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(54) TERMINAL DEVICE AND WIRING APPARATUS WITH SAME

(57) An object is to provide a terminal device and a wiring apparatus with the same, which can suppress a contact state of an electric wire in contact with a terminal portion from falling into an unstable state. A terminal device (1) includes a terminal portion (2), a pressing portion (3) and a locking portion (4). The pressing portion (3) is disposed to face one surface (20) of the terminal portion (2), and configured to hold an electric wire (100) inserted along an inserting direction from an insertion port (11) so that the electric wire (100) is sandwiched between the pressing portion (3) and the terminal portion (2). The locking portion (4) is elastic; disposed to face the one surface (20) of the terminal portion (2); and configured to restrict movement of the electric wire (100) toward the insertion port (11) by contact with the electric wire (100). The pressing portion (3) and the locking portion (4) are members independently separated from each other.

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Description

TECHNICAL FIELD

[0001] This invention generally relates to terminal devices and wiring apparatuses with same and, more particularly, to a terminal device to be connected with an electric wire by the electric wire being inserted, and a wiring apparatus with the same.

BACKGROUND ART

[0002] Conventionally, there has been known a terminal device with a so-called quick connection structure, to which an electric wire can be connected without using a screw, for the purpose of facilitating connection of the electric wire to a wiring apparatus such as a switch (for example, refer to a Document 1: JP 2002-151172 A).

[0003] The terminal device described in the Document 1 includes a terminal portion (terminal plate) made of conductive material and a locking spring. The terminal portion has a C-shape, and the locking spring is housed in a space surrounded by the terminal portion. The locking spring has a central piece, a locking piece and a pressing piece, which are formed by bending a plate material that is elastic. The locking piece and the pressing piece are provided at both ends of the central piece, respectively. In the terminal device, when inserted from an insertion port (electric wire insertion-hole), the electric wire is sandwiched and held by a spring force of the locking spring between both of the locking piece and the pressing piece and a contact piece of the terminal portion. In this state, the electric wire can be locked by an end edge of the locking piece biting into the electric wire, and further, the pressing piece elastically holds the electric wire between itself and the terminal portion by the pressing piece pressing the electric wire against the terminal portion.

[0004] In the conventional terminal device as the above, a locking portion (the locking piece of the locking spring), which locks the electric wire, and a pressing portion (the pressing piece of the locking spring), which presses the electric wire against the terminal portion, are integrally formed as the locking spring. For this reason, for example when a force is applied from the electric wire to the locking portion upon insertion of the electric wire, this force is transmitted from the locking portion to the pressing portion, and accordingly, there is a possibility that it influences the force of pressing the electric wire against the terminal portion. As a result, it may cause a contact state of the electric wire in contact with the terminal portion to be unstable.

SUMMARY OF INVENTION

[0005] The present invention has been made in view of the above-described problems, and an object of the present invention is to provide a terminal device and a wiring apparatus with the same, which can suppress a contact state of an electric wire in contact with a terminal portion from falling into an unstable state.

[0006] A terminal device according to an aspect of the present invention includes a terminal portion, a pressing portion and a locking portion. The pressing portion is disposed to face one surface of the terminal portion, and configured to hold an electric wire inserted along an inserting direction from an insertion port so that the electric wire is sandwiched between the pressing portion and the terminal portion. The locking portion is elastic; disposed to face the one surface of the terminal portion; and configured to restrict movement of the electric wire toward the insertion port by contact with the electric wire. The pressing portion and the locking portion are members independently separated from each other.

[0007] A wiring apparatus according to an aspect of the present invention includes the terminal device and an apparatus body configured to house therein the terminal device.

BRIEF DESCRIPTION OF DRAWINGS

[0008]

FIG. 1A is a front view of a basic configuration of a terminal device according to a First Embodiment of the present invention, and FIG. 1B is a front view, partially broken, of the basic configuration of the terminal device in a state where an electric wire is connected thereto;

FIG. 2A is a perspective view of the basic configuration of the terminal device when viewed from a positive direction of a Y axis, and FIG. 2B is a perspective view of the basic configuration of the terminal device when viewed from a negative direction of the Y axis;

FIG. 3A is a perspective view of a terminal block of the terminal device when viewed from the positive direction of the Y axis, and FIG. 3B is a perspective view of the terminal block when viewed from the negative direction of the Y axis;

FIG. 4A is a perspective view of a spring block of the terminal device when viewed from the positive direction of the Y axis, and FIG. 4B is a perspective view of the spring block when viewed from the negative direction of the Y axis;

FIG. 5 is an exploded perspective view of a whole configuration of the terminal device when viewed from the positive direction of the Y axis;

FIG. 6A is a perspective view of the whole configuration of the terminal device when viewed from the positive direction of the Y axis, and FIG. 6B is a perspective view of the whole configuration of the terminal device when viewed from the negative direction of the Y axis;

FIG. 7 is a cross-sectional view of the whole configuration of the terminal device;

FIG. 8 is a perspective view of a wiring apparatus according to the First Embodiment of the present invention; and

FIG. 9A is a perspective view of a terminal device according to a Second Embodiment of the present invention when viewed from the positive direction of the Y axis, and FIG. 9B is a perspective view of the terminal device when viewed from the negative direction of the Y axis.

DESCRIPTION OF EMBODIMENTS

(First Embodiment)

(1) Outline

[0009] As shown in FIGS. 1A and 1B, a terminal device 1 according to a First Embodiment is a so-called quick connection terminal, to which an electric wire 100 can be connected by the electric wire 100 being inserted thereto. The terminal device 1 includes a terminal portion 2 having electrical conductivity. In the terminal device 1, the terminal portion 2 and the electric wire 100 are electrically connected to each other by the electric wire 100 coming into contact with the terminal portion 2. FIG. 1A illustrates only the terminal device 1 in a state where the electric wire 100 is not connected, and FIG. 1B illustrates the terminal device 1 and the electric wire 100 in a state where the electric wire 100 is connected, partially indicated by imaginary lines (two-dot chain lines). The terminal device 1 may be used for a wiring apparatus such as a switch or an outlet. A wiring apparatus 10 with the terminal device 1 (refer to FIG. 8) will be explained in a column of "(2.7) Wiring Apparatus" described later.

[0010] As shown in FIGS. 1A to 2B, the terminal device 1 includes a pressing portion 3 and a locking portion 4 in addition to the terminal portion 2. When the electric wire 100 entering from an insertion port 11 is inserted between the terminal portion 2 and the pressing portion 3, the electric wire 100 is electrically connected to the terminal portion 2. When inserted between the terminal portion 2 and the locking portion 4, movement of the electric wire 100 toward the insertion port 11 is restricted by the locking portion 4, and accordingly, the electric wire 100 is locked. As long as the insertion port 11 mentioned herein is a space which the electric wire 100 passes through to be introduced between the terminal portion 2 and both of the pressing portion 3 and the locking portion 4, the terminal device 1 is not needed to have the insertion port 11 with an entity, and may have only a function as the insertion port 11. FIGS. 1A to 2B illustrate the insertion port 11 without an entity. Alternatively, the insertion port 11 may be an insertion-hole 81 (refer to FIG. 5) with an entity, which is formed in a casing 8 (refer to FIG. 5) described later.

[0011] When the electric wire 100 is an insulated wire where a core wire made of a conductor is covered with an insulation coating, an end of the electric wire 100 from which the insulation coating is peeled off, namely only the core wire, is inserted from the insertion port 11. The electric wire 100 may be any of a single wire where the core wire is formed of a single conductor wire, and a stranded wire where the core wire is formed of two or more conductor wires.

(2) Details

(2.1) Basic Configuration

[0012] Hereinafter, a basic configuration of the terminal device 1 will be described in detail with reference to FIGS. lAto 4B.

[0013] In the following explanations, a "facing direction" in which the terminal portion 2 and the pressing portion 3 face each other is defined as an X axis direction, and a direction of directing to the terminal portion 2, when viewed from the pressing portion 3, is defined as a positive direction of an X axis. In addition, an "inserting direction" in which the electric wire 100 is inserted (the inserting direction being perpendicular to the X axis direction) is defined as a Y axis direction, and a direction of inserting the electric wire 100 is defined as a positive direction of a Y axis. Furthermore, a direction in which two electric wires 100 connected to the terminal device 1 are arranged (the direction being perpendicular to both of the X axis and the Y axis) is defined as a Z axis direction (i.e., a direction perpendicular to a paper face of FIG. 1A), and a direction of directing to the front side of the paper face of FIG. 1A is defined as a positive direction of a Z axis. However, the purpose of those directions is not to restrict a use direction of the terminal device 1. Arrows indicating the directions of the X axis, the Y axis and the Z axis in the figures are illustrated merely for convenience of explanation, and the arrows each do not have an entity. A matter that the facing direction and the inserting direction are exactly orthogonal to each other (cross at an angle of 90°) is not an essential constituent for the terminal device 1 as long as those directions cross each other.

[0014] The terminal device 1 according to this embodiment is a bipolar type of terminal device that is connectable with at most two electric wires 100. That is, since the terminal device 1 has two insertion ports 11, two electric wires 100 can be simultaneously connected through the two insertion ports 11, respectively. In the terminal device 1, since the two electric wires 100 are electrically connected to the single terminal portion 2, the two electric wires 100 connected in the terminal device 1 are electrically connected to each other via the terminal portion 2. The terminal device 1 may be therefore used as a feed terminal, for example.

[0015] The terminal device 1 includes two members: a terminal block 12; and a spring block 13. The terminal block 12 and the spring block 13 are respectively provided as different members. In other words, the terminal block 12 and the spring block 13 are members independ-

ently separated from each other. The terminal portion 2 and the pressing portion 3 are included in the terminal block 12. The locking portion 4 is included in the spring block 13. The terminal block 12 is formed of a metal plate having electrical conductivity. The spring block 13 is formed of a metal plate having elasticity. The terminal block 12 (pressing portion 3) and the spring block 13 (locking portion 4) are made of materials different from each other, respectively. The spring block 13 is combined with the terminal block 12 so as to be housed in a space surrounded by the terminal block 12.

(2.2) Terminal Block

[0016] As shown in FIGS. 3A and 3B, the terminal block 12 includes a connecting portion 5 and a holding portion 6, in addition to the terminal portion 2 and the pressing portion 3. The connecting portion 5 is to join the terminal portion 2 and the pressing portion 3. The connecting portion 5 joins: an end on an opposite side, of the terminal portion 2, from the insertion ports 11 in the Y axis direction; and the pressing portion 3. In other words, ends (upper ends in FIG. 3A) on opposite sides, of the terminal portion 2 and the pressing portion 3, from the insertion ports 11 in the Y axis direction are joined to each other by the connecting portion 5.

[0017] The terminal block 12 is made of copper (Cu) for example. In this embodiment, since the terminal device 1 is a bipolar type, the pressing portion 3 is provided in plural and the connecting portion 5 is also provided in plural (two pressing portions 3 and two connecting portions 5 in this embodiment). Here, the terminal device 1 has a configuration that is in plane symmetry with respect to the Z axis direction in which two pressing portions 3 (or two connecting portions 5) are arranged. For this reason, hereinafter, unless otherwise noted, only one of the two pressing portions 3 will be explained, and explanation of the other of the two pressing portions 3 will be appropriately omitted. Similarly, only one of the two connecting portions 5 will be explained, and explanation of the other of the two connecting portions 5 will be appropriately omitted.

[0018] In this embodiment, the pressing portions 3, the connecting portions 5, the terminal portion 2 and the holding portion 6 are integrally formed. In other words, the terminal portion 2, the two pressing portions 3, the two connecting portions 5 and the holding portion 6 are made of a sheet of metal plate. In this embodiment, the terminal portion 2, pressing portions 3, connecting portions 5 and holding portion 6, which constitute the terminal block 12, are formed by a sheet of metal plate being subjected to punching and bending.

[0019] The terminal portion 2 has a rectangular plate shape. The terminal portion 2 is configured so that one surface 20 in a thickness direction thereof (X axis direction) faces the pressing portions 3. That is, the electric wire 100 inserted from the insertion port 11 is introduced between the one surface 20 of the terminal portion 2 and a corresponding pressing portion 3, and electrically connected to the terminal portion 2 so as to be in contact with the one surface 20 of the terminal portion 2.

[0020] The terminal portion 2 is provided in the one surface 20 with a guide groove 23 that extends in the Y axis direction. The guide groove 23 restricts movement of the electric wire 100 toward directions other than the Y axis direction, in a plane (Y-Z plane) along the one surface 20, thereby limiting a moving direction of the electric wire 100 to only the Y axis direction. The guide grooves 23 is provided in two so as to respectively correspond to two electric wires 100, and two guide grooves 23 are formed in the one surface 20 of the terminal portion 2. The two guide grooves 23 are respectively arranged at both ends of the one surface 20 in the Z axis direction. Each guide groove 23 has a bottom surface 231 that is shaped so that a cross-sectional shape of the bottom surface 231 perpendicular to the inserting direction is curved convexly toward the positive direction of the X axis. In this embodiment, each guide groove 23 is formed by curving part of the terminal portion 2.

[0021] In addition, the terminal portion 2 is provided in a central region of the one surface 20 with an opening window 24 that penetrates the terminal portion 2 in the thickness direction thereof. The opening window 24 has a rectangular opened shape. The opening window 24 is a hole which part of a release member 9 described later is made to pass through.

[0022] As shown in FIGS. 1A and 1B, each pressing portion 3 is disposed at a position of facing a first region 21 of the one surface 20 of the terminal portion 2 in the X axis direction (the facing direction). The first region 21 mentioned herein is a region facing a corresponding pressing portion 3, of the one surface 20 of the terminal portion 2. Each pressing portion 3 is configured to hold an electric wire 100 inserted along the Y axis direction from the insertion port 11 so that the electric wire 100 is sandwiched between itself and the first region 21. In other words, while the electric wire 100 inserted from the insertion port 11 is introduced between the one surface 20 of the terminal portion 2 and the pressing portion 3, the pressing portion 3 applies to the electric wire 100 a force in a direction of pressing the electric wire 100 against the one surface 20. That is, the electric wire 100 is pressed against the first region 21 of the one surface 20 of the terminal portion 2 by the pressing portion 3, which can generate a proper contact pressure between the terminal portion 2 and the electric wire 100.

[0023] Each pressing portion 3 includes a first pressing piece 31, a second pressing piece 32 and a third pressing piece 33. The first pressing piece 31, second pressing piece 32 and third pressing piece 33 are arranged along the Y axis direction in order of the first pressing piece 31, second pressing piece 32 and third pressing piece 33 from the side of the connecting portion 5 (i.e., the side opposite from the insertion port 11).

[0024] The first pressing piece 31 has a rectangular plate shape, and is substantially parallel to the one sur-

face 20 of the terminal portion 2. An end on an opposite side, of the first pressing piece 31, from the insertion port 11 in the Y axis direction is connected with the connecting portion 5. Another end of the first pressing piece 31 on the side of the insertion port 11 in the Y axis direction is connected with the second pressing piece 32. The second pressing piece 32 has a rectangular plate shape, and is inclined relative to the one surface 20 of the terminal portion 2 so as to be closer to the terminal portion 2 as approaching the insertion port 11 in the Y axis direction. An end on an opposite side, of the second pressing piece 32, from the first pressing piece 31 in the Y axis direction is connected with the third pressing piece 33. The third pressing piece 33 has a rectangular plate shape, and is inclined relative to the one surface 20 of the terminal portion 2 so as to be closer to the terminal portion 2 as separated from the insertion port 11 in the Y axis direction.

[0025] That is, the third pressing piece 33 has a structure that a cross-sectional shape thereof perpendicular to the Z axis direction is approximately a V-shape together with the second pressing piece 32. In the pressing portion 3, a contact portion 34, which joins the second pressing piece 32 and the third pressing piece 33, is at a position closest to the one surface 20 of the terminal portion 2. In other words, the pressing portion 3 includes the contact portion 34 curved convexly toward the terminal portion 2 in the X axis direction, in a plane (X-Y plane) including both of the X axis direction and the Y axis direction. In this embodiment, the contact portion 34 is curved at a prescribed radius of curvature.

[0026] As shown in FIGS. 3A and 3B, each connecting portion 5 is projected toward a direction opposite to the insertion port 11 from an end on the opposite side, of the terminal portion 2, from the insertion port 11 in the Y axis direction. That is, the terminal portion 2 and each pressing portion 3 are joined to each other by the connecting portion 5 provided so as to be projected in the positive direction of the Y axis from the ends (upper ends in FIG. 3A) on the opposite side, thereof, from the insertion port 11 in the Y axis direction.

[0027] Each connecting portion 5 includes a curved part 51. The curved part 51 is curved convexly toward a direction opposite to the insertion port 11 in the Y axis direction, in a plane (X-Y plane) including both of the X axis direction and the Y axis direction. In this embodiment, the curved part 51 is curved like a circular arc shape. The curved part 51 has an internal diameter that is approximately equal to a distance between the first pressing piece 31 of the pressing portion 3 and the terminal portion 2.

[0028] Furthermore, each connecting portion 5 is set so that a size thereof in the Z axis direction is smaller than a size of a corresponding pressing portion 3 in the Z axis direction. More specifically, the connecting portions 5 are not formed over the full length of the terminal portion 2 in the Z axis direction, but formed so as to avoid interference with regions, in which the guide grooves 23 are formed, of the terminal portion 2. Accordingly, each connecting portion 5 can have a lower elastic coefficient and can be more easily bent, compared with a case where the size of each connecting portion 5 in the Z axis direction is equal to the size of the corresponding pressing portion 3 in the Z axis direction.

[0029] The holding portion 6 is formed integrally with the terminal portion 2, and configured so as to hold, between itself and the terminal portion 2, the locking portion 4 (spring block 13). The holding portion 6 is provided so as to be projected from an end on an opposite side, of the terminal portion 2, from the connecting portions 5 in the Y axis direction. That is, the holding portion 6 is connected with the end (lower end in FIG. 3A) of the terminal portion 2 on the side of the insertion port 11 in the Y axis direction.

[0030] The holding portion 6 includes a first holding piece 61, a second holding piece 62 and a third holding piece 63. The first holding piece 61, second holding piece 62 and third holding piece 63 are continuously arranged in order of the first holding piece 61, second holding piece 62 and third holding piece 63 from the side of the terminal portion 2. In this embodiment, all of: a part of joining the terminal portion 2 and the first holding piece 61; a joining part between the first and second holding pieces 61 and 62; and a joining part (a restricting part 64) between the second and third holding pieces 62 and 63 are curved at a prescribed radius of curvature.

[0031] The first holding piece 61 has a rectangular plate shape, and is projected in the negative direction of the X axis from the terminal portion 2. The first holding piece 61 and the terminal portion 2 are substantially orthogonal to each other. An end on an opposite side, of the first holding piece 61, from the terminal portion 2 in the X axis direction is connected with the second holding piece 62. The second holding piece 62 has a rectangular plate shape, and is projected in the positive direction of the Y axis from the first holding piece 61. The second holding piece 62 and the first holding piece 61 are substantially orthogonal to each other. An end on an opposite side, of the second holding piece 62, from the first holding piece 61 in the Y axis direction is connected with the third holding piece 63. The third holding piece 63 has a rectangular plate shape, and is projected in the positive direction of the X axis from the second holding piece 62. The third holding piece 63 and the second holding piece 62 are substantially orthogonal to each other.

[0032] That is, the second holding piece 62 faces the one surface 20 of the terminal portion 2, and the third holding piece 63 faces the first holding piece 61. Although the detail is described later, the holding portion 6 positions the spring block 13 by the restricting part 64 that is a part of joining the second and third holding pieces 62 and 63. In this embodiment, a dimensional relationship between the second holding piece 62 and the terminal portion 2 is defined so that those lengths in the Y axis direction are approximately the same as each other. The holding portion 6 therefore has a structure that a cross-

sectional shape thereof perpendicular to the Z axis direction is approximately a rectangular frame shape together with the terminal portion 2. The spring block 13 is housed in a space surrounded by the holding portion 6 and the terminal portion 2. Furthermore, a dimensional relationship between the first holding piece 61 and the third holding piece 63 is defined so that, in the X axis direction, a size of the third holding piece 63 is smaller than a size of the first holding piece 61, thereby forming a gap between the third holding piece 63 and the terminal portion 2. The pressing portion 3 is introduced through this gap into the space between the second holding piece 62 and the terminal portion 2.

[0033] The first holding piece 61 is provided with a cutout-hole 611 that penetrates the first holding piece 61 in a thickness direction thereof. The cutout-hole 611 is disposed at a position corresponding to the insertion port 11. The electric wire 100 inserted from the insertion port 11 can be therefore introduced through the cutout-hole 611 into the space surrounded by the holding portion 6 and the terminal portion 2. The cutout-hole 611 is provided in two so as to respectively correspond to two electric wires 100, and two cutout-holes 611 are formed in the first holding piece 61. The two cutout-holes 611 are respectively disposed at both ends of the first holding piece 61 in the Z axis direction.

[0034] Furthermore, the first holding piece 61 is provided in a central part thereof with a through-hole 612 that penetrates the first holding piece 61 in the thickness direction thereof. The through-hole 612 has a circular opened shape. Since the through-hole 612 is not an essential constituent for the terminal device 1, the through-hole 612 may be omitted.

(2.3) Spring Block

[0035] As shown in FIGS. 4A and 4B, the spring block 13 includes an extending portion 7 in addition to the locking portion 4. The spring block 13 is made of Steel Special Use Stainless (SUS) for example. The spring block 13 is formed of a metal plate thinner than the terminal block 12. In this embodiment, since the terminal device 1 is a bipolar type, the locking portion 4 is provided in plural (in this embodiment, two locking portions). Here, the terminal device 1 has a configuration that is in plane symmetry with respect to the Z axis direction in which two locking portions 4 are arranged. For this reason, hereinafter, unless otherwise noted, only one of the two locking portions 4 will be explained and explanation of the other of the two locking portions 4 will be appropriately omitted.

[0036] In this embodiment, the locking portions 4 and the extending portion 7 are integrally formed. In other words, the two locking portions 4 and the extending portion 7 are made of a sheet of metal plate. In this embodiment, the locking portions 4 and extending portion 7, which constitute the spring block 13, are formed by a sheet of metal plate being subjected to punching and bending.

[0037] As shown in FIGS. 1A and 1B, each locking portion 4 is disposed at a position of facing a second region 22 of the one surface 20 of the terminal portion 2 in the X axis direction (the facing direction). The second region 22 mentioned herein is a region that is different from the first region 21, of the one surface 20 of the terminal portion 2, in the Y axis direction, and faces the locking portion 4. The second region 22 is disposed between the first region 21 and the insertion port 11 in the Y axis direction. That is, the first region 21 and the second region 22 are arranged along the Y axis direction in order of the second region 22 and the first region 21 from the side of the insertion port 11.

[0038] Each locking portion 4 is configured to restrict movement of the electric wire 100 toward the insertion port 11 by contact with the electric wire 100 inserted along the Y axis direction from the insertion port 11. In other words, while the electric wire 100 inserted from the insertion port 11 is introduced between the one surface 20 of the terminal portion 2 and the locking portion 4, the locking portion 4 is configured to sandwich the electric wire 100 between itself and the second region 22. That is, the electric wire 100 is pressed against the second region 22 of the one surface 20 of the terminal portion 2 by the locking portion 4, which can generate a proper contact pressure between the terminal portion 2 and the electric wire 100.

[0039] In this embodiment, each locking portion 4 has a rectangular plate shape, and is inclined relative to the one surface 20 of the terminal portion 2 so as to be closer to the terminal portion 2 as separated from the insertion port 11 in the Y axis direction. Each locking portion 4 is configured to restrict the movement of the electric wire 100 toward the insertion port 11 by the locking portion 4 being, at an end edge 41 thereof closest to the one surface 20 of the terminal portion 2, in contact with the electric wire 100. That is, each locking portion 4 is projected, from a part (spring part 42) joining the each locking portion 4 and the extending portion 7, in a direction (i.e., the positive direction of the Y axis) in which the electric wire 100 is inserted, and inclined relative to the one surface 20 of the terminal portion 2 so as to make the end edge 41 closer to the one surface 20 of the terminal portion 2. While the electric wire 100 is introduced between the one surface 20 of the terminal portion 2 and the locking portion 4, the end edge 41 of the locking portion 4 is in contact with the electric wire 100. Accordingly, when a force in a direction (the negative direction of the Y axis) of causing the electric wire 100 to move toward the insertion port 11 is applied to the electric wire 100, the locking portion 4 is caught by the electric wire 100 so that the end edge 41 thereof bites into the electric wire 100, and the electric wire 100 can be therefore locked.

[0040] As shown in FIGS. 4A and 4B, the extending portion 7 is projected, in a direction opposite to the insertion port 11, from ends (lower ends in FIG. 4A) of the locking portions 4 on the side of the insertion port 11 in the Y axis direction. In other words, the extending portion

7 is constituted by part of the spring block 13, which extends in the positive direction of the Y axis from an end on an opposite side, of the locking portion 4, from the end edge 41. The spring part 42, which is a part of joining the locking portion 4 and the extending portion 7, applies an elastic force to the locking portion 4. In other words, the spring block 13 includes the spring part 42 curved convexly toward the side of the insertion port 11 in the Y axis direction, in a plane (X-Y plane) including both of the X axis direction and the Y axis direction. In this embodiment, the spring part 42 is curved at a prescribed radius of curvature.

[0041] The extending portion 7 includes a first extending piece 71 and a second extending piece 72. The first extending piece 71 and the second extending piece 72 are connected with each other in order of the first extending piece 71 and the second extending piece 72 from the side of the locking portion 4.

[0042] The first extending piece 71 has a rectangular plate shape, and as shown in FIGS. 1A and 1B, is approximately parallel to the one surface 20 of the terminal portion 2. An end of the first extending piece 71 on a side of the insertion port 11 in the Y axis direction is connected with the locking portion 4. Another end on an opposite side, of the first extending piece 71, from the locking portion 4 in the Y axis direction is connected with the second extending piece 72. The second extending piece 72 has a rectangular plate shape, and is projected in the positive direction of the X axis from the first extending piece 71. The second extending piece 72 and the first extending piece 71 are substantially orthogonal to each other.

[0043] That is, the second extending piece 72 has a structure that a cross-sectional shape thereof perpendicular to the Z axis direction is approximately an L-shape together with the first extending piece 71. The spring block 13 is positioned with respect to the terminal block 12 by making a corner 73, which is a part of joining the first and second extending pieces 71 and 72, come into contact with the restricting part 64 of the terminal block 12. The corner 73 is always not in contact with the restricting part 64, but there is a gap between the corner 73 and the restricting part 64. That is, when the spring block 13 is moved toward the positive direction of the Y axis relatively with respect to the terminal block 12, the corner 73 comes into contact with the restricting part 64, and the movement of the spring block 13 can be accordingly restricted. Therefore, the spring block 13 is positioned with respect to the terminal block 12. The corner 73 is curved at a prescribed radius of curvature.

[0044] Here, a size of the spring block 13 in the Y axis direction is defined so as to be slightly smaller than a distance between the first holding piece 61 and the third holding piece 63 of the terminal block 12. A size of the spring block 13 in the X axis direction is defined so as to be slightly larger than a distance between the terminal portion 2 and the second holding piece 62 of the terminal block 12. Accordingly, the spring block 13 is slightly loosely positioned in the Y axis direction, and can be housed in a space surrounded by the holding portion 6 and the terminal portion 2 so as to be in a compressed state in the X axis direction. That is, in a state where the spring block 13 has been combined with the terminal block 12, the spring part 42 is elastically deformed so as to cause the end edges 41 of the locking portions 4 to be closer to the first extending piece 71, and the spring block 13 accordingly falls into the compressed state in the X axis direction. A dimensional relationship between the second extending piece 72 and the third holding piece 63 is defined so that those lengths in the X axis direction are approximately equal to each other, which can form, between the second extending piece 72 and the terminal portion 2, a gap for introducing the pressing portion 3 between the second holding piece 62 and the terminal portion 2.

[0045] The first extending piece 71 is provided in a central part thereof with a through-hole 711 that penetrates the first extending piece 71 in a thickness direction thereof. The through-hole 711 has a circular opened shape. The first extending piece 71 is further provided with a slit 712 that penetrates the first extending piece 71 in the thickness direction thereof and extends from the through-hole 711 toward the locking portions 4. The slit 712 extends to the end edges 41 of the locking portions 4 through the spring part 42. The two locking portions 4 are separated from each other in the Z axis direction by the slit 712. Since the through-hole 711 is not an essential constituent for the terminal device 1, the through-hole 711 may be omitted.

(2.4) Dimensional Relationship

[0046] Next, a dimensional relationship among the terminal portion 2, the pressing portions 3 and the locking portions 4 will be described in a state where the spring block 13 has been combined with the terminal block 12.

[0047] As shown in FIG. 1B, in the X axis direction, a first distance L1 is set so as to be larger than a second distance L2, where the first distance L1 represents a distance between each pressing portion 3 and a corresponding first region 21, and the second distance L2 represents a distance between each locking portion 4 and a corresponding second region 22. In this embodiment, since the terminal portion 2 is provided in the one surface 20 with the guide grooves 23, the first and second distances L1 and L2 mentioned above and a third distance L3 mentioned later are all defined based on a bottom surface 231 that is the deepest part of each guide groove 23, as a reference. That is, the first distance L1 is a distance between: the contact portion 34, which is at a position closest to the one surface 20 of the terminal portion 2, of each pressing portion 3; and the bottom surface 231 that is the deepest part of the corresponding guide groove 23 in the first region 21 of the terminal portion 2. Similarly, the second distance L2 is a distance between: the end edge 41, which is at a position closest to the one surface 20 of the terminal portion 2, of each locking portion 4;

and the bottom surface 231 that is the deepest part of the corresponding guide groove 23 in the second region 22 of the terminal portion 2.

[0048] An end on the side of the insertion port 11 in the Y axis direction, of each pressing portion 3, namely the third pressing piece 33 is inclined relative to the one surface 20 of the terminal portion 2 so as to be further separated from the terminal portion 2 as approaching the insertion port 11 in the Y axis direction. That is, the third pressing piece 33 is inclined so as to be further separated from the terminal portion 2 as separated from the contact portion 34. Accordingly, a distance between: an end edge on the opposite side, of the third pressing piece 33, from the contact portion 34; and the terminal portion 2 is larger than a distance between the contact portion 34 and the terminal portion 2. In the embodiment, in the X axis direction, a distance between: the end edge on the opposite side, of the third pressing piece 33, from the contact portion 34; and the bottom surface 231 that is the deepest part of the corresponding guide groove 23 of the terminal portion 2 is defined as the third distance L3.

[0049] In short, the relationship between the first, second and third distances L1, L2 and L3 meets that the first distance L1 is larger than the second distance L2, and the third distance L3 is larger than the first distance L1 (L2 < L1 < L3).

[0050] Incidentally, the electric wire 100 to be inserted from the insertion port 11 preferably has a wire diameter φX that is more than the first distance L1 and less than the third distance L3. The wire diameter φX of the electric wire 100 mentioned herein is a wire diameter φX of an electric wire 100 defined as an electric wire connectable with the terminal device 1. When the electric wire 100 is an insulated wire, the wire diameter φX corresponds to a diameter of a core wire to be inserted from the insertion port 11. The relationship between the first, second and third distances L1, L2 and L3 and the wire diameter φX meets that the first distance L1 is larger than the second distance L2, and the wire diameter φX is larger than the first distance L1, and the third distance L3 is larger than the wire diameter φX (L2 < L1 < φX < L3). Note that the wire diameter φX mentioned herein means an outer diameter of the electric wire 100 to be inserted from the insertion port 11 (a diameter of the core wire in the case of the insulated wire), and may be appropriately determined in accordance with, for example, IEC (International Electrotechnical Commission) standard or the like.

(2.5) Connection Method of Electric Wire

[0051] Next, a method for connecting the electric wire 100 to the terminal device 1 with the configuration as above will be described with reference to FIGS. 1A and 1B.

[0052] A worker inserts the electric wire 100 as a connected target into the terminal device 1 through the insertion port 11 in the positive direction of the Y axis. When the electric wire 100 is inserted, an end of the electric wire 100 is first introduced between the locking portion 4 and the terminal portion 2 (the second region 22). Here, the second distance L2 and the wire diameter φX of the electric wire 100 have the dimensional relationship of "L2 < φX", as described in the column of "(2.4) Dimensional Relationship". For this reason, the locking portion 4 is pressed by the end of the electric wire 100, and the end edge 41 of the locking portion 4 is displaced in a direction of being separated from the one surface 20 of the terminal portion 2. At this time, in the spring block 13, the spring part 42 is elastically deformed so that its radius of curvature is reduced. The locking portion 4 therefore applies, to the electric wire 100, a force in a direction of pressing the electric wire 100 against the terminal portion 2.

[0053] When the electric wire 100 is further inserted from this state, the end of the electric wire 100 is introduced between the pressing portion 3 and the terminal portion 2 (the first region 21). Here the first distance L1, the third distance L3 and the wire diameter φX of the electric wire 100 have the dimensional relationship of "L1 < φX < L3", as described in the column of "(2.4) Dimensional Relationship". For this reason, the end of the electric wire 100 is guided by the third pressing piece 33 so as to be introduced between the contact portion 34 and the terminal portion 2. The contact portion 34 is then pressed by the end of the electric wire 100, and the contact portion 34 of the pressing portion 3 is therefore displaced in a direction of being separated from the one surface 20 of the terminal portion 2. At this time, in the terminal block 12, the connecting portion 5 is elastically deformed so that a radius of curvature of the curved part 51 is increased. The pressing portion 3 therefore applies, to the electric wire 100, a force in a direction of pressing the electric wire 100 against the terminal portion 2.

[0054] In short, in a state where the inserted electric wire 100 has reached a prescribed position, since the electric wire 100 is pressed against the one surface 20 (the first region 21) of the terminal portion 2 by the pressing portion 3, the proper contact pressure is generated between the terminal portion 2 and the electric wire 100, and the electric wire 100 and the terminal portion 2 are electrically connected to each other. Furthermore, in this state, movement of the electric wire 100 toward a direction of being pulled out from the insertion port 11 is restricted by the end edge 41 of the locking portion 4 being in contact with the electric wire 100, and accordingly, the electric wire 100 is locked.

[0055] Here a positional relationship between the locking portion 4 and the pressing portion 3, and a size of each of the locking portion 4 and the pressing portion 3 are defined so that the locking portion 4 does not come into contact with the pressing portion 3 when the end edge 41 of the locking portion 4 is displaced in a direction of being separated from the one surface 20 of the terminal portion 2. In other words, the positional relationship between the locking portion 4 and the pressing portion 3 in the Y axis direction, and the size of each of the locking portion 4 and the pressing portion 3 are defined so that

the pressing portion 3 is not disposed on a locus of the end edge 41 of the locking portion 4. Thus, when the electric wire 100 is inserted, the locking portion 4 and the pressing portion 3 are not simultaneously displaced, but the locking portion 4 is first displaced and the pressing portion 3 is then displaced. Accordingly, the magnitude of a force required for inserting the electric wire 100 can be more reduced, compared with a configuration that the locking portion 4 and the pressing portion 3 are simultaneously displaced. As above while the locking portion 4 is set so as not to come into contact with the pressing portion 3, a distance between the first region 21 and the second region 22 in the Y axis direction is preferably made as small as possible. A length of the electric wire 100 which should be inserted can be reduced by reducing the distance between the first region 21 and the second region 22, which can downsize the terminal device 1.

(2.6) Overall Configuration

[0056] Next, an overall configuration of the terminal device 1 including a casing 8 and a release member 9 will be described with reference to FIGS. 5 to 7. That is, the terminal device 1 includes the casing 8 and the release member 9, in addition to the above-mentioned terminal block 12 and spring block 13.

[0057] The casing 8 is made of material having electric insulation, such as synthetic resin. The casing 8 is shaped like a box that has a space for housing the terminal block 12 and the spring block 13. In a state where the terminal block 12 and the spring block 13 have been housed in the casing 8, at least the holding portion 6 is fixed to the casing 8. In this embodiment, the box-shaped casing 8 is illustrated, which are opened in two directions of the positive direction of the Y axis and the positive direction of the Z axis. The casing 8 is provided with an insertion-hole 81 that is disposed at a position corresponding to the insertion port 11, of the casing 8, and penetrates a bottom plate of the casing 8 in the Y axis direction. The insertion-hole 81 has a circular opened shape, and is provided in two so as to correspond to two electric wires 100. Although illustration of the insertion port 11 is omitted in FIGS. 5 to 6B, the insertion-hole 81 of the casing 8 corresponds to the insertion port 11 in the terminal device 1 with the casing as above.

[0058] Furthermore, the casing 8 is provided with an operational window 82 that is disposed at a position corresponding to the opening window 24, of the casing 8, and penetrates a side wall of the casing 8 in the X axis direction. The operational window 82 is a hole which an action part 93 of the release member 9 described later is made to pass through. In addition, the casing 8 is provided with a pair of bearing parts 83 for holding the release member 9, and the bearing parts 83 are respectively formed in inside surfaces, which are paired and face each other in the Z axis direction, of inside surfaces of the operational window 82. A shaft part 91 of the release member 9 as described later is inserted in the pair of bearing parts 83.

[0059] The release member 9 is a member for releasing the restriction of the movement of the electric wire 100, performed by the locking portion 4, namely the locking of the electric wire 100 by the locking portion 4. The release member 9 is made of material having electric insulation, such as synthetic resin. The release member 9 is configured to be movable relatively to the terminal portion 2 between a normal position and a release position. The release member 9 is configured to apply, when moved from the normal position to the release position, a force to the locking portion 4 in a direction of being separated from the second region 22 so as to release the restriction (the locking) of the movement of the electric wire 100 by the locking portion 4. FIGS. 6A to 7 show a state where the release member 9 is at the normal position.

[0060] More specifically, the release member 9 includes the shaft part 91, an operational part 92 and the action part 93. The shaft part 91 has a columnar shape extending along the Z axis direction. The release member 9 is held by the casing 8 in a state where the release member 9 can be turned around the shaft part 91 with respect to the casing 8, by both ends of the shaft part 91 in the Z axis direction being respectively inserted into the paired bearing parts 83. Thus, the release member 9 can be turned (moved) between the normal position and the release position around the shaft part 91. The operational part 92 is a part to be operated for moving the release member 9 from the normal position to the release position. The release member 9 is held by the casing 8 so that at least part of the operational part 92 is exposed from the casing 8. The action part 93 is a part for applying to the locking portion 4 a force in a direction of being separated from the second region 22, when the release member 9 is moved from the normal position to the release position. The release member 9 is held by the casing 8 so that at least part of the action part 93 is made to face the end edge 41 of the locking portion 4 through the operational window 82 of the casing 8 and the opening window 24 of the terminal portion 2.

[0061] According to the above configuration, when the connection between the terminal device 1 and the electric wire 100 is released, the worker operates the release member 9 to release the locking of the electric wire 100, performed by the locking portion 4, and accordingly, can pull out the electric wire 100 from the insertion port 11. That is, when the worker pushes the operational part 92 in a direction shown by an arrow A1 in FIG. 7 from the state where the release member 9 is at the normal position, the release member 9 is turned around the shaft part 91, and moved to the release position. At this time, the action part 93 is moved in a direction shown by an arrow A2 in FIG. 7, and applies to the end edge 41 of the locking portion 4 a force in a direction of being separated from the second region 22. When the end edge 41 is moved in the direction of being separated from the second region 22, the locking portion 4 is separated from

the electric wire 100. The restriction (the locking) of the movement of the electric wire 100 by the locking portion 4 can be therefore released.

[0062] Furthermore, the terminal device 1 in this embodiment is configured so that a force is applied from the single release member 9 simultaneously to the two locking portions 4. That is, the action part 93 of the release member 9 is disposed at a position over the two locking portions 4 in the Z axis direction. Thus, when the release member 9 is moved from the normal position to the release position, the force in the direction of being separated from the second region 22 is applied simultaneously to the two locking portions 4, and the locking by the two locking portions 4 is simultaneously released.

(2.7) Wiring Apparatus

[0063] The terminal device 1 with the above-mentioned configuration can be used for a wiring apparatus 10 as shown in FIG. 8, for example. The wiring apparatus 10 illustrated in FIG. 8 is a switch to be attached to a wall in a building or the like and to be used. The wiring apparatus 10 includes: an apparatus body 101 having a rectangular parallelopiped shape; and the terminal device 1 housed in the apparatus body 101. In the example of FIG. 8, the apparatus body 101 is provided on a front surface thereof with a handle 102. The wiring apparatus 10 is configured so that a contact point in the apparatus body 101 is switched on/off whenever the handle 102 is pushed.

[0064] The wiring apparatus 10 includes two terminal devices 1, each of which is the terminal device 1 with the above-mentioned configuration. The two terminal devices 1 are housed in the apparatus body 101 so that insertion-holes 81 (refer to FIG. 5) thereof are exposed on a rear surface of the apparatus body 101. Accordingly, in the wiring apparatus 10, connection of the electric wire 100 can be achieved by the electric wire 100 being inserted from the side of the rear surface of the apparatus body 101.

[0065] The casing 8 (refer to FIG. 5) of the terminal device 1 may be a member independently separated from a case body of the apparatus body 101, or may be part of the case body of the apparatus body 101. The release member 9 (refer to FIG. 7) is held by the case body of the apparatus body 101 or the casing 8 so that at least part of the operational part 92 (refer to FIG. 7) is exposed from the case body of the apparatus body 101.

(3) Advantage

[0066] As described above, a terminal device 1 according to a first aspect includes a terminal portion 2, a pressing portion 3 and a locking portion 4. The pressing portion 3 is disposed to face one surface 20 of the terminal portion 2, and configured to hold an electric wire 100 inserted along an inserting direction (Y axis direction) from an insertion port 11 so that the electric wire 100 is sandwiched between the pressing portion 3 and the terminal portion 2. The locking portion 4 is elastic; disposed to face the one surface 20 of the terminal portion 2; and configured to restrict movement of the electric wire 100 toward the insertion port 11 by contact with the electric wire 100. The pressing portion 3 and the locking portion 4 are members independently separated from each other.

[0067] According to this configuration, since the electric wire 100 is held at two positions: between the pressing portion 3 and the terminal portion 2; and between the locking portion 4 and the terminal portion 2, the electric wire 100 is suppressed from being inclined with respect to the inserting direction (Y axis direction). Thus, the electric wire 100 can be brought into surface-contact with the terminal portion 2 regardless of hardness of the electric wire 100, which can stabilize a contact state between the electric wire 100 and the terminal portion 2. The stabilization of the contact state between the electric wire 100 and the terminal portion 2 can lead to a stabilization of a contact resistance between the electric wire 100 and the terminal portion 2, and therefore, an increase in temperature of the terminal portion 2 can be suppressed by an increase in the contact resistance. In addition, the pressing portion 3 of pressing the electric wire 100 against the terminal portion 2 by sandwiching the electric wire 100 between itself and the terminal portion 2 is members independently separated from each other. Accordingly, for example even when a force is applied from the electric wire 100 to the locking portion 4 upon insertion of the electric wire 100, this force is not transmitted from the locking portion 4 to the pressing portion 3, and the force of pressing the electric wire 100 against the terminal portion 2 is therefore easily stabilized. Therefore, the terminal device 1 has an advantage that the contact state of the electric wire 100 in contact with the terminal portion 2 can be suppressed from falling into an unstable state.

[0068] Regarding a terminal device 1 according to a second aspect, in the first aspect, in a facing direction (X axis direction) in which the pressing portion 3 and the terminal portion 2 face each other, a first distance L1 is preferably larger than a second distance L2, where the first distance L1 is a distance between the pressing portion 3 and the one surface 20 of the terminal portion 2, and the second distance L2 is a distance between the locking portion 4 and the one surface 20 of the terminal portion 2. According to this configuration, since an interval between the pressing portion 3 and the terminal portion 2 is wider than an interval between the locking portion 4 and the terminal portion 2, the pressing portion 3 hardly interrupts movement of the electric wire 100 in the inserting direction (Y axis direction), and the electric wire 100 can be therefore smoothly inserted/removed. Note that this configuration is not an essential constituent for the terminal device 1, and for example, the first distance L1 may be equal to or smaller than the second distance L2.

[0069] Regarding a terminal device 1 according to a third aspect, in the first aspect or the second aspect, an

end of the pressing portion 3 on a side of the insertion port 11 in the inserting direction (Y axis direction) is preferably inclined relative to the one surface 20 of the terminal portion 2. In this case, the end of the pressing portion 3 on the side of the insertion port 11 in the inserting direction (Y axis direction) is preferably inclined so as to be further separated from the terminal portion 2 as approaching the insertion port 11 in the inserting direction. According to this configuration, upon insertion of the electric wire 100, an end of the electric wire 100 is guided by the end of the pressing portion 3 on the side of the insertion port 11 in the inserting direction (Y axis direction) so as to be introduced between the pressing portion 3 and the terminal portion 2, and accordingly, the insertion of the electric wire 100 can be easily achieved. Note that this configuration is not an essential constituent for the terminal device 1, and for example, the end of the pressing portion 3 on the side of the insertion port 11 in the inserting direction (Y axis direction) may not be inclined relative to the one surface 20 of the terminal portion 2.

[0070] A terminal device 1 according to a fourth aspect, in any one of the first to third aspects, preferably further includes a connecting portion 5 that joins the terminal portion 2 and the pressing portion 3. According to this configuration, the pressing portion 3 of pressing the electric wire 100 against the terminal portion 2 by sandwiching the electric wire 100 between itself and the terminal portion 2 is joined to the terminal portion 2 by the connecting portion 5. In other words, the pressing portion 3 can be treated as a single component together with the terminal portion 2. For this reason, the force of pressing the electric wire 100 against the terminal portion 2 is further suppressed from varying, compared with a case where the terminal portion 2 and the pressing portion 3 are components independently separated from each other. Therefore, the terminal device 1 has an advantage that the contact state of the electric wire 100 in contact with the terminal portion 2 can be suppressed from falling into an unstable state. Note that this configuration is not an essential constituent for the terminal device 1, and for example, connecting portion 5 may be omitted.

[0071] Regarding a terminal device 1 according to a fifth aspect, in the fourth aspect, the connecting portion 5 preferably joins: an end on an opposite side, of the terminal portion 2, from the insertion port 11 in the inserting direction (Y axis direction); and the pressing portion 3. According to this configuration, the electric wire 100 inserted from the insertion port 11 can be suppressed from interfering with the connecting portion 5, and the flexibility of design of the connecting portion 5 can be enhanced. Note that this configuration is not an essential constituent for the terminal device 1, and for example, the connecting portion 5 may join: an end of the terminal portion 2 on the side of the insertion port 11 in the inserting direction (Y axis direction); and the pressing portion 3. Alternatively, the connecting portion 5 may join: one end of the terminal portion 2 in the Z axis direction; and the pressing portion 3.

[0072] Regarding a terminal device 1 according to a sixth aspect, in the fifth aspect, the connecting portion 5 is preferably projected, toward a direction opposite to the insertion port 11, from the end on the opposite side, of the terminal portion 2, from the insertion port 11 in the inserting direction (Y axis direction). According to this configuration, since a distance between the pressing portion 3 and a fulcrum when the pressing portion 3 is displaced is increased depending on a projected amount of the connecting portion 5, it is possible to sufficiently secure a displacement amount of the pressing portion 3 while reducing a deformed amount of the connecting portion 5. A selection width of a wire diameter φX of a connectable electric wire 100 can be therefore extended. Note that this configuration is not an essential constituent for the terminal device 1, and for example, the connecting portion 5 may not be projected from the end on the opposite side, of the terminal portion 2, from the insertion port 11 in the inserting direction (Y axis direction).

[0073] Regarding a terminal device 1 according to a seventh aspect, in the sixth aspect, the connecting portion 5 preferably includes a curved part 51, and the curved part 51 is preferably curved convexly toward the direction opposite to the insertion port 11 in the inserting direction, in a plane including both of the inserting direction and a facing direction in which the pressing portion 3 and the terminal portion 2 face each other. According to this configuration, a stress applied to the connecting portion 5 upon the displacement of the pressing portion 3 is dispersed in the curved part 51, and the stress is therefore suppressed from being generated intensively in the connecting portion 5. Thus, the connecting portion 5 is suppressed from plastically deforming, and the pressing force of the pressing portion 3 can be easily maintained. Note that this configuration is not an essential constituent for the terminal device 1, and for example, the connecting portion 5 may not include the curved part 51.

[0074] Regarding a terminal device 1 according to an eighth aspect, in any one of the fourth to seventh aspects, the pressing portion 3, the connecting portion 5 and the terminal portion 2 are preferably integrally formed. According to this configuration, since the pressing portion 3 is electrically conductive to the terminal portion 2 via the connecting portion 5, the electric wire 100 can be electrically connected to the terminal portion 2 even when brought into contact with any of the terminal portion 2 and the pressing portion 3. The contact resistance between the electric wire 100 and the terminal portion 2 can be therefore further stabilized. Note that this configuration is not an essential constituent for the terminal device 1, and for example, the pressing portion 3, the connecting portion 5 and the terminal portion 2 may be members independently separated from one another.

[0075] A terminal device 1 according to a ninth aspect, in any one of the first to eighth aspects, preferably further includes a holding portion 6 that is formed integrally with the terminal portion 2, and the holding portion 6 is preferably configured to hold a spring block 13 including the

locking portion 4 between the holding portion 6 and the terminal portion 2. According to this configuration, since a relative position of the locking portion 4 with respect to the terminal portion 2 is determined by the holding portion 6, the electric wire 100 can be stably locked by the locking portion 4. Furthermore, when the holding portion 6 is made of metal material, the relative position of the locking portion 4 with respect to the terminal portion 2 is hardly varied depending on a change in temperature or the like, compared with a case where the locking portion 4 is held by the casing 8 and the like made of synthetic resin, for example. Note that this configuration is not an essential constituent for the terminal device 1, and for example, the holding portion 6 may be omitted and the spring block 13 may be held by the casing 8 and the like.

[0076] Regarding a terminal device 1 according to a tenth aspect, in the ninth aspect, the holding portion 6 preferably includes a restricting part 64. The restricting part 64 is preferably in contact with the spring block 13 on an opposite side of the spring block 13 from the insertion port 11 in the inserting direction (Y axis direction), and in contact with the spring block 13 on an opposite side of the spring block 13 from the terminal portion 2 in a facing direction (X axis direction) in which the pressing portion 3 and the terminal portion 2 face each other. According to this configuration, since movement of the spring block 13 in a direction of being separated from the insertion port 11 and the terminal portion 2 is restricted by the restricting part 64, the spring block 13 is positionally stabilized upon the insertion of the electric wire 100, and accordingly, the electric wire 100 can be stably locked by the locking portion 4. Note that this configuration is not an essential constituent for the terminal device 1, and for example, the restricting part 64 may be omitted and the movement of the spring block 13 may be restricted by the casing 8 and the like.

[0077] Regarding a terminal device 1 according to an eleventh aspect, in any one of the first to tenth aspects, the pressing portion 3 and the locking portion 4 are preferably made of materials different from each other, respectively. According to this configuration, it is possible to apply the best material for each of: the pressing portion 3 for pressing the electric wire 100 against the terminal portion 2; and the locking portion 4 for locking the electric wire 100. For example, it is possible to apply material having excellent electrical conductivity for the pressing portion 3, and material having excellent elasticity for the locking portion 4. Note that this configuration is not an essential constituent for the terminal device 1, and for example, the pressing portion 3 and the locking portion 4 may be made of the same material.

[0078] Regarding a terminal device 1 according to a twelfth aspect, in any one of the first to eleventh aspects, the terminal portion 2 is preferably provided in the one surface 20 with a guide groove 23 extending in the inserting direction (Y axis direction). According to this configuration, movement of the electric wire 100 to directions other than the inserting direction (Y axis direction) in a plane along the one surface 20 is restricted by the guide groove 23. Workability for inserting the electric wire 100 can be therefore improved. In particular, when the electric wire 100 is a stranded wire with a core wire formed of two or more conductor wires, the conductor wires forming the core wire hardly fall apart by the electric wire 100 passing through the guide groove 23. Note that this configuration is not an essential constituent for the terminal device 1, and for example, the guide groove 23 may be omitted.

[0079] Regarding a terminal device 1 according to a thirteenth aspect, in the twelfth aspect, the guide groove 23 preferably has a bottom surface 231 that is shaped so that a cross-sectional shape of the bottom surface 231 perpendicular to the inserting direction (Y axis direction) is curved convexly toward a direction opposite to the pressing portion 3 in a facing direction in which the pressing portion 3 and the terminal portion 2 face each other. According to this configuration, the electric wire 100 can be made so as to easily pass through a center of the guide groove 23 in a width direction thereof (Z axis direction). In particular, when the electric wire 100 is a stranded wire with a core wire formed of two or more conductor wires, the conductor wires forming the core wire are further suppressed from falling apart. Note that this configuration is not an essential constituent for the terminal device 1, and for example, the guide groove 23 may have a bottom surface 231 formed like a V-shape.

[0080] A terminal device 1 according to a fourteenth aspect, in any one of the first to thirteenth aspects, preferably further includes a release member 9 that is movable relatively to the terminal portion 2 between a normal position and a release position. The release member 9 is preferably configured to apply, when moved from the normal position to the release position, a force to the locking portion 4 in a direction of being separated from the one surface 20 of the terminal portion 2 so as to release restriction of movement of the electric wire 100 performed by the locking portion 4. According to this configuration, the electric wire 100 can be easily pulled out in a state where the restriction of movement of the electric wire 100 performed by the locking portion 4 has been released by operating the release member 9. Note that this configuration is not an essential constituent for the terminal device 1, and for example, the release member 9 may be omitted.

[0081] Regarding a terminal device 1 according to a fifteenth aspect, in any one of the first to fourteenth aspects, in the inserting direction (Y axis direction), the locking portion 4 is preferably disposed between the pressing portion 3 and the insertion port 11. According to this configuration, the locking portion 4 locks the electric wire 100 at a position close to the insertion port 11, and the pressing portion 3 presses the electric wire 100 against the terminal portion 2 at a position far from the insertion port 11. Accordingly, even when a force in a direction perpendicular to the inserting direction (Y axis direction) is applied to the electric wire 100, the force of pressing the

electric wire 100 against the terminal portion 2 is stabilized, and the contact state between the terminal portion 2 and the electric wire 100 can be easily stabilized. Note that this configuration is not an essential constituent for the terminal device 1, and for example, the pressing portion 3 may be disposed between the locking portion 4 and the insertion port 11 in the inserting direction (Y axis direction).

[0082] A terminal device 1 according to a sixteenth aspect, in any one of the first to fifteenth aspects, preferably includes a plurality of the pressing portions 3 (two pressing portions in the case of the First Embodiment), each of which is configured to individually hold a corresponding electric wire 100 of a plurality of the electric wires 100 so that the corresponding electric wire 100 is sandwiched between the each pressing portion 3 and the terminal portion 2. According to this configuration, since each of a plurality of the pressing portions 3 individually applies a pressing force to a corresponding electric wire 100 of a plurality of the electric wires 100 respectively inserted from a plurality of the insertion ports 11, the followability of the pressing portions 3 to the electric wires 100 can be improved, and the contact state between the electric wires 100 and the terminal portion 2 can be stabilized. Note that this configuration is not an essential constituent for the terminal device 1, and for example, a single pressing portion 3 may be configured to hold a plurality of the electric wires 100, respectively inserted from a plurality of the insertion ports 11, between the single pressing portion 3 and the terminal portion 2.

[0083] Regarding a terminal device 1 according to a seventeenth aspect, in any one of the first to sixteenth aspects, the pressing portion 3 preferably includes a contact portion 34, and the contact portion 34 is curved convexly toward the terminal portion 2 in a facing direction in which the pressing portion 3 and the terminal portion 2 face each other, in a plane including both of the inserting direction and the facing direction. According to this configuration, when the electric wire 100 is moved in the inserting direction (Y axis direction), since the electric wire 100 comes into contact with the contact portion 34 of the pressing portion 3, the electric wire 100 is suppressed from being caught by the pressing portion 3. The electric wire 100 can be therefore smoothly inserted into or removed from the terminal device 1. Note that this configuration is not an essential constituent for the terminal device 1, and for example, the pressing portion 3 may not include the curved contact portion 34.

[0084] Regarding a terminal device 1 according to an eighteenth aspect, in any one of the first to seventeenth aspects, the locking portion 4 is preferably inclined relative to the one surface 20 of the terminal portion 2 so as to be closer to the terminal portion 2 as separated from the insertion port 11 in the inserting direction (Y axis direction). In this case, the locking portion 4 is preferably configured to restrict the movement of the electric wire 100 toward the insertion port 11 by the locking portion 4 being, at an end edge 41 thereof closest to the one surface 20 of the terminal portion 2, in contact with the electric wire 100. According to this configuration, by the electric wire 100 being only inserted from the insertion port 11, the locking portion 4 is pressed by an end of the electric wire 100, and the end edge 41 of the locking portion 4 is displaced in a direction of being separated from the one surface 20 of the terminal portion 2. The electric wire 100 can be therefore inserted without operation to the release member 9. Note that this configuration is not an essential constituent for the terminal device 1, and for example, the locking portion 4 may have a shape different from the above-mentioned shape.

[0085] A wiring apparatus 10 includes: the terminal device 1 according to any one of the first to eighteenth aspects; and an apparatus body 101 configured to house therein the terminal device 1. According to this configuration, the wiring apparatus 10 has an advantage that the contact state of the electric wire 100 in contact with the terminal portion 2 can be suppressed from falling into an unstable state. Note that the terminal device 1 is not limited to be used for the wiring apparatus 10, but may be to be used for an electrical apparatus such as a home appliance, or the terminal device 1 may be used alone.

(4) Variations

[0086] Hereinafter, variations of the First Embodiment will be listed.

[0087] The guide groove 23 is not limited to have the configuration that the part of the terminal portion 2 is formed to be curved as described in the First Embodiment, but may have a configuration that is formed by cutting the one surface 20 of the terminal portion 2 through a cutting process, for example.

[0088] The terminal portion 2, pressing portion 3, connecting portion 5 and holding portion 6, which constitute the terminal block 12, are not limited to have the configuration that is formed by bending a single metal plate, but may be formed through an extrusion molding process or the like, for example. Similarly, the locking portion 4 and extending portion 7, which constitute the spring block 13, are not limited to have the configuration that is formed by bending a single metal plate, but may be formed through an extrusion molding process or the like, for example.

[0089] The matter that the contact portion 34 is curved at a prescribed radius of curvature is not an essential constituent for the terminal device 1, and for example, the contact portion 34 may be formed angularly. Similarly, the matter that the corners of the holding portion 6 and the corners of the extending portion 7 are curved at a prescribed radius of curvature is not an essential constituent for the terminal device 1, and for example, they may be formed angularly. In addition similarly, the matter that the spring part 42 is curved at a prescribed radius of curvature is not an essential constituent for the terminal device 1, and for example, it may be formed angularly.

[0090] As long as the terminal block 12 has electrical

conductivity, the material for the terminal block 12 is not limited to copper, but may be copper alloy such as brass, tin (Sn) bronze or phosphor (P) bronze. Similarly, as long as the spring block 13 has elasticity, the material for the spring block 13 is not limited to Steel Special Use Stainless, but may be for example iron (Fe), copper alloy or the like. The terminal block 12 (pressing portion 3) and the spring block 13 (locking portion 4) may be made of the same material.

[0091] The terminal device 1 is not limited to a bipolar type of terminal device that is connectable with at most two electric wires 100, but may be a terminal device that is connectable with three or more electric wires 100, such as a three-pole type connectable with at most three electric wires 100, or a four-pole type connectable with at most four electric wires 100. In this case, in the terminal device 1, the number of each of the pressing portions 3, locking portions 4 and connecting portions 5 is preferably equal to the number of the poles. That is, when the terminal device 1 is a three-pole type, the number of each of the pressing portions 3, locking portions 4 and connecting portions 5 is preferably three.

[0092] The pressing portion 3, connecting portion 5 and terminal portion 2 are not limited to be formed integrally, but may be members independently separated from one another. More specifically, the pressing portion 3, connecting portion 5 and terminal portion 2 independently separated from one another may be coupled with one another by, for example, caulking, welding, crimping or the like.

[0093] Although it is described in the First Embodiment that the release member 9 is operated only when the electric wire 100 is pulled out, it may be operated when the electric wire 100 is inserted. That is, when connecting the electric wire 100 to the terminal device 1, the worker may operate the release member 9 and insert the electric wire 100 in a state where the end edge 41 of the locking portion 4 has been displaced in a direction of being separated from the one surface 20 of the terminal portion 2 by the operation of the release member 9.

(Second Embodiment)

[0094] A terminal device 1A according to this embodiment is a unipolar type of terminal device that is connectable with only one electric wire. Hereinafter, components similar to those of the First Embodiment are assigned with the same reference signs and explanations thereof will be appropriately omitted.

[0095] As shown in FIG. 9, the terminal device 1A corresponds to a configuration that is obtained by dividing the terminal device 1 (refer to FIGS. 6A and 6B) according to the First Embodiment into two equal parts in the Z axis direction. That is, the number of the insertion port 11 in the terminal device 1A is one, and one electric wire 100 can be connected through the one insertion port 11. In the terminal device 1A, the one electric wire 100 is electrically connected to a single terminal portion 2. In the terminal device 1A, each of the pressing portion 3, locking portion 4 and connecting portion 5 is provided in one.

[0096] Similarly to the First Embodiment, the terminal device 1A of this embodiment explained above has an advantage that the contact state of the electric wire 100 in contact with the terminal portion 2 can be suppressed from falling into an unstable state. Furthermore similarly to the First Embodiment, the terminal device 1A may be used for the wiring apparatus 10 (refer to FIG. 8).

[0097] The configuration of the Second Embodiment can be applied appropriately in combination with the configuration (including the variations) of the First Embodiment.

REFERENCE SIGNS LIST

[0098]

1, 1A	Terminal Device
2	Terminal Portion
3	Pressing Portion
4	Locking Portion
5	Connecting Portion
6	Holding Portion
9	Release Member
10	Wiring Apparatus
11	Insertion Port
13	Spring Block
20	One Surface
23	Guide Groove
34	Contact Portion
41	End Edge
51	Curved Part
64	Restricting Part
100	Electric Wire
101	Apparatus Body
231	Bottom Surface
L1	First Distance
L2	Second Distance

Claims

1. A terminal device (1, 1A), comprising:

a terminal portion (2);
a pressing portion (3) that is disposed to face one surface (20) of the terminal portion (2), the pressing portion (3) being configured to hold an electric wire (100) inserted along an inserting direction from an insertion port (11) so that the electric wire (100) is sandwiched between the pressing portion (3) and the terminal portion (2); and
a locking portion (4) that is elastic, the locking portion (4) being disposed to face the one surface (20) of the terminal portion (2), and the locking portion (4) being configured to restrict move-

ment of the electric wire (100) toward the insertion port (11) by contact with the electric wire (100),
the pressing portion (3) and the locking portion (4) being members independently separated from each other.

2. The terminal device (1, 1A) according to claim 1, wherein
in a facing direction in which the pressing portion (3) and the terminal portion (2) face each other, a first distance (L1) between the pressing portion (3) and the one surface (20) of the terminal portion (2) is larger than a second distance (L2) between the locking portion (4) and the one surface (20) of the terminal portion (2).

3. The terminal device (1, 1A) according to claim 1 or 2, wherein
an end of the pressing portion (3) on a side of the insertion port (11) in the inserting direction is inclined relative to the one surface (20) of the terminal portion (2) so as to be further separated from the terminal portion (2) as approaching the insertion port (11) in the inserting direction.

4. The terminal device (1, 1A) according to any one of claims 1 to 3, further comprising a connecting portion (5) that joins the terminal portion (2) and the pressing portion (3).

5. The terminal device (1, 1A) according to any one of claims 1 to 4, further comprising a holding portion (6) that is formed integrally with the terminal portion (2), wherein
the holding portion (6) is configured to hold a spring block (13) including the locking portion (4) between the holding portion (6) and the terminal portion (2).

6. The terminal device (1, 1A) according to claim 5, wherein
the holding portion (6) comprises a restricting part (64) that is in contact with the spring block (13) on an opposite side of the spring block (13) from the insertion port (11) in the inserting direction,
the restricting part (64) being in contact with the spring block (13) on an opposite side of the spring block (13) from the terminal portion (2) in a facing direction in which the pressing portion (3) and the terminal portion (2) face each other.

7. The terminal device (1, 1A) according to any one of claims 1 to 6, wherein
the pressing portion (3) and the locking portion (4) are made of materials different from each other, respectively.

8. The terminal device (1, 1A) according to any one of claims 1 to 7, wherein
the terminal portion (2) is provided in the one surface (20) with a guide groove (23) that extends in the inserting direction.

9. The terminal device (1, 1A) according to claim 8, wherein
the guide groove (23) has a bottom surface (231) that is shaped so that a cross-sectional shape of the bottom surface (231) perpendicular to the inserting direction is curved convexly toward a direction opposite to the pressing portion (3) in a facing direction in which the pressing portion (3) and the terminal portion (2) face each other.

10. The terminal device (1, 1A) according to any one of claims 1 to 9, further comprising a release member (9) that is movable relatively to the terminal portion (2) between a normal position and a release position, wherein
the release member (9) is configured to apply, when moved from the normal position to the release position, a force to the locking portion (4) in a direction of being separated from the one surface (20) of the terminal portion (2) so as to release restriction of movement of the electric wire (100) performed by the locking portion (4).

11. A wiring apparatus (10), comprising:

the terminal device (1, 1A) according to any one of claims 1 to 10; and
an apparatus body (101) configured to house therein the terminal device (1, 1A).

FIG. 1A

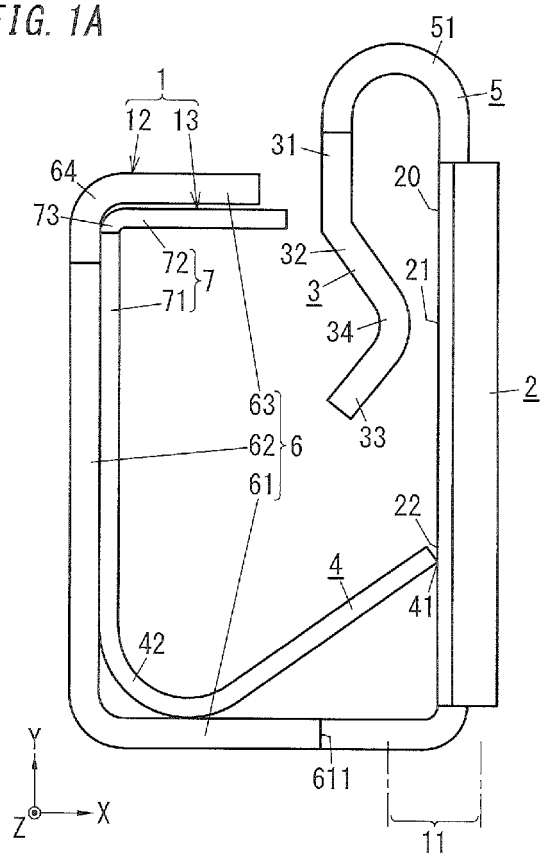
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FIG. 1B

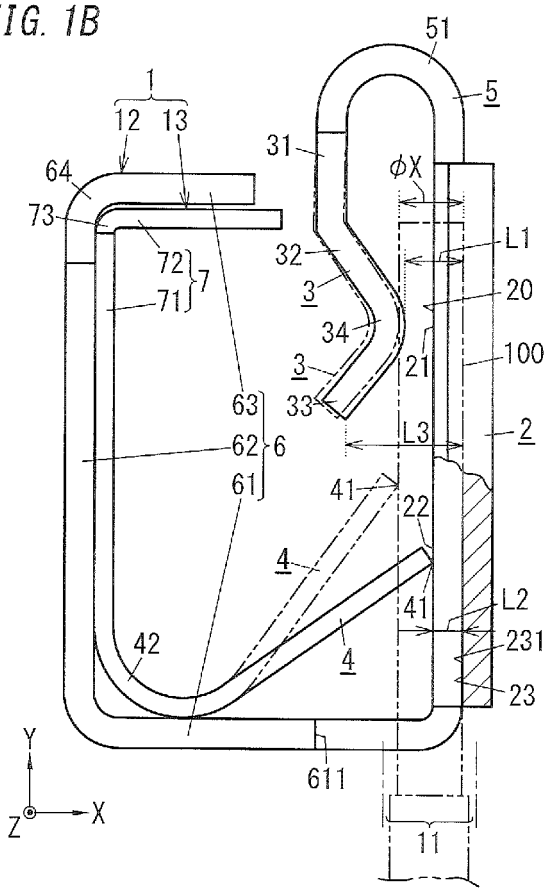
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FIG. 2A

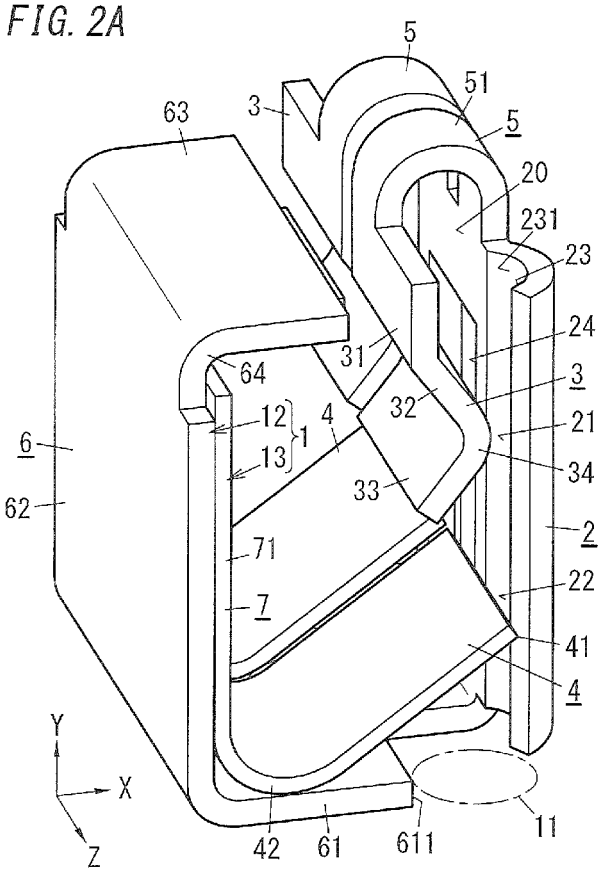
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FIG. 2B

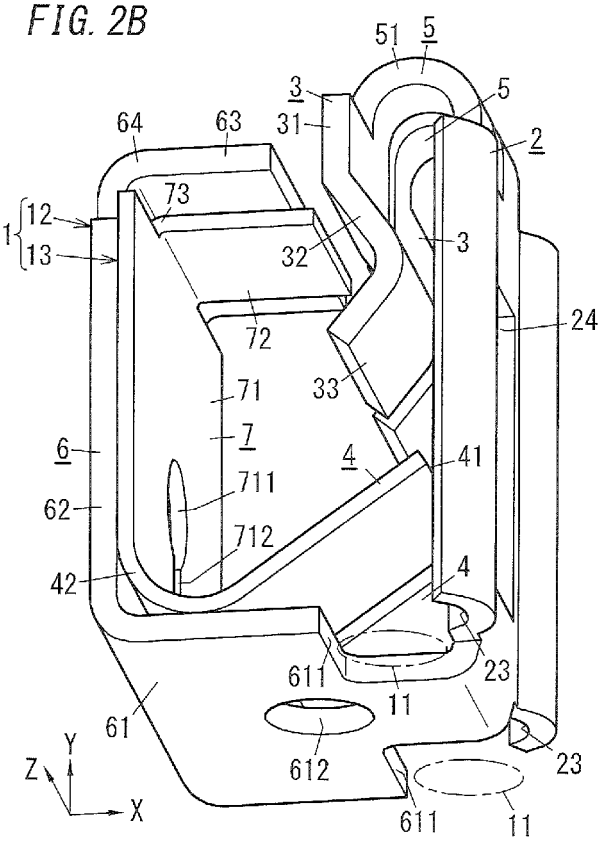
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FIG. 3A

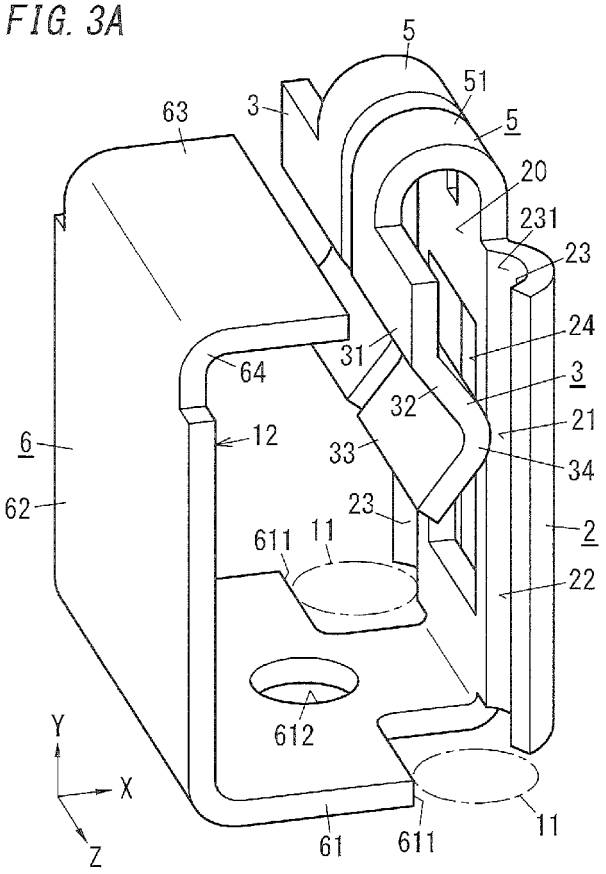
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FIG. 3B

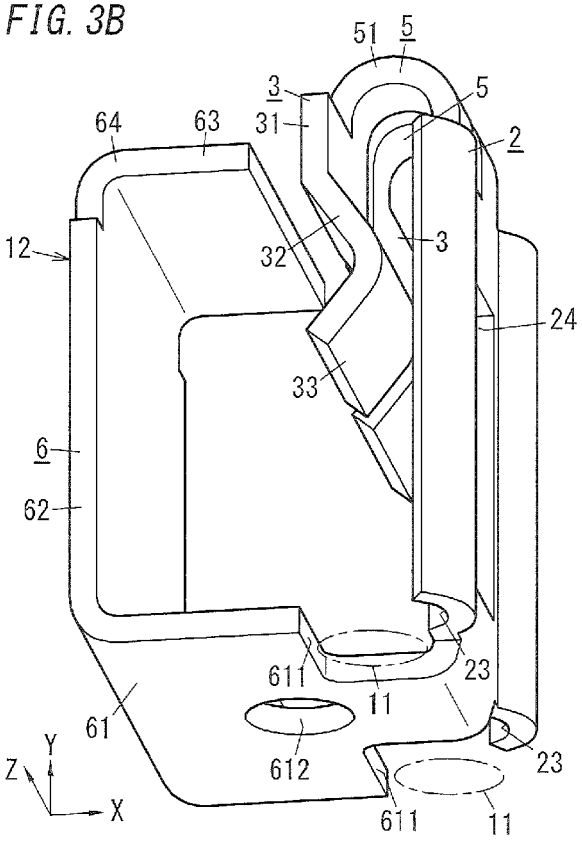
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FIG. 4A

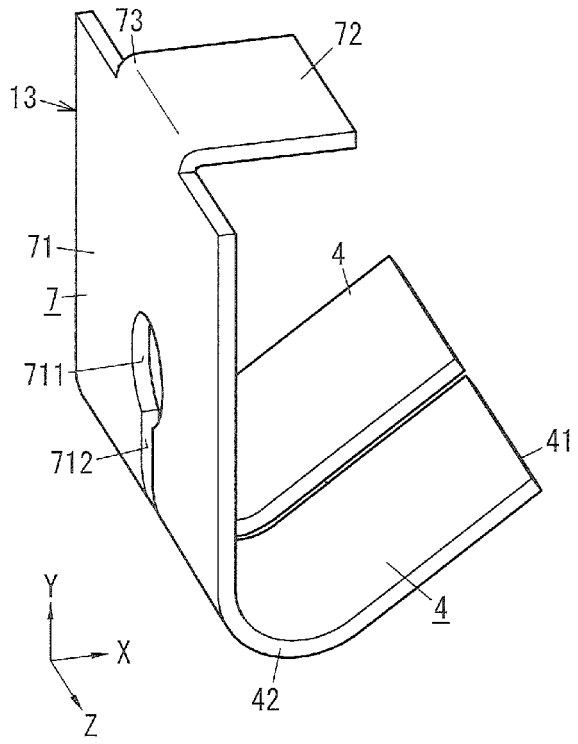

FIG. 4B

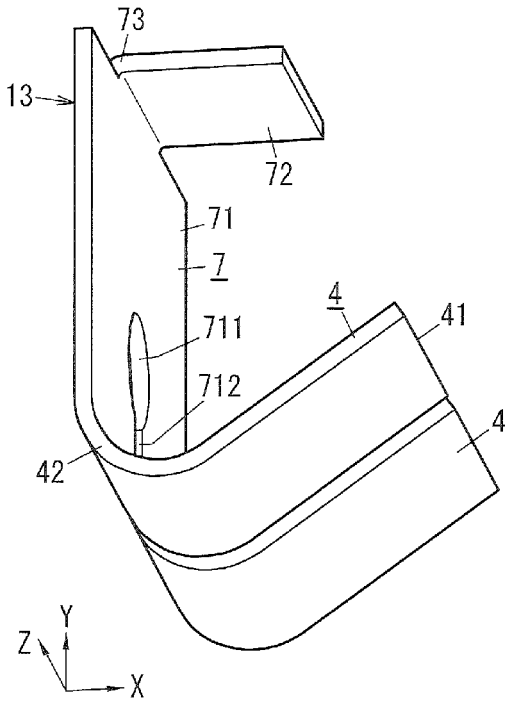

FIG. 5

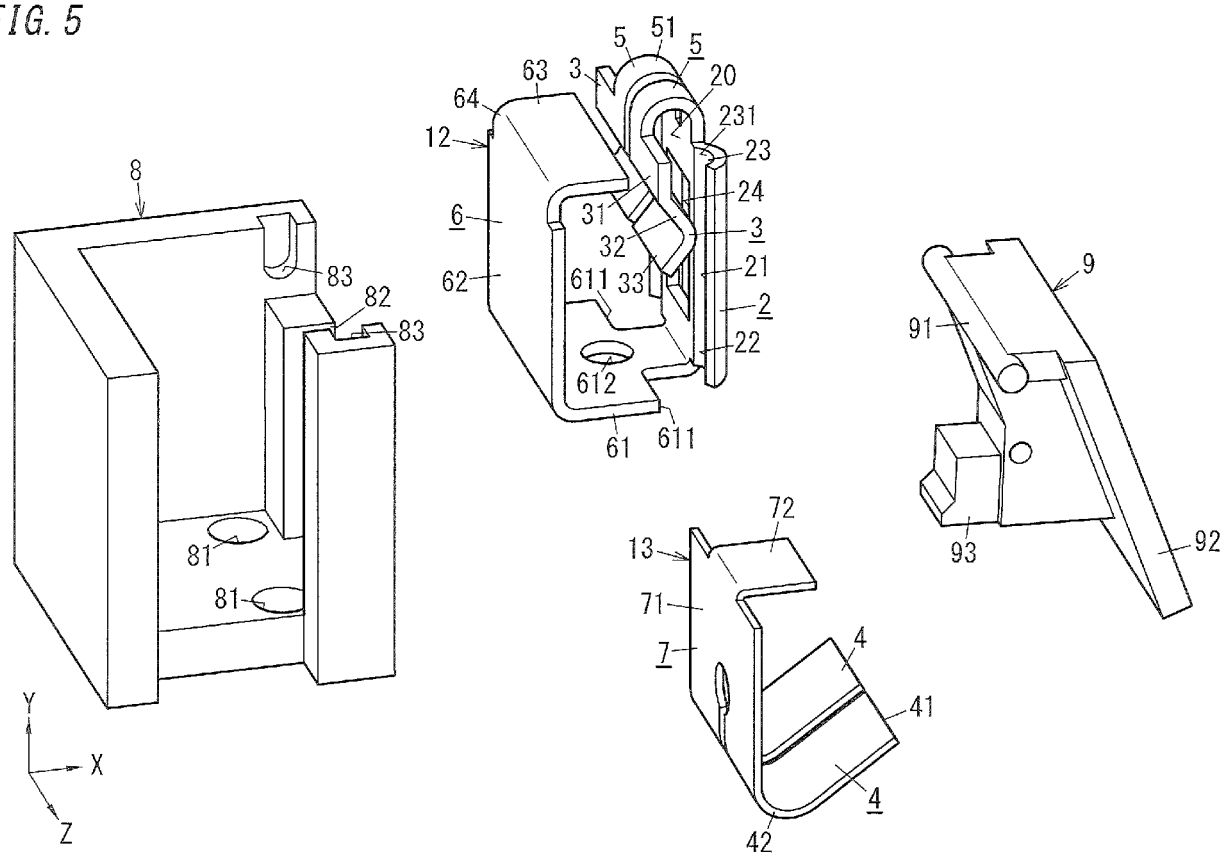
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FIG. 6A

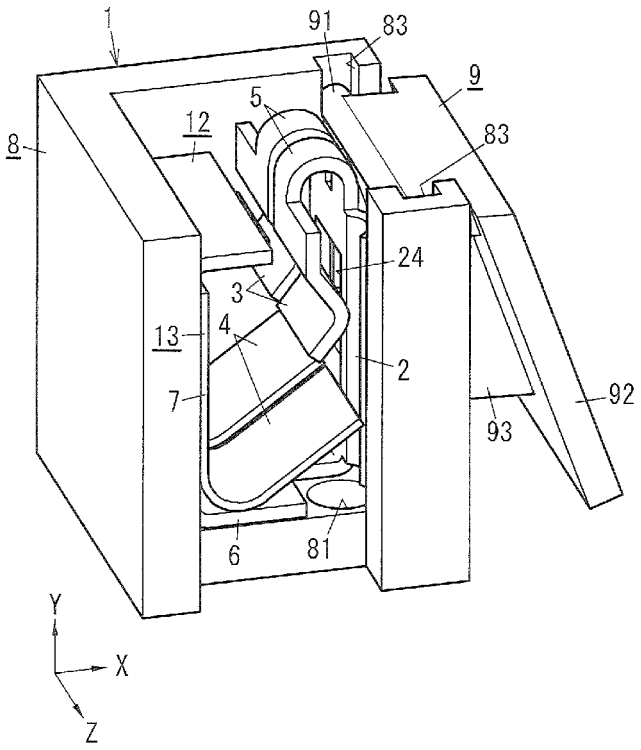
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FIG. 6B

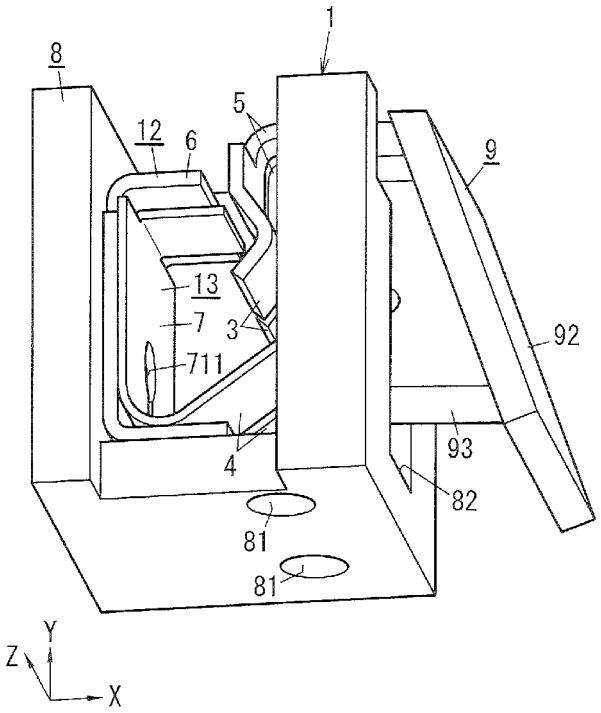
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FIG. 7

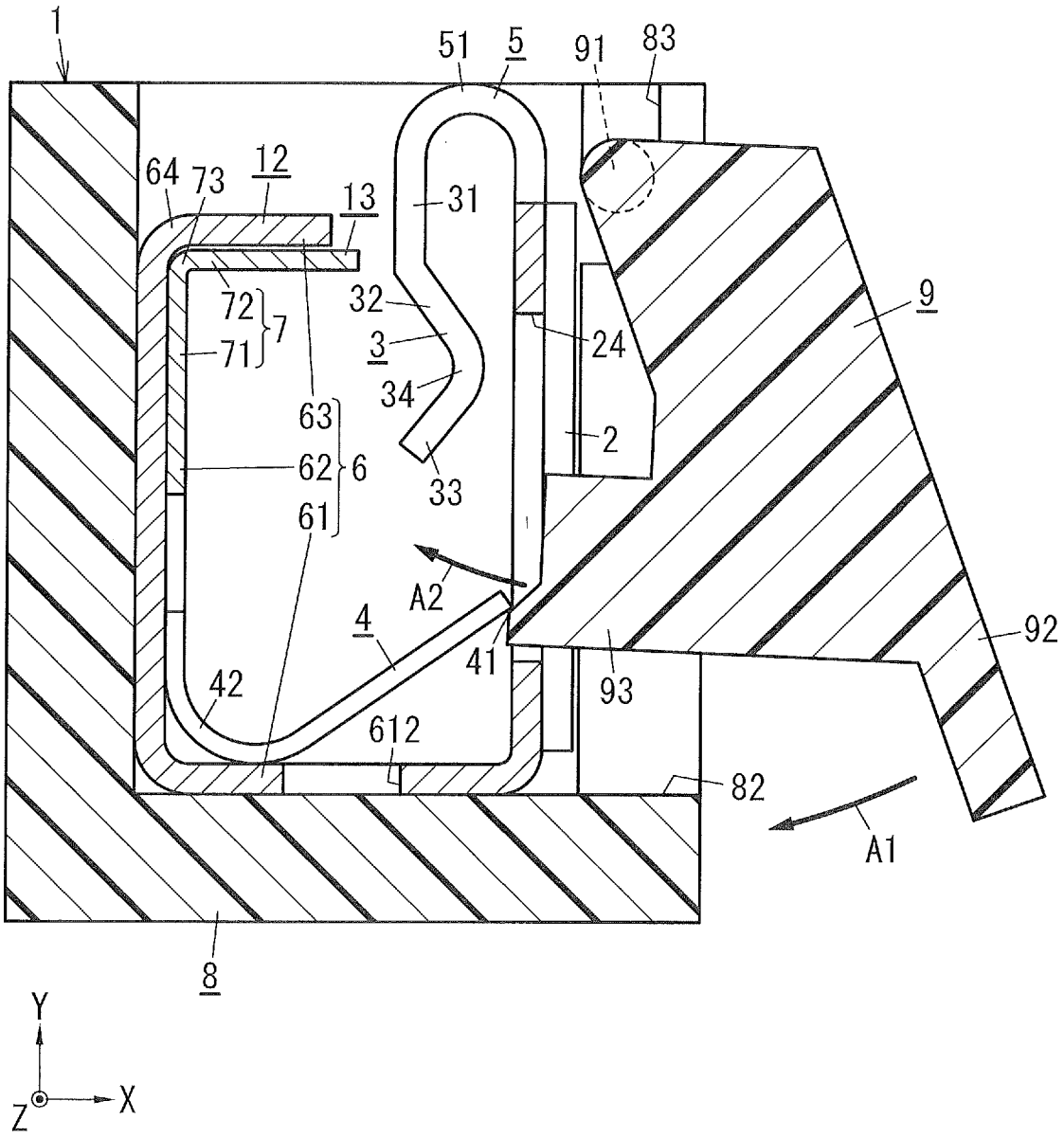
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FIG. 8

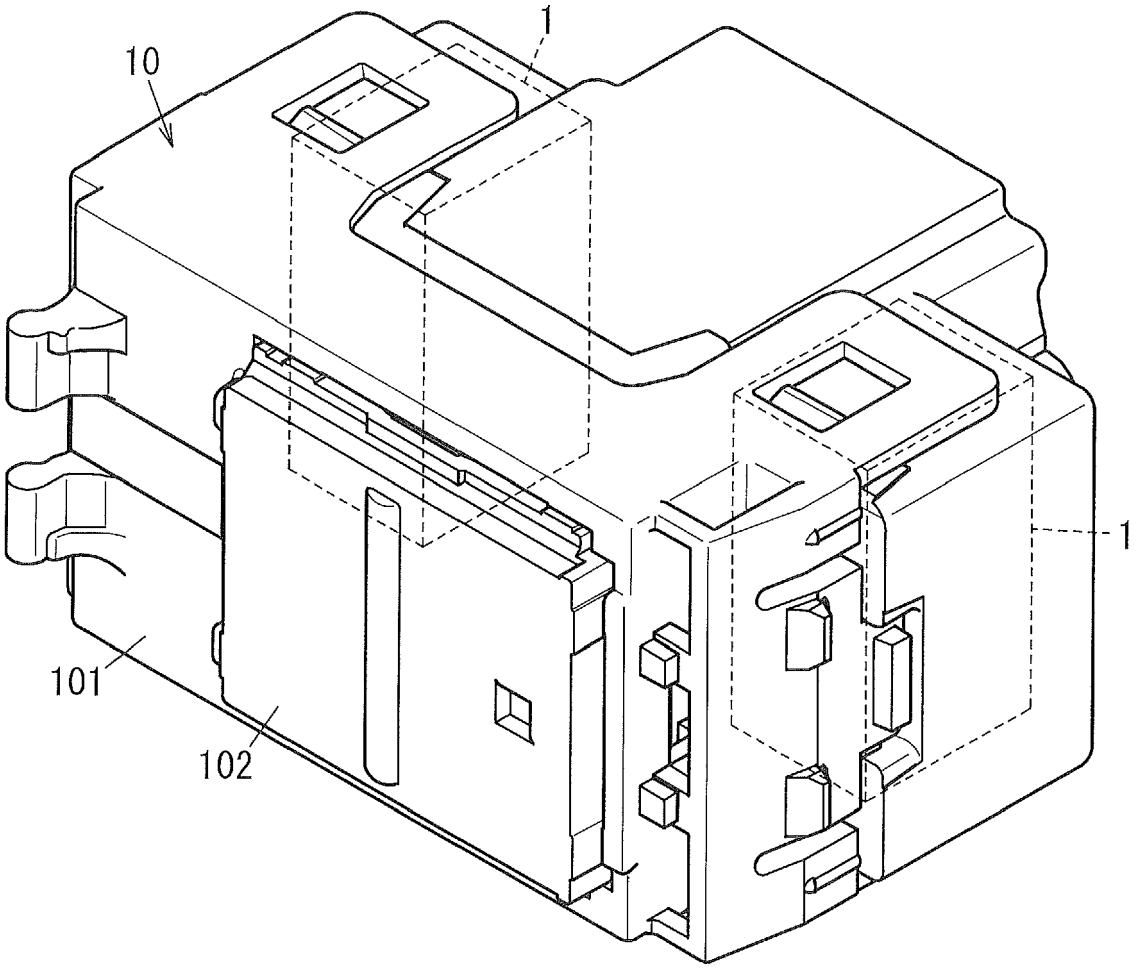

FIG. 9A

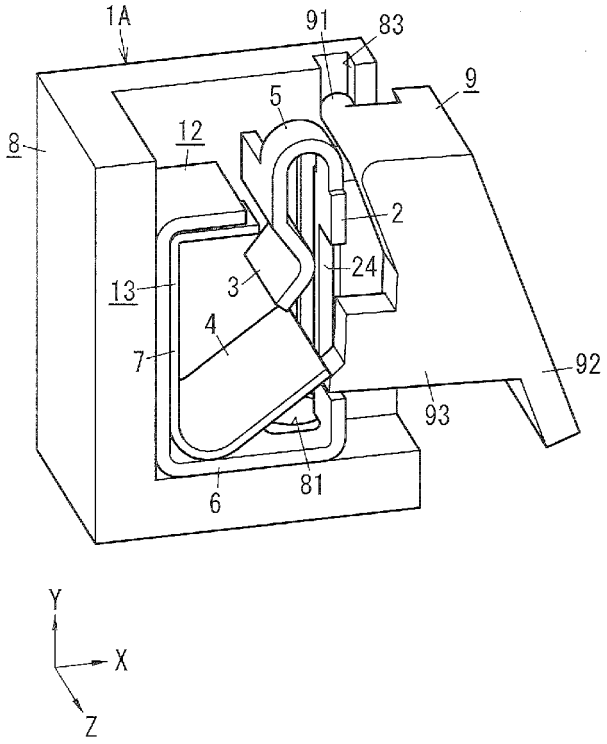
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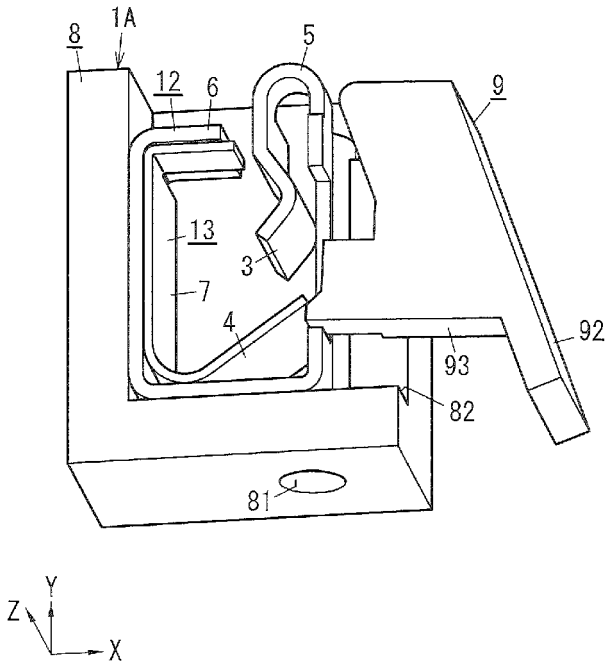
FIG. 9B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EUROPEAN SEARCH REPORT

Application Number
EP 17 16 2479

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X	EP 0 828 314 A1 (ELEKTROKONTAKT AS [NO]) 11 March 1998 (1998-03-11) * claim 1; figures 1,2 *	1,2,4-6, 8,9,11	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	19 June 2017	Jiménez, Jesús

CATEGORY OF CITED DOCUMENTS

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