ABSTRACT OF THE DISCLOSURE

An object of the present invention is to provide a terminal fitting capable of reliably fulfilling an inverted insertion preventing function and ensuring a waterproof function.

In a female terminal in which a pair of left and right stabilizers 30 are formed to extend from one surface of a main portion 21 in the form of a rectangular tube, the pair of stabilizers 30 are formed at positions at a predetermined distance from and inwardly of opposite left and right lateral edges of the one surface of the main portion 21 toward a widthwise center to assume such oblique postures that both extending ends gradually come closer to each other, whereby the extending ends of the both stabilizers 30 are located within a circumscribed circle X of the main portion 21, C-surfaces 35A are formed on corner portions of the outer lateral edges of extending end surfaces 31 of the both stabilizers 30 and R-surfaces 37A are formed on lateral edges 36 of the C-surfaces 35A on base end sides of the stabilizers 30.

FIG. 7

WHAT IS CLAIMED IS:

1. A terminal fitting (20) for a connector, comprising:

a main portion (21) substantially in the form of a rectangular tube; and

at least one stabilizer (30) for preventing inverted insertion which is formed to extend from one surface (25) of the main portion (21),

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) 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); and

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 at least one R-surface (37) is formed on lateral edge of the C-surface (35) on a base end side of the stabilizer (30).

2. A terminal fitting according to claim 1, wherein a pair of stabilizers (30) are formed at positions at a specified distance (D) from and inwardly of opposite left and right lateral edges (25E) of the one surface (25) of the main portion (21) toward the widthwise center (WC) to assume such oblique postures that both extending ends (30E) gradually come closer to each other, whereby the extending ends (30E) of the both stabilizers (30) are located within a circumscribed circle (X) of the main portion (21).

3. A terminal fitting according to claim 2, wherein C-surfaces (35) are formed on corner portions of the outer lateral edges of extending end surfaces

(31) of the both stabilizers (30) and R-surfaces (37) are formed on lateral edges of the C-surfaces (35) on base end sides of the stabilizers(30).

4. A terminal fitting according to any one of the preceding claims, wherein the C-surface(s) (35B) is/are formed on outer corner portion(s) of front end surface(s) of the stabilizers (30) in an inserting direction of the terminal fitting (20) and/or the R-surface(s) (37B) is/are formed on the rear edges of the C-surface(s) (35B).

5. A terminal fitting according to any one of the preceding claims, wherein:

a lance hole (29) to be engaged with a locking lance (57) provided in the cavity (50) is formed in the one surface (25) of the main portion (21); and

the pair of stabilizers (30) are formed by bending cut pieces at substantially opposite lateral edges of the lance hole (29).

6. A terminal fitting according to any one of the preceding claims, wherein one or more reinforcing beads (39) are formed over the stabilizer(s) (30), the lateral edges of the lance hole (29) and/or side surfaces (24) of the main portion (21) preferably connected at right angles to the lateral edges of the lance hole (29) to project outward more preferably by hammering.

7. A terminal fitting according to claim 5 or 6, wherein the stabilizer (30) has a width shorter than the length of the lance hole (29) in forward and backward directions and/or wherein a short extending dimension of the stabilizer (30) is less than about half of the width thereof.

8. A fluidproof connector comprising a connector housing (40) and at least one terminal fitting (20) according to any one of the preceding claims mounted on an end of a wire (10) together with a resilient plug (15) is at least

partly inserted and accommodated into a cavity (50) of the connector housing (40) so that the resilient plug (15) is fitted into an entrance of the cavity (50) to provide sealing.

9. A fluidproof connector according to claim 8, 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).

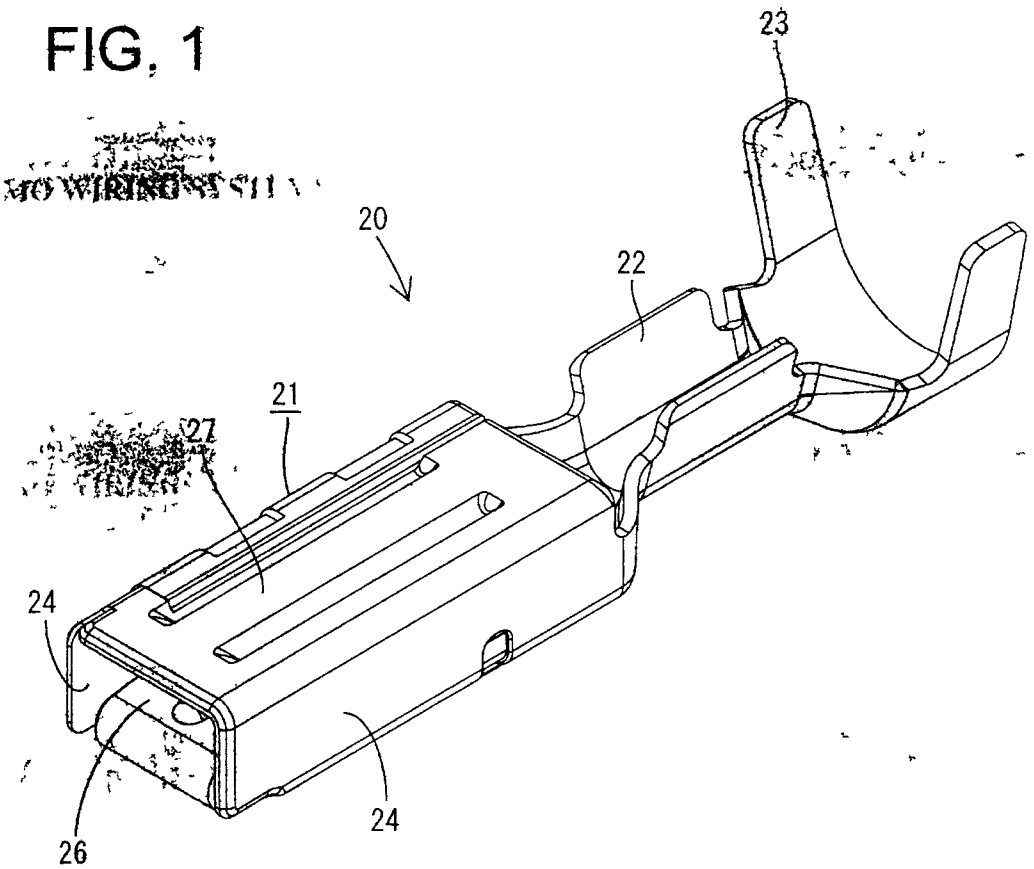
10. A fluidproof connector according to claim 9, wherein the sealing hole (52) is formed to have the same diameter as the circumscribed circle (X) of the main portion (21) of the terminal fitting (20).

11. A fluidproof connector according to claim 9 or 10, wherein at least one restricting portion (63) for preventing any further insertion of the terminal fitting (20) by the contact with the stabilizer(s) (30) when the terminal fitting (20) is inserted in an improper posture is formed at a hole edge portion of the terminal accommodating hole (51) preferably including a ceiling wall of a tapered hole (53).

Dated this 21/02/2012

HRISHIKESH RAY CHAUDHURY
OF REMFRY & SAGAR
ATTORNEY FOR THE APPLICANTS

FIG. 1



(HRISHIKESH RAY CHAUDHURY)
OF REMFRY & SAGAR
ATTORNEY FOR THE APPLICANTS

ORIGINAL

0480 DEL 12

21 FEB 2012

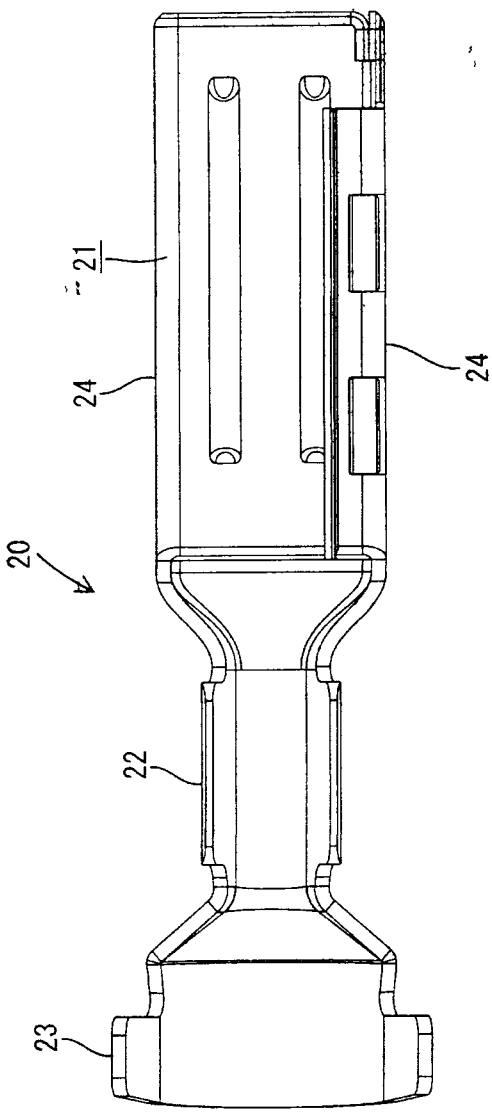


FIG. 2

(HRISHIKESH RAY CHAUDHURY)
OF REMFRY & SAGAR
ATTORNEY FOR THE APPLICANTS

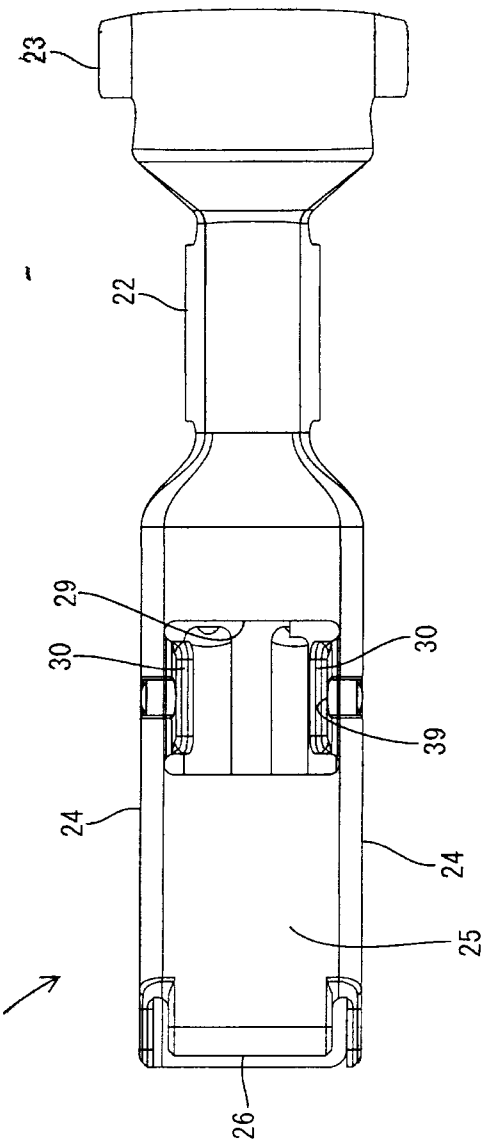


FIG. 3

(HRISHIKESH RAY CHAUDHURY)
OF REMFRY & SAGAR
ATTORNEY FOR THE APPLICANTS

ORIGINAL

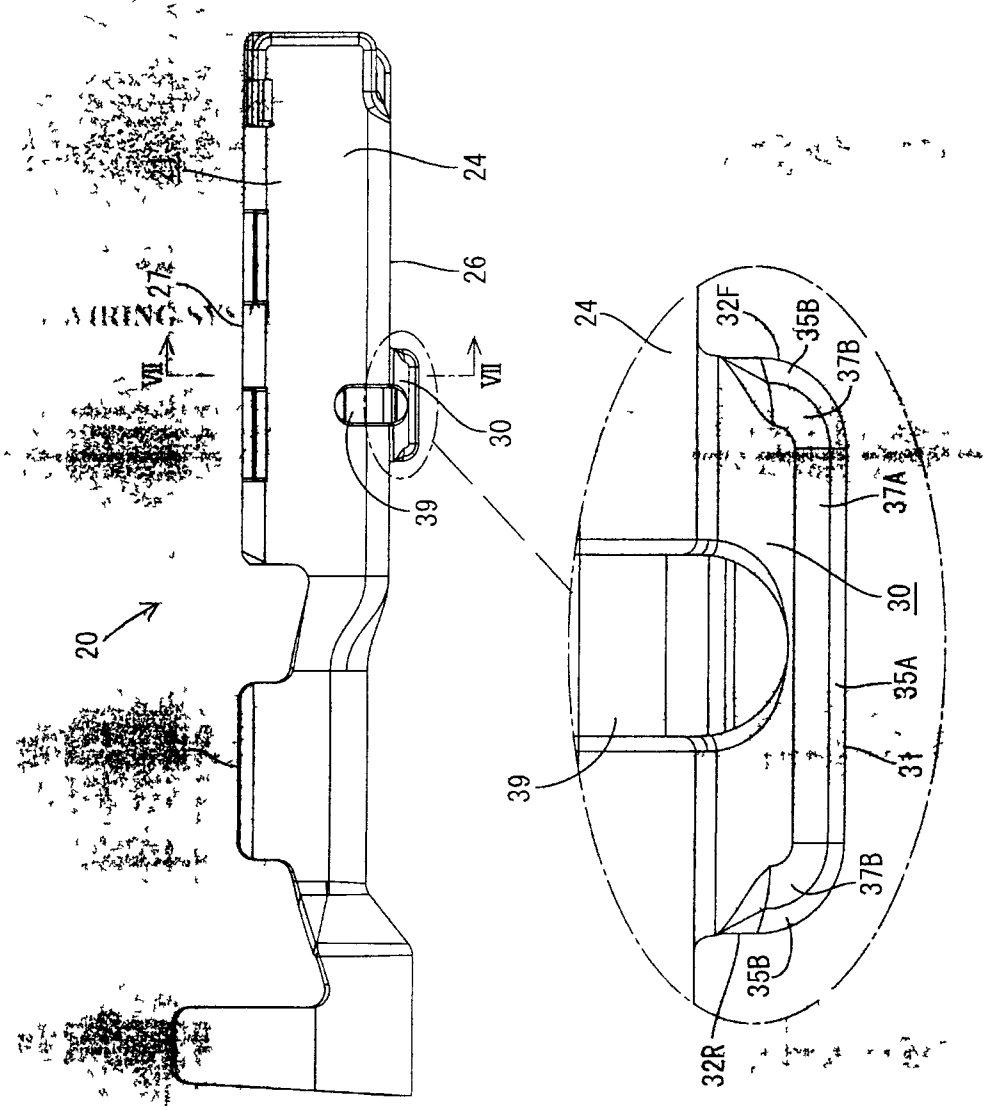
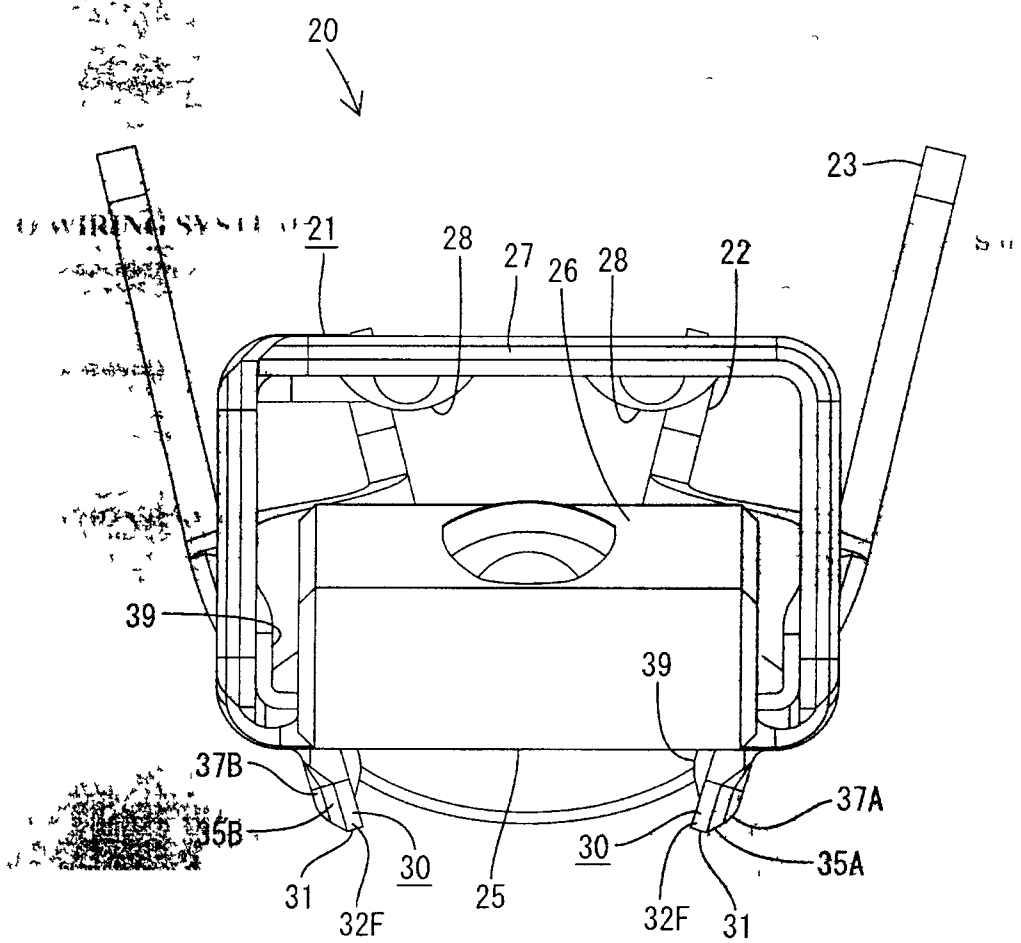


FIG. 4

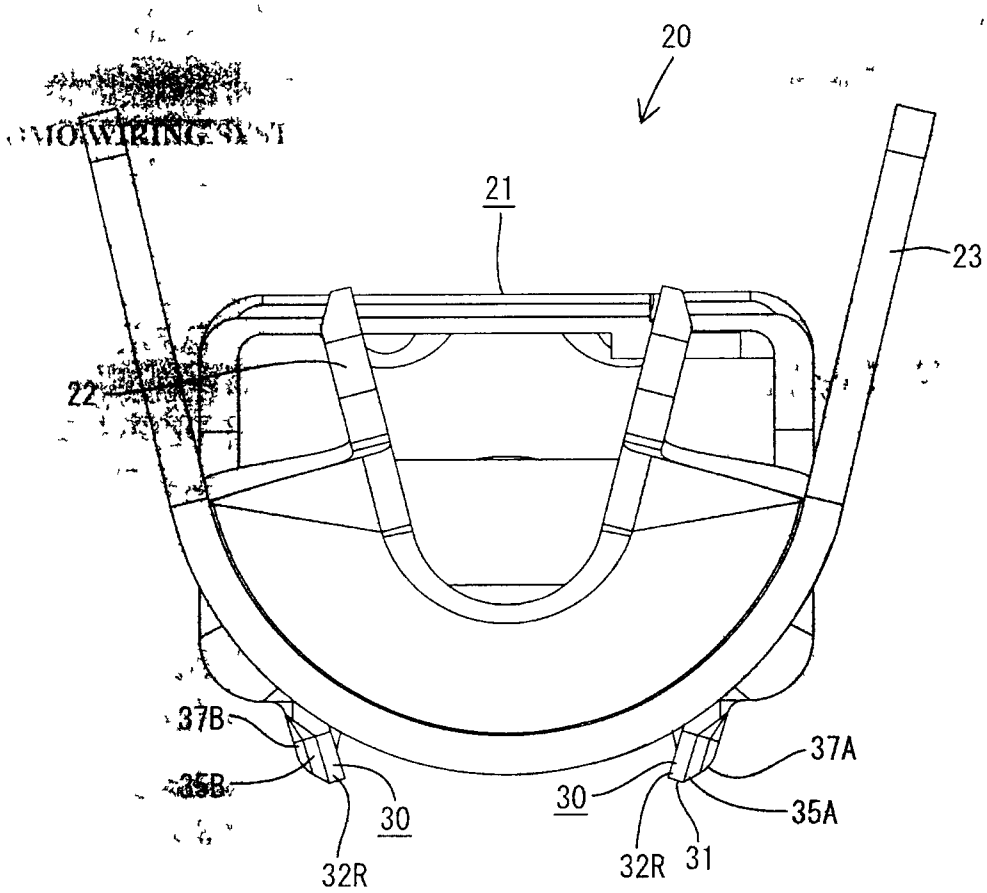
(HRISHIKESH RAY CHAUDHURY)
OF REMFRY & SAGAR
ATTORNEY FOR THE APPLICANTS

FIG. 5



(HRISHIKESH RAY CHAUDHURY)
OF REMFRY & SAGAR
ATTORNEY FOR THE APPLICANTS

FIG. 6



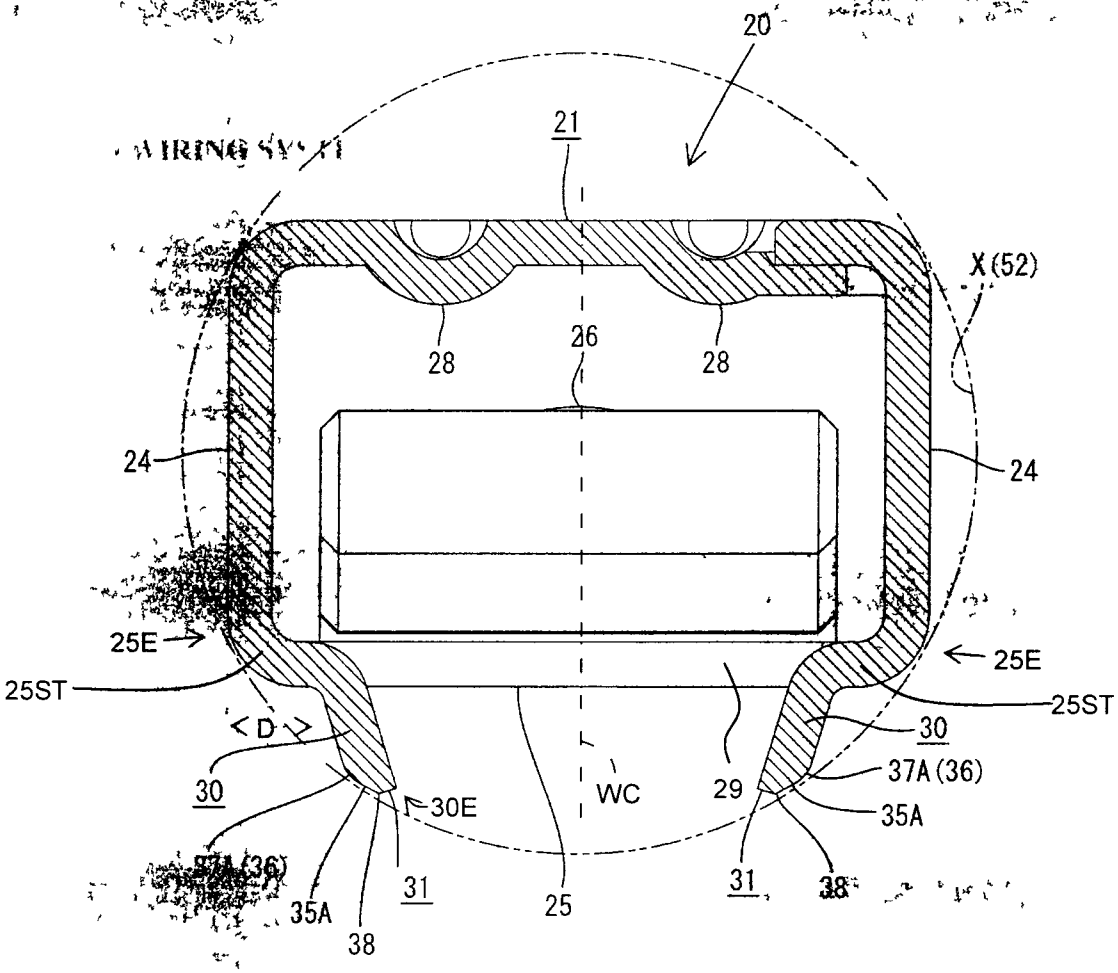
(HRISHIKESH RAY CHAUDHURY)
OF REMFRY & SAGAR
ATTORNEY FOR THE APPLICANTS

ORIGINAL

10480 DEL 12

FIG. 7

21 FEB 2012



(HRISHIKESH RAY CHAUDHURY)
OF REMFRY & SAGAR
ATTORNEY FOR THE APPLICANTS

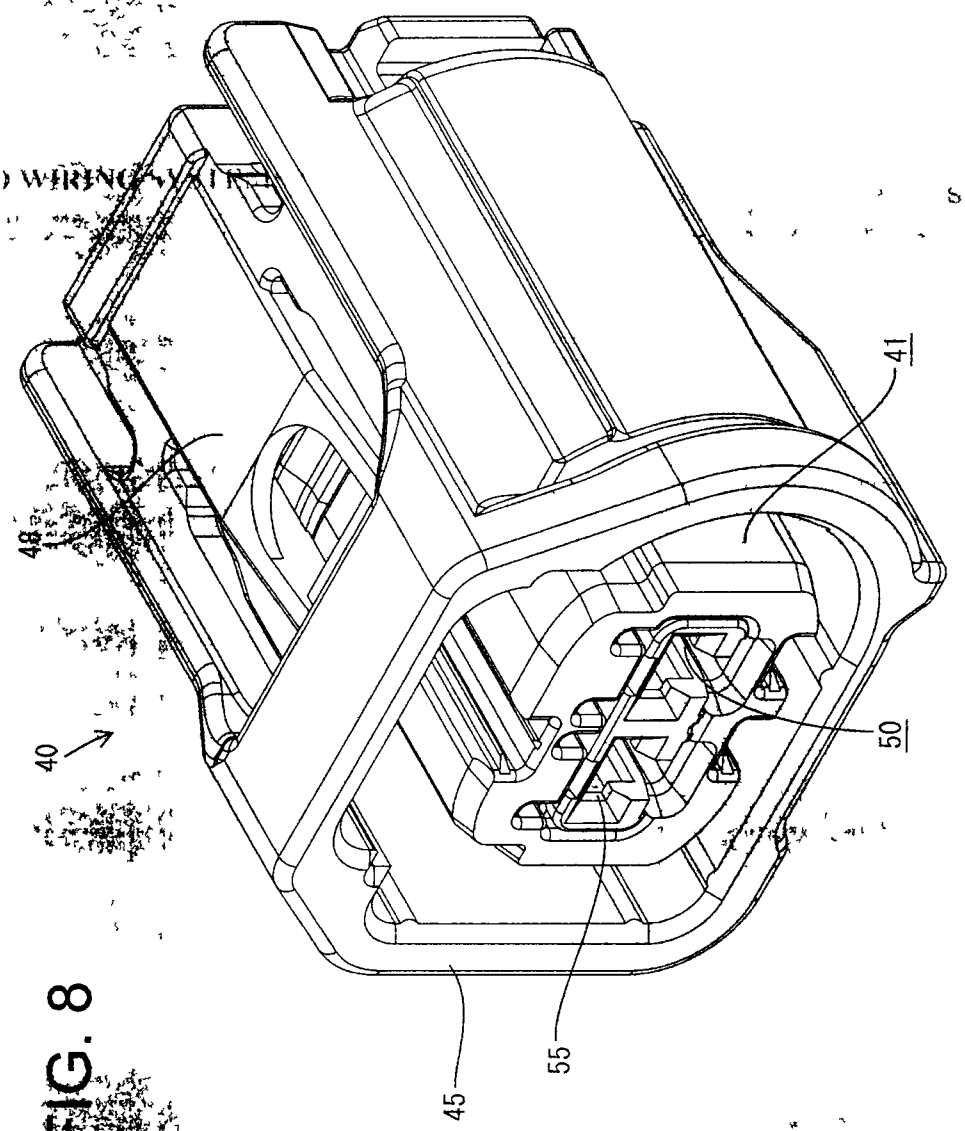


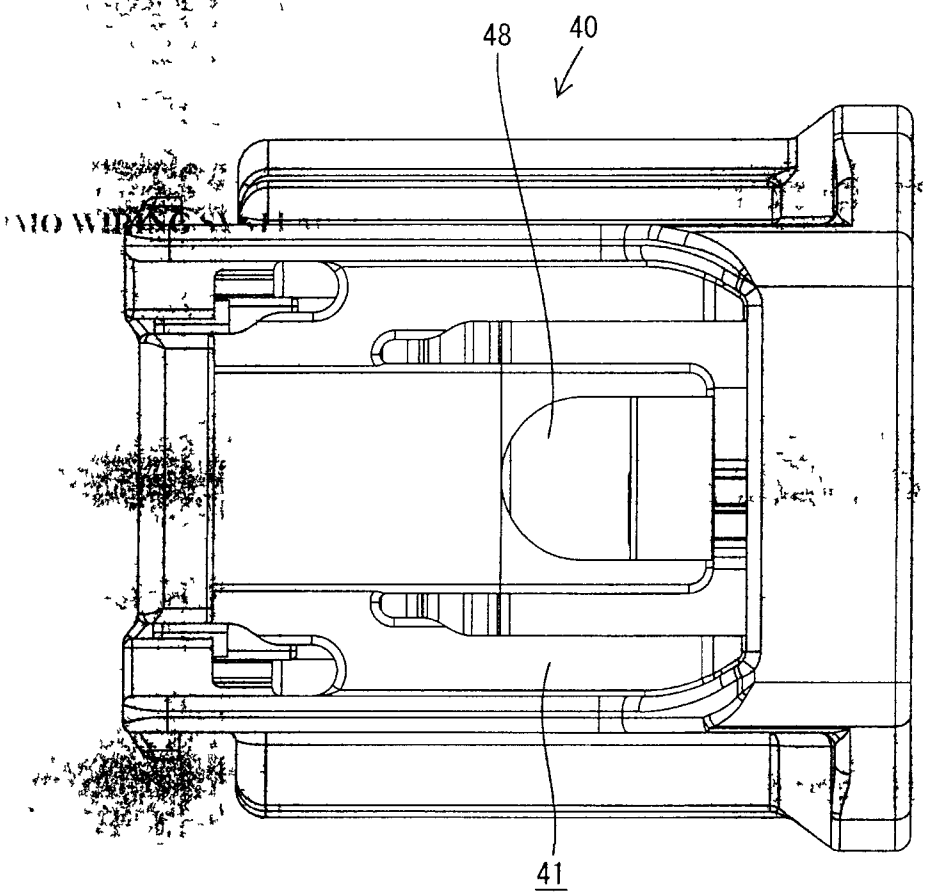
FIG. 8

(HRISHIKESH RAY CHAUDHURY)
OF REMFRY & SAGAR
ATTORNEY FOR THE APPLICANTS

ORIGINAL

0480 DEL 12

FIG. 9

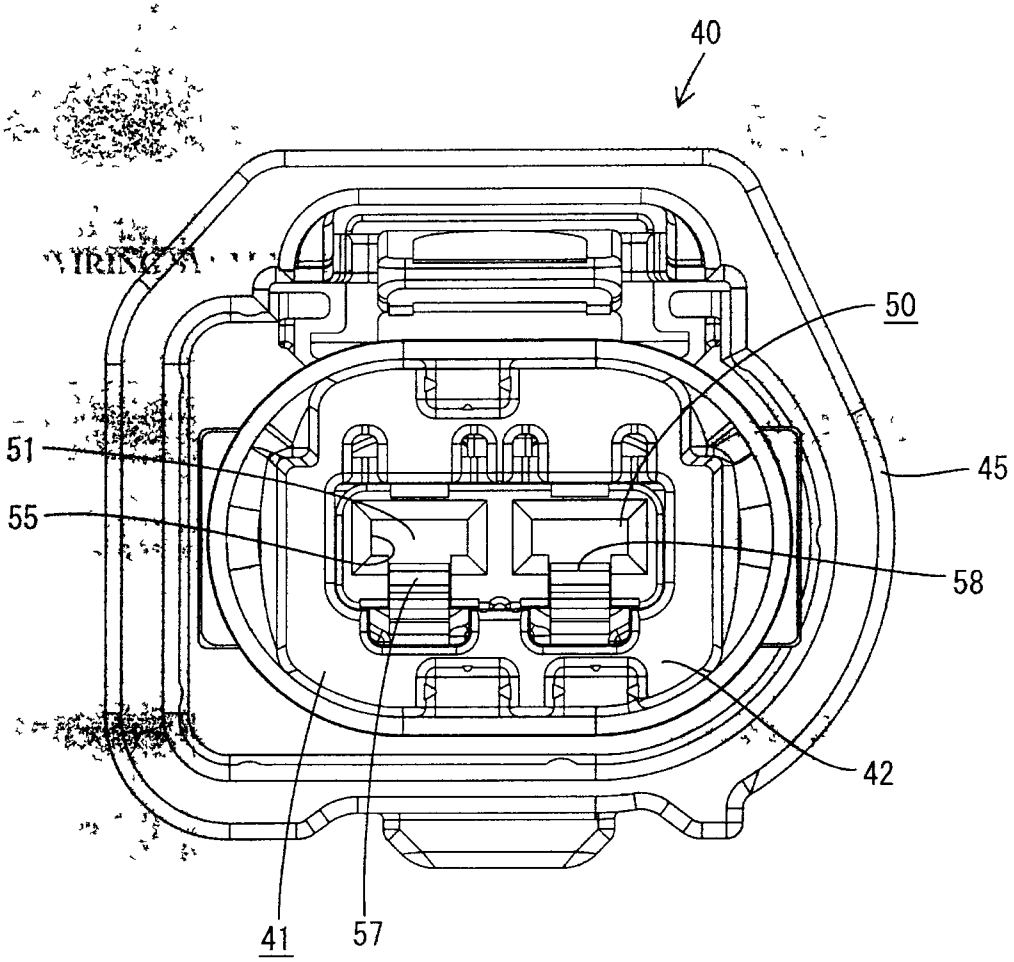


(HRISHIKESH RAY CHAUDHURY)
OF REMFRY & SAGAR
ATTORNEY FOR THE APPLICANTS

ORIGINAL

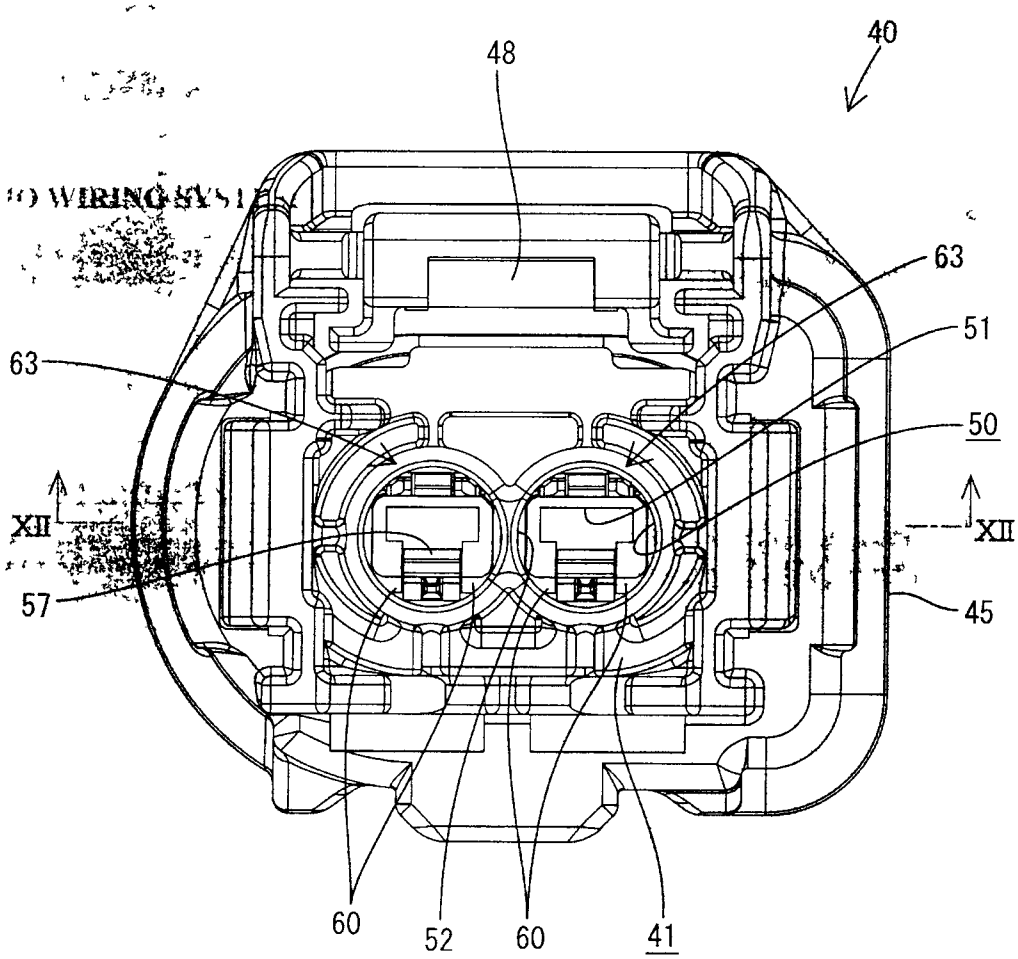
10480 DEL 12

FIG. 10



(HRISHIKESH RAY CHAUDHURY)
OF REMFRY & SAGAR
ATTORNEY FOR THE APPLICANTS

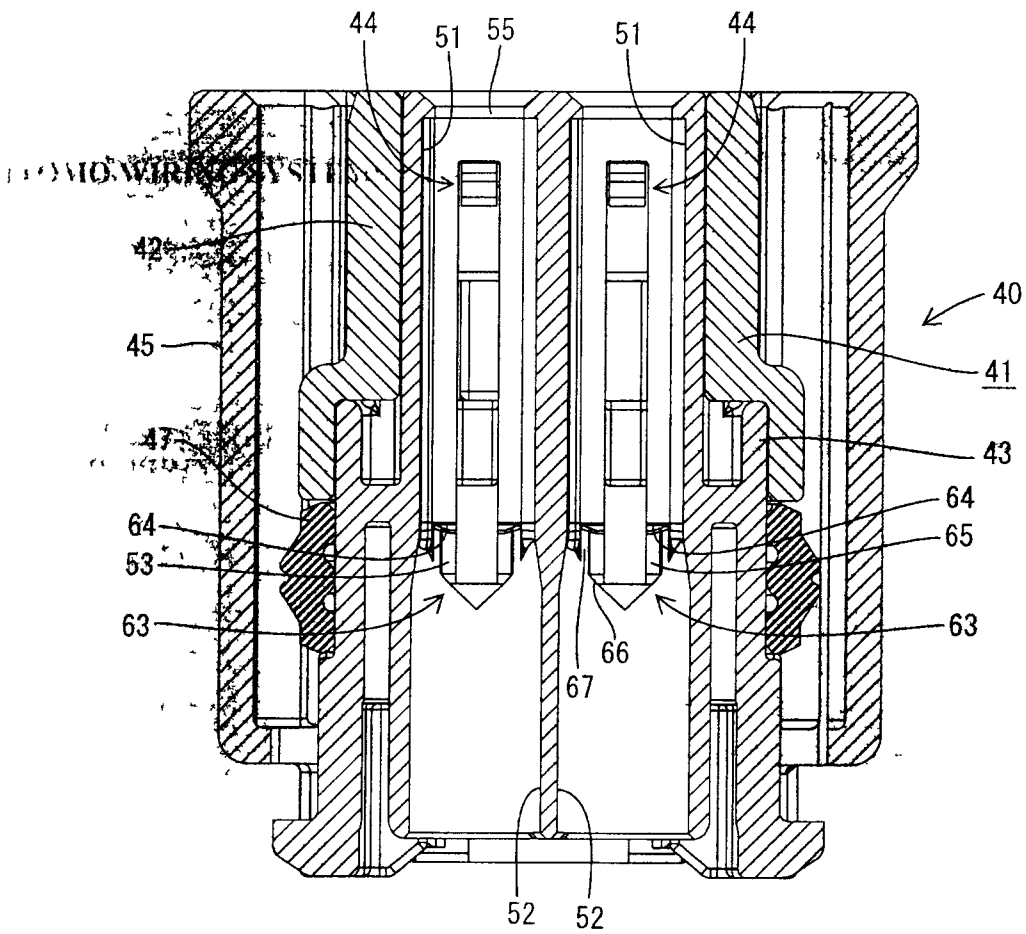
FIG. 11



(HRISHIKESH RAY CHAUDHURY)
OF REMFRY & SAGAR
ATTORNEY FOR THE APPLICANTS

ORIGINAL

FIG. 12



(HRISHIKESH RAY CHAUDHURY)
OF REMFRY & SAGAR
ATTORNEY FOR THE APPLICANTS

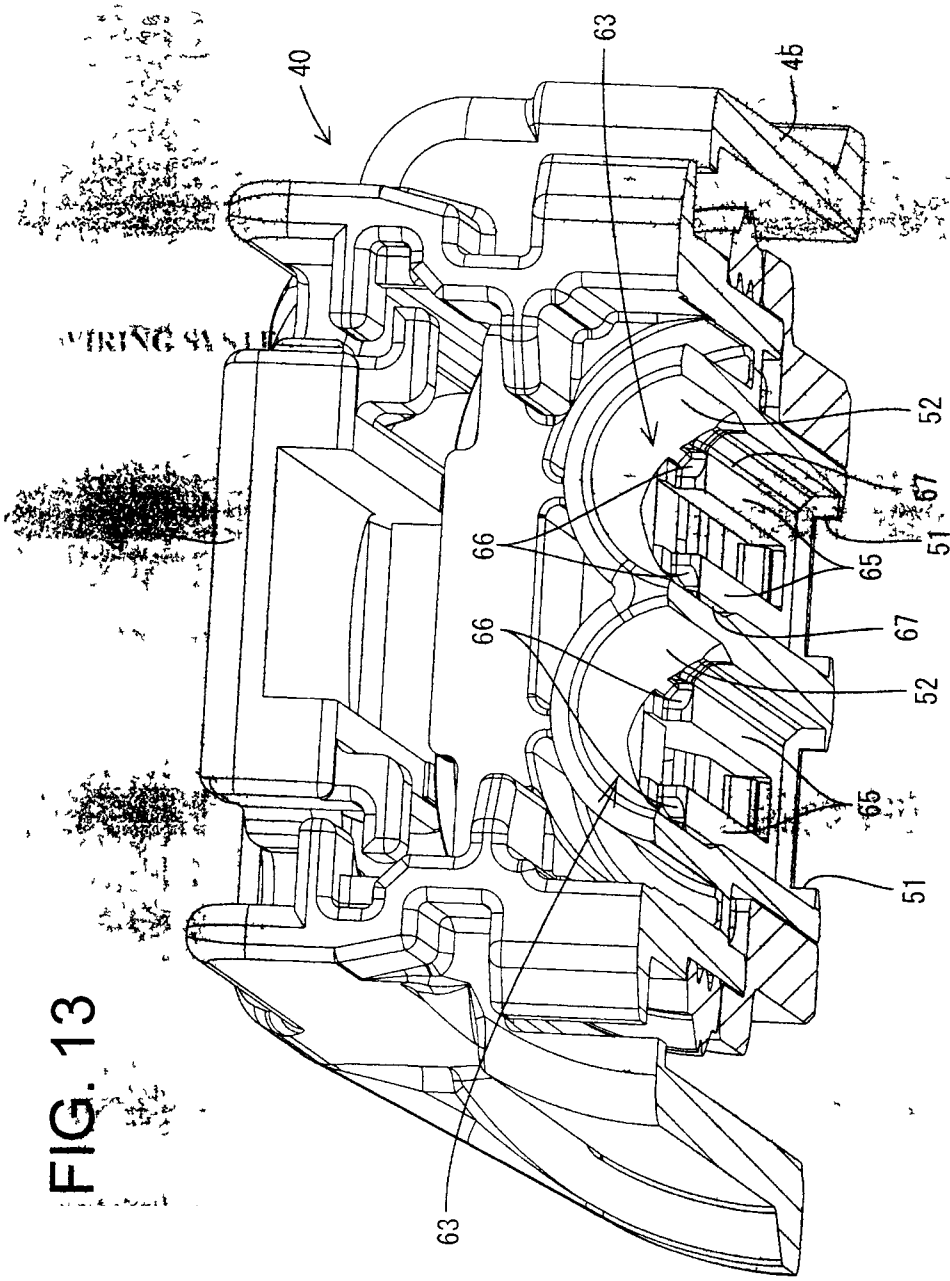


FIG. 13

(HRISHIKESH RAY CHAUDHURY)
OF REMFRY & SAGAR
ATTORNEY FOR THE APPLICANTS

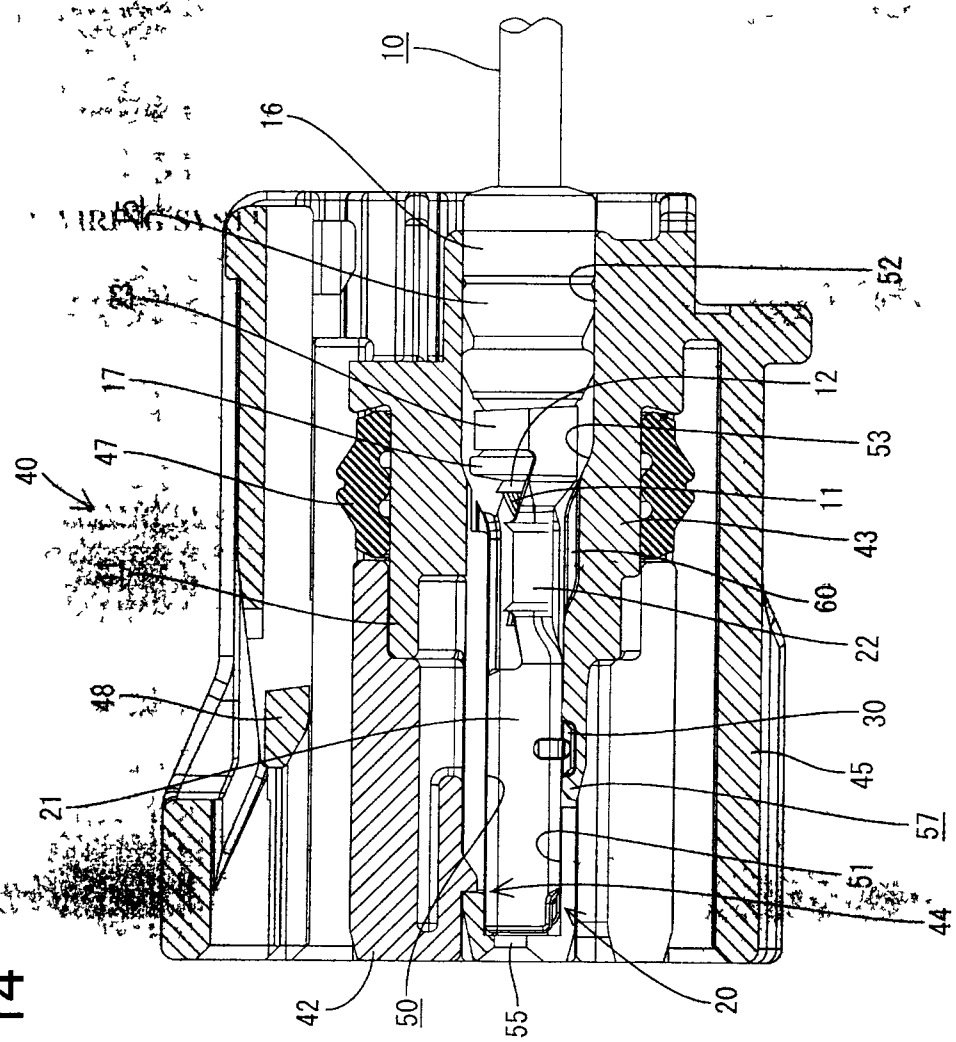


FIG. 14

(HRISHIKESH RAY CHAUDHURY)
OF REMFRY & SAGAR
ATTORNEY FOR THE APPLICANTS

10480 DEL 12

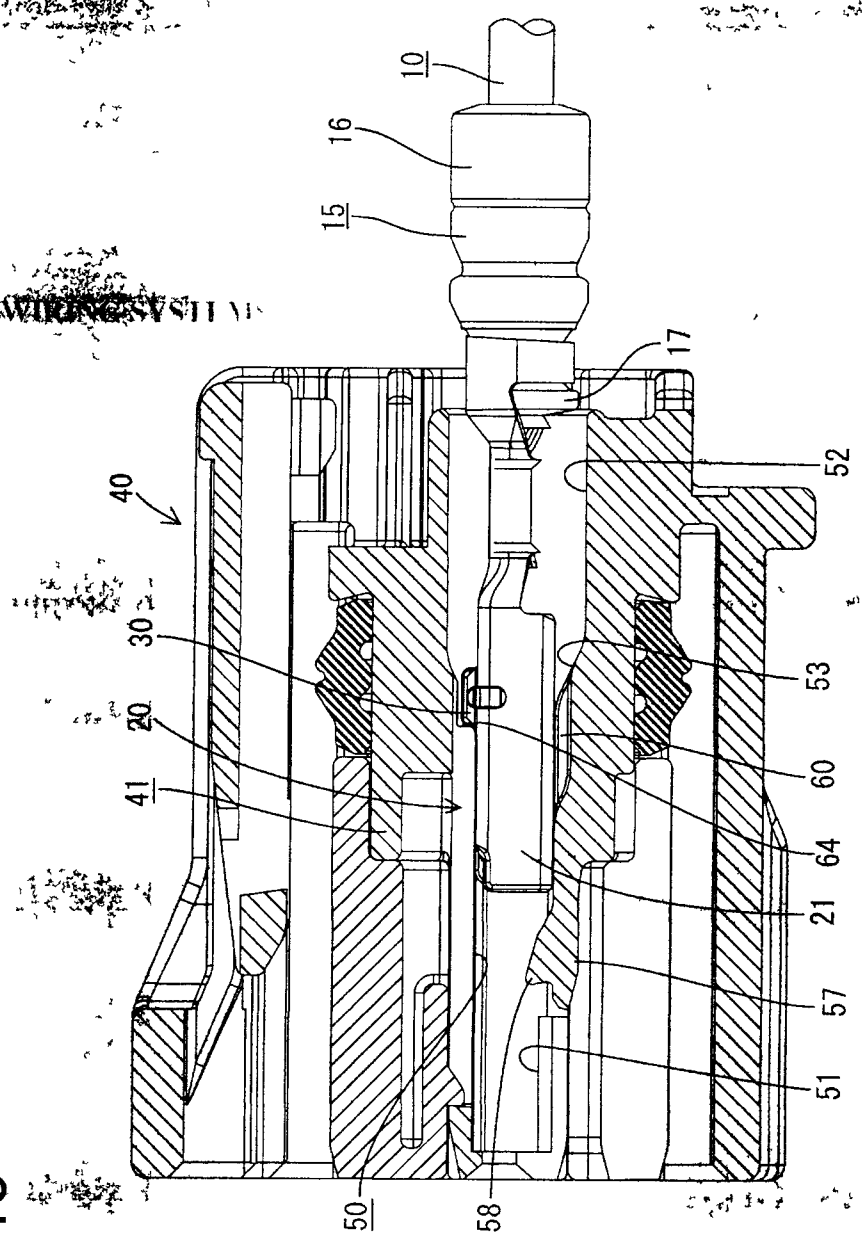


FIG 15

(HRISHIKESH RAY CHAUDHURY)
OF REMFRY & SAGAR
ATTORNEY FOR THE APPLICANTS

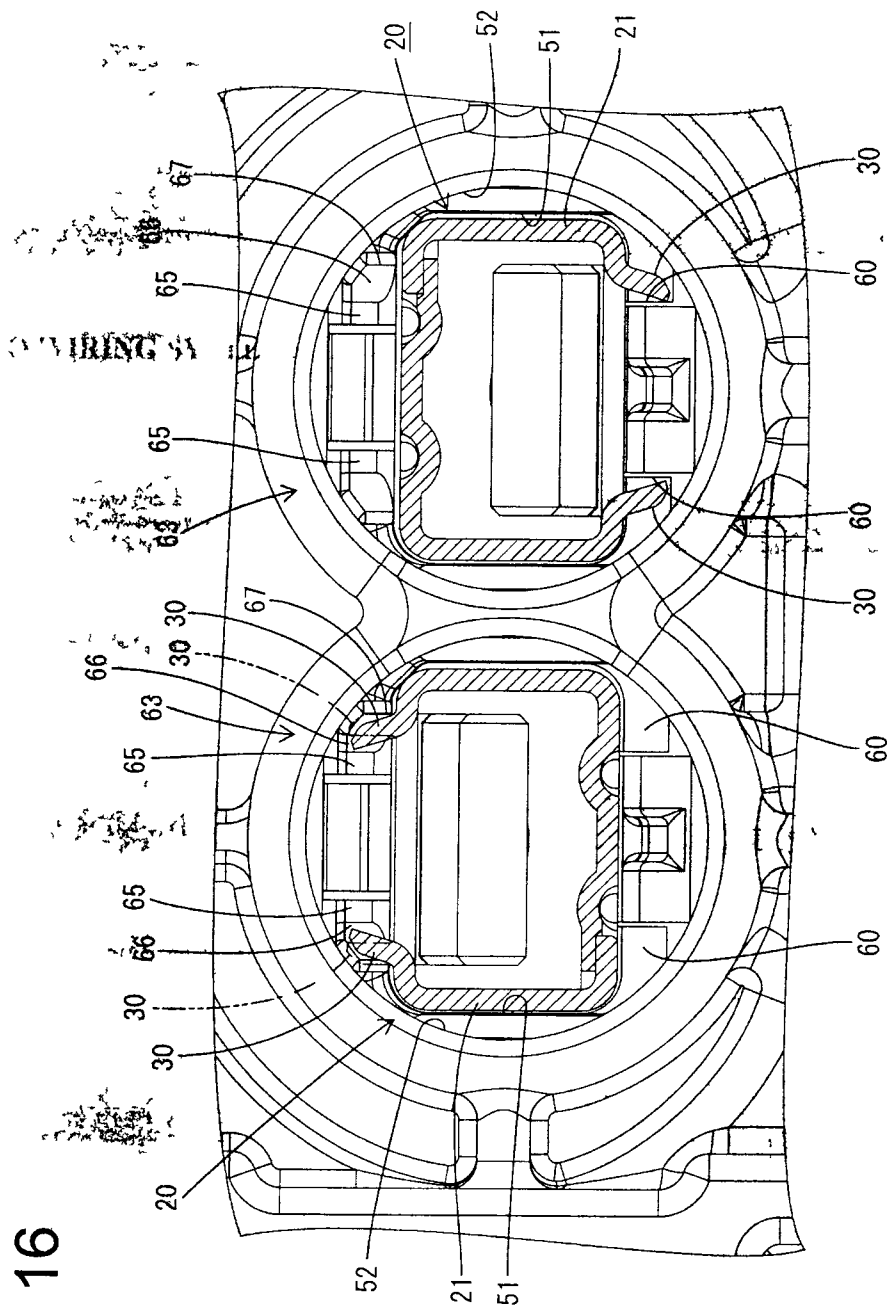
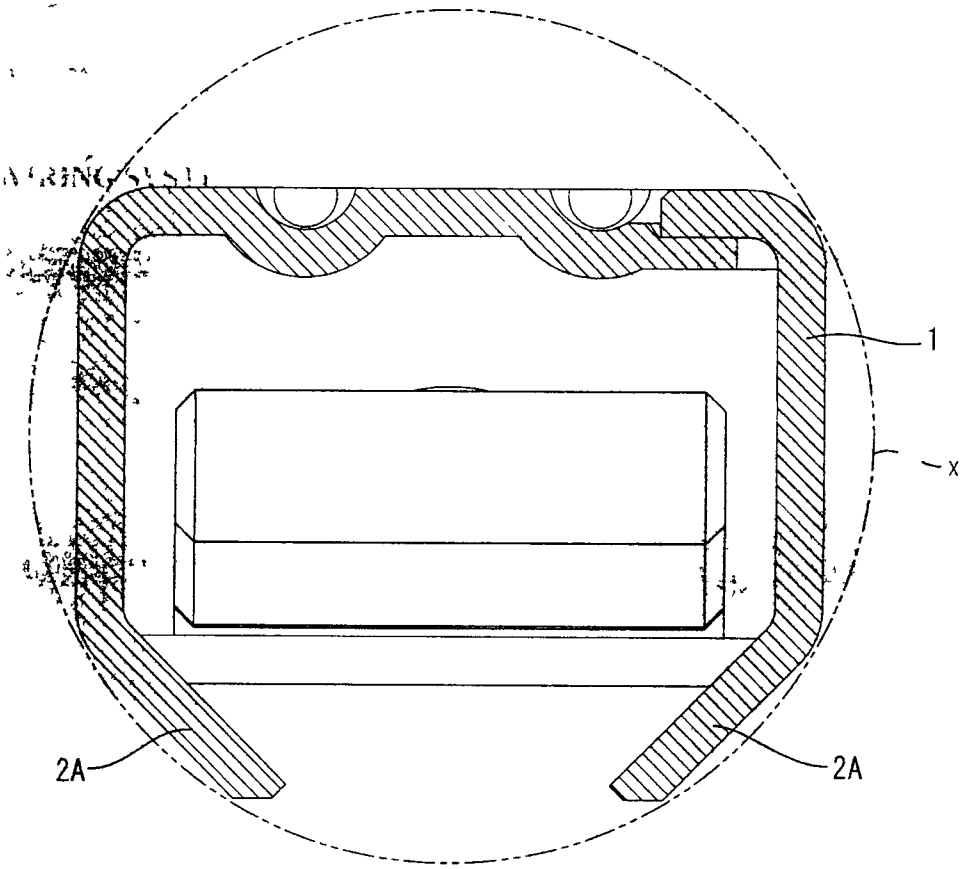


FIG. 16

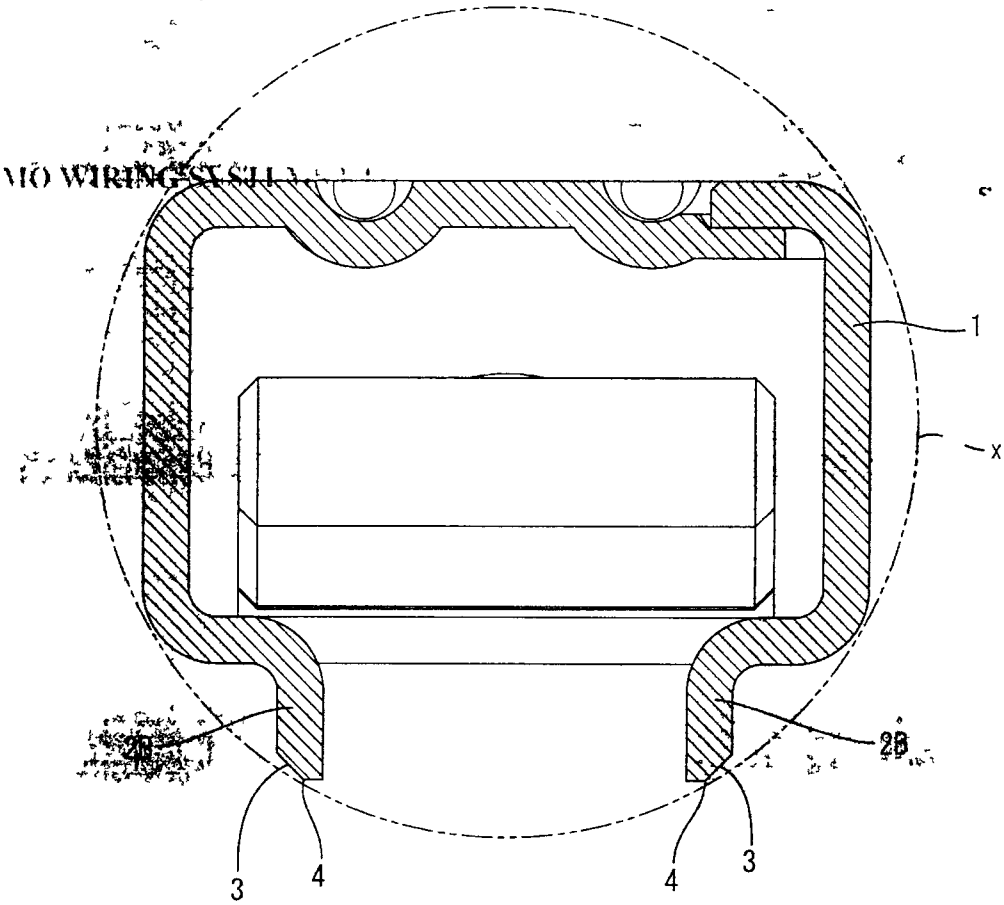
(HRISHIKESH RAY CHAUDHURY)
OF REMFRY & SAGAR
ATTORNEY FOR THE APPLICANTS

FIG. 17



(HRISHIKESH RAY CHAUDHURY)
OF REMFRY & SAGAR
ATTORNEY FOR THE APPLICANTS

FIG. 18



(HRISHIKESH RAY CHAUDHURY)
OF REMFRY & SAGAR
ATTORNEY FOR THE APPLICANTS

Terminal Fitting and Fluidproof Connector Provided Therewith

The present invention relates to a terminal fitting with one or more stabilizers for preventing inverted insertion and to a fluid- or waterproof connector provided with such a terminal fitting.

Conventionally, a terminal fitting of this type is known from Japanese Unexamined Patent Publication No. H09-97644. This terminal fitting is shaped such that a pair of stabilizers vertically extend from the opposite left and right lateral edges of the bottom surface of a main portion in the form of a rectangular tube and is crimped and connected to an end of a wire, and a rubber plug is mounted on the rear side of the terminal fitting when the terminal fitting is accommodated in an individual waterproof connector.

On the other hand, a connector housing is formed with cavities into which the terminal fittings are inserted. Specifically, each cavity is shaped to include a rectangular terminal accommodating hole into which the main portion of the terminal fitting is substantially closely inserted and a circular sealing hole provided continuous with and behind the terminal accommodating hole and having a larger diameter than the terminal accommodating hole to allow the rubber plug to be closely fitted. Further, a plurality of left and right insertion paths for permitting passage of the stabilizers provided on the terminal fitting are formed in the bottom wall of the terminal accommodating hole.

When the terminal fitting is inserted in a proper posture into the corresponding cavity of the connector housing, the main portion of the terminal

fitting is inserted to a proper position into the terminal accommodating hole while the stabilizers are inserted into the insertion paths, and the rubber plug is closely fitted into the sealing hole.

On the other hand, if the terminal fitting is inserted in a posture vertically inverted from the proper one into the cavity, the stabilizers come into contact with a hole edge portion at a side of the terminal accommodating hole vertically opposite to the side where the insertion paths are provided during insertion, whereby any further insertion is prevented to prevent erroneous insertion of the terminal fitting.

There has been a progressive requirement for miniaturization also for individual waterproof connectors for accommodating such terminal fittings. 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. For example, it is effective to set the diameter of the sealing hole close to that of a circumscribed circle of the main portion of the terminal fitting. In this case, it is particularly 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.

As an example of the above scratch preventing measure, it has been proposed to form a pair of left and right stabilizers 2A such that respective projecting ends are oblique to be closer to each other as shown in FIG. 17 so as to be located within a circumscribed circle x of a main portion 1. According to this measure, depending on the cross-sectional shape of the main portion 1, e.g. if the main portion 1 has, for example, a relatively laterally long cross-sectional shape, the stabilizers 2A need to be largely inclined and formed to be

long to ensure engaging margins with a hole edge portion of a terminal accommodating hole in the case of inverted insertion. Then, the stabilizers 2A are likely to be deformed in inclined directions when coming into contact with the hole edge portion of the terminal accommodating hole and an inverted insertion preventing function may not be fulfilled.

Further, it has been also proposed to locate a pair of left and right stabilizers 2B within a circumscribed circle x by forming the stabilizers 2B to vertically extend at positions at a predetermined distance from and inwardly of the opposite left and right lateral edges of the bottom surface of a main portion 1 toward a widthwise center as shown in FIG. 18. According to this measure, the stabilizers 2B are difficult to deform and, thus, the inverted insertion preventing function can be sufficiently fulfilled.

In this terminal fitting, to prevent the stabilizers 2B from biting into the inner peripheral surface of the sealing hole, corner portions of the outer lateral edges of projecting end surfaces of the stabilizers 2B are hammered to form C-surfaces 3. Nevertheless, so-called edges 4 are formed on the lateral edges of the chamber surfaces 3 at projecting end sides. Since these edges 4 cannot be hammered due to a receiving die of a press machine, they have to be left as they are and scratching on the inner peripheral surface of the sealing hole cannot be perfectly avoided, with the result that a waterproof function may be impaired.

The present invention was completed in view of the above situation and an object thereof is to provide a terminal fitting capable of reliably fulfilling an inverted insertion preventing function and ensuring a waterproof function.

This object is solved according to the invention by the features of the independent claims. Particular embodiments of the invention are subject of the dependent claims.

According to one aspect of the invention, there is provided a terminal fitting for a connector (particularly for a fluid- or waterproof connector in which the terminal fitting and a resilient plug are mounted on an end of a wire, the terminal fitting is at least partly inserted and accommodated into a cavity of a connector housing and the resilient plug is fitted into an entrance of the cavity to provide sealing), comprising: a main portion substantially in the form of a rectangular tube; and at least one stabilizer for preventing inverted insertion which is formed to extend from one surface of the main portion, wherein: the stabilizer is formed at a position at a specified distance from and inwardly of a lateral edge of the one surface of the main portion 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; and at least one C-surface is formed on corner portions of the outer lateral edges of extending end surface of the stabilizer and at least one R-surface is formed on lateral edge of the C-surface on a base end side of the stabilizer.

According to a particular embodiment, a pair of stabilizers are formed at positions at a specified distance from and inwardly of opposite left and right lateral edges of the one surface of the main portion toward the widthwise center to assume such oblique postures that both extending ends gradually come closer to each other, whereby the extending ends of the both stabilizers are located within a circumscribed circle of the main portion.

Particularly, C-surfaces are formed on corner portions of the outer lateral edges of extending end surfaces of the both stabilizers and R-surfaces are formed on lateral edges of the C-surfaces on base end sides of the stabilizers.

According to a further particular embodiment, there is provided a terminal fitting for a waterproof connector in which the terminal fitting and a rubber plug are mounted on an end of a wire, the terminal fitting is inserted and accommodated into a cavity of a connector housing and the rubber plug is fitted into an entrance of the cavity to provide sealing, comprising a main portion in the form of a rectangular tube; and a pair of left and right stabilizers for preventing inverted insertion which are formed to extend from one surface of the main portion, wherein the pair of stabilizers are formed at positions at a predetermined distance from and inwardly of opposite left and right lateral edges of the one surface of the main portion toward a widthwise center to assume such oblique postures that extending ends of the both stabilizers gradually come closer to each other, whereby the extending ends of the both stabilizers are located within a circumscribed circle of the main portion; and C-surfaces are formed on corner portions of the outer lateral edges of extending end surfaces of the both stabilizers and R-surfaces are formed on lateral edges of the C-surfaces on base end sides of the stabilizers.

Here, the C-surfaces particularly substantially are straight chamfered portions and the R-surfaces are curved chamfered portions.

If the entrance of the cavity is formed to be as small as possible in conformity with the circumscribed circle of the main portion including the stabilizers, the following functions and effects can be obtained. The pair of left and right stabilizers are formed at the positions inwardly of the left and right

edges of the one surface of the main portion to assume such oblique postures that the extending ends gradually come closer to each other in forming the stabilizers within the circumscribed circle of the main portion. Thus, to attain necessary engaging margins, an angle of inclination of the stabilizers can be maximally suppressed and the stabilizers can be formed to be short, whereby it is possible to make the stabilizers difficult to incline and deform and reliably fulfill an inverted insertion preventing function.

Further, by forming the C-surfaces on the corner portions of the outer lateral edges on the extending end surfaces of the respective stabilizers, interference of the extending ends of the stabilizers with the inner peripheral surface of the entrance of the cavity is avoided. Here, edges are still present on the opposite lateral edges of the C-surfaces. However, since the stabilizers are formed to be inclined obliquely inwardly, the lateral edges on the tip sides of the stabilizers out of the opposite lateral edges of the C-surfaces are located inside the circumscribed circle of the main portion and, on the other hand, the lateral edges on the base end sides are located on the circumscribed circle. Since the lateral edges on the base end sides can be hammered, the R-surfaces are further formed on the lateral edges on the base end sides of the C-surfaces. Thus, the edges that will interface with the inner peripheral surface of the entrance of the cavity are eliminated from the extending ends of the stabilizers and scratching on the inner peripheral surface of the entrance of the cavity by the stabilizers is prevented.

That is, it is possible to reliably fulfill the inverted insertion preventing function by the stabilizers and ensure a waterproof function by preventing

scratching on the inner peripheral surface of the entrance of the cavity by the stabilizers.

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

(1) The C-surface(s) is/are formed on outer corner portion(s) of front end surfaces of the stabilizers in an inserting direction of the terminal fitting and/or the R-surface(s) is/are formed on the rear edge(s) of the C-surface(s).

Even if the stabilizers come into contact with an edge portion of the entrance of the cavity in inserting the terminal fitting into the cavity, they can be smoothly inserted into the cavity by being guided by the C-surfaces and the R-surfaces on the front end surfaces of the stabilizers.

(2) A lance hole to be engaged with a locking lance provided in the cavity may be formed in the one surface of the main portion; and the pair of stabilizers may be formed by bending cut pieces at substantially opposite lateral edges of the lance hole. Furthermore, one or more reinforcing beads may be formed over the stabilizer(s), the lateral edges of the lance hole and/or side surfaces of the main portion preferably connected at right angles to the lateral edges of the lance hole to project outward more preferably by hammering. Further particularly, a lance hole to be engaged with a locking lance provided in the cavity is formed in the one surface of the main portion; the pair of stabilizers are formed by bending cut pieces at opposite left and right lateral edges of the lance hole; and reinforcing beads are formed over the stabilizers, the lateral edges of the lance hole and side surfaces of the main portion connected at right angles to the lateral edges of the lance hole to project outward by hammering.

This construction can prevent the stabilizers from being inclined and deformed more than necessary.

(3) The stabilizer may have a width shorter than the length of the lance hole in forward and backward directions and/or a short extending dimension of the stabilizer may be less than about half of the width thereof.

According to a further aspect of the invention, there is provided a water- or fluidproof connector comprising a connector housing and at least one terminal fitting according to the above aspect of the invention or a particular embodiment thereof mounted on an end of a wire together with a resilient plug is at least partly inserted and accommodated into a cavity of the connector housing so that the resilient plug is fitted into an entrance of the cavity to provide sealing.

According to a particular embodiment, the cavity is 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 wherein 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, is formed at the rear side while communicating with the terminal accommodating hole.

Particularly, the sealing hole is formed to have the same diameter as the circumscribed circle of the main portion of the terminal fitting.

Further particularly, at least one restricting portion for preventing any further insertion of the terminal fitting by the contact with the stabilizer(s) when the terminal fitting is inserted in an improper posture is formed at a hole edge portion of the terminal accommodating hole preferably including a ceiling wall of a tapered hole.

According to the above, it is possible to reliably fulfill an inverted insertion preventing function and ensure a waterproof function by preventing scratching on the inner peripheral surface of the entrance of the cavity.

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,

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

FIG. 17 is a lateral section of one conventional terminal fitting, and

FIG. 18 is a lateral section of another conventional terminal fitting.

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.

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 fodled 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/or 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 projection(s) 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 or at 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 a lenghtwise 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 1/4) 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/or 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 margins.

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 reinforcing 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.

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 stabilizer(s) 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 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 or left and 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.

As described above, in the female terminal 20 of this embodiment, the one or more, particularly the pair of lateral (left and right) stabilizers 30 are formed at the positions inwardly of the lateral (left and right) edge(s) of the outer or bottom surface of the main portion 21 to assume such oblique postures that the extending or distal end(s) are arranged more inward than the base ends thereof (particularly so that distal ends of the stabilizers 30 gradually come closer to each other) in forming or arranging the stabilizer(s) 30 within the circumscribed circle X of the main portion 21. Thus, to attain necessary engaging margins, an angle of inclination of the stabilizers 30 can be maximally suppressed and the stabilizers 30 can be formed to be short, whereby it is possible to make the stabilizers 30 difficult to incline and deform and reliably fulfill an inverted insertion preventing function.

Further, by particularly forming the C-surfaces 35A on the corner portions of the outer lateral edges of the extending end surfaces 31 of the respective stabilizers 30, interference of the extending ends of the stabilizers 30 with the

inner peripheral surface of the sealing hole 52 at the entrance side of the cavity 50 is avoided. Here, edges are still present on the opposite lateral edges of the C-surfaces 35A. However, since the stabilizers 30 are formed to be inclined obliquely inwardly, the lateral edges 38 on the tip sides of the stabilizers 30 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 are located on the circumscribed circle X. Since the lateral edges 36 on the base end sides can be hammered, the R-surfaces 37A particularly are further formed on the lateral edges on the base end sides of the C-surfaces 35A. Thus, the edges that will interface with the inner peripheral surface of the sealing hole 52 are eliminated from the extending ends of the stabilizers 30 and scratching on the inner peripheral surface of the sealing hole 52 by the stabilizers 30 is prevented.

That is, it is possible to reliably fulfill the inverted insertion preventing function by the stabilizers 30 and ensure a waterproof function by preventing scratching on the inner peripheral surface of the sealing hole 52 of the cavity 50 by the stabilizers 30.

Further, the C-surfaces 35B particularly are formed on the outer corner portions of the front end surfaces 32F of the stabilizers 30 and the R-surfaces 37B particularly are formed on the rear edges of the C-surfaces 35B. Even if the extending ends of the stabilizers 30 are caught by the lower hole edge of the sealing hole 52, for example, due to upward inclination of the main portion 21 when the female terminal 20 is at least partly inserted into the sealing hole 53 of the cavity 50, the extending ends can be smoothly inserted into the sealing hole

52 by 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.

The one or more, particularly the pair of lateral (left and right) stabilizers 30 particularly are formed by bending the cut pieces laterally of the lance hole 29, particularly at the substantially opposite (left and/or right) lateral edges of the lance hole 29, and the one or more reinforcing beads 39 particularly are formed over the stabilizers 30, the lateral edges of the lance hole 29 and the side plates 24 of the main portions 21 to project outward by hammering. This prevents the stabilizers 30 from being inclined and deformed inward more than necessary. For example, if the female terminal 20 is inserted in an inverted posture, the front end surfaces 32F of the stabilizers 30 can be reliably brought into contact with the taper surfaces 66 of the posture displacing portions 65 to displace the stabilizers 30 to the vertical postures, whereby the inverted insertion preventing function can be reliably fulfilled.

Accordingly, to provide a terminal fitting capable of reliably fulfilling an inverted insertion preventing function and ensuring a waterproof function, in a (particularly female) terminal in which a pair of left and right stabilizers 30 are formed to extend from one surface 25 of a main portion 21 substantially in the form of a rectangular or polygonal tube, the pair of stabilizers 30 are formed at positions at a specified (predetermined or predeterminable) distance D from and inwardly of substantially opposite left and right lateral edges 25E of the one surface 25 of the main portion 21 toward a widthwise center WC to assume such oblique postures that both extending ends gradually come closer to each other, whereby the extending ends of the both stabilizers 30 are located within a circumscribed circle X of the main portion 21, C-surfaces 35A are formed on

corner portions of the outer lateral edges of extending end surfaces 31 of the both stabilizers 30 and R-surfaces 37A are formed on lateral edges 36 of the C-surfaces 35A on base end sides of the stabilizers 30.

<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) The stabilizer structure in the female terminal of the present invention is effective as a scratch preventing means for the sealing hole of the cavity of the female housing which has at minimum a diameter equivalent to the diameter of the circumscribed circle of the main portion of the female terminal, but the stabilizer structure of the present invention may also be applied in the case of accommodating the female terminal into a cavity of a female housing including a sealing hole having a larger diameter.

(2) Although the female housing for accommodating the female terminal includes the posture displacing portions for displaying the postures of the stabilizers by being engaged with the stabilizers when the female terminal is inserted in an inverted posture in the above embodiment, these posture displacing portions may be omitted.

(3) The pair of left and right stabilizers may be formed to be displaced in forward and backward directions, and such stabilizers are also included in the technical scope of the present invention.

(4) The present invention is similarly applicable to male terminals without being limited to the female terminal illustrated in the above embodiment.

LIST OF REFERENCE NUMERALS

10 ... wire

15 ... rubber plug (resilient plug or member)

20 ... female terminal (terminal fitting)

21 ... main portion

24 ... side plate (side surface)

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

25E ... lateral edge

29 ... lance hole

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

39 ... reinforcing bead

40 ... female housing (connector housing)

50 ... cavity

51 ... terminal accommodating hole

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

57 ... locking lance

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