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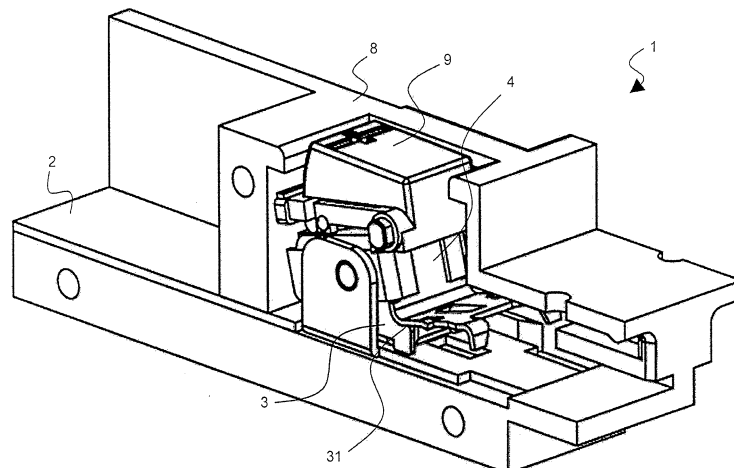
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(54) **TERMINAL BLOCK**

(57) Provided is a terminal block to which a terminal can reliably be connected through a single operation, and a connection work can be performed easily by both hands with the terminal block. The terminal block includes: a base to be electrically connected to a terminal to be inserted; a stopper movable between a first position and a

second position above the base; and a lever configured to cause the stopper to move from the first position to the second position, and to be held on a shoulder portion of the stopper when the stopper is positioned at the second position.

FIG. 1



Description

Technical Field

[0001] The present invention relates to a terminal block to which a terminal can be connected through a single operation.

Background Art

[0002] Hitherto, a terminal block of a screw connection type has been known. For example, in Patent Literature 1, there is disclosed a terminal block device in which a screw is operated to rotate in a fastening direction by a screw driver so that a distal end portion of an electric wire is sandwiched in a solderless manner from above and below by a sandwiching surface portion of a terminal fitting and a sandwiching surface portion of a movable fitting. When connecting the electric wire to the terminal block device, a screw-head portion of the screw is operated to rotate in the loosening direction by the screw driver. With this, the movable fitting and a nut member in the terminal block device are moved downward inside an internal space of the terminal block device. Then, an electric-wire insertion space is secured between the sandwiching surface portion of the movable fitting and the sandwiching surface portion of the terminal fitting. The electric-wire insertion space is opened on a front side of the terminal block device through an opening for electric-wire insertion.

[0003] The distal end portion of the electric wire is inserted through the opening for electric-wire insertion into the electric-wire insertion space from the front side of a terminal block main body. Then, the screw-head portion of the screw is operated to rotate in the fastening direction by the screw driver so that the movable fitting and the nut member are moved upward inside the internal space along with the rotation of the screw. As a result, the sandwiching surface portion of the movable fitting is moved to approach the sandwiching surface portion of the terminal fitting, and the distal end portion of the electric wire, which is inserted in the electric-wire insertion space, is sandwiched in a solderless manner from above and below by the sandwiching surface portion of the terminal fitting and the sandwiching surface portion of the movable fitting. With the above-mentioned work, the electric wire is connected to the terminal block device.

Citation List

Patent Literature

[0004] PTL 1: Japanese Patent Application Laid-Open No. 2007-109461

Summary of Invention

Technical Problem

[0005] The related-art terminal blocks employ the screw wire-connection method in most cases. That is, many of products, which are so-called "terminal" and "terminal block", are "screw fastening-type terminal blocks". Therefore, the screw may be forgotten to be fastened, and thus the electric wire may not be connected, which causes disconnection. Further, a fastening torque of the screw is varied depending on an operator who performs an electric wire connection work, and hence a contact resistance between the electric wire and the terminal fitting may be increased. With this, when a current is caused to flow, the terminal block device may generate heat, which is a cause of ignition. In addition, the screw may be loosened due to temperature change or vibration in the vicinity of the terminal block device. Also when the screw is loosened, the contact resistance may be increased, which is a cause of heat generation or ignition in the terminal block device.

[0006] Moreover, in the related-art screw wire-connection method, the screw is lost at the time of the wire connection in many cases, and hence a work is interrupted at the time of the electric wire connection work in many cases. Further, one hand is occupied to fasten the screw, thus leading to a problem in difficulty in connection work.

Solution to Problem

[0007] In order to solve the above-mentioned problems, according to one embodiment of the present invention, there is provided a terminal block, including: a base to be electrically connected to a terminal to be inserted; a stopper movable between a first position and a second position above the base; and a lever to be held on a shoulder portion of the stopper when the stopper is positioned at the second position.

[0008] Further, according to another embodiment of the present invention, there is provided a terminal block, including: a base to be electrically connected to a terminal to be inserted; a stopper movable between a first position and a second position above the base; and a lever configured to cause the stopper to move from the first position to the second position, and to be held on a shoulder portion of the stopper when the stopper is positioned at the second position.

[0009] Further, according to another embodiment of the present invention, there is provided a terminal block, including: a base to be electrically connected to a terminal to be inserted; a stopper movable between a first position and a second position above the base; and a lever configured to cause the stopper to move from the first position to the second position, and to be held on a shoulder portion of the stopper when the stopper is positioned at the second position, wherein the stopper is movable from the second position to the first positions by being pressed

with a terminal to be inserted, and wherein the lever is configured to be biased to pivot toward the base when the stopper is moved from the second position to the first position.

[0010] With this, the terminal can reliably be connected to the terminal block through a single operation. Further, when the stopper is positioned at the second position, the lever is held on the shoulder portion of the stopper so that the lever can be maintained at a wire connection standby state. Therefore, one hand does not become unusable, and hence a connection work can be performed easily by both hands.

[0011] Further features of the present invention will become apparent from the following description of exemplary embodiments referring to the attached drawings.

Brief Description of Drawings

[0012]

Fig. 1 is a perspective view of a terminal block according to a first embodiment of the present invention.

Fig. 2 is an exploded view of the terminal block according to the first embodiment.

Fig. 3 is a sectional view for illustrating an operation of the terminal block according to the first embodiment.

Fig. 4 is a sectional view for illustrating an operation of a stopper according to the first embodiment.

Fig. 5 is a perspective view of a terminal block according to a second embodiment of the present invention.

Fig. 6 is an exploded view of the terminal block according to the second embodiment.

Fig. 7 is a perspective view of a box according to the second embodiment.

Fig. 8 is a sectional view of the terminal block according to the second embodiment.

Fig. 9 is a sectional view for illustrating an operation of the terminal block according to the second embodiment.

Fig. 10 is a sectional view for illustrating an operation of a stopper according to the second embodiment.

Fig. 11 is a perspective view of a terminal block according to a third embodiment of the present invention.

Fig. 12 is an exploded view of a terminal block according to a fourth embodiment of the present invention.

Fig. 13 is a sectional view for illustrating an operation of a stopper according to the fourth embodiment.

Fig. 14 is a sectional view for illustrating the operation of the stopper according to the fourth embodiment.

Description of Embodiments

[0013] Now, exemplary embodiments of the present

invention are described in detail referring to the drawings. Note that, dimensions, materials, shapes, relative positions of components, and the like to be described in the embodiments below are arbitrary, and may be changed depending on a configuration of a device to which the present invention is adopted or various conditions. The scope of the present invention is not limited to the embodiments described in detail below unless otherwise noted. An upside and a downside herein correspond to an upward direction and a downward direction in a gravity direction, respectively. A side on which a terminal is inserted into a terminal block is referred to as "front side", and a side opposite to the front side is referred to as "rear side".

[First Embodiment]

[0014] Referring to Fig. 1 and Fig. 2, a terminal block 1 according to a first embodiment of the present invention is described. The terminal block 1 includes a base 2 mounted to a box 8 and to be electrically connected to the terminal to be inserted, a stopper 3 movable between a first position and a second position above the base 2, and a lever 4 causing the stopper 3 to move from the first position to the second position. Fig. 1 is a perspective view of the terminal block 1 in a state in which the stopper 3 is positioned at the second position. The lever 4 is held in a state in which the lever 4 climbs onto shoulder portions 31 of the stopper 3 when the stopper 3 is positioned at the second position.

[0015] In an assembly of the terminal block 1, first, the stopper 3 having the shoulder portions 31 is placed on and fitted into a portion between two raised portions 21 of the base 2. Then, the lever 4 is put over the stopper 3 so that a bent portion 41 of the lever 4 is positioned on the side on which the terminal is inserted (front side) with respect to the shoulder portions 31 of the stopper 3. Next, a torsion spring (first biasing member) 6 is arranged in a portion between both end portions of the stopper 3, and a first end portion 61 of the torsion spring 6 is held in abutment against a first abutment portion 32 of the stopper 3. Under this state, a shaft 5 is inserted into an inner side of the torsion spring 6. At this time, the shaft 5 passes through shaft holes 22 of the raised portions 21 of the base 2 and shaft holes 42 of the lever 4 to be axially supported by the raised portions 21.

[0016] Then, a compression spring 7 is inserted between the lever 4 and the base 2. The compression spring 7 serves as a second biasing member configured to bias the lever 4 in a direction in which the lever 4 pivots toward the base 2. At this time, the compression spring 7 is arranged at a portion below the lever 4 and on the base 2 so that a positioning portion 43, which is a part of the lever 4 and protrudes inward from the lever 4, is inserted into an inner side of the compression spring 7. Next, the base 2 is mounted to the box 8. A clearance 83 is secured between a wall portion 81 and a bottom portion 82 of the box 8, and the base 2 is inserted in the clearance 83.

After that, a button 9 is fitted onto the lever 4. A box having the same shape as that of the box 8 or a side plate (not shown) having a shape corresponding to the box 8 is mounted so as to be opposed to the box 8, and coupling screws (not shown) are inserted into screw holes 84 of the box 8. In this manner, the terminal block 1 can be assembled.

[0017] Next, each of members included in the terminal block 1 is described. Confirmation holes 85 are formed in the box 8, and the terminal can be confirmed through each confirmation hole 85 in a state in which the terminal is inserted. Further, a shaft hole 86 is formed in the box 8, for inserting a shaft portion 91 of the button 9. In addition, on the box 8, a first stopper portion 87 for restricting upward movement of the button 9 while being held in abutment against an upper part of a rear portion 92 of the button 9, and a second stopper portion 88 for restricting downward movement of the button 9 while being held in abutment against a lower part of the rear portion 92 of the button 9, are formed. Further, on the box 8, a third stopper portion 89 for restricting upward movement of the button 9 while being held in abutment against an elastic portion 93 of the button 9 in a state in which the button 9 has been pressed, is formed. The elastic portion 93 is elastically deformable toward an inner side of the button 9, and thus, when the button 9 is pressed, the elastic portion 93 is deformed so that the button 9 can be moved while climbing over the third stopper portion 89. Protrusions 94 are formed on distal ends of the elastic portions 93, and in the state in which the button 9 has been pressed, the each protrusion 94 is brought into abutment against the third stopper portion 89. With this, the upward movement of the button 9 is restricted so that backlash of the button 9 can be prevented.

[0018] A groove 95 having a cross shape is formed in the button 9, and the button 9 can be pressed by inserting a distal end of a driver into the groove 95. When the button 9 is pressed by a finger, the groove 95 functions to prevent slip. The torsion spring 6 serving as the first biasing member is held in abutment against each of the lever 4 and the stopper 3, and biases the stopper 3 in a direction in which the stopper moves from the first position to the second position. The lever 4 can cause the stopper 3 to move from the first position to the second position through intermediation of the torsion spring 6. More specifically, a cutout portion 44 is formed in the lever 4, and a second end portion 62 of the torsion spring 6 on a side opposite to a side on which the torsion spring 6 is held in abutment against the stopper 3 is held in abutment against the cutout portion 44. Therefore, when the button 9 is pressed so that a rear portion of the lever 4 is moved downward, along with the movement, the first end portion 61 of the torsion spring 6 biases the first abutment portion 32 of the stopper 3. With this, the stopper 3 is moved forward (to the second position). Then, along with the movement of the stopper 3, the lever 4 climbs onto the shoulder portions 31.

[0019] A first claw portion 45 is formed in the lever 4,

and when a round terminal is inserted as the terminal to be connected to the terminal block 1, the first claw portion 45 is inserted into a hole portion 23 of the base 2. Further, when the round terminal is connected to the terminal block 1, the first claw portion 45 is inserted into a circle of the round terminal. With this, the round terminal can be prevented from coming off. In addition, a pair of second claw portions 46 is formed on the lever 4, and when the round terminal is connected to the terminal block 1, the second claw portions 46 are inserted into cutout portions 24 of the base 2. When the round terminal is connected to the terminal block 1, the second claw portions 46 are brought into abutment against a side surface of the round terminal. With this, lateral movement (pivot) of the round terminal can be regulated. Further, a pair of third claw portions 47 is formed in the lever 4, and when the round terminal is connected to the terminal block 1, the third claw portions 47 are held in point contact with an upper surface of the round terminal. With this, a lower surface of the round terminal is pressed against an upper surface of the base 2 so that the round terminal can be electrically connected to the base 2 with an appropriate force.

[0020] In addition, a pair of reinforcing portions 48 is formed on the lever 4, and the reinforcing portions 48 are positioned so as to cover a front side of a center portion of the lever 4. The center portion corresponds to a portion between a front portion of the lever 4, in which the first claw portion 45, the second claw portions 46, and the third claw portions 47 are formed, and the rear portion of the lever 4, in which the cutout portion 44 and the like are formed. A force in a direction in which the rear portion pivots upward about the shaft 5 is constantly applied to the rear portion of the lever 4 by the compression spring 7. Therefore, the center portion may be deformed, but through the reinforcement by the reinforcing portions 48, the deformation can be prevented.

[0021] Next, referring to Fig. 3 and Fig. 4, an operation of the terminal block 1 is described. In an initial state (shipping state) in Fig. 3, the button 9 is positioned at an initial position and the stopper 3 is positioned at the first position (initial position). Front sides of the shoulder portions 31 of the stopper 3 are held in abutment against a rear side of the bent portion 41 of the lever 4. With this, the movement of the stopper 3 to the second position is regulated by the lever 4. In the initial state, the front portion of the lever 4 is held in abutment against the upper surface of the base 2, and thus a round terminal 100 cannot be inserted. In order to connect the round terminal 100 from this state, first, an operator presses downward the button 9 against a biasing force of the compression spring 7 as illustrated in a middle stage 1. With this, a rear portion of the button 9 pivots downward about the shaft portion 91 (Fig. 2), and an abutment portion 96 of the button 9 presses downward the rear portion of the lever 4 so that the rear portion of the lever 4 also pivots downward about the shaft 5. When the lever 4 pivots, with the torsion spring 6 held in abutment against the

cutout portion 44 (Fig. 2) of the lever 4, the first abutment portion 32 of the stopper 3 is biased forward. Therefore, the stopper 3 starts to move to the second position (stand-by position).

[0022] When the operator further presses the button 9, the elastic portion 93 (Fig. 2) of the button 9 is deformed to climb over the third stopper portion 89 (Fig. 2) of the box 8, and the button 9 is pressed down to a lower limit position illustrated in a middle stage 2 in Fig. 3. In a state in which the button 9 is positioned at the lower limit position (lower pressing limit state), a lower side of the rear portion of the button 9 is held in abutment against an upper surface of the second stopper portion 88 (Fig. 2) of the box 8, and thus the button 9 is not moved further downward. The elastic portion 93 of the button 9 is held in abutment against the third stopper portion 89 so that the upward movement of the button 9 is restricted. With this, the backlash of the button 9 can be prevented.

[0023] The stopper 3 is further moved forward with respect to a position illustrated in the middle stage 1, and is positioned at the second position in the lower pressing limit state. In the lower pressing limit state (state in which the stopper 3 is positioned at the second position), as illustrated in a middle stage 3 in Fig. 3, the lever 4 is held in a state in which the lever 4 climbs onto the shoulder portions 31 of the stopper 3 (wire connection standby state). That is, the bent portion 41 of the lever 4 is held in abutment against the shoulder portions 31 of the stopper 3, and thus the lever 4 does not pivot even when the operator releases his/her hand from the button 9. In order that the lever 4 easily climbs, upper edges of the shoulder portions 31 of the stopper 3 each have a curved shape. A lower surface of the bent portion 41 of the lever 4 has substantially a curved shape. Then, along with the forward movement of the stopper 3, the bent portion 41 climbs onto the upper edges while being held in abutment against the shoulder portions 31. As illustrated in the middle stages 1 to 3, as a result of the upward pivot of the front portion of the lever 4 about the shaft 5, the front portion of the lever 4 is positioned at an upper limit position in the wire connection standby state.

[0024] Referring to Fig. 4, the operation of the stopper 3 is described further in detail. An initial stage in Fig. 4 corresponds to the initial state in Fig. 3, and a middle stage 3 in Fig. 4 corresponds to the middle stage 3 in Fig. 3.

[0025] The terminal block 1 includes the button 9 having the abutment portion 96 held in abutment against the lever 4. In the initial state, the abutment portion 96 formed on a lower portion of the button 9 is positioned on the lever 4. The stopper 3 is positioned at the first position. Then, the operator presses the button 9 so that the lever 4 pivots. That is, the abutment portion 96 of the button 9 presses downward the rear portion of the lever 4 so that the rear portion of the lever 4 pivots downward about the shaft 5. When the lever 4 pivots, the torsion spring 6, which is held in abutment against the cutout portion 44 (Fig. 2) of the lever 4, biases forward the first abutment

portion 32 (Fig. 2) of the stopper 3. With this, as illustrated in the middle stage 3 in Fig. 4, the stopper 3 is moved to the second position. In a state in which the stopper 3 is positioned at the second position, a front side of the stopper 3 is held in abutment against the rear side of the bent portion 41 of the lever 4 at a portion above the shoulder portions 31. Therefore, the forward movement of the stopper 3 is regulated, and thus the stopper 3 is not moved forward with respect to the second position.

[0026] Next, as illustrated in a late stage 1 in Fig. 3, the operator inserts the round terminal 100 (electric wire) into a terminal hole 11 of the terminal block 1. In this case, the operator inserts the round terminal 100 until a distal end of the round terminal 100 is brought into abutment against a second abutment portion 33 (Fig. 2) of the stopper 3. When the operator further inserts the round terminal 100, as illustrated in a late stage 2 in Fig. 3, the stopper 3 is pressed by the inserted round terminal 100 to move from the second position to the first position. Then, as a result of the movement of the stopper 3 from the second position to the first position, the bent portion 41 of the lever 4 descends from the shoulder portions 31 of the stopper 3. With this, the front portion of the lever 4, which is biased by the compression spring 7, pivots toward the base 2 about the shaft 5. Then, when the third claw portions 47 (Fig. 2) of the lever 4 are brought into abutment against an upper surface of the round terminal 100, a lower surface of the round terminal 100 is pressed against and surface-contacted with the upper surface of the base 2. With this, the contact area between the round terminal 100 and the base 2 is increased, and a contact pressure is determined depending on the biasing force of the compression spring 7 so that increase in contact resistance can be suppressed. Therefore, even when an electric wire (terminal) in which a large current flows is connected, the heat generation or ignition in the terminal block 1 can be prevented.

[0027] According to the terminal block 1 of the first embodiment as described above, automatic wire connection can be performed only by mounting the terminal (solderless terminal with a hole) on a distal end portion of the electric wire and inserting the terminal into the terminal hole. That is, only through the insertion of the terminal, the terminal is sandwiched between an internal electrode (base 2) and the lever 4. With this mechanism, the wire connection can be performed safely and reliably. Further, only through the insertion of the terminal, the terminal is automatically sandwiched to perform the wire connection. With this mechanism, regardless of the operator, stable wire connection can constantly be performed. That is, in the related-art screw fastening-type terminal, due to variation of screw fastening caused by an operator for wire connection, there is a fear in that heat generation or ignition may be caused due to looseness of a wire connection portion. In addition, depending on a use environment of a mounting device, there is a fear in that the screw may be loosened due to a temperature cycle, vibration, or the like. In contrast, according to the terminal

block 1 of the first embodiment, a terminal wire-connection portion (base 2) and the terminal are constantly brought into contact with each other with a certain pressure due to the biasing force of the compression spring. As a result, it is possible to provide a terminal block 1, which enables safe and reliable wire connection even under a condition that a mechanical factor or a climatic factor is changed, such as the variation caused by the operator for wire connection, the vibration, the temperature cycle, or the like.

[0028] Further, according to the terminal block 1 of the first embodiment, the terminal can reliably be connected to the terminal block 1 through a single operation. In addition, when the stopper 3 is positioned at the second position, the lever 4 is held on the shoulder portions 31 of the stopper 3 so that the lever 4 can be maintained in the wire connection standby state. Therefore, one hand does not become unusable, and hence the connection work can be performed easily by both hands. For example, the wire connection work itself can be performed by one hand, and hence a work for holding the terminal block 1 in a specific posture can be performed by the other free hand.

[Second Embodiment]

[0029] Referring to Fig. 5 and Fig. 6, a terminal block 201 according to a second embodiment of the present invention is described. The terminal block 201 according to the second embodiment includes a compression spring 206 instead of the torsion spring 6 according to the first embodiment. Further, the terminal block 201 includes a holder 221 instead of the raised portions 21 of the base 2 according to the first embodiment. In the description of the second embodiment, differences from the first embodiment are described. The components described in the first embodiment are denoted by the same reference symbols, and descriptions thereof are therefore omitted. Unless otherwise noted, the components denoted by the same reference symbols each have substantially the same operation and function, and actions and effects thereof are also substantially the same.

[0030] The terminal block 201 includes a base 202 mounted to a box 208 and to be electrically connected to a terminal 100 (Fig. 9) to be inserted, a stopper 203 movable between a first position and a second position above the base 202, and a lever 204 to be held in a state in which the lever 204 climbs onto shoulder portions 31 of the stopper 203 when the stopper 203 is positioned at the second position. Fig. 5 is a perspective view of the terminal block 201 in a state in which the stopper 203 is positioned at the second position. As illustrated in Fig. 6, the terminal block 201 has a symmetric structure between a near side and a far side in Fig. 6 across a wall portion 281. Therefore, although not illustrated, two stoppers 203, two levers 204, and the like can be mounted to the box 208. Therefore, the terminal 100 can also be connected to each of both sides of the terminal block 201.

[0031] In an assembly of the terminal block 201, first, the holder 221 is inserted onto the base 202 so as to sandwich a corresponding narrow portion 225 of the base 202. Then, the stopper 203 is placed above the base 202 so that the stopper 203 is fitted between portions of the holder 221. Next, the lever 204 is put over the stopper 203 so that a bent portion 41 of the lever 204 is positioned on a side on which the terminal is inserted (front side) with respect to the shoulder portions 31 of the stopper 203. Then, a shaft 5 is inserted into shaft holes 2212 of the holder 221 and shaft holes 42 of the lever 204. With this, the shaft 5 is axially supported by the holder 221.

[0032] Then, a compression spring 207 is inserted between the lever 204 and the base 202. At this time, the compression spring 207 is arranged at a portion below the lever 204 and on the base 202 so that a positioning portion 43, which is a part of the lever 204 and protrudes inward from the lever 204, is inserted into an inner side of the compression spring 207. Next, the compression spring 206 is inserted into a spring receiving portion 2213 of the holder 221 and a spring receiving portion 232 of the stopper 203. At this time, the compression spring 206 is inserted so that a distal end of the spring receiving portion 2213 (Fig. 8) and a distal end of the spring receiving portion 232 (Fig. 8) each enter an inner side of the compression spring 206. Then, the base 202 is mounted to the box 208. At this time, the compression spring 206 is accommodated in a corresponding accommodating space 2803 secured below the base 202. As described above, the spring receiving portion 2213 and the spring receiving portion 232 are exposed to an outside of the lever 204. Thus, the compression spring 206 is easily mounted, and the assembly of the terminal block 201 is further facilitated.

[0033] A clearance 283 is secured between the wall portion 281 and a bottom portion 282 of the box 208, and the base 202 is inserted in the clearance 283. Further, partition walls 2800 are formed in the box 208, for separating adjacent terminals from each other. The partition walls 2800 have grooves 2801 formed therein, and side ends of wide portions 226 of the base 202 are inserted into the grooves 2801. In addition, clearances 2802 are secured in the bottom portion 282 of the box 208. End portions 227 of the base 202 are inserted in the clearances 2802. The end portions 227 are formed by bending both ends of the base 202 into substantially an L-shape in cross-section. In other words, both the ends of the base 202 are bent downward.

[0034] After that, a button 209 is fitted onto the lever 204. A box having the same shape as that of the box 208 or a side plate (not shown) having a shape corresponding to the box 208 is mounted so as to be opposed to the box 208, and coupling screws (not shown) are inserted into screw holes 284 of the box 208. In this manner, the terminal block 201 according to the second embodiment can be assembled. The compression spring 206 (Fig. 2) is used instead of the torsion spring 6, and hence a work for bringing the end portion of the torsion spring 6 into

abutment against the first abutment portion 32 (Fig. 2) and the like becomes unnecessary. Therefore, the terminal block 201 can be assembled more easily.

[0035] Next, each of members included in the terminal block 201 is described. The lever 204 according to the second embodiment has a height larger than that of the lever 4 (Fig. 2) according to the first embodiment. With this, a length of the compression spring 207 can be set larger, and hence the compression spring 207 having a longer life can be used. Further, the pair of second claw portions 46 (Fig. 2) is not formed on the lever 204 according to the second embodiment. However, even when a force in the lateral direction is applied to the terminal 100, the terminal 100 is brought into abutment against the partition wall 2800 so that movement (pivot) of the terminal 100 can be regulated.

[0036] The box 208 has shaft holes 286 formed therein, for inserting a shaft portion 91 of the button 209. Only the single shaft hole 286 is illustrated in Fig. 6. However, the shaft hole 286 is also formed at the same position on a near side in Fig. 6. In addition, the box 208 has first stopper portions 287 formed thereon, for restricting upward movement of the button 209 while being held in abutment against an upper part of a rear portion 92 of the button 209. Unlike the first embodiment, the box 208 does not have the second stopper portion 88 (Fig. 2) and the third stopper portion 89 (Fig. 2). However, the button 209 has elastic portions 93 each held in abutment against a corresponding inner surface of the box 208 on which the base 202 and the stopper 203 are accommodated, that is, the partition wall 2800. Therefore, backlash of the button 209 can be prevented. That is, the corresponding elastic portion 93 of the button 209 is held in abutment against the partition wall 2800 of the box 208, and thus, by the elastic portion 93, a protrusion 94 formed on the distal end of the elastic portion 93 is pressed against the partition wall 2800 of the box 208. With this, the movement of the button 209 is restricted due to a frictional force between the partition wall 2800 of the box 208 and the protrusion 94, and hence the backlash of the button 209 can be prevented.

[0037] Curved surface portions 2804 are formed on outer surfaces of the partition walls 2800 of the box 208 on sides on which the terminal 100 (Fig. 9) is inserted, respectively. In other words, the curved surface portions 2804 are formed on outer surfaces of the terminal block 201 on the sides on which the terminal 100 is inserted, respectively. In the first embodiment, an outer surface of the terminal block 1 on the side on which the terminal 100 is inserted is formed into a flat surface. In contrast, according to the second embodiment, the outer surfaces of the box 208 are less easily damaged due to the curved surface portions 2804, and hence decrease of a yield caused by poor external appearance can be prevented. Further, when the outer surfaces are each formed into a flat surface, gases easily accumulate on corner portions of the outer surfaces at the time of molding. With the formation of the curved surface portions 2804 on the out-

er surfaces, the gases easily flow outside, and hence decrease of the yield caused by poor molding can be prevented.

[0038] A depressed portion is formed between the two first stopper portions 287 of the box 208. An indication plate, an indication seal, or the like can be arranged on the depressed portion so as to indicate a pole of the terminal or the like. In addition, a plurality of walls are formed in the box 208 at an area below a region in which the base 202 is inserted. With the plurality of walls, the rigidity of the box 208 can be increased. Further, the thickness of the bottom portion 282 of the box 208 can be reduced as compared to that of the bottom portion 82 of the box 8 according to the first embodiment. Therefore, a time period for the molding can be reduced, and molding cost can be reduced.

[0039] Regulating portions 2805 are formed on the box 208 at portions above terminal holes 11 of the terminal block 201, for regulating the movement (pivot) of the terminal 100. For example, even when a force in the upward direction is applied to the terminal 100, the terminal 100 is brought into abutment against the corresponding regulating portion 2805. With this, the pivot of the terminal 100 can be regulated. A lower surface of the regulating portion 2805, that is, a surface on the base 202 side is an inclined surface inclined with respect to the base 202 to be inserted. With this, even when a distal end of the lever 204 pivots, the distal end of the lever 204 avoids the regulating portion 2805 so that contact between the lever 204 and regulating portion 2805 can be prevented. Only the single regulating portion 2805 is illustrated in Fig. 6. However, the regulating portion 2805 is also formed at the same position on the near side in Fig. 6.

[0040] The base 202 has a center portion positioned between the two narrow portions 225 in addition to the wide portions 226 each positioned between the narrow portion 225 and the end portion 227. In a direction orthogonal to a longitudinal direction of the base 202, a width of each of the narrow portions 225 is smaller than that of the center portion, and a width of each of the wide portions 226 is larger than that of the center portion. An upper surface of each of the wide portions 226 is subject to knurling, and a concavo-convex pattern is formed finely. Note that, the concavo-convex pattern may be formed by embossing or the like instead of the knurling. Further, the base 202 has spring stoppers 2219 protruding upward therefrom. The spring stoppers 2219 each regulate movement of the compression spring 207 while being held in abutment against the compression spring 207.

[0041] Referring to Fig. 7 and Fig. 8, the screw holes 284 of the box 208 according to the second embodiment are described. Fig. 7 is an illustration of a state of the box 208 illustrated in Fig. 6 when viewed from an opposite side to a side on which the base 202 is inserted at the time of the assembly. On the opposite side, stepped portions 2841 are formed on end portions of the screw holes 284 of the box 208. Now, referring to Fig. 8, the stepped portions 2841 are described further in detail. In an upper

part of Fig. 8, a state in which the box 208 and a side plate 200 are combined with each other is illustrated. In a lower part of Fig. 8, a sectional view taken along the line A-A in the upper part is illustrated. Note that, two boxes 208 may be combined with each other.

[0042] The stepped portions 2841 of the screw holes 284, which are opposed to each other, are formed complementarily to each other. When the box 208 and the side plate 200 are combined with each other, stepped portions 2841 B are inserted into stepped portions 2841A. That is, an inner diameter of each of the stepped portions 2841A on the side on which the base 202 is inserted at the time of the assembly is larger than an outer diameter of each of the stepped portions 2841B on the side opposite thereto. Then, the stepped portions 2841B as male sides are inserted into the stepped portions 2841A as female sides so that the box 208 and the side plate 200 are combined with each other. With this, by an amount corresponding to a dimension of the stepped portion 2841, a creepage distance between the terminals via the screw hole 284 can be enlarged.

[0043] Also in a case of the box 208, the inner diameter of each of the stepped portions 2841A on the side on which the base 202 is inserted at the time of the assembly is larger than an outer diameter of each of stepped portions 2841B. Also when the two boxes 208 are combined with each other, the stepped portions 2841B are inserted into the stepped portions 2841A. A side plate, which is to be combined with the box 208 on the side on which the base 202 is inserted at the time of the assembly, has formed thereon stepped portions 2841B each having an outer diameter smaller than the inner diameter of each of the stepped portions 2841 A.

[0044] As illustrated in Fig. 6, the box 208 has projecting portions 2807 on the side on which the base 202 is inserted. The projecting portions 2807 protrude at portions below the terminal holes 11 in a direction orthogonal to an extending direction of the base 202. Further, the box 208 has grooves 2806 (Fig. 7) on the side opposite to the side on which the base 202 is inserted, and the projecting portions 2807 and the grooves 2806 are formed complementarily to each other. An inner dimension of each of the grooves 2806 is larger than an outer dimension of each of the projecting portions 2807, and at the time of the assembly, the projecting portions 2807 are inserted into the grooves 2806. With this, by an amount corresponding to dimensions of the projecting portion 2807 and the groove 2806, a creepage distance between the terminals can be enlarged. In addition, even when a load is applied to the terminal 100 (terminal hole 11), deformation of the box 208 can be prevented to maintain flatness of the box 208.

[0045] The side plate 200 similarly has projecting portions 2807 or grooves 2806 formed therein. That is, the side plate 200, which is to be combined on the side on which the base 202 is inserted, has the grooves 2806 corresponding to the projecting portions 2807 of the box 208. The side plate 200, which is to be combined on the

side opposite to the side on which the base 202 is inserted, has the projecting portions 2807 corresponding to the grooves 2806 of the box 208.

[0046] Next, referring to Fig. 9 and Fig. 10, an operation of the terminal block 201 is described. In an initial state (shipping state) in Fig. 9, the button 209 is positioned at an initial position and the stopper 203 is positioned at the first position (initial position). In the initial state, a front portion of the lever 204 is held in abutment against an upper surface of the base 202, and thus the round terminal 100 cannot be inserted. Further, the compression spring 206 (first biasing member) is provided so as to be held in abutment against the stopper 203, for biasing the stopper 203 in a direction in which the stopper 203 moves from the first position to the second position (standby position) (Fig. 10). The stopper 203 is biased toward the second position by the compression spring 206 arranged between the spring receiving portion 2213 extending from the holder 221 and the spring receiving portion 232 extending from the stopper 203. With this, the stopper 203 is biased toward the terminal hole 11. In a state in which the stopper 203 is positioned at the first position, front sides of the shoulder portions 31 of the stopper 203 are held in abutment against a rear side of the bent portion 41 of the lever 204 so that forward movement of the stopper 203 is regulated.

[0047] In order to connect the round terminal 100 from this state, first, the operator presses downward the button 209 against a biasing force of the compression spring 207 as illustrated in a middle stage 1 in Fig. 9. With this, a rear portion of the button 209 pivots downward about the shaft portion 91, and as illustrated in Fig. 10, the abutment portion 96 of the button 209 presses downward a rear portion of the lever 204 so that the rear portion of the lever 204 also pivots downward about the shaft 5. When the lever 204 pivots, the bent portion 41 of the lever 204 is moved upward. With this, the shoulder portions 31 are not held in abutment against the bent portion 41 any more so that regulation of the stopper 203 is released. Therefore, the stopper 203 starts to move to the second position due to the compression spring 206.

[0048] When the operator further presses the button 209, the button 209 is pressed down to a lower limit position illustrated in a middle stage 2 in Fig. 9. Then, the stopper 203 is further moved forward with respect to a position illustrated in the middle stage 1, and is positioned at the second position in a state in which the button 209 is positioned at the lower limit position (lower pressing limit state). In the lower pressing limit state, a front side of the spring receiving portion 232 (Fig. 10) of the stopper 203 is held in abutment against a front side of an inner edge of a corresponding hole portion 228 (Fig. 6) of the base 202 or a front side of an inner edge of a hole portion 2218 (Fig. 6) of the holder 221. With this, the stopper 203 is not moved further forward. In the lower pressing limit state (state in which the stopper 203 is positioned at the second position), as illustrated in a middle stage 3 in Fig. 9, the lever 204 is held in a state in which the lever 204

climbs onto the shoulder portions 31 of the stopper 203 (wire connection standby state). With this, the lever 204 does not pivot even when the operator releases his/her hand from the button 209.

[0049] Referring to Fig. 10, the operation of the stopper 203 is described further in detail. An initial stage in Fig. 10 corresponds to the initial state in Fig. 9, and a middle stage 3 in Fig. 10 corresponds to the state in the middle stage 3 in Fig. 9.

[0050] In the initial state, the abutment portion 96 formed on the lower portion of the button 209 is positioned on the lever 204. The stopper 203 is positioned at the first position. In this state, the stopper 203 is biased toward the terminal hole 11 by the compression spring 206. However, the forward movement of the stopper 203 is regulated by the bent portion 41 of the lever 204. When the operator presses the button 209, the abutment portion 96 of the button 209 presses downward the rear portion of the lever 204 so that the rear portion of the lever 204 pivots downward about the shaft 5. When the lever 204 pivots, the bent portion 41 of the lever 204 is moved upward. With this, the regulation of the stopper 203 is released so that the stopper 203 is moved to the second position as illustrated in the middle stage 3 in Fig. 9.

[0051] Next, as illustrated in a late stage 1 in Fig. 9, the operator inserts the round terminal 100 (electric wire) from the terminal hole 11 of the terminal block 201. That is, the round terminal 100 is inserted until the distal end of the round terminal 100 is brought into abutment against a second abutment portion 33 of the stopper 203. When the operator further inserts the round terminal 100, as illustrated in a late stage 2 in Fig. 9, the stopper 203 is pressed by the inserted round terminal 100 to move from the second position to the first position. Then, as a result of the movement of the stopper 203 from the second position to the first position, the bent portion 41 of the lever 204 descends from the shoulder portions 31 of the stopper 203. With this, the front portion of the lever 204, which is biased by the compression spring 207, pivots toward the base 202 about the shaft 5. Then, when third claw portions 47 of the lever 204 are brought into abutment against the upper surface of the round terminal 100, the lower surface of the round terminal 100 is pressed against and surface-contacted with the upper surface of the base 202.

[0052] In an upper left frame in Fig. 9, an enlarged schematic plan view of a wire connection portion each in the wire connection standby state (middle stage 3) and a state at the time of the wire connection (late stage 2) is illustrated. That is, in an upper part of the frame, the stopper 203 and the lever 204 in the wire connection standby state are illustrated, in which the lever 204 climbs onto the shoulder portions 31 of the stopper 203. Further, in a lower part of the frame, the stopper 203, the lever 204, and the round terminal 100 in a wire-connected state are illustrated, in which the third claw portions 47 of the lever 204 are held in abutment against the upper surface of the round terminal 100, and the first claw portion 45 is

inserted into a circle of the round terminal 100. In the wire-connected state, the first claw portion 45 is caught on an inner edge of the round terminal 100 so that the round terminal 100 can be prevented from coming off.

As illustrated in the frame, the stopper 3 is positioned at the second position in the wire connection standby state. At the time of the wire connection, the stopper 203, which is pressed by the inserted round terminal 100, is moved backward from the second position to the first position.

[0053] According to the terminal block 201 of the second embodiment as described above, it is possible to provide a terminal block 201 easier in assembly than that in the first embodiment. Further, the automatic wire connection can be performed only by mounting the terminal on the distal end portion of the electric wire and inserting the terminal into the terminal hole. That is, only through the insertion of the terminal, the terminal is sandwiched between an internal electrode (base 202) and the lever 204. With this mechanism, the wire connection can be performed safely and reliably. Further, only through the insertion of the terminal, the terminal is automatically sandwiched to perform the wire connection. With this mechanism, regardless of the operator, the stable wire connection can constantly be performed. Further, the wire connection can be performed safely and reliably even under the condition that the mechanical factor or the climatic factor is changed, such as the variation caused by the operator for wire connection, the vibration, the temperature cycle, or the like. Further, also according to the terminal block 201 of the second embodiment, the terminal can reliably be connected to the terminal block 201 through a single operation. In addition, one hand does not become unusable, and hence the connection work can be performed easily by both hands.

[0054] Instead of the compression spring 206, the stopper 203 may be moved forward by bringing a part of the lever 204 into abutment against the stopper 203. For example, the lever 204 may have an abutment portion protruding inward therefrom, which is formed on a rear end of the lever 204, and the abutment portion may be brought into abutment against a rear end of the stopper 203. In this case, when the lever 204 pivots, the rear end of the stopper 203 is pressed by the abutment portion of the lever 204 so that the stopper 203 is moved forward toward the terminal hole 11 along with the pivot of the lever 204. Further, an inner surface of a rear side of a lower part of the lever 204 and an outer surface of a rear side of an upper part of the stopper 203 may be brought into abutment against each other so that the stopper 203 is moved forward by a frictional force between the lever 204 and the stopper 203. In addition, a lever 204 having an outer dimension smaller than an outer dimension (width in a direction orthogonal to an extending direction of the base 202) of the stopper 203 may be prepared, and an outer surface of the rear side of the lower part of the lever 204 and an inner surface of the rear side of the upper part of the stopper 203 may be brought into abutment against each other. That is, the lever 204 may be arranged in an

inner side of the stopper 203, and the lever 204 and the stopper 203 may be brought into abutment against each other.

[Third Embodiment]

[0055] Referring to Fig. 11, a terminal block 301 according to a third embodiment of the present invention is described. Unlike the first and second embodiments, the terminal block 301 of the third embodiment is constructed such that a shorting bar 300 can be inserted therein. In an upper part in Fig. 11, a state in which the shorting bar 300 is not inserted is illustrated, and in a lower part in Fig. 11, a state in which the shorting bar 300 is inserted through a corresponding hole portion 3809 for a shorting bar is illustrated. In the description of the third embodiment, differences from the first and second embodiments are described. The components described in the first and second embodiments are denoted by the same reference symbols, and descriptions thereof are therefore omitted. Unless otherwise noted, the components denoted by the same reference symbols each have substantially the same operation and function, and actions and effects thereof are also substantially the same.

[0056] A box 308 of the terminal block 301 according to the third embodiment has accommodating spaces 3808 secured below terminal holes 11, for accommodating a plate spring 310. The accommodating spaces 3808 are opened to the outside through the hole portions 3809 for a shorting bar. Upper parts of the accommodating spaces 3808 are opened to the inside so as to receive end portions 327 of a base 302. The end portions 327 are formed by bending both ends of the base 302 into a substantially Z-like shape in cross-section, and both the ends of the base 302 each have a portion bent downward and a portion bent forward. Note that, when two boxes 308 are combined with each other, or the box 308 and a side plate are combined with each other, an adjacent terminal hole 11 also has the same structure for inserting the shorting bar 300 therein. That is, the terminal block 301 can be combined with the box 308 or the side plate which has the accommodating spaces 3808.

[0057] As illustrated in an upper part of Fig. 11, in the state in which the shorting bar 300 is not inserted, the corresponding end portion 327 of the base 302 is held in abutment against an upper end of the plate spring 310 so that the base 302 is biased upward. On the other hand, as illustrated in a lower part of Fig. 11, in the state in which the shorting bar 300 is inserted, the shorting bar 300 is held in abutment against the upper end of the plate spring 310 so that the shorting bar 300 is biased upward. Further, the shorting bar 300 is held in abutment against the end portion 327 of the base 302. In this manner, through the insertion of the shorting bar 300, adjacent bases 302 are electrically connected to each other through intermediation of the shorting bar 300 so that adjacent terminals 100 can be short-circuited to each other.

[0058] According to the terminal block 301 of the third embodiment as described above, it is possible to provide a terminal block 301 into which the shorting bar 300 can be inserted. Further, accommodating spaces 2803 for the compression spring 206 are secured below the base 302, and correspondingly, a lower part of the box 308 is enlarged. However, with the arrangement of the plate spring 310 in the lower part, the space can effectively be utilized. Further, the automatic wire connection can be performed only by mounting the terminal on the distal end portion of the electric wire and inserting the terminal into the terminal hole. Further, only through the insertion of the terminal, the terminal is automatically sandwiched to perform the wire connection. With this mechanism, regardless of the operator, the stable wire connection can constantly be performed. Further, the wire connection can be performed safely and reliably even under the condition that the mechanical factor or the climatic factor is changed, such as the variation caused by the operator for wire connection, the vibration, the temperature cycle, or the like. Further, also according to the terminal block 301 of the third embodiment, the terminal can reliably be connected to the terminal block 301 through a single operation. In addition, one hand does not become unusable, and hence the connection work can be performed easily by both hands.

[0059] Note that, the shape of the shorting bar 300 illustrated in Fig. 11 is an example, and a shorting bar having another shape or an electric wire (terminal) for causing short circuit may also be inserted. Further, the shape of the plate spring 310 is an example, and a spring having another shape or an elastic member such as rubber may be used instead. In addition, the terminal block 301 according to the third embodiment may be combined with the terminal block 201 according to the second embodiment (Fig. 5) into which the shorting bar 300 is not inserted or the like. In this case, the terminal block 301 and the terminal block 201, which are combined with each other, have a terminal block into which the shorting bar 300 can be inserted and a terminal block into which the shorting bar 300 cannot be inserted.

[Fourth Embodiment]

[0060] Referring to Fig. 12 to Fig. 14, a terminal block 401 according to a fourth embodiment of the present invention is described. Unlike the first to third embodiments, the terminal block 401 of the fourth embodiment is constructed such that a thermal fuse 400 can be accommodated therein. In the description of the fourth embodiment, differences from the first to third embodiments are described. The components described in the first to third embodiments are denoted by the same reference symbols, and descriptions thereof are therefore omitted. Unless otherwise noted, the components denoted by the same reference symbols each have substantially the same operation and function, and actions and effects thereof are also substantially the same.

[0061] The terminal block 401 includes a compression spring 206 and a holder 221. Further, the terminal block 401 includes a base 402 mounted to a box 408 and to be electrically connected to a terminal 100 (not shown) to be inserted, a stopper 203 movable between a first position and a second position above the base 402, and a lever 404 to be held in a state in which the lever 404 climbs onto shoulder portions 31 of the stopper 203 when the stopper 203 is positioned at the second position.

[0062] In an assembly of the terminal block 401, first, the holder 221 is inserted onto the base 402 so as to sandwich a narrow portion 225 of the base 402. Then, the stopper 203 is placed on the base 402 so that the stopper 203 is fitted between portions of the holder 221. Next, the lever 404 is put over the stopper 203 so that a bent portion 41 of the lever 404 is positioned on a side on which the terminal is inserted (front side) with respect to the shoulder portions 31 of the stopper 203. Then, a rivet serving as a shaft 405 is inserted into shaft holes 2212 of the holder 221 and shaft holes 42 of the lever 404.

[0063] Then, a compression spring 207 is inserted between the lever 404 and the base 402 so that a positioning portion 43 of the lever 404 is inserted into an inner side of the compression spring 207. Next, the compression spring 206 is inserted into a spring receiving portion 2213 of the holder 221 and a spring receiving portion 232 of the stopper 203 (Fig. 13). Then, the base 402 is mounted to the box 408.

[0064] A lower end of a wall portion 481 of the box 408 is bent to protrude forward. Then, a clearance 483 is secured between the lower end of the wall portion 481 and a rear end of a bottom portion 482, and the base 402 is inserted in the clearance 483. Further, a partition wall 4800 is formed in the box 408, for separating adjacent terminals from each other. The partition wall 4800 has a groove 4801 formed therein, and a protrusion 426 formed on a side end of a wide portion 226 of the base 402 is inserted into the groove 4801. After that, a button 409 is fitted onto the lever 404. A side plate (not shown) having a shape corresponding to the box 408 is mounted so as to be opposed to the box 408, and coupling screws (not shown) are inserted into screw holes 284 of the box 408.

[0065] In the fourth embodiment, further, a corresponding lead wire 410 of the thermal fuse 400 is inserted into one of a pair of insertion holes 510 of a corresponding fuse terminal 500 formed of phosphor bronze. Then, the lead wire 410 is sandwiched by connection portion 520 of the fuse terminal 500, and an end portion of the lead wire 410 is extracted from another of the pair of insertion holes 510. In a state in which the thermal fuse 400 is connected to the two fuse terminals 500, the thermal fuse 400 and the two fuse terminals 500 are inserted in an accommodating space 4808 of the box 408. The terminal block 401 assembled in this manner can be fixed to a circuit board (not shown) through insertion of a mounting boss 489 (Fig. 13) formed on a lower surface of the box 408 into a hole formed in the circuit board. Then, a connecting end portion 429 of the base 402 and connecting

end portions 529 of the fuse terminals 500 are soldered to be connected to wires on the circuit board.

[0066] Next, each of members included in the terminal block 401 is described. The button 409 has an insertion portion 497 extending downward, and the lever 404 has an insertion hole 449 into which the insertion portion 497 is to be inserted. The insertion portion 497 has a shaft receiving portion 498 to be held in abutment against the shaft 405. Further, the shaft receiving portion 498 has a bent shape complementarily to an outer shape of the shaft 405, and a lower end portion of the shaft receiving portion 498 has a shape swelling toward the shaft 405 side. With this, the shaft 405 is caught on the swelling portion so that the button 409 is regulated from being dropped off from the box 408.

[0067] Further, the button 409 has a groove 495 formed therein, and the distal end of the driver is inserted into the groove 495 so that the button 409 can be pressed. The groove 495 is formed to be tapered as approaching to a rear side thereof, and hence is wider on a front side thereof so that the distal end of the driver can easily be inserted into the groove 495. An upper surface of the button 409 is formed into a curved surface shape so as to prevent the upper surface of the button 409 from being brought into contact with an inner surface of the box 408 when the button 409 is pressed. The size of the button 409 is set so that the button 409 does not protrude from an opening portion 4895 of the box 408 when the button 409 is mounted. With this, the terminal block 401 can be downsized.

[0068] A clearance 4802 is secured on a rear side of the accommodating space 2803 for the compression spring 206. The connecting end portion 429 of the base 402 is inserted into the clearance 483 and the clearance 4802. A curved surface portion 4804 is formed on an outer surface of the partition wall 4800 of the box 408 on a side on which the terminal 100 is inserted. Further, the accommodating space 4808 partitioned by a plurality of walls is secured in the box 408 at a portion below a region in which the base 402 is inserted. The thermal fuse 400 is accommodated in an upper part of the accommodating space 4808, and the fuse terminals 500 are accommodated in a lower part of the accommodating space 4808.

[0069] The base 402 has the connecting end portion 429, the narrow portion 225, a chamfered end portion 427, and the wide portion 226. The connecting end portion 429 is formed by bending downward a rear end of the base 402 into substantially an L-shape in cross-section. Further, the base 402 has a spring stopper 2219, a hole portion 228, and a hole portion 23. Note that, the connecting end portion 429 may be formed by a plurality of branched end portions.

[0070] Next, referring to Fig. 13 and Fig. 14, an operation of the terminal block 401 is described. In Fig. 13, an initial state (shipping state) is illustrated, in which the button 409 is positioned at an initial position and the stopper 203 is positioned at the first position (initial position). When the operator presses downward the button 409

against a biasing force of the compression spring 207, a rear portion of the button 409 pivots downward. Then, the button 409 held in abutment against the lever 404 presses downward the lever 404 so that a rear portion of the lever 404 also pivots downward about the shaft 405.

[0071] When the lever 404 pivots, the bent portion 41 of the lever 404 is moved upward. With this, the shoulder portions 31 are not held in abutment against the bent portion 41 any more so that regulation of the stopper 203 is released. Therefore, the stopper 203 starts to move to the second position due to the compression spring 206. Then, in a lower pressing limit state (state in which the stopper 203 is positioned at the second position), as illustrated in Fig. 14, the lever 404 is held in a state in which the lever 404 climbs onto the shoulder portions 31 of the stopper 203 (wire connection standby state).

[0072] When the operator inserts the round terminal 100 (not shown) into a terminal hole 411 of the terminal block 401, the stopper 203 is pressed by the inserted round terminal 100 to move from the second position to the first position. Then, as a result of the movement of the stopper 203 from the second position to the first position, third claw portions 47 (Fig. 12) of the lever 404 are brought into abutment against the upper surface of the round terminal 100. Then, the lower surface of the round terminal 100 is pressed against and surface-contacted with an upper surface of the base 402.

[0073] The box 408 of the terminal block 401 according to the fourth embodiment has the accommodating space 4808 secured below the base 402, for accommodating the thermal fuse 400 and the fuse terminals 500 (Fig. 12). The thermal fuse 400 is arranged in the upper part of the accommodating space 4808 so as to be held in contact with the base 402. Further, the thermal fuse 400 is disconnected at, for example, 120°C, and through detection of the disconnection, a process of stopping the device, issuing an alert, or the like can be performed.

[0074] The fuse terminals 500 are arranged in the lower part of the accommodating space 4808. In addition, the accommodating space 4808 has a front-portion space and a rear-portion space, in which the lead wires 410 of the thermal fuse 400 are arranged. The front-portion space and the rear-portion space are secured in a front portion and a rear portion of the accommodating space 4808, respectively. The front-portion space and the rear-portion space are set to have a sufficient length, for example, such a size that lead wires 410 of 120 mm can be accommodated. In other words, the front-portion space and the rear-portion space are secured in passages from the thermal fuse 400 to the respective fuse terminals 500. The front-portion space and the rear-portion space are configured to accommodate sagging portions of the lead wires 410. With this, it is possible to prevent the heat generated in the solder connection from being transmitted from each of the fuse terminals 500 to the thermal fuse 400 to cut off the fuse.

[0075] The connection portions 520 of the fuse termi-

nals 500 are formed by being bent upward, and function as plate springs for biasing upward the lead wires 410. Therefore, each of the lead wires 410, which is inserted into the pair of insertion holes 510 (Fig. 12) of the fuse terminal 500, is sandwiched between an upper portion of the fuse terminal 500 and an end portion of the connection portion 520.

[0076] The box 408 has steps serving as regulating portions 4520 for regulating the connection portions 520 from being spread outward. In a state in which the lead wires 410 are sandwiched, the connection portions 520 are pressed downward, and are deformed to be spread outward. In order to suppress the deformation, the regulating portions 4520 are brought into contact with the bent portions of the fuse terminals 500 when accommodating the thermal fuse 400 and the fuse terminals 500. With this, the connection portions 520, which are held in abutment against the regulating portions 4520, are narrowed so that the end portions of the connection portions 520 are pressed upward to bite into the lead wires 410. Therefore, the lead wires 410 and the connection portions 520 can reliably be connected to each other.

[0077] According to the terminal block 401 of the fourth embodiment as described above, it is possible to provide a terminal block 401 that can accommodate the thermal fuse 400. Further, automatic wire connection can be performed only by mounting the terminal on the distal end portion of the electric wire and inserting the terminal into the terminal hole. Further, only through the insertion of the terminal, the terminal is automatically sandwiched to perform the wire connection. With this mechanism, regardless of the operator, the stable wire connection can constantly be performed. Further, the wire connection can be performed safely and reliably even under the condition that the mechanical factor or the climatic factor is changed, such as the variation caused by the operator for wire connection, the vibration, the temperature cycle, or the like. Further, also according to the terminal block 401 of the fourth embodiment, the terminal can reliably be connected to the terminal block 401 through a single operation. In addition, one hand does not become unusable, and hence the connection work can be performed easily by both hands.

[0078] The present invention is described above referring to the embodiments. However, the present invention is not limited to the above-mentioned embodiments. The present invention also encompasses the invention modified within a scope not deviated from the present invention, and the invention equivalent to the present invention. Further, the above-mentioned embodiments and modifications may be combined with each other as appropriate within the scope not deviated from the present invention.

[0079] For example, in the first embodiment, the third claw portions 47 are formed in the front portion of the lever 4. However, instead of the third claw portions 47, a plurality of projections and depressions may be formed on a lower surface of the front portion of the lever 4. Fur-

ther, a terminal usable for the terminal block 1 of the present invention is not limited to a round solderless terminal, and a Y-shaped solderless terminal or the like may be used.

[0080] Further, the lever 4 is not limited to the configuration having the bent portion 41. For example, the lever 4 may have a protrusion that climbs onto the shoulder portions 31 of the stopper 3 instead of the bent portion 41. In this case, the protrusion is held in abutment against the shoulder portions 31 when the stopper 3 is positioned at the second position. With this, the lever 4 is held on the shoulder portions 31. In addition, instead of the torsion spring 6, a compression spring serving as a biasing member may be used. In this case, one end of the compression spring is held in abutment against the first abutment portion 32 of the stopper 3, and another end of the compression spring is held in abutment against the cutout portion 44 of the lever 4. Further, all the compression springs 7 and 207 and the compression spring 206 may be substituted by a spring having another shape or an elastic member such as rubber.

[0081] Further, a height of the second abutment portion 33 may be set equal to a height of each of the shoulder portions 31. With this, a distal end of the terminal 100 can be prevented from being sandwiched between the second abutment portion 33 and the bent portion 41 of the lever 204.

[0082] Note that, this application claims the benefit of Japanese Patent Application No. 2013-012800 filed on January 28, 2013, and Japanese Patent Application No. 2013-143578 filed on July 9, 2013, the entire disclosure of which is incorporated herein by reference.

Reference Signs List

[0083] 1: terminal block, 2: base, 3: stopper, 4: lever, 5: shaft, 6: torsion spring, 7: compression spring, 8: box, 9: button, 11: terminal hole, 21: raised portion, 22: shaft hole, 23: hole portion, 24: cutout portion, 31: shoulder portion, 32: first abutment portion, 33: second abutment portion, 41: bent portion, 42: shaft hole, 43: positioning portion, 44: cutout portion, 45: first claw portion, 46: second claw portion, 47: third claw portion, 48: reinforcing portion, 61: first end portion, 62: second end portion, 81: wall portion, 82: bottom portion, 83: clearance, 84: screw hole, 85: confirmation hole, 86: shaft hole, 87: first stopper portion, 88: second stopper portion, 89: third stopper portion, 91: shaft portion, 92: rear portion, 93: elastic portion, 94: protrusion, 95: groove, 96: abutment portion, 100: round terminal, 200: side plate, 201: terminal block, 202: base, 209: button, 203: stopper, 204: lever, 206: compression spring, 207: compression spring, 208: box, 221: holder, 225: narrow portion, 226: wide portion, 227: end portion, 228: hole portion, 232: spring receiving portion, 281: wall portion, 282: bottom portion, 283: clearance, 284: screw hole, 286: shaft hole, 287: first stopper portion, 300: shorting bar, 301: terminal block, 302: base, 327: end portion, 308: box, 310: plate spring, 400: thermal

fuse, 401: terminal block, 402: base, 404: lever, 405: shaft, 408: box, 409: button, 410: lead wire, 411: terminal hole, 426: protrusion, 427: end portion, 429: connecting end portion, 449: insertion hole, 481: wall portion, 482: bottom portion, 483: clearance, 489: mounting boss, 495: groove, 497: insertion portion, 498: shaft receiving portion, 500: fuse terminal, 510: insertion hole, 520: connection portion, 529: connecting end portion, 2800: partition wall, 2801: groove, 2802: clearance, 2803: accommodating space, 2804: curved surface portion, 2805: regulating portion, 2806: groove, 2807: projecting portion, 2841A: stepped portion, 2841B: stepped portion, 2212: shaft hole, 2213: spring receiving portion, 2218: hole portion, 2219: spring stopper, 3808: accommodating space, 3809: hole portion for shorting bar, 4800: partition wall, 4801: groove, 4802: clearance, 4804: curved surface portion, 4808: accommodating space, 4895: opening portion, 4520: regulating portion

Claims

1. A terminal block, comprising:

a base to be electrically connected to a terminal to be inserted;
a stopper movable between a first position and a second position above the base; and
a lever to be held on a shoulder portion of the stopper when the stopper is positioned at the second position.

2. A terminal block according to claim 1, further comprising a first biasing member held in abutment against each of the lever and the stopper, the first biasing member configured to bias the stopper in a direction moving from the first position to the second position, wherein the lever is configured to cause the stopper to move from the first position to the second position via the first biasing member, and wherein the lever is configured to climb onto the shoulder portion along with the movement of the stopper.

3. A terminal block according to claim 1, further comprising a first biasing member held in abutment against the stopper, the first biasing member configured to bias the stopper in a direction moving from the first position to the second position, wherein the stopper is configured to move from the first position to the second position due to a biasing force of the first biasing member when regulation by the lever is released, and wherein the lever is configured to climb onto the shoulder portion along with the movement of the stopper.

4. A terminal block according to any one of claims 1 to 3, further comprising a second biasing member configured to bias the lever in a direction pivoting toward the base. 5
5. A terminal block according to any one of claims 1 to 4, further comprising a third biasing member arranged so as to face the base, the third biasing member configured to bias toward the base a member to be inserted. 10
6. A terminal block according to any one of claims 1 to 5, further comprising a button which has an abutment portion held in abutment against the lever, wherein the lever is configured to pivot by pressing the button. 15
7. A terminal block according to any one of claims 1 to 6, further comprising a box configured to accommodate the base and the stopper, wherein the button has an elastic portion held in abutment against an inner surface of the box. 20
8. A terminal block according to any one of claims 1 to 6, further comprising a box configured to accommodate the base and the stopper, wherein the box has a hole portion into which a shorting bar is to be inserted. 25
9. A terminal block according to any one of claims 1 to 6, further comprising a box configured to accommodate the base and the stopper, wherein the box has an accommodating space configured to accommodate a thermal fuse. 30
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FIG. 1

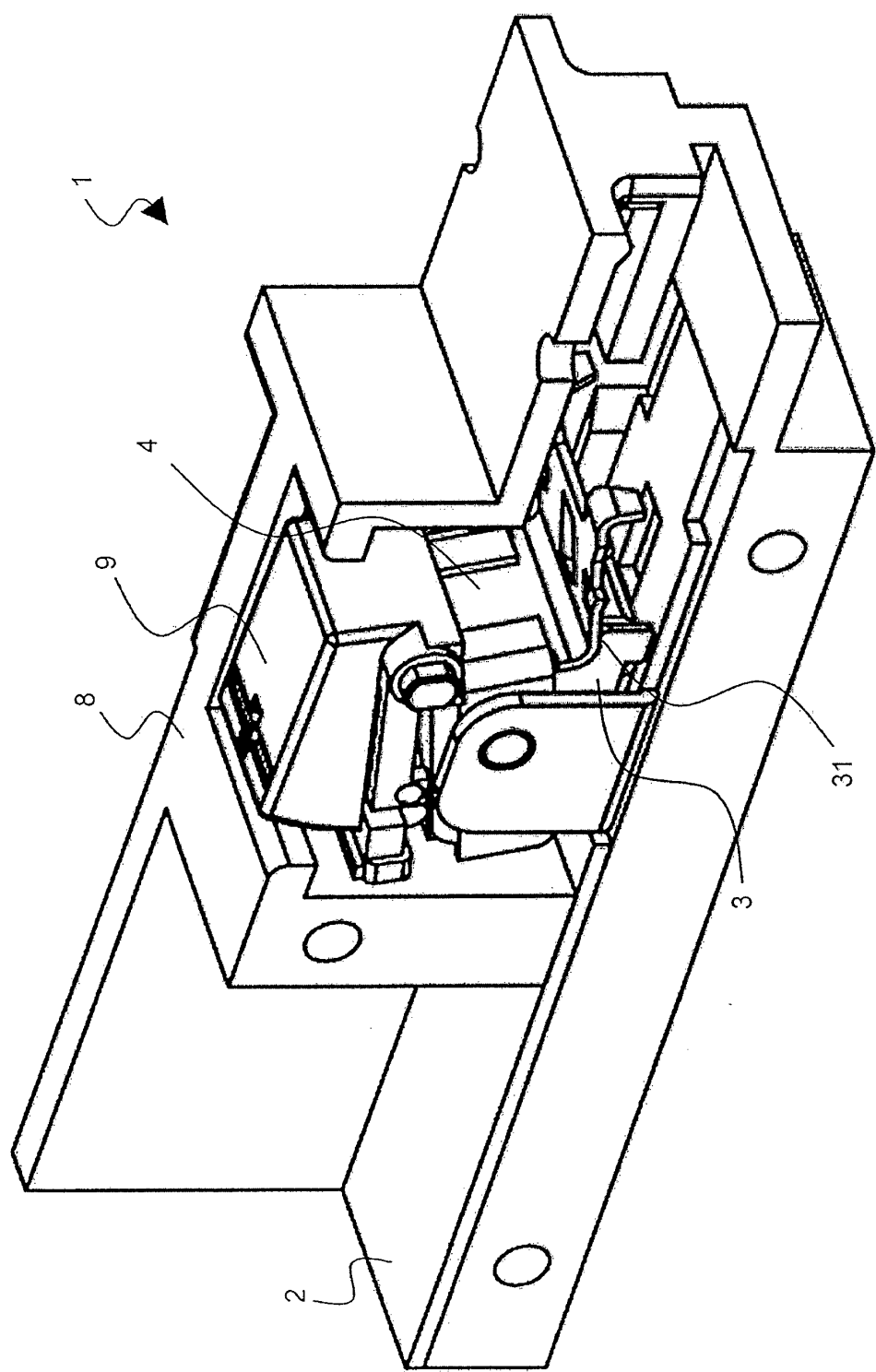


FIG. 2

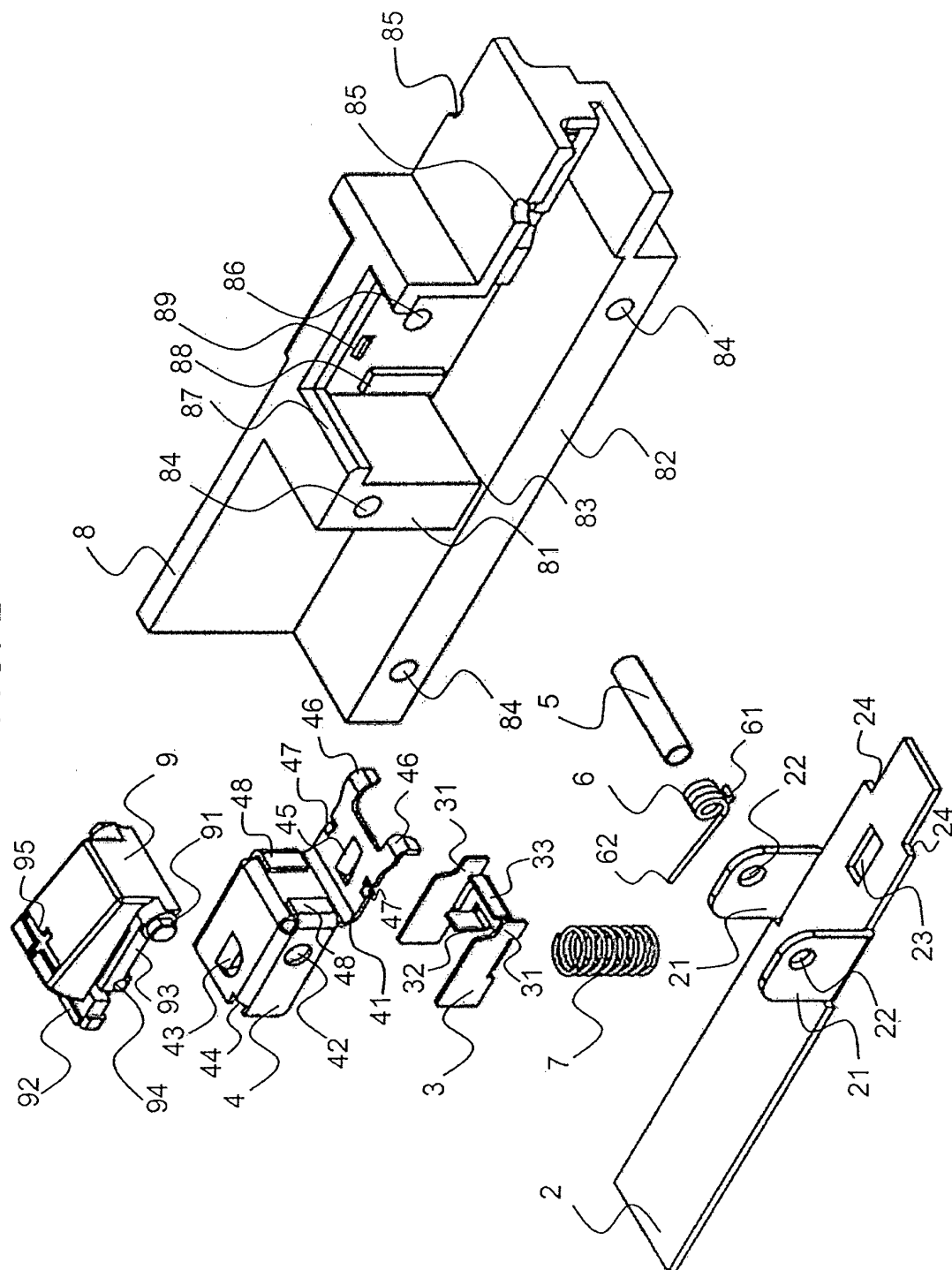


FIG. 3

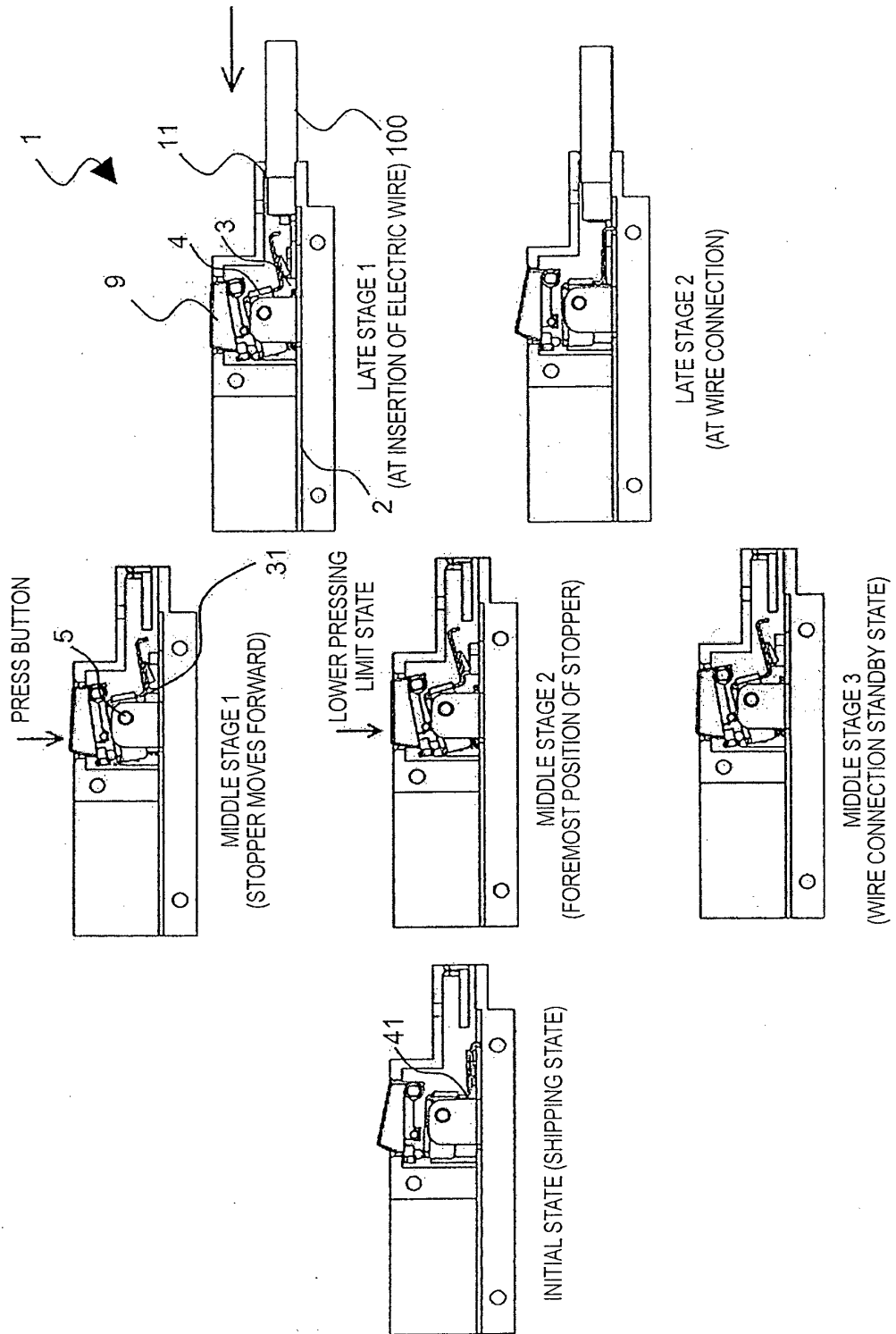


FIG. 4

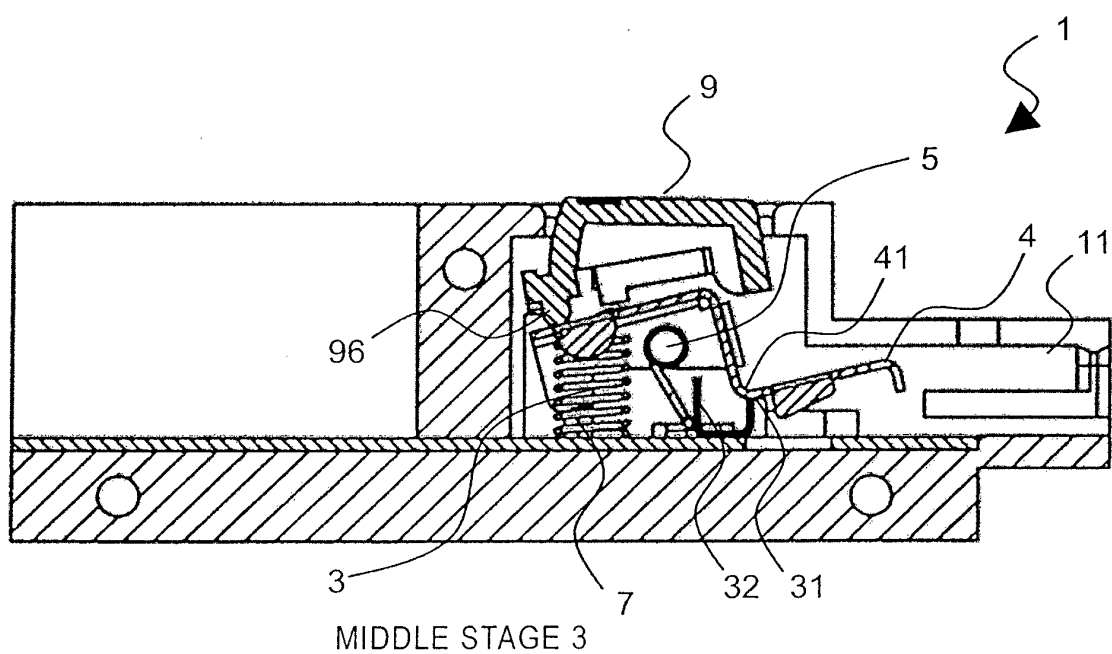
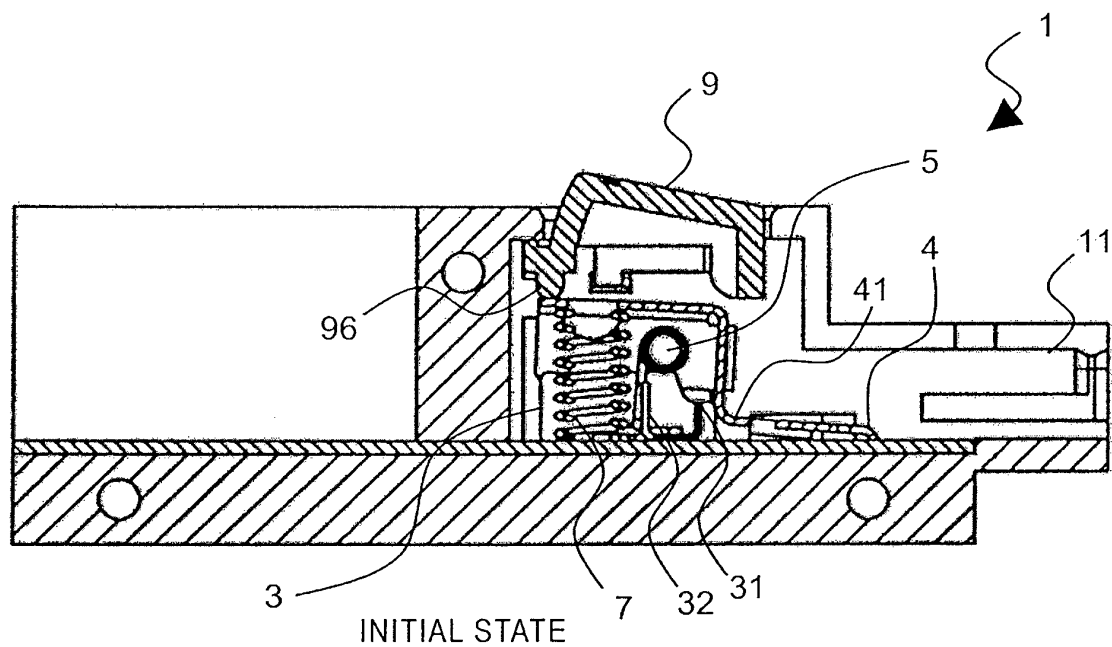


FIG. 5

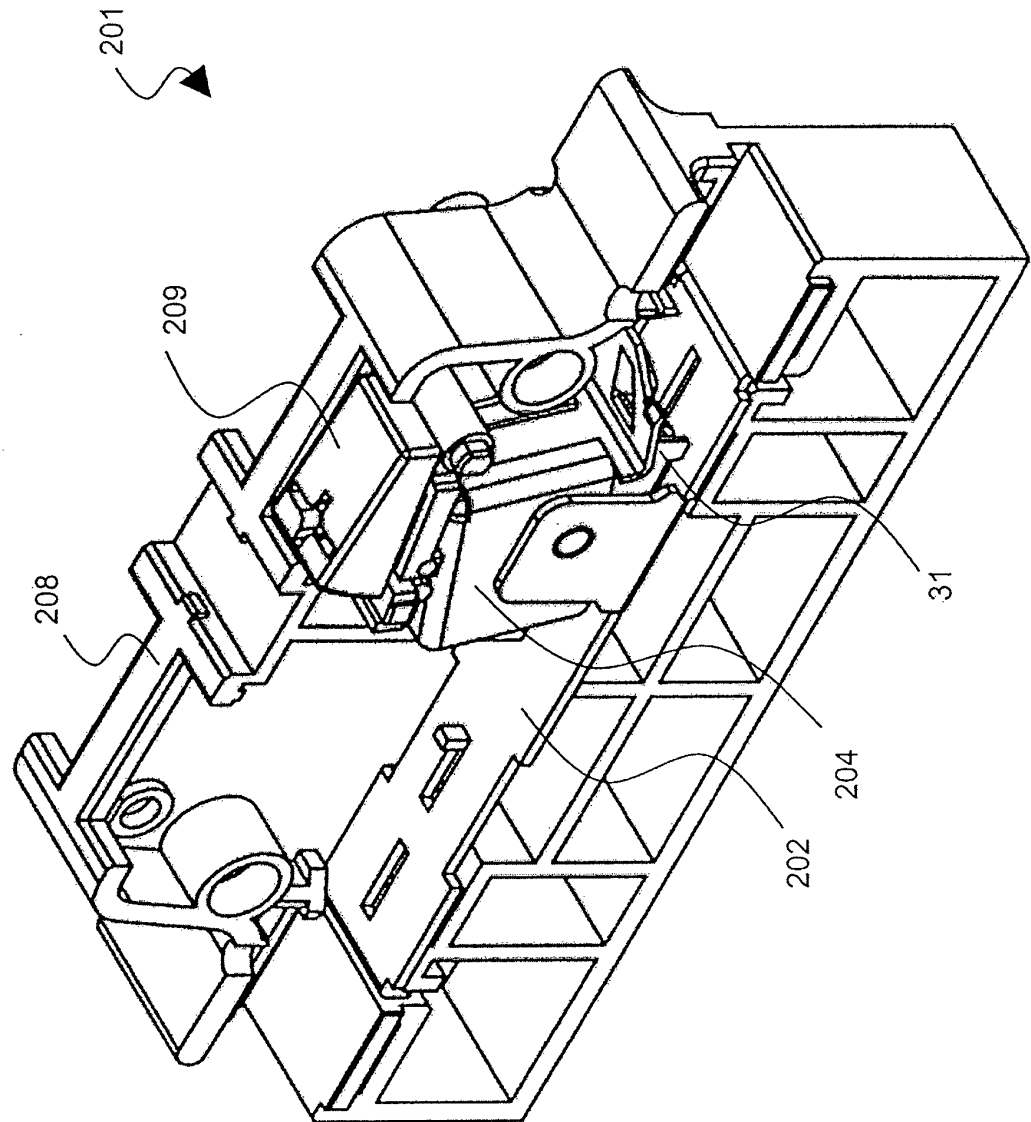


FIG. 6

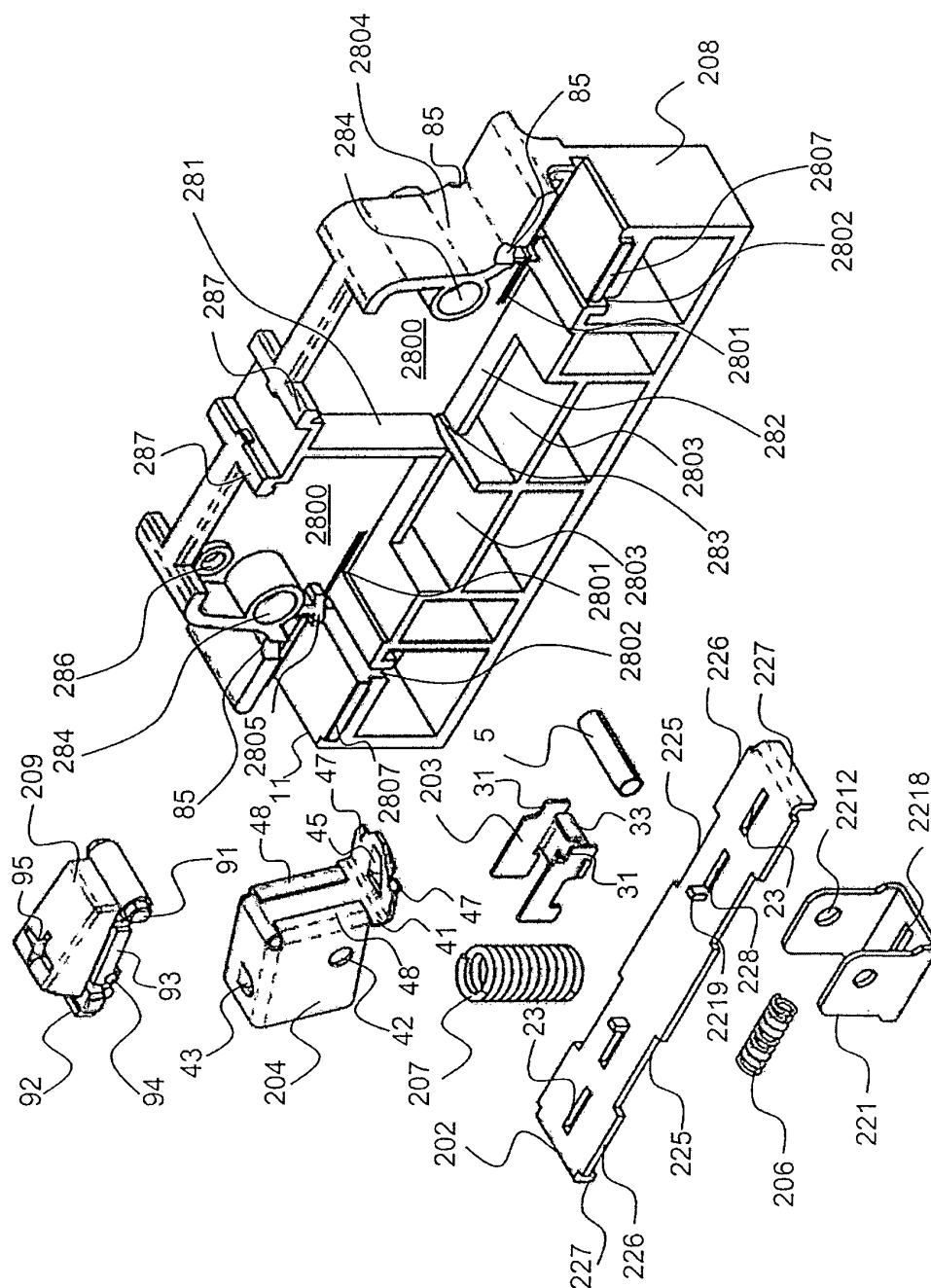


FIG. 7

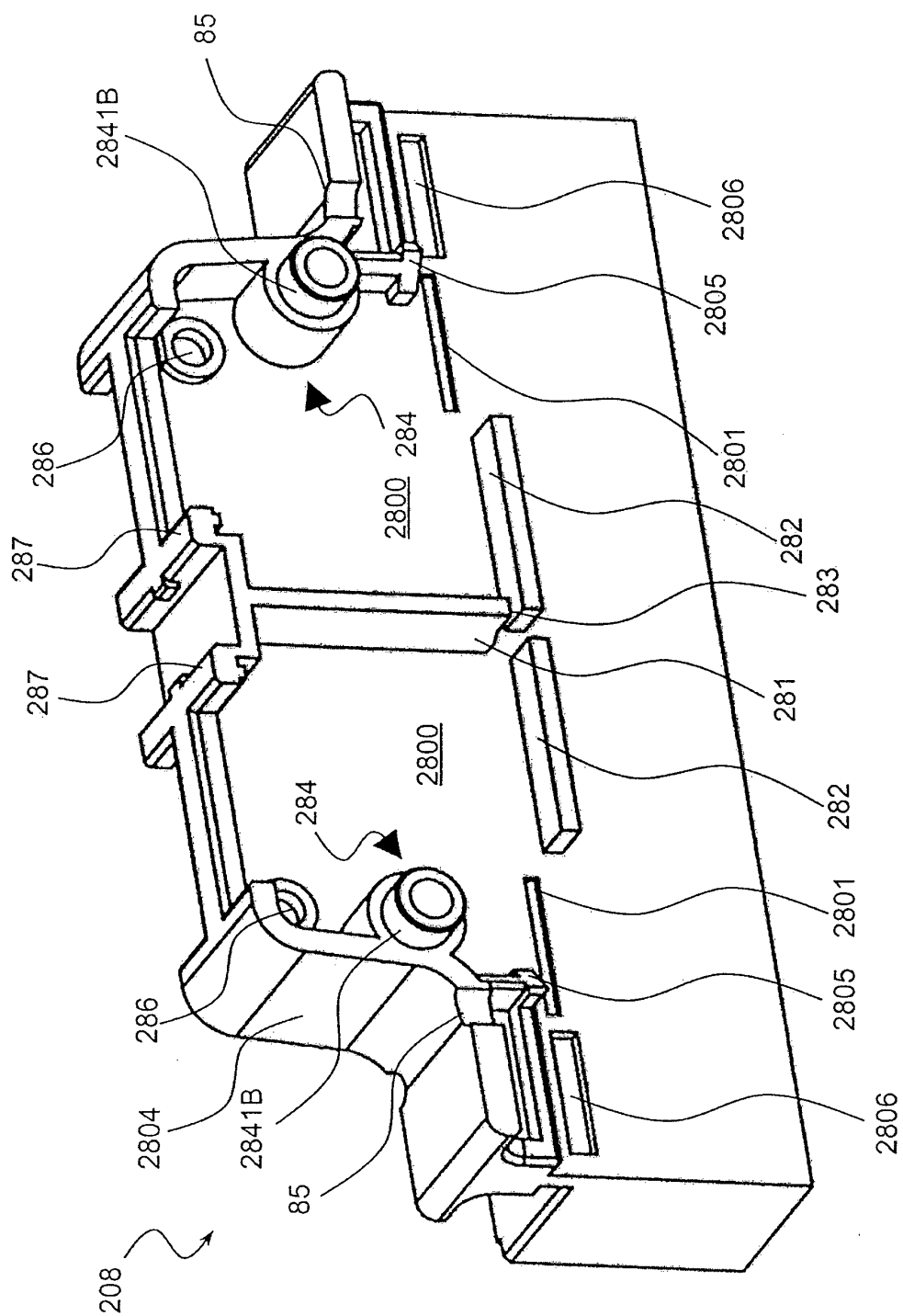


FIG. 8

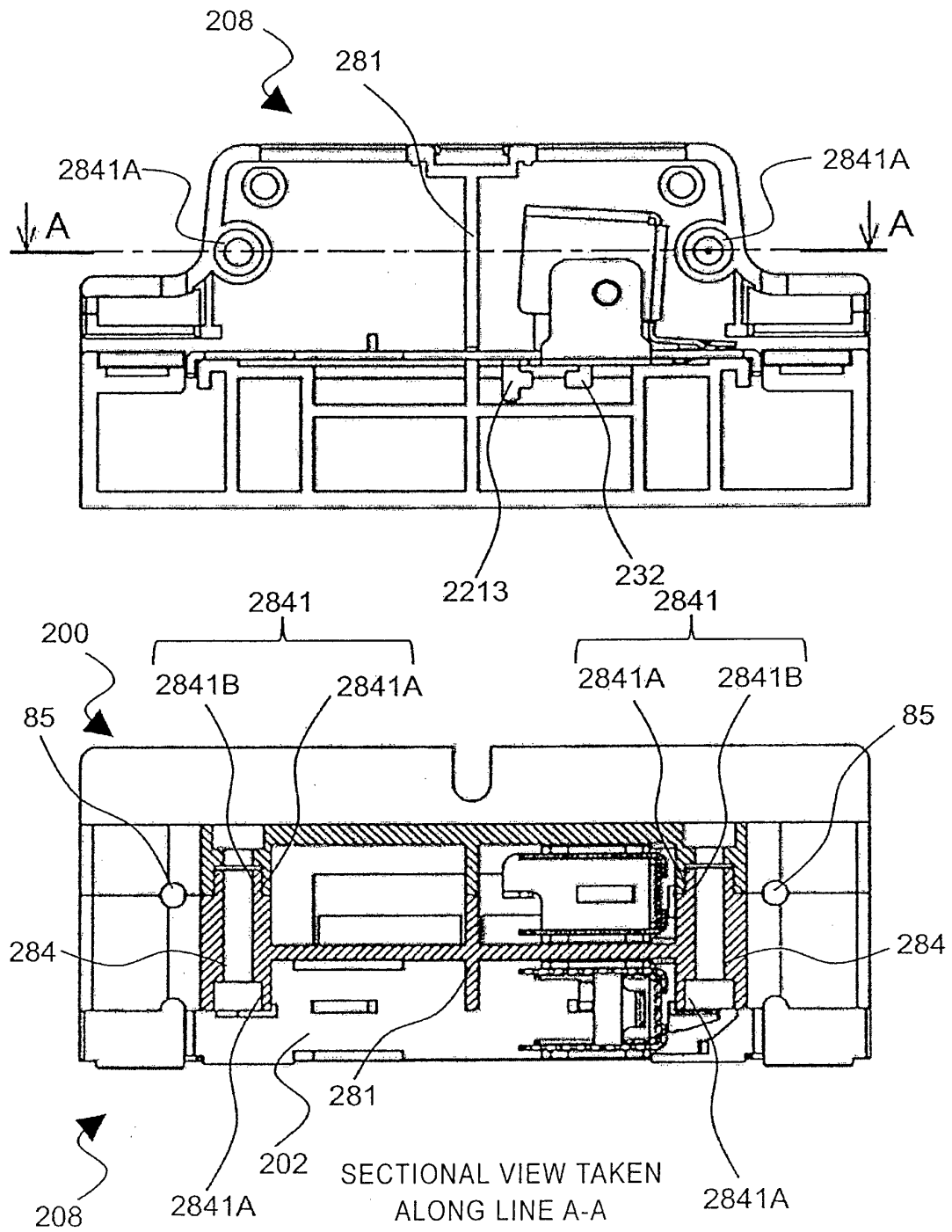


FIG. 9

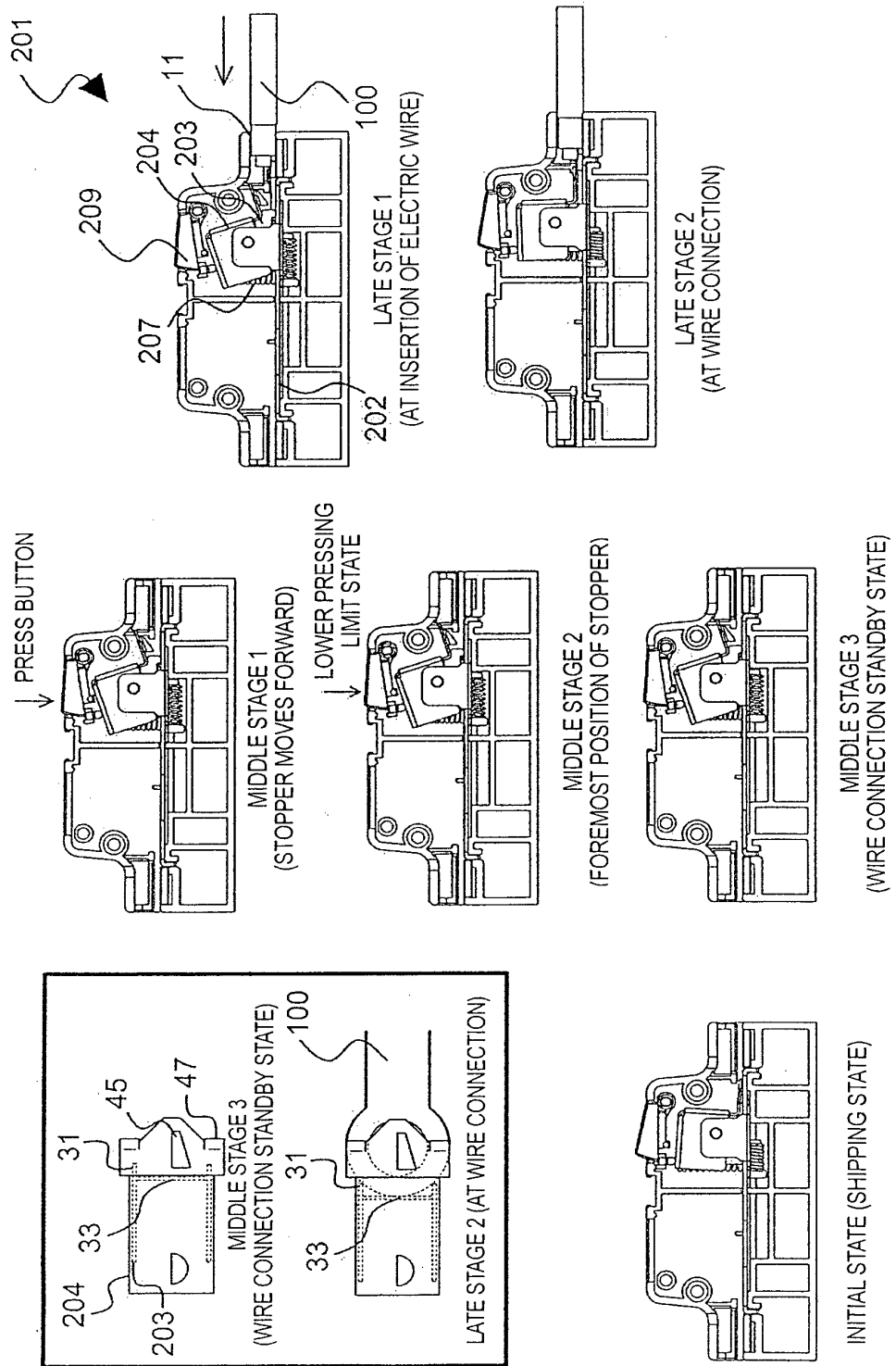
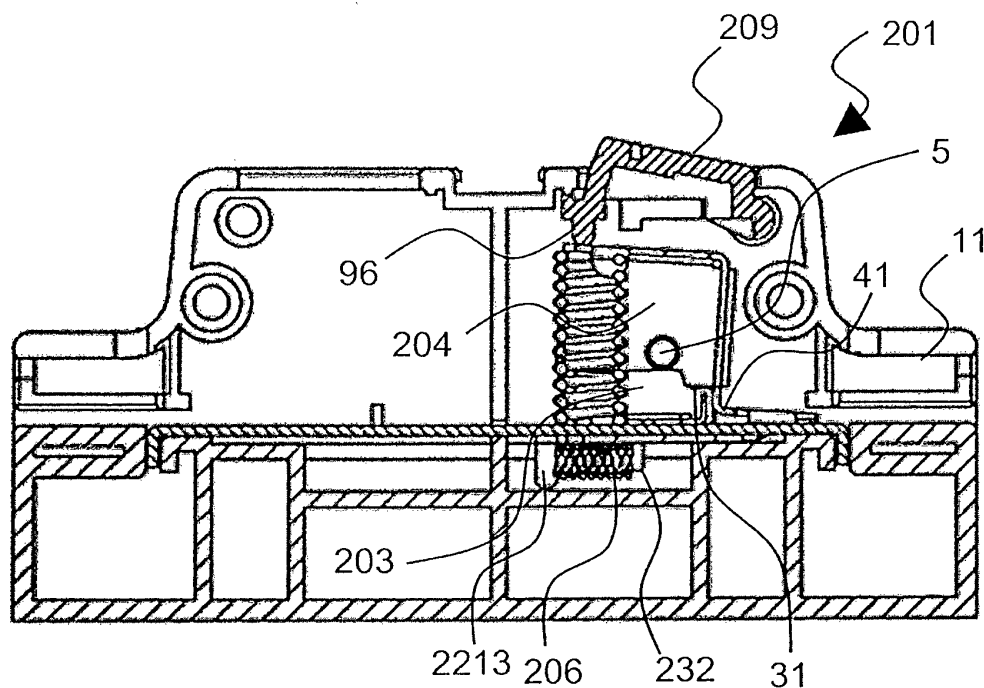
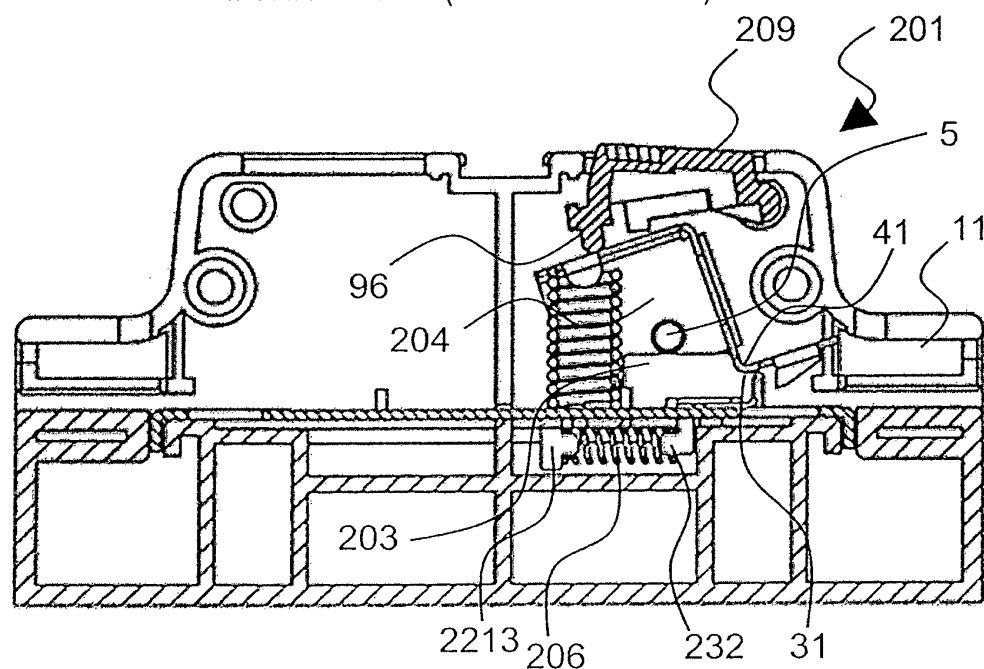


FIG. 10



INITIAL STATE (SHIPPING STATE)



MIDDLE STAGE 3 (WIRE CONNECTION STANDBY STATE)

FIG. 11

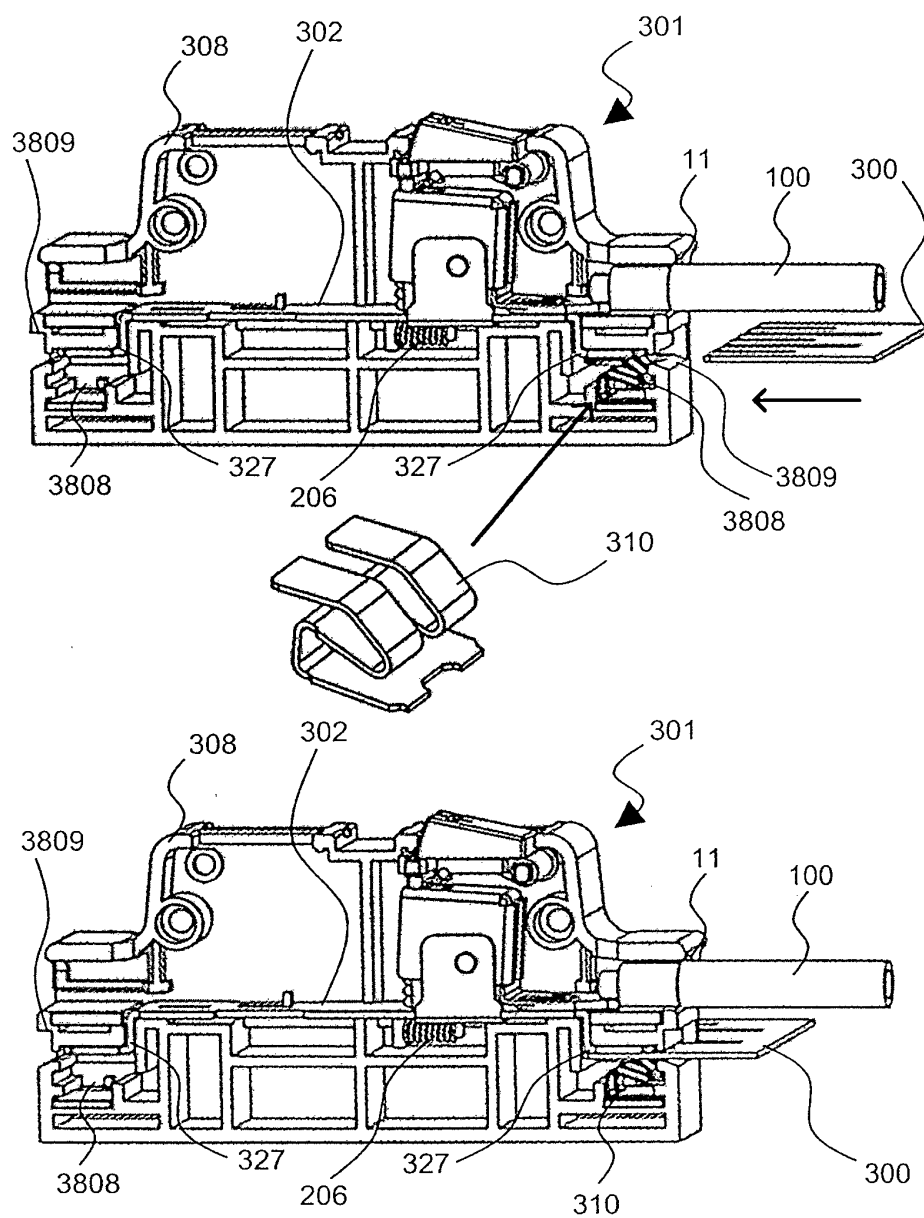


FIG. 12

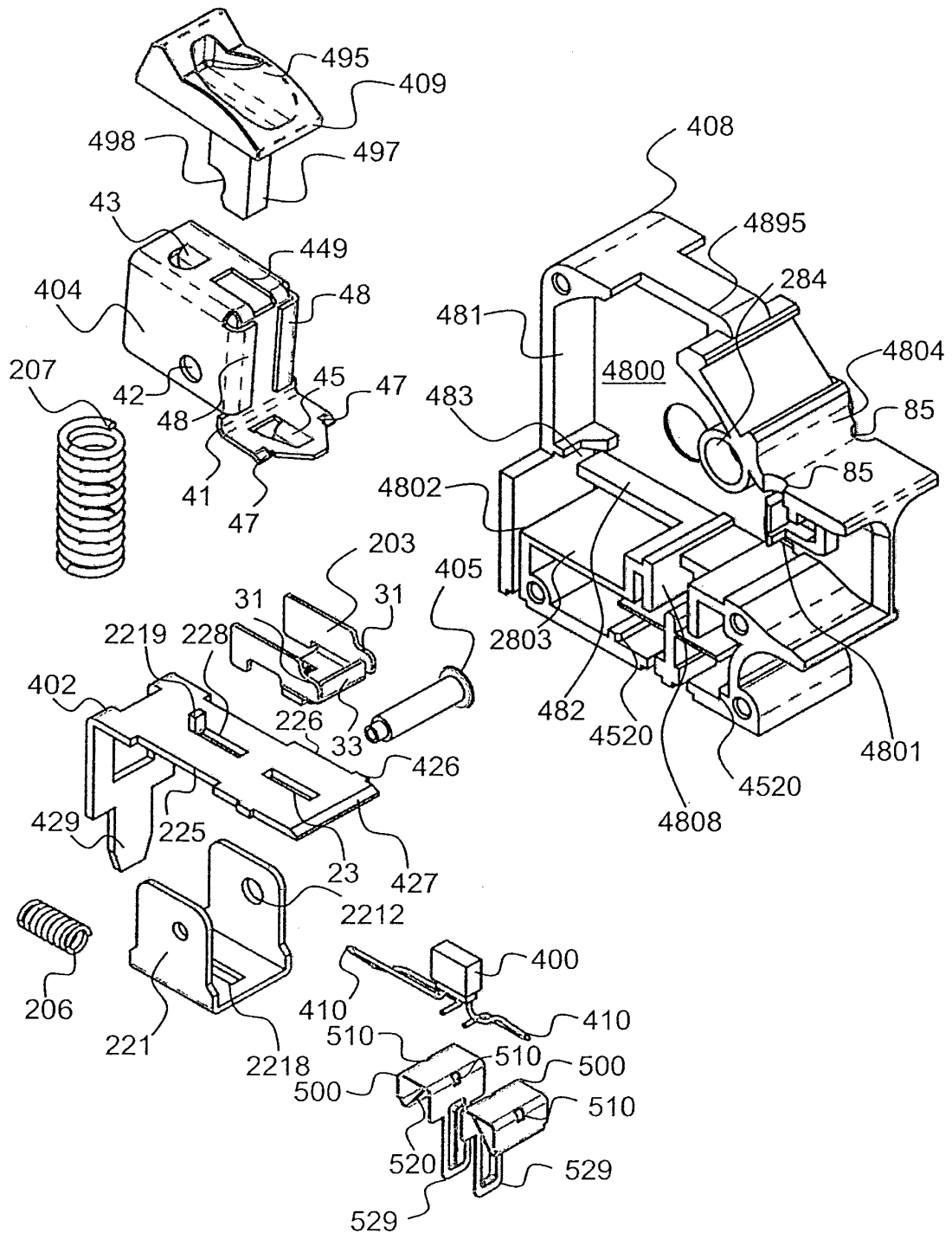


FIG. 13

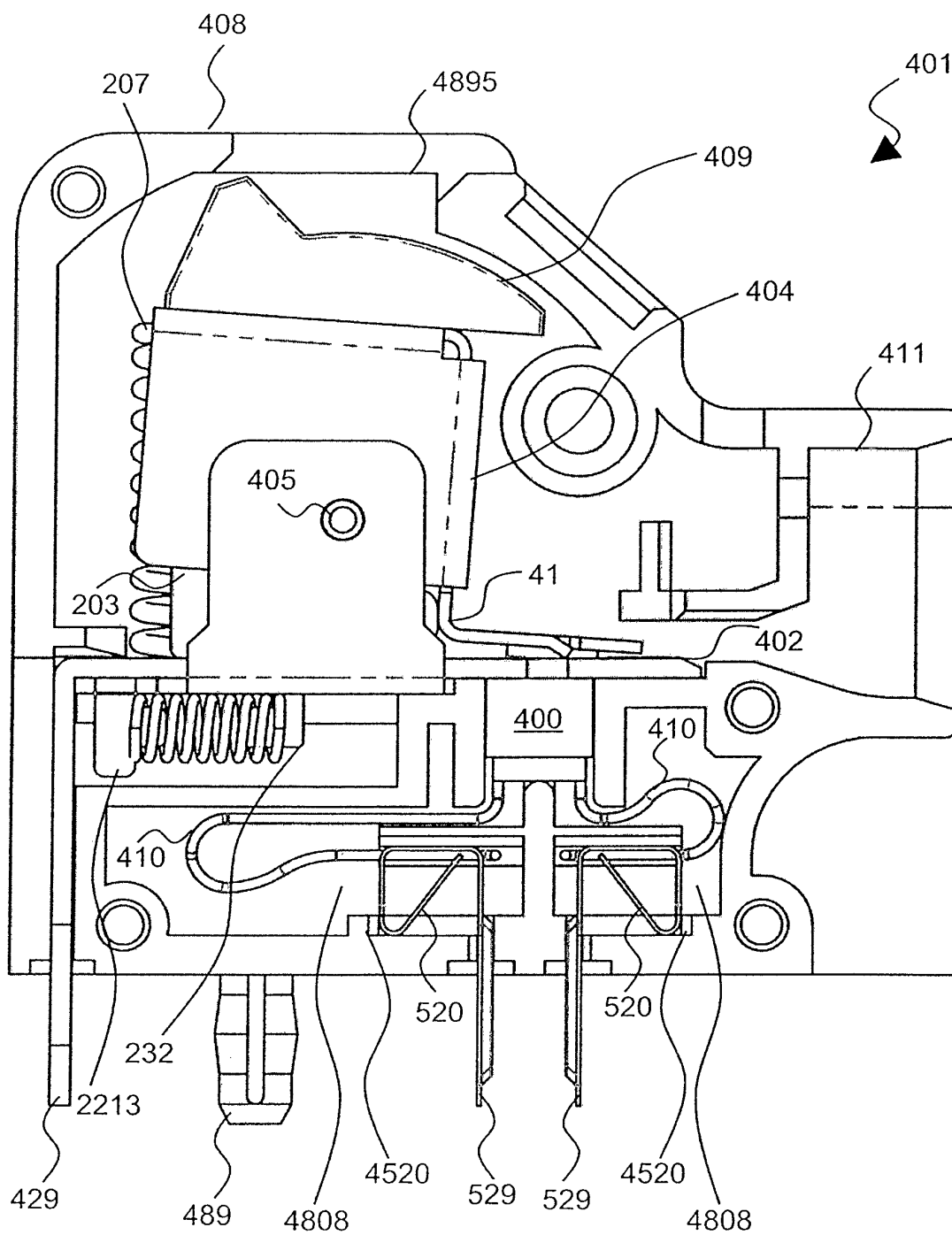
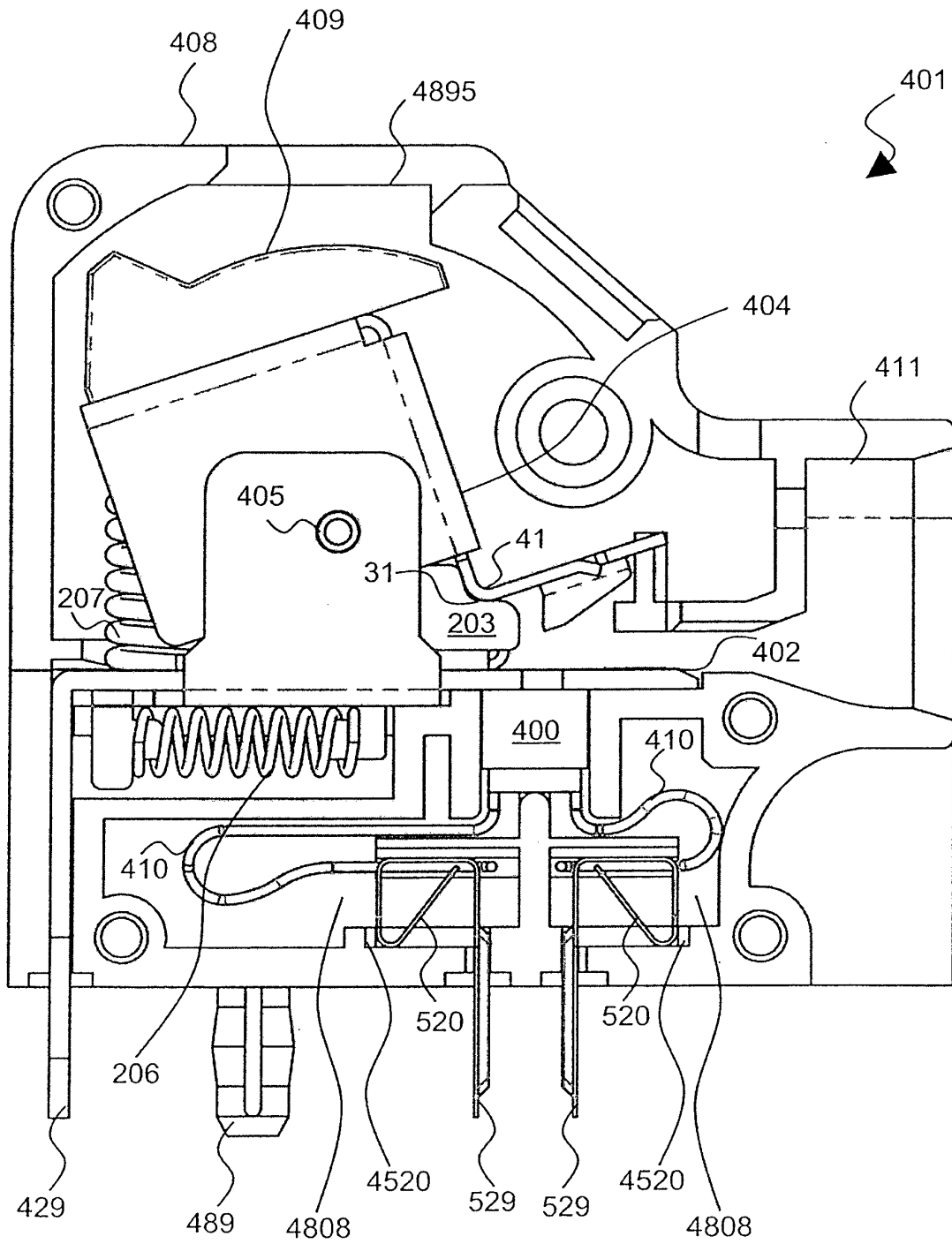


FIG. 14



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/000420

A. CLASSIFICATION OF SUBJECT MATTER

H01R4/48(2006.01)i, H01R9/22(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01R4/48, H01R9/22

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2014
Kokai Jitsuyo Shinan Koho	1971-2014	Toroku Jitsuyo Shinan Koho	1994-2014

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CD-ROM of the specification and drawings annexed to the request of Japanese Utility Model Application No. 034678/1993(Laid-open No. 005258/1995) (Kabushiki Kaisha Empire), 24 January 1995 (24.01.1995), paragraph [0016]; fig. 1 (Family: none)	1-9
A	JP 04-155783 A (Matsushita Electric Works, Ltd.), 28 May 1992 (28.05.1992), page 3, lower left column, line 5 to lower right column, line 6; fig. 2 (Family: none)	1-9

☒ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

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"P" document published prior to the international filing date but later than the priority date claimed

"I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
19 March, 2014 (19.03.14)Date of mailing of the international search report
01 April, 2014 (01.04.14)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/000420

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 052997/1986 (Laid-open No. 165670/1987) (Sharp Corp.), 21 October 1987 (21.10.1987), specification, page 7, line 5 to page 8, line 1; fig. 1, 2 (Family: none)	1-9
A	JP 2007-109461 A (Emuden Musen Kogyo Kabushiki Kaisha), 26 April 2007 (26.04.2007), paragraph [0022]; fig. 1, 4, 5 (Family: none)	1-9

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/000420

5 (1) In claim 4, there is a description of "a second biasing member which biases the lever in a direction in which the lever is rotated toward the base".

10 "The second biasing member" in this description corresponds to a compression spring 7 in an embodiment from the first sentence of paragraph [0016].

In paragraph [0020], there is a description that "force in a direction in which a lever 4 is rotated upward around a shaft 5 is always applied to the back part of the lever by the compression spring 7", and in paragraph [0021], there is a description that "a button 9 is pressed downward against the biasing force of the compression spring 7".

15 (There is the statement involving similar meaning in also paragraph [0047].)

From [fig. 1], [fig. 2], and the like, a base 2 is located below the lever 4.

20 In consequence, according to the descriptions in these paragraphs [0020] and the like, "the compression spring 7 which biases the lever 4 in a direction in which the lever is rotated in an opposite direction to the base 2" is shown in the description.

Meanwhile, the abovementioned description of claim 4 means "the compression spring 7 which biases the lever 4 in a direction in which the lever is rotated toward the base 2".

25 Consequently, the above-said statement in claim 4 is in contradiction with that disclosed in the description.

Therefore, the search was carried out on "the compression spring 7 which biases the lever 4 in a direction in which the lever is rotated in an opposite direction to the base 2", which is disclosed in the description.

30 (2) In claim 5, there is a description of "a third biasing member which is disposed to face the base and biases an inserted member toward the base", but it is unclear what "the third biasing member" in this description shows in the embodiment.

Therefore, the search was carried out on condition that "the third biasing member" corresponds to "a flat spring 310" in the embodiment.

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2007109461 A [0004]
- JP 2013012800 A [0082]
- JP 2013143578 A [0082]