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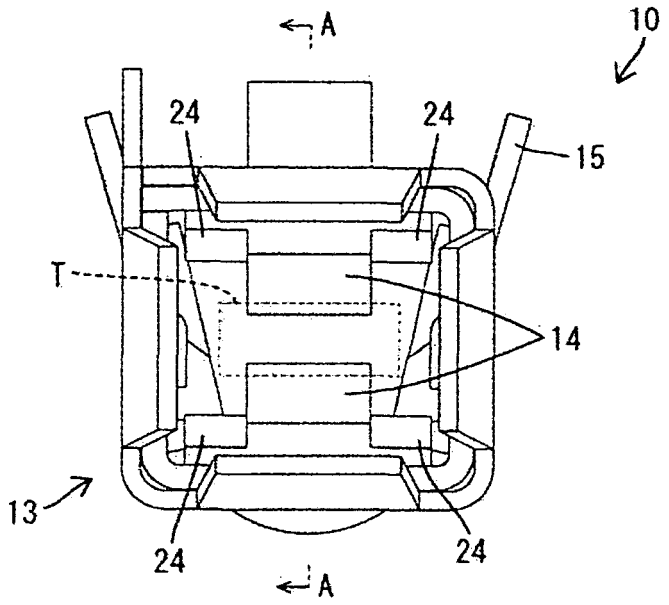
(54) Terminal fitting

(57) An object of the present invention is to prevent the posture inclination of a resilient contact piece.

A terminal fitting 10 includes a rectangular tube portion 13 into which a tab T is to be inserted from front, resilient contact pieces 14 which extend along an inserting direction of the tab T in the rectangular tube portion 13 and come into contact with the tab T inserted into the rectangular tube portion 13 while being resiliently deformed, and a pair of resilient pieces 24 which extend from opposite side edges of each resilient contact piece 14 in a width direction and are able to resiliently come into contact with an inner wall surface of the rectangular tube portion 13.

FIG. 1



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Description

[0001] The present invention relates to a terminal fitting.

[0002] Japanese Unexamined Patent Publication No. 2003-045536 discloses such a female terminal fitting that a resilient contact piece extending along an inserting direction of a tab is accommodated in a rectangular tube portion, into which the tab is to be inserted, and the plate-like tab inserted into the rectangular tube portion is electrically conductively connected by being sandwiched between the resiliently deformed resilient contact piece and a pressure receiving wall portion constituting the rectangular tube portion.

[0003] When the above terminal fitting is subjected to vibration or impact, the posture of the resilient contact piece may be so inclined that there is a height difference between opposite side edges in a width direction. If the resilient contact piece is inclined, a clearance is formed between the resilient contact piece and the tab and a contact state becomes unstable. Therefore, a countermeasure is desired.

[0004] The present invention was completed in view of the above situation and an object thereof is to prevent the posture inclination of a resilient contact piece.

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

[0006] According to the invention, there is provided a terminal fitting, comprising: a tube portion into which a tab is to be at least partly inserted in an insertion direction; at least one resilient contact piece which substantially extends along the inserting direction of the tab in the tube portion and comes into contact with the tab inserted into the tube portion while being resiliently deformed; and one or more resilient pieces which extend from the resilient contact piece in a width direction and are able to resiliently come into contact with an inner wall surface of the tube portion.

[0007] Even if an external force acts to incline the posture of the resilient contact piece, the posture inclination of the resilient contact piece is prevented since the one or more resilient pieces resiliently come into contact with the inner wall surface of the tube portion.

[0008] According to a particular embodiment, a pair of resilient pieces is provided which extend from substantially opposite side edges of the resilient contact piece in the width direction.

[0009] According to a further particular embodiment, there is provided a terminal fitting, comprising a rectangular tube portion into which a tab is to be inserted from front; a resilient contact piece which extends along an inserting direction of the tab in the rectangular tube portion and comes into contact with the tab inserted into the rectangular tube portion while being resiliently deformed; and a pair of resilient pieces which extend from opposite side edges of the resilient contact piece in a width direction and are able to resiliently come into contact with an inner wall surface of the rectangular tube portion.

[0010] Even if an external force acts to incline the posture of the resilient contact piece, the posture inclination of the resilient contact piece is prevented since the pair of resilient pieces resiliently come into contact with the inner wall surface of the rectangular tube portion.

[0011] Particularly, the resilient contact piece extends from a supporting wall portion forming part of the tube portion; and/or the resilient piece(s) extend(s) from a base end portion of the resilient contact piece.

[0012] Further particularly, the resilient contact piece extends from a supporting wall portion constituting the rectangular tube portion; and the resilient pieces extend from a base end portion of the resilient contact piece.

[0013] The supporting wall portion has a high rigidity and is difficult to deform since it constitutes the rectangular tube portion. Accordingly, the base end portion of the resilient contact piece linked to the supporting wall portion is also difficult to incline and deform. In addition, since the base end portion of this resilient contact piece is reinforced by the resilient pieces, the rigidity of the base end portion of the resilient contact piece is increased. In this way, the posture inclination of the resilient contact piece is reliably prevented.

[0014] Further particularly, the terminal fitting further comprises a shell which is a component separate from the resilient contact piece, at least partly surrounds the resilient contact piece and forms part of the tube portion.

[0015] Specifically, the terminal fitting further comprises a shell which is a component separate from the resilient contact piece, surrounds the resilient contact piece and constitutes the rectangular tube portion.

[0016] If a rectangular tube portion is entirely formed to be integral to the resilient contact piece, the rectangular tube portion and the resilient contact piece may present design restrictions to each other. In that respect, a degree of freedom in designing the resilient contact piece and the rectangular tube portion is high in the present invention since the rectangular tube portion is formed using the shell that is separate from the resilient contact piece.

[0017] Further particularly, the terminal fitting further comprises at least one restricting portion which is formed at the (particularly rectangular) tube portion and restricts displacements of the resilient piece(s) in an extending direction of the resilient piece(s) by being resiliently brought into contact with the extending end(s) of the resilient piece(s).

[0018] When the resilient pieces come into contact with the restricting portion while the tab is inserted into the rectangular tube portion to resiliently come into contact with the resilient contact piece, resilient deformation amounts of the resilient pieces increase thereafter. Therefore, an inclination preventing effect by resilient restoring forces of the resilient pieces is enhanced.

[0019] Further particularly, the base end portion of the resilient contact piece is reinforced by the one or more resilient pieces such that the rigidity of the base end por-

tion of the resilient contact piece is increased.

[0020] Further particularly, a front end part of the supporting portion serves as a front frame-like portion having a high rigidity by continuously extending over the entire circumference and/or wherein a rear end part of the supporting portion serves as a rear frame-like portion having a high rigidity by continuously extending over the entire circumference.

[0021] Further particularly, the resilient contact piece is formed in the supporting wall portion by cutting and bending, wherein a cut area of the resilient contact piece in forward and backward directions is a range from the rear end of the front frame-like portion to the front end of the rear frame-like portion.

[0022] Further particularly, a base end portion of the resilient contact piece is directly linked to the front frame-like portion.

[0023] Further particularly, an extending end of the resilient contact piece and/or an extending end of the resilient piece is located such as to be held in contact with or proximately face the inner surface of the tube portion and/or wherein an extending end of the resilient piece

[0024] Further particularly, an extending end of the resilient piece is substantially facing an extending end of the restricting portion substantially along forward and backward directions while particularly being spaced apart.

[0025] Further particularly, a base end portion of the resilient contact piece is wider than an area behind it and the widened part(s) particularly serve(s) as a pair of projecting portions projecting in the width direction.

[0026] 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 front view of a terminal fitting according to a first embodiment,
FIG. 2 is a front view of a terminal main body,
FIG. 3 is a front view of a shell,
FIG. 4 is a section along A-A of FIG. 1,
FIG. 5 is a section along A-A showing a state where the insertion of a tab into a rectangular tube portion is started,
FIG. 6 is a section along A-A showing a state where the insertion of the tab progresses and extending ends of resilient pieces are in contact with restricting portions,
FIG. 7 is a section along A-A showing a state where the insertion of the tab is completed,
FIG. 8 is a plan view of the terminal main body,
FIG. 9 is a section along B-B of FIG. 2,
FIG. 10 is a plan view of the shell,
FIG. 11 is a section along C-C of FIG. 3,
FIG. 12 is a perspective view of a terminal fitting according to a second embodiment,
FIG. 13 is a side view of the terminal fitting,
FIG. 14 is a section along D-D of FIG. 13,
FIG. 15 is a section along E-E of FIG. 13,
FIG. 16 is a section along E-E showing a state where a tab is inserted in a rectangular tube portion,
FIG. 17 is a section of a terminal fitting according to a third embodiment, and
FIG. 18 is a section of a terminal main body according to the third embodiment.

<First Embodiment>

[0027] Hereinafter, a first specific embodiment of the present invention is described with reference to FIGS. 1 to 11. A terminal fitting 10 of this first embodiment is shaped to be long and narrow in forward and backward directions as a whole particularly by assembling a terminal main body 11 and a shell 12 which are components separate from each other as shown in FIGS. 4 to 7. A front area (particularly a substantially half area) of the terminal fitting 10 at or near a front end side in forward and backward directions FBD is a (particularly substantially rectangular or polygonal) tube portion 13 into which a tab T of a male terminal is to be at least partly inserted from front, and one or more resilient contact pieces 14 to be resiliently brought into contact with the tab T are provided at (particularly at least partly accommodated in) the (particularly substantially rectangular or polygonal) tube portion 13. A rear area (particularly a substantially half area of) the terminal fitting 10 at or near a rear end side is a wire connection portion which is to be connected to a wire and particularly comprises at least one wire crimping portion 15 in the form of at least one open barrel which is crimped and connected to the wire.

[0028] The terminal main body 11 is formed by applying bending, folding and/or embossing and the like to a conductive (particularly metal) plate material punched out or cut into a specified (predetermined or predeterminable) shape. As shown in FIGS. 2, 4, 8 and 9, a front end area of the terminal main body 11 is a (particularly substantially box-shaped) supporting portion 16 constituting or forming part of the tube portion 13 and a rear end area of the terminal main body 11 is or forms part of the wire connection portion (particularly the wire crimping portion 15). The (box-shaped) supporting portion 16 specifically is formed in the shape of a (particularly substantially rectangular or polygonal) tube by including a lower wall portion 17 (as a particular supporting wall portion), one or more, particularly a pair of side wall portions 18 projecting or standing up at an angle different from 0° or 180°, preferably substantially at a right angle from (particularly both lateral (left and right) edges of) the lower wall portion 17 and an upper wall portion 19 (as a particular supporting wall portion) extending at an angle different from 0° or 180°, preferably substantially at a right angle from (particularly the distal or upper end edge of) one side wall portion 18.

[0029] As shown in FIGS. 2, 4, 8 and 9, a front end part of the (particularly substantially box-shaped) supporting portion 16 serves as a front frame-like portion 20 particularly having a high rigidity by continuously extending over the entire circumference. As shown in FIGS. 4, 8 and 9, a rear end part of the (particularly substantially box-shaped) supporting portion 16 serves as a rear frame-like portion 21 particularly having a high rigidity by continuously extending over the entire circumference. The lateral (left and/or right) side wall portion(s) 18 particularly is/are in the form of flat plates in their entireties, such as, without being cut and bent or perforated.

[0030] As shown in FIGS. 4 to 9, the lower wall portion 17 and the upper wall portion 19 particularly are formed with a pair of substantially vertically symmetric resilient contact pieces 14 particularly by cutting and bending. A cut area of the resilient contact pieces 14 in forward and backward directions FBD is a range from the rear end of the front frame-like portion 20 to the front end of the rear frame-like portion 21. The resilient contact pieces 14 particularly substantially extend backward (or in the inserting direction ID) in a cantilever manner from a front portion of the supporting portion 16, particularly from the front frame-like portion 20. That is, base end portions 14F of the resilient contact pieces 14 particularly are directly linked to the front frame-like portion 20. As shown in FIGS. 4 to 7, the shapes of the resilient contact pieces 14 viewed sideways (in a direction crossing an inserting direction ID of the tab T into the tube portion 13 and/or opposite vertical directions in which the pair of resilient contact pieces 14 are facing) are curved to bulge inward and/or toward the mating resilient contact pieces 14. Specifically, a part where a facing distance (vertical distance) between the both resilient contact pieces 14 is shortest serves as a contact portion 22 with the tab T.

[0031] As shown in FIGS. 2 and 8, a formation area of the resilient contact pieces 14 in the width direction (or a direction intersecting the inserting direction ID and/or forward and backward directions FBD) is intermediate parts (particularly substantially central parts) of the lower wall portion 17 and the upper wall portion 19. Further, as shown in FIG. 8, the base end portion 14F of the resilient contact piece 14 particularly is wider than an area behind it and the widened parts particularly serve as a pair of (particularly substantially bilaterally symmetric) projecting portions 23 projecting in the width direction WD. The lower wall portion 17 and/or the upper wall portion 19 particularly are (particularly each) formed with one or more, particularly a pair of resilient pieces 24 substantially extending backward (or in the inserting direction ID) in a cantilever manner from (the pair of) projecting portions 23 (base portion 14F of the resilient contact piece 14). The pair of resilient pieces 24 formed on the (particularly each) resilient contact piece 14 particularly substantially are bilaterally symmetric. Further, the resilient piece(s) 24 of the lower wall portion 17 and that/those of the upper wall portion 19 particularly are vertically symmetric. Length(s) of the resilient piece(s) 24 in forward and backward directions FBD particularly is/are shorter than that/those of the resilient contact piece(s) 14. Further, the rear end(s) (extending end(s)) of the resilient piece(s) 24 particularly is/are located more backward than the contact portion 22. The shape(s) of the resilient piece(s) 24 viewed sideways particularly is/are curved to bulge toward the mating resilient piece(s) 24.

[0032] As shown in FIGS. 3, 10 and 11, the shell 12 includes a lower plate portion 25, one or more, particularly a pair of side plate portions 26 projecting or standing up at an angle different from 0° or 180°, preferably substantially at a right angle from (particularly the both lateral (left and right) edges of) the lower plate portion 25 and an upper plate portion 27 extending at an angle different from 0° or 180°, preferably substantially at a right angle from particularly the distal or upper end edge of) one side plate portion 26. The lower plate portion 25 and the upper plate portion 27 particularly are each formed with one or more, particularly a pair of restricting portions 28 extending obliquely inwardly of the shell 12 toward the front particularly by cutting and bending. The pair of restricting portions 28 particularly substantially are bilaterally symmetric with each other. Further, the resilient pieces 24 of the lower wall portion 25 and those of the upper plate portion 27 particularly substantially are vertically symmetric with each other.

[0033] As shown in FIGS. 4 to 7, the shell 12 particularly is to be assembled with the terminal main body 11 to be externally mounted on the (substantially box-shaped) supporting portion 16. In a state where the shell 12 is assembled, the tube portion 13 at least partly is formed by the shell 12 and the supporting portion 16. The lower plate portion 25 and the lower wall portion 17 at least partly overlap substantially in surface contact with each other, the lateral (left and/or right) side plate portion (s) 26 and the lateral (left and/or right) side wall portion (s) 18 (also) at least partly overlap substantially in surface contact with each other, and/or the upper plate portion 27 and the upper wall portion 19 (also) at least partly overlap substantially in surface contact with each other.

[0034] As shown in FIGS. 4 to 7, the rear end(s) (extending end(s)) of the resilient contact piece(s) 14 particularly is/are located in the vertical direction to be held in contact with or proximately face the inner surface of the upper plate portion 27 or the inner surface of the lower plate portion 25. The rear end(s) (extending end(s)) of the resilient piece(s) 24 particularly is/are located in the vertical direction to be held in contact with or proximately face the inner surface of the upper plate portion 27 or the inner surface of the lower plate portion 25. Further, as shown in FIG. 4, the rear end(s) (extending end(s)) of the resilient piece(s) 24 particularly is/are facing the front end(s) (extending end(s)) of the restricting portion(s) 28 from front in forward and backward directions FBD while particularly being spaced apart.

[0035] Next, functions of this first embodiment are described. In the process of inserting the tab T into the rectangular tube portion 13, the tab T contacts the one or

more contact pieces 14 (particularly at least partly thrusts itself between the upper and lower resilient contact pieces 14), whereby the (both) resilient contact piece(s) 14 is/are resiliently deformed outwardly (particularly to vertically move away from each other) while displacing the contact portion 22 obliquely backward as shown in FIG. 5. As the resilient contact piece(s) 14 is/are resiliently deformed, the resilient piece(s) 24 is/are resiliently deformed outwardly (particularly to vertically move away from each other) with the extending end(s) thereof held in contact with the upper plate portion 27 or the lower plate portion 25, and/or the extending end(s) of the resilient piece(s) 24 is/are displaced backward while sliding in contact with the upper plate portion 27 or the lower plate portion 25.

[0036] When the insertion of the tab T progresses, the extending end(s) of the resilient piece(s) 24 come(s) into contact with the front end(s) of the restricting portions 28 as shown in FIG. 6 and cannot be displaced backward thereafter even if the insertion of the tab T and the resilient deformation of the resilient contact piece(s) 14 further progress. Thus, as the insertion of the tab T and the resilient deformation of the resilient contact piece(s) 14 further progress, resilient deformation amount(s) and resilient restoring force(s) of the resilient piece(s) 24 increase. As shown in FIG. 7, the resilient deformation amount(s) and resilient restoring force(s) of the resilient piece(s) 24 are maximized when the inserting operation of the tab T is completed.

[0037] The terminal fitting 10 of this first embodiment includes the tube portion 13 into which the tab T is to be at least partly inserted in the inserting direction ID (particularly substantially from front), and the resilient contact piece(s) 14 that extend(s) substantially along the inserting direction ID of the tab T in the tube portion 13 and come(s) into contact with the tab T inserted into the tube portion 13 while being resiliently deformed. In the case of such a terminal fitting 10, the posture(s) of the resilient contact piece(s) 14 may be so inclined that there is a height difference between opposite side edges in the width direction when the terminal fitting 10 is subjected to vibration or impact. As a result, clearances may be formed between the tab T and the resilient contact pieces 14 and a contact state may become unstable.

[0038] However, the terminal fitting 10 of this first embodiment particularly includes the one or more, particularly the pair of resilient pieces 24 that extend from the opposite side edges of each resilient contact piece 14 in the width direction WD and can resiliently come into contact with the inner wall surface of the tube portion 13. Thus, even if an external force acts to incline the posture of the resilient contact piece 14, the one or more, particularly the pair of resilient pieces 24 resiliently come into contact with the inner wall surface of the tube portion 13 (inner surface of the upper plate portion 27 or the lower plate portion 25), wherefore the posture inclination of the resilient contact piece 14 is prevented.

[0039] The resilient contact piece(s) 14 particularly substantially extend from the lower wall portion 17 and/or the upper wall portion 19 constituting or forming part of the (particularly substantially rectangular or polygonal) tube portion 13 and the resilient piece(s) 24 extend from the base end portion(s) 14F of the resilient contact piece (s) 14. The lower wall portion 17 and the upper wall portion 19 particularly have a high rigidity and are difficult to deform since they form the (particularly substantially rectangular or polygonal) tube portion 13. Thus, the base end portion(s) 14F of the resilient contact piece(s) 14 linked to these lower wall portion 17 and/or upper wall portion 19 are also difficult to incline and deform. In addition, since the base end portion(s) 14F of the resilient contact piece(s) 14 is/are reinforced by the one or more resilient pieces 24, the rigidity of the base end portion(s) 14F of the resilient contact piece(s) 14 is increased. In this way, the posture inclination of the resilient contact pieces 14 is reliability prevented.

[0040] Further, the terminal fitting 10 particularly includes the one or more restricting portions 28 that are formed at the tube portion 13 and restrict displacements of the resilient piece(s) 24 in its/their extending directions by being resiliently brought into contact with the extending end(s) of the resilient piece(s) 24. According to this configuration, if the resilient piece(s) 24 come(s) into contact with the restricting portion(s) 28 while the tab T is at least partly inserted into the tube portion 13 to resiliently come into contact with the resilient contact piece(s) 14, resilient deformation amount(s) of the resilient piece(s) 24 increase(s) thereafter. In this way, an inclination preventing effect by resilient restoring force(s) of the resilient piece(s) 24 is enhanced.

[0041] If a rectangular tube portion is entirely formed to be integral to resilient contact pieces, the rectangular tube portion and the resilient contact pieces may present design restrictions to each other. In that respect, the terminal fitting 10 of this first embodiment particularly includes the shell 12 that is a component separate from the resilient contact pieces 14, at least partly surround the resilient contact piece(s) 14 and constitutes or forms part of the tube portion 13. That is, the tube portion 13 particularly is formed using the shell 12 separate from the resilient contact piece(s) 14. Therefore, a degree of freedom in designing the resilient contact pieces 14 and the rectangular tube portion 13 is high.

[0042] Accordingly, to prevent the posture inclination of a resilient contact piece, a terminal fitting 10 includes a tube portion 13 into which a tab T is to be at least partly inserted in an insertion direction ID, one or more resilient contact pieces 14 which substantially extend along the inserting direction ID of the tab T in the tube portion 13 and come(s) into contact with the tab T at least partly inserted into the tube portion 13 while being resiliently deformed, and one or more, particularly a pair of resilient pieces 24 which extend from (particularly opposite side edges of) the resilient contact piece(s) 14 in a width direction WD and is/are able to resiliently come into contact with an inner wall surface of the tube portion 13.

<Second Embodiment>

[0043] Next, a second specific embodiment of the present invention is described with reference to FIGS. 12 to 16. A terminal fitting 30 of this second embodiment is shaped to be long and narrow in forward and backward directions FBD as a whole particularly by assembling a terminal main body 31 and a shell 32 which are components separate from each other as shown in FIGS. 12, 15 and 16. A front area (particularly a substantially half area) of the terminal fitting 30 at a front end side in forward and backward directions FBD is a (particularly substantially rectangular or polygonal) tube portion 33 into which a tab T of a male terminal is to be at least partly inserted in an insertion direction ID, e.g. substantially from front. One or more resilient contact pieces 34 to be resiliently brought into contact with the tab T are at least partly accommodated in or provided at the tube portion 33. A rear area (particularly a substantially half area) of the terminal fitting 30 at a rear end side is a wire connection portion which is to be connected to a wire and particularly comprises at least one wire crimping portion 35 in the form of an open barrel which is crimped, bent or folded and connected to the wire.

[0044] The terminal main body 31 particularly is formed by applying bending, folding and/or embossing and the like to a conductive (particularly metal) plate material punched out or cut into a specified (predetermined or predeterminable) shape. A front end area of the terminal main body 31 is a contact functioning portion 36 and/or a rear end area of the terminal main body 31 is the wire connection portion (particularly the wire crimping portion 35). The contact functioning portion 36 particularly includes at least one supporting portion 37, one or more, particularly a pair of resilient contact pieces 34 and one or more, particularly two pairs of resilient pieces 42. As shown in FIGS. 12, 14 to 16, the supporting portion 37 includes a lower wall portion 38 and a pair of side wall portions 39 (as a particular supporting wall portion) projecting or standing up at an angle different from 0° or 180°, preferably substantially at a right angle from (particularly both lateral (left and right) edges of) the lower wall portion 38.

[0045] As shown in FIGS. 12, 15 and 16, the one or more, particularly the pair of resilient contact pieces 34 substantially extend forward (direction opposite to an inserting direction ID of the tab T into the tube portion 33 in forward and backward directions FBD) particularly in a cantilever manner from the side wall portion(s) 39 and/or particularly substantially bilaterally symmetric. The shapes of the resilient contact pieces 34 viewed from above (in a direction crossing the inserting direction ID of the tab T into the tube portion 33 and/or opposite lateral directions in which the pair of resilient contact pieces 34 substantially are facing) particularly are curved to bulge toward the mating resilient contact pieces 34. A part where a facing distance (lateral distance) between the both resilient contact pieces 34 particularly is shortest serves as a contact portion 40 with the tab T.

[0046] As shown in FIG. 12, a front end part (extending end part) of the resilient contact piece 34 particularly has a larger height than an area behind it, and this widened part serves as one or more, particularly a pair of (particularly substantially vertically symmetric) projecting portions 41 vertically projecting from both upper and lower edges of the resilient contact piece 34. Each resilient contact piece 34 particularly is formed with one or more, particularly a pair of resilient pieces 42 substantially extending backward in a cantilever manner from the pair of projecting portions 41 (extending end part of the resilient contact piece 34). The pair of resilient pieces 42 formed on each resilient contact piece 34 particularly substantially are vertically symmetric. Further, the resilient pieces 42 on the right side and those on the left side particularly substantially are bilaterally symmetric. Length(s) of the resilient piece(s) 42 in forward and backward directions FBD particularly is/are shorter than that/those of the resilient contact piece(s) 34. Further, the rear end(s) (extending end(s)) of the resilient piece(s) 42 particularly is/are located behind the contact portion 40. The shape (s) of the resilient piece(s) 42 viewed from above is/are curved to bulge inwardly particularly substantially toward the mating resilient pieces 42.

[0047] As shown in FIGS. 13 to 16, the shell 32 includes a lower plate portion 43, a pair of side plate portions 44 projecting or standing up at an angle different from 0° or 180°, preferably substantially at a right angle from (particularly the both lateral (left and right) edges of) the lower plate portion 43 and an upper plate portion 45 extending at an angle different from 0° or 180°, preferably substantially at a right angle from (particularly the distal or upper end edge of) one side plate portion 44. As shown in FIGS. 12, 15 and 16, the lateral (left and/or right) side plate portion(s) 44 particularly is/are (particularly each) formed with one or more, particularly a pair of restricting portions 46 substantially extending obliquely inwardly of the shell 32 toward the front particularly by cutting and bending. The pair of restricting portions 46 formed on each side plate portion 44 particularly substantially are vertically symmetric. Further, the right restricting portions 46 and the left restricting portions 46 particularly substantially are bilaterally symmetric.

[0048] The shell 32 is to be assembled with the terminal main body 31 to at least partly surround the contact functioning portion 36. In a state where the shell 32 is assembled, the tube portion 33 is at least partly formed by the shell 32 and the supporting portion 37. As shown in FIG. 14, the lower plate portion 43 and the lower wall portion 38 particularly at least partly overlap substantially in surface contact with each other, and/or the lateral (left and/or right) side plate portion(s) 44 and the lateral (left and/or right) side wall portion(s) 39 particularly (also) at least partly overlap substantially in surface contact with each other. Further, one or more holding pieces 47 folded to extend inward or downward inside the supporting portion 37 from the distal or upper end edges of the side plate

portion(s) 44 particularly are at least partly fitted to be held in close contact with the inner surfaces of the lateral (left and/or right) side wall portion(s) 39, whereby the shell 32 and the terminal main body 31 particularly are held in an assembled state. Further, the rigidity of the lateral (left and/or right) side wall portion(s) 39 to which the base end portion(s) of the resilient contact piece(s) 34 is/are directly linked is increased by engagement with the shell 32.

[0049] In the assembled state of the shell 32 and the terminal main body 31, the rear end(s) (extending end(s)) of the resilient piece(s) 42 particularly is/are located in the lateral direction to be held in contact with or proximately face the inner surface(s) of the side wall portion (s) 44 as shown in FIGS. 15 and 16. Further, the rear end(s) (extending end(s)) of the resilient piece(s) 24 particularly is/are facing the front end(s) (extending end(s)) of the restricting portion(s) 46 from front in forward and backward directions FBD while being spaced apart.

[0050] Next, functions of the second embodiment are described. In the process of inserting the tab T into the (particularly rectangular or polygonal) tube portion 33, the tab T contacts the one or more resilient contact pieces 34 whereby the resilient contact piece(s) 34 is/are deformed outwardly, particularly the tab T thrusts itself between the lateral (left and right) resilient contact pieces 34, whereby the both resilient contact pieces 34 are resiliently deformed to laterally move away from each other, while displacing the contact portion 40 obliquely backward. As the resilient contact piece(s) 34 is/are resiliently deformed, the resilient piece(s) 42 is/are resiliently deformed laterally (to particularly laterally move away from each other) with the extending end(s) thereof held in contact with the side plate portion(s) 44 and/or the extending end(s) of the resilient contact piece(s) 42 particularly is/are displaced backward while sliding in contact with the side plate portion(s) 44. When the inserting operation of the tab T is completed, resilient deformation amount (s) and resilient restoring force(s) of the resilient piece(s) 42 are maximized

[0051] Note that when the tab T is properly inserted into the tube portion 33, the resilient piece(s) 42 do(es) not come into contact with the restricting portion(s) 46. However, if the tab T is inserted in an improper posture and the resilient deformation amount of the resilient contact piece 34 increases beyond a proper range, the extending end(s) of the resilient piece(s) 42 come(s) into contact with the front end(s) of the restricting portion(s) 46 while the resilient deformation amount of the resilient contact piece 34 falls within the range of resiliency limit. Thus, any further resilient deformation of the resilient contact piece 34 is hindered. In this way, it is prevented in this second embodiment that the resilient contact pieces 34 are deformed beyond the resiliency limit thereof.

[0052] The terminal fitting 30 of this second embodiment includes the (particularly substantially rectangular or polygonal) tube portion 33 into which the tab T is to be at least partly inserted in the insertion direction ID (from front), and the resilient contact piece(s) 34 that substantially extend along the inserting direction ID of the tab T in or at the tube portion 33 and come into contact with the tab T at least partly inserted into the tube portion 33 while being resiliently deformed. In the case of such a terminal fitting 30, the posture(s) of the resilient contact piece(s) 34 may be so inclined that there is a height difference between opposite side edges in the width direction when the terminal fitting 30 is subjected to vibration or impact. As a result, clearances may be formed between the tab T and the resilient contact piece(s) 34 and a contact state may become unstable.

[0053] However, the terminal fitting 30 of this second embodiment includes the one or more, particularly the pair of resilient pieces 42 that extend from (particularly the substantially opposite side edges of) the (particularly each) resilient contact piece(s) 34 in the vertical direction and can resiliently come into contact with the inner wall surface of the tube portion 33. Thus, even if an external force acts to incline the posture of the resilient contact piece 34, the (pair of) resilient piece(s) 42 resiliently come (s) into contact with the inner wall surface of the tube portion 33 (inner surface of the side wall portion 44), wherefore the posture inclination of the resilient contact piece 34 is prevented.

[0054] If a rectangular tube portion is entirely formed to be integral to resilient contact pieces, the rectangular tube portion and the resilient contact pieces may present design restrictions to each other. In that respect, the terminal fitting 30 of this second embodiment particularly includes the shell 32 that is a component separate from the resilient contact pieces 34, at least partly surrounds the resilient contact piece(s) 34 and constitutes or forms part of the tube portion 33. That is, the tube portion 33 particularly is formed using the shell 32 separate from the resilient contact piece(s) 34. Therefore, a degree of freedom in designing the resilient contact pieces 34 and the tube portion 33 is high.

<Third Embodiment>

[0055] Next, a third specific embodiment of the present invention is described with reference to FIGS. 17 and 18. A terminal fitting 50 of this third embodiment is shaped to be long and narrow in forward and backward directions FBD as a whole particularly by assembling a terminal main body 51 and a shell 52 which are components separate from each other. A front area (particularly a substantially half area) of the terminal fitting 50 at a front end side in forward and backward directions FBD is a (particularly substantially rectangular or polygonal) tube portion 53 into which a tab T of a male terminal is to be at least partly inserted in an insertion direction ID (e.g. from front), and one or more resilient contact pieces 54 to be resiliently brought into contact with the tab T are at least partly accommodated in or provided at the tube portion 53. A rear area (particularly a substantially half area) of the terminal fitting 50 at a rear end side is a wire connec-

tion portion which is to be connected with a wire and which particularly comprises at least one wire crimping portion 55 in the form of at least one open barrel which is to be crimped or bent or folded and connected to the wire.

[0056] The terminal main body 51 is formed particularly by applying bending, folding and/or embossing and the like to a conductive (particularly metal) plate material punched out or cut into a specified (predetermined or predeterminable) shape. A front end area of the terminal main body 51 is a contact functioning portion 56 and a rear end area of the terminal main body 51 is the wire connection portion (particularly the wire crimping portion 55). The contact functioning portion 56 includes a (particularly substantially box-shaped) supporting portion 57, one or more, particularly a pair of resilient contact pieces 54 and one or more, particularly two pairs of resilient pieces 58. The (box-shaped) supporting portion 57 includes a lower wall portion 59 (as a particular supporting wall portion), one or more, particularly a pair of side wall portions 60 standing up or projecting at an angle different from 0° or 180°, preferably substantially at a right angle from (particularly both lateral (left and right) edges of) the lower wall portion 59 and an upper wall portion 61 (as a particular supporting wall portion) extending at an angle different from 0° or 180°, preferably substantially at a right angle from one side wall portion 60. The rigidity of the box-shaped supporting portion 57 particularly is increased by continuously extending over the entire circumference.

[0057] As shown in FIG. 17, the (particularly pair of vertically symmetric) resilient contact piece(s) 54 substantially extend(s) forward (direction opposite to an inserting direction ID of the tab T into the tube portion 53 in forward and backward directions FBD) particularly substantially in a cantilever manner from the lower wall portion 59 and/or the upper wall portion 61 and particularly substantially vertically symmetric. The shape(s) of the resilient contact piece(s) 54 viewed sideways (in a direction crossing an inserting direction ID of the tab T into the tube portion 53 and/or opposite vertical directions in which the pair of resilient contact pieces 54 are facing) are curved to bulge inwardly particularly substantially toward the mating resilient contact pieces 54. A part where a facing distance (vertical distance) between the both resilient contact pieces 54 particularly is shortest serves as a contact portion 62 with the tab T.

[0058] A formation area of the resilient contact piece(s) 54 in the width direction particularly is intermediate parts (particularly substantially central parts) of the lower wall portion 59 and/or the upper wall portion 61. Further, an extending end part (front end part) of the resilient contact piece 54 particularly is wider than an area between opposite end parts and the widened parts serve as one or more, particularly a pair of (particularly substantially bilaterally symmetric) projecting portions 63 projecting in the width direction. The contact functioning portion 56 is formed with one or more, particularly a pair of (particularly substantially bilaterally symmetric) resilient pieces 58 which link the projecting portion(s) 63 and the lower wall portion 59 or the projecting portion(s) 63 and the upper wall portion 61. That is, the resilient piece(s) 58 particularly is/are supported at both front and rear ends. Further, the resilient piece(s) 58 linked to the lower wall portion 59 and that/those linked to the upper wall portion 61 particularly substantially are vertically symmetric. The shape(s) of the resilient piece(s) 58 viewed sideways are curved to bulge outward particularly substantially in directions away from the mating resilient pieces 58 (i.e. to bulge in directions opposite to the resilient contact pieces 54).

[0059] As shown in FIG. 17, the shell 52 includes a lower plate portion 64, one or more, particularly a pair of side plate portions (not shown) standing up or projecting at an angle different from 0° or 180°, preferably substantially at a right angle from (particularly the both lateral (left and right) edges of) the lower plate portion 64 and an upper plate portion 66 extending at an angle different from 0° or 180°, preferably substantially at a right angle from (particularly the distal or upper end edge of) one side plate portion. The shell 52 particularly is to be assembled with the terminal main body 51 to at least partly surround the contact functioning portion 56. In a state where the shell 52 is assembled, the tube portion 53 at least partly is formed by the shell 52 and the supporting portion 57. The lower plate portion 64 and the lower wall portion 59 particularly at least partly overlap substantially in surface contact with each other, and/or the lateral (left and/or right) side plate portion(s) and the lateral (left and/or right) side wall portion(s) 60 particularly (also) at least partly overlap substantially in surface contact with each other. Further, the resilient piece(s) 58 particularly are located to be held in contact with or proximately face the inner surface(s) of the lower plate portion 64 and/or the upper plate portion 66.

[0060] In the process of inserting the tab T into the tube portion 53, the tab T contacts the resilient contact piece(s) 54 and particularly thrusts itself between the upper and lower resilient contact pieces 54, whereby the (both) resilient contact piece(s) 54 is/are resiliently deformed outwardly particularly to vertically move away from each other. As the resilient contact piece(s) 54 is/are resiliently deformed, the resilient piece(s) 58 is/are resiliently deformed while being held in contact with the lower plate portion 64 or the upper plate portion 66. When the inserting operation of the tab T is completed, resilient deformation amount(s) and resilient restoring force(s) of the resilient piece(s) 58 is/are maximized.

[0061] The terminal fitting 50 of this third embodiment includes the (particularly substantially rectangular or polygonal) tube portion 53 into which the tab T is to be at least partly inserted in the insertion direction ID (e.g. from front), and the resilient contact piece(s) 54 that substantially extend(s) along the inserting direction ID of the tab T in the tube portion 53 and come(s) into contact with the tab T inserted into the tube portion 53 while being resiliently deformed. In the case of such a terminal fitting 50,

the posture(s) of the resilient contact piece(s) 54 may be so inclined that there is a height difference between opposite side edge(s) in the width direction when the terminal fitting 50 is subjected to vibration or impact. As a result, clearances may be formed between the tab T and the resilient contact piece(s) 54 and a contact state may become unstable.

[0062] However, the terminal fitting 50 of this third embodiment includes the one or more, particularly the pair of resilient pieces 58 that extend from (particularly the substantially opposite side edges of each of) the resilient contact piece(s) 54 in the lateral direction and can resiliently come into contact with the inner wall surface of the tube portion 53. Thus, even if an external force acts to incline the posture of the resilient contact piece 54, the one or more, particularly the pair of resilient pieces 58 resiliently come(s) into contact with the inner wall surface of the tube portion 53 (inner surfaces of the lower plate portion 64 and/or the upper plate portion 66), wherefore the posture inclination of the resilient contact piece 54 is prevented.

<Other Embodiments>

[0063] The present invention is not limited to the above described and illustrated embodiments. For example, the following embodiments are also included in the technical scope of the present invention.

(1) Although the wire crimping portion is formed behind the rectangular tube portion in the first to third embodiments, the present invention is also applicable to a terminal fitting to be connected to a wire by insulation displacement, or soldering and/or a terminal fitting to be connected to a circuit board.

(2) Although the tab is sandwiched between the pair of resilient contact pieces in the first to third embodiments, the present invention is also applicable to a terminal fitting in which a tab is sandwiched or at least partly inserted between a wall portion constituting or forming part of a (particularly substantially rectangular or polygonal) tube portion and a single resilient contact piece or between three or more contact pieces.

(3) Although the resilient contact pieces substantially extend backward (same direction as the inserting direction of the tab) in a cantilever manner in the first embodiment, they may substantially extend forward (direction opposite to the inserting direction of the tab) in a cantilever manner.

(4) Although the resilient contact pieces substantially extend forward (direction opposite to the inserting direction of the tab) in a cantilever manner in the second embodiment, they may substantially extend backward (same direction as the inserting direction of the tab) in a cantilever manner.

(5) Although the rectangular tube portion is formed by assembling the (particularly substantially box-shaped) supporting portion integral to the resilient contact piece(s) and the shell that is a component separate from the resilient contact piece(s) in the first to third embodiments, it may be entirely formed to be integral or unitary to the resilient contact pieces without providing the shell.

(6) Although the extending end part(s) of the resilient piece(s) is/are resiliently brought into contact with the restricting portion(s) of the (particularly rectangular or polygonal) tube portion in the process of at least partly inserting the tab in the first embodiment, the (rectangular or polygonal) tube portion may not be provided with the restricting portion(s).

(7) The structure of the first embodiment for bringing the extending end part(s) of the resilient piece(s) into contact with the restricting portion(s) in the process of inserting the tab can be applied to the second embodiment.

(8) Although excessive resilient deformation(s) of the resilient contact piece(s) is/are prevented by bringing the resilient piece(s) into contact with the restricting portion(s) in the second embodiment, it is also possible not to provide the restricting portion(s).

(9) The structure of the second embodiment for preventing excessive resilient deformation(s) of the resilient contact piece(s) by bringing the resilient piece (s) into contact with the restricting portion(s) can be applied to the first embodiment.

Reference Numerals

[0064]

T	tab
10	terminal fitting
12	shell
13	rectangular tube portion
14	resilient contact piece
14F	base end portion of resilient contact piece
17	lower wall portion (supporting wall portion)
19	upper wall portion (supporting wall portion)
24	resilient piece
28	restricting portion
30, 50	terminal fitting
32, 52	shell
33, 53	rectangular tube portion
34, 54	resilient contact piece
41, 63	projecting portion
42, 58	resilient piece

Claims

1. A terminal fitting (T), comprising:

a tube portion (13; 33; 53) into which a tab (T) is to be at least partly inserted in an insertion direction (ID);

at least one resilient contact piece (14; 34; 54) which substantially extends along the inserting direction (ID) of the tab (T) in the tube portion (13; 33; 53) and comes into contact with the tab (T) inserted into the tube portion (13; 33; 53) while being resiliently deformed; and
one or more resilient pieces (24; 42; 58) which extend from the resilient contact piece (14; 34; 54) in a width direction (WD) and are able to resiliently come into contact with an inner wall surface of the tube portion (13; 33; 53).

2. A terminal fitting according to claim 1, wherein a pair of resilient pieces (24; 42; 58) is provided which extend from substantially opposite side edges of the resilient contact piece (14; 34; 54) in the width direction (WD).

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

the resilient contact piece (14; 34; 54) extends from a supporting wall portion (18; 19; 39; 59; 61) forming part of the tube portion (13; 33; 53); and/or
the resilient piece(s) (24; 42; 58) extend(s) from a base end portion (14F) of the resilient contact piece (14; 34; 54).

4. A terminal fitting according to any one of the preceding claims, further comprising a shell (12; 32; 52) which is a component separate from the resilient contact piece (14; 34; 54), at least partly surrounds the resilient contact piece (14; 34; 54) and forms part of the tube portion (13; 33; 53).

5. A terminal fitting according to any one of the preceding claims, further comprising at least one restricting portion (28) which is formed at the tube portion (13) and restricts displacements of the resilient piece(s) (24) in an extending direction of the resilient piece (s) (24) by being resiliently brought into contact with the extending end(s) of the resilient piece(s) (24).

6. A terminal fitting according to any one of the preceding claims, wherein the base end portion (14F) of the resilient contact piece (14; 34; 54) is reinforced by the one or more resilient pieces (24) such that the rigidity of the base end portion (14F) of the resilient contact piece (14; 34; 54) is increased.

7. A terminal fitting according to any one of the preceding claims, wherein a front end part of the supporting portion (16)serves as a front frame-like portion (20) having a high rigidity by continuously extending over the entire circumference and/or wherein a rear end part of the supporting portion (16) serves as a rear frame-like portion (21) having a high rigidity by continuously extending over the entire circumference.

8. A terminal fitting according to claim 7, wherein the resilient contact piece (14; 34; 54) is formed in the supporting wall portion (18; 19; 39; 59; 61) by cutting and bending, wherein a cut area of the resilient contact piece (14; 34; 54) in forward and backward directions (FBD) is a range from the rear end of the front frame-like portion (20) to the front end of the rear frame-like portion (21).

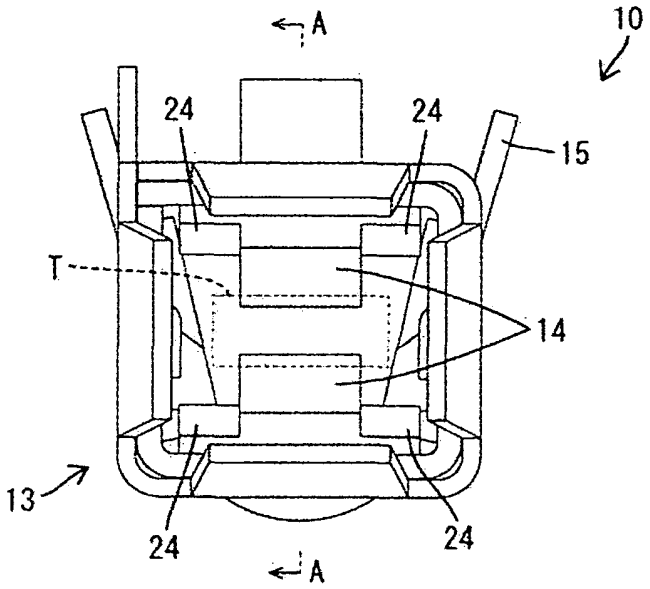
9. A terminal fitting according to claim 7 or 8, wherein a base end portion (14F) of the resilient contact piece (14) is directly linked to the front frame-like portion (20).

10. A terminal fitting according to any one of the preceding claims, wherein an extending end of the resilient contact piece (14; 34; 54) and/or an extending end of the resilient piece (24; 42; 58) is located such as to be held in contact with or proximately face the inner surface of the tube portion (13; 33; 53) and/or wherein an extending end of the resilient piece (24; 42; 58)

11. A terminal fitting according to any one of the preceding claims, wherein an extending end of the resilient piece (24) is substantially facing an extending end of the restricting portion (28) substantially along forward and backward directions (FBD) while particularly being spaced apart.

12. A terminal fitting according to any one of the preceding claims, wherein a base end portion (14F) of the resilient contact piece (14; 34; 54) is wider than an area behind it and the widened part(s) particularly serve(s) as a pair of projecting portions (23; 41; 63) projecting in the width direction (WD).

FIG. 1


A
10
24
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T
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13
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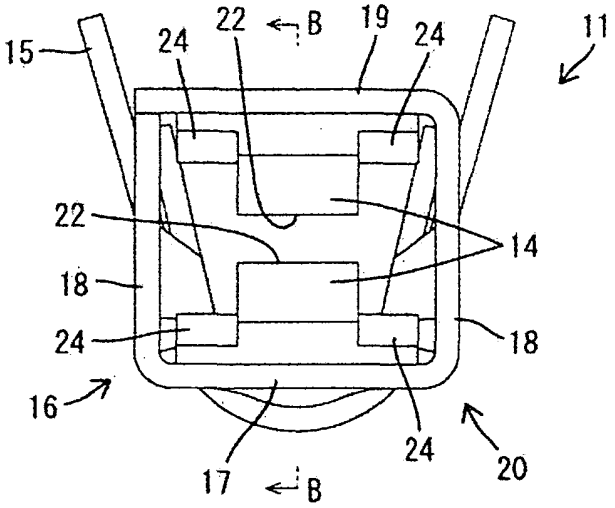
24
A

FIG. 2


15
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20
17
B

FIG. 3

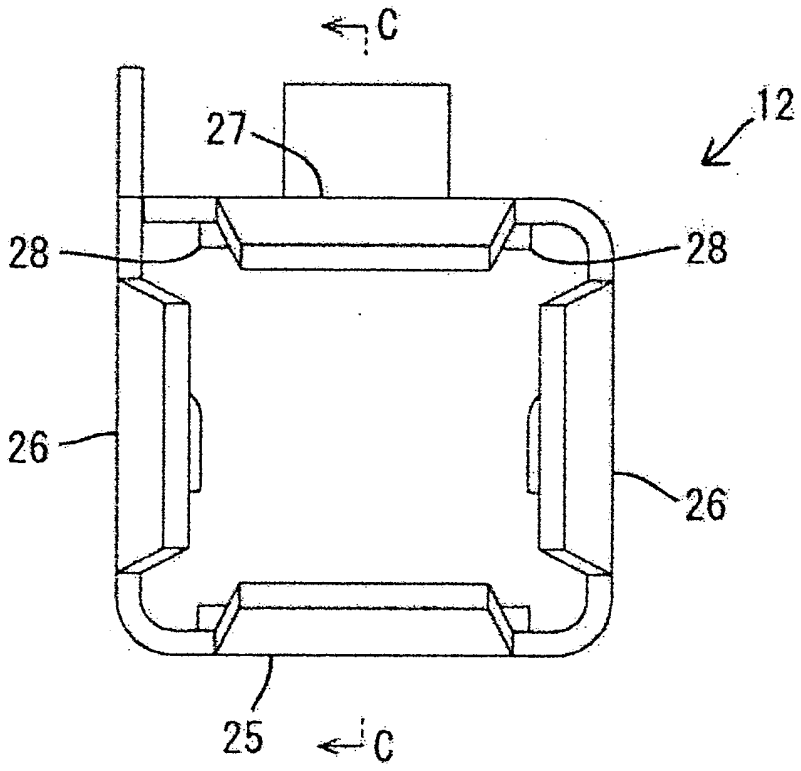


FIG. 4

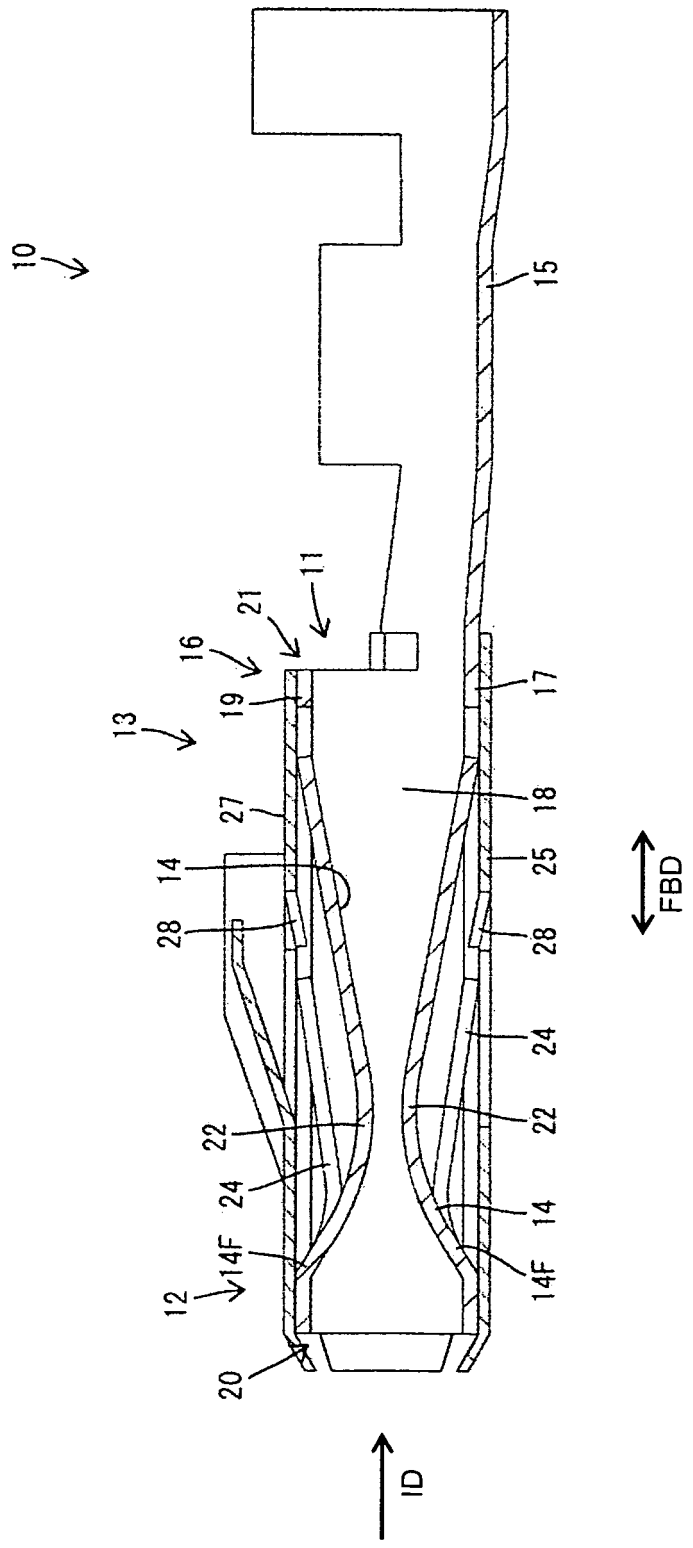


FIG. 5

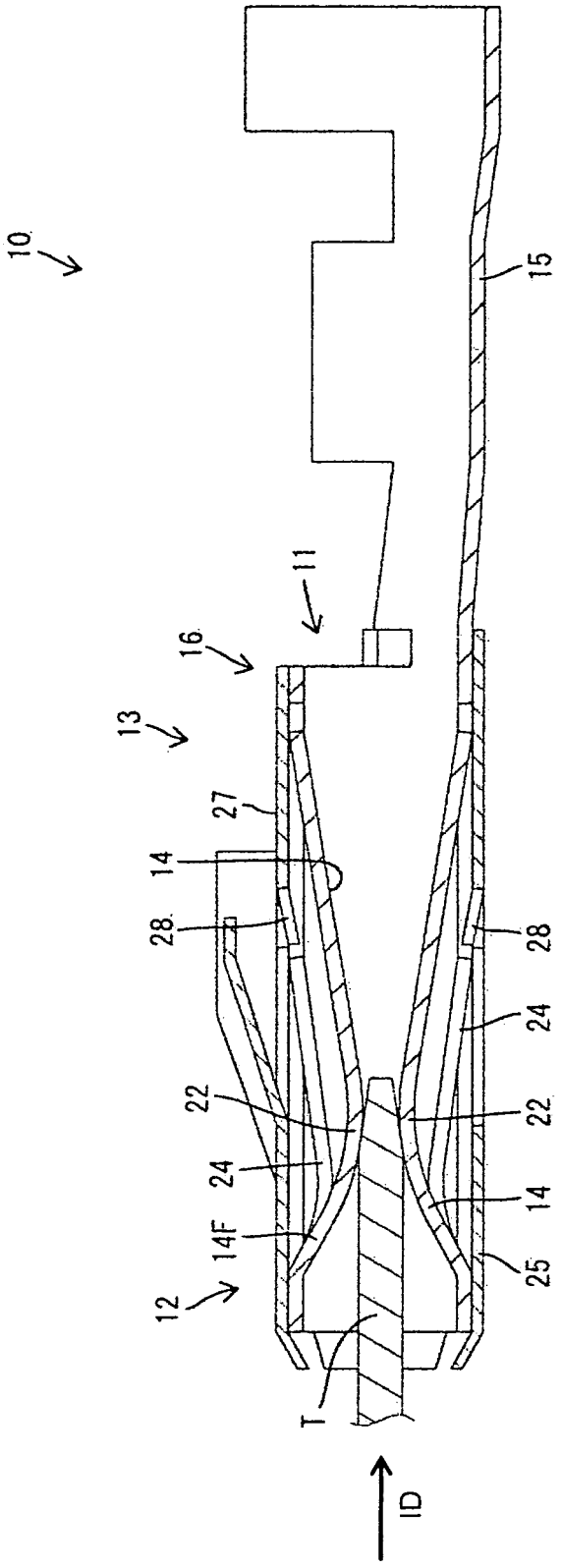


FIG. 6

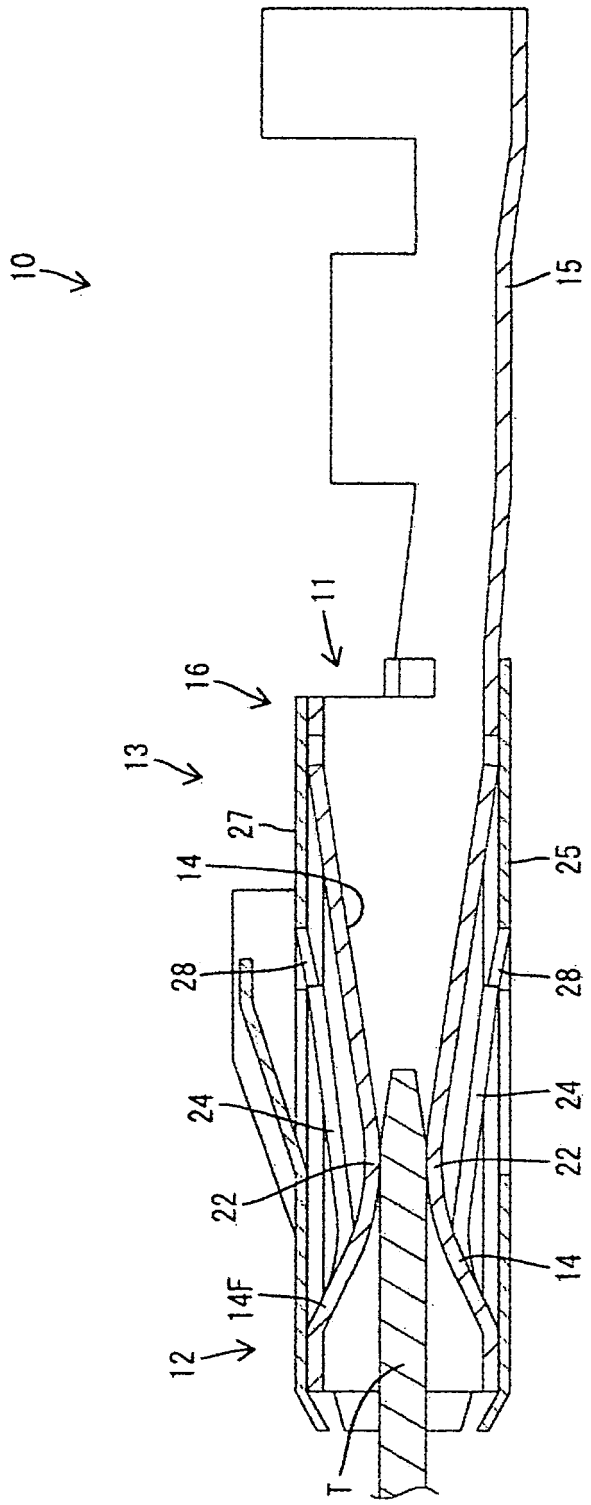


FIG. 7

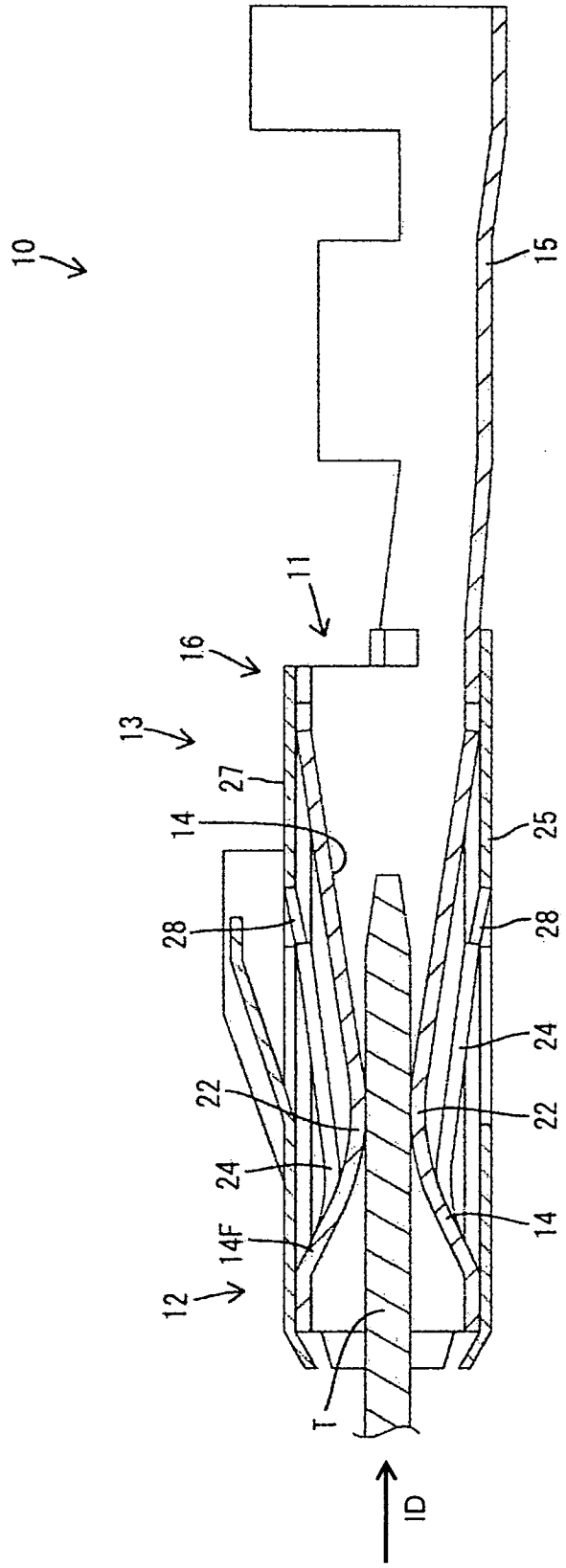


FIG. 8

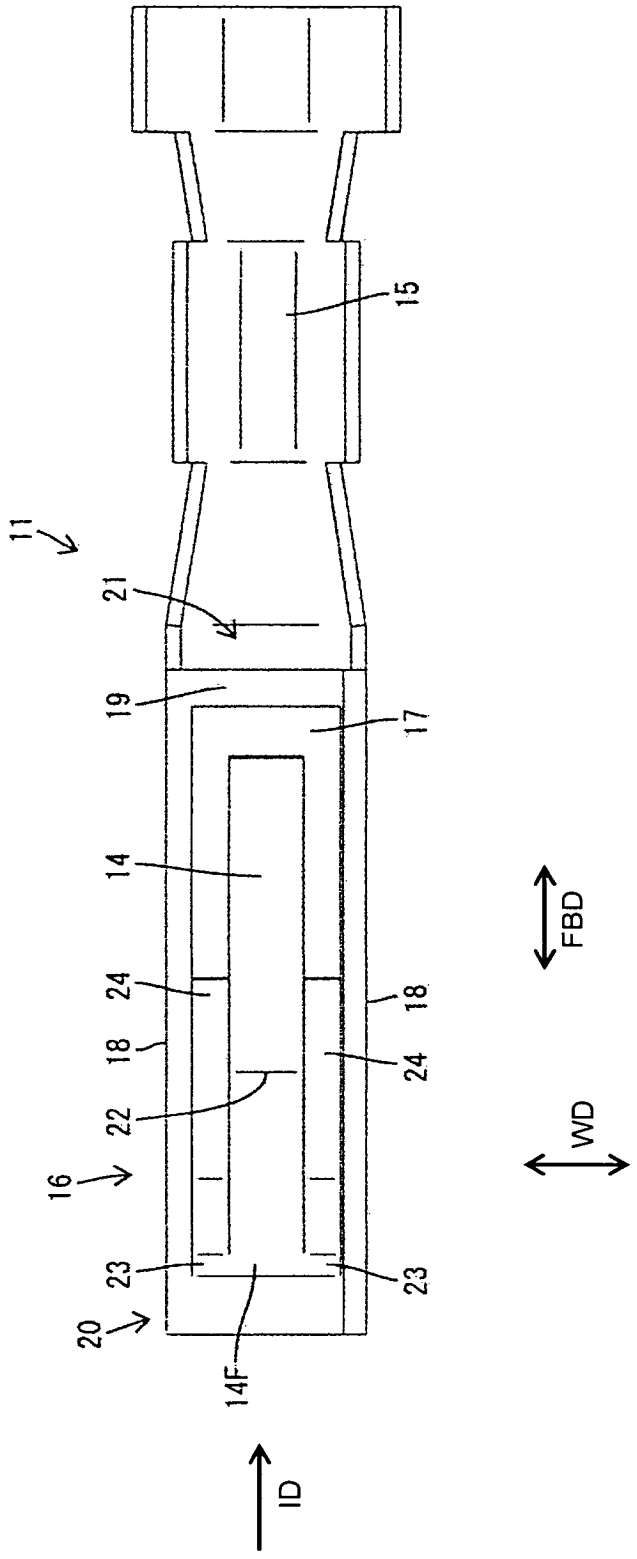


FIG. 9

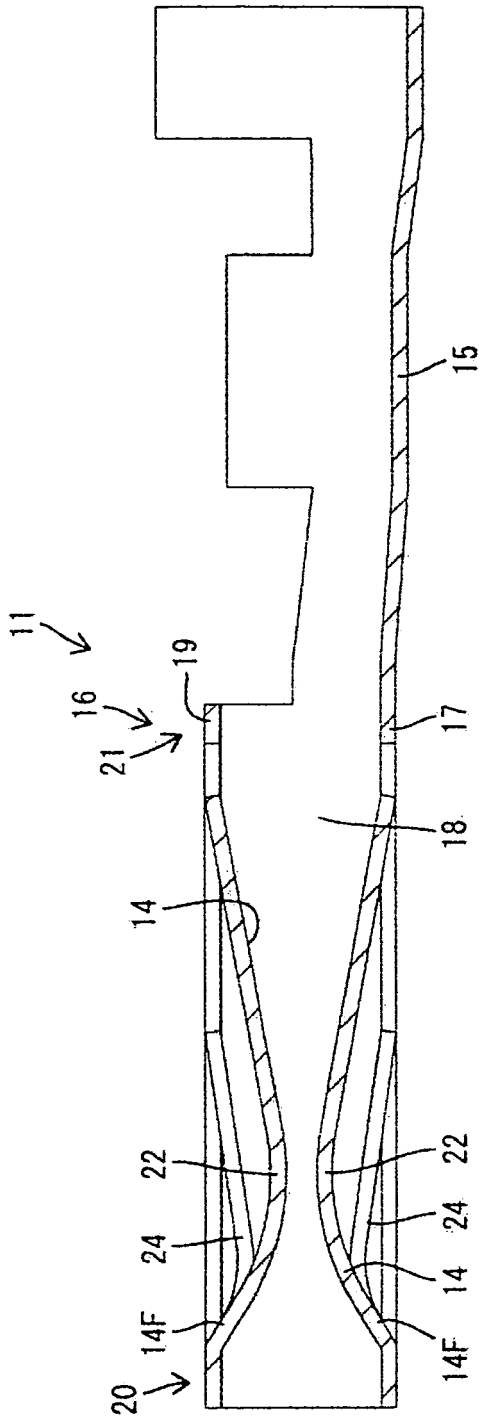


FIG. 10

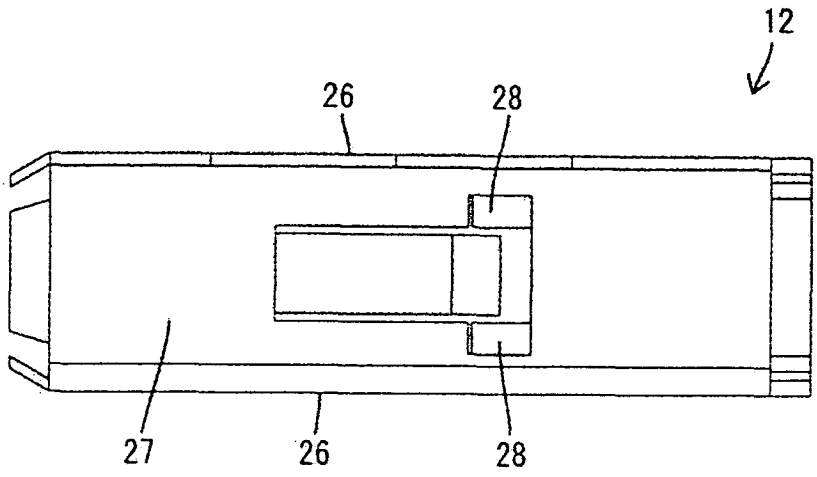


FIG. 11

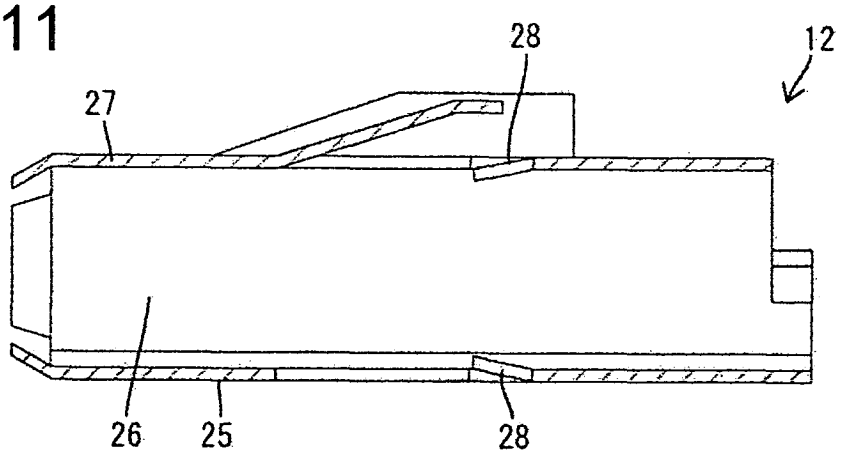


FIG. 12

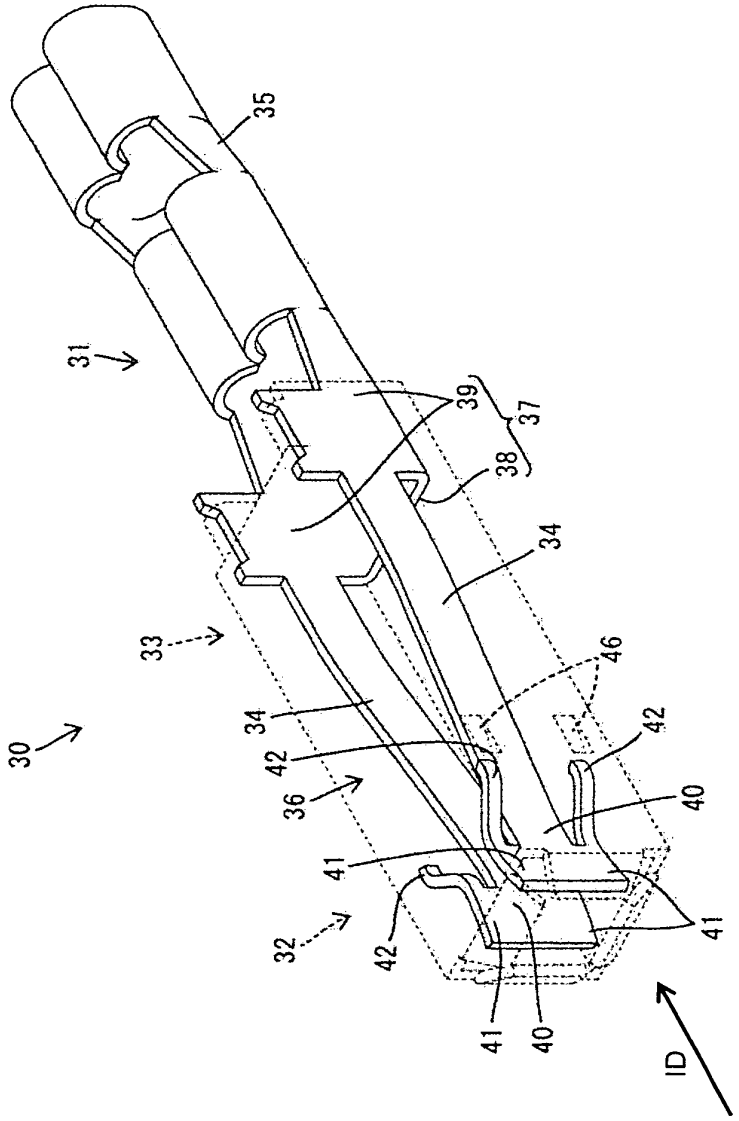


FIG. 13

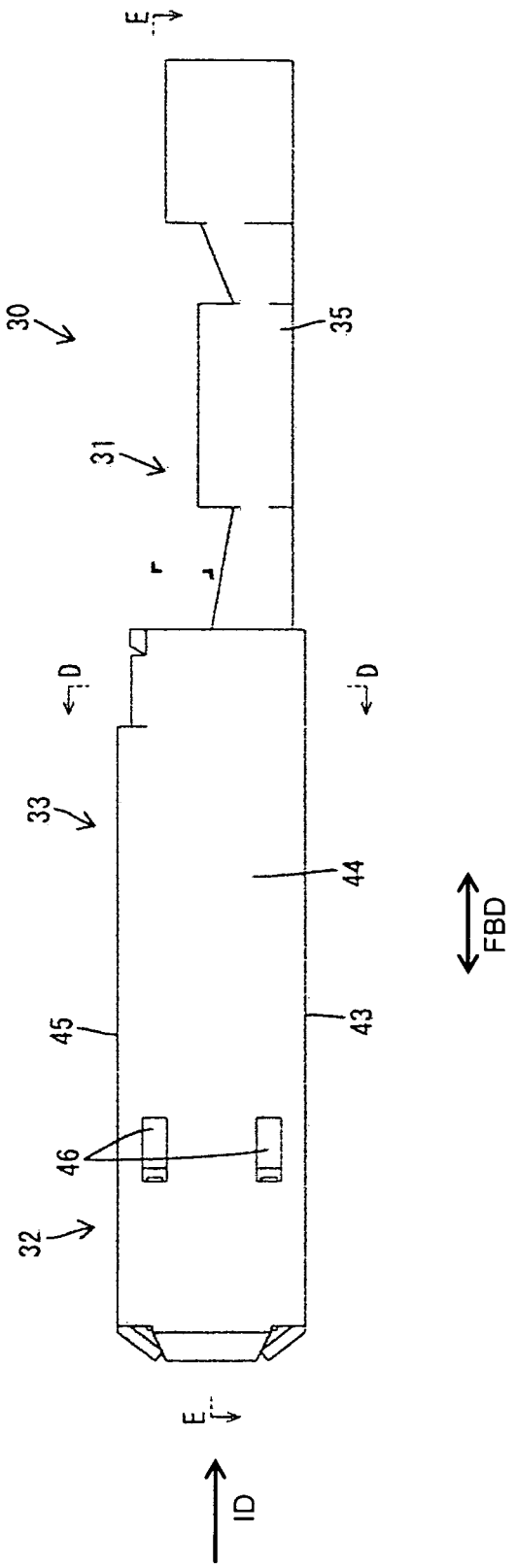


FIG. 14

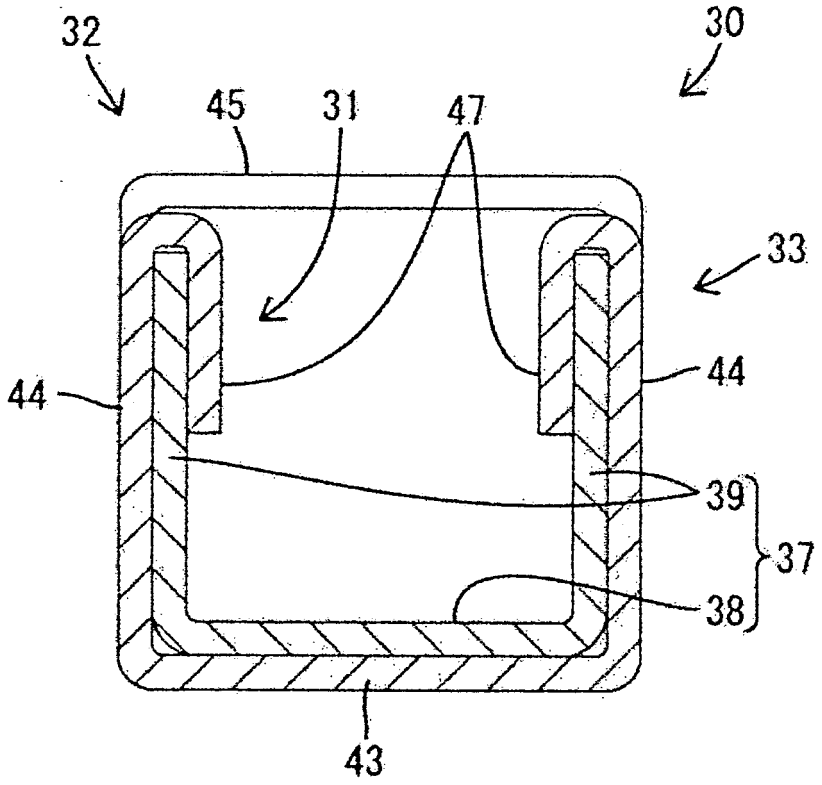


FIG. 15

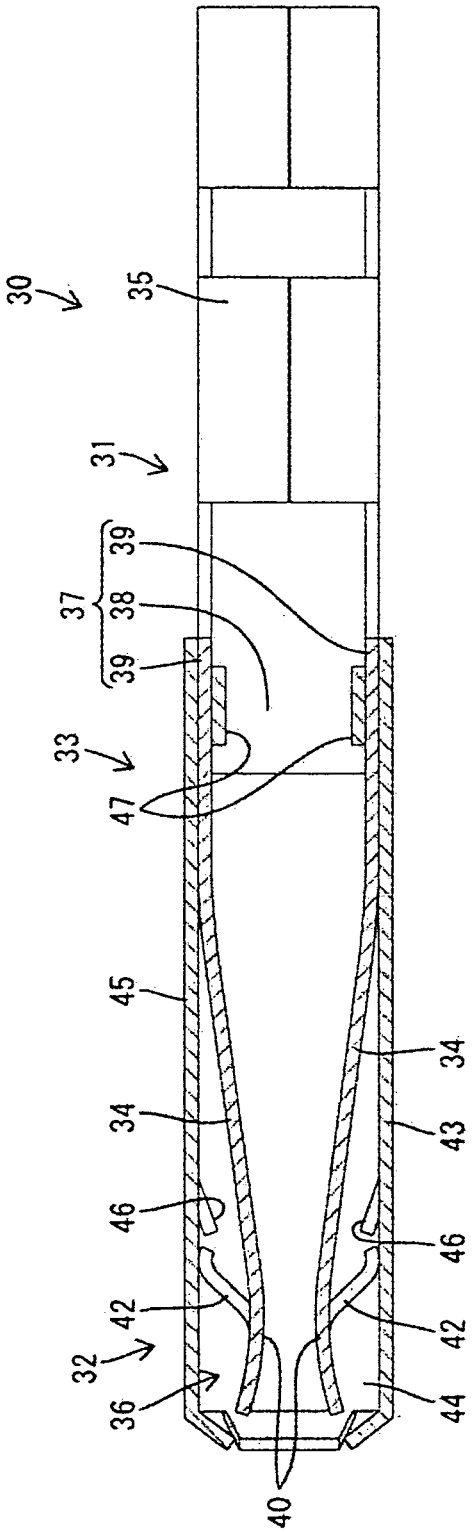


FIG. 16

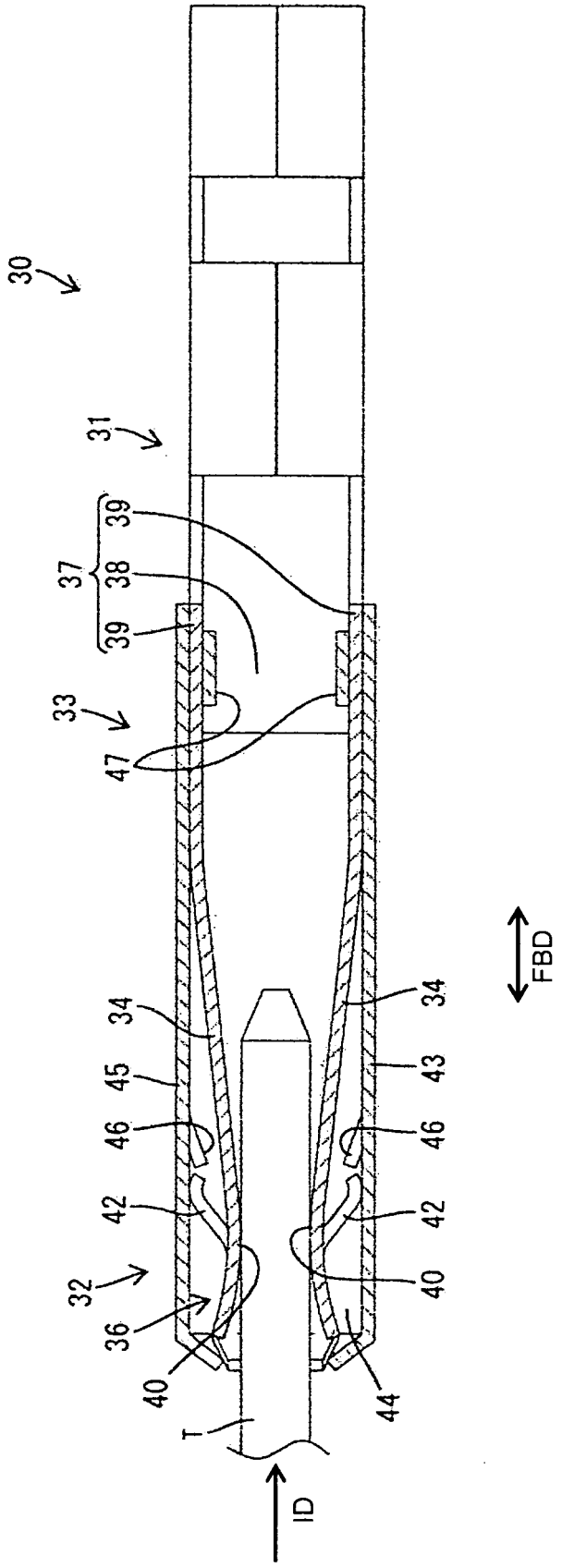


FIG. 17

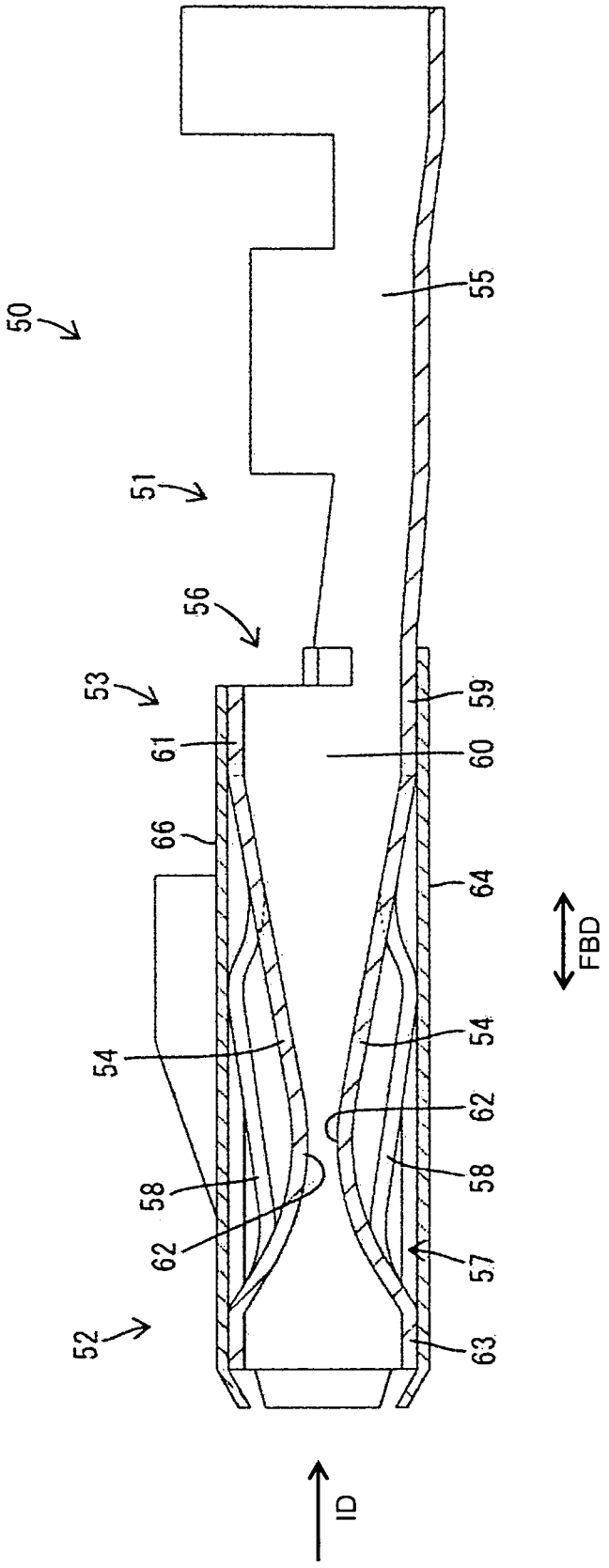
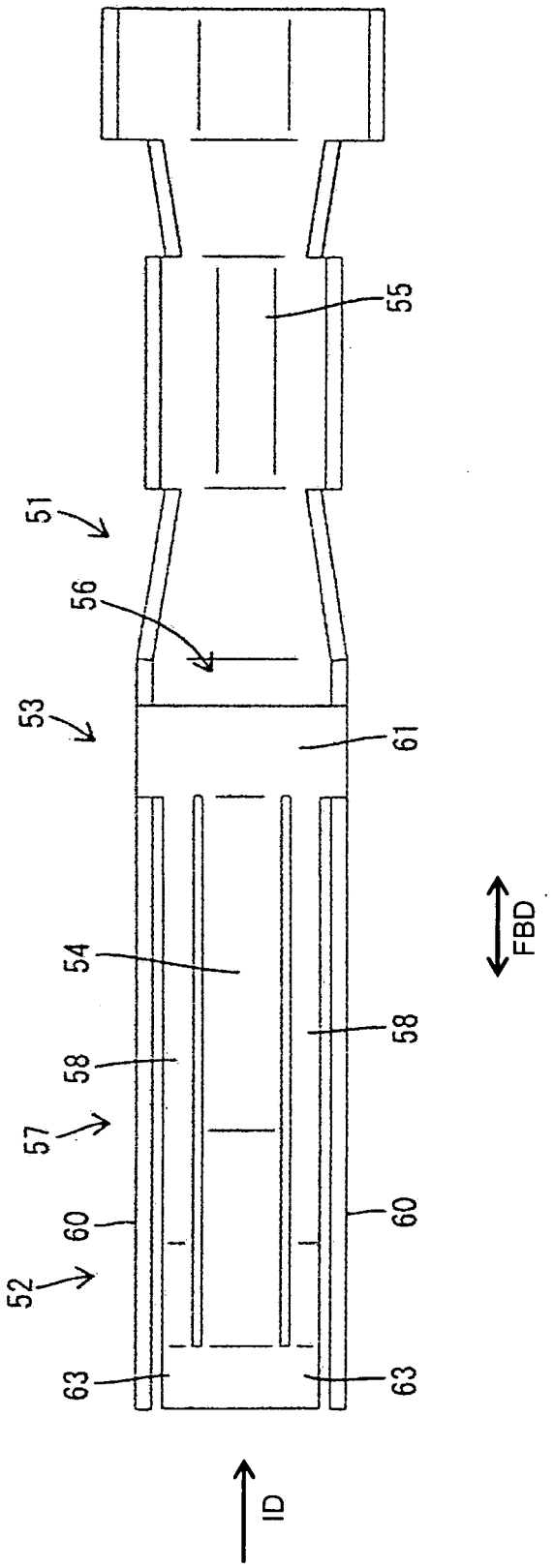


FIG. 18



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EUROPEAN SEARCH REPORT

Application Number
EP 12 00 6393

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	10 January 2013	López García, Raquel

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L : document cited for other reasons

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