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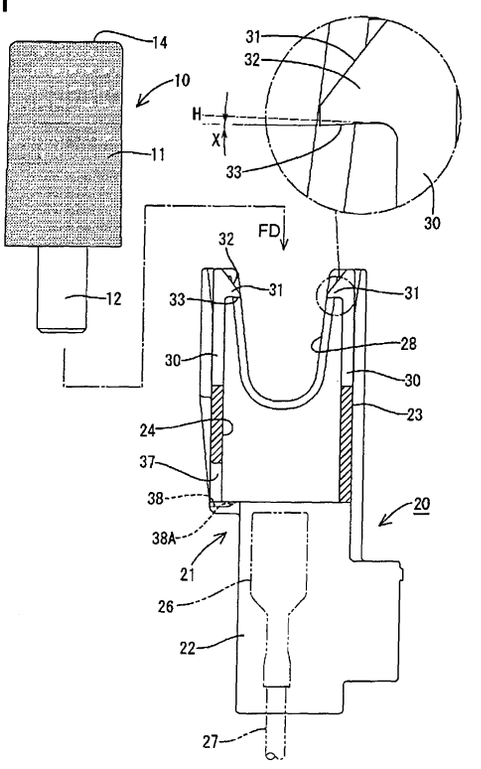
(54) A connector and junction box provided therewith

(57) A pair of locking pieces 30 are provided at opposite side walls of a fitting recess 24. Each locking piece 30 is formed in such a manner as to be resiliently deformable and is formed with a locking hook portion 31 on the inner surface of the upper end thereof. The lower surface of the locking hook portion 31 serves as a locking surface 33. This locking surface 33 is inclined downward toward its projecting end with respect to a horizontal plane in parallel with an upper surface 14 of a main body 11 of a relay 10. When a force acting upward in withdrawing direction is exerted on the relay 10 fitted in a fitting recess 24, the locking hook portions 31 are pressed, whereby the opposite locking pieces 30 are resiliently deformed so as to widen a spacing therebetween. However, the locking surfaces 33 are still held inclined downward toward their projecting ends or at worst held horizontal in parallel to the upper surface 14 of the main body 11. As a result, a locking force for locking the relay 10 can continue to act, thereby effectively preventing the withdrawal of the relay 10.

FIG. 1



EP 1 363 364 A1

Description

[0001] The present invention relates to a connector with which an electrical and/or electronic part such as a relay, resistor, fuse, integrated circuit or the like is connected and is, more particularly, designed to improve a construction of a portion thereof for locking the electrical and/or electronic part, and to a junction box provided therewith.

[0002] This type of connector for relay is, as shown in FIG. 8, constructed such that a fitting recess 3 into which a relay 2 is fittable is provided in the upper surface of a housing 1 in which terminal fittings are accommodated, and locking pieces 4 each having a locking hook portion 5 at the leading end thereof are so provided on the circumferential wall of the fitting recess 3 as to project upward and as to be resiliently deformable. When being fitted into the fitting recess 3 from above, the relay 2 is inserted thereinto while resiliently deforming the locking pieces 4 so as to cause them to escape outward. When the relay 2 is inserted to a proper position, the locking pieces 4 are restored and return to their original positions, whereby the locking hook portions 5 are engaged with the end edges of an upper surface 2A of the relay 2 to lock the relay 2 so as not to come out.

[0003] One example of a connector for relay adopting such a locking construction as above is disclosed in Japanese Unexamined Patent Publication No. 9-35605.

[0004] In the prior art connector for relay, locking surfaces 5A of the locking hook portions 5 to be engaged with the upper surface 2A of the relay 2 are formed to horizontally extend in parallel to the upper surface 2A of the relay 2 when the locking pieces 4 are in a natural state.

[0005] Thus, for example, when a force (arrow in FIG. 8) is exerted on the relay 2 in withdrawing direction, the locking hook portions 5 are pressed, whereby the opposite locking pieces 4 are so resiliently deformed as to widen a spacing therebetween. Accordingly, as enlargedly shown at an upper part in FIG. 8, the locking surfaces 5A of the locking hook portions 5 are inclined upward toward the projecting ends of the locking portions 5 by an angle x, such that projecting end sides thereof are gradually disengaged from the upper surface 2A of the relay.

[0006] As a result, a locking force for locking the relay 2 becomes weaker, and if a force further acts in withdrawing direction, the locking hook portions 5 are disengaged while widening a spacing therebetween by being guided by the locking surfaces 5A inclined upward, with the result that the relay 2 may relatively easily come out of the fitting recess 2A.

[0007] The present invention was developed in view of the above problem and an object thereof is to firmly lock an electrical and/or electronic part.

[0008] This object is solved according to the invention by a connector according to claim 1 and by a junction box according to claim 10. Preferred embodiments of the invention are subject of the dependent claims.

[0009] According to the invention, there is provided a connector formed with a fitting recess into which a terminal-provided electrical and/or electronic part such as a relay is at least partly fittable or insertable and used to establish a connection between at least one terminal fitting at least partly mounted therein and the terminal of the electrical and/or electronic part, at least one locking piece having a locking portion engageable with a locking surface or portion (e.g. the rear portion, a stepped portion, a projecting portion or the like) of the electrical and/or electronic part with respect to or substantially along its inserting direction being so provided at at least one wall surface of the fitting recess as to be resiliently deformable,

wherein a locking surface of the locking portion to be engaged with the (mating) locking surface of the electrical and/or electronic part is so inclined as to gradually approach the locking surface of the electrical and/or electronic part toward the projecting end thereof when the locking piece is in a natural state.

[0010] According to a preferred embodiment of the invention, there is provided a connector formed with a fitting recess into which a terminal-provided electrical part such as a relay is fittable and used to establish a connection between a terminal fitting mounted therein and the terminal of the electrical part, a locking piece having a locking portion engageable with the rear surface of the electrical part with respect to its inserting direction being so provided at a wall surface of the fitting recess as to be resiliently deformable,

wherein a locking surface of the locking portion to be engaged with the rear surface of the electrical part is so inclined as to gradually approach the rear surface of the electrical part toward the projecting end thereof when the locking piece is in a natural state.

[0011] Since the locking surface of the locking portion is so inclined as to gradually approach the rear surface of the electrical part toward its projecting end, even if a force acts on the electrical part in withdrawing direction to slightly open the locking piece and the locking portion, the locking surface is still held inclined to gradually approach the rear surface of the electrical part toward its projecting end or at worst held horizontal in parallel with the rear surface of the electrical part. Thus, a force for locking the electrical part can continue to act, thereby effectively preventing the withdrawal of the electrical part.

[0012] Preferably, an insertion portion into which a jig for forcibly resiliently deforming the locking piece in unlocking direction is at least partly insertable is formed at the locking portion of the locking piece, preferably at the projecting end thereof.

[0013] The locked state is canceled by inserting the jig into the insertion portion of the locking portion and forcibly resiliently deforming the locking piece to such a position where it is disengaged from the electrical part. This makes it easier to resiliently deform the locking

piece and further makes it easier to detach the electrical part.

[0014] Further preferably, an insertion opening which is open to the fitting recess, preferably to or in the back surface of the fitting recess, and through which a jig for lifting the electrical and/or electronic part is at least partly insertable is formed in a surrounding wall of the fitting recess.

[0015] The electrical and/or electronic part can be lifted or moved in a withdrawing direction in the fitting recess and withdrawn by thrusting the jig between the back surface of the fitting recess and the electrical part via the insertion opening and then twisting the jig. Thus, the electrical and/or electronic part can be efficiently detached without being inadvertently damaging or scratching.

[0016] Still further preferably, the insertion opening comprises a guiding surface for guiding the jig for lifting the electrical and/or electronic part towards the electrical and/or electronic part arranged in the fitting recess.

[0017] Most preferably, the locking piece comprises a guiding portion for coming into contact with the electric and/or electronic piece for guiding a deformation of the locking piece and/or an at least partial insertion of the electric and/or electronic piece into the fitting recess.

[0018] According to a further preferred embodiment of the invention, the locking piece is formed by providing one or more slits in a respective portion of a housing of the connector.

[0019] Preferably, the locking surface is so inclined as to gradually approach the locking surface of the electrical and/or electronic part toward the projecting end thereof or held substantially in parallel to the locking surface of the electrical and/or electronic part, when the locking piece is in a state, where the locking piece is resiliently deformed in a deforming direction and/or where the locking portion is at least partly engaged with the locking surface of the electrical and/or electronic part.

[0020] Further preferably, the locking surface is so inclined as to define an angle to the locking surface of the electrical and/or electronic part and/or to a direction substantially normal to the inserting direction of the electrical and/or electronic part into the fitting recess, wherein the angle is smaller than approximately 10°, more preferably smaller than approximately 5°.

[0021] Most preferably, a confirming window is provided for confirming the proper position of the electric and/or electronic part bin the fitting recess.

[0022] According to the invention, there is further provided a junction box for an automotive vehicle comprising a connector according to the invention or a preferred embodiment thereof.

[0023] These and other objects, features and advantages of the present invention will become apparent upon on reading of the following detailed description of preferred embodiments and accompanying drawings in which:

FIG. 1 is a front view partly in section of a connector according to one preferred embodiment of the present invention showing a state before a relay is connected,

FIG. 2 is a fragmentary perspective view showing a construction near a portion where a locking piece is provided,

FIG. 3 is a vertical section of the locking piece,

FIG. 4 is a fragmentary perspective view showing a construction near a portion where a confirming window is formed,

FIG. 5 is a front view partly in section of the connector showing a state where the relay is properly connected,

FIG. 6 is a front view partly in section of the connector showing a state where a withdrawing force is exerted on the relay,

FIG. 7 is a partial enlarged section of the connector showing a relay withdrawing operation, and

FIG. 8 is a front view partly in section of a prior art connector.

[0024] Hereinafter, one preferred embodiment of the present invention is described with reference to FIGS. 1 to 7.

[0025] A connector 20 for relay with which a relay 10 (as a preferred electric or electronic part) is connected or connectable is illustrated in this embodiment as shown in FIG. 1.

[0026] The relay 10 is provided with a main body 11 formed e.g. of a synthetic resin material preferably substantially into a short and rectangular column shape and one or more, preferably a plurality of tab-shaped relay terminals 12 (as preferred contact portions) project from the lower surface of the main body 11 by a specified (predetermined or predeterminable) arrangement.

[0027] The connector 20 is provided with a housing 21 formed e.g. of a synthetic resin material. A substantially rectangular tube portion 23 preferably having a slightly larger rectangular cross section is formed on the upper surface of a housing main body 22. The inside of the rectangular tube portion 23 serves as a fitting recess or space or receptacle 24 into which the relay 10 is at least partly fitted or fittable or insertable.

[0028] In the housing main body 22, one or more, preferably a plurality of vertically extending cavities (unillustrated) are arranged at positions substantially corresponding to the relay terminals 12 or to the contact portions thereof. One or more terminal insertion openings formed at the upper ends of the cavities are open in the bottom surface of the fitting recess 24 and the relay terminals 12 are insertable therethrough. Further, one or more female terminal fittings 26 connectable with the respective relay terminals 12 and connected or connectable with ends of wires 27 are at least partly accommodated in the corresponding cavities by being inserted thereinto preferably from below or from a side opposite to an insertion side of the relay 10.

[0029] The fitting recess 24 preferably has a depth substantially larger than the height of the main body 11 of the relay 10 by a specified (predetermined or predeterminable) distance and is formed with window holes or recesses 28 used to hold the relay 10 preferably by cutting upper portions of a pair of opposite side walls of four walls thereof.

[0030] One or more locking pieces 30 for locking the relay 10 so as not to come out are provided respectively at a side wall, preferably at another pair of opposite side walls of the fitting recess 24. As shown in FIG. 2, each locking piece 30 is formed into a cantilever shape by forming slits 34 at the opposite or lateral sides thereof. The upper or extending ends of the locking pieces 30 are resiliently deformable in inward and outward directions or along a deforming direction DD of the fitting recess 24 or toward and away from fitting recess 24 where the relay 10 is to be arranged or accommodated. A locking hook portion 31 is formed at the inner surface of the upper or distal end or end portion of each locking piece 30.

[0031] The upper or distal surface of each locking hook portion 31 serves as a guiding surface 32 slanted such that the locking hook portion 31 is tapered toward its upper or distal end. In other words, the distance from the substantially opposite locking hook portions 31 becomes greater towards the distal ends thereof (or to a mating side with the relay 10).

[0032] On the other hand, the lower or inner surface of the locking hook portion 31 serves as a locking surface 33 arranged at an angle different from 0° or 180°, preferably substantially normal to a fitting direction FD of the relay 10 into the connector 20 and substantially engageable with the outer edge of the upper surface 14 (as a preferred locking surface or portion) of the main body 11 of the relay 10. As enlargedly shown at an upper part in FIG. 1, this locking surface 33 preferably is inclined downward to its projecting end or the projecting end 31 PE of the locking hook portion 31, defining an angle X to a substantially horizontal surface H which is substantially in parallel to the upper surface 14 of the main body 11 of the relay 10 or to a direction substantially normal to the fitting direction FD. In other words, the locking surface 33 preferably is so inclined as to hinder an upward movement of the upper surface 14 of the main body 11. The angle X preferably is smaller than approximately 10°, more preferably smaller than approximately 5° (not including 0°). As shown in FIGS. 2 and 3, this locking hook portion 31 has a portion, preferably a widthwise substantially middle portion, of its leading end cut away to form an insertion portion 35 into which the leading end of a jig J1 (see FIG. 5) for forcibly resiliently deforming the locking piece 30 in outward direction or in the deforming direction DD (unlocking direction) is at least partly insertable.

[0033] Further, as shown in FIGS. 1 and 4, a confirming window 37, preferably having a lower edge substantially in flush with the bottom surface of the fitting recess 24, is formed at a lower position or portion of one of the side walls of the fitting recess 24 preferably where the locking pieces 30 are provided. Through this confirming window 37, whether or not the relay 10 is properly fitted into the fitting recess 24 preferably up to its bottom surface can be visually confirmed.

[0034] A groove-shaped or recessed insertion opening 38 through which the leading end of a jig J2 (see FIG. 7) for lifting the relay 10 is at least partly insertable is formed over an area extending substantially from the lower edge of this confirming window 37 to a position slightly receded into the bottom surface of the fitting recess 24. A back or inner surface 38A of this insertion opening 38 is inclined upward toward its upper end or toward the fitting recess 24 for the relay 10.

[0035] Next, the functions of the preferred embodiment of the present invention thus constructed are described.

[0036] The relay 10 (as a preferred electric or electronic part) is, as indicated by an arrow in FIG. 1, inserted in the fitting direction into the fitting recess 24 of the connector 20 from a fitting side, preferably from above. The respective outer edges of the lower or lateral surface of the main body 11 come substantially into contact with the corresponding guide surfaces 32 of the locking hook portions 31 of the locking pieces 30 to press them, whereby the relay 10 is pushed in while resiliently deforming the locking pieces 30 so as to cause them to escape outward or in the deformation direction.

[0037] As shown in FIG. 5, when the relay 10 is pushed in substantially to a proper position where the main body 11 comes substantially into contact with the bottom surface or back end of the fitting recess 24, the upper surface 14 (or rear surface as seen in the fitting direction FD) of the main body 11 slips under the locking hook portions 31. As a result, the locking pieces 30 are resiliently restored preferably substantially to their original shape, and the locking surfaces 33 of the locking hook portions 31 are substantially engaged with the corresponding outer edges of the upper surface 14 of the main body 11 to lock the relay 10. During this time, the relay terminals 12 at least partly enter the corresponding cavities to be connected with the female terminal fittings 26 at least partly accommodated therein.

[0038] In this state, a force may be exerted on the relay 10 upward in unlocking direction (direction substantially opposite to the fitting direction) as indicated by an arrow in FIG. 6. In such a case, as shown in FIG. 6, the locking hook portions 31 are pressed, whereby the opposite locking pieces 30 are resiliently deformed so as to widen a spacing therebetween. However, the locking surfaces 33 are still held inclined downward toward their projecting ends (or the projecting end 31PE of the locking hook portion 31) or at worst held substantially horizontal or substantially in parallel to the upper surface 14 of the main body 11 of the relay 10 as enlargedly shown at an upper part in FIG. 6. As a result, a locking force for locking the relay 10 can continue to act, thereby ef-

fectively preventing the withdrawal of the relay 10.

[0039] On the other hand, the relay 10 is properly withdrawn from the fitting recess 24 in the following procedure for maintenance or other reason. In such a case, as shown in FIG. 5, the leading end of the jig J1 is first at least partly inserted into the insertion portion 35 formed in the locking hook portion 31 of one locking piece 30, and the jig J1 is moved substantially in a deflection direction of the locking pieces 30 or in a direction of an arrow in FIG. 5, whereby the locking piece 30 is forcibly resiliently deformed in outward direction to disengage the locking hook portion 31 from the upper surface 14 of the main body 11 of the relay 10. Then, the side of the main body 11 disengaged from the locking hook portion 31 is slightly lifted by holding the main body 11 to bring the locking hook portion 31 onto the side surface of the main body 11, i.e. to hold this side of the main body 11 unlocked.

[0040] Subsequently, the other locking piece 30 is resiliently deformed in outward direction using the jig J1 to be disengaged, and the opposite side of the main body 11 is slightly lifted to also bring the locking hook portion 31 at this side onto the side surface of the main body 11.

[0041] Next, as shown in FIG. 7, the leading end of the jig J2 is at least partly inserted through the insertion opening 38 provided in the confirming window 37 and thrusts itself between the lower surface of the main body 11 of the slightly lifted relay 10 and the bottom surface of the fitting recess 24 (or between the back end of the fitting recess 24 and a corresponding surface of the relay 10) preferably while being guided by the inclination of the back surface 38A. Thereafter, by twisting the jig J2 preferably so as to rotate it about its longitudinal axis or by inclining the jig J2 such as to lift its leading end away from the back end surface of the fitting recess 24, the relay 10 is further lifted in the fitting recess 24. Then, the relay 10 can be taken out from the fitting recess 24 by holding the main body 11 of the relay 10 again and pulling it upward.

[0042] As described above, according to this embodiment, the locking surface 33 of the locking hook portion 31 provided at each locking piece 30 is so inclined at an angle X as to gradually approach the upper surface 14 of the main body 11 of the relay 10 or so as to be inclined towards a back end surface of the fitting recess 24 toward its projecting end. Thus, even if a force is exerted on the relay 10 in withdrawing direction to slightly widen a spacing between the locking pieces 30 and a spacing between the locking hook portions 31, the locking surfaces 33 are still held inclined downward toward their projecting ends or at worst held substantially horizontal or substantially in parallel to the upper surface 14 of the relay 10. As a result, the locking force for locking the relay 10 can continue to act, thereby effectively preventing the withdrawal of the relay 10.

[0043] In the case of withdrawing the relay 10 from the fitting recess 24 for maintenance or other reason, it is easy to forcibly resiliently deform the locking pieces 30 in order to cancel a locked state of the relay 10 since the insertion portions 35 for the jig J1 preferably are provided in the locking hook portions 31.

[0044] Further, by inserting the jig J2 through the insertion opening 38 provided in the confirming window 37, the jig J2 can easily thrust itself between the lower surface of the main body 11 and the bottom surface of the fitting recess 24 without damaging or scratching the main body 11 of the relay 10. By successively twisting the jig J2, the relay 10 can be smoothly lifted in the fitting recess 24.

[0045] As a result, the relay 10 can be efficiently withdrawn from the fitting recess 24.

[0046] Accordingly, to firmly lock an electrical part such as a relay 10, one or more, preferably a pair of locking pieces 30 are provided at opposite side walls of a fitting recess 24. Each locking piece 30 is formed in such a manner as to be resiliently deformable and is formed with a locking hook portion 31 on the inner surface of the upper end thereof. The lower surface of the locking hook portion 31 serves as a locking surface 33. This locking surface 33 is inclined downward or inwardly toward its projecting end with respect to a substantially horizontal plane and/or substantially in parallel with an upper or rear surface 14 (as a preferred locking surface) of a main body 11 of a relay 10 (as a preferred electric and/or electronic part). When a force acting upward in withdrawing direction is exerted on the relay 10 fitted in a fitting recess 24, the locking hook portions 31 are pressed, whereby the opposite locking pieces 30 are resiliently deformed so as to widen a spacing therebetween. However, the locking surfaces 33 are still held inclined downward toward their projecting ends or at worst held horizontal in parallel to the upper surface 14 of the main body 11. As a result, a locking force for locking the relay 10 can continue to act, thereby effectively preventing the withdrawal of the relay 10.

<Other Embodiments>

[0047] The present invention is not limited to the above described and illustrated embodiment. For example, following embodiments are also embraced by the technical scope of the present invention as defined by the claims. Beside the following embodiments, various changes can be made without departing from the scope and spirit of the present invention as defined by the claims.

(1) Although a pair of locking pieces facing each other are provided in the foregoing embodiment, the locking piece may be provided at only one surface or at three or more surfaces.

(2) The connector may be either separately formed from a junction box or the like and fitted thereinto later or may be so formed as to directly project from the junction box.

(3) The present invention is also applicable to connectors in general connectable with other electrical and/or electronic parts or compliances such as fuses, resistors, transistors, CPU and/or integrated circuits.

(4) The present invention was described with reference to a connector in which the locking pieces interact with the rear or upper surface of the relay as the preferred electric and/or electronic part, however, it should be understood that the respective locking pieces may interact with another locking surface or portion of the electric and/or electronic part such as a stepped surface or portion, a recess, and/or projections provided on the electric and/or electronic part.

LIST OF REFERENCE NUMERALS

[0048]

10 ...	relay
11 ...	main body
12 ...	relay terminal
14 ...	upper surface (of main body 11)
20 ...	connector
22 ...	housing main body
24 ...	fitting recess
26 ...	female terminal
30 ...	locking piece
31 ..	locking hook portion (locking section)
33 ...	locking surface
35 ...	insertion portion
37 ...	confirming window
38 ...	insertion opening
J1. J2 ...	jig

Claims

1. A connector formed with a fitting recess (24) into which a terminal-provided electrical and/or electronic part (10) such as a relay is at least partly fittable and used to establish a connection between at least one terminal fitting (26) at least partly mounted therein and the terminal (12) of the electrical and/or electronic part (10), at least one locking piece (30) having a locking portion (31) engageable with a locking surface (14) of the electrical and/or electronic part (10) with respect to its inserting direction (FD) being so provided at at least one wall surface of the fitting recess (24) as to be resiliently deformable,

wherein a locking surface (35) of the locking portion (31) to be engaged with the locking surface (14) of the electrical and/or electronic part (10) is so inclined as to gradually approach the locking surface (14) of the electrical and/or electronic part (10) toward the projecting end (31 PE, 33PE) thereof when the locking piece (31) is in a natural state.

2. A connector according to claim 1, wherein an insertion portion (35) into which a jig (J1) for forcibly resiliently deforming the locking piece (30) in unlocking direction is at least partly insertable is formed at the locking portion (31) of the locking piece (30), preferably at the projecting end (31 PE, 33PE) thereof.

3. A connector according to one or more of the preceding claims, wherein an insertion opening (38) which is open to the fitting recess (24), preferably to the back surface of the fitting recess (24) and through which a jig (J2) for lifting the electrical and/or electronic part (10) is at least partly insertable is formed in a surrounding wall of the fitting recess (24).

4. A connector according to claim 3, wherein the insertion opening (38) comprises a guiding surface (38A) for guiding the jig (J2) for lifting the electrical and/or electronic part (10) towards the electrical and/or electronic part (10) arranged in the fitting recess (24).

5. A connector according to one or more of the preceding claims, wherein the locking piece (30) comprises a guiding portion (32) for coming into contact with the electric and/or electronic piece (10) for guiding a deformation of the locking piece (30) and/or an at least partial insertion of the electric and/or electronic piece (10) into the fitting recess (24).

6. A connector according to one or more of the preceding claims, wherein the locking piece (30) is formed by providing one or more slits (34) in a respective portion of a housing (21) of the connector (20).

7. A connector according to one or more of the preceding claims, wherein the locking surface (35) is so inclined as to gradually approach the locking surface (14) of the electrical and/or electronic part (10) toward the projecting end (31PE) thereof or held substantially in parallel to the locking surface (14) of the electrical and/or electronic part (10), when the locking piece (31) is in a state (FIG. 6), where the locking piece (30) is resiliently deformed in a deforming direction (DD) and/or where the locking portion (31) is at least partly engaged with the locking surface (14) of the electrical and/or electronic part (10).

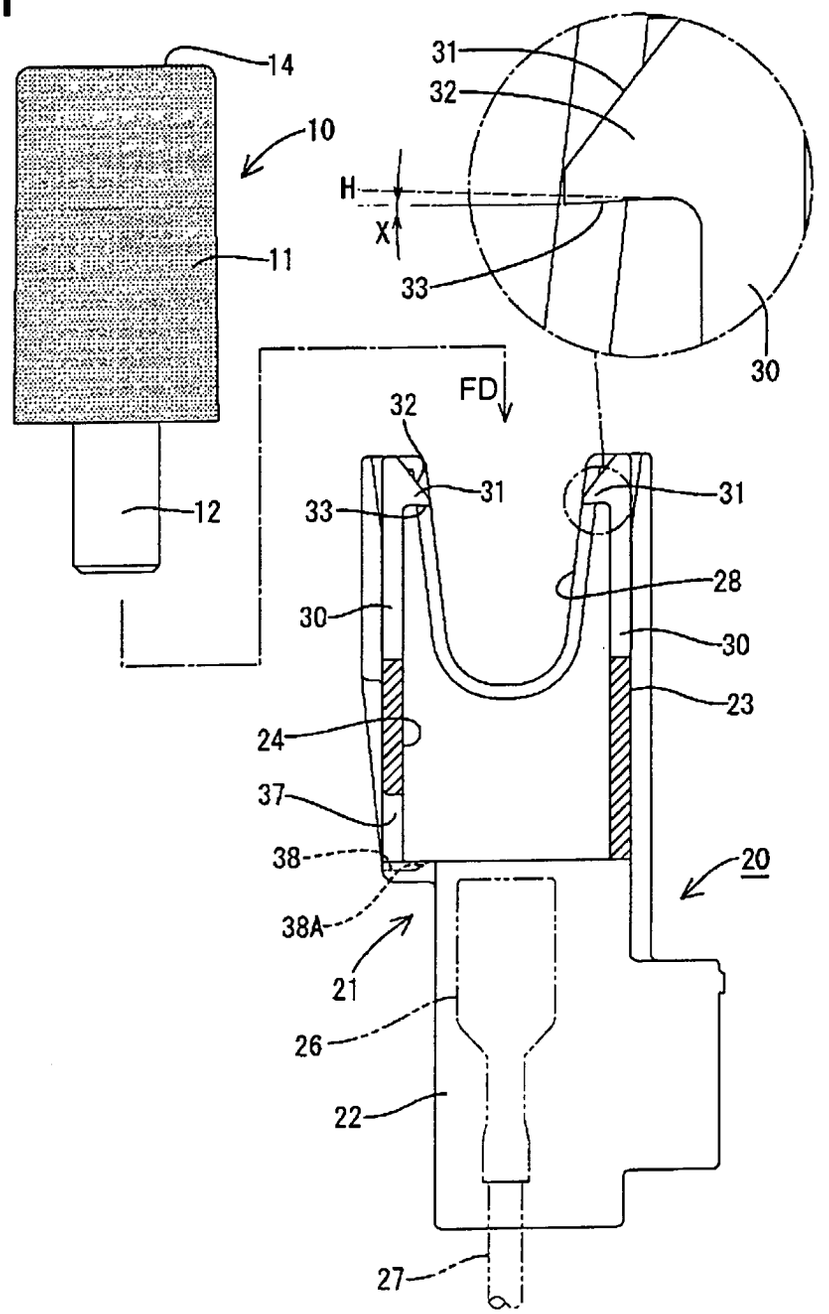
8. A connector according to one or more of the preceding claims, wherein the locking surface (35) is so inclined as to define an angle (X) to the locking surface (14) of the electrical and/or electronic part

(10) and/or to a direction substantially normal to the inserting direction (FD) of the electrical and/or electronic part (10) into the fitting recess (24), wherein the angle (X) is smaller than approximately 10°, more preferably smaller than approximately 5°.

9. A connector according to one or more of the preceding claims, wherein a confirming window (37) is provided for confirming the proper position of the electric and/or electronic part (10) in the fitting recess (24).

10. A junction box for an automotive vehicle comprising a connector according to one or more of the preceding claims.

FIG. 1


14
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FD
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23
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37
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38A
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FIG. 2

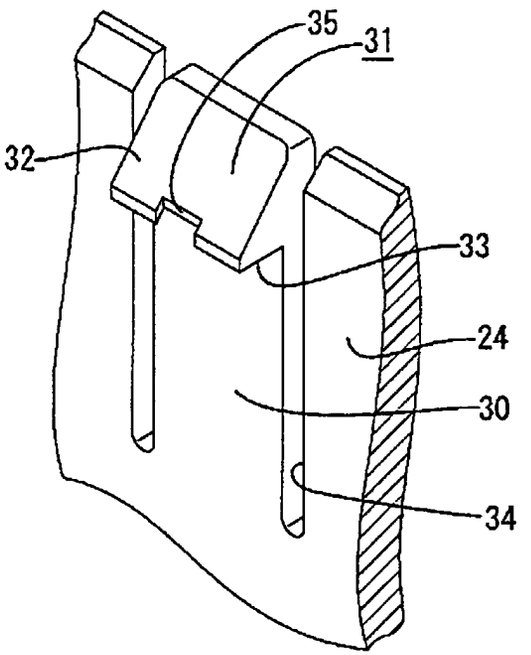


FIG. 3

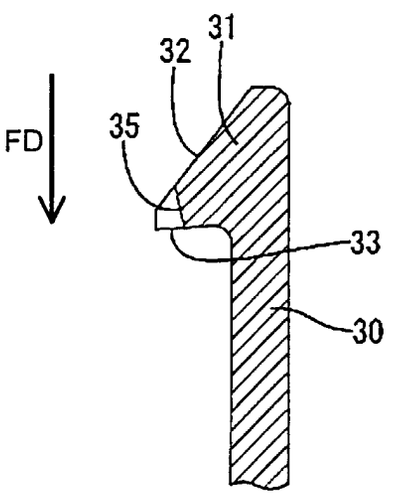


FIG. 4

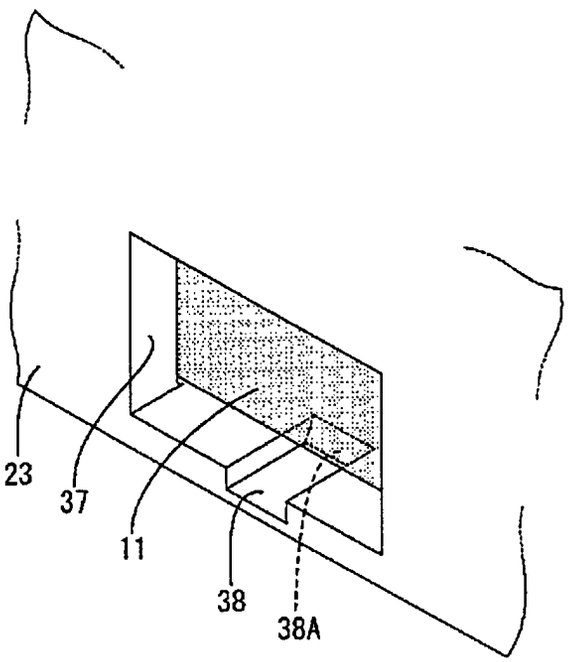


FIG. 5

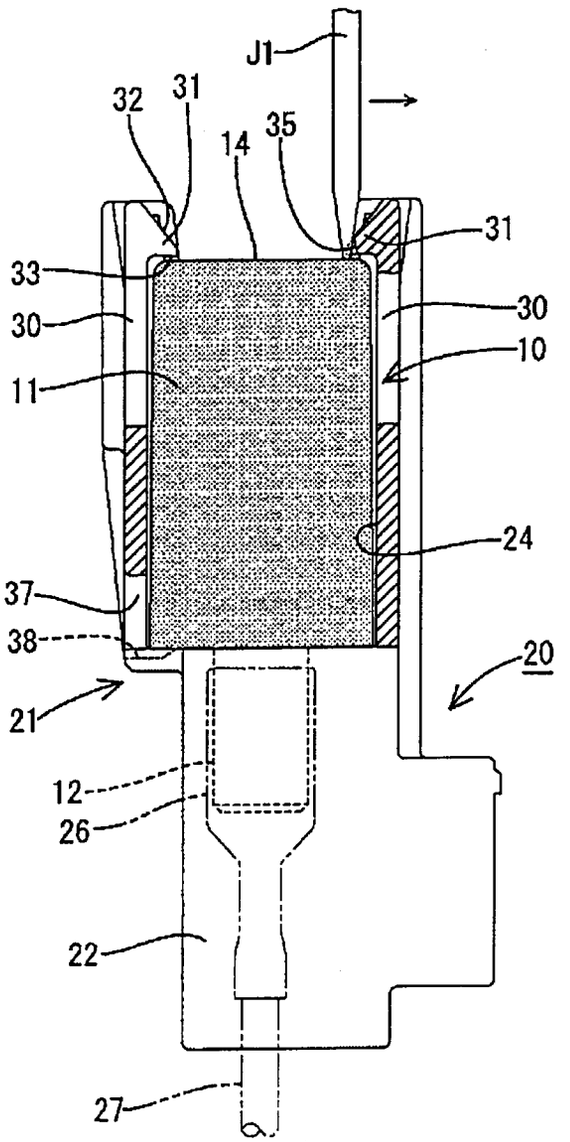


FIG. 6

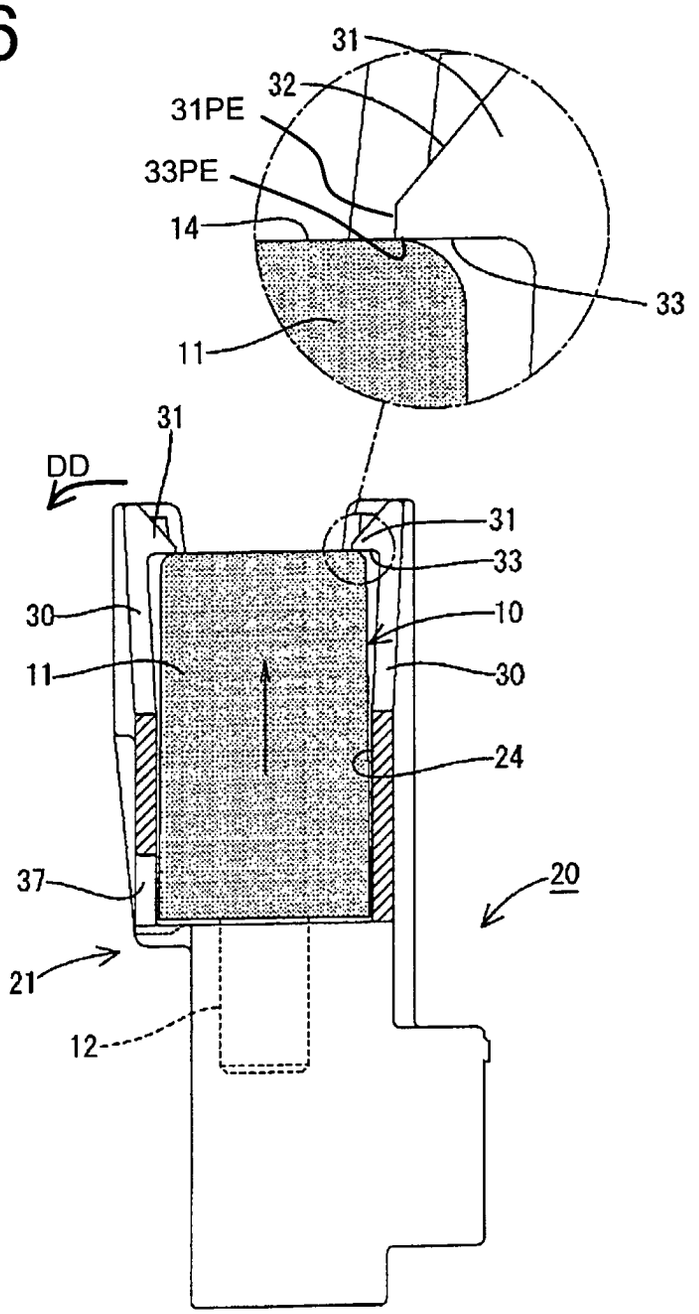


FIG. 7

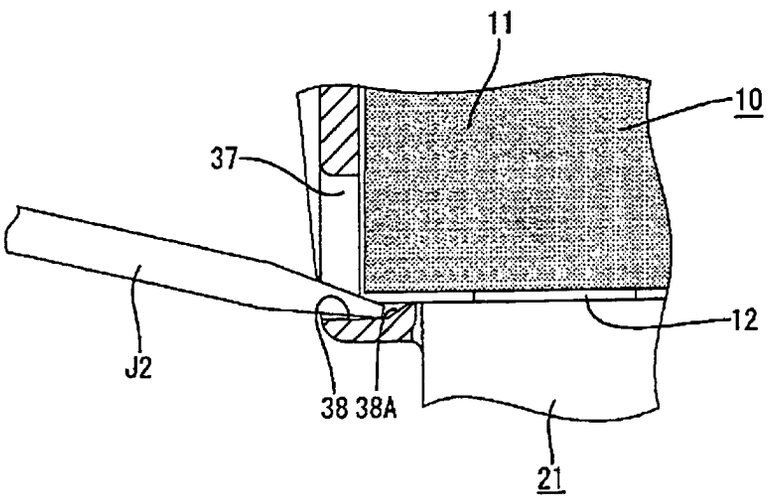
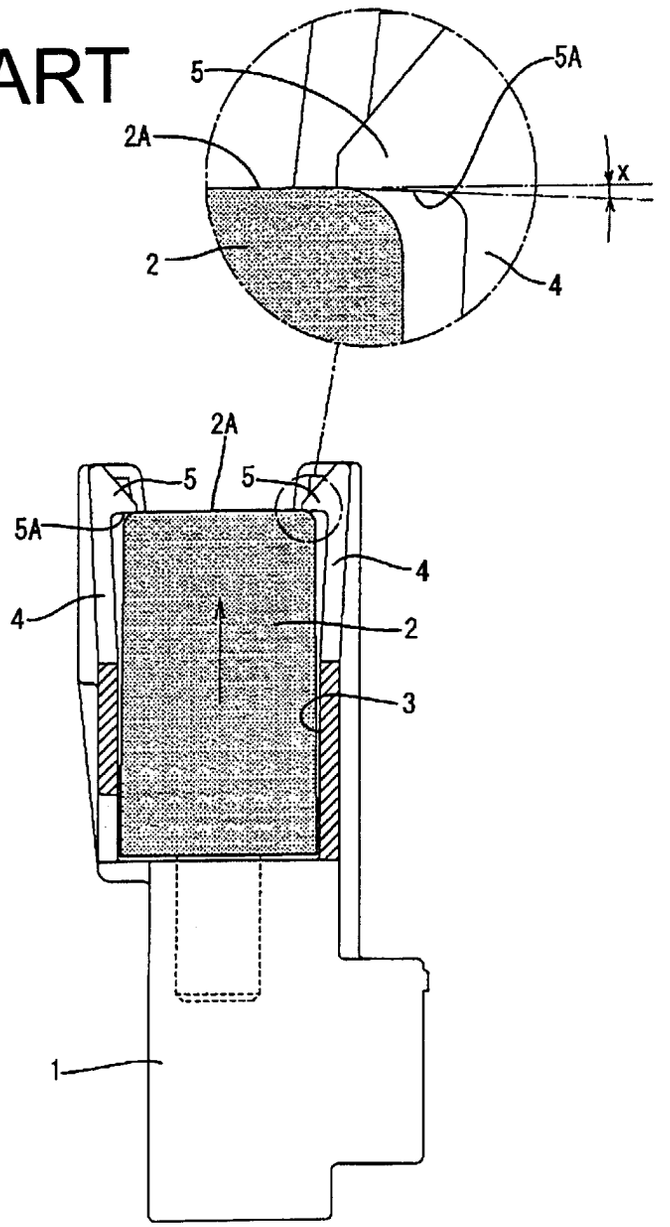


FIG. 8
PRIOR ART



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 00 9832

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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