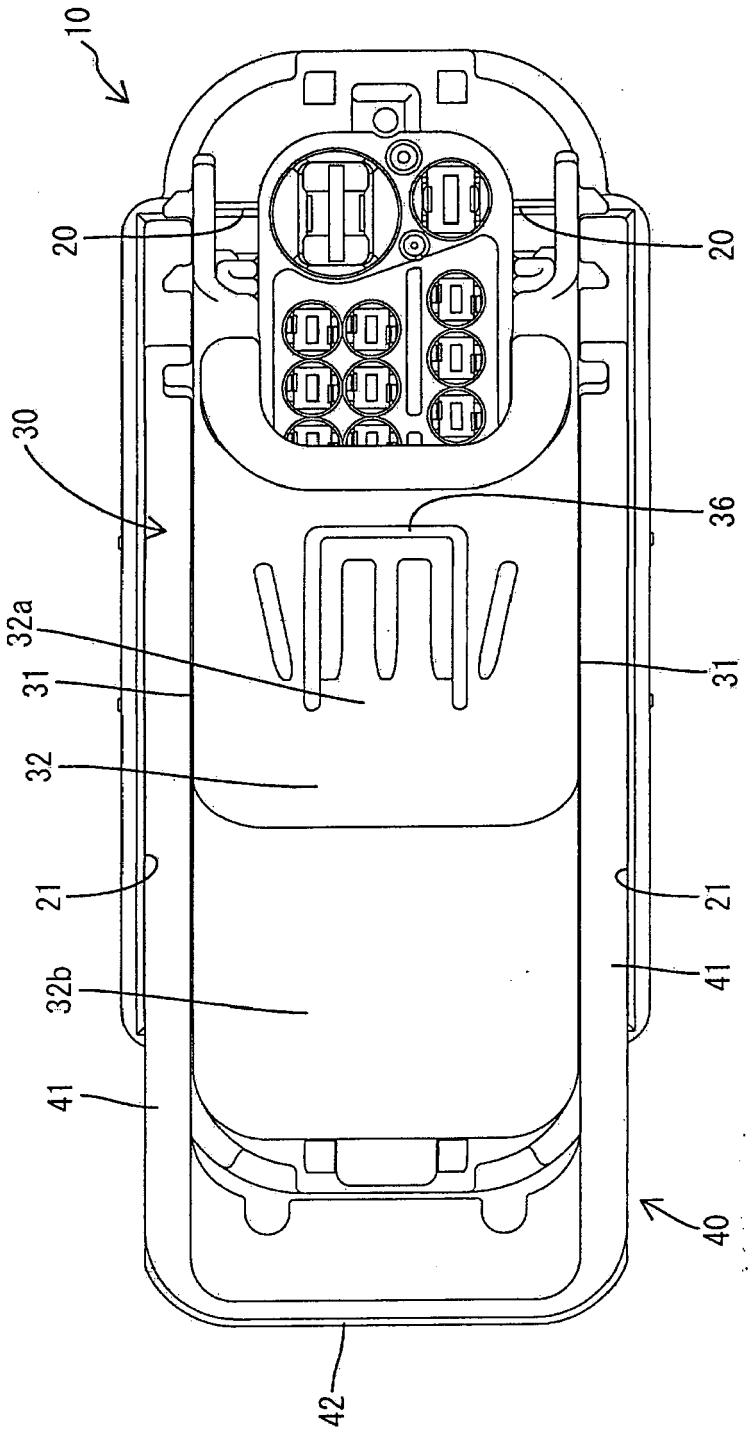
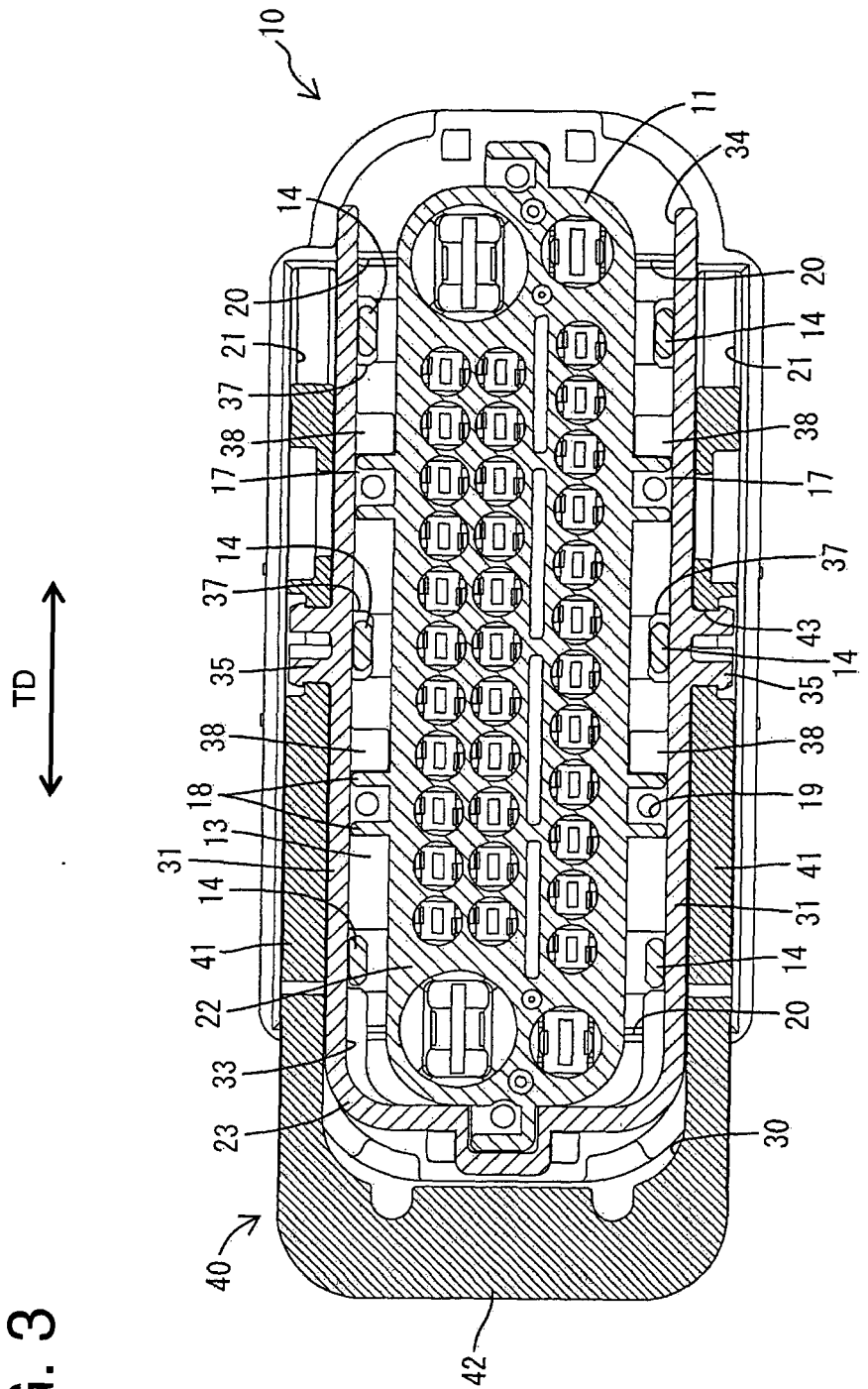


FIG. 3



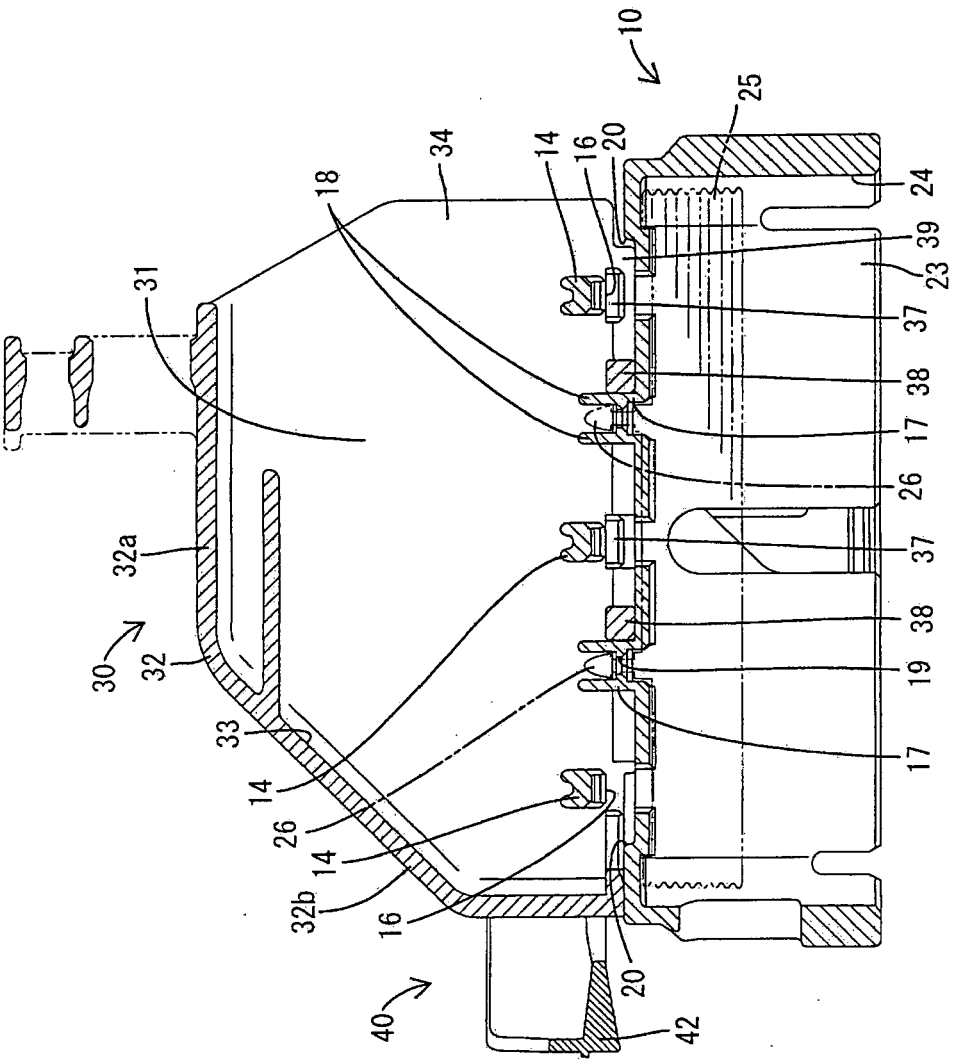

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FIG. 4

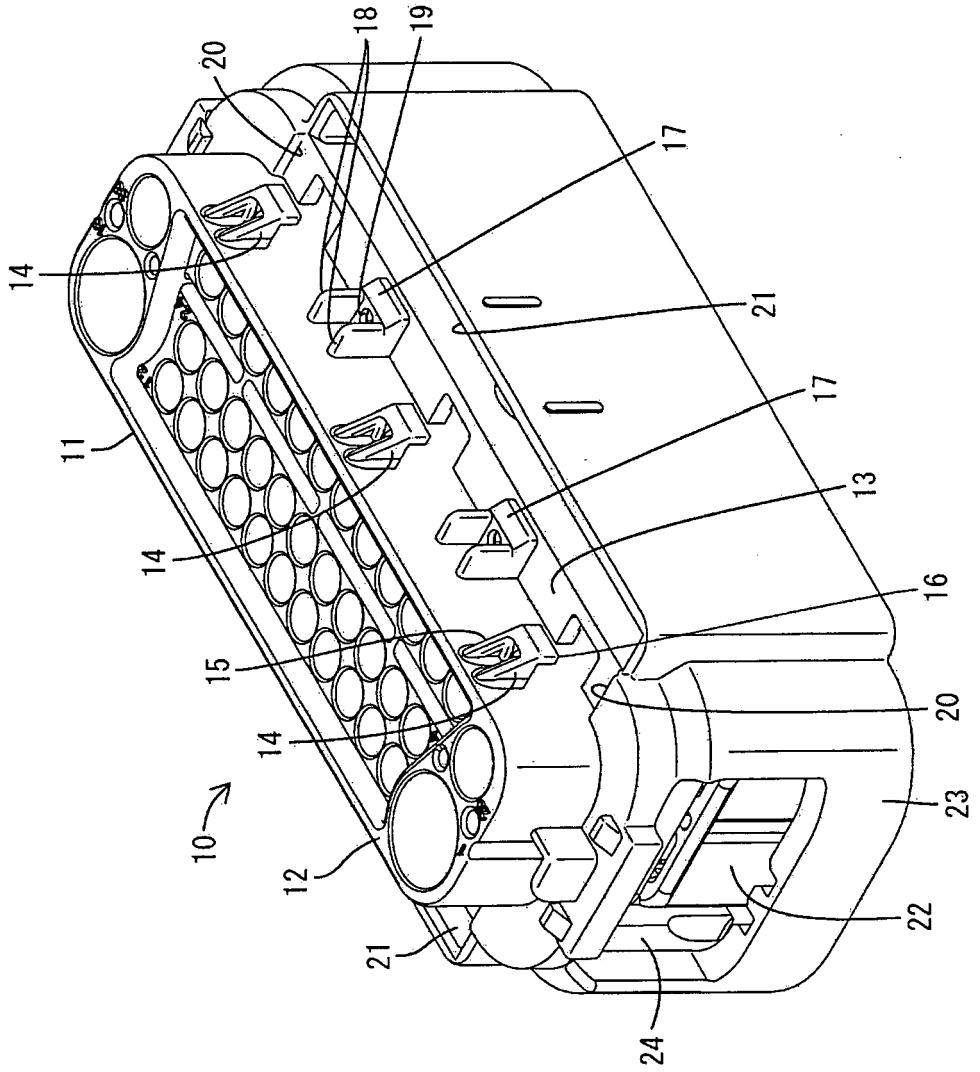


FIG. 5

FIG. 6

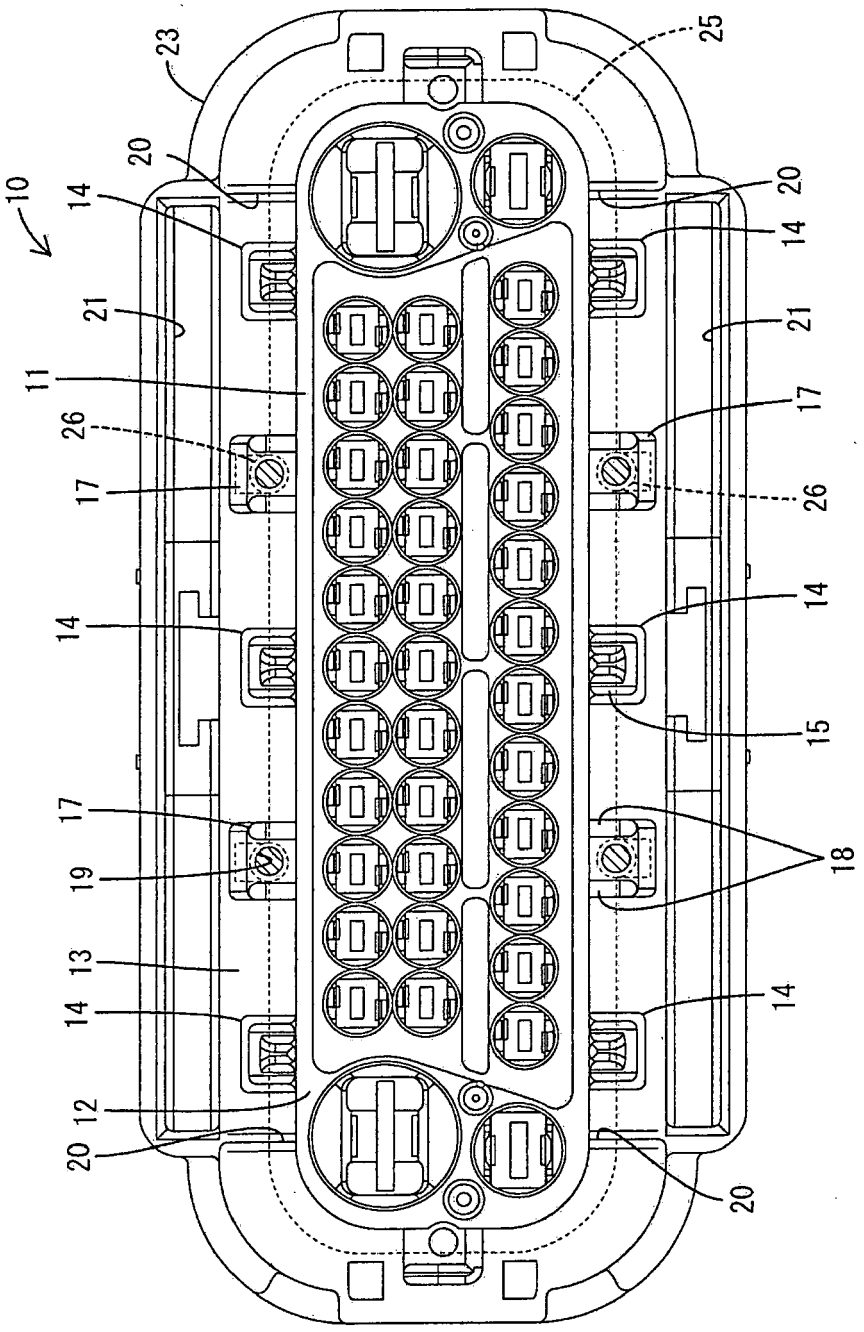


FIG. 7

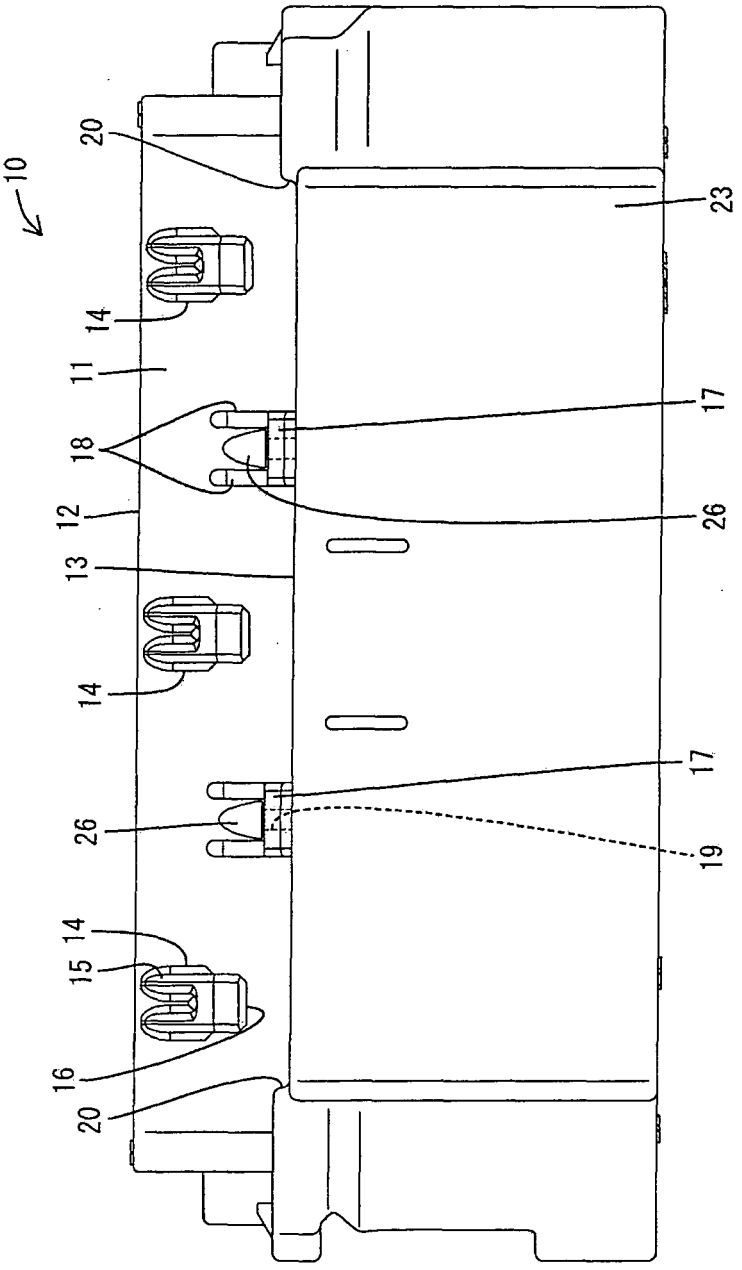


FIG. 8

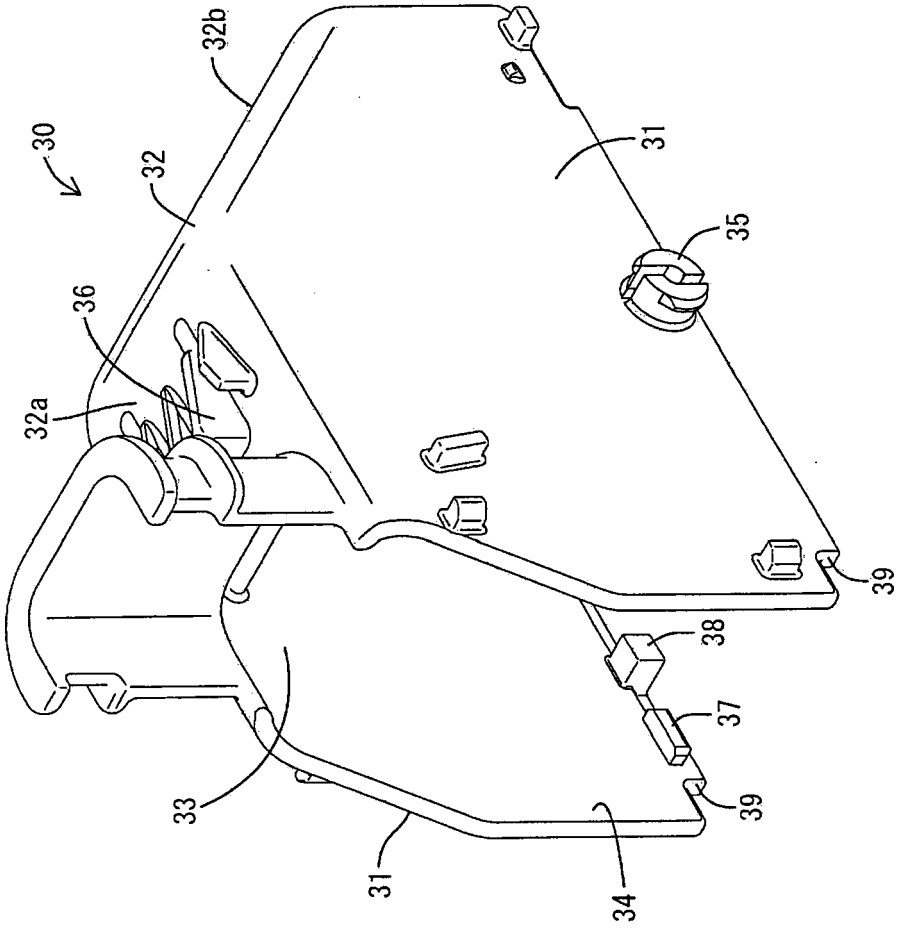
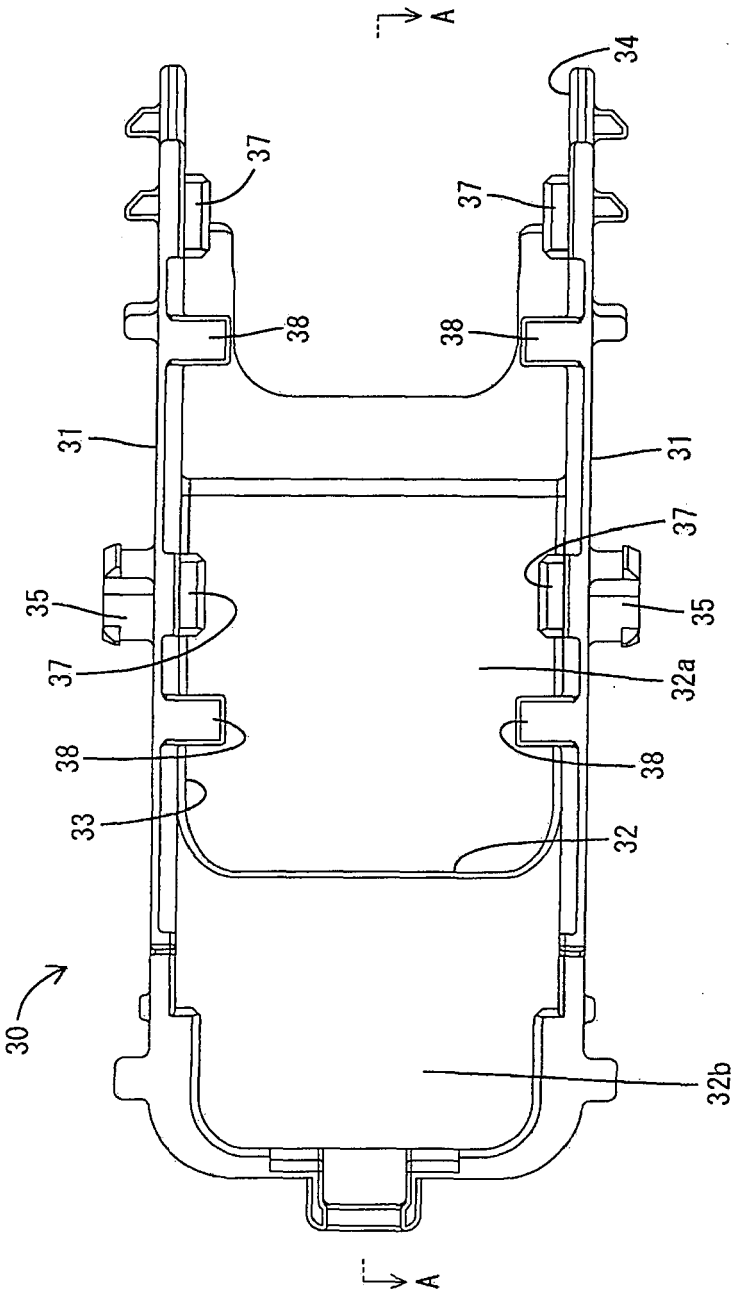


FIG. 9



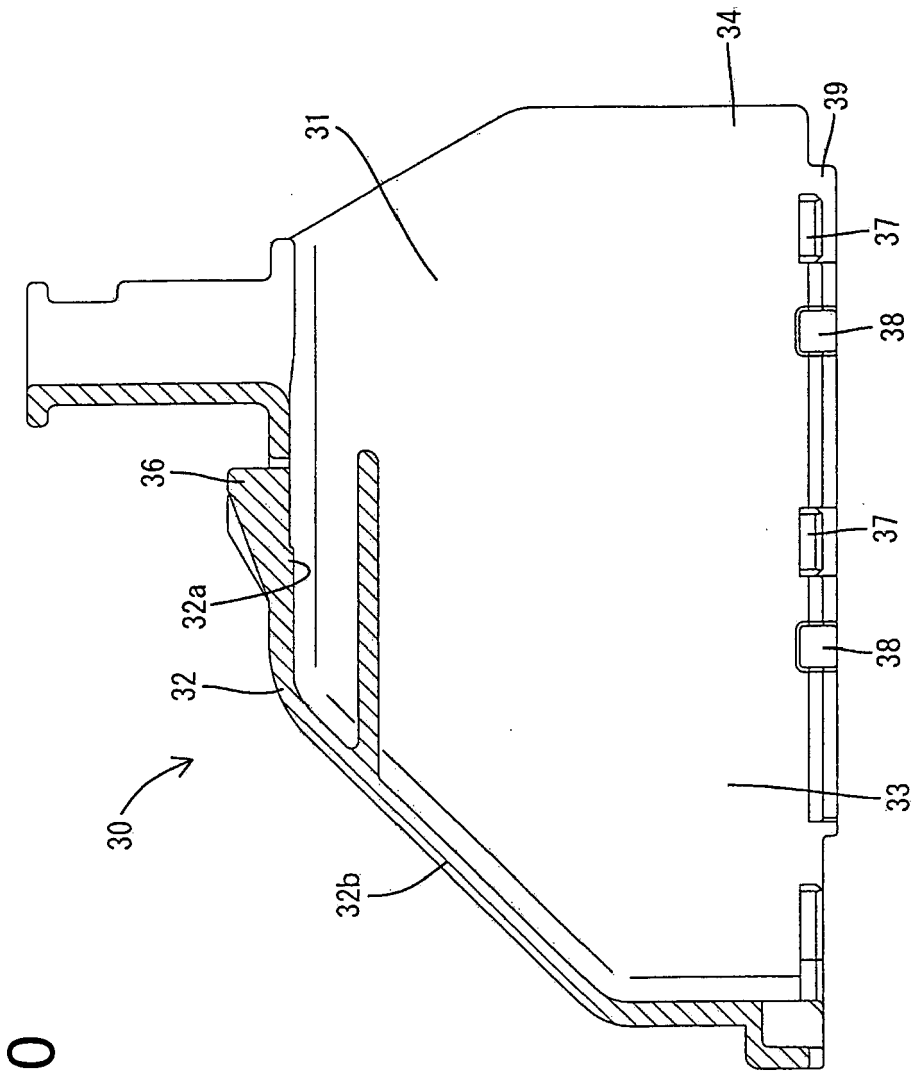


FIG. 10

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 08 00 8949

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2001/044228 A1 (NORO YUTAKA [JP] ET AL) 22 November 2001 (2001-11-22) * paragraphs [0053], [0069], [0071]; figures 7,14 *	1-4,7-14	INV. H01R13/629
Y		5,6,15	
Y	US 2004/266265 A1 (HAYASHI HIROYUKI [JP]) 30 December 2004 (2004-12-30) * paragraph [0077]; figure 1 *	5,6,15	

TECHNICAL FIELDS SEARCHED (IPC)

H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	25 September 2008	Garcia Congosto, M

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25-09-2008

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2001044228 A1	22-11-2001	JP 3726638 B2	14-12-2005
		JP 2001326022 A	22-11-2001
US 2004266265 A1	30-12-2004	DE 102004029306 A1	05-01-2005

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Patent documents cited in the description

- JP 2004199990 A **[0002]**