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## ABSTRACT OF THE DISCLOSURE

An object of the present invention is to reliably fulfill a function of preventing erroneous insertion of a terminal fitting.

In a connector constructed such that stabilizers 30 come into contact with restricting surfaces 64 of a hole edge of a terminal accommodating hole 51 at a side opposite to a side where insertion paths 60 are provided, thereby preventing any further insertion of the female terminal 20, when a female terminal 20 is inserted in a posture vertically inverted from a proper posture, posture displacing portions 65 for displaying extending postures of the stabilizers 30 to increase engaging margins with the restricting surfaces 64 by being engaged with the stabilizers 30 of the female terminal 20 inserted in the inverted posture are provided on the restricting surfaces 64 of the terminal accommodating hole 51.

FIG. 13

WHAT IS CLAIMED IS:

1. A connector, comprising at least one terminal fitting (20) and a connector housing (40) with at least one cavity (50) into which the at least one terminal fitting (20) is to be at least partly inserted, wherein:

the terminal fitting (20) is formed with at least one stabilizer (30) for preventing improper insertion which extends from one surface (25) of a main portion (21);

the cavity (50) of the connector housing (40) includes at least one terminal insertion hole (51) into which the main portion (21) of the terminal fitting (20) is substantially closely fitted, a widened entrance part (52) provided at a front side of the terminal insertion hole (51), and at least one insertion path (60) formed in one surface of the terminal insertion hole (51) to permit passage of the stabilizer (30);

the stabilizer (30) is insertable to a proper position while the stabilizer (30) passes in the insertion path (60) when the terminal fitting (20) is inserted in a substantially proper posture, whereas the stabilizer (30) comes into contact with a hole edge portion (64) adjacent to or at a angular position of the terminal insertion hole (51) different of a angular position where the insertion path (60) is provided to prevent any further insertion of the terminal fitting (20) when the terminal fitting (20) is inserted in an improper posture radially displaced from the proper one; and

at least one posture displacing portion (65) for displacing an extending posture of the stabilizer (30) to increase an engaging margin with the hole edge portion (64) by being engaged with the stabilizer (30) of the terminal fitting (20)

inserted in the improper posture is provided at or near the hole edge portion (64) of the terminal insertion hole (51).

2. A connector according to claim 1, wherein the stabilizer (30) of the terminal fitting (20) is formed to assume an oblique posture.

3. A connector according to any one of the preceding claims, wherein the posture displacing portion (65) is formed with at least one taper surface (66) for displacing the stabilizer (30) toward a substantially vertical posture by coming into contact with the stabilizer (30).

4. A connector according to claim 2 or 3, wherein:

a pair of left and right stabilizers (30) are formed to assume such oblique postures that respective extending ends gradually come closer to each other; and

a pair of left and right posture displacing portions (65) project forward from the hole edge portion (64) of the terminal insertion hole (51).

5. A connector according to claim 4, wherein the taper surface (66) is formed on an outer corner portion of the projecting end of each posture displacing portion (65).

6. A connector according to any one of the preceding claims, wherein:

the terminal fitting (20) and a resilient plug (15) are mounted on an end of a wire (10), the resilient plug being located behind the terminal fitting (20); and

the resilient plug (15) is closely fittable into the entrance part of the cavity (50) in the connector housing (40) when the terminal fitting (20) is properly inserted into the cavity (50).

7. A connector according to any one of the preceding claims, wherein the stabilizer (30) is formed at a position at a specified distance (D) from and inwardly of a lateral edge (25E) of the one surface (25) of the main portion (21) of the terminal fitting (20) toward a widthwise center (WC) to assume such an oblique posture toward the widthwise center (WC), whereby the extending end (30E) of the stabilizer (30) is located within a circumscribed circle (X) of the main portion (21).

8. A connector according to claim 7, wherein at least one C-surface (35) is formed on corner portions of the outer lateral edges of extending end surface (31) of the stabilizer (30) and/or at least one R-surface (37) is formed, particularly on lateral edge of the C-surface (35), on a base end side of the stabilizer (30).

9. A connector according to any one of the preceding claims, wherein the cavity (50) is formed with a terminal accommodating hole (51), into which the main portion (21) of the terminal (20) is to be closely fitted which has a laterally long rectangular cross section, and wherein a sealing hole (52), into which the resilient plug (15) mounted on a rear side of the terminal (20) is to be closely fitted has a circular cross section, is formed at the rear side while communicating with the terminal accommodating hole (51).

10. A connector according to claim 9, wherein the sealing hole (52) is formed to have the same diameter as a circumscribed circle (X) of the main portion (21) of the terminal (20).

11. A connector according to any one of the preceding claims, wherein a locking lance (57) is provided in the cavity (50) of the housing (40) to lock the terminal fitting (20) inserted therein, and wherein the insertion path (60)

is provided to substantially extend in forward and backward directions are formed adjacent to the locking lance (57) in a lateral wall of the cavity (50).

12. A connector according to claim 11, wherein a pair of insertion paths (60) are provided substantially in parallel to each other at the substantially opposite lateral sides of the locking lance (57) in the lateral wall of the cavity (50), preferably substantially from a tapered hole (53) to the terminal insertion hole (51) and/or wherein the one or more insertion paths (60) have closed ends near the leading end of the locking lance (57).

13. A connector according to any one of the preceding claims, wherein a guide groove (67) in which the stabilizer (30) at least partly is insertable is formed at the outer side of the posture displacing portion (65) to substantially face straight in a vertical direction, and a front end of the guide groove (67) reaches the hole edge portion (64).

Dated this 21/02/2012

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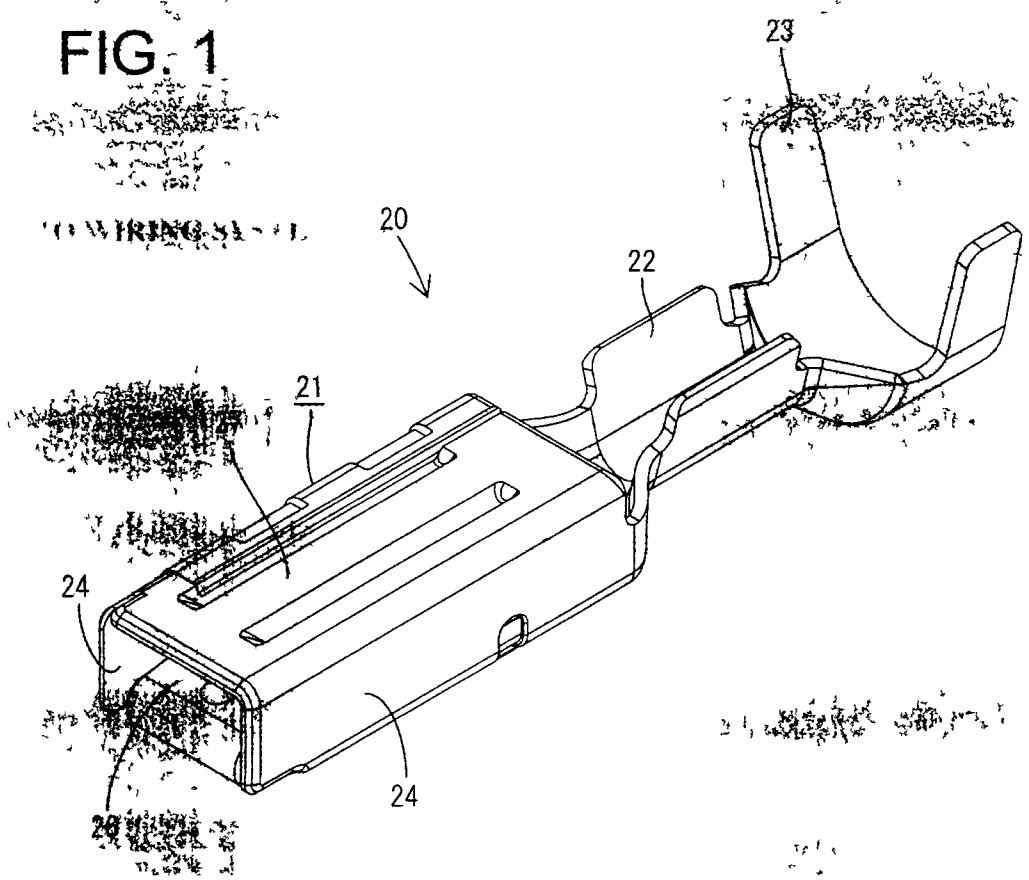
FIG. 1



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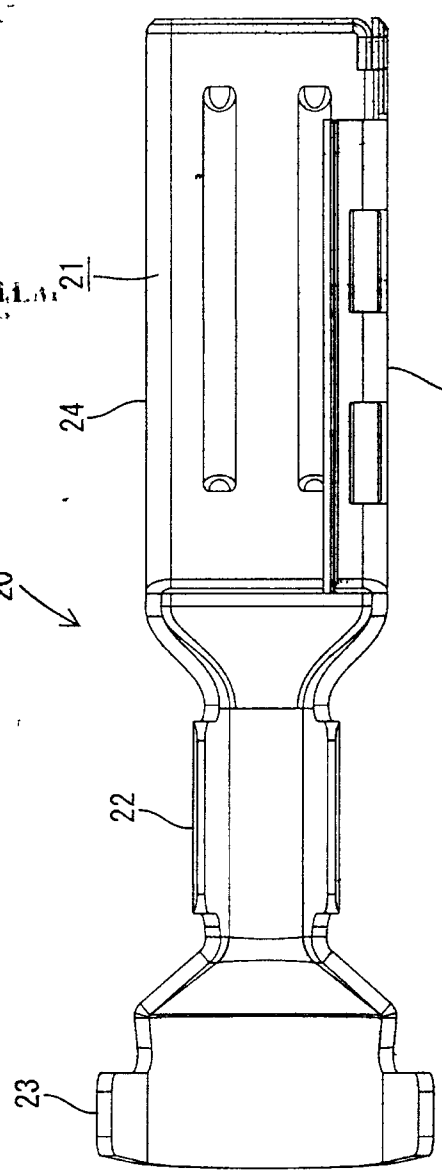


FIG. 2



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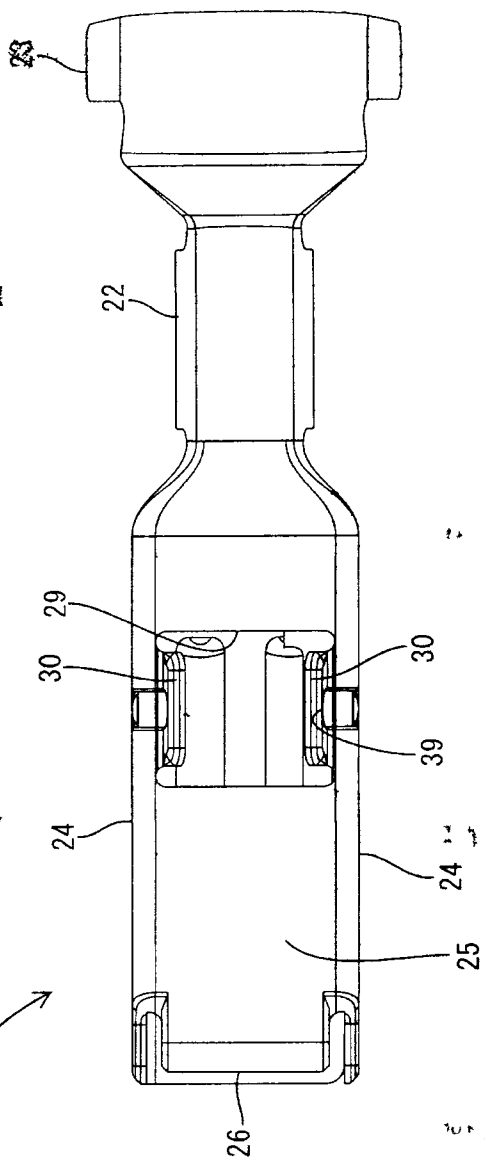


FIG

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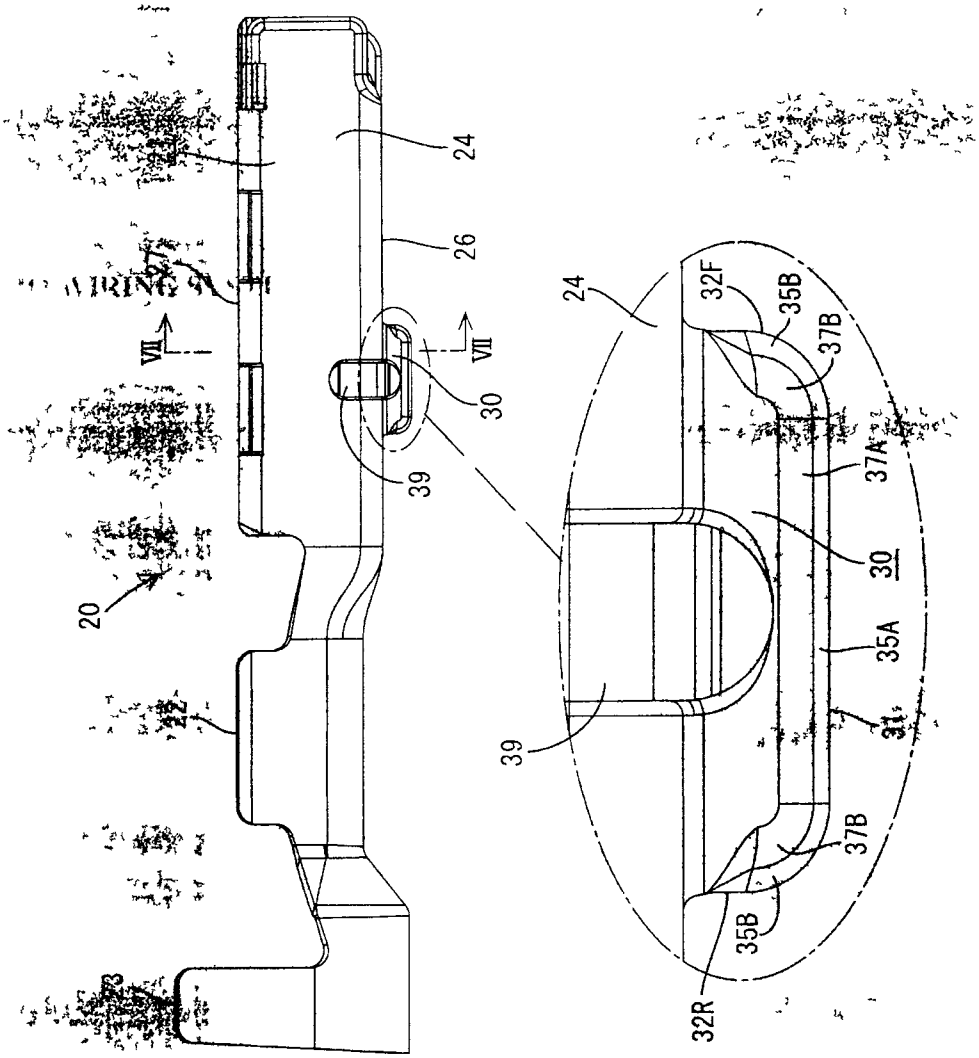


FIG. 4



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FIG. 5

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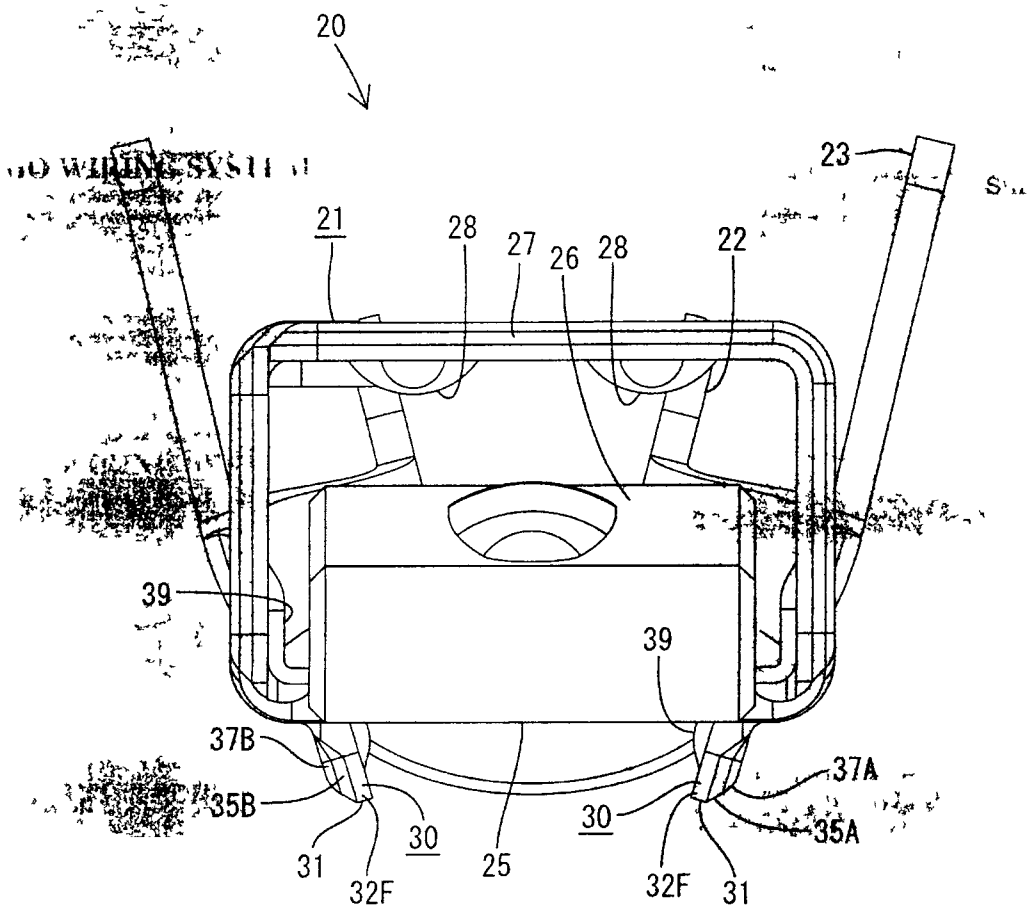


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FIG. 6

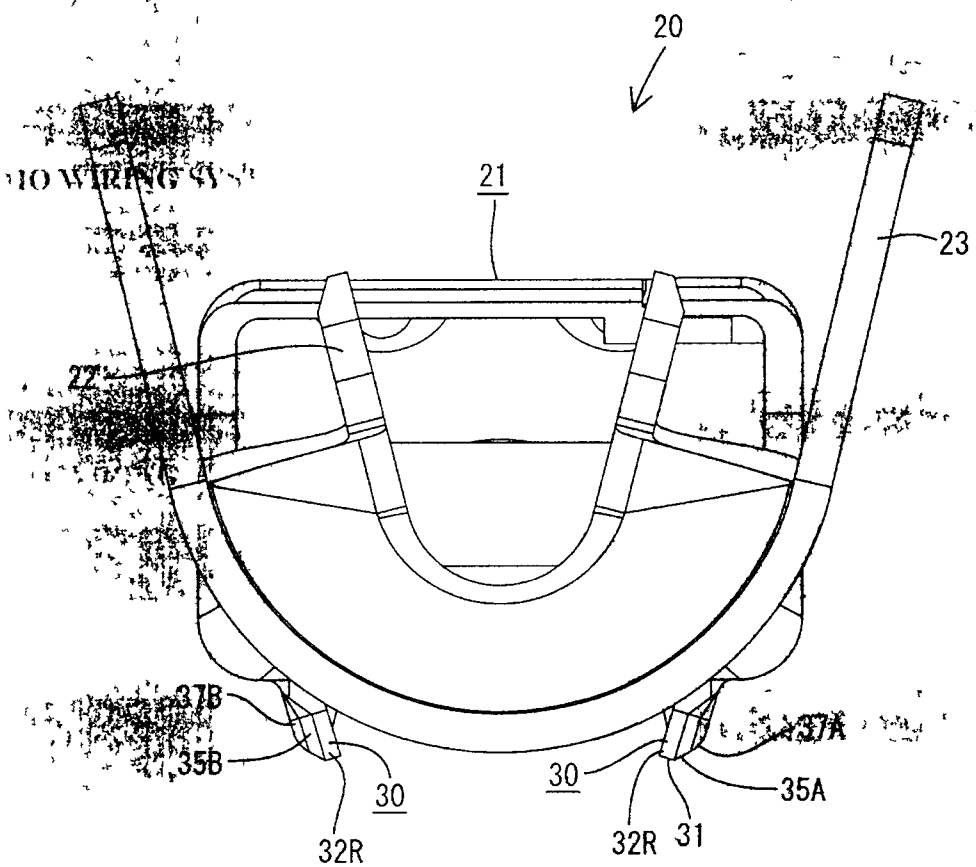




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FIG. 7

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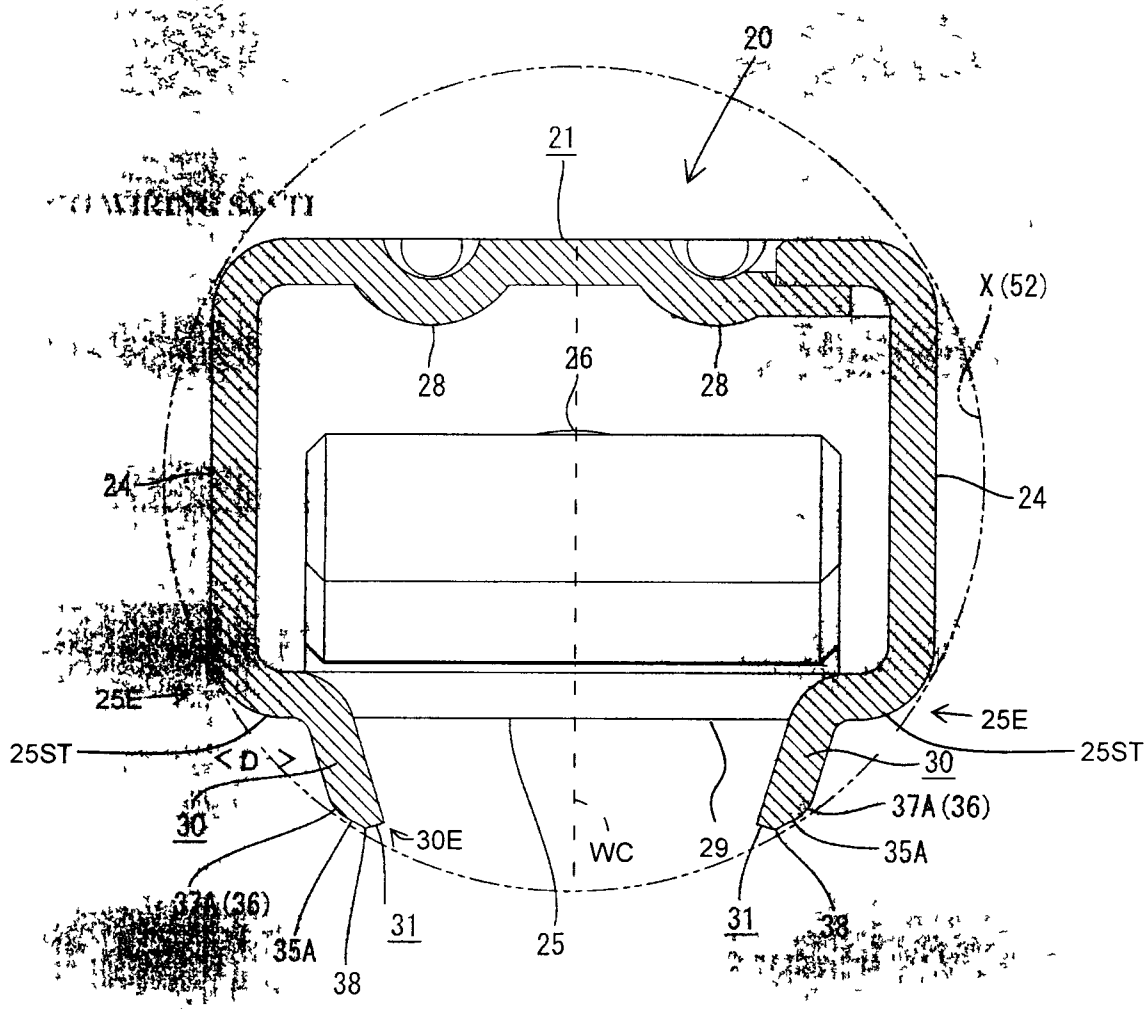


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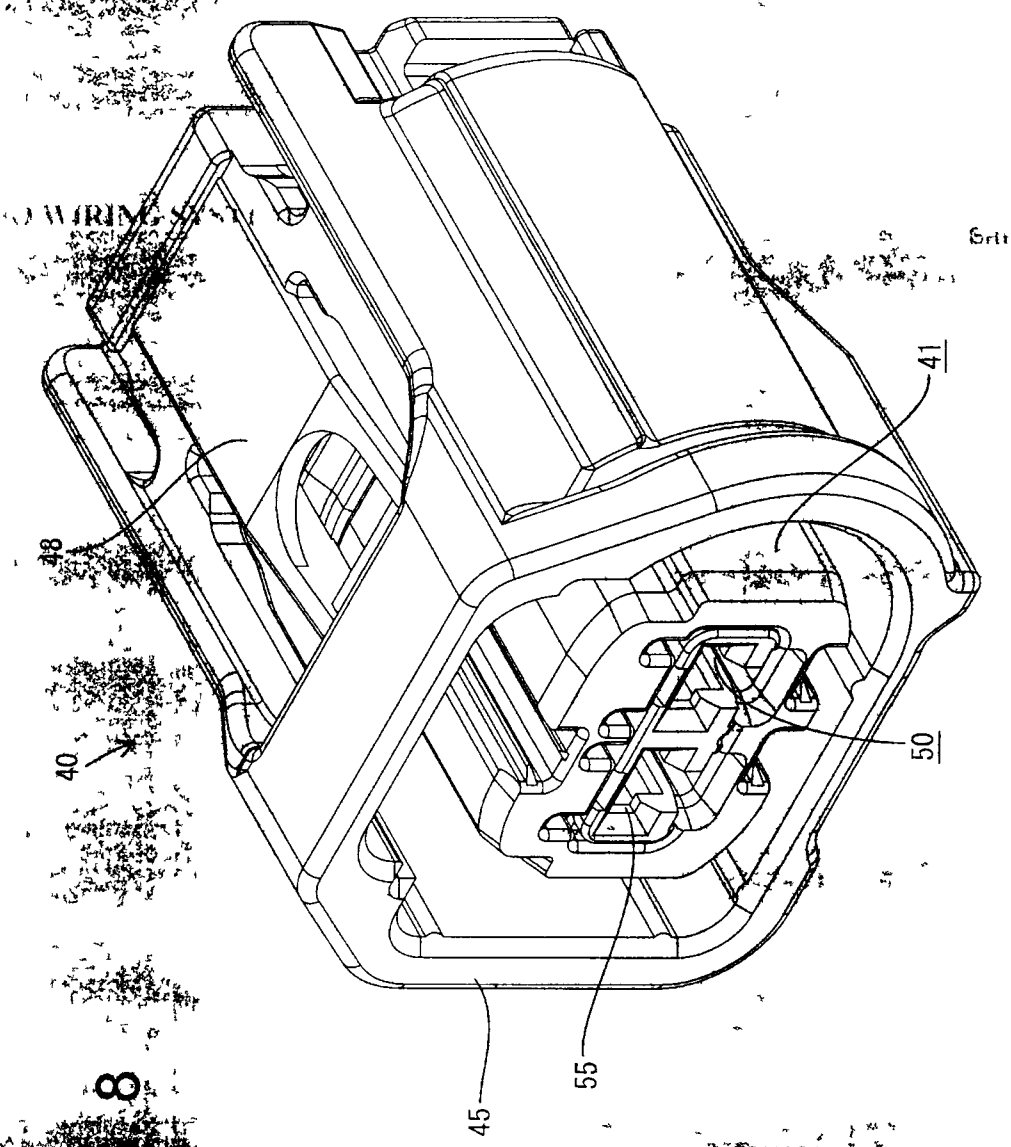


FIG. 8

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FIG. 9

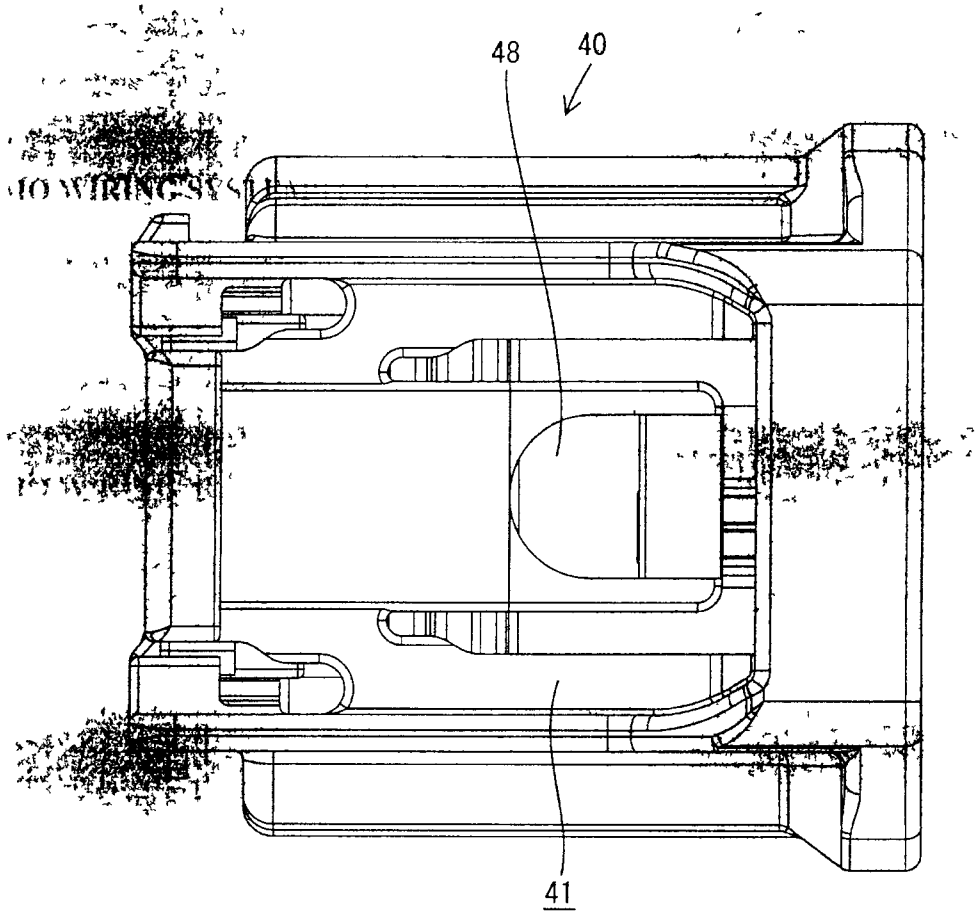


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FIG. 10

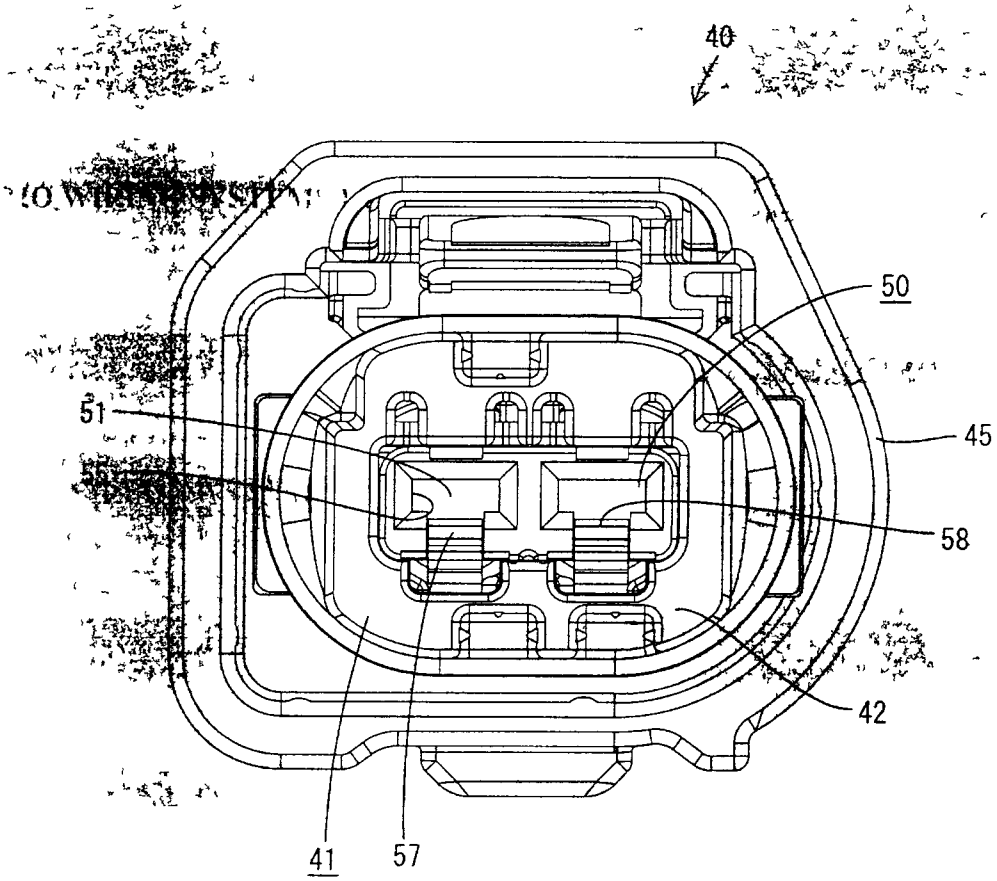


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FIG. 11

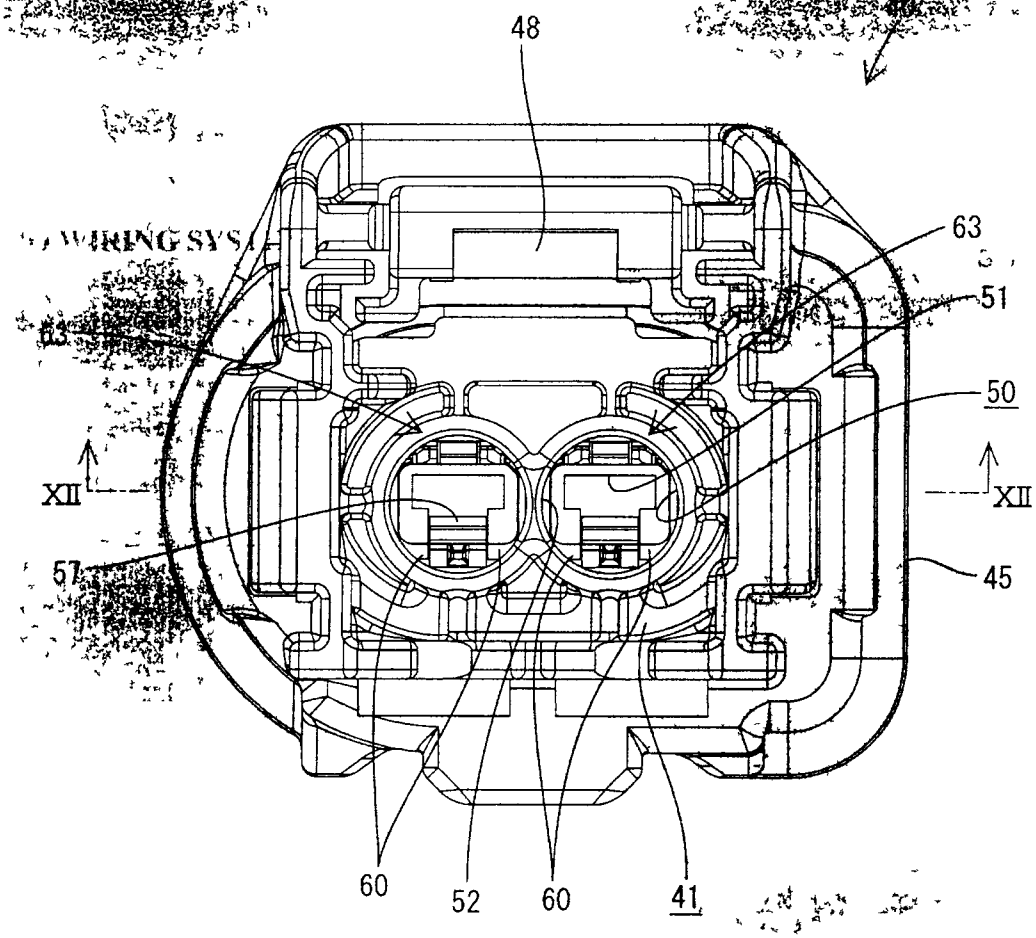




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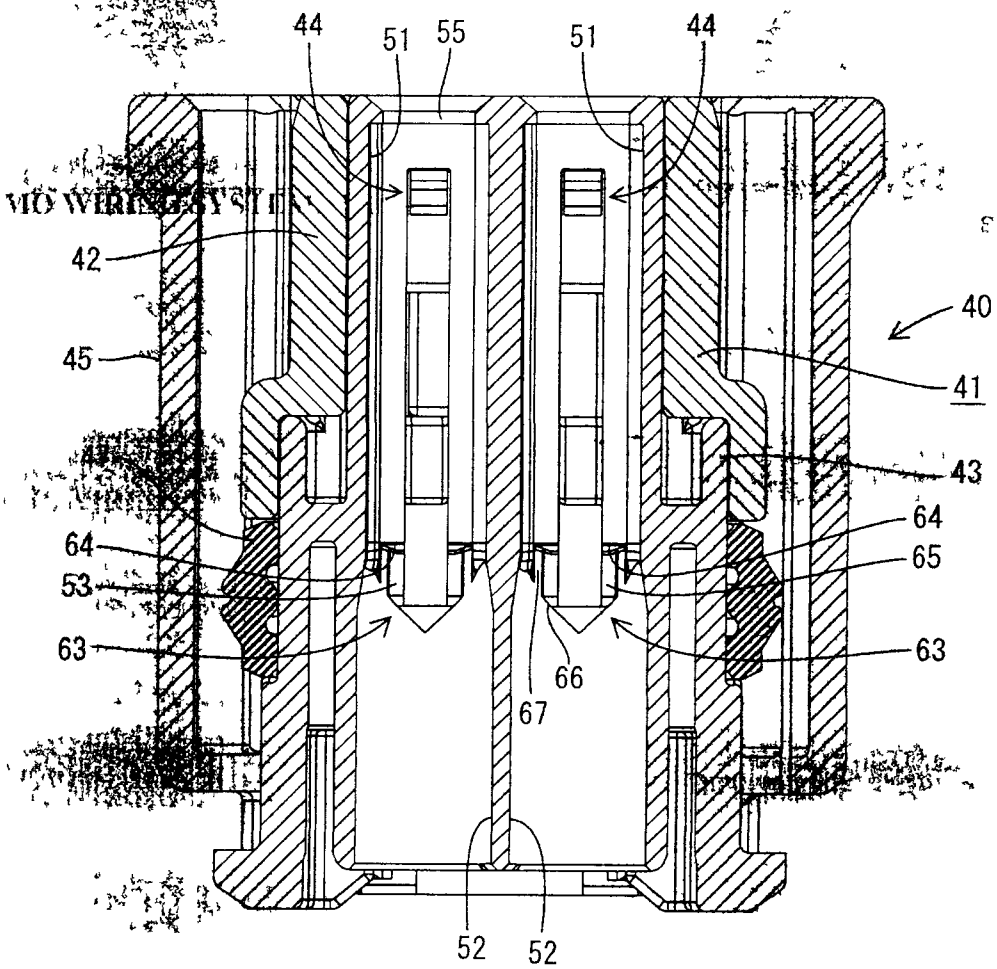
FIG. 12





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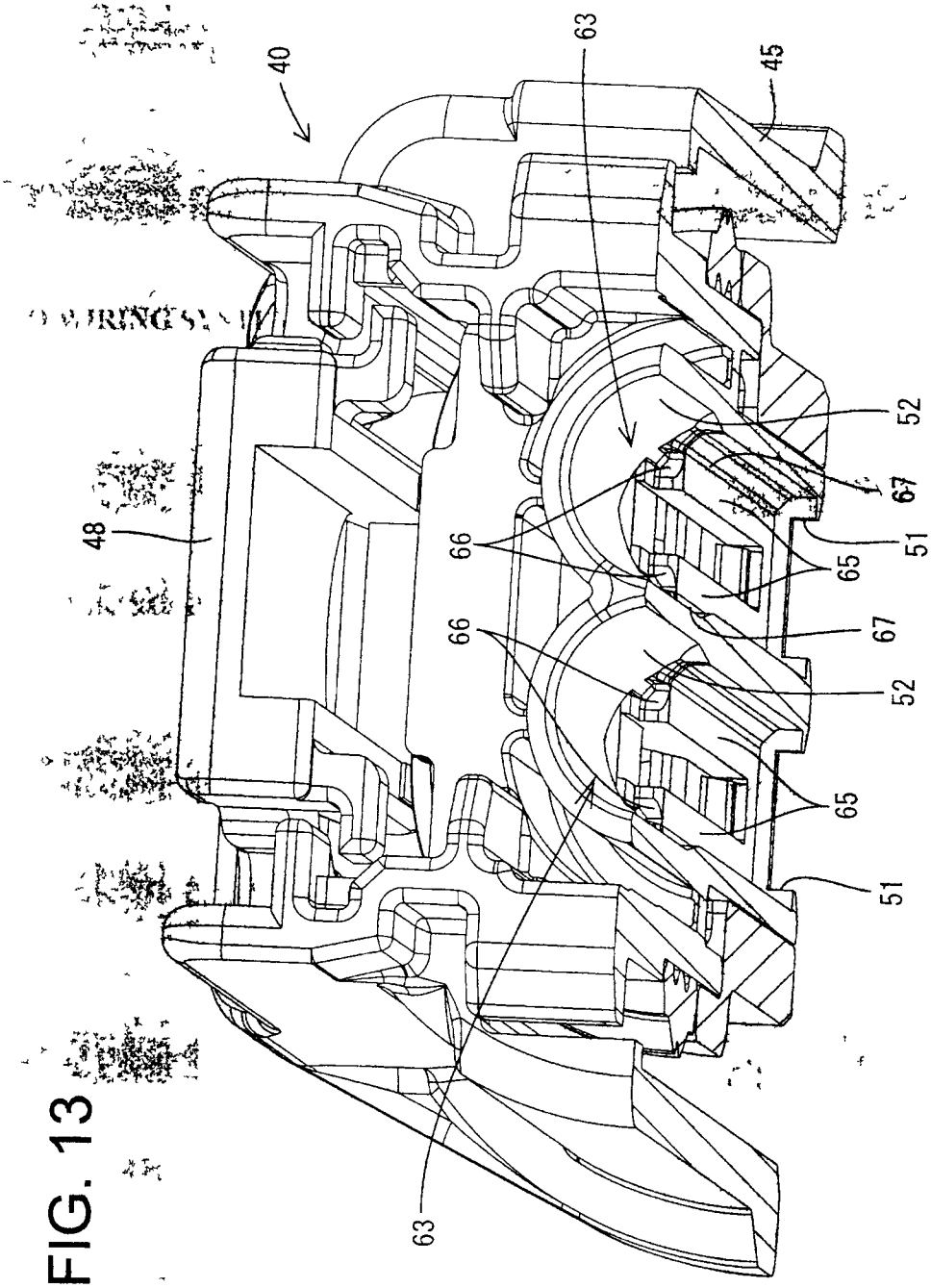


FIG. 13



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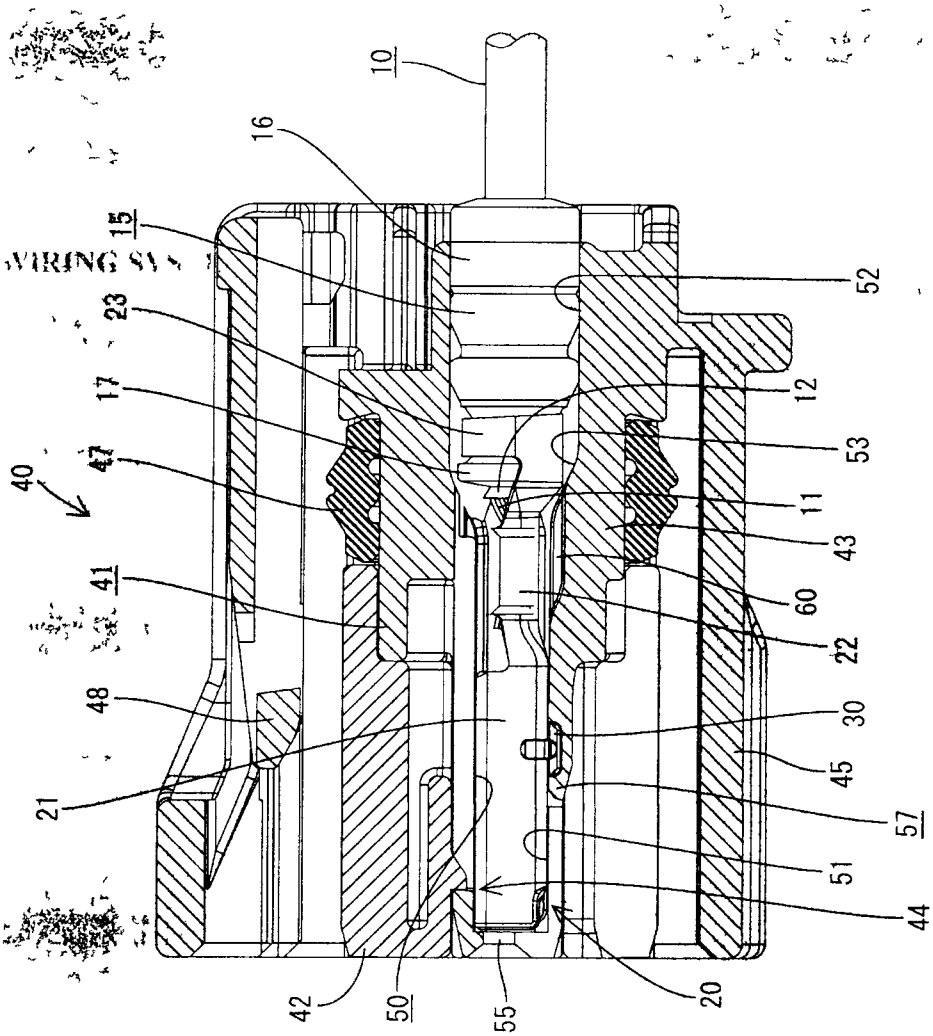


FIG. 14



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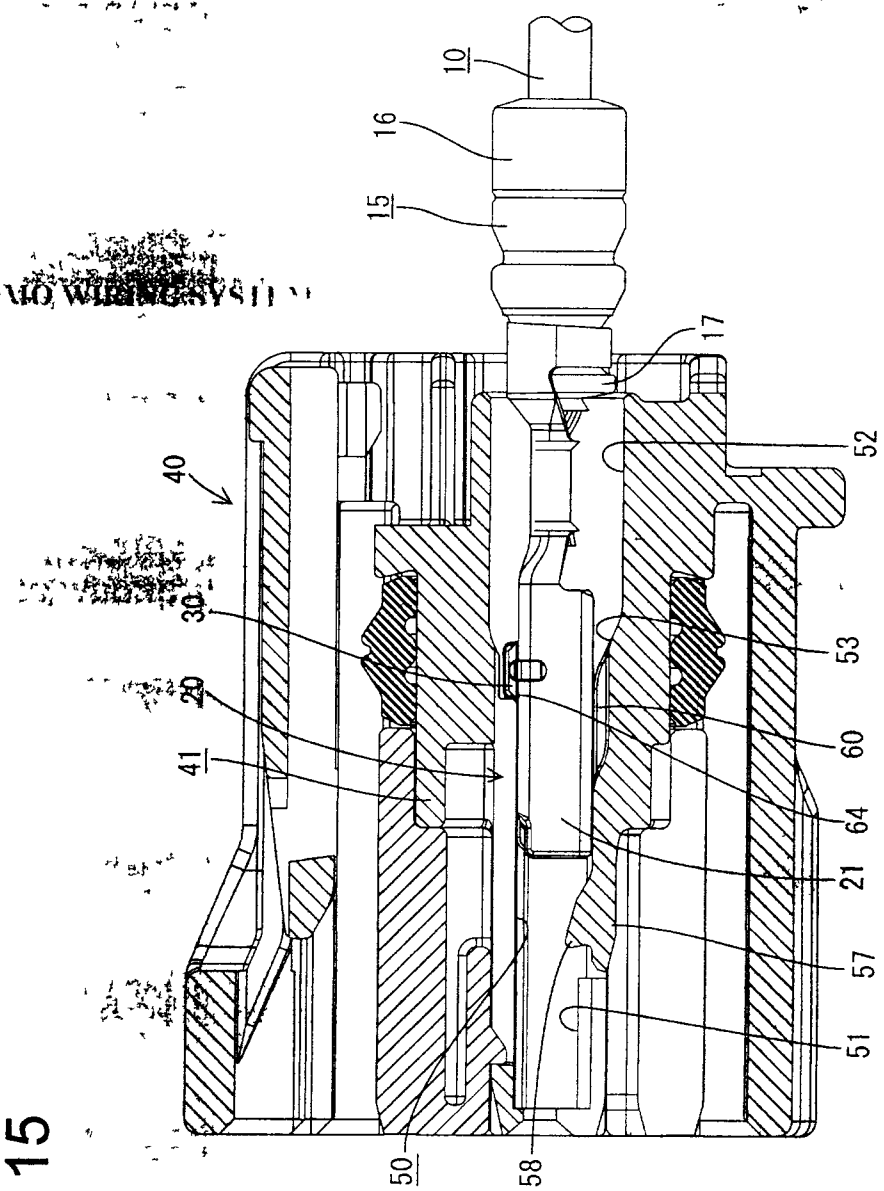


FIG. 15



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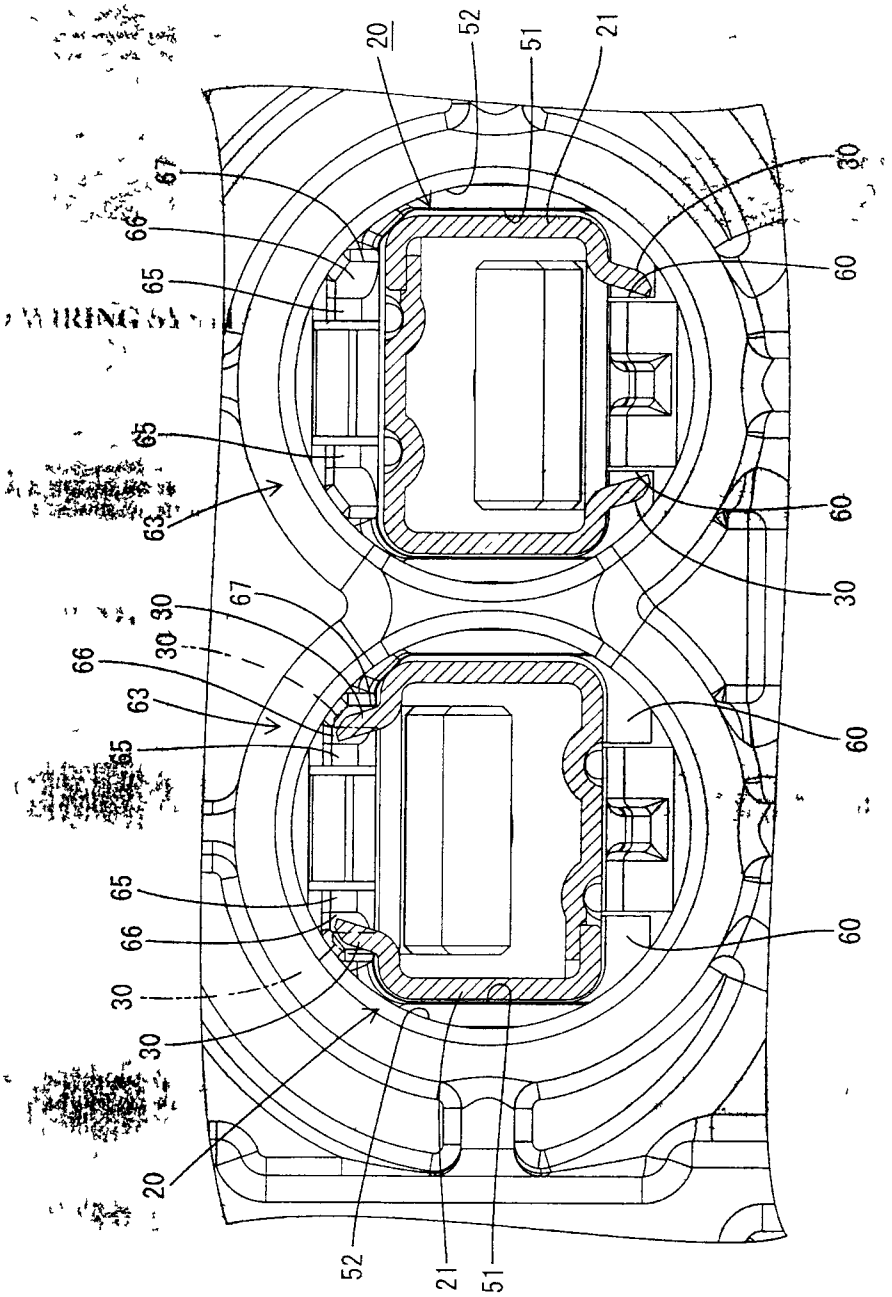


FIG. 16

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# Connector

The present invention relates to a connector with a function of preventing an improper such as an inverted insertion of a terminal fitting.

The following connector is known as an example of an individual waterproof connector with a function of preventing inverted insertion of a terminal fitting. This connector is structured such that a terminal fitting and a rubber plug are mounted on an end of a wire and the terminal fitting is formed with a pair of left and right stabilizers extending from opposite lateral edges of, e.g. the bottom surface of a main portion and, on the other hand, a connector housing is formed with a cavity composed of a terminal insertion hole into which the main portion of the terminal fitting is substantially closely fitted and a sealing hole connected at a front side of the terminal insertion hole and widened so that the rubber plug is closely fitted, and a pair of insertion paths for permitting passage of the stabilizers are provided in the bottom wall of the terminal insertion hole.

If the terminal fitting is inserted in a proper posture into the cavity, it is inserted to a proper position while the stabilizers pass in the insertion paths and the rubber plug is closely fitted into the sealing hole to provide sealing. On the other hand, if the terminal fitting is inserted in a posture vertically inverted from the proper one, the stabilizers come into contact with an upper hole edge portion at a side of the terminal insertion hole opposite to a side where the insertion paths are provided, thereby preventing any further insertion of the terminal fitting.

There has been a progressive requirement for miniaturization also for such connectors. As one measure for that, it has been proposed to make smaller the diameters of the rubber plug and the sealing hole, into which the rubber plug is to be fitted. In this case, it is necessary to prevent projecting ends of the stabilizers from interfering with the inner peripheral surface of the sealing hole to scratch the inner peripheral surface in inserting the terminal fitting into the cavity. Accordingly, conventionally, a measure capable of avoiding interference with the inner peripheral surface of the sealing hole has been taken by forming the pair of left and right stabilizers to assume such oblique postures that the respective extending ends gradually come closer to each other (see, for example, Japanese Unexamined Patent Publication No. 2005-183342).

However, when the terminal fitting formed with the oblique stabilizers as described above is inserted in an inverted posture and the stabilizers come into contact with a hole edge portion of the terminal accommodating or insertion hole, the stabilizers are likely to be deformed in inclined directions, sufficient engaging margins with the hole edge portion cannot be ensured and the stabilizers may be possibly inserted into the terminal accommodating or insertion hole. That is, an inverted insertion preventing function is not fulfilled in some cases.

The present invention was completed in view of the above situation and an object thereof is to reliably fulfill a function of preventing erroneous insertion of a terminal fitting.

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.

According to the invention, there is provided a connector, comprising at least one terminal fitting and a connector housing with at least one cavity into which the terminal fitting is to be at least partly inserted, wherein the terminal fitting is formed with at least one stabilizer for preventing improper insertion (such as inverted insertion) which extends from one surface of a main portion; the cavity of the connector housing includes at least one terminal insertion hole into which the main portion of the terminal fitting is substantially closely fitted, a widened entrance part provided (particularly connected) at a front side of the terminal insertion hole, and at least one insertion path formed in one surface of the terminal insertion hole to permit passage of the stabilizer; the stabilizer is insertable to a proper position while the stabilizer passes in the insertion path when the terminal fitting is inserted in a substantially proper posture, whereas the stabilizer comes into contact with a hole edge portion adjacent to or at a angular or azimuthal position of the terminal insertion hole different of a angular or azimuthal position where the insertion path is provided to prevent any further insertion of the terminal fitting when the terminal fitting is inserted in an improper posture radially displaced from the proper one (particularly whereas the stabilizer comes into contact with a hole edge portion at a side of the terminal insertion hole opposite to a side where the insertion path is provided to prevent any further insertion of the terminal fitting when the terminal fitting is inserted in a posture substantially vertically inverted from the proper one); and at least one posture displacing portion for displacing an extending posture of the stabilizer to increase an engaging margin with the hole edge portion by being engaged with the stabilizer of the terminal fitting inserted in the improper (particularly inverted)

posture is provided at or near the hole edge portion of the terminal insertion hole.

When the terminal fitting is inserted in an improper position (i.e. in a posture radially or angularly displaced with respect to the proper position) such as the substantially vertically or symmetrically inserted posture, the stabilizer is engaged with the posture displacing portion during insertion and the extending posture is displaced in a direction to increase the engaging margin with the hole edge portion, so that the stabilizer comes into contact with the hole edge portion while being engaged therewith. It is possible to reliably prevent the stabilizer from entering the terminal insertion hole when the terminal fitting is erroneously inserted and, consequently, reliably fulfill an erroneous insertion preventing function.

The present invention may also be embodied to have the following constructions.

(1) The stabilizer of the terminal fitting may be formed to assume an oblique posture. The posture displacing portion further may be formed with at least one taper surface for displacing the stabilizer toward a substantially vertical posture by coming into contact with the stabilizer.

By forming the stabilizer to assume the oblique posture, interference of the stabilizer with, for example, the inner peripheral surface of the entrance part of the cavity is suppressed. When the terminal fitting is erroneously inserted, the stabilizer is displaced to the vertical posture by being guided by the taper surface of the posture displacing portion during insertion, i.e. the stabilizer comes into contact with the hole edge portion of the terminal accommodating or insertion hole with a large engaging margin. An inverted insertion preventing

function is more reliably fulfilled while scratching by the stabilizer is suppressed when the terminal fitting is inserted in the proper posture.

(2) A pair of left and right stabilizers may be formed to assume such oblique postures that respective extending ends gradually come closer to each other; and a pair of left and right posture displacing portions may project forward from the hole edge portion of the terminal insertion hole. Furthermore, the taper surface may be formed on an outer corner portion of the projecting end of each posture displacing portion.

When the terminal fitting is erroneously inserted, the both stabilizers come into contact with the corresponding taper surfaces of the posture displacing portions during insertion, are displaced outwardly toward the vertical postures by being guided by the taper surfaces and come into contact with the hole edge portion of the terminal insertion hole while being kept in the vertical postures. Large engaging margins with the hole edge portion are ensured by displacing the respective stabilizers to the vertical postures, and the pressing of the terminal fitting is more reliably prevented since the posture displacing portions are located at the inner sides of the stabilizers to prevent inward inclination of the stabilizers.

(3) The terminal fitting and a resilient plug (particularly a rubber plug) are mounted on an end of a wire, the resilent plug (particularly rubber plug) being located behind the terminal fitting; and the resilent plug (particularly rubber plug) is closely fittable into the entrance part of the cavity in the connector housing when the terminal fitting is properly inserted into the cavity.

In the individual fluid- or liquid- or waterproof connector, it is possible to more reliably fulfill the function of preventing inverted insertion of the terminal

fitting while suppressing scratching on the inner peripheral surface of the sealing hole by the stabilizer, i.e. ensuring sealing performance when the terminal fitting is properly inserted.

(4) The stabilizer may be formed at a position at a specified distance from and inwardly of a lateral edge of the one surface of the main portion of the terminal fitting toward a widthwise center to assume such an oblique posture toward the widthwise center, whereby the extending end of the stabilizer is located within a circumscribed circle of the main portion.

(5) At least one C-surface may be formed on corner portions of the outer lateral edges of extending end surface of the stabilizer and/or at least one R-surface may be formed, particularly on lateral edge of the C-surface, on a base end side of the stabilizer.

(6) The cavity may be formed with a terminal accommodating hole, into which the main portion of the terminal is to be closely fitted which has a laterally long rectangular cross section, and a sealing hole, into which the resilient plug mounted on a rear side of the terminal is to be closely fitted has a circular cross section, may be formed at the rear side while communicating with the terminal accommodating hole.

(7) The sealing hole may be formed to have the same diameter as a circumscribed circle of the main portion of the terminal.

(8) A locking lance may be provided in the cavity of the housing to lock the terminal fitting inserted therein, and the insertion path may be provided to substantially extend in forward and backward directions are formed adjacent to the locking lance in a lateral wall of the cavity.

(9) A pair of insertion paths may be provided substantially in parallel to each other at the substantially opposite lateral sides of the locking lance in the lateral wall of the cavity, preferably substantially from a tapered hole to the terminal insertion hole and/or the one or more insertion paths may have closed ends near the leading end of the locking lance.

(10) A guide groove in which the stabilizer at least partly is insertable may be formed at the outer side of the posture displacing portion to substantially face straight in a vertical direction, and a front end of the guide groove reaches the hole edge portion.

According to the above, erroneous insertion of the terminal fitting can be more reliably prevented.

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 a female terminal according to one embodiment of the present invention,

FIG. 2 is a plan view of the female terminal,

FIG. 3 is a bottom view of the female terminal,

FIG. 4 is a side view of the female terminal,

FIG. 5 is an enlarged front view of the female terminal,

FIG. 6 is an enlarged rear view of the female terminal,

FIG. 7 is an enlarged section along VII-VII of FIG. 4,

FIG. 8 is a perspective view of a female housing,

FIG. 9 is a plan view of the female housing,

FIG. 10 is a front view of the female housing,

FIG. 11 is a rear view of the female housing,

FIG. 12 is a section along XII-XII of FIG. 11,

FIG. 13 is a perspective view partly in section along XII-XII of FIG. 11,

FIG. 14 is a longitudinal section when a female terminal is inserted in a proper posture,

FIG. 15 is a longitudinal section when the female terminal is inserted in an inverted posture, and

FIG. 16 is an enlarged rear view of a part where a cavity is formed,

Hereinafter, one particular embodiment of the present invention is described with reference to FIGS. 1 to 16. In this embodiment, a case where the present invention specifically is applied to an individual fluid- or waterproof connector is illustrated.

A connector of this embodiment includes, as shown in FIG. 14, one or more, e.g. two female terminals 20 fixed to respective (particularly ends of) wires 10 and a connector housing 40 (hereinafter, female housing 40) for at least partly accommodating these one or more female terminals 20.

[0014]

The female terminal 20 is described with reference to FIGS. 1 to 7. The female terminal 20 is formed particularly by press-working a conductive (particularly metal) plate with excellent electrical conductivity and includes a main portion 21, into which a tab of a mating male terminal (not shown) is to be at least partly inserted for connection, and a wire connection portion to be electrically connected to the end of the wire 10 and particularly comprising at

least one wire barrel 22 and at least one insulation barrel 23 provided behind the main portion 21 and to be crimped or bent or folded and connected to the end of the wire 10 as shown in FIG. 1.

The main portion 21 particularly substantially is in the form of a rectangular or polygonal tube long in forward and backward directions and having a laterally long cross section, and four corners of the main portion 21 are rounded. A resilient contact piece 26 (particularly formed by folding a tongue piece extending from the front edge of a bottom plate 25 to have a mountain or pointed shape) is provided in or at the main portion 21, and/or one or more (e.g. two) elongated projections 28 substantially long in forward and backward directions are formed on the inner surface of a ceiling plate 27 particularly by hammering while particularly being spaced part in a width direction.

When being at least partly inserted into the main portion 21 through a front opening, the tab of the mating male terminal is resiliently sandwiched between the resilient contact piece 26 and the elongated projections 28 and electrical connection is established between the female terminal 20 and the male terminal.

The bottom plate 25 of the main portion 21 is formed with a lance hole or recess 29 to be resiliently engaged with a locking lance 57 provided in a cavity 50 of the female housing 40, and one or more stabilizers 30 for inverted insertion preventing purpose for preventing the female terminal 20 from being erroneously inserted in a vertically inverted posture into the cavity 50. The stabilizers 30 are described later.

The female terminal 20 as described above is mounted on or fixed to the end of the wire 10 together with the rubber plug 15 (as a particular resilient

member) as shown in FIG. 14. The rubber plug 15 particularly is somewhat long in forward and backward directions and shaped such that a mounting portion 17 is formed on (particularly the front surface of) a plug body 16 having a diameter somewhat larger than that of a circumscribing circle X (see FIG. 7) of the main portion 21 of the female terminal 20 and a center hole, into which the wire 10 is closely insertable, is formed.

The wire barrel 22 is to be crimped or bent or folded and connected to (particularly an end of) a core 11 exposed by stripping the wire 10, and the insulation barrel 23 is to be crimped or bent or folded and connected to an end of an insulation coating 12 and/or the mounting portion 17 of the rubber plug 15, whereby the female terminal 20 and the rubber plug 15 are mounted on the end of the wire 10 as described above.

The stabilizers 30 are described. As shown in FIG. 3, the lance hole 29 is open in the bottom surface of the main portion 21 of the female terminal 20. More specifically, the lance hole 29 is formed to have a somewhat laterally long rectangular shape with a width substantially equivalent to a distance between the inner surfaces of left and right side plates 24 of the main portion 21 at a lengthwise intermediate position (particularly a position slightly behind a lengthwise central part) of the bottom surface of the main portion 21.

One or more, particularly a pair of lateral (left and/or right) stabilizers 30 are provided, and formed by bending cut pieces outward or downward at or near the lateral (left and/or right) lateral edges of the above lance hole 29. Strictly speaking, the stabilizers 30 are formed to extend at positions at a specified (predetermined or predeterminable) distance D (more than about about 1.5 times the thickness of the side plate 24, e.g. about twice the thickness

of the side plate 24 including a bending margin) from and inwardly of the (particularly substantially opposite left and right) lateral edge(s) 25E of the outer or bottom surface 25 of the main portion 21 toward a widthwise center WC as shown in FIG. 7. In other words, the base end of the stabilizer 30 is spaced inwardly from the lateral edge 25E by a distance D so as to form a step-like portion 25ST and the stabilizer 30 extends outwardly from the main portion 21 adjacent to the step-like portion 25ST. Furthermore, the stabilizer 30 extends obliquely with respect to the outer or bottom surface 25 of the main portion 21 towards the widthwise center WC (being defined an imaginary plane arranged in longitudinal direction of the main portion 21 and dividing the main portion 21 into two parts, see FIG. 7).

The stabilizers 30 have a width (slightly) shorter than the length of the lance hole 29 in forward and backward directions and/or a short extending dimension which is less than about half (e.g. about ¼) of the width thereof, and/or front and/or rear corner portions of the extending ends thereof particularly are rounded or beveled.

One or more C-surfaces 35A, 35B are formed in the thickness (particularly in substantially half thickness areas) of the stabilizers 30 on outer corner portions (or extending ends 30E) extending over extending end surfaces 31 and front and rear end surfaces 32F, 32R of such stabilizers 30. Here, the C-surfaces 35A, 35B particularly substantially are straight chamfered portions (portions being substantially straight along the forward and backward directions, see e.g. FIG. 4, and chamfered or beveled when seen in a direction orthogonal thereto, see FIG. 7).

As shown in FIG. 7, the stabilizers 30 are also formed to assume oblique postures that the extending or distal ends thereof gradually come closer to each other, whereby the extending ends 30E of the both stabilizers 30 are located within the above circumscribed (imaginary) circle X of the main portion 21. In other words, the stabilizer(s) 30 are formed or bent such as to be arranged inside the imaginary circle X circumscribed around the main portion 21 of the terminal fitting 20 and tangentially contacting the corner portions thereof, see FIG. 7.

R-surfaces 37A particularly are formed on lateral edges 36 at base end sides on the inner ones of the C-surfaces 35A, 35B formed on the outer corner portions particularly substantially extending over the extending end surfaces 31 and the front and rear end surfaces 32F, 32R of the stabilizers 30, i.e. on the C-surfaces 35A. Further, R-surfaces 37B particularly are formed on the rear edges of the C-surfaces 35B of the front end surfaces 32F and/or on the front edges of the C-surfaces 35B of the rear end surfaces 32R. Here, the R-surfaces 37A, 37B particularly substantially are curved chamfered portions.

The significance of forming the C-surfaces 35A on the corner portions of the outer lateral edges of the extending end surfaces 31 of the stabilizers 30 and forming the R-surfaces 37A on the lateral edges 36 of the C-surfaces 35A on the base end sides of the stabilizers 30 as described above is as below.

As shown in FIG. 7, by forming the C-surfaces 35A on the corner portions of the outer lateral edges of the extending end surfaces 31 of the stabilizers 30, interference of these corner portions with the circumscribed circle X can be avoided (i.e. the stabilizer(s) 30 are arranged inside the circle X) even

if the stabilizers 30 have the extending dimension sufficient to ensure engaging margi.:s.

Here, edges are still present on the opposite lateral edges of the C-surfaces 35A. However, by forming the stabilizers 30 to be inclined obliquely inwardly, lateral edges 38 on the tip sides out of the opposite lateral edges of the C-surfaces 35A are located inside the circumscribed circle X of the main portion 21 and, on the other hand, the lateral edges 36 on the base end sides particularly are located on the circumscribed circle X. Since the lateral edges 36 on the base end sides can be hammered, interference of the edges with the circumscribed circle X is avoided by further forming the R-surfaces 37A on the lateral edges 36 on the base end sides of the C-surfaces 35A.

As described above, the one or more, particularly the pair of lateral (left and right) stabilizers 30 particularly are formed by bending the cut pieces at the left and right lateral edges of the lance hole 29. One or more eeinforcing beads 39 are formed over at least part of the stabilizers 30, the lateral edges of the lance hole 29 and/or the side plates 24 of the main portion 21 to project outward particularly by hammering.

Next, the female housing 40 is described. The female housing 40 is made e.g. of synthetic resin and shaped such that a tubular portion 45 having an open front surface is at least partly provided around a terminal accommodating portion 41 in which the one or more female terminals 20 are to be at least partly accommodated as shown in FIGS. 8 and 14. Note that a front end portion 42 of the terminal accommodating portion 41 is or may be formed as a separate piece and integrally assembled with a rear end portion 43 via at least one lock mechanism 44.

When this female housing 40 is connected with an unillustrated mating male housing in which male terminals are mounted, a receptacle of the male housing is at least partly inserted between the terminal accommodating portion 41 and the tubular portion 45 of the female housing 40 particularly to provide sealing between the female housing 40 and the male housing via a seal ring 47 mounted on the base end side of the terminal accommodating portion 41 and particularly a lock arm 48 provided on the tubular portion 45 is resiliently engaged with a lock portion of the male housing to lock the female housing 40 and the male housing in a connected state.

One or more (e.g. two) cavities 50 into which the respective female terminal(s) 20 described above are to be at least partly inserted and accommodated are formed (particularly substantially side by side in a lateral direction) in the terminal accommodating portion 41 of the female housing 40. The (particularly each) cavity 50 is formed such that a terminal accommodating hole 51, into which the main portion 21 of the female terminal 20 is to be closely fitted and inserted and which has a laterally long rectangular cross section, is formed particularly in an area slightly more than a front half and a sealing hole 52, into which the rubber plug 15 mounted on the rear side of the female terminal 20 is to be closely fitted and/or which has a circular cross section, is formed at the rear side while communicating with the terminal accommodating hole 51. This sealing hole 52 particularly is formed to have the same diameter as the circumscribed circle X of the main portion 21 of the female terminal 20 described above. The rear end of the terminal accommodating hole 51 and the front end of the sealing hole 52 particularly are connected by a tapered hole 53.

A terminal insertion opening 55 through which the tab of the male terminal mounted in the mating male housing is to be at least partly inserted is formed in or at the front wall of the terminal accommodating hole 51. Further, a (particularly substantially cantilever-like) locking lance 57 substantially projecting forward is formed at the lateral (e.g. bottom) wall of the terminal accommodating hole 51. When the main portion 21 of the female terminal 20 in a proper posture is inserted to a proper position into the terminal accommodating hole 51 (particularly substantially until coming into contact with the front wall) while resiliently deforming the locking lance 57 as described later, the lance hole 29 formed in the lateral or bottom surface of the main portion 21 of the female terminal 20 reaches the position of a projection 58 of the locking lance 57 and the projection 58 is at least partly fitted into the lance hole 29 while the locking lance 57 is returning, whereby the main portion 21, i.e. the female terminal 20 is retained and accommodated.

Roughly speaking, when the female terminal 20 is inserted to the proper position, the main portion 21 and the wire barrel 22 of the female terminal 20 particularly substantially are accommodated in the terminal accommodating hole 51, the insulation barrel 23 of the female terminal 20 and the mounting portion 17 of the rubber plug 15 particularly substantially are accommodated in the tapered hole 53 and the front end of the sealing hole 52 and a front part of the plug body 16 of the rubber plug 15 particularly substantially is accommodated in the rear side of the sealing hole 52 as shown in FIG. 14.

One or more insertion paths 60 into which the one or more (e.g. pair of left and right) stabilizers 30 projecting from the outer or bottom surface of the main portion 21 of the female terminal 20 can be individually inserted and which

substantially extend in forward and backward directions are formed adjacent to the locking lance 57 in the lateral or bottom wall of the cavity 50, particularly substantially in parallel to each other at the substantially opposite lateral (left and right) sides of the locking lance 57 in the bottom wall of the cavity 50, particularly substantially from the tapered hole 53 to the terminal accommodating hole 51. The respective insertion paths 60 have closed ends near the leading end of the locking lance 57.

On the other hand, at least one restricting portion 63 for preventing any further insertion of the female terminal 20 by the contact with the stabilizers 30 when the female terminal 20 is inserted in an improper posture such as a posture vertically inverted from the proper posture is formed at a hole edge portion (particularly an upper hole edge part or portion) of the terminal accommodating hole 51 including the ceiling wall of the tapered hole 53.

The restricting portion 63 is described in detail with reference to FIGS. 12 and 13. One or more restricting surfaces 64 at an angle different from 0° or 180°, preferably substantially perpendicular to an axial direction are formed at an (particularly upper) edge portion of the terminal accommodating hole 51 at positions slightly behind (before) a connecting part of the terminal accommodating hole 51 with the tapered hole 53. One or more posture displacing portions 65 (particularly substantially in the form of lateral (left and/or right) rectangular bars) are formed particularly substantially in parallel to each other to project backward (toward the sealing hole 52) from these restricting surfaces 64.

One or more taper surfaces 66 are formed at one or more outer corner portions of the end surfaces of the respective posture displacing portions 65.

The respective taper surfaces 66 particularly are formed at positions where the pair of left and right stabilizers 30 can come into contact with the taper surfaces 66 when the female terminal 20 is in the vertically inverted posture. One or more guide grooves 67 in which the stabilizers 30 at least partly are insertable are formed at the outer sides of the respective posture displacing portions 65 to substantially face straight in a vertical direction, and the back ends (front ends) of the respective guide grooves 67 reach the above restricting surfaces 64.

Next, functions of this embodiment structured as described above are described.

In the case of accommodating the female terminal 20 into the corresponding cavity 50 of the female housing 40, the female terminal 20 is so oriented that the one or more stabilizers 30 are located at the lower side, and is inserted into the cavity 50 (particularly substantially from behind) as shown in FIG. 14.

After a while after the insertion, the stabilizers 30 are also inserted into the sealing hole 52. At that time, the extending ends of the stabilizers 30 may be possibly caught by the lower hole edge of the sealing hole 52 such as due to upward inclination of the main portion 21, but are smoothly inserted into the sealing hole 52 while being guided by the C-surfaces 35B and the R-surfaces 37B formed on the outer corner portions of the front end surfaces 32F of the stabilizers 30.

Thereafter, the main portion 21 of the female terminal 20 including the stabilizers 30 is pushed while sliding substantially in contact with the inner peripheral surface of the sealing hole 52. At that time, there is a high possibility that the lateral edges 36 on the base end sides of the C-surfaces 35A formed

on the extending end surfaces 31 of the stabilizers 30 come into contact with the inner peripheral surface of the sealing hole 52 as shown in FIG. 7. However, since the R-surfaces 37A are formed on the lateral edges 36, scratching on the inner peripheral surface of the sealing hole 52 is avoided.

When the female terminal 20 is further pushed such as by pushing the rear end of the rubber plug 15, the front end of the main portion 21 is at least partly inserted into the terminal accommodating hole 51 while being guided by the tapered hole 53 and the main portion 21 is pushed into the terminal accommodating hole 51 in the intermediate position or middle of insertion while the (particularly both) stabilizer(s) 30 is/are inserted into the corresponding insertion path(s) 60 as shown on the right side of FIG. 16. When the main portion 21 is pushed to the proper position to particularly come into contact with the front wall of the terminal accommodating hole 51 as shown in FIG. 14, the locking lance 57 is resiliently at least partly fitted into the lance hole or recess 29, whereby the female terminal 20 is retained and accommodated in the terminal accommodating hole 51. Simultaneously, the front end part of the plug body 16 of the rubber plug 15 particularly is closely fitted into the rear end portion of the sealing hole 52 to seal the cavity 50.

On the other hand, if the female terminal 20 is inserted in an improper posture such as a vertically inverted posture, i.e. in a posture in which the stabilizers 30 are located at the upper side as shown in FIG. 15, the extending ends of the both stabilizers 30 come into contact with the taper surfaces 66 of the corresponding posture displacing portions 65 as shown on the left side of FIG. 16 at a timing at which the main portion 21 is guided by the tapered hole 53 and at least partly enters the terminal accommodating hole 51. If the female

terminal 20 is further pushed, the stabilizers 30 are displaced to vertical postures by being guided by the taper surfaces 66 as shown by chain line in FIG. 16, pass in the guide grooves 67 at the outer sides of the posture displacing portions 65 while being kept in the vertical postures and then come into contact with the restricting surfaces 64 as shown in FIG. 15.

Further pushing of the female terminal 20 is prevented in the above manner and insertion of the female terminal 20 in a wrong posture is detected. Large engaging margins with the restricting surfaces 64 are ensured by displacing the stabilizers 30 to the vertical postures, and inward inclination of the stabilizers 30 is prevented by the posture displacing portions 65 at the inner sides of the stabilizers 30. Thus, the pushing of the female terminal 20 is reliably prevented.

Since the rubber plug 15 is not fitted in the sealing hole 52 when the pushing is prevented in the above manner, the female terminal 20 can be easily pulled back such as by holding the rubber plug 15 and pulling the wire 10 backward. Thereafter, the female terminal 20 may be corrected to the proper posture and inserted into the cavity 50 again.

According to this embodiment, the following functions and effects can be obtained. In the female terminal 20 of this embodiment, the structure of a part specifically where the one or more (particularly the pair of lateral e.g. left and/or right) stabilizers 30 for preventing improper insertion such as inverted insertion are provided on the outer or bottom surface of the main portion 21 is such that the extending ends of the both stabilizers 30 particularly are located within the circumscribed (imaginary) circle X of the main portion 21 by forming the stabilizers 30 at the positions at the specified (predetermined or

predeterminable) distance D from and inwardly of the lateral (left and/or right) edges 25E of the bottom surface 25 of the main portion 21 toward the widthwise center WC to assume such oblique postures that the extending ends 30E gradually come closer to each other, and the one or more C-surfaces 35A are formed at the corner portions of the outer lateral edges of the extending end surfaces 31 of the both stabilizers 30 and the one or more R-surfaces 37A are formed on the lateral edges 36 of the C-surfaces 25A on the base end sides of the stabilizers 30.

By such a structure, scratching on the inner peripheral surface of the sealing hole 52 in the cavity 50 by the stabilizers 30 can be prevented when the female terminal 20 is at least partly inserted in a substantially proper posture into the cavity 50. However, since the both stabilizers 30 particularly are in the oblique postures to be inclined inwardly toward each other, there is a possibility, even though slight, that the engaging margins are small or the stabilizers 30 are inclined and deformed so that the stabilizers 30 enter the terminal accommodating hole 51 if the female terminal 20 is inserted in an inverted posture and comes into contact with the hole edge portion of the terminal accommodating hole 51.

Contrary to this, in this embodiment, the one or more restricting portions 63 including the one or more posture displacing portions 65 and the like are formed at the hole edge portion (particularly the lateral or upper hole edge portion) of the terminal accommodating hole 51 to substantially come into contact with the one or more respective stabilizers 30 when the female terminal 20 is erroneously inserted. That is, if the female terminal 20 is erroneously inserted, the extending end(s) of the (particularly both) stabilizer(s) 30 come(s)

into contact with the corresponding taper surface(s) 66 of the posture displacing portion(s) 65 when the main portion 21 at least partly enters the terminal accommodating hole 51. If the female terminal 20 is further pushed in, the stabilizer(s) 30 is/are displaced or guided particularly to the vertical posture(s) by being guided or urged by the taper surface(s) 66, pass(es) in the respective guide groove(s) 67 at the outer side(s) of the posture displacing portion(s) 65 while being kept in the vertical posture(s), and then come into contact with the respective restricting surface(s) 64.

That is, large engaging margins with the restricting surface(s) 64 are ensured by displacements of the stabilizer(s) 30 to the vertical posture(s) and the pushing or insertion of the female terminal 20 is reliably prevented by preventing inward inclination of the stabilizer(s) 30 by the one or more posture displacing portion(s) 65 at the inner side(s) of the stabilizer(s) 30.

As a result, in the female connector of the individual fluid- or waterproof type, it is possible to reliably fulfill a function of preventing improper or inverted insertion of the female terminal 20 while suppressing scratching on the inner peripheral surface of the sealing hole 52 by the stabilizer(s) 30, i.e. ensuring sealing performance when the female terminal 20 is properly inserted.

Accordingly, to reliably fulfill a function of preventing erroneous insertion of a terminal fitting, in a connector constructed such that one or more stabilizers 30 come into contact with one or more restricting surfaces 64 of a hole edge of a terminal accommodating hole 51 at a side different (e.g. substantially opposite) to a side where one or more insertion paths 60 are provided, thereby preventing any further insertion of the female terminal 20, when a female terminal 20 is at least partly inserted in an improper posture (such as a posture

inclined by an angle different from 0° or 180° with respect to a proper posture, e.g. substantially vertically inverted from a proper posture), one or more posture displacing portions 65 for displaying extending posture(s) of the stabilizer(s) 30 to increase engaging margins with the respective restricting surface(s) 64 by being engaged with the stabilizer(s) 30 of the female terminal 20 at least partly inserted in the improper posture (e.g. the inverted posture) is/are provided on the restricting surface(s) 64 of the terminal accommodating hole 51.

<Other Embodiments>

The present invention is not limited to the above described and illustrated embodiment. For example, the following embodiments are also included in the technical scope of the present invention.

(1) Although the one or more stabilizers formed to assume the oblique postures are displaced to the vertical postures in the above embodiment, the postures of the stabilizers before and after the displacements do not matter as long as the engaging margins with the hole edge portion of the terminal accommodating hole increase after the displacements.

(2) Although the pair of left and right stabilizers are provided on the bottom surface of the main portion of the female terminal in the above embodiment, the number, arrangement positions and the like of the stabilizers may be other than those described above.

(3) Although the female waterproof connector in which the female terminals are to be at least partly accommodated in the female housing is illustrated in the above embodiment, the present invention is similarly applicable to male fluid- or waterproof connectors in which one or more male terminals are at least partly accommodated in a male housing.

(4) Without limitation to individual waterproof connectors, the present invention can be widely applied to waterproof connectors including a one-piece resilient plug or rubber plug and even non-waterproof connectors, i.e. connectors in general that are of a type that a terminal fitting including a stabilizer for preventing improper or inverted insertion is accommodated in a cavity of a connector housing.

LIST OF REFERENCE NUMERALS

10 ... wire

15 ... rubber plug (resilient plug)

20 ... female terminal (terminal fitting)

21 ... main portion

25 ... bottom plate (one surface of main portion 21)

30 ... stabilizer

30E ... extending end (of stabilizer 30)

31 ... extending end surface (of stabilizer 30)

32F ... front end surface (of stabilizer 30)

35A ... C-surface (of extending end surface 31)

35B ... C-surface (of front end surface 32F)

36 ... lateral edge on base end side (of C-surface 35A)

37A ... R-surface

37B ... R-surface

40 ... female housing (connector housing)

50 ... cavity

51 ... terminal accommodating hole (terminal insertion hole)

52 ... sealing hole (entrance part of cavity 50)

57 ... locking lance

60 ... insertion path

63 ... restricting portion

64 ... restricting surface (hole edge portion)

65 ... posture displacing portion

66 ... taper surface

X ... circumscribed circle (of main portion 21 of female terminal 20)