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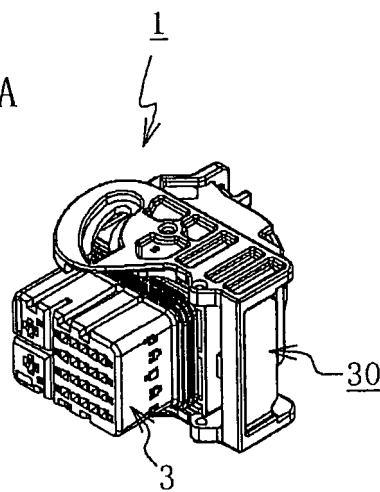
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(54) **Electric connector**

(57) An electric connector has: a connector housing 3 inside which pins are housed and which has at the front a portion for coupling with a counterpart connector and at the rear a holder mounting portion; a sealing member 35 that is fitted onto the outer periphery of the holder mounting portion; a rear holder 6 which has at the front a portion for clamping of the sealing member 35 and which is fixed onto the holder mounting portion; a rear cover 20 which covers the rear of the rear holder 6; and a manipulation lever 30 that latches to the counterpart connector. The pair of opposed outer walls of the rear holder 6 are formed as double walls constituted of an inner plate and an outer plate with a gap therebetween, and in such double walls there are formed housing latching portions with which the connector housing 3 engages, cover installation portions to which the rear cover 20 is mounted, and lever mounting portions to which the manipulation lever 30 is mounted. Thanks to such a structure, an electric connector is provided in which the housing latching portions, cover installation portions and lever mounting portions are gathered together on a single member, so that the shapes of such latching portions, etc., are rendered simple, and assembly also is rendered simple.

FIG. 1A



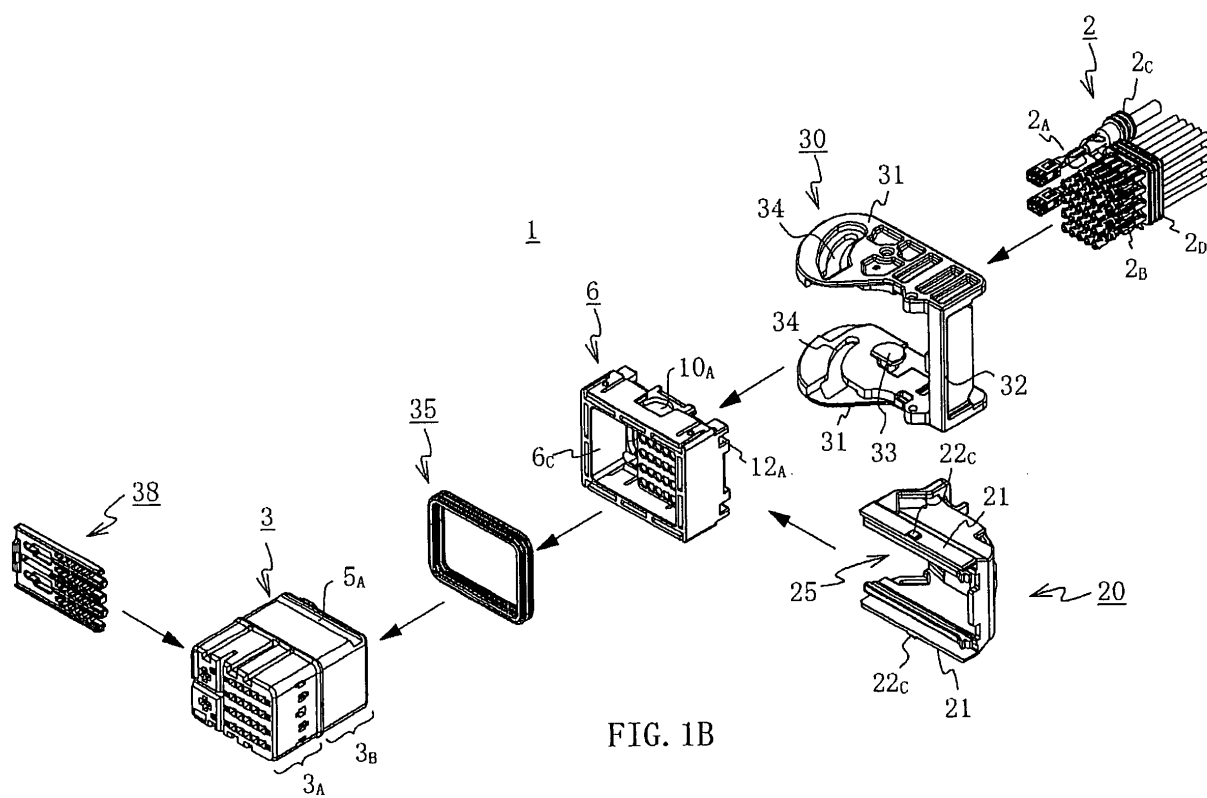


FIG. 1B

Description

BACKGROUND

1. Technical Field

[0001] The present invention relates to an electric connector. More particularly, the present invention relates to an electric connector whose coupling with a counterpart connector is facilitated via manipulation of a manipulation lever.

2. Related Art

[0002] Large numbers of patents present electric connectors that are so contrived that a manipulation lever is fitted to the housing of either one of a pair of first and second connectors that couple together, and by engaging this manipulation lever with the housing of the other connector and turning it, coupling of the first and second connectors can be effected smoothly. Representative examples are set forth in US Patent 5647752 and in JP-A-2005-123102 issued in Japan.

[0003] Fig. 18 is an exploded perspective view of a related art electric connector. As Fig. 18 shows, the electric connector set forth in US Patent 5647752 has a pair of male and female connectors that couple together, of which the female connector 40 includes a connector housing 41 and a latching lever 44 that is mounted to the housing 41.

[0004] The connector housing 41 has an outer housing 41A at the front and an inner housing 41B at the rear. The outer housing 41A is provided, at both sides on the rear edge, with receiving slots 42, 42 that are open at the rear. These receiving slots 42, 42 form a pair, but the reference numeral for one thereof is omitted in Fig. 18. Likewise below, where items form a pair, the reference numeral for one thereof is omitted.

[0005] Facing the receiving slots 42, 42 are engaging portions 43, 43 provided in the inner housing 41B. At the end portion of each of these engaging portions 43, 43 there is provided a flexible engaging piece 43A. During fitting of the flanged projecting portions 45, 45 into the receiving slots 42, 42, these flexible engaging pieces 43A, 43A are resiliently displaced by protrusions 45C, 45C, thus allowing the protrusions 45C, 45C to pass through.

[0006] Also, the latching lever 44 is provided with flanged projecting portions 45, 45 that are turnable around a particular turn axis P running through the two side portions, and that moreover are in positions on the inner surfaces of the two side portions that lie along the turn axis P. The flanged projecting portions 45, 45 have columnar pivot portions 45A, 45A, flanges 45B, 45B at the tip portions, and protrusions 45C, 45C that project from the flanges. The latching lever 44 is also provided with slide-contact slots 46, 46 on both sides.

[0007] To mount the latching lever 44 to the connector

housing 41, first the latching lever 44 is moved along the outer housing 41A toward the receiving slots 42, and the flanged projecting portions 45 are inserted into the receiving slots 42. Via such insertion, the pivot portions 45A of the flanged projecting portions 45 of the latching lever 44 are inserted into the U-shaped receiving slots 42 in the rear edges of the outer housing 41A.

[0008] Next, the latching lever 44 is slid along the receiving slots 42, and as a result of such sliding, the protrusions 45C come into sliding contact with the tongue-like flexible engaging pieces 43A of the engaging portions 43 that are provided as integral parts of the inner housing 41B, and the flexible engaging pieces 43A rise up. More precisely, the flexible engaging pieces 43A are pushed outwards. When the latching lever 44 is pushed in further to a position where the pivot portions 45A reach the innermost part of the receiving slots 42, the protrusions 45C that protrude up from the flanges 45B pass through, exploiting the resilience of the flexible engaging pieces 43A. As a result, the flexible engaging pieces 43A, which had been pushed outward, return to their original positions, and the tips of the flexible engaging pieces 43A contact against and are latched onto the protrusions 45C of the flanged projecting portions 45, which have advanced deep into the slot interior. Thereby, the latching lever 44 is fixed.

[0009] The electric connector set forth in JP-A-2005-123102 is composed of: a plurality of pins; a connector housing in which the pins are housed, a rear holder that is installed to the rear portion of the connector housing and has a plurality of through-holes through which the pins are inserted; a sealing member that is interposed between the connector housing and the rear holder; and a manipulation lever and rear cover that are fitted to the rear portion of the connector housing. This electric connector is so configured that sliding of the rear cover results in the rear holder being fixed to the connector housing, and simultaneously in the sealing member being clamped, so that watertightness is preserved between the outer surfaces of the electric wire portions of the wired pins and the sealing member.

[0010] According to the electric connector set forth in US Patent 5647752, the mating and latching of the two members can be effected in a simple manner, by the operation of pushing the latching lever onto the connector housing. More precisely, when the flanged projecting portions 45 are inserted into the U-shaped receiving slots 42, the protrusions 45C push the flexible engaging pieces 43A outward, and when the latching lever 44 is pushed in further, the protrusions 45C pass through, exploiting the resilience of the flexible engaging pieces 43A. As a result, the flexible engaging pieces 43A, which had been pushed outward, return to their original positions, and the protrusions 45C are latched by the tips of the flexible engaging pieces. Once latched in this way, the latching lever will not come out of place, even if an external force opposite to the direction in which the latching lever was pushed in should act thereon.

[0011] However, the protrusions of the flanged projecting portions are merely latched by the end portions of the flexible latching pieces; after such latching, the flexible latching pieces are not locked. Therefore, there is a risk that if some strong external force such as an impact of some kind acts on the latching lever, the flexible latching pieces will be resiliently deformed and the latching of their tip portions and the protrusions will come undone. Should this latching come undone, the connection with the counterpart connector will be rendered faulty, causing the operation of the electric equipment connected to these connectors to be stopped. Further, if the connectors are waterproof type, the watertightness with the counterpart connector will become faulty.

[0012] Also, in the electric connector set forth in JP-A-2005-123102, since the connector housing in which the plurality of pins is housed must be provided with portions for mounting/coupling of the rear holder, manipulation lever and rear cover, the housing's structure is complex.

SUMMARY

[0013] Various aspects and features of the present invention are defined in the appended claims.

An advantage of some aspects of the invention is to provide the housing latching portions, cover installation portions and lever mounting portions gathered together on a single member, so as to provide an electric connector in which the shapes of such latching portions, etc., are rendered simple, and which can be assembled in a simple manner.

[0014] Another advantage of the invention is to provide an electric connector whose coupling with a counterpart connector will be firm, so that the manipulation lever will not come out of place even if subjected to a strong external force such as an impact.

[0015] A further advantage of the invention is to provide an electric connector in which the manipulation lever can be fixed via the lever's pivot axles, and hence the manipulation lever fixing means are rendered simple.

[0016] A still further advantage of the invention is to provide an electric connector so configured that it is not possible to mount the rear cover in the wrong direction, and assembly is thus facilitated.

[0017] According to an aspect of the invention, an electric connector includes: a connector housing inside which pins are housed, and which has at the front an insertion portion into which a counterpart connector is inserted, and at the rear a holder mounting portion; a sealing member that is mounted onto the outer periphery of the holder mounting portion; a rear holder the front end portion of which is a contacting surface for contacting with the sealing member; which has at the front a mating cavity that is fixed onto the holder mounting portion, and at the rear a cover installation portion; and which is fixed to the connector housing with the sealing member interposed; and a rear cover which is mounted to the cover installation portion via sliding motion. The electric connector incor-

porates the features that: the pair of opposed outer walls of the rear holder are formed as a double wall constituted of an inner plate and an outer plate with a gap therebetween, and in such double wall there is formed a housing latching portion with which the connector housing engages, a cover installation portion to which the rear cover is mounted, and a lever mounting portion to which the manipulation lever is mounted.

[0018] The housing latching portions may be formed as a latching arm possessing resilience that are provided on the inner plate, with a latching bar being provided at the end of such latching arm, and a latching slot may be provided in the surface of the connector housing; so that the rear holder is latched to the connector housing via the latching bar being engaged into the latching slot.

[0019] The cover installation portion may be formed as a pair of support projections provided on the inner plate, plus a separation prevention projection provided on the rear wall at the rear of the rear cover, with a flat-bottomed slot being also provided in the rear cover; so that the rear cover is fixed by such support projections and separation prevention projection.

[0020] The lever mounting portion may be formed as a pivot projection provided on the opposed surfaces of the manipulation lever's pair of opposed lever arms, plus a receiving hole that communicate with the gap between the double wall of the rear holder; so that the pivot projection is inserted into such gap through the receiving hole, and the pivot projection is supported so as to be freely rotatable inside the receiving hole.

[0021] The pivot projections may have an axle that rises up from the lever arm and a flange provided on the top of such axle, so that when the pivot projection is inserted into the receiving hole, the flange will be inserted into the aforementioned gap, and the manipulation lever's opposed surface will be brought into contact against the upper plate of the double wall.

[0022] A first cam slot for guidance toward the pivot projection may be provided on the lever arm's opposed surface, a turn restricting portion may be provided on the pivot projection's axle, and a latching projection may be provided on the rear cover's sidewall surface; so that during coupling with the counterpart connector, the rear cover's latching projection will be positioned between the manipulation lever's cam slot and turn restricting portion, and turning of the pivot projection will thereby be restricted.

[0023] Inside the manipulation lever's first cam slot, a latching slot may be provided adjacent to the turn restricting portion, so that during coupling with the counterpart connector, the latching projection will fit inside such latching slot and the turn restricting portion will contact against the latching projection fitted inside the latching slot, restricting turning of the pivot projection.

[0024] The turn restricting portions may be formed as a flat edge plus a circular edge that are provided on the outer surface of the axle, in such a manner that the flat edge will contact against the latching projection.

[0025] A second cam slot that inhibits mounting of the rear cover may be provided on the opposed surfaces of the pair of lever arms.

[0026] Thanks to the foregoing structure, the present invention yields the superior advantages that will now be described. Namely, according to an aspect the invention, the housing latching portion, cover installation portion and lever mounting portion are provided gathered together in the rear holder; consequently it is a simple matter to form these housing latching portion etc., and moreover it is possible to link these latching portion, etc. More precisely, the connector housing usually houses the pin and their accessories, etc., and therefore has a complex structure, so that providing the aforementioned latching portion, etc., on the connector housing would render the structure thereof even more complex, whereas it is a simple matter to form the latching portion etc., on the rear holder since few other parts are mounted thereto, unlike the connector housing. Also, gathering together in the rear holder the housing latching portion, cover installation portion and lever mounting portion facilitates linking of these items, so that it is possible, for example, to first link the connector housing to the rear holder via the housing latching portion, then mount the manipulation lever to the lever mounting portion, and follow that with the operation of installing the rear cover to the cover mounting portion, thus effecting assembly of the electric connector in a successive and simple manner.

[0027] According to one preferable aspect, the housing latching portion is formed as a latching arm possessing resilience that is provided on the inner plate, with a latching bar being provided at the end of such latching arm, and a latching slot is provided in the surface of the connector housing; so that by engaging the housing latching portion's latching bar into the housing's latching slot, the rear holder can be latched simply and firmly to the connector housing.

[0028] According to another preferable aspect, the cover installation portion is formed as a pair of support projections provided on the inner plate, plus a separation prevention projection provided on the rear wall at the rear of the rear cover, with a flat-bottomed slot being provided in the rear cover; so that, by fixing the rear cover via such support projection and separation prevention projection, the rear cover can be installed simply and firmly to the rear holder.

[0029] According to another preferable aspect, the lever mounting portion is formed as a pivot projection provided on the opposed surfaces of the manipulation lever's pair of lever arms, plus a receiving hole that communicates with the gap between the rear holder's double wall; so that the manipulation lever can be mounted simply and firmly to the rear holder.

[0030] According to another preferable aspect, the pivot projection is formed as an axle that rises up from the lever arm plus a flange provided on the top of such axle, so that when the pivot projection is inserted into the receiving hole, the flange will be inserted into the afore-

mentioned gap, and the manipulation lever's opposed surface will be brought into contact against the upper plate of the double wall. As a result, even if a large external force should act on the manipulation lever, there will be no deformation since the upper plate will be contacting against the manipulation lever's opposed surface, and hence detachment of the pivot projection can be prevented.

[0031] According to another preferable aspect, a latching slot will preferably be provided adjacent to the turn restricting portion inside the manipulation lever's first cam slot, so that during coupling with the counterpart connector, the latching projection will fit inside such latching slot and the turn restricting portion will contact against the latching projection fitted inside the latching slot, restricting turning of the pivot projection. This will result in firm fixing of the manipulation lever and reliable coupling with the counterpart connector. Further, since turning of the manipulation lever will be restricted when coupling with the counterpart connector is effected, the sealing member mounted to the connector housing will not come loose, and good waterproofing effects will be obtained.

[0032] According to another preferable aspect, a second cam slot that inhibit mounting of the rear cover will preferably be provided on the opposed surfaces of the pair of lever arms.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033] Example embodiments of the present invention will now be described by way of example only with reference to the accompanying drawings, wherein like numbers reference like elements.

[0034] Illustrating an electric connector of an embodiment of the invention, Fig. 1A is a perspective view of the whole connector and Fig. 1B is an exploded version of the perspective view of Fig. 1A.

[0035] Illustrating the electric connector of Fig. 1 turned through 180 degrees, Fig. 2A is a perspective view of the whole connector and Fig. 2B is an exploded version of the perspective view of Fig. 2A.

[0036] Illustrating the connector housing of Figs. 1 and 2, Fig. 3A is an enlarged perspective view of the connector housing in Fig. 1B, and Fig. 3B is an enlarged perspective view of the connector housing in Fig. 2B.

[0037] Illustrating the rear holder of Figs. 1 and 2, Fig. 4A is an enlarged perspective view of the rear holder in Fig. 1B, and Fig. 4B is an enlarged perspective view of the rear holder in Fig. 2B.

[0038] Illustrating the rear cover of Figs. 1 and 2, Fig. 5A is an enlarged perspective view of the rear cover in Fig. 1B, and Fig. 5B is an enlarged perspective view of the rear cover in Fig. 2B.

[0039] Illustrating the manipulation lever of Figs. 1 and 2, Fig. 6A is an enlarged perspective view of the manipulation lever in Fig. 1B, and Fig. 6B is an enlarged perspective view of the manipulation lever in Fig. 2B.

[0040] Illustrating the manipulation lever in the process

of being mounted to the rear holder, Fig. 7A is a perspective view with a cut made through the relevant parts, and Fig. 7B is a side view of Fig. 7A.

[0041] Illustrating the manipulation lever after mounting to the rear holder, Fig. 8A is a perspective view with a cut made through the relevant parts, and Fig. 8B is a side view of Fig. 8A.

[0042] Illustrating the process of joining the connector housing and the rear holder, Fig. 9A is a perspective view of the items prior to being joined, Fig. 9B is a perspective view of the items after being joined, and Fig. 9C is an enlarged sectional view of portion IXC in Fig. 9B.

[0043] Illustrating the process of mounting the rear cover to the connector housing plus rear holder assembly shown in Fig. 9, Fig. 10A is a perspective view of the items prior to such mounting, Fig. 10B is a perspective view of the items after such mounting, and Fig. 10C is an enlarged sectional view of portion XC in Fig. 10B.

[0044] Illustrating the process of joining the connector housing and the rear holder, Fig. 11A is a perspective view of the items prior to being joined, Fig. 11B is a perspective view of the items after being joined, and Fig. 11C is an enlarged sectional view of portion XIC in Fig. 11B.

[0045] Illustrating the process of mounting the rear cover to the connector housing plus rear holder assembly shown in Fig. 11, Fig. 12A is a perspective view of the items prior to being joined, Fig. 12B is a perspective view of the items in the process of being joined, and Fig. 12C is an enlarged view of portion XIIC in Fig. 12B.

[0046] Illustrating mounting of the rear cover to the rear holder, Fig. 13A is a plan view, and Figs. 13B to 13D show stepwise the states in the mounting of the rear cover, being sectional views along line XIIB - XIIB in Fig. 13A.

[0047] Illustrating mounting of the rear cover to the rear holder, Fig. 14A is a plan view, and Figs. 14B and 14C show stepwise the states in the mounting of the rear cover, being sectional views along line XIVB - XIVB in Fig. 14A.

[0048] Illustrating the male connector, Fig. 15A is a perspective view of the whole connector, and Fig. 15B is an exploded version of the perspective view of Fig. 15A.

[0049] Illustrating the two connectors in the state prior to coupling, Fig. 16A is a perspective view of the whole, Fig. 16B is a rear view seen in direction X in Fig. 16A, Fig. 16C is a sectional view of the housing side of a line cut along XVIC - XVIC in Fig. 16B, and Fig. 16D is a sectional view of the manipulation lever side of a line cut along XVIC - XVIC in Fig. 16B.

[0050] Illustrating the two connectors in the state after coupling, Fig. 17A is a perspective view of the whole, Fig. 17B is a rear view seen in direction X in Fig. 17A, Fig. 17C is a sectional view of the housing side of a line cut along XVIIC - XVIIC in Fig. 17B, and Fig. 17D is a sectional view of the manipulation lever side of a line cut along XVIIC - XVIIC in Fig. 17B.

[0051] Fig. 18 is an exploded perspective view of a

related art electric connector.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0052] Exemplary embodiments of the present invention will now be described with reference to the accompanying drawings. First will be described, with reference to Figs. 1 to 6, the whole of an electric connector according to a first embodiment, and the individual parts composing such connector. Figs. 1 and 2 show the whole connector and its individual parts, while Figs. 3 to 6 show the individual parts. The arrows between the parts in Figs. 1B and 2B indicate the direction of assembly.

[0053] As shown in Figs. 1 and 2, this electric connector ("connector" below) 1 consists of a female connector, and has a plurality of female pins 2, a female connector housing 3 in which the pins 2 are housed ("connector housing" below), a rear holder 6 that is mounted to the rear of the connector housing 3, a manipulation lever 30 that is mounted to the outer wall of the rear holder 6 and facilitates coupling with the counterpart connector, and a rear cover 20 that is mounted to the rear portion of the rear holder 6 and covers the rear end portions of the pins 2. The structure is such that a ring-like sealing member 35 is mounted to the outer periphery wall of the connector housing 3, and a terminal position assurance ("TPA" below) 38 that senses the fitting condition of the pins is mounted to a sidewall of the connector housing 3. The individual parts composing the connector will now be described in detail.

[0054] As shown in Figs. 1 and 2, the female pins 2 are made up of two types of female pin of differing sizes; more precisely, relatively large-sized female pins ("large pins" below) 2_A, and female pins of a smaller size ("small pins" below) 2_B. The female pins of each type have a contacting portion at the forward end and a lead wire fixing portion at the rear end, the lead wires being connected to the fixing portions. Ring-shaped sealing members 2c are fitted around the outer peripheries of the lead wires of the large pins 2_A. The small pins 2_B are gathered into a cluster of, for example, 20 pins, and a ring-like sealing member 2_D is fitted around the periphery of such pin cluster.

[0055] As shown in Fig. 3, the connector housing 3 is enclosed by roughly rectangular front and rear walls 3₁, 3₂ at the front and rear and by a pair of opposed top and bottom walls 3₃, 3₃ and left and right sidewalls 3₄, 3₄, around its periphery, and has a front portion constituted of an insertion portion 3_A for insertion of the counterpart connector, and a rear portion constituted of a roughly oblong member having a coupling portion 3_B that is fitted into the rear holder 6. Such member is formed as a molding of insulating synthetic resin.

[0056] In the interior of this connector housing 3 there are formed, from the rear wall 3₂ towards the front wall 3₁, through-holes 4_A, 4_B through which the two types of female pins 2_A, 2_B are inserted (see Fig. 3B). The large pins 2_A are inserted into the through-holes 4_A, and the

cluster of small pins 2_B is inserted into the through-hole 4_B . In the front wall 3_1 there are formed insertion holes for insertion of the male pins of the counterpart connector 40 (see Fig. 15) that connect with the pins 2_A , 2_B inserted through the insertion holes 4_A , 4_B in the rear wall 3_2 . Further, the front wall 3_1 of the connector housing 3 is divided up by a narrow slot. Division of the front wall 3_1 by such slot means that coupling with the counterpart connector will be smooth, since during insertion into such connector the slot's width will contract.

[0057] In one of the sidewalls 3_4 of the insertion portion 3_A there is formed a mounting hole 5_B into which the TPA 38 is mounted. Also, in the top and bottom walls 3_3 , 3_3 at the rear end of the coupling portion 3_B there is formed a flat-bottomed latching groove 5_A into which a latching bar 11_B of the rear holder 6 to be described later (see Fig. 9) latches. Between this flat-bottomed latching groove 5_A and the rear wall 3_2 is located a sidewall portion 5_A that constitutes the sidewall of the flat-bottomed latching groove 5_A . This sidewall portion 5_A is formed as a part of the top wall 3_3 . A similar latching groove 5_A and sidewall portion 5_A are also formed in the bottom wall 3_3 . Further, a rib 3_0 that restricts the motion of the sealing member 35 is formed on the outer periphery of the connector housing 3 at the boundary between the insertion portion 3_A and the holder coupling portion 3_B .

[0058] As shown in Fig. 4, the rear holder 6 has roughly rectangular front and rear walls 6_1 , 6_2 at the front and rear, and an outer periphery constituted of a member that is enclosed by pairs of opposed outer walls, namely top and bottom walls 6_3 , 6_3 and left and right sidewalls 6_4 , 6_4 . Such member is formed as a molding of insulating synthetic resin. In the front wall 6_1 at the front of the rear holder 6 there is formed a mating cavity 6_C for insertion of the coupling portion 3_B of the connector housing 3. The interior of this mating cavity 6_C is partitioned by a partitioning wall 6_D , and in the partitioning wall 6_D there are formed through-holes through which the two types of pin 2_A , 2_B are inserted.

[0059] The top and bottom walls 6_3 , 6_3 are each provided with a cover mounting portion RC and a lever mounting portion LC, to which are mounted a rear cover 20 and a manipulation lever 30 respectively, and with a housing latching portion LA that engages with the connector housing 3. The top and the bottom cover mounting portions RC, lever mounting portions LC and housing latching portions LA are each formed with the same structure, and all are formed by molding of the top and bottom walls 6_3 , 6_3 into a particular structure. Likewise the bottom wall 6_3 and the top wall 6_3 both have the same structure. To avoid duplication in the description therefore, the top wall 6_3 only is described below.

[0060] As shown in Fig. 4, the top wall 6_3 has a particular thickness and a certain gap 6_G formed between the inner and outer surfaces, being a double wall, or more precisely being composed of an outer plate 6_A and an inner plate 6_B with the gap 6_G interposed. This gap 6_G is of a dimension such that the flange 33_B of the manipu-

lation lever 30 to be described later can be inserted therein and turned. The outer plate 6_A is foreshortened in the front-rear direction, that is, extends from the front wall 6_1 to a point short of the rear wall 6_2 . In other words, the width of the outer plate 6_A stops short compared to that of the left and right sidewalls 6_4 , 6_4 . As a result of such foreshortening of the outer plate 6_A , the rear wall 6_2 is also foreshortened compared to the front wall. It is in between the foreshortened outer plate 6_A and rear wall 6_2 that the cover and lever mounting portions RC, LB and the housing latching portion LA are formed.

[0061] The outer plate 6_A is partitioned by plural slits 8_0 , 8_0 , which extend from the rear edge to shortly before the front wall 6_1 , into three areas, namely into first to third areas 6_{A1} to 6_{A3} , being in this manner partially divided up. The first and third areas 6_{A1} and 6_{A3} are formed to the same size, while the second area 6_{A2} is formed larger than the first and third areas 6_{A1} and 6_{A3} . Roughly in the center of this large second area 6_{A2} there is provided a rectangular recess 9 having a particular width and depth and extending from the rear wall 6_2 toward the front wall 6_1 . The second area 6_{A2} is further divided into subareas 6_{A21} , 6_{A21} at the two ends of the recess 9. The bottom 9_A of the recess 9 is formed to be flat. Thanks to the recess bottom 9_A being made flat, the cut portion 33_B of the flange 33_B of the pivot projection 33 to be described later can be aligned with such flat surface, and hence it will be a simple matter to remove the pivot projection 33 from the gap 6_G .

[0062] The rear portions of the first and third areas 6_{A1} and 6_{A3} are extended past a step difference 6_0 toward the rear wall 6_2 . Such extensions constitute support projections 7_A , 7_A of a particular thickness and width. The thickness of these support projections 7_A , 7_A is such as to enable insertion into the flat-bottomed slots 22_0 of the rear cover 20.

[0063] The inner plate 6_B is partitioned into five areas, namely into first to fifth areas 6_{B1} to 6_{B5} , being in this manner partially divided up. The first and fifth areas 6_{B1} and 6_{B5} - the side areas - are the same size. Likewise the second and fourth areas 6_{B2} and 6_{B4} are the same size. The first and fifth areas 6_{B1} and 6_{B5} form support projections 7_A , 7_A . The third area 6_{B3} has a larger surface area than the other areas, and an edge that is extended to the rear. In the third area 6_{B3} there is formed a receiving hole 10_A into which the pivot projection 33 of the manipulation lever 30 fits. The receiving hole 10_A is formed almost exactly beneath the recess 9 in the outer plate 6_A . Also, the receiving hole 10_A communicates with the gap 6_0 . At the extended edge portion of the third area 6_{B3} there is formed a guide surface 10_B which consists of an inclined plane. Further, the bottom of the third area 6_{B3} forms a surface of the inner wall 6_B , surrounding the mating cavity 6_C , the thickness thereof being such as to enable insertion into the flat-bottomed slots 22_0 of the rear cover 20.

[0064] Thus, the support projections 7_A , 7_A and the inner plate 6_B are formed to the same thickness, and are

inserted into the flat-bottomed slots 22₀ of the rear cover 20 to be described later. At the left and right sidewalls 6₄, 6₄ surfaces of the rear wall 6₂ there are formed mounting portions 12_A, 12_A into which the rear cover 20 will be inserted.

[0065] Also, on the rear wall 6₂, between the two mounting portions 12_A, 12_A, there is formed a rail projection 6_{2A} with top and bottom edges projecting outward at particular heights. Such a rail projection 6_{2A} is also formed at the bottom of the rear wall 6₂. Thanks to the provision of these rail projections 6_{2A}, the rear cover 20 will, for example, when inserted into one of the fitting portions 12_A, be guided by the rail projections 6_{2A} and as a result will be held to the rear holder 6, and will not separate from the rear holder 6. The rail projections 6_{2A} are separation prevention projections since they prevent separation of the rear cover 20.

[0066] Latching portions 11, 11 that engage with the connector housing 3 are formed in the second and fourth areas 6_{B2}, 6_{B4}. These latching portions 11, 11 are formed almost exactly beneath the subareas 6_{A21}, 6_{A21} of the outer plate 6_A, and have each the same structure.

[0067] As shown in Fig. 9C, these latching portions 11 have: a base portion 11₀ that is joined to the inner plate 6_B; a latching arm 11_A that extends from the base portion and has a particular length; and, located at the end of the latching arm 11_A, an upper projection that projects upward from the end portion, that is, a projecting block 11_C, and a lower projection that projects downward, that is, a latching bar 11_B. Partially separated from the inner plate 6_B by a long incision, the latching arm 11_A is an elastic arm piece possessing resilience. The latching bar 11_B engages into the flat-bottomed latching groove 5_A in the connector housing 3. The projecting block 11_C performs the role of inhibiting mounting of the rear cover 20 to the rear holder 6 if engagement of the latching bar 11_B with the latching groove 5_A is incomplete. Further, when engagement of the latching bar 11_B with the latching groove 5_A is completely effected, the top of the projecting block 11_C will contact against the sidewall 22_A of the rear cover 20, so that motion of the latching arm 11_A will be restricted, rendering firm the engagement of the latching bar 11_B with the latching groove 5_A. As a result, the connector housing 3 and rear holder 6 will be soundly joined.

[0068] The cover and lever mounting portions RC, LB and the housing latching portion LA are formed between the outer and inner plates 6_A and 6_B and the rear wall 6₂, as shown in Fig. 4. The cover mounting portion RC is composed principally of the support projections 7_A, 7_A, the inner plate 6_B of the second area 6_{B2} between the support projections 7_A, 7_A, and the rail projection 6_{2A}. The lever mounting portion LB is composed principally of the gap 6_G between the inner and outer plates 6_A, 6_B, and the receiving hole 10_A provided in the inner plate 6_B. Further, the housing latching portion LA is made up of the latching portions 11, 11 provided in the second and fourth areas 6_{B2}, 6_{B4} of the inner plate 6_B, and the latching portions 11 are composed of a base portion 11₀ that is

joined to the inner plate 6_B, a latching arm 11_A that extends from the base portion and has a particular length, and, located at the end of the latching arm 11_A, a projecting block 11_C that projects upward from the end portion and a latching bar 11_B that projects downward (see Fig. 9C). Thus, according to such structure the housing latching portion LA, cover mounting portion RC and lever mounting portion LB are gathered in the rear holder 6; consequently it is a simple matter to form these, and moreover it is possible to link the cover mounting portion RC and lever mounting portion LB with the housing latching portion LA. More precisely, the connector housing 3 usually houses the pins and their accessories, etc., and therefore has a complex structure, so that providing the above-mentioned latching portion, etc., on the connector housing 3 would render the structure thereof even more complex, whereas it is a simple matter to form the housing latching portion LA, etc., on the rear holder 6 since few other parts are mounted thereon. Also, gathering together the housing latching portion LA, cover mounting portion RC and lever mounting portion LB in the rear holder facilitates linking of these items, so that it is possible, for example, to first link the rear holder 6 to the connector housing 3 via the housing latching portion LA, then mount the manipulation lever 30 via the lever mounting portion LB, and then install the rear cover 20 via the cover mounting portion RC, thus effecting assembly of the connector in a successive and simple manner.

[0069] As shown in Fig. 5, the rear cover 20 is a member for leading out in a particular direction the multiple lead wires that are drawn out from the rear wall 6₂ of the rear holder 6, and has a pair of opposed sidewalls 21, 21 with a space 25 of a particular size therebetween, and a top wall 24 connected to the sidewalls 21, 21, being formed as a molding of insulating synthetic resin. The top wall 24 is formed as a curved surface, being joined to the sidewalls 21, 21 at its side and top edges, and having one edge formed as an opening 26. The inner interior of this opening 26, that is, at the end portions of the sidewalls 21, 21, is approximately enclosed by an enclosing wall 24_A. In the top wall 24 there is provided a projection 24_B onto which the latching portion 32_A of the manipulation lever 30 latches. The opening 26 serves as a lead-out hole that leads the lead wires out to the exterior.

[0070] The gap 25 between the pair of sidewalls 21, 21 serves as an insertion opening for insertion of the rear wall 6₂ of the rear holder 6. Since both sidewalls 21, 21 have the same structure, the description below will deal with one sidewall only.

[0071] The sidewall 21 is formed with a thick edge, and in this thick edge there is formed a flat-bottomed slot 22₀ enclosed by opposed first and second sidewall portions 22_A, 22_B. More precisely, the flat-bottomed slot 22₀ has opposed first and second sidewall portions 22_A, 22_B of which one, the first sidewall portion 22_A, constitutes part of the sidewall 21, and the other, the second sidewall portion 22_B, constitutes part of the inner wall. Roughly at

the longitudinal center of the outer face of the first sidewall portion 22_A there is formed a latching projection 22c that projects upward. This latching projection 22c is formed as a roughly square-shaped low-profile projection. The latching projection 22c performs a misinsertion prevention role, preventing the rear cover 20 from being mounted in the wrong direction because of the manipulation lever 30 after the manipulation lever 30 has been mounted to the rear holder 6. In addition, when fitted into the latching groove 36_B in the manipulation lever 30, the latching projection 22c also performs the role of fixing the manipulation lever 30 in the required position. The space between the first and second sidewall portions 22_A, 22_B, or in other words the gap that is the flat-bottomed slot 22₀, is formed to have a width that is almost the same as or slightly larger than the thickness of the support projections 7_A, 7_A of the rear holder 6. The flat-bottomed slot 22₀ serves as a guide slot for when the rear cover 20 is mounted to the rear holder 6, and as an installation slot for the rear cover 20. Also, the second sidewall portion 22_B is provided with a guide rail 23.

[0072] As shown in Fig. 6, the manipulation lever 30 has a pair of opposed lever arms 31, 31, and a connecting piece 32 that connects the lever arms 31, 31, the whole being formed as a molding of insulating synthetic resin. Each of the lever arms 31, 31 is constituted of a flat plate body and both have the same structure. More precisely, each lever arm 31 has an outer wall 31_A and an inner wall 31_B, and in each inner wall 31_B there are formed a pivot projection 33 that supports the lever, a cam hole 34, and a pair of first and second cam slots 36, 37. The pivot projection 33 is formed to have an axle 33_A whose base rises from the inner wall 31_B of the lever arm 31, and a flange 33_B integrated with the top of the axle 33_A. The cam hole 34 runs through both the inner and the outer walls 31_A, 31_B. The connecting piece 32 is provided with a latching portion 32_A. During coupling with the counterpart connector 40, this latching portion 32_A is latched onto the projection 29_B of the rear cover 20, thereby fixing the manipulation lever 30 in the required position.

[0073] The manipulation lever 30 is mounted to the rear holder 6 so as to turn freely, but the axle 33_A is provided with a turn restricting portion 33_A that restricts such turning. As Fig. 6C shows, this turn restricting portion 33_A is of a teardrop shape, such that its cross-section, supposing the axle 33_A to be cut through in a plane orthogonal to the direction in which the axle 33_A rises up from the lever arm 31, has flat edges 33_{A1} and a circular edge 33_{A2}.

[0074] The flange 33_B is in the shape of a disc with a cut-off portion 33_B at the edge, and is of a size that enables insertion into the receiving hole 10_A. The provision of the cut-off portion 33_B facilitates installation to the receiving hole 10_A.

[0075] The pair of first and second cam slots 36, 37 are formed on the side that faces in the opposite direction to the pivot projection 33's direction of insertion. These cam slots 36, 37 are formed by further reducing the thick-

ness of the lever arm 31 past the step difference portion 31_C. More precisely, the first cam slot 36 has: a guide face 36_A over which the latching projection 22c of the rear cover 20 slides; a first stopper 36₁ against which the latching projection 22c contacts; and a latching slot 36_B into which the latching projection 22c latches, the first stopper 36₁ and latching slot 36_B being formed as a part of the step difference portion 31_C. The guide face 36_A is formed to extend from the connecting piece 32 toward the edge of the lever arm 31, with a particular width and length. Also, the pivot projection 33 is formed in a location near to the first stopper 36₁.

[0076] The second cam slot 37 is provided on the opposite edge to that where the connecting piece 32 of the lever arm 31 is provided. The second cam slot 37 is formed as a reduced-thickness portion with a guide surface 37_A in the inner wall 31_B past the step difference 31_C. This guide surface 37_A of the second cam slot 37 formed past the step difference 31_C is also a surface over which the latching projection 22c slides, but is formed to have a size that is smaller than the guide surface 36_A of the first cam slot 36. In addition, the step difference 31_C serves as a second stopper.

[0077] The cam hole 34 runs through both the inner and the outer walls 31_A, 31_B of the lever arm 31. The cam hole 34 has a guide hole 34_A that guides the engaging projection 42 (see Fig. 15) of the counterpart connector 40 to be described later. A step difference portion 34_B is formed around the guide hole 34_A. The flange 42_B of the engaging projection 42 of the counterpart connector 40 latches onto this step difference portion 34_B.

[0078] As shown in Figs. 1 and 2, the sealing member 35 is constituted of a ring-like member with a hollow interior, and is formed from rubber material possessing resilience. The outer peripheral surface of this ring-like member will preferably be given an indented-and-protruding form. Rendering the outer peripheral surface indented-and-protruding will make for good watertightness with the counterpart connector 40.

[0079] The process of assembling the connector 1 will now be described with reference to Figs. 1 to 14. Figs. 7 and 8 are explanatory views illustrating the mounting of the manipulation lever to the rear holder. In Figs. 7 and 8, parts of the rear holder and manipulation lever are excised to facilitate understanding of the internal structure. Figs. 8 to 12 are explanatory views illustrating joining of the rear holder to the connector housing, while Figs. 13 and 14 are explanatory views illustrating installation of the rear cover to the rear holder.

[0080] This connector 1 is assembled via the following processes: (I) sealing member mounting process, (II) holder joining process, (III) pin mounting process, (IV) TPA mounting process, (V) lever mounting process, and (VI) rear cover mounting process.

[0081] In the (I) sealing member mounting process, the sealing member 35 is mounted over the outer surface of the coupling portion 3_B of the connector housing 3 until contact is made with the rib 3₀, these items being among

the connector components shown in, for example, Figs. 1 and 2. When the sealing member 35 is mounted as far as the position where it contacts the rib 3₀, the inner periphery of the sealing member 35 fits tightly against the outer periphery of the connector housing 3, enabling mounting of the rear holder 6. Mounting of the sealing member 35 effects a watertight sealing between the housing connector 3 and rear holder 6 to be described later. In the (II) holder joining process, succeeding the sealing member 35 the coupling portion 3_B of the connector housing 3 is inserted into the rear holder 6. Via such insertion, the latching bar 11_B of the latching portion 11 is sunk into the latching groove 5_A and engages into the mating cavity 6C. The rear holder 6 is thereby latched and fixed to the connector housing 3. In the (III) pin mounting process, the large pins 2_A and the cluster of small pins 2_B are inserted from the rear of the rear holder 6 through the through-holes 4_A and 4_B, respectively, in the connector housing 3, and thereby both sets of pins are housed and fixed inside the connector housing 3 with the rear holder 6 mounted thereto. In the (IV) TPA mounting process, the TPA 38 is inserted into the mounting hole 5_B in the connector housing 3, fixing the female pins 2 inside the connector housing 3.

[0082] Subsequently in the (V) lever mounting process, the work of installing the manipulation lever 30 to the assembly assembled in processes (I) to (IV) is carried out. In this installation work, first of all the manipulation lever 30 is positioned at the rear of the rear holder 6 as shown in Fig. 7A and pushed in with the pivot projections 33, 33 provided on the lever arms 31, 31 oriented toward the receiving holes 10_A, 10_A. Via such pushing-in, the flanges 33_B, 33_B of each pivot projection 33, 33 are slid over the guide surfaces 10_B, 10_B, and simultaneously the lever arms 31, 31 are pushed outwards, that is, in the upward and downward directions indicated by the arrows Y₁, Y₁ in Fig. 7B, so that gaps G₀, G₀ are formed between the inner walls 31_B, 31_B of the lever arms 31, 31 and the respective outer walls 6_A, 6_A of the rear holder. When the lever arms 31, 31 are pushed in further, the flanges 33_B, 33_B are inserted through the respective receiving holes 10_B, 10_B into the gaps 6_C, 6_C, as shown in Fig. 8. Simultaneously with such insertion, the lever arms 31, 31 are returned by their elastic resilience to their original positions, so that the aforementioned gaps G₀, G₀ are eliminated and the lever arms' inner walls 31_B, 31_B contact against the outer plates 6_A, 6_A. When the manipulation lever 30 is turned in this state, the edges of the flanges 33_B, 33_B enter into the gaps 6_C, 6_C between the inner and outer plates 6_A, 6_B, becoming undislodgeable therefrom, and the manipulation lever 30 is installed in a freely turnable state relative to the rear holder 6. Thus, the flanges 33_B, 33_B will not be dislodged even if subjected to an external force opposite to that exerted when the manipulation lever 30 was pushed in. This means that after being mounted to the rear holder 6, the manipulation lever 30 will not become detached therefrom even if an impact or other strong external force should act on the manipu-

lation lever 30.

[0083] When the manipulation lever 30 is mounted to the rear holder 6, a gap G (see Fig. 13B) into which the first sidewall portion of the rear cover 20 will be pushed is formed between the lever arms 31, 31 of the manipulation lever 30 and the inner plates 6_B, 6_B of the rear holder 6. This gap G is composed of a first gap G₁ that is opposite the guide surface 36_A of the manipulation lever 30, and a second gap G₂ that is opposite the inner wall 31_B, the first gap G₁ being wider than the second gap G₂.

[0084] Finally, the rear cover 20 is installed to the rear holder 6. In the (VI) rear cover mounting process, firstly the rear cover 20 is positioned at the part of the connector housing 3 indicated by arrow A₁ in Fig. 13A, that is, on the side where the manipulation lever 30's connecting piece 32 is located, and the rear cover 20 is inserted in the direction of the first gap G₁ between the rear holder and the manipulation lever 30. Such insertion is effected along the direction of one of the mounting portions 12_A, so that one of the support projections 7_A will be inserted into the flat-bottomed slots 22₀, 22₀ of the rear cover 20. The rear cover 20's guide rails 23, 23 will be inserted along the rail projections 6_{2A}, 6_{2A}. In this way the rear cover 20, being inserted through one of the mounting portions 12_A, will be supported by the support projections 7_A, 7_A, the inner plate 6_B of the third area 6_{B3}, and the rail projections 6_{2A}, and therefore will not become detached from the rear holder 6.

[0085] The foregoing processes (I) to (VI) complete the assembly of the connector 1. However, there will be cases where the rear holder 6 is not joined completely to the connector housing 3 in the (II) holder joining process. When such a case occurs, not only will the rear holder 6 and connector housing 3 not be completely joined, but also the sealing member 35 will not be fully mounted and the desired waterproofing effects will not be obtained. Such a state will constitute misassembly of the connector 1. Accordingly, this connector 1 is rendered able to sense such misassembly by utilizing the latching portions 11, 11 of the rear holder 6.

[0086] This misassembly sensing will now be described with reference to Figs. 11 and 12. Figs. 11 and 12 are explanatory views illustrating the misassembly, and correspond to Figs. 9 and 10 respectively.

[0087] First of all, the sealing member 35 is mounted to the coupling portion 3_B at the rear of the connector housing 3, the mating cavity 6c at the front of the rear holder 6 is mated onto the coupling portion 3_B, and the rear holder 6 is pushed onto the coupling portion 3_B. Such pushing-on of the rear holder 6 brings the front wall 6₁ surface of the rear holder 6 into contact with an edge face of the sealing member 35. If the rear holder 6 is incompletely pushed in at this point, then due to the resilience of the latching arm 11_A, the latching bar 11_B of the latching portion 11 will climb on top of the sidewall portion 5_A of the latching groove 5_A, and the projecting block 11c will be lifted upward (see Fig. 11C). If it is attempted to mount

the rear cover 20 to the rear holder 6 in such a state, then as shown in Fig. 12C, such attempt to slide the rear cover 20 onto the rear holder 6 will fail because the first sidewall portion 22_A of the rear cover 20 will collide with the projecting block 11c. It will thus be possible to sense, from the fact that the rear cover 20 cannot be mounted, that the sealing member 35 has not been properly pressed against the connector housing 3, and that the connector housing 3 and rear holder 6 are in a non-joined state.

[0088] If on the other hand, as shown in Figs. 9 and 10, the rear holder 6 is fully pushed in, so that the latching bar 11_B of the latching portion 11 sinks into and engages with the flat-bottomed latching groove 5_A, then since the projecting block 11_C will already have retracted downward, the sliding motion of the rear cover 20 will not be inhibited. When the rear cover 20 is mounted onto the rear holder 6, the sealing member 35 will be mounted in the regular position, so that watertightness between the connector housing 3 and rear holder 6 is reliably effected, and at the same time, complete joining of the connector housing 3 and rear holder 6 will be assured. In such state, the top of the projecting block 11_C will contact with the rear cover 20's first sidewall portion 22_A, restricting the mobility thereof, so that the engagement of the connector housing 3 and rear holder 6 will be firm.

[0089] Also, as Fig. 5 shows, the pair of opposed sidewalls 21, 21 have identical structure, which might pose a risk of the rear cover 20 being mounted in the direction of arrow A₂ in Fig. 14A. If the rear cover 20 were mounted in that direction, the manipulation lever 30 could not be manipulated. Accordingly this connector 1 is so contrived that it is not possible to mount the rear cover 20 in the direction of arrow A₂. More precisely, if the rear cover 20 is mounted to the rear holder 6 in the direction of arrow A₂ in Fig. 14, the first sidewall portion 22_A of the rear cover 20 will enter inside the second gap G₂, and although the entrance of the second gap G₂ is rendered large by the presence of the manipulation lever 30's second cam slot 37 at such opening, the second cam slot 37's length is less than the width of the first cam slot 36, so that when the rear cover 20 is pushed in further, the latching projection 22c on the sidewall 22_A surface will collide with the step difference portion 31_C, that serves as second stopper, and any further pushing in of the rear cover 20 will be blocked. In this way, mounting of the rear cover 20 in the direction of arrow A₂ is rendered impossible.

[0090] The connector 1 thus assembled is coupled with a counterpart connector 40. The male connector that is such counterpart connector will now be described. Fig. 15 illustrates the male connector, Fig. 15A being a perspective view of the whole male connector, and Fig. 15B being an exploded version of the perspective view in Fig. 15A.

[0091] The counterpart connector 40 consists of a male connector, being composed, as Fig. 15 shows, of a plurality of male pins 43 and a male connector housing 41 in which such pins are housed.

[0092] The male pins 43 are composed of relatively large-sized male pins 43_A and smaller-sized male pins 43_B that are connected to the female large pins 2_A and small pins 2_B, respectively, of the connector 1. The male connector housing 42 has roughly rectangular front and rear walls 41₁, 41₂ at the front and rear, and an outer periphery that is enclosed by pairs of opposed outer walls, specifically by upper and lower walls 41_s, 41_s and left and right sidewalls 41₄, 41₄. In the front wall 41₁ there is formed a hollow cavity having an insertion opening into which the connector 1 is inserted, and the inner wall of this hollow cavity stands close to the rear wall 41₂, the whole being formed as a molding of insulating synthetic resin.

[0093] In the rear wall 41₂ of the male connector housing 41 there are formed fitting holes 41_A, 41_B into which the male pins 42 fit. On the top and bottom walls 41₃, 41₃ of the connector housing there are formed engaging projections 42, 42 that project outwards from locations close to the insertion opening. These engaging projections 42, 42 are composed of a pivot 42_A that rises from the wall surface, and a flange 42_B that is provided on top of the pivot 42_A; these are formed to be integrated with the male connector housing 41. The flange 42_B is roughly a disc in shape. The engaging projections 42 are of a size to engage with the cam holes 34 of the manipulation lever 30 of the connector 1. To assemble this counterpart connector 40, the large pins 43_A and small pins 43_B are inserted into the fitting holes 41_A and 41_B respectively of the male connector housing 41 and fixed therein.

[0094] Coupling of the connector 1 and the counterpart connector 40 will now be described. Figs. 16 and 17 are explanatory views illustrating coupling of the two connectors, Fig. 16 illustrating the uncoupled and Fig. 17 the coupled state. In Figs. 16B, 16C, 17B and 17C, the counterpart connector 40 is omitted.

[0095] To couple the connector 1 and the counterpart connector 40, the connector 1 is brought near to the counterpart connector 40, and the insertion portion 3_A of the connector housing 3 located at the front of the connector 1 is inserted into the fitting hole 41_A in the front face of the connector housing 41 of the counterpart connector 40 (see Fig. 16A). Before the two connectors 1, 40 are coupled, the cam holes 34, 34 of the manipulation lever 30 are, as shown in Figs. 16A to 16C, held in positions parallel to the rear holder 6 without being engaged onto the engaging projections 42, 42 of the counterpart connector 40. These positions are held via contacting of the outer surfaces of the latching projection 22c of the rear cover 20 with the first stopper 36₁ inside the first cam slot 36 and the circular edge 33_{A2} of the turn restricting portion 33_A, as shown in Fig. 16D. Thanks to such holding, the manipulation lever 30 will not rock in the arrow B directions (see Figs. 16A and 16C).

[0096] Next, the counterpart connector 40's latching projections 42, 42 are inserted into the open portions of the manipulation lever 30's cam holes 34, 34 as shown in Fig. 17, after which the manipulation lever 30 is rotated

to the rear of the rear cover 20, by grasping the manipulation lever 30's connecting piece 32 between finger and thumb. As a result of such rotation of the manipulation lever 30, the counterpart connector 40's latching projections 42, 42 are guided into the guide portions of the cam holes 34, 34 and the two connectors 1, 40 are drawn in directions such that they approach each other. When the manipulation lever 30 is rotated further, the connecting piece 32 moves to the rear of the rear cover 20, whereupon coupling of the two connectors 1, 40 is complete and electric contact is effected between the pins 2, 43 of the two connectors 1, 40. Upon such completion of the coupling of the two connectors 1, 40, the manipulation lever 30 is fixed in the position at the rear of the rear cover 20 to which the connecting piece 32 thereof moved. The fixing of the manipulation lever 30 in this position is effected as follows. The latching projection 22c of the rear cover 20 enters inside the latching groove 36_B, and a flat edge 33_{A1} of the turn restricting portion 33_A contacts against an outer face of the latching projection 22c in such entered state, so that turning of the pivot projection 33 - that is, turning of the manipulation lever 30 - is restricted, as shown in Fig. 17D. As a result of such holding and fixing, the manipulation lever 30 will not rock in the arrow C directions. Also, latching of the manipulation lever 30 is rendered even more reliable by the fact that the latching portion 32_A provided on the connecting piece 32 latches onto the projection 24_B on the top wall 24 of the rear cover 20.

[0097] In addition, when the two connectors 1, 40 are coupled, the outer periphery surface of the sealing member 35 contacts liquid-tightly against the inner wall of the fitting hole 41_A in the counterpart connector, thereby rendering sound the watertightness between the two connectors 1, 40.

Various further aspects and features of the present invention are defined in the appended claims. Various combinations of features may be made other than the specific combination of features identified by the dependency of the appended claims.

Claims

1. An electric connector comprising:

a connector housing inside which pins are housed, and which has at the front an insertion portion into which a counterpart connector is inserted, and at the rear a holder mounting portion; a sealing member that is mounted onto the outer periphery of the holder mounting portion; a rear holder the front end portion of which is a contacting surface for contacting with the sealing member; which has at the front a mating cavity that is fixed onto the holder mounting portion, and at the rear a cover installation portion; and which is fixed to the connector housing with the

sealing member interposed; and a rear cover which is mounted to the cover installation portion via sliding motion; the pair of opposed outer walls of the rear holder being formed as a double wall constituted of an inner plate and an outer plate with a gap therebetween, and in such double wall there being formed a housing latching portion with which the connector housing engages, a cover installation portion to which the rear cover is mounted, and a lever mounting portion to which the manipulation lever is mounted.

2. The electric connector according to claim 1, wherein the housing latching portion is formed as a latching arm possessing resilience that are provided on the inner plate, with a latching bar being provided at the end of such latching arm, and a latching slot are provided in the surface of the connector housing; so that the rear holder is latched to the connector housing via the latching bar being engaged into the latching slot.

3. The electric connector according to claim 1, wherein the cover installation portion is formed as a pair of support projections provided on the inner plate, plus a separation prevention projection provided on the rear wall at the rear of the rear cover, with a flat-bottomed slot being also provided in the rear cover; so that the rear cover is fixed by such support projection and separation prevention projection.

4. The electric connector according to claim 1, wherein the lever mounting portion is formed as a pivot projection provided on the opposed surfaces of the manipulation lever's pair of opposed lever arms, plus a receiving hole that communicate with the gap between the double wall of the rear holder; so that the pivot projection is inserted into such gap through the receiving hole, and the pivot projection is supported so as to be freely rotatable inside the receiving hole.

5. The electric connector according to claim 4, wherein the pivot projection has an axle that rises up from the lever arm and a flange provided on the top of such axle, so that when the pivot projection is inserted into the receiving hole, the flange will be inserted into the aforementioned gap, and the manipulation lever's opposed surface will be brought into contact against the upper plate of the double wall.

6. The electric connector according to claim 4, wherein a first cam slot for guidance toward the pivot projection is provided on the lever arm's opposed surface, a turn restricting portion is provided on the pivot projection's axle, and a latching projection is provided on the rear cover's sidewall surface; so that during coupling with the counterpart connector, the rear

cover's latching projection will be positioned between the manipulation lever's cam slot and turn restricting portion, and turning of the pivot projection will thereby be restricted.

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7. The electric connector according to claim 6, wherein a latching slot is provided adjacent to the turn restricting portion inside the manipulation lever's first cam slot, so that during coupling with the counterpart connector, the latching projection will fit inside such latching slot and the turn restricting portion will contact against the latching projection fitted inside the latching slot, restricting turning of the pivot projection. 10
8. The electric connector according to claim 6, wherein the turn restricting portion is formed as a flat edge plus a circular edge that are provided on the outer surface of the axle, in such a manner that the flat edge will contact against the latching projection. 15 20
9. The electric connector according to claim 4, wherein a second cam slot that inhibit mounting of the rear cover is provided on the opposed surfaces of the pair of lever arms. 25

30

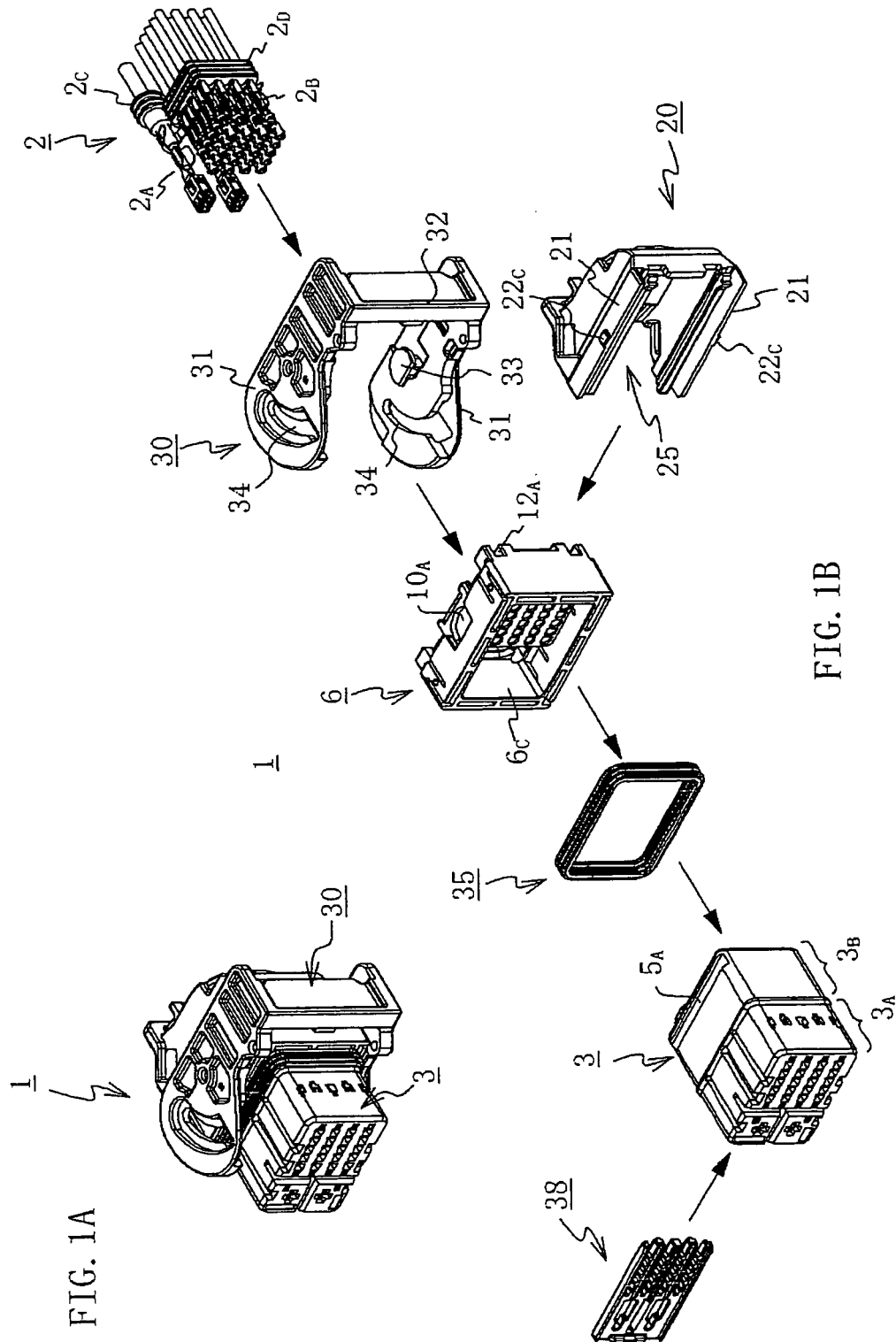
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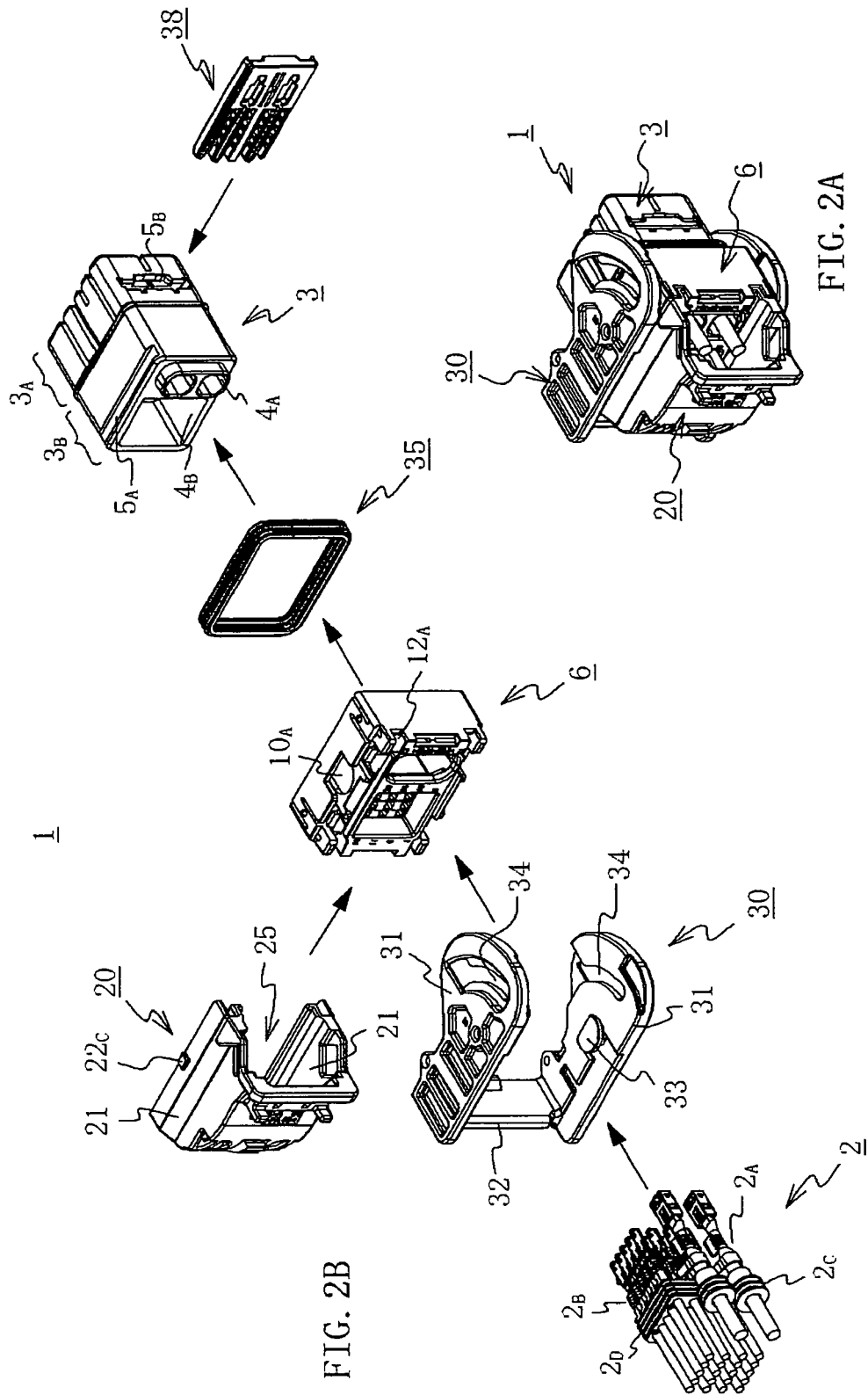


FIG. 3A

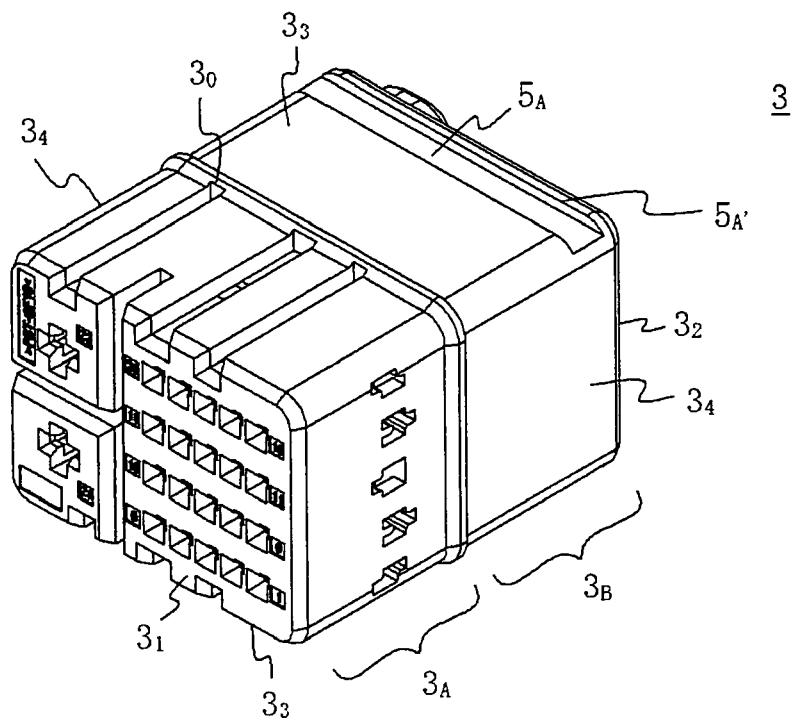


FIG. 3B

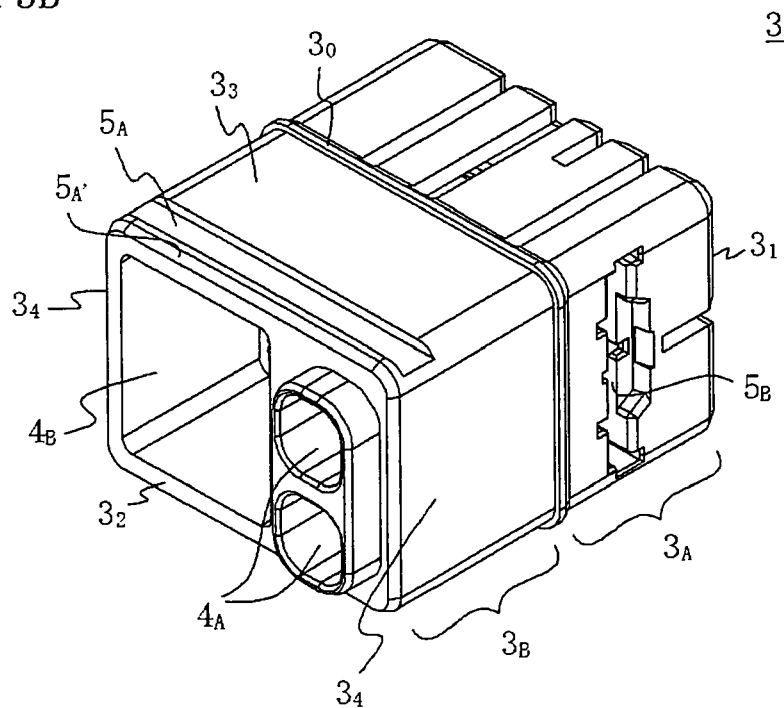


FIG. 4A

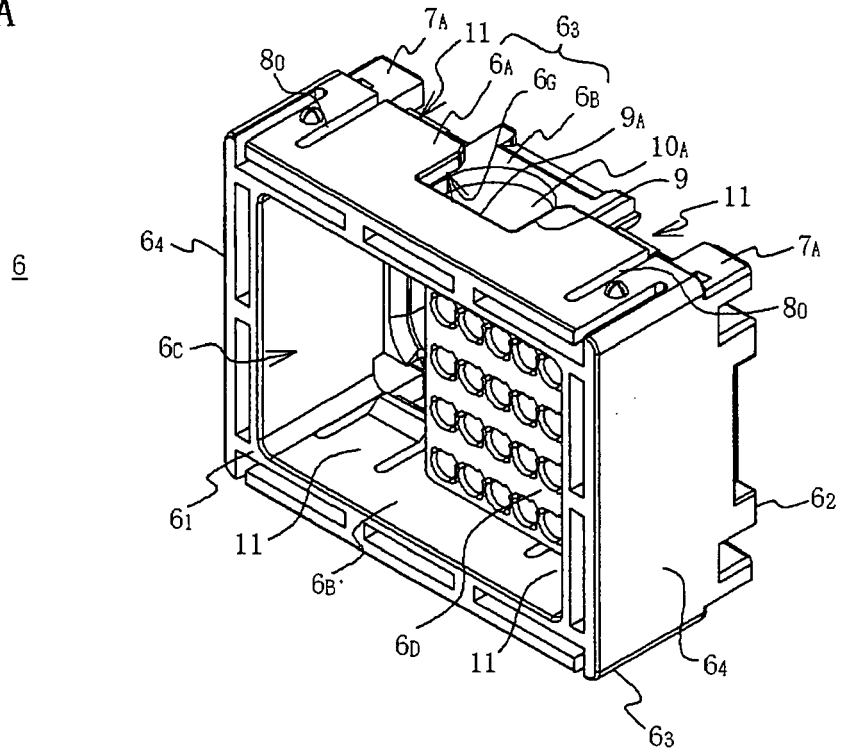


FIG. 4B

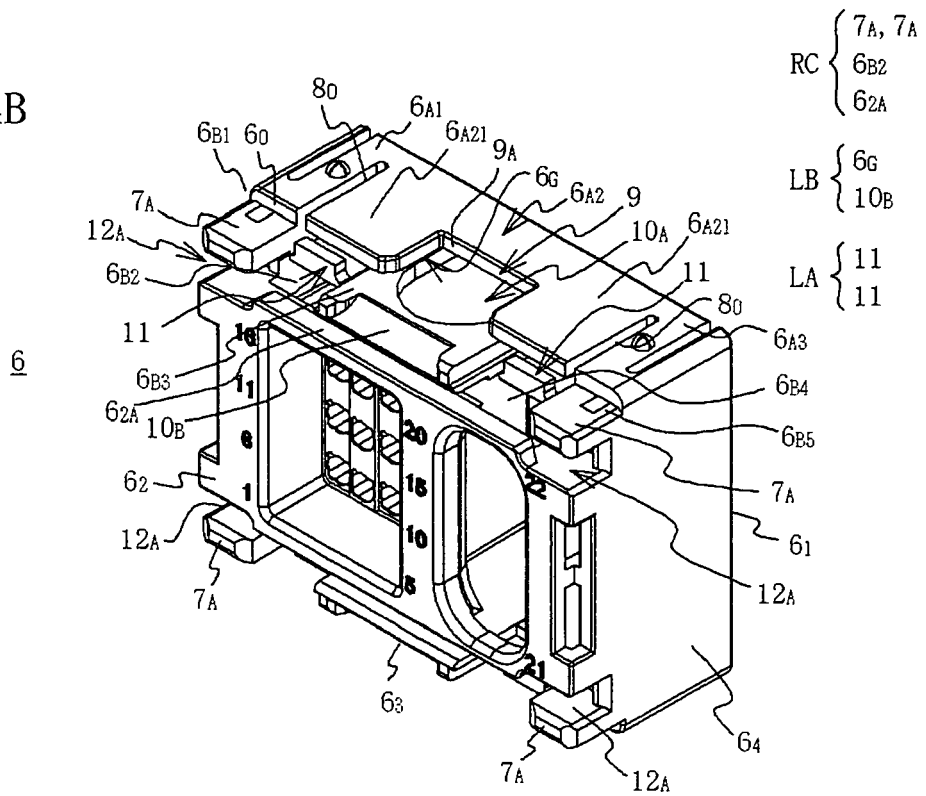


FIG. 5A

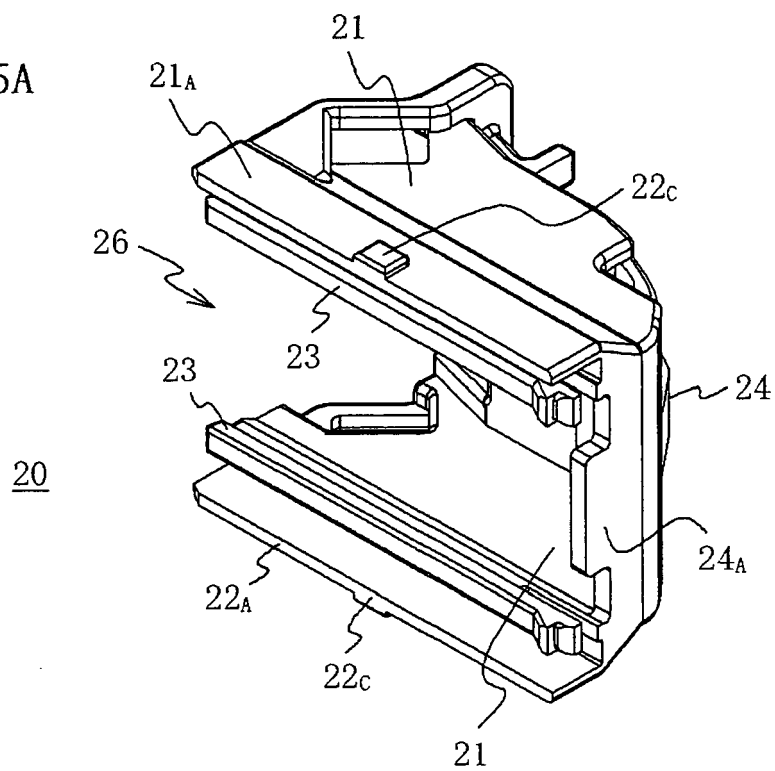


FIG. 5B

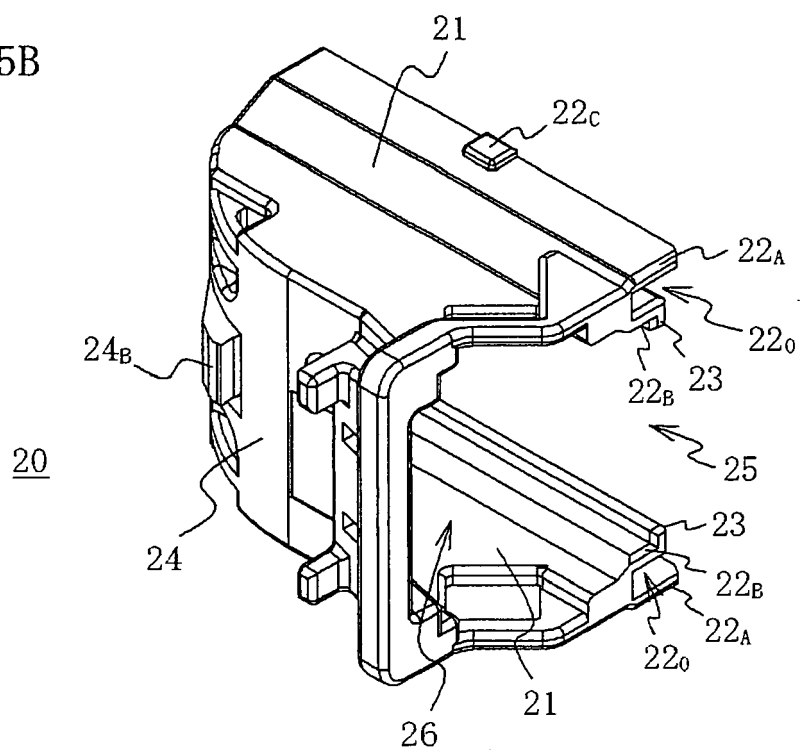


FIG. 6A

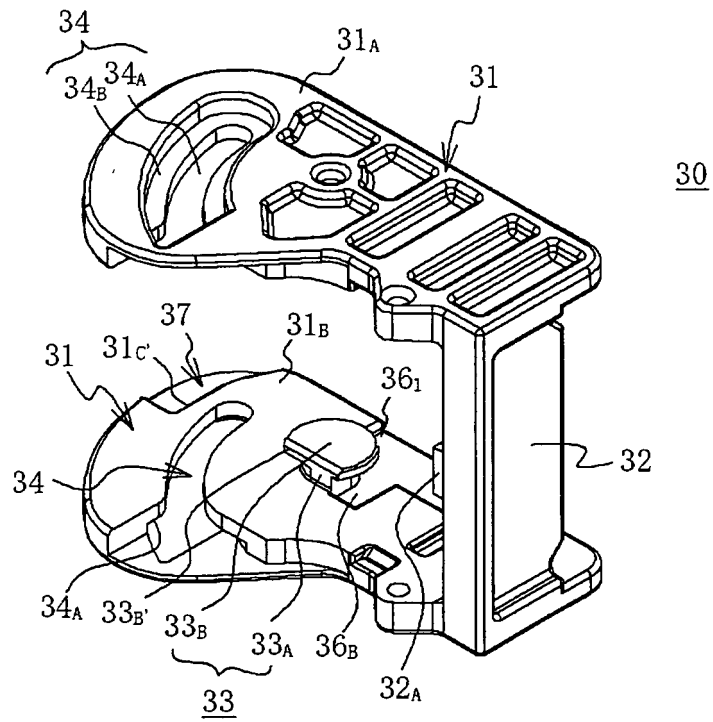


FIG. 6B

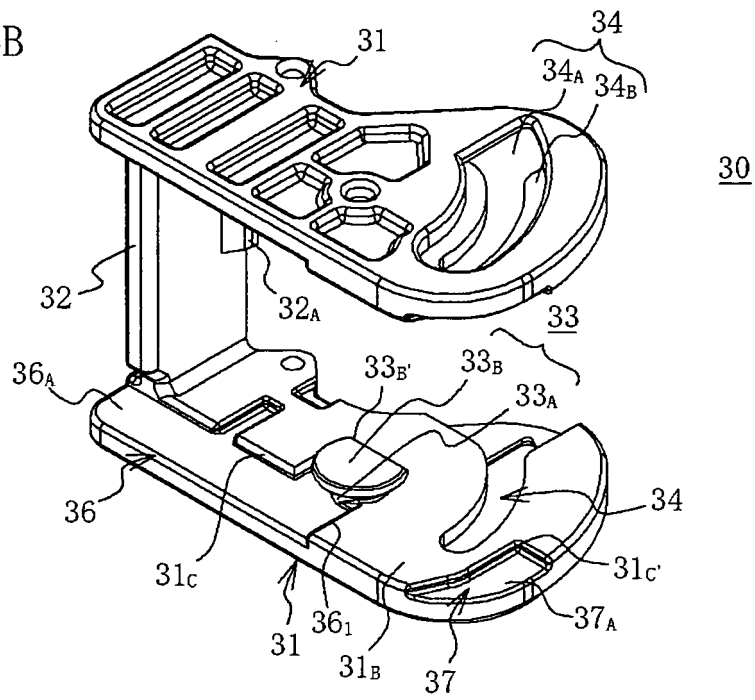


FIG. 6C

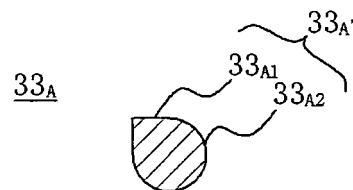


FIG. 7A

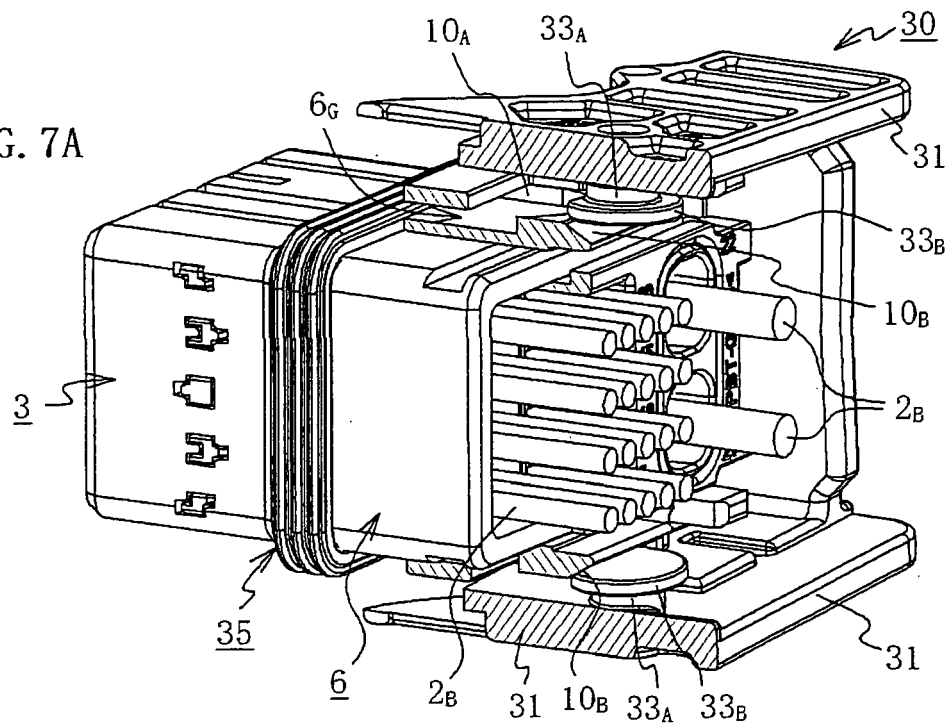


FIG. 7B

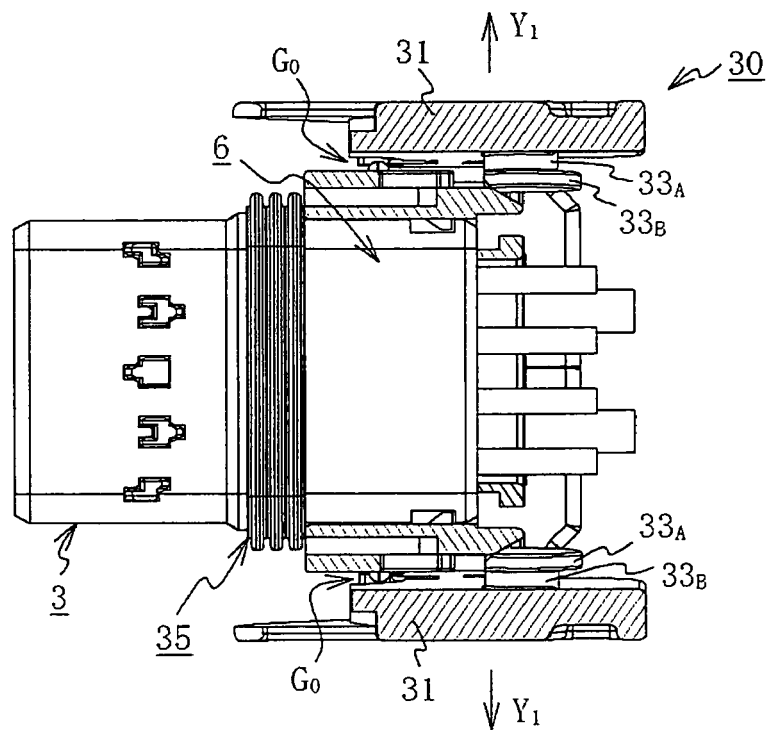


FIG. 8A

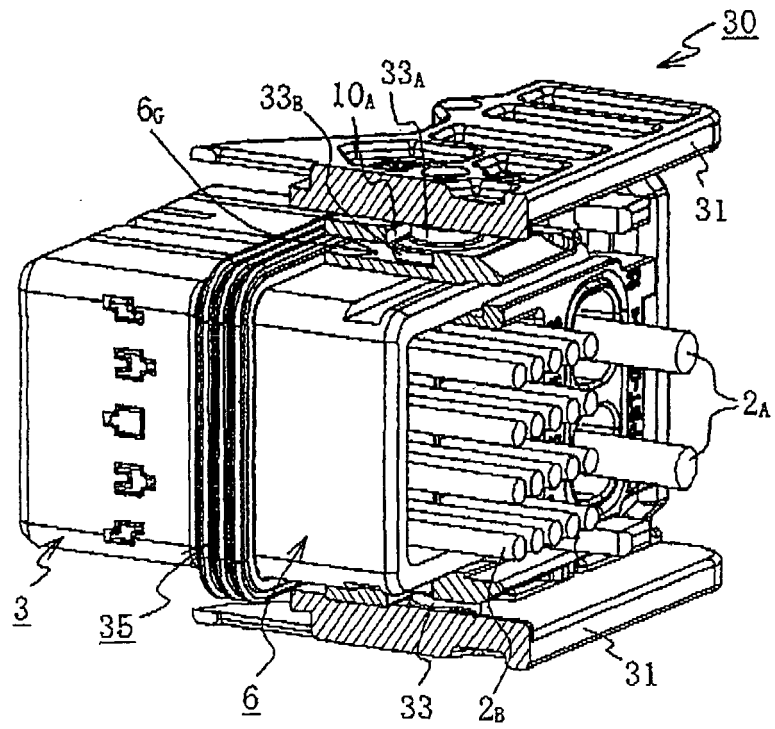
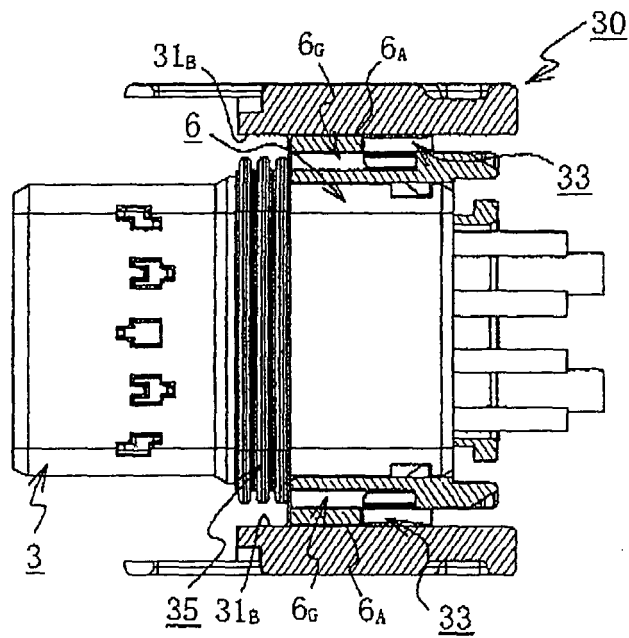


FIG. 8B



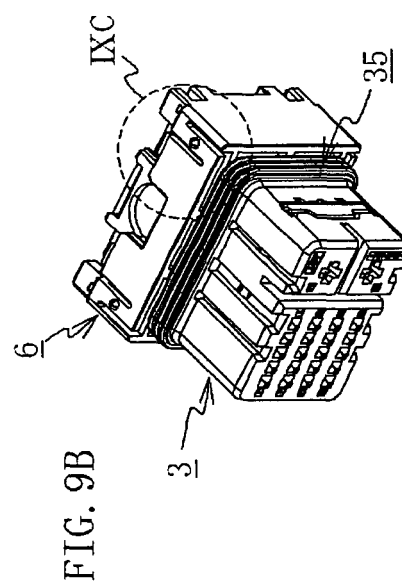
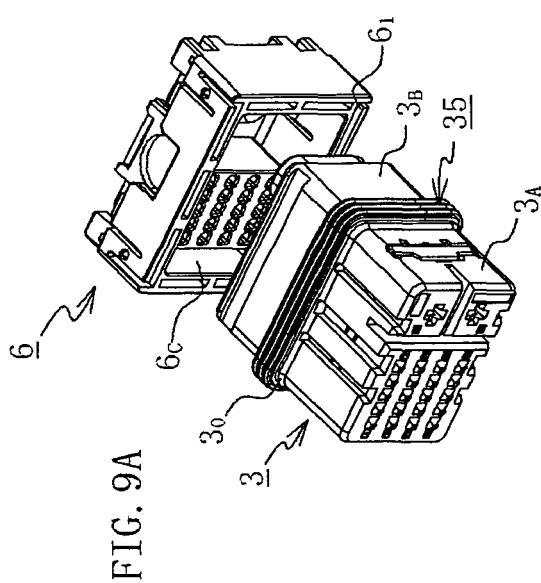
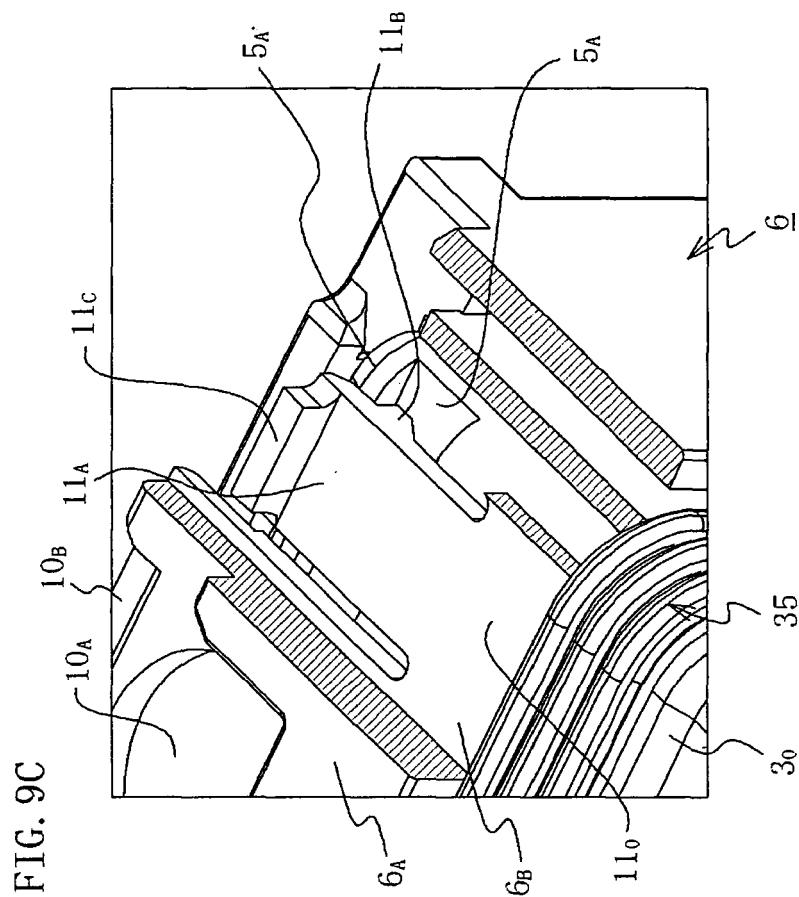


FIG. 10A

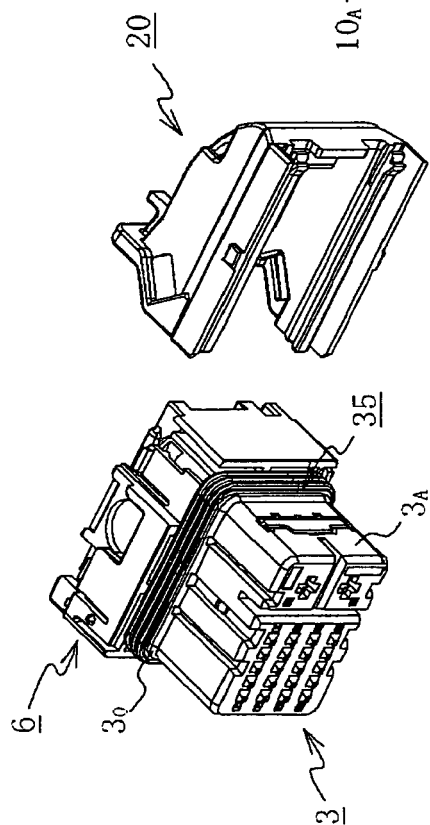


FIG. 10B

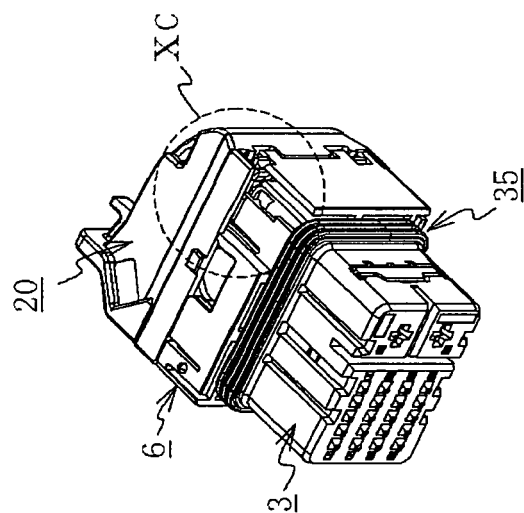
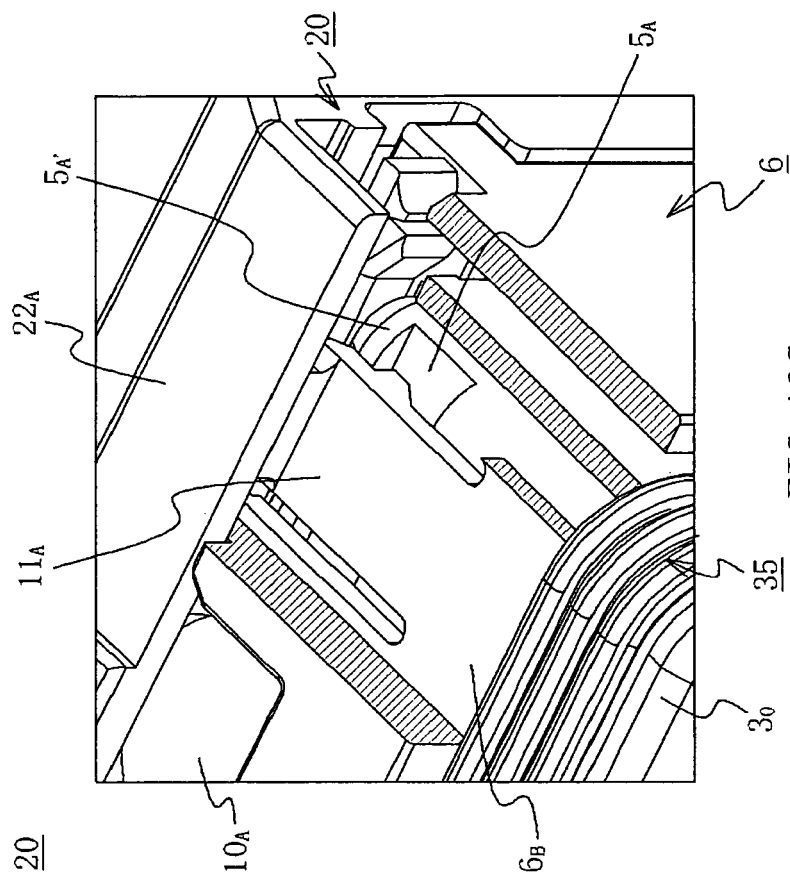


FIG. 10C



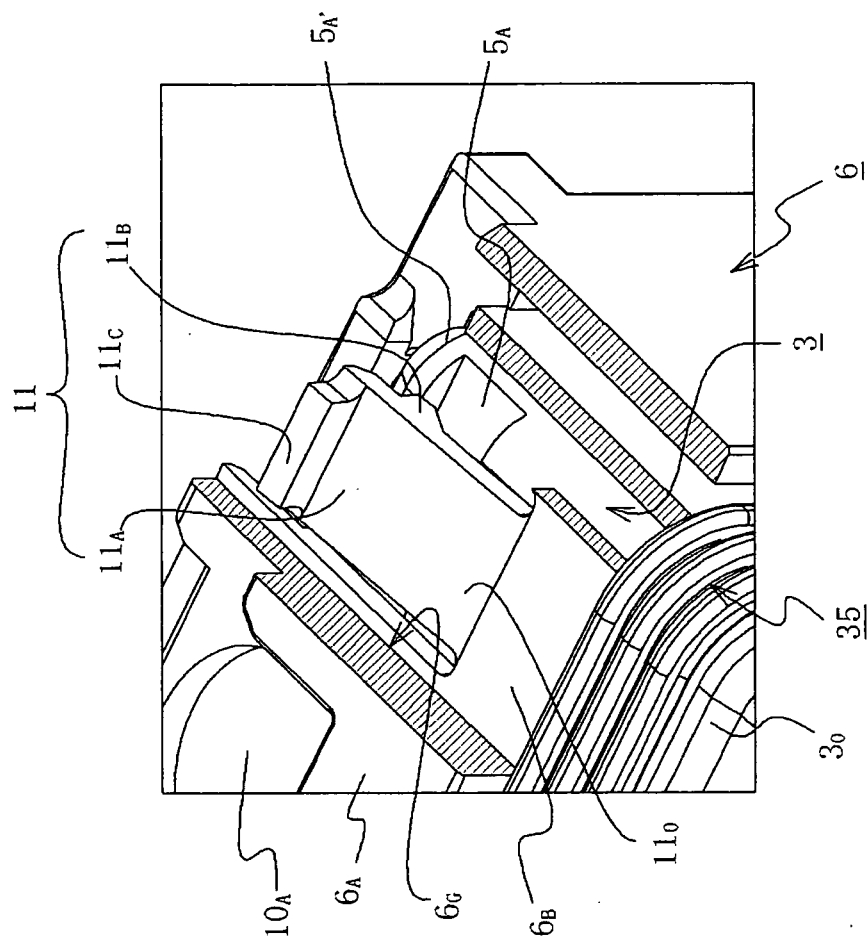


FIG. 11C

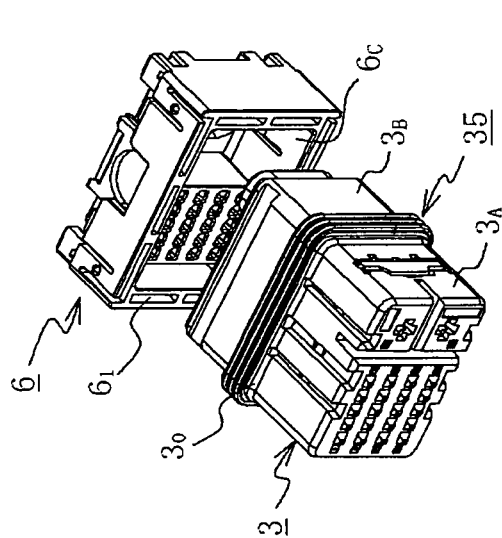


FIG. 11A

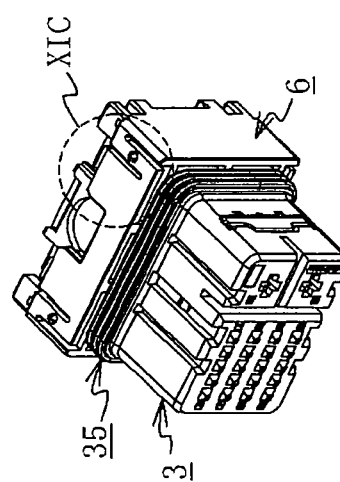


FIG. 11B

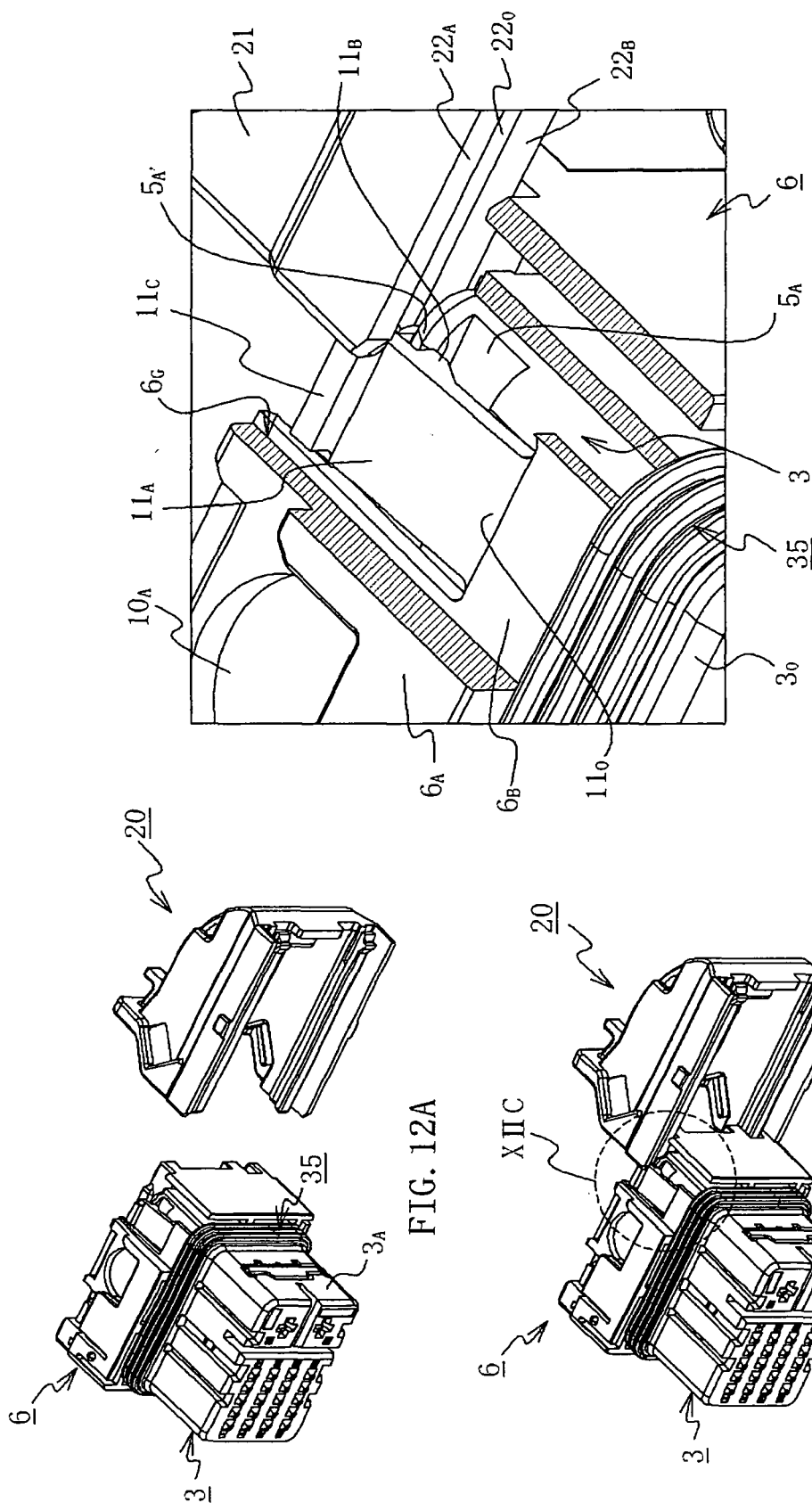
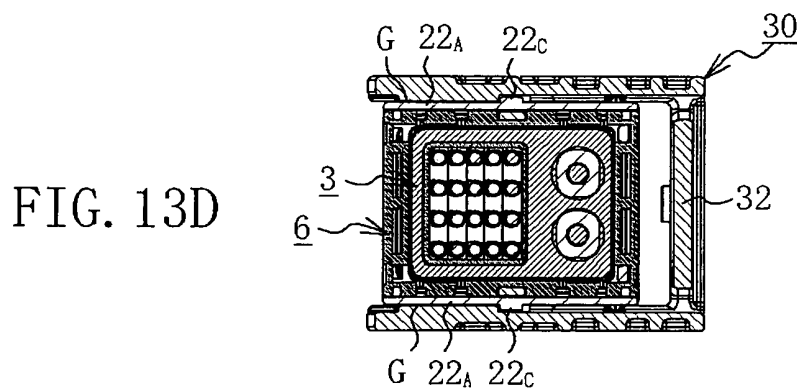
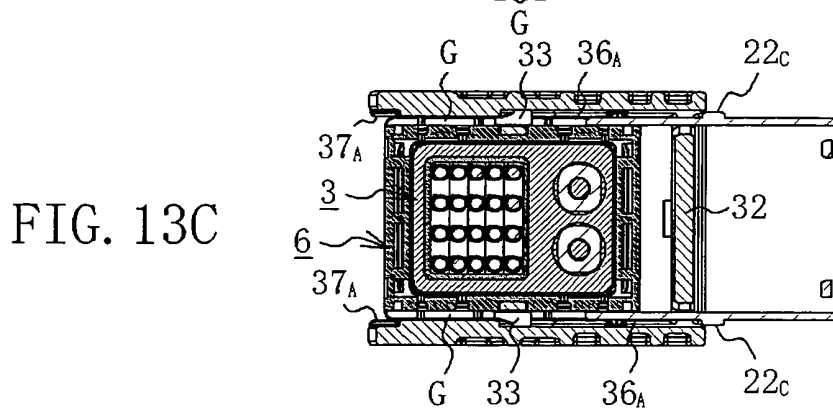
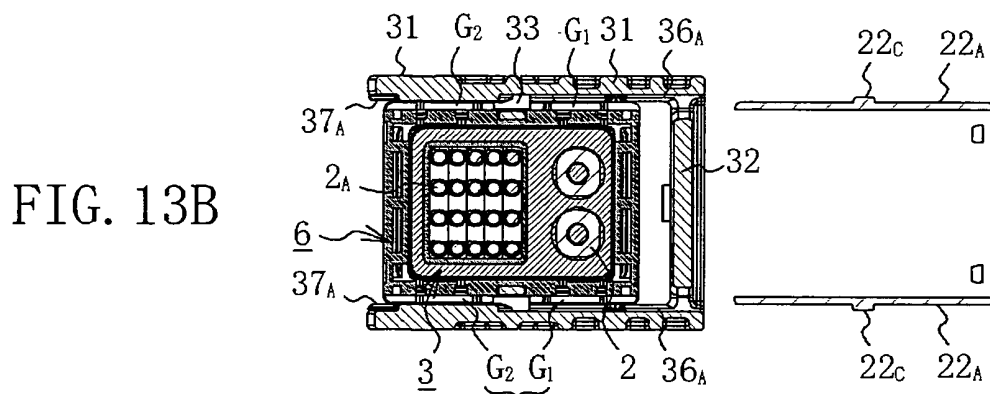
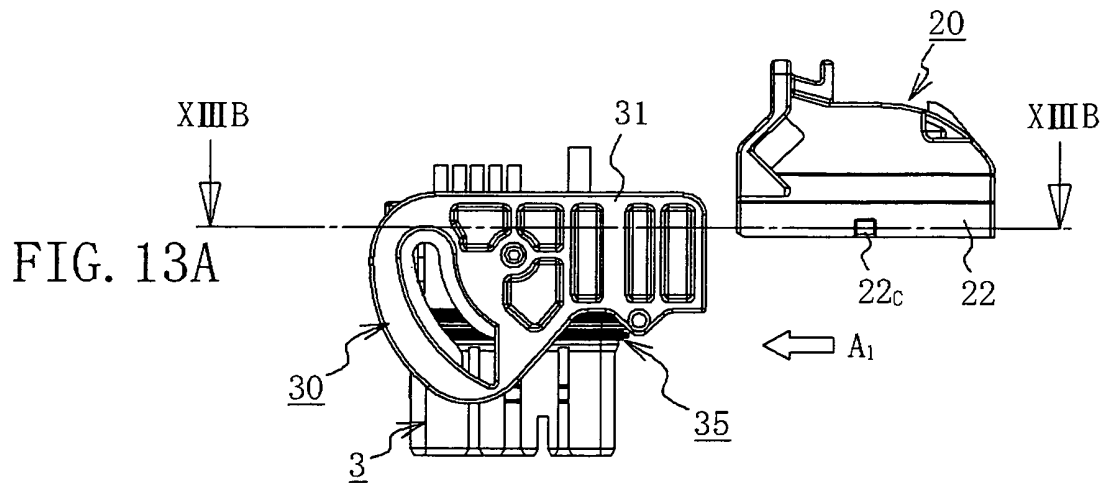


FIG. 12C

FIG. 12B



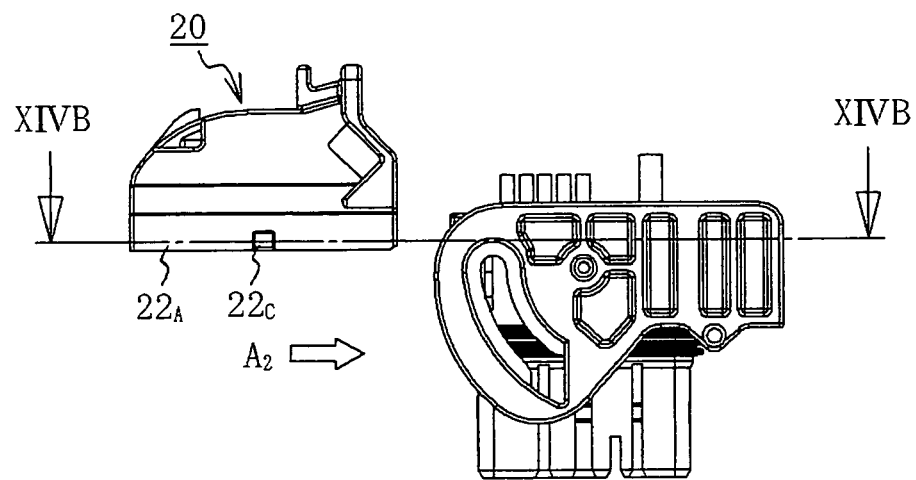


FIG. 14A

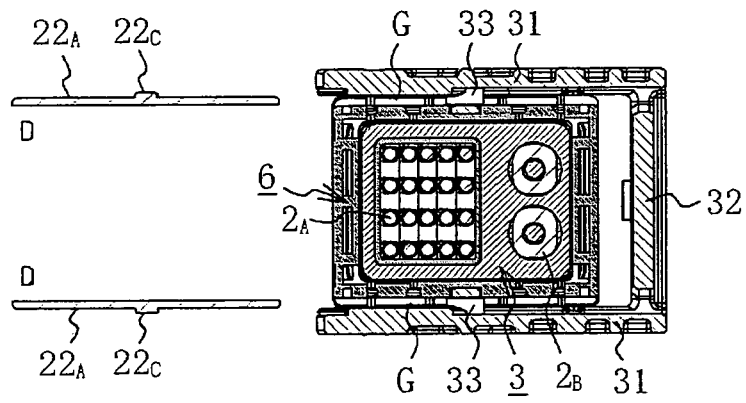


FIG. 14B

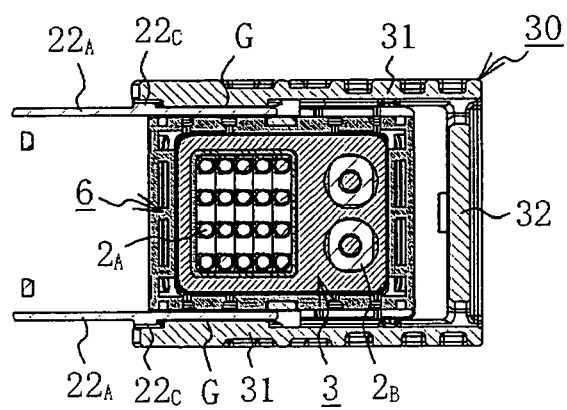


FIG. 14C

FIG. 15A

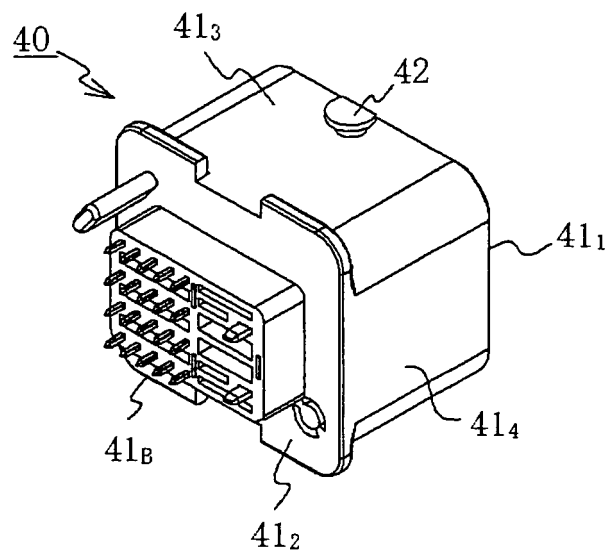
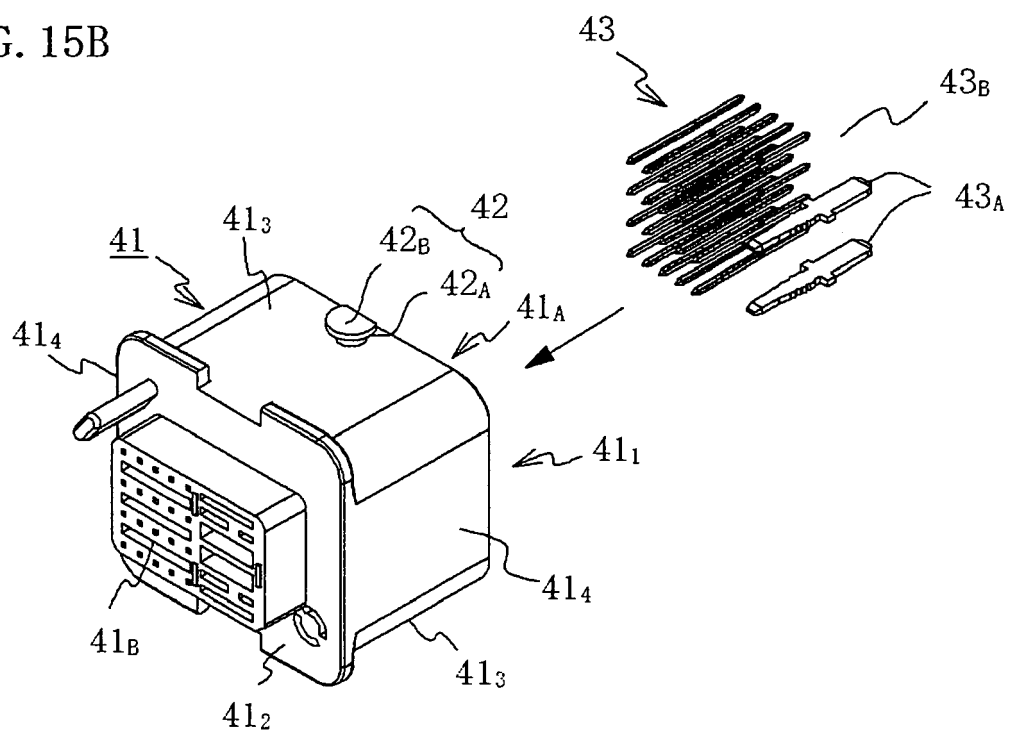


FIG. 15B



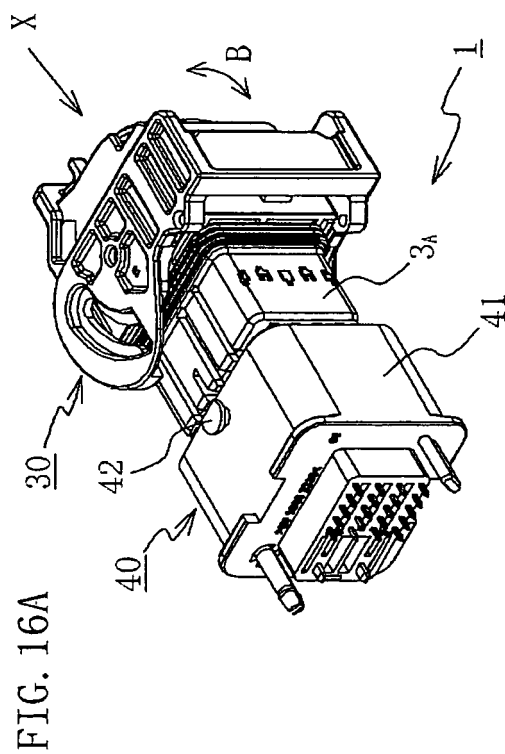


FIG. 16C

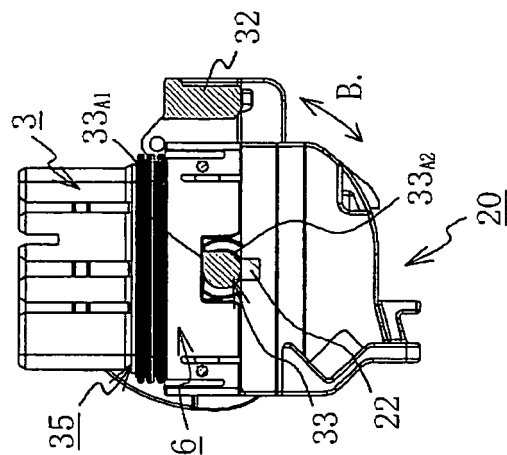


FIG. 16B

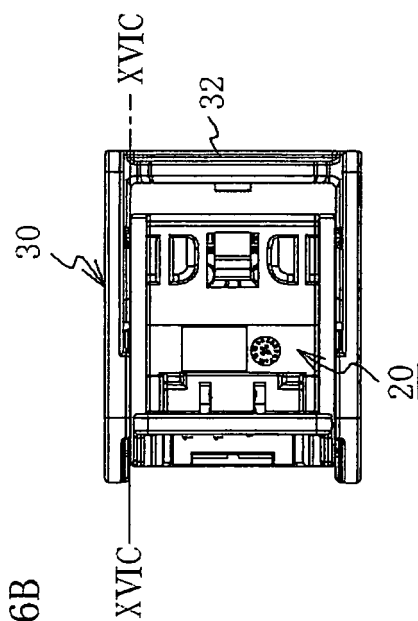
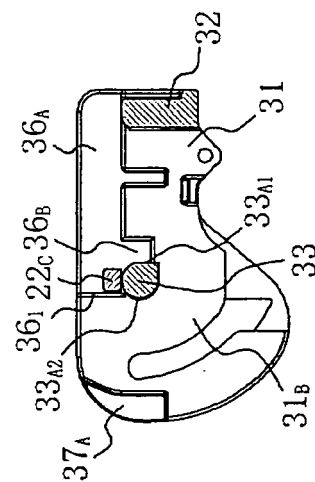


FIG. 16D



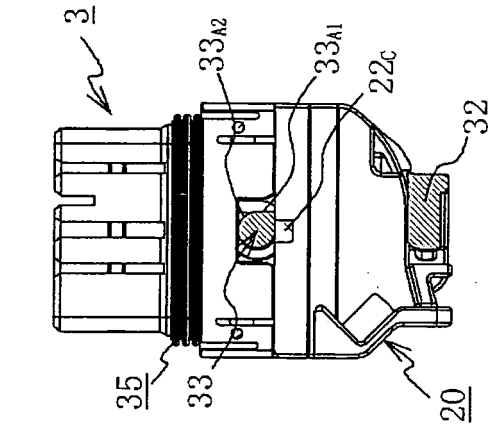


FIG. 17C

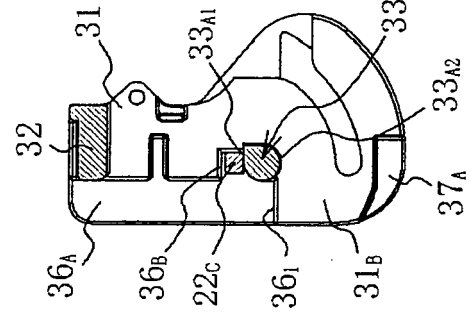


FIG. 17D

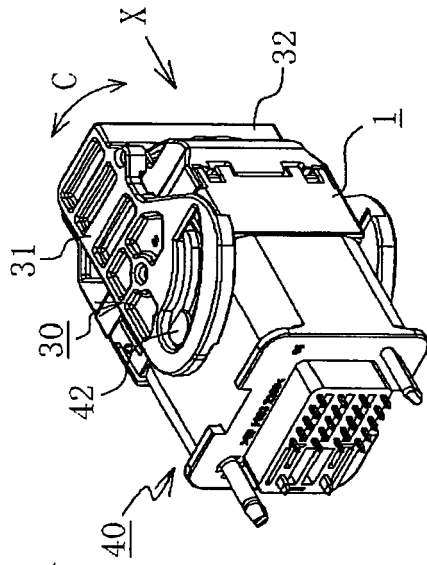


FIG. 17A

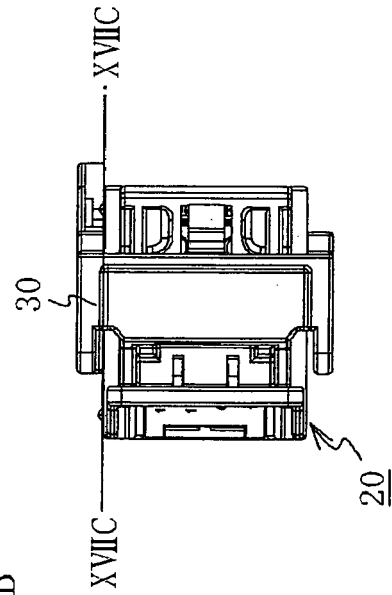
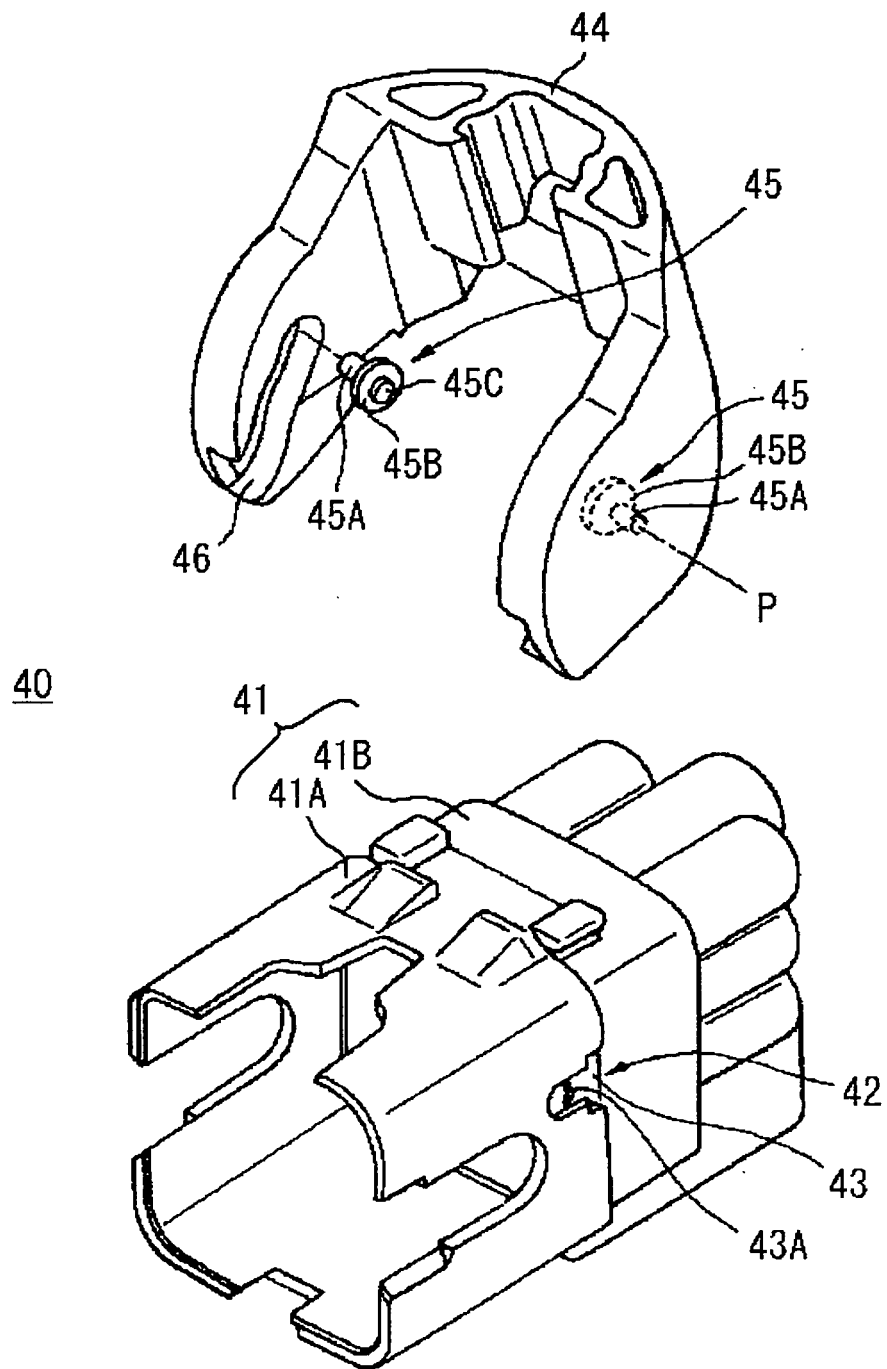


FIG. 17B

FIG.18



(prior art)

REFERENCES CITED IN THE DESCRIPTION

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