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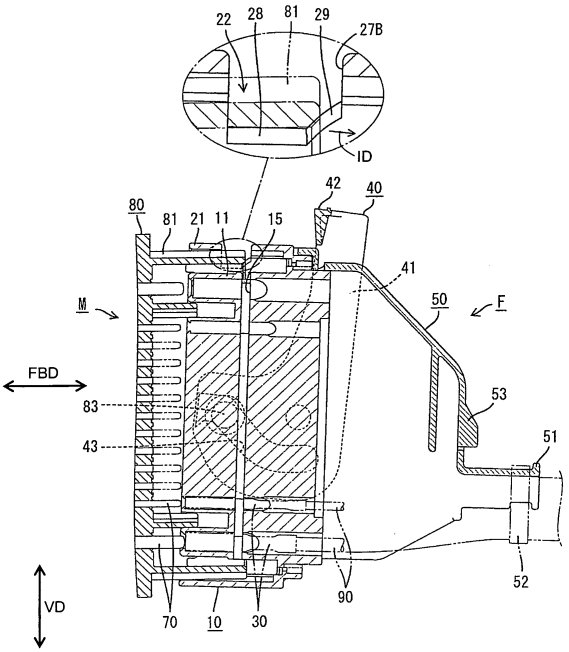
(54) A connector

(57) An object of the present invention is to improve operability and the like by smoothly carrying out a connecting operation of two connectors.

A female connector F is provide with a terminal accommodating portion 11, a tubular portion 21 surrounding the terminal accommodating portion 11 and defining an insertion space A for a male connector housing 80 to the terminal accommodating portion 11, and a retainer 60 for retaining female terminal fittings 30 by being mounted into the terminal accommodating portion 11 and entering cavities 12. The tubular portion 21 is formed with an insertion opening 22 for the retainer 60, and the four corner portions of the tubular portion 21 serve as arcuate portions 25 in the form of curved surfaces. Guiding edges 29 arranged in areas including the arcuate portions 25, oblique to an inserting direction of the male connector housing 80 and formed to narrow spacing therebetween toward the front side in the inserting direction are formed at the opposite opening edges of the insertion opening 22 of the tubular portion 21.

FIG. 3



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Description

[0001] The present invention relates to a connector.

[0002] A connector provided with a retainer is known from Japanese Unexamined Patent Publication No. 2003-115350. This connector is provided with a terminal accommodating portion having cavities capable of accommodating terminal fittings, a tubular portion surrounding the terminal accommodating portion and a retainer mountable on the terminal accommodating portion through a retainer insertion opening formed in the tubular portion to enter the cavities while being fitted into a retainer mount hole formed in the terminal accommodating portion, thereby retaining the terminal fittings properly inserted in the cavities so as not to come out. At the time of connection with a mating connector, the retainer insertion opening of the tubular portion is open and a mating connector housing is inserted into an insertion space defined between the tubular portion and the terminal accommodating portion through the inside of the retainer insertion opening, whereby the two connector housings are properly connected.

[0003] In the case where four corner portions of a tubular portion 2 are curved and an insertion opening 3 for a retainer is formed in one curved portion 4 as shown in FIG. 7, the leading end of a mating connector housing 5 might get caught by the opening edge (rear opening edge) of the insertion opening 3 in an open state if a connecting operation proceeds while the two connectors are relatively inclined from proper postures. Then, any further connecting operation is restricted and, if an attempt is made to forcibly carry out the connecting operation, it might lead to the breakage of the terminal fittings and the connector housings.

[0004] The present invention was developed in view of the above situation, and an object thereof is to improve quality and operability by smoothly carrying out an operation of connecting two connectors.

[0005] This object is solved according to the invention by the features of the independent claim. Preferred embodiments of the invention are subject of the dependent claims.

[0006] According to the invention, there is provided a connector, comprising:

a terminal accommodating portion including one or more cavities capable of at least partly accommodating one or more respective terminal fittings, and
a tubular portion at least partly surrounding the terminal accommodating portion and defining together with the terminal accommodating portion an insertion space for a mating connector housing, and
at least two corner parts of the tubular portion serving as curved portions substantially in the form of curved surfaces,

wherein guiding edges arranged in areas at least partly including the curved portions, extending in directions oblique to an inserting direction of the mating connector housing and formed to narrow spacing therebetween toward the front side in the inserting direction are formed at the opposite opening edges of the insertion opening of the tubular portion.

[0007] A connecting operation of the two connectors can be started while the mating connector housing is inserted into the insertion space between the tubular portion and the terminal accommodating portion. In this case, the opposite opening edges of the insertion opening of the tubular portion are formed in the areas including the curved or arcuate portions substantially in the form of curved surfaces and include the guiding edges extending in the directions oblique (or at an angle different from 0°, 90° or 180°) to the inserting direction of the mating connector housing and formed to narrow the spacing therebetween toward the front side in the inserting direction. Thus, even if the connecting postures of the two connectors should be obliquely inclined from proper postures, the connecting operation can be carried out while the mating connector housing is substantially guided to a proper connection position by the guiding edges. Accordingly, the connecting operation of the two connectors are smoothly carried out without being stopped at an intermediate stage or halfway, with the result that operability can be improved and an undesirable situation such as the breakage of the one or more terminal fittings can be prevented.

[0008] According to a preferred embodiment of the invention, the connector further comprises a retainer for retaining and holding the one or more terminal fittings by being mounted into the terminal accommodating portion and at least partly entering the one or more cavities.

[0009] Preferably, the tubular portion is formed with an insertion opening for the retainer.

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

a terminal accommodating portion including cavities capable of accommodating terminal fittings,
a tubular portion surrounding the terminal accommodating portion and defining an insertion space for a mating connector housing to the terminal accommodating portion, and
a retainer for retaining and holding the terminal fittings by being mounted into the terminal accommodating portion and entering the cavities,
the tubular portion being formed with an insertion opening for the retainer and at least two corner parts of the tubular portion serving as arcuate portions in the form of curved surfaces,

wherein guiding edges arranged in areas including the arcuate portions, extending in directions oblique to an inserting direction of the mating connector housing and formed to narrow spacing therebetween toward the front side in the inserting direction are formed at the opposite opening edges of the insertion opening of the tubular

portion.

[0011] The retainer is mounted into the terminal accommodating portion to enter the cavities through the insertion opening of the tubular portion, and a connecting operation of the two connectors is started while the mating connector housing is inserted into the insertion space between the tubular portion and the terminal accommodating portion in this state. In this case, the opposite opening edges of the insertion opening of the tubular portion are formed in the areas including the arcuate portions in the form of curved surfaces and include the guiding edges extending in the directions oblique to the inserting direction of the mating connector housing and formed to narrow the spacing therebetween toward the front side in the inserting direction. Thus, even if the connecting postures of the two connectors should be obliquely inclined from proper postures, the connecting operation can be carried out while the mating connector housing is guided to a proper connection position by the guiding edges. Accordingly, the connecting operation of the two connectors are smoothly carried out without being stopped halfway, with the result that operability can be improved and an undesirable situation such as the breakage of the terminal fittings can be prevented.

[0012] Further preferably, a flat portion substantially in the form of a flat surface is present between the curved portions corresponding to the two corner parts of the tubular portion.

[0013] Still further preferably, the guiding edges are formed to extend from the rear ends to the front ends thereof with respect to the inserting direction of the mating connector housing with the rear ends thereof set in the curved portions and the front ends thereof set in the flat portion.

[0014] Most preferably, a flat portion in the form of a flat surface is present between the arcuate portions corresponding to the two corner parts of the tubular portion, and

the guiding edges are formed to extend from the rear ends to the front ends thereof with respect to the inserting direction of the mating connector housing with the rear ends thereof set in the arcuate portions and the front ends thereof set in the flat portion.

[0015] The guiding edges are formed to extend from the rear end positions to the front end positions thereof with respect to the inserting direction of the mating connector housing with the rear end positions thereof set in the arcuate portions and the front end positions thereof set in the flat portion. Thus, the leading end of the mating connector housing moves in sliding contact with the guiding edges from the rear sides toward the front sides of the guiding edges, wherefore the connecting postures of the two connectors can be reliably corrected to proper ones.

[0016] According to a further preferred embodiment of the invention, the insertion opening substantially has a polygonal shape as a whole, preferably a transversely symmetrical hexagonal shape.

[0017] Preferably, the insertion opening is defined by a pair of lateral opening edges extending substantially in width direction in parallel with each other and a pair of lateral opening edges shorter than the opening edges, wherein the pair of lateral opening edges preferably are comprised of a pair of lateral opening edges extending substantially in the inserting direction in parallel with each other and/or a pair of lateral guiding edges extending in directions oblique to the inserting direction and/or width direction.

[0018] Further preferably, the connector further comprises an operable member for displaying a cam action to perform or assist a connection of the connector with the mating connector.

[0019] Still further preferably, the connector further comprises a cover for at least partly covering a surface of the connector housing, wherein the cover functions as a wire cover for guiding one or more wires drawn out from the surface of the connector housing in a specified direction.

[0020] Most preferably, the cover positions the operable member at an operation starting position.

[0021] 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 side view in section showing a state before connectors are connected in one embodiment,
FIG. 2 is a side view in section showing a state after the connectors are connected,
FIG. 3 is a side view in section showing an intermediate state of a connecting operation in an improper posture,
FIG. 4 is a plan view of a female connector housing,
FIG. 5 is a front view partly in section of a female connector housing with a retainer mounted at a partial locking position,
FIG. 6 is a front view partly in section of the female connector housing with the retainer mounted at a full locking position, and
FIG. 7 is a side view of a prior art.

[0022] One preferred embodiment of the present invention is described with reference to FIGS. 1 to 6. A connector of this embodiment is illustrated as a female lever-type connector F at least partly accommodating one or more female terminal fittings 30 and having a lever 40 (as a preferred operable member) mounted thereon or at least partly therein, and is provided with a female connector housing 10, a cover 50, the lever 40 and preferably a retainer 60, wherein the female connector housing 10 includes a terminal accommodating portion 11 and a tubular portion 21. On the other hand, a mating connector is a male connector M at least partly accommo-

dating one or more male terminal fittings 70 and is provided with the one or more male terminal fittings 70 and a male connector housing 80 (corresponding to a preferred mating connector housing), wherein the male connector housing 80 includes a receptacle 81. It should be noted that sides of the two connector housings to be connected are referred to as front sides concerning forward and backward directions FBD and reference is made to FIG. 1 concerning vertical direction VD in the following description.

[0023] The male connector housing 80 is made e.g. of a synthetic resin, includes a terminal mounting portion 82 for holding the male terminal fittings 70 penetrating therethrough and the receptacle 81 in the form of an open tube located before or adjacent to the terminal mounting portion 82 and preferably has a shape long in height direction (vertical direction VD) as a whole. The terminal mounting portion 82 preferably is to be immovably fixed to a device side, and preferably a plurality of rows of male terminal fittings 70 transversely mounted substantially side by side are arranged in height direction in the terminal mounting portion 82. The leading sides of the male terminal fittings 70 are arranged to at least partly project into the receptacle 81, and one or more (preferably substantially cylindrical) cam pins 83 project from the (preferably substantially opposite) outer surface(s) of the receptacle 81.

[0024] The female connector housing 10 is made e.g. of a synthetic resin, preferably has a vertically long shape in height direction (vertical direction VD) as a whole and includes the terminal accommodating portion 11 for at least partly accommodating the one or more female terminal fittings 30 and the tubular portion 21 at least partly, preferably substantially fully surrounding the side surfaces of the terminal accommodating portion 11 as shown in FIGS. 1 to 5. The mating receptacle 81 is at least partly inserted or insertable into a clearance (hereinafter, "insertion space A") defined between the inner surfaces of the tubular portion 21 and the outer surfaces of the terminal accommodating portion 11 substantially in the inserting direction ID, preferably substantially from front, whereby the two connector housings 10, 80 can be connected. The rear end of the tubular portion 21 is integrally or unitarily connected to the rear part of the terminal accommodating portion 11 via a coupling wall 19.

[0025] The terminal accommodating portion 11 is formed with one or more, preferably a plurality of cavities 12 into which the one or more respective female terminal fittings 30 connected with one or more ends of respective wires 90 are at least partly insertable from an insertion side, preferably substantially from behind, and which preferably are arranged in height direction (vertical direction VD) and/or width direction WD so as to substantially conform to the male terminal fittings 70. A front stop wall 13 for the female terminal fitting 30 is formed at or near the front end of each cavity 12, and a converging (preferably substantially conical) guiding surface 14 is formed over at least part, preferably over the substantially entire circumference in the front surface of the front stop wall 13.

[0026] Further, the terminal accommodating portion 11 is formed with a (preferably substantially narrow and long) retainer mount hole 15 which preferably makes an opening in an end surface of the terminal accommodating portion 11, i.e. an end surface at a shorter side (shown upper surface) and extends in height direction while crossing the respective cavities 12 in height direction. Although the end surface of the terminal accommodating portion 11 is at least partly covered by the tubular portion 21, the opening of the retainer mount hole 15 communicates with the outside through an insertion opening 22 formed in the tubular portion 21 for the at least partial insertion of the retainer 60.

[0027] One or more retainer engaging portions 16 (preferably having a triangular or pointed cross section and) adapted to hold the retainer 60 are formed to project at one or more positions on end surfaces at longer sides of the terminal accommodating portion 11, i.e. lateral (left and/or right) surfaces preferably near the shorter side where the retainer mount hole 15 is formed. As described later, the retainer 60 is displaceable between a partial locking position 1 P (as a preferred first position) and a full locking position 2P (as a preferred second position) by moving over the retainer engaging portions 16 while being engaged therewith.

[0028] The tubular portion 21 is formed to surround the terminal accommodating portion 11 over at least part of, preferably the substantially entire circumference and is comprised of one or more, preferably a pair of lateral (left and/or right) longer side portions 23, one or more, preferably a pair of lateral (upper and/or lower) shorter side portions 24 (corresponding to a preferred flat portion), and one or more arcuate or bent or curved portions 25 in the form of curved surfaces connecting the longer side portions 23 and the shorter side portions 24 and forming part of four corner parts. Out of these, each arcuate portion 25 preferably substantially has a quarter-circular arcuate cross section and/or the opposite ends thereof are integrally or unitarily connected with the corresponding longer side portion 23 and shorter side portion 24. The longer side portions 23 preferably are substantially flat surfaces substantially vertical in height direction, and the shorter side portions 24 preferably are substantially flat surfaces substantially horizontal in width direction WD. In other words, the longer side portions 23 are arranged at an angle different from 0° or 180°, preferably substantially normal with respect to the shorter side portions 24. Each longer side portion 23 preferably has a double-plate structure by two plate portions 26 arranged substantially side by side in width direction WD, and an accommodation space B into which a corresponding arm portion 41 of the lever 40 is at least partly insertable is defined between the two plate portions 26. The front surface of the longer side portion 23 is preferably substantially closed by placing the front ends of the two plate portions 26 one after the other, and a cam-pin introducing opening (not shown) for receiving the cam pin 83 from front is formed

in this closed part.

[0029] The tubular portion 21 is formed with the insertion opening 22 for the retainer 60, which opening 22 extends in a lateral portion of the tubular portion 21, preferably substantially from the shorter side portion 24 to the arcuate portions 25 while widening its width toward the front side. Specifically, as shown in FIG. 4, the insertion opening 22 preferably substantially has a polygonal shape as a whole, i.e. preferably a transversely symmetrical hexagonal shape and is defined by a pair of lateral (left and right) opening edges 27A, 27B extending substantially in width direction WD in parallel with each other and a pair of lateral (left and right) opening edges 28, 29 (corresponding to preferred substantially opposite opening edges) shorter than the opening edges 27A, 27B, wherein the pair of lateral (left and right) opening edges 28, 29 preferably are comprised of a pair of lateral (left and right) lateral opening edges 28 extending substantially in forward and backward directions FBD (connecting direction of the two connector housings 10, 80) in parallel with each other and a pair of lateral (left and right) guiding edges 29 extending in directions oblique to forward and backward directions FBD (or the inserting direction ID) and/or width direction WD. The respective guiding edges 29 gradually narrow spacing therebetween from the front ends toward the rear ends by having the front ends thereof connected with the rear ends of the lateral opening edges 28 and having the rear ends thereof connected with the opposite ends of the rear opening edge 27B. In short, a front part of the insertion opening 22 preferably substantially has a rectangular shape and a rear part thereof has a trapezoidal shape, i.e. a (preferably substantially isosceles) trapezoidal shape whose shorter side is the rear opening edge 27B. In connection with the mating male connector housing 80, the front ends of the respective guiding edges 29 are rear ends with respect to an inserting direction ID of the male connector housing 80 and the rear ends thereof are front ends with respect to the inserting direction ID of the male connector housing 80. In other words, the lateral opening edges 28 and the lateral guiding edges 29 are arranged to be substantially continuous along the inserting direction ID. It should be understood, however, that even though in the above embodiment the lateral opening edges 28 and the lateral guiding edges 29 are arranged to be inclined with respect to each other, the lateral opening edges 28 and the lateral guiding edges 29 may be substantially continuously arranged in a smooth manner (i.e. without a corner portion) similar to a bottleneck. The lateral guiding edges 29 are inclined with respect to the inserting direction ID with a constant or continuously changing degree of inclination (along the inserting direction ID).

[0030] The pair of front and rear opening edges 27A, 27B cross the shorter side portion 24 preferably over the substantially entire width, wherein the front opening edge 27A is so long that the opposite ends thereof reach the arcuate or curved portions 25 and/or the rear opening edge 27B preferably has substantially the same length as the width of the shorter side portion 24. The front ends of the guiding edges 29 preferably are set in areas of the arcuate or curved portions 25 and the rear ends thereof are set in boundary portions 24A between the arcuate or curved portions 25 and the shorter side portion 24. In the shown case, the shorter side portion 24 preferably is arranged at a slightly higher position, so that the boundary portions 24A to the arcuate portions 25 stand up to form steps. Further, the pair of lateral (left and right) opening edges 28 substantially vertically penetrate the arcuate portions 25 in thickness direction, and these cut surfaces are upwardly inclined with respect to a vertical plane.

[0031] The retainer 60 is made e.g. of a synthetic resin and includes a coupling portion 61 extending substantially in width direction WD, one or more, preferably a pair of lateral (left and/or right) leg portions 62 projecting (preferably substantially in parallel with each other) from the (preferably substantially opposite) end(s) of the coupling portion 61 and an engaging projection 63 projecting from an intermediate position of the coupling portion 61 substantially in parallel with the leg portion 62. The coupling portion 61 is shaped substantially in conformity with the insertion opening 22 so as to be at least partly insertable into the insertion opening 22, and the engaging projection 63 is shaped substantially in conformity with the retainer mount hole 15 so as to be at least partly insertable into the retainer mount hole 15. A partial locking or first recess 64 and a full locking or second recess 65 are formed one above the other in height direction (vertical direction VD and/or a mounting direction of the retainer 60 into the connector housing 10) in the inner surface of each leg portion 62. Such a retainer 60 preferably functions as a so-called side type retainer, and is so mounted as to cross over the end portion (upper end portion) of the terminal accommodating portion 11 while the engaging projection 63 is at least partly inserted into the retainer mount hole 15. The retainer 60 is movable between a partial locking position 1 P (or first position, state shown in FIG. 5) where the partial locking recesses 64 are engaged with the retainer engaging portions 16 with the coupling portion 61 distanced from the end surface of the terminal accommodating portion 11 and a full locking position 2P (or second position, state shown in FIG. 6) which is reached by being pushed from the partial locking position 1 P and where the full locking recesses 65 are engaged with the retainer engaging portions 16 with the coupling portion 61 held in proximity to or in contact with the end surface of the terminal accommodating portion 11, and the leg portions 62 can move over the retainer engaging portions 16 accompanied by movements thereof to widen spacing therebetween while the retainer 60 is moved. With the retainer 60 located at the partial locking position 1 P, one or more locking bodies 66 of the engaging projection 63 are located outside or displaced from the one or more cavities 12, whereby the insertion and withdrawal of the one or more female terminal fittings 30 into and from the cavities 12 are permitted. With the retainer 60 located at

the full locking position 2P, the one or more locking bodies 66 of the engaging projection 63 at least partly enter the one or more cavities 12, whereby the one or more female terminal fittings 30 properly inserted in the cavities 12 are locked so as not to come out.

[0032] The cover 50 is made e.g. of a synthetic resin and substantially in the form of a cap capable of at least partly covering the rear surface of the female connector housing 10. This cover 50 functions as a wire cover for guiding the one or more wires 90 drawn out from the rear surface of the female connector housing 10 in a specified (predetermined or predeterminable) direction, and a wire draw-out tube 51 stands on the rear surface thereof. The respective wires 90 preferably are bundled by a band 52 tied onto the wire draw-out tube 51 after being at least partly inserted into the wire draw-out tube 51, and are drawn out backward to the outside or on a back side. Further, a lever locking portion 53 capable of locking the lever 40 is resiliently de-formably formed preferably on the rear surface of the cover 50.

[0033] The lever 40 is likewise made e.g. of a synthetic resin, includes an operable portion 42 and one or more, preferably a pair of left and right arm portions 41 projecting from the (preferably substantially opposite) ends of the operable portion 42 and preferably is substantially gate-shaped as a whole. Such a lever 40 is so mounted preferably substantially from behind as to cross over the cover 50, and is supported on one or more supporting shafts 55 provided on the cover 50 so as to be movable between a rotation starting position (as a preferred operation starting position) and a rotation ending position (as a preferred operation ending position). At the rotation starting position, the operable portion 42 of the lever 40 is located near the female connector housing 10, more specifically near the insertion opening 22 of the tubular portion 21 (see FIG. 1). At the rotation ending position, the operable portion 42 of the cover 50 is distant from the female connector housing 10 and resiliently engaged with the lever locking portion 53 to prevent the rotation of the lever 40 in a returning direction (toward the rotation starting position). Each arm portion 41 is formed with a cam groove 43 extending in a specified (predetermined or predeterminable) direction, and the entrance of the cam groove 43 is located as an opening at the outer peripheral edge of the arm portion 41. When the lever 40 is displaced or operated (preferably rotated or pivoted about the supporting shafts 55) from the rotation starting position toward the rotation ending position, the cam pins 83 are relatively moved in the cam grooves 43 to fulfill a cam mechanism, whereby the two connector housings 10, 80 are pulled toward each other or an approaching movement thereof is assisted.

[0034] Next, functions of this embodiment are described. First, the lever 40 is mounted on the cover 50 and left at the rotation starting position (operation starting position) and, in this state, the cover 50 is mounted on the rear part of the connector housing 10. Then, the retainer 60 is mounted at least partly into the terminal accommodating portion 11 through the insertion opening 22 of the tubular portion 21 and left at the partial locking position 1 P (first position). In this state, the insertion opening 22 of the tubular portion 21 is in the open state as shown in FIG. 1 since the retainer 60 is entirely moved toward the terminal accommodating portion 11. After the one or more, preferably all the female terminal fittings 30 are at least partly inserted into the cavities 12 of the terminal accommodating portion 11, the retainer 60 is pushed or displaced to reach the full locking position 2P (second position). If the operation of pushing the retainer 60 is hindered in this case, it can be known that any one of the female terminal fittings 30 is insufficiently inserted. Thus, this insufficiently inserted female terminal fitting 30 is inserted to a proper depth and the retainer 60 is pushed again to the full locking position 2P.

[0035] Subsequently, with the female connector housing 10 substantially opposed to the male connector housing 80, the male connector housing 80 and the female connector housing 10 are relatively brought closer to each other along the inserting direction ID (arrow shown in FIG. 1). After the cam pins 83 of the male connector housing 80 are at least partly introduced into the entrances of the cam grooves 43 of the lever 40, the lever 40 is displaced or operated (preferably rotated or pivoted) toward the rotation ending position (operation ending position) preferably by gripping or operating the operable portion 42. If the connecting operation is started with the two connector housings 10, 80 opposed to each other in correct postures in this case, the receptacle 81 is at least partly inserted into the insertion space A between the tubular portion 21 and the terminal accommodating portion 11 from front and passes the opening edge of the insertion opening 22 of the tubular portion 21 without being interfered. Thereafter, if the lever 40 is operated (preferably rotated or pivoted) towards or to the rotation ending position (operation ending position) as shown in FIG. 2, the leading end of the receptacle 81 reaches a position where it can come into contact with the coupling portion 61, whereby the two connector housings 10, 80 are connected to a proper depth and, simultaneously, the female and male terminal fittings 30, 70 are electrically connected at proper depths.

[0036] On the other hand, if the connecting operation is started while at least one of the two connector housings 10, 80 is in an oblique posture with respect to the connecting direction (or inserting direction ID) as shown in FIG. 3, the leading end of the receptacle 81 at least partly enters the insertion space A, but might come into contact with the opening edge of the insertion opening 22 of the tubular portion 21, i.e. the pair of lateral (left and right) opening edges 28, 29 during the insertion. If the connecting operation proceeds in this contact state, the leading end of the receptacle 81 moves in sliding contact from the lateral opening edges 28 to the guiding edges 29 and moves further backward substantially along the guiding edges 29. Then, the inserting posture of the receptacle 81 is corrected little by little in such a direction that the

leading end of the receptacle 81 substantially faces the insertion space A (direction of an arrow shown in FIG. 3) as the connecting operation proceeds since the guiding edges 29 are formed to gradually shorten the spacing therebetween (or to converge) toward the back side. Thus, the leading end of the receptacle 81 reaches the proper connecting position while passing the opening edge of the insertion opening 22, particularly the rear opening edge 27B without being interfered. In other words, the connecting operation of the two connector housings 10, 80 smoothly proceeds without being stopped halfway, thus improving overall operability of the connector assembly.

[0037] As described above, this embodiment has the following effects.

[0038] The pair of lateral (left and right) opening edges 28, 29 of the insertion opening 22 of the tubular portion 21 are formed in the arcuate or bent or curved portions 25 substantially in the form of curved surfaces and include the guiding edges 29 extending in the directions oblique to the inserting direction ID of the male connector housing 80 and formed to narrow the spacing therebetween toward the back side. Thus, even if either one or both of the two connector housings 10, 80 are connected in such a posture inclined from the proper posture, the connecting operation can proceed while the male connector housing 80 (receptacle 81) is guided substantially toward the proper connecting position by the guiding edges 29. Accordingly, the connecting operation of the two connector housings 10, 80 smoothly proceeds particularly without being stopped halfway, with the result that operability can be improved and an undesirable situation such as the breakage of the male terminal fittings 70 can be prevented. In a lever-type connector such as the one of this embodiment, the connecting operation might be forcibly carried out as the lever 40 is operated without the interfering state of the male connector housing 80 and the opening edge of the insertion opening 22 of the tubular portion 21 being noticed, which might lead to a breakage. Therefore, the meaning of being able to guide the two connector housings 10, 80 to the properly connected state by such guiding edges 29 is significant.

[0039] Further, since the front end positions of the guiding edges 29 are set in the curved or arcuate portions 25 and the rear end positions of the guiding edges 29 are set in the boundary portions 24A to the curved or arcuate portions 25 at the shorter side portion 24, the leading end of the male connector housing 80 (leading end of the receptacle 81) can move from the front end sides toward the rear end sides of the guiding edges 29 while being held substantially in sliding contact with the guiding edges 29, wherefore the connecting postures of the two connector housings 10, 80 can be reliably corrected to proper ones.

[0040] Accordingly, to improve operability and the like by smoothly carrying out a connecting operation of two connectors, a female connector F is provided with a terminal accommodating portion 11, a tubular portion 21 at least partly, preferably substantially fully surrounding the terminal accommodating portion 11 and defining an insertion space A for a male connector housing 80 to the terminal accommodating portion 11, and preferably a retainer 60 for retaining one or more female terminal fittings 30 by being at least partly mounted into the terminal accommodating portion 11 and at least partly entering cavities 12. The tubular portion 21 is formed with an insertion opening 22 for the retainer 60, and the four corner portions of the tubular portion 21 serve as curved or arcuate portions 25 substantially in the form of curved surfaces. One or more guiding edges 29 arranged in areas including the curved or arcuate portions 25, oblique to an inserting direction ID of the male connector housing 80 and formed to narrow spacing therebetween toward the front side in the inserting direction ID are formed at the (preferably substantially opposite) opening edge(s) of the insertion opening 22 of the tubular portion 21.

[0041] 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) Although the guiding edges are substantially entirely formed in the areas of the curved or arcuate portions in the foregoing embodiment, the guiding edges may be formed to extend from the curved or arcuate portions to the shorter side portion according to the present invention.

(2) Although the guiding edges are substantially straight in the foregoing embodiment, they may be curved according to the present invention.

(3) Although the curved or arcuate portions are provided at the four corner parts of the terminal accommodating portion in the foregoing embodiment, it may be sufficient to provide the arcuate portions only at two corner parts at the opposite side of one shorter side portion of the terminal accommodating portion according to the present invention.

(4) Although the lever is mounted on the female connector housing via the cover in the foregoing embodiment, it may be directly mounted on the female connector housing according to the present invention.

(5) The present invention is also applicable in the case where an insertion opening, into which the retainer is inserted, is formed in the male connector housing.

(6) The present invention is also applicable to connectors not having any operable member or in which the lever as the preferred operable member has a different movement path such as a slider moving along a substantially linear or other path.

LIST OF REFERENCE NUMERALS

[0042]

F female connector
M male connector
10 female connector housing
11 terminal accommodating portion
12 cavity
15 retainer mount hole
21 tubular portion
22 insertion opening
24 shorter side portion (flat portion)
25 arcuate portion (curved portion)
28 lateral opening edge
29 guiding edge
30 female terminal fitting (terminal fitting)
40 lever
43 cam groove
50 cover
60 retainer
70 male terminal fitting
80 male connector housing (mating connector housing)
81 receptacle
A insertion space

Claims

1. A connector (F), comprising:

a terminal accommodating portion (11) including one or more cavities (12) capable of at least partly accommodating one or more respective terminal fittings (30), and
a tubular portion (21) at least partly surrounding the terminal accommodating portion (11) and defining together with the terminal accommodating portion (11) an insertion space (A) for a mating connector housing (M), and

at least two corner parts (25) of the tubular portion (21) serving as curved portions (25) substantially in the form of curved surfaces,
wherein guiding edges (29) arranged in areas at least partly including the curved portions (25), extending in directions oblique to an inserting direction (ID) of the mating connector housing (M) and formed to narrow spacing therebetween toward the front side in the inserting direction (ID) are formed at the opposite opening edges of the insertion opening of the tubular portion (21).

2. A connector according to claim 1, further comprising a retainer (60) for retaining and holding the one or more terminal fittings (30) by being mounted into the terminal accommodating portion (11) and at least partly entering the one or more cavities (13).

3. A connector according to claim 2, wherein the tubular portion (21) is formed with an insertion opening (22) for the retainer (60).

4. A connector according to one or more of the preceding claims, wherein a flat portion (24) substantially in the form of a flat surface is present between the curved portions (25) corresponding to the two corner parts of the tubular portion (21).

5. A connector according to claim 4, wherein the guiding edges (29) are formed to extend from the rear ends to the front ends thereof with respect to the inserting direction (ID) of the mating connector housing (M) with the rear ends thereof set in the curved portions (25) and the front ends thereof set in the flat portion (24).

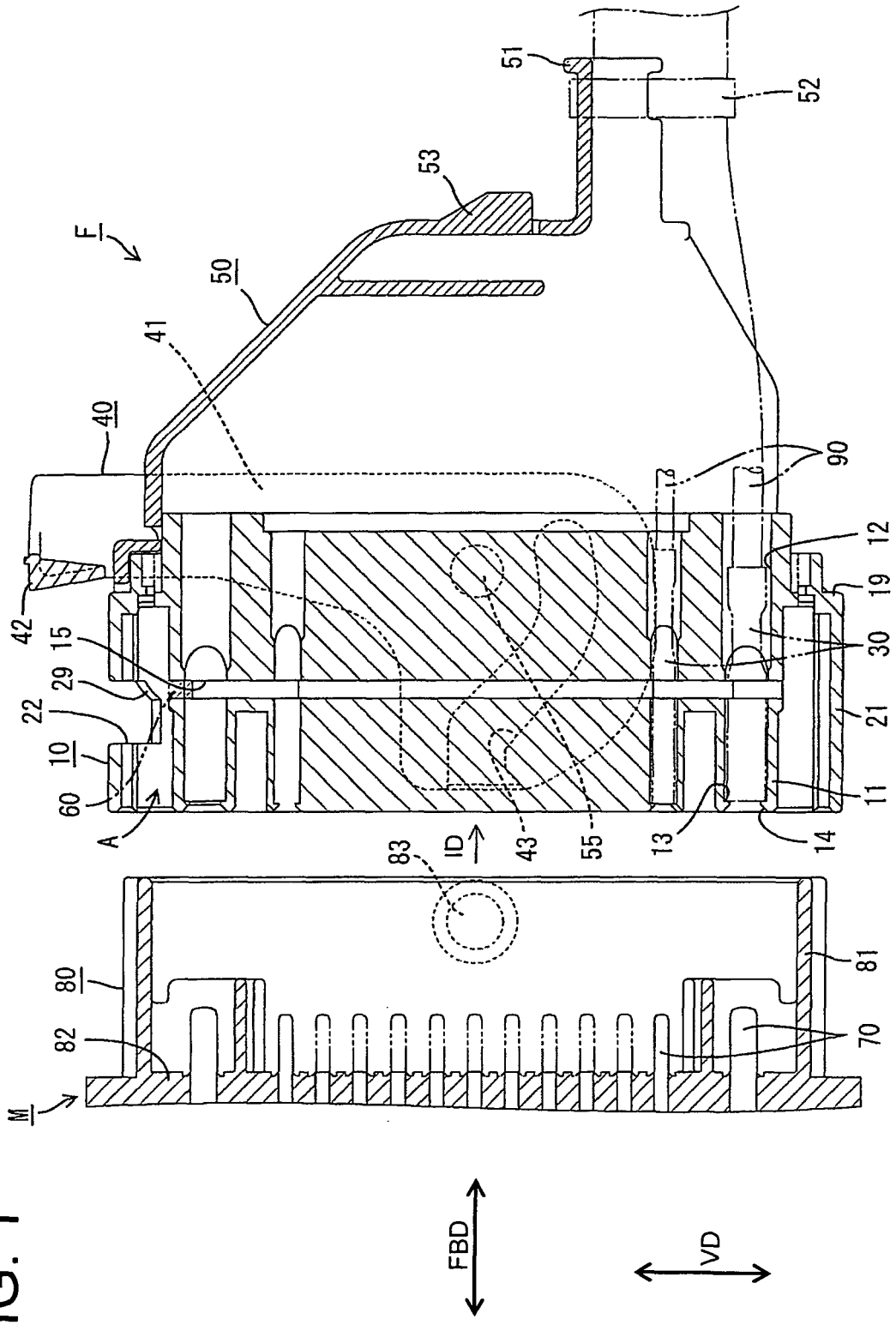
6. A connector according to one or more of the preceding claims in combination with claim 3, wherein the insertion opening (22) substantially has a polygonal shape as a whole, preferably a transversely symmetrical hexagonal shape.

7. A connector according to claim 6, wherein the insertion opening (22) is defined by a pair of lateral opening edges (27A, 27B) extending substantially in width direction (WD) in parallel with each other and a pair of lateral opening edges (28, 29) shorter than the opening edges (27A, 27B), wherein the pair of lateral opening edges (28, 29) preferably are comprised of a pair of lateral opening edges (28) extending substantially in the inserting direction (ID) in parallel with each other and/or a pair of lateral guiding edges (29) extending in directions oblique to the inserting direction (ID) and/or width direction (WD).

8. A connector according to one or more of the preceding claims, further comprising an operable member (40) for displaying a cam action to perform or assist a connection of the connector (F) with the mating connector (M).

9. A connector according to one or more of the preceding claims, further comprising a cover (50) for at least partly covering a surface of the connector housing (10), wherein the cover (50) functions as a wire cover for guiding one or more wires (90) drawn out from the surface of the connector housing (10) in a specified direction.

10. A connector according to claim 9, wherein the cover (50) positions the operable member (40) at an operation starting position.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52
53
F
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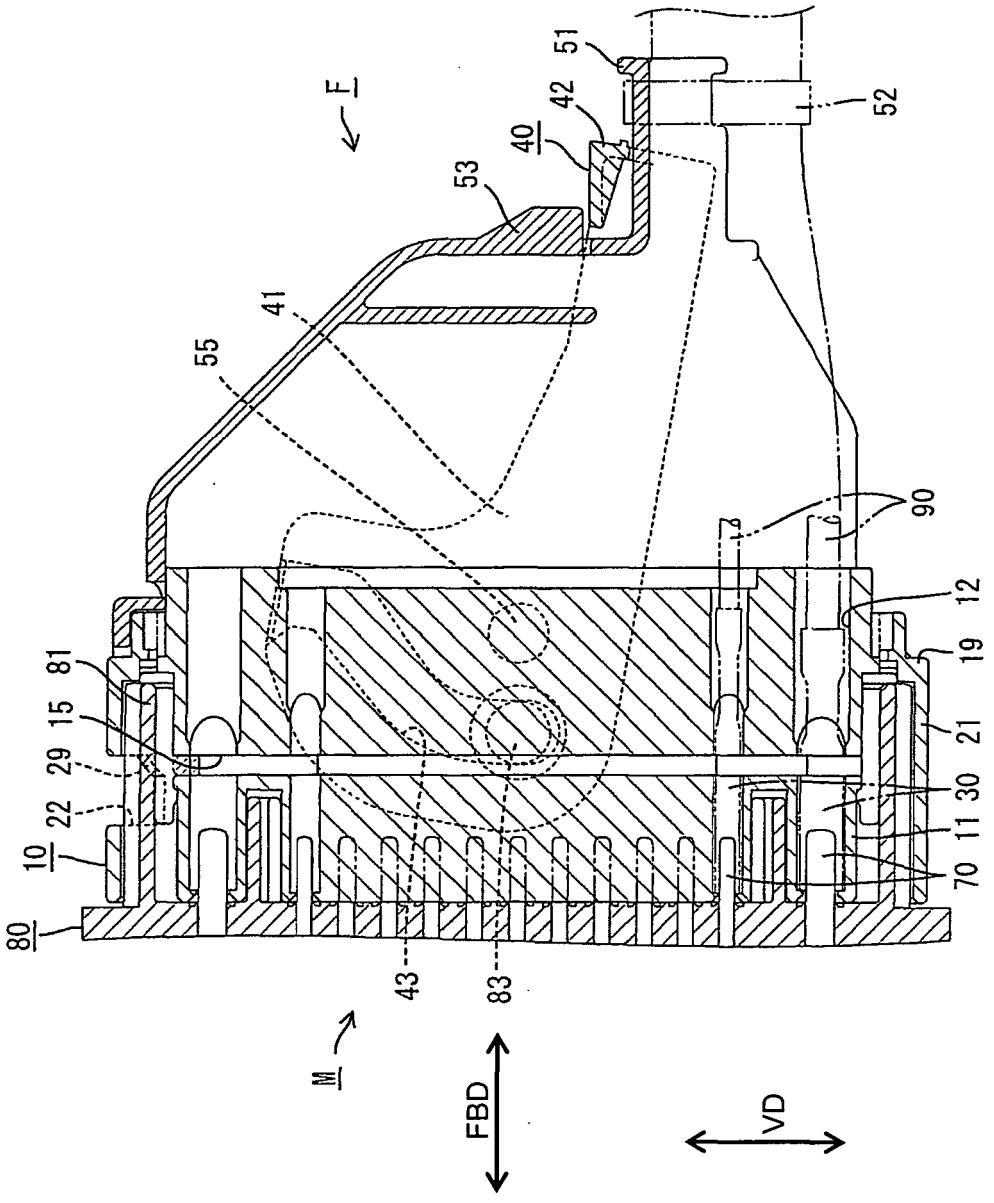
41
40
90
12
19
30
21
11
14
13
55
43
ID
83
42
15
29
22
10
60
A
80
82
M
81
70
FBD
VD

FIG. 1

FIG. 2


F
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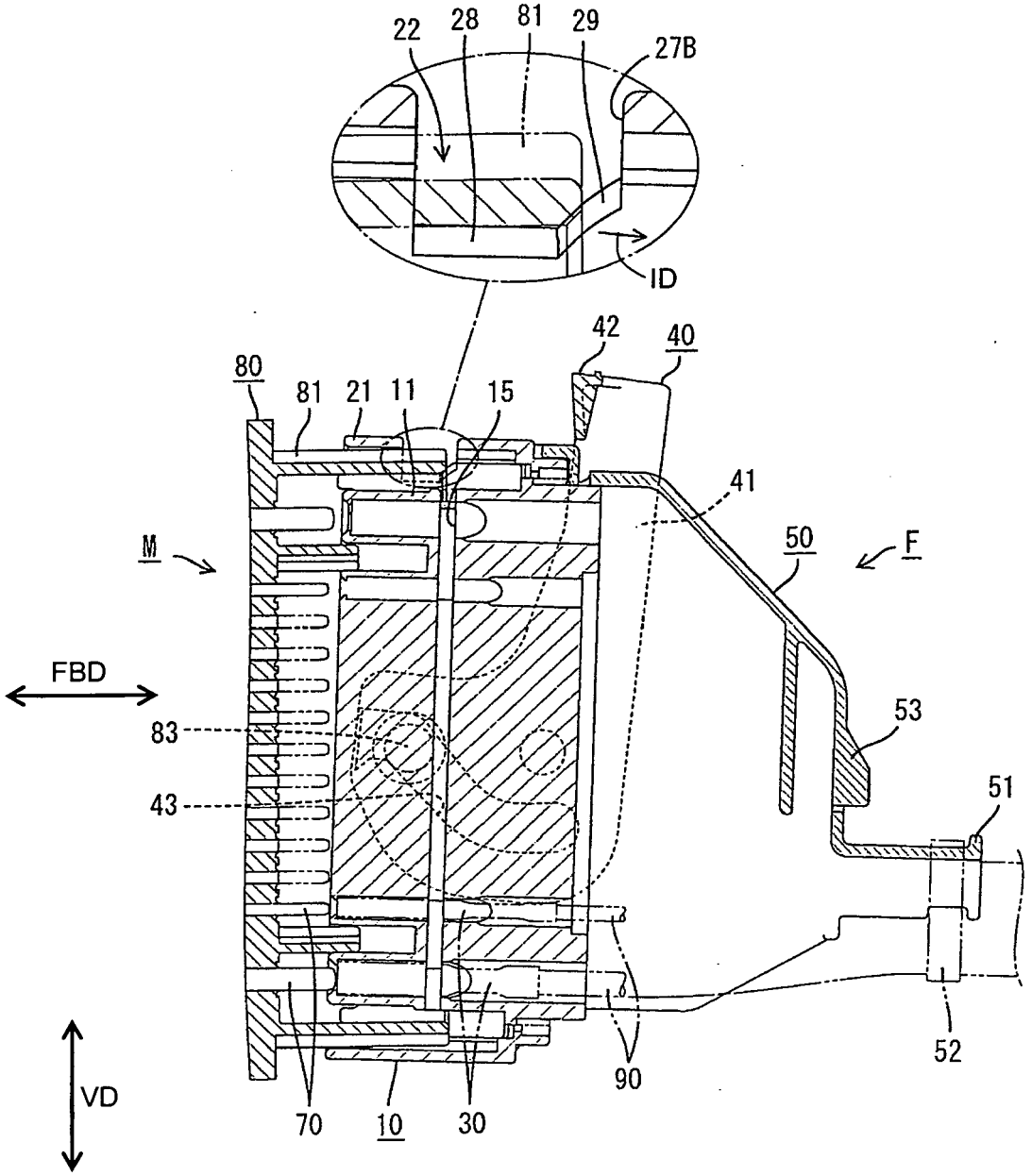
80
43
83
M
FBD
VD

FIG. 3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81
29
27B
ID
42
40
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81
21
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M
50
F
FBD
53
83
43
51
52
90
VD
70
10
30

FIG. 4

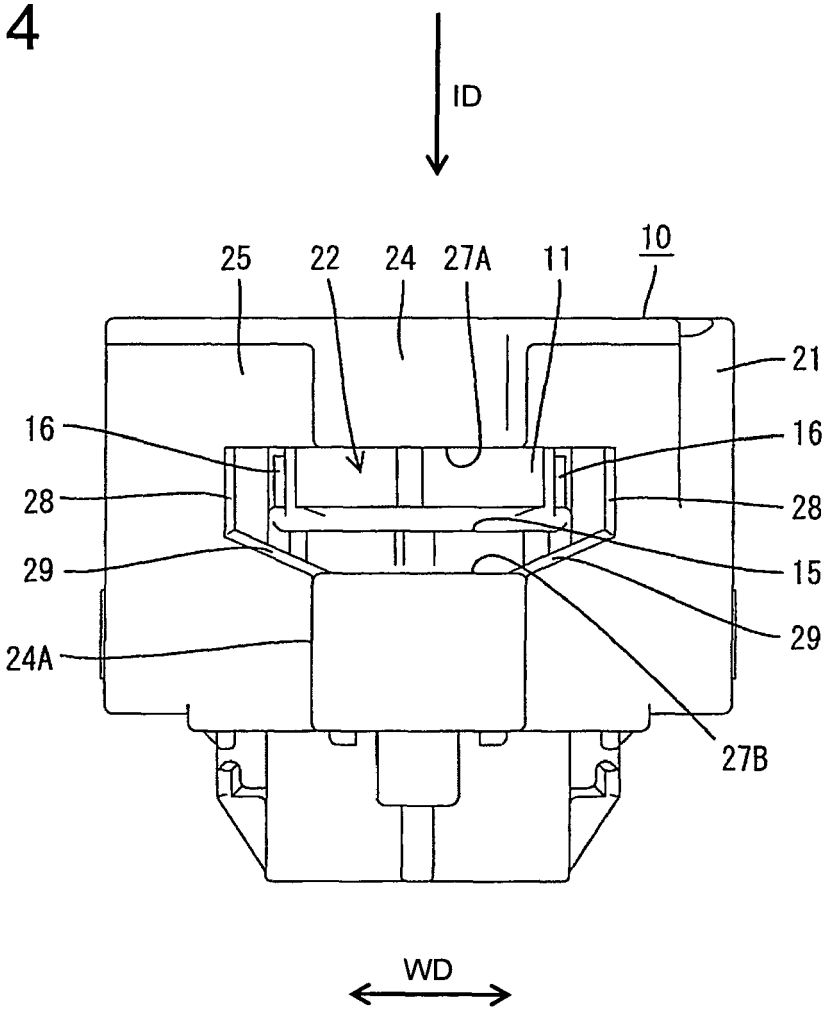
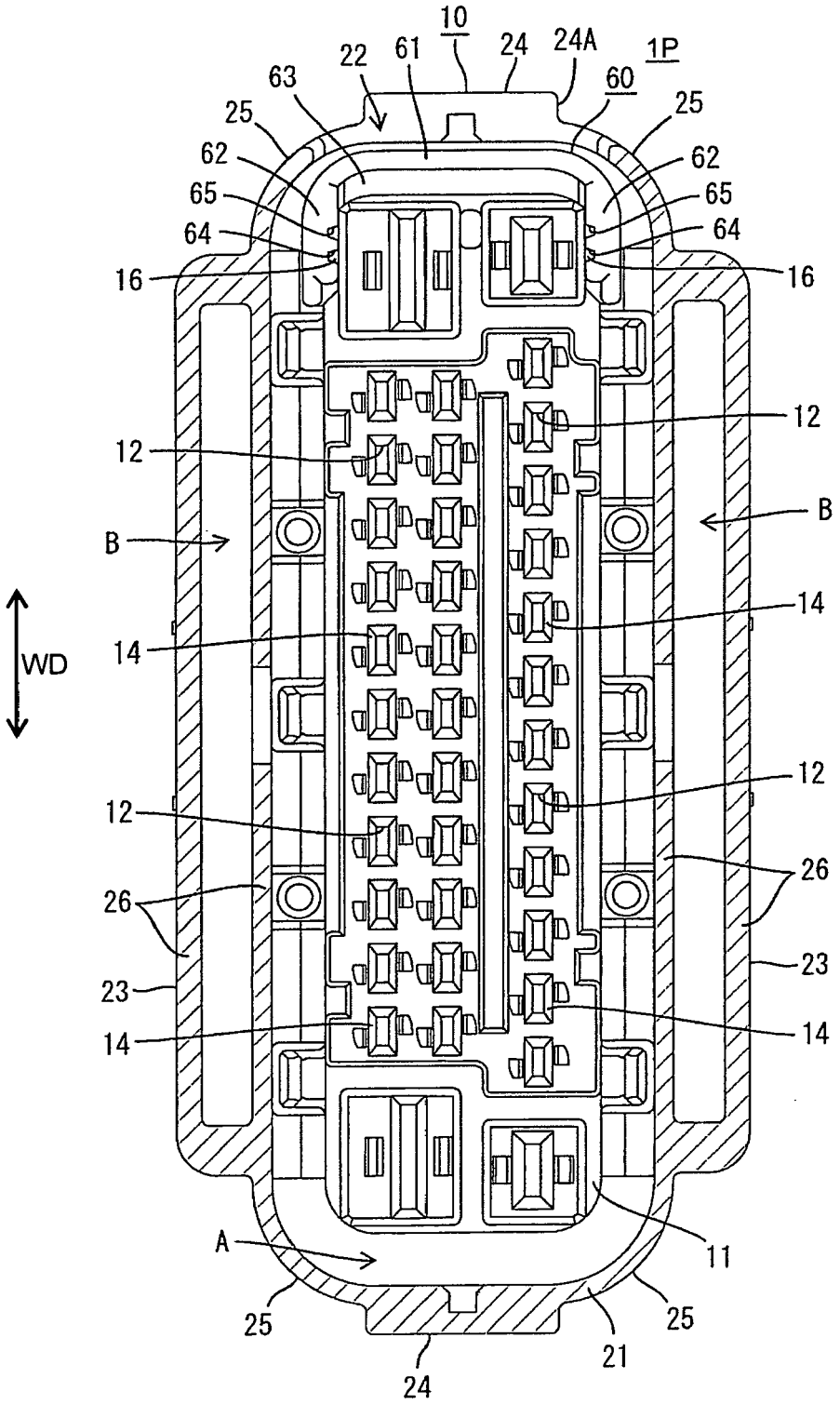


FIG. 5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22
61
24
24A
1P
63
60
25
25
62
62
65
65
64
64
16
16
12
12
B
B
WD
14
14
12
12
26
26
23
23
14
14
A
11
25
25
21
24

FIG. 6

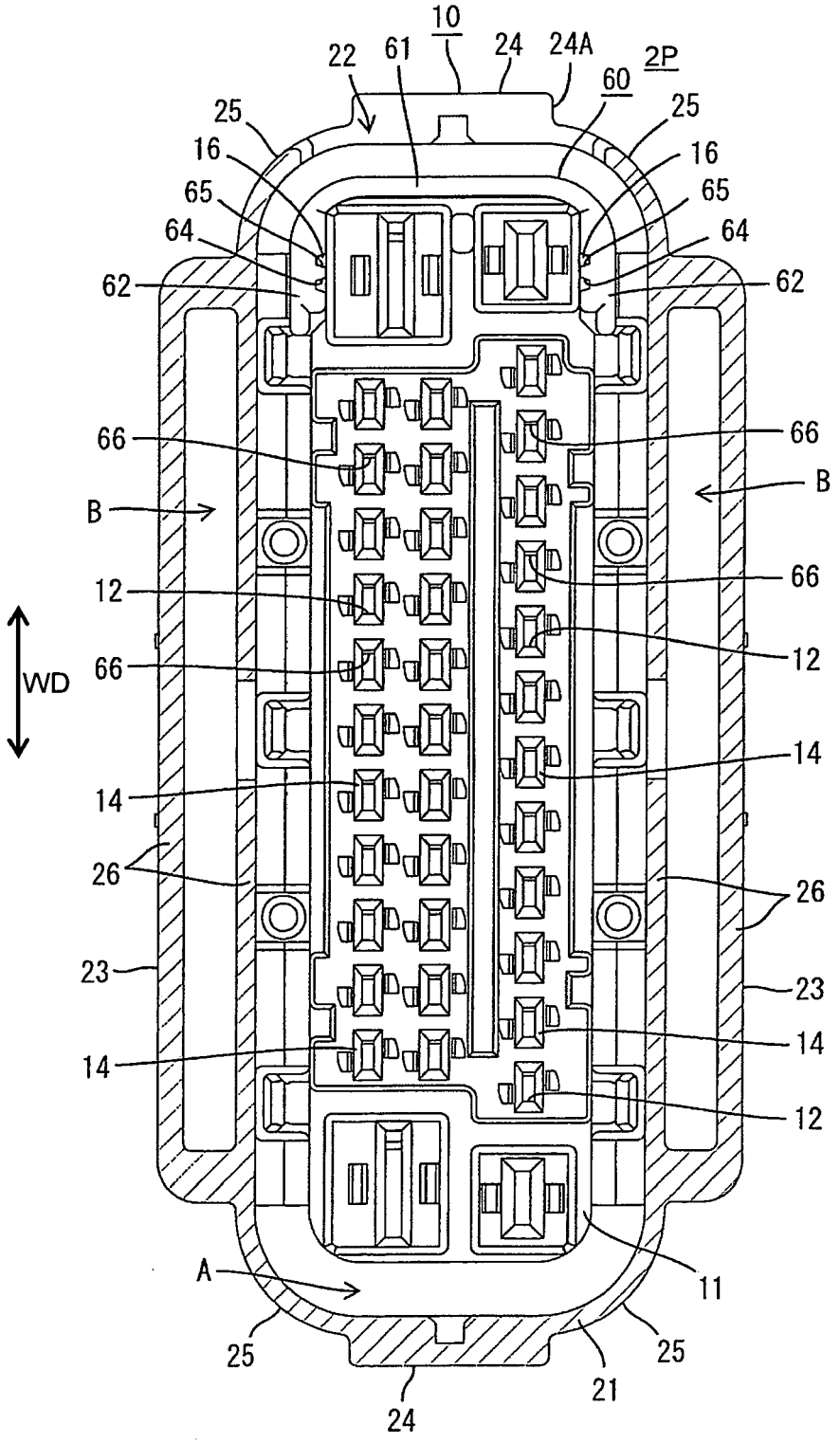
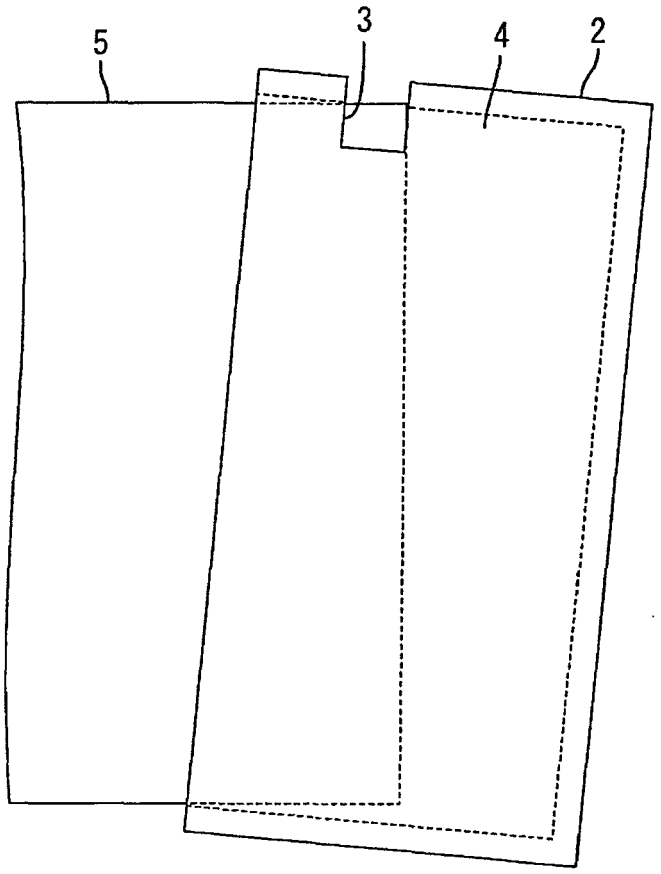


FIG. 7
PRIOR ART



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EUROPEAN SEARCH REPORT

Application Number
EP 07 02 0342

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
D,A	JP 2003 115350 A (YAZAKI CORP) 18 April 2003 (2003-04-18) * abstract; figures 1-8 *	1-4	INV. H01R13/629 H01R13/436
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A	WO 97/11515 A (WHITAKER CORP [US]; BETSUI KAZUHISA [JP]) 27 March 1997 (1997-03-27) * page 4, line 1 - line 31; figures 1,2 *	1-3,8-10	

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
Berlin	11 March 2008	Marcolini, Paolo

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3

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11-03-2008

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