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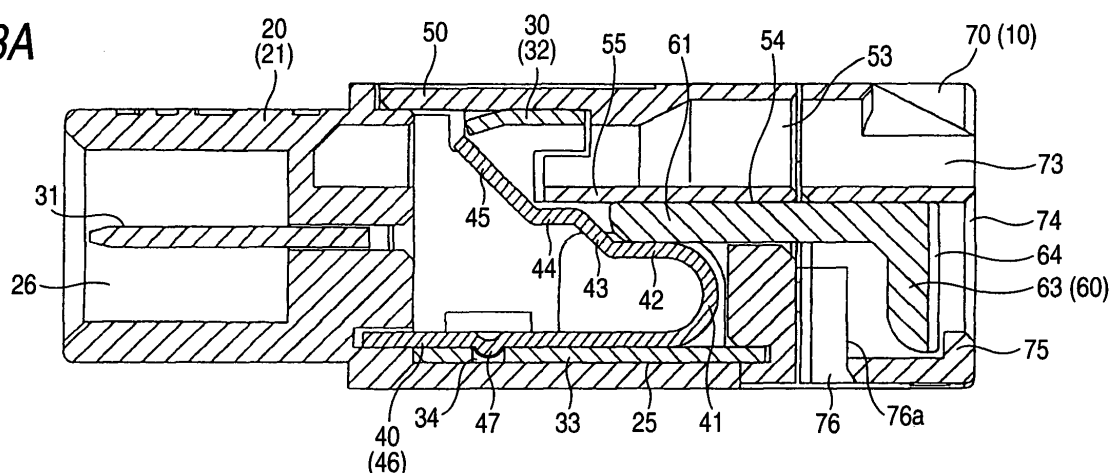
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(54) **Electric wire connecting connector**

(57) There is provided an electric wire connecting connector which does not perform an incorrect operation and has excellent workability. A cover (70) is fitted to a housing (11) composed of a case (20) and a base (50), and a head part (63) of an operation lever (60) is housed. An opening operation hole (74) through which

the head part (63) of the operation lever (60) positioned in a wire connection state can be pressed in an axial direction is provided in the cover (70). Further, a connecting operation hole (76) through which the head part (63) of the operation lever (60) positioned in an open state can be operated is provided between the housing (11) and the cover (70).

FIG. 3A



Description

Background of the Invention

[0001] The present invention relates to an electric wire connecting connector, and particularly to an electric wire connecting connector for electrical connection by holding an electric wire tightly by use of a connection metal fitting and a plate spring pressed against this.

[0002] Conventionally, as an electric wire connecting connector, for example, there is a relay connector disclosed in JP-A-10-12294.

[0003] That is, the relay connector is provided with electric wire fixing mechanisms including housings 5 and 19, terminal metal fittings 7 and 21, plate springs 9 and 23, and release buttons 11 and 25, respectively. Then, for example, the release button 11 is pressed into the housing 5 to elastically deform the plate spring 9, and then, an electric wire 31 is inserted in the housing 5. Next, the release button 11 is pulled back to elastically return the plate spring 9, so that the electric wire 31 is pressed and held tightly by the terminal metal fitting 7 and the plate spring 9 and the electrical wire connection is completed.

[0004] However, in the foregoing relay connector, the release buttons 11 and 25 are respectively exposed from the housing 5. Thus, for example, when an obstacle happens to collide with the release buttons 11 and 25, there is a fear that the lock is released and the electric wire 31 falls off.

[0005] Besides, in the foregoing relay connector, the release buttons 11 and 25 are pressed in to bring about an open state, while the release buttons 11 and 25 are pulled back to bring about a wire connection state. Thus, in the insertion and withdrawal working of the electric wire 31, it is necessary to perform two different kinds of operations, that is, the pressing operation and the pull-back operation, and the workability is poor. Especially, in the case where the release button is returned, a pull-back force higher than a pressing force necessary for pressing the release buttons 11 and 25 is required, and there is a problem that the workability is worse.

Summary of the Invention

[0006] In view of the foregoing problems, the present invention has an object to provide an electric wire connecting connector which does not make an incorrect operation and has excellent workability.

[0007] In order to achieve the above object, in an electric wire connecting connector in which a substantially L-shaped operation lever is inserted and pushed in an axial direction through an insertion hole provided in a housing, a substantially V-shaped plate spring incorporated in the housing is elastically deformed to form a gap between a connection metal fitting incorporated in the housing and the plate spring and to bring about an open state, and then, an electric wire is positioned in the gap,

next, the operation lever is pulled back to elastically return the plate spring, and the electric wire is held tightly by the connection metal fitting and the plate spring to bring about a wire connection state, the electric wire connecting connector of the invention is structured such that a cover is fitted to the housing to house a head part of the operation lever, an opening operation hole through which the head part of the operation lever positioned in the wire connection state can be pressed in the axial direction is provided in the cover, and a connecting operation hole through which the head part of the operation lever positioned in the open state can be operated is provided between the housing and the cover.

[0008] According to this invention, the whole operation lever is housed in the housing and the cover. Thus, an obstacle does not happen to collide from the outside, and an incorrect operation can be prevented. Besides, in any case where the operation lever is operated to bring about the open state and the wire connection state, the processing can be performed by one kind of operation, that is, pressing the rod, so that the workability is improved. Especially, in any case where the operation lever is operated to bring about the open state and the wire connection state, the pressing forces are practically equal to each other and the workability is further improved.

[0009] As an example of this invention, a stopper for preventing the operation lever pulled out of the housing from fall off may be provided in the cover.

[0010] According to this example, the stopper prevents damage of the operation lever in the case where the operation lever is forcibly pulled out.

[0011] As another example of this invention, a stopper coming in contact with an end face of the head part of the operation lever jumping out of the housing may be provided at an opening edge of the opening operation hole of the cover.

[0012] According to this example, by a collision sound of the operation lever coming in contact with the stopper, it is possible to confirm whether or not the operation lever becomes in the wire connection state, and the workability is improved.

[0013] Another electric wire connecting connector of the invention includes an electric wire connecting connector body in which a substantially L-shaped operation lever is inserted and pushed in an axial direction through an insertion hole provided in a housing, a substantially V-shaped plate spring incorporated in the housing is elastically deformed to form a gap between a connection metal fitting incorporated in the housing and the plate spring and to bring about an open state, and then, an electric wire is positioned in the gap, next, the operation lever is pulled back to elastically return the plate spring, and the electric wire is held tightly by the connection metal fitting and the plate spring to bring about a wire connection state, and a first and a second outside covers rotatably attached to the electric wire connecting

connector body and housing the electric wire connecting connector body in a space formed by combining them, wherein a protrusion to be inserted between a side surface of the housing and a head part of the operation lever positioned in the open state so as to operate the operation lever is provided on the first outside cover.

[0014] According to the electric wire connecting connector of this invention, even if the operation lever protrudes from the housing of the electric wire connecting connector body, since it is covered and housed by the first and the second outside covers, an obstacle does not happen to collide from the outside and an incorrect operation can be prevented.

[0015] Besides, the protrusion provided on the first outside cover operates the head part of the operation lever positioned in the open state. Thus, the operation lever can be automatically brought into the wire connection state by merely turning the first outside cover to fit it to the electric wire connecting connector body, and the operation lever can be operated through one-touch operation. Thus, in the case where plural operation levers are provided side by side, the workability can be remarkably improved.

[0016] As an example of this invention, a stopper coming in contact with an end face of the operation lever jumping out of the electric wire connecting connector body may be provided on the first outside cover.

[0017] According to this example, it is possible not only to prevent the operation lever from fall off, but also to confirm that the operation lever is in the wire connection state by a collision sound between the operation lever and the stopper of the first outside cover, and the workability is improved.

[0018] As another example of this invention, the first and the second outside covers may be provided with a magnetic shield function.

[0019] According to this example, there are effects that the first and the second outside covers can prevent not only an incorrect operation of the electric wire connecting connector, but also an influence of outer disturbance by means of the magnetic shield.

Brief Description of the Drawings

[0020]

Fig. 1 is a perspective view showing a first embodiment of an electric wire connecting connector of the invention;

Fig. 2 is an exploded perspective view of Fig. 1;

Figs. 3A and 3B are sectional views of the electric wire connecting connector shown in Fig. 1 before and after an operation;

Figs. 4A and 4B are perspective views of the electric wire connecting connector shown in Fig. 1 before and after the operation;

Fig. 5 shows a second embodiment of an electric wire connecting connector of the invention, in which

Fig. 5A is a perspective view showing the whole and Fig. 5B is a perspective view showing a state where an outside cover is opened;

Fig. 6 is an exploded perspective view of Fig. 5;

Figs. 7A and 7B are sectional views showing the electric wire connecting connector shown in Fig. 5 in the middle of an operation; and

Figs. 8A and 8B are sectional views showing the electric wire connecting connector shown in Fig. 5 in the middle of the operation.

Detailed Description of the Invention

[0021] Embodiments of the present invention will be described with reference to the accompanying drawings of Figs. 1 to 8.

[0022] As shown in Figs. 1 to 4, a first embodiment of the invention relates to a case where it is applied to an electric wire connecting connector 10.

[0023] The electric wire connecting connector 10 is such that as shown in Fig. 2, connection metal fittings 30, plate springs 40 and operation levers 60 are incorporated in an internal space formed by fitting a cover 70 to a housing 11 composed of a case 20 and a base 50. Incidentally, reference numeral 12 designates a lock lever.

[0024] The case 20 is a resin molded part having a recess 21 which is provided at one side of an upper surface thereof and to which the base 50 and the cover 70 described later can be fitted. Guide grooves 24 and 24 are respectively formed on the inner surfaces of arm parts 22 and 23 at both sides of the case 20, and engaging recesses 24a and 24b are respectively formed in the guide grooves 24. The engaging recesses 24a and 24b are for positioning the case 50 and the cover 70 described later. Further, plural positioning grooves 25 are provided side by side on the bottom of the recess 21 positioned between the arm parts 22 and 23. Besides, a fitting opening part 26 into which pin terminals 31 of the connection metal fittings 30 described later protrude is formed on a one-side end face of the case 20 (Fig. 3).

[0025] Each of the connection metal fittings 30 is made of a metal plate punched by presswork, and the pin terminal 31 protrudes laterally from a one-side edge part thereof. Further, an upper and a lower edges of the connection metal fitting 30 are respectively subjected to bending, so that an upper bent piece 32 and a lower bent piece 33 are formed. A positioning hole 34 for positioning the plate spring 40 described later is provided in the lower bent piece 33 (Fig. 3).

[0026] As shown in Fig. 3, the plate spring 40 is formed by bending a band-like spring member to have a substantially V-shaped form, and a first bent part 43, a second bent part 44 and a pressing tongue part 45 are sequentially formed in a relay holding part 42 continuous with a bent part 41. Further, a positioning protrusion 47 engaging with the positioning hole 34 of the connection

metal fitting 30 is formed on a bottom 46 of the plate spring 40 by protrusion working.

[0027] The positioning protrusion 47 of the plate spring 40 is engaged with the positioning hole 34 of the connection metal fitting 30, so that the pressing tongue part 45 comes in press contact with the lower surface edge part of the upper bent piece 32. Next, the lower bent piece 33 of the connection metal fitting 30 is positioned and fitted to each of the plural positioning grooves 25 provided side by side on the bottom of the case 20, so that the pin terminal 31 protrudes into the fitting opening 26 of the case 20 (Fig. 3).

[0028] The base 50 has such a shape that it can be fitted to the recess 21 of the case 20, and is made of a transparent resin material. Especially, guide stepped parts 51 and 51 are formed on opposite side surfaces of the base 50 at both sides, and engaging protrusions 52 are protruded from the guide stepped parts 51. Further, electric wire insertion holes 53 and operation lever insertion holes 54 are formed up and down in a one-side end face of opposite both-side surfaces of the base 50. Further, a partition wall 55 for partitioning space communicating with the electric wire insertion holes 53 and the operation lever insertion holes 54 is formed in the inside of the base 50.

[0029] Then, the base 50 is inserted between the arm parts 22 and 23 of the case 20, the stepped parts 51 and 51 of the base 50 are fitted in the guide grooves 24 and 24 of the arm parts 22 and 23 and is slid, and the protrusions 52 of the base 50 are engaged with the recesses 24a of the arm parts 22 and 23 to prevent the base 50 from coming out.

[0030] The operation lever 60 has a substantially L-shaped form in front, and a radius surface 62 is formed at a lower surface end edge part of an axial part 61 thereof, while an operation groove 64 is formed on an outward surface of a head part 63 thereof.

[0031] Then, when the axial part 61 of the operation lever 60 is inserted in the insertion hole 54 of the base 50 and is pushed in, the end part of the axial part 61 is brought into press contact and is held tightly between the partition wall 55 of the base 50 and the relay holding part 42 of the plate spring 40.

[0032] The cover 70 has such a shape that it can be slid and inserted between the both-side arm parts 22 and 23 of the case 20, and guide stepped parts 71 and 71 are formed on opposite side surfaces at both sides thereof. An engaging protrusion 72 is protruded on the guide stepped part 71. Further, a one-side end face of both-side end faces of the cover 70 has such a shape that it can be coupled to the cover 50 laterally, and electric wire insertion holes 73 and opening operation holes 74 are provided up and down on the remaining one-side end face. A stopper 75 for preventing the operation lever 60 from jumping out is formed at an opening edge part of each of the operation holes 74. Further, a notch part 76a is provided at a bottom edge part of the cover 70. This notch part 76a and the one-side end face of the

case 50 can form a connecting long hole 76 which communicates with the opening operation hole 74 and through which the head part 63 of the operation lever 60 can be operated.

[0033] Then, the cover 70 is inserted between the arm parts 22 and 23 of the case 20, the stepped parts 71 of the cover 70 are fitted in the guide grooves 24 and 24 of the arm parts 22 and 23 and are slid, and the protrusions 72 and 72 of the cover 70 are engaged with the recesses 24b and 24b of the arm parts 22 and 23. By this, it is possible to prevent the cover 70 from coming out, and the electric wire insertion hole 73 communicates with the electric wire insertion hole 53 of the base 50. Further, as shown in Fig. 3A, the head part 63 of the operation lever 60 can be seen through the opening operation hole 74 of the cover 70. Besides, the connecting long hole 76 is formed of the notch part 76a and the one-side end face of the case 50. Then, the axial part 61 of the operation lever 60 can be seen through the connecting long hole 76 (Fig. 4A).

[0034] Next, an operation method of the electric wire connecting connector having the foregoing structure will be described.

[0035] First, when the head part 63 of the operation lever 60 is pushed in from the opening operation hole 74 by a not-shown operation rod, the radius surface 62 of the axial part 61 of the operation lever 60 gets over the first bent part 43 from the relay hold part 42 of the plate spring 40, and pushes down the plate spring 40. Thus, the axial part 61 of the operation lever 60 is held tightly between the plate spring 40 and the partition wall 55 of the base 50. As a result, a gap is produced between the free end of the pressing tongue part 45 and the upper bent piece 32 of the connection metal fitting 30. At this time, the head part 63 of the operation lever 60 can be seen through the connecting long hole 76. According to this embodiment, since substantially the whole upper surface of the axial part 61 of the pushed operation lever 60 is in press contact with the partition wall 55 of the base 50, there is a merit that the operation lever 60 is hard to damage.

[0036] Next, an electric wire 100 is inserted through the electric wire insertion hole 73 of the cover 70, and a core wire 101 is positioned between the upper bent piece 32 of the connection metal fitting 30 and the end edge part of the pressing tongue part 45. According to this embodiment, since the base 50 is formed of the transparent resin material, it is possible, from the outside of the base 50, to see whether the core wire 101 of the electric wire 100 is disposed at a predetermined position, and there is a merit that the workability of the connecting operation can be improved.

[0037] Then, when an operation rod is pushed in the connecting long hole 76, after the operation lever 60 is slightly slid outward, the operation lever 60 is instantaneously pushed out by the spring force of the elastically returned plate spring 40. Thus, the head part 63 of the operation lever 60 collides with the stopper 75 to emit a

collision sound. As a result, the plate spring 40 is elastically returned, and the upper bent piece 32 of the connection metal fitting 30 and the pressing tongue part 45 of the plate spring 40 hold the core wire 101 of the electric wire 100 tightly so that the wire connection state is obtained.

[0038] In this embodiment, although the operation lever 60 is about to jump out to the outside by the spring force of the plate spring 40, the head part 63 of the operation lever 60 collides with the stopper 75 of the cover 70 and is locked. Especially, when the head part 63 of the operation lever 60 collides with the stopper 75 of the cover 70, the collision sound is produced, and the operation of the operation lever 60 can be confirmed by the collision sound. Besides, in case noticeable painting of orange or the like is applied to an inner surface of the head part 63 of the operation lever 60, the confirmation is further facilitated.

[0039] According to this embodiment, the opening operation and the connecting operation can be performed by one kind of pressing operation, and the workability is high.

[0040] Besides, in the case where the position of the operation lever 60 is in the wire connection state, the head part 63 of the operation lever 60 can be clearly seen through the opening operation hole 74 of the cover 70, while the head part 63 of the operation lever 60 can not be seen through the connecting long hole 76. Further, in the case where the position of the operation lever 60 is in the open state, although the head part 63 of the operation lever 60 is hard to see through the opening operation hole 74 of the cover 70, the head part 63 of the operation lever 60 can be clearly seen through the connecting long hole 76. As stated above, according to this embodiment, the wire connection state or the open state can be confirmed by seeing the position of the operation lever 60 in two directions, which is convenient.

[0041] Further, according to this embodiment, the head parts 63 of the plural operation levers 60 can be seen through the connecting long hole 76. Thus, not only the operation levers 60 can be selected and operated one by one, but also the plural operation levers 60 can be operated at once when a wide operation rod is inserted in the connecting long hole 76, and the workability is further improved.

[0042] As shown in Figs. 5 to 8, a second embodiment is such that an electric wire connecting connector body 13 is housed in a first outside cover 80 and a second outside cover 90.

[0043] As shown in Fig. 6, the electric wire connecting connector body 13 is almost similar to the first embodiment, and a significantly different point is that the cover 70 in the first embodiment is not provided. Thus, both-side arm parts 22 and 23 of a case 20 of the second embodiment are shorter than the both-side arm parts 22 and 23 of the case 20 of the first embodiment. As a result, when axial parts 61 of operation levers 60 are respectively inserted in insertion holes 54 of a base 50,

head parts 63 of the operation levers 60 protrude from the outside surface of the base 50. Incidentally, the same portions as the first embodiment are designated by the same reference numerals and their description will be omitted.

[0044] The first and the second outside covers 80 and 90 have such shapes that they can cover the electric wire connecting connector body 13 from above and below. Especially, an operating projection 81 for operating the head part 63 of the operation lever 60 to slide it, and a stopper 82 for preventing the operation lever 60 from jumping out are formed on the bottom of the first outside cover 80.

[0045] The first and the second outside covers 80 and 90 are rotatably supported such that axial holes 83 and 91 are respectively engaged with axial parts 20a and 20b provided to protrude from both-side edge parts of the case 20. Thus, when the first and the second outside covers 80 and 90 are turned, and engaging pawls 84 and 92 respectively formed on abutting surfaces are respectively engaged with engaging holes 93 and 85 to unify, the electric wire connecting connector body 13 is covered, and electric wire insertion holes 14 and 15 are formed (Fig. 5).

[0046] Next, an operation method of the electric wire connecting connector of the second embodiment will be described.

[0047] First, in the case where an electric wire (not shown) is connected, as shown in Fig. 7A, the first and the second outside covers 80 and 90 are opened. Then, the protruding head parts 63 of the respective operation levers 60 are pushed in the base 50 by a not-shown operation rod, and first bent parts 43 are pushed down by axial parts 61 of the operation levers 60. As a result, plate springs 40 are elastically deformed and pressing tongue pieces 45 are pushed down, so that a gap is formed between a lower surface edge part of an upper bent piece 32 and the pressing tongue part 45 (Fig. 7B). Next, a not-shown electric wire is inserted through an electric wire insertion hole 53, and its core wire is positioned between the lower surface edge part of the upper bent piece 32 and the pressing tongue part 45. At this time, since base 50 is made of a transparent material, the position of the core wire can be seen.

[0048] Then, the first outside cover 80 is turned to be fitted to the electric wire connecting connector body 13, so that the projection 81 of the first cover 80 is inserted between the base 50 and the head part 63 of the operation lever 60. Thus, the operation lever 60 is slightly pushed outward and after slide movement, the operation lever 60 is instantaneously pushed out by the spring force of the plate spring 40. However, the head part 63 of the operation lever 60 collides with the stopper 82 of the first outside cover 80 to prevent the operation lever 60 from jumping out. At this time, the operation lever 60 emits a collision sound, and the operation of the operation lever 60 can be confirmed by the collision sound.

[0049] Next, the second outside cover 90 is turned to

be fitted to the first outside cover 80, and the engaging pawls 84 and 92 are respectively engaged with the engaging holes 93 and 84, so that the connecting operation of the electric wire is ended.

[0050] According to this embodiment, not only an open state can be produced by respectively pressing the head parts 63 of the operation levers 60 protruding from the insertion holes 54, but also the open state can be produced by pressing the plural operation levers 60 by a wide operation rod at the same time. Further, the first outside cover 80 is fitted to the electric wire connecting connector body 13, so that the projection 81 of the first outside cover 80 drives the head parts 63 of the plural operation levers 60 at the same time to bring about the wire connection state. Thus, the connecting operation of plural electric wires can be performed through one-touch operation, and there is a merit that the workability is remarkably improved.

[0051] Besides, the first outside cover 80 is fitted to the electric wire connecting connector body 13, and after the operation levers 60 are brought into the wire connection states at once, the second outside cover 90 can be fitted to the electric wire connecting connector body 13. Thus, since the second outside cover 90 can be fitted after the wire connection states of all the electric wires are confirmed, it is possible to prevent defective wire connection from occurring.

[0052] Incidentally, the first and the second outside covers 80 and 90 of the second embodiment may be formed by performing press working to metal plates so as to enable magnetic shielding, or may be formed by applying metal plating to resin molded parts. Besides, the first and the second outside covers 80 and 90 for magnetic shielding may be formed by combining metal plates formed by press working and resin molded parts.

[0053] Besides, in the foregoing embodiment, although the description has been given of the case where the connection metal fitting 30 includes the pin terminal 31, the invention may be applied to a connection metal fitting including a socket terminal.

[0054] According to the present invention, the whole operation lever is housed in the housing and the cover. Thus, an obstacle does not happen to collide from the outside, and an incorrect operation can be prevented. Besides, in any case where the operation lever is operated to bring about the open state and the wire connection state, the processing can be performed by one kind of operation of pushing the operation rod, the workability is improved. Especially, in any case where the operation lever is operated to bring about the open state and the wire connection state, the pressing forces are practically equal to each other, and there is an effect that the workability is further improved.

Claims

1. An electric wire connecting connector in which a

substantially L-shaped operation lever is inserted and pushed in an axial direction through an insertion hole provided in a housing, a substantially V-shaped plate spring incorporated in the housing is elastically deformed to form a gap between a connection metal fitting incorporated in the housing and the plate spring and to bring about an open state, and then, an electric wire is positioned in the gap, next, the operation lever is pulled back to elastically return the plate spring, and the electric wire is held tightly by the connection metal fitting and the plate spring to bring about a wire connection state, **characterized in that**

a cover is fitted to the housing to house a head part of the operation lever, an opening operation hole through which the head part of the operation lever positioned in the wire connection state can be pressed in the axial direction is provided in the cover, and a connecting operation hole through which the head part of the operation lever positioned in the open state can be operated is provided between the housing and the cover.

2. The electric wire connecting connector according to claim 1, **characterized in that** a stopper for preventing the operation lever pulled out of the housing from falling off is provided in the cover.

3. The electric wire connecting connector according to claim 1, **characterized in that** a stopper coming in contact with an end face of the head part of the operation lever jumping out of the housing is provided at an opening edge part of the opening operation hole of the cover.

4. An electric wire connecting connector comprising:

an electric wire connecting connector body in which a substantially L-shaped operation lever is inserted and pushed in an axial direction through an insertion hole provided in a housing, a substantially V-shaped plate spring incorporated in the housing is elastically deformed to form a gap between a connection metal fitting incorporated in the housing and the plate spring and to bring about an open state, and then, an electric wire is positioned in the gap, next, the operation lever is pulled back to elastically return the plate spring, and the electric wire is held tightly by the connection metal fitting and the plate spring to bring about a wire connection state; and

a first and a second outside covers rotatably attached to the electric wire connecting connector body and housing the electric wire connecting connector body in a space formed by combining them, **characterized in that** a protrusion to be inserted between a side sur-

face of the housing and a head part of the operation lever positioned in the open state so as to operate the operation lever is provided on the first outside cover.

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5. The electric wire connecting connector according to claim 4, **characterized in that** a stopper coming in contact with an end face of the operation lever jumping out of the electric wire connecting connector body is provided on the first outside cover.

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6. The electric wire connecting connector according to claim 4 or 5, **characterized in that** the first and the second outside covers are provided with a magnetic shield function.

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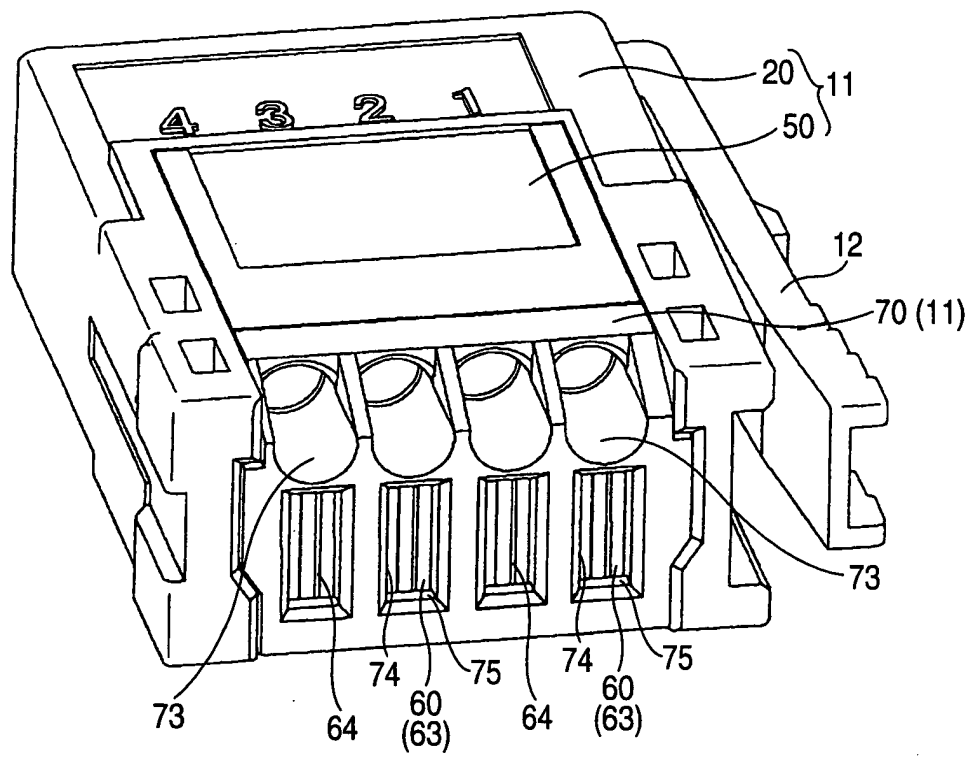
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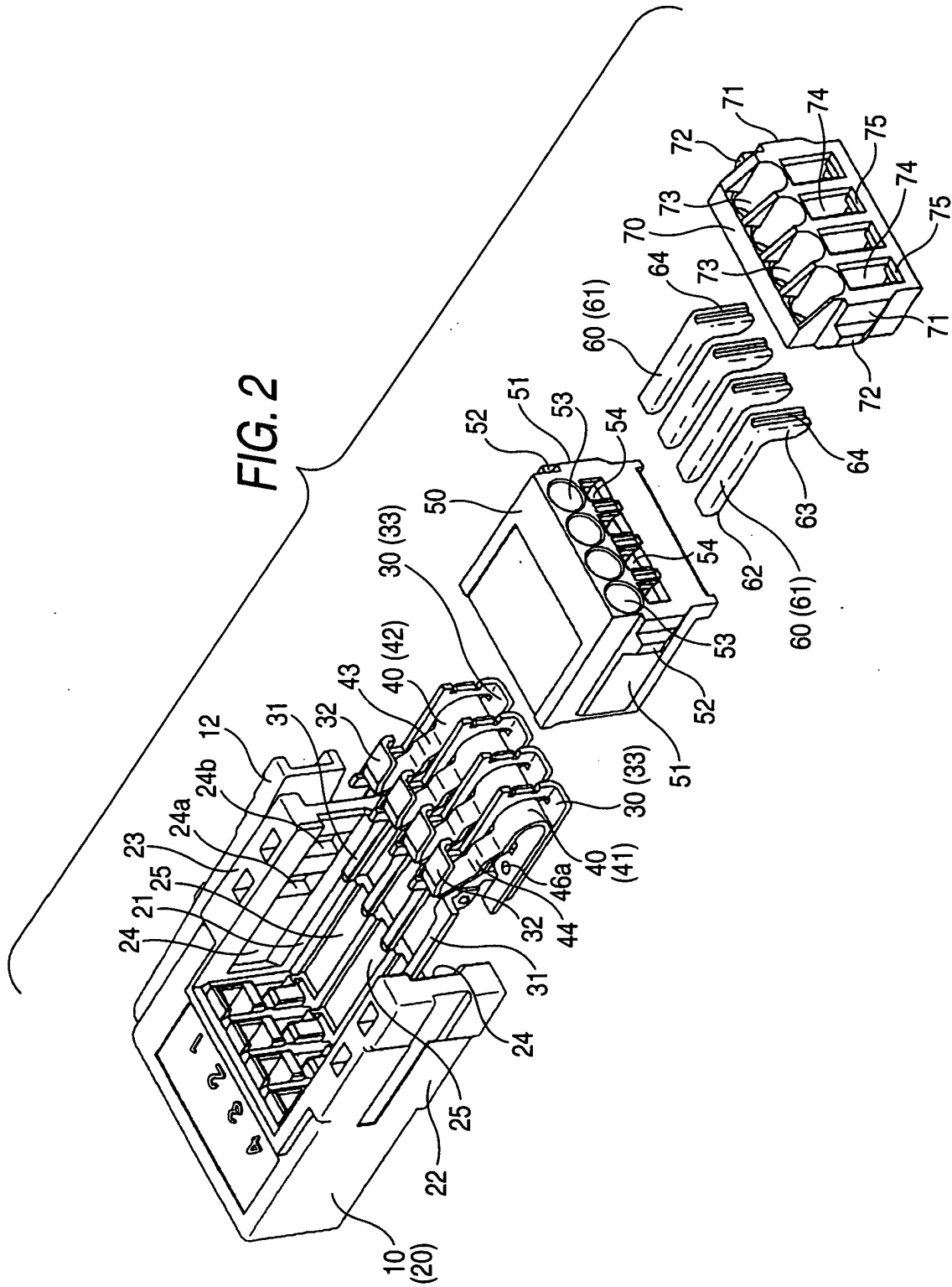
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FIG. 1





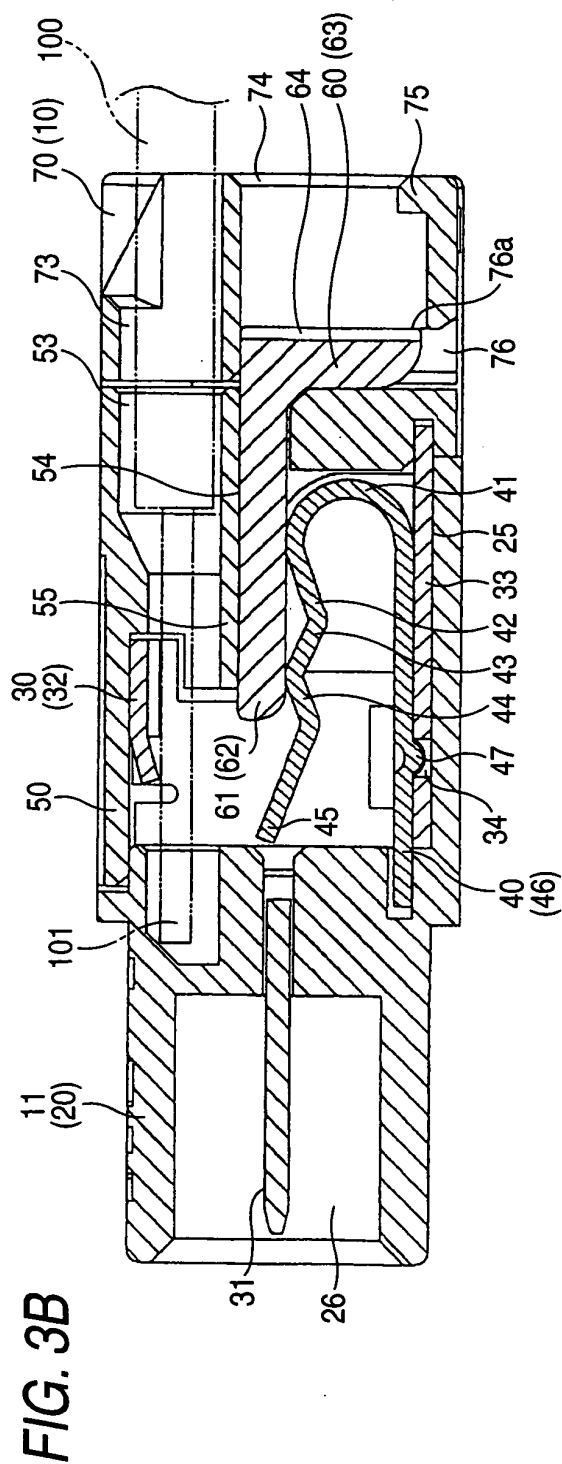
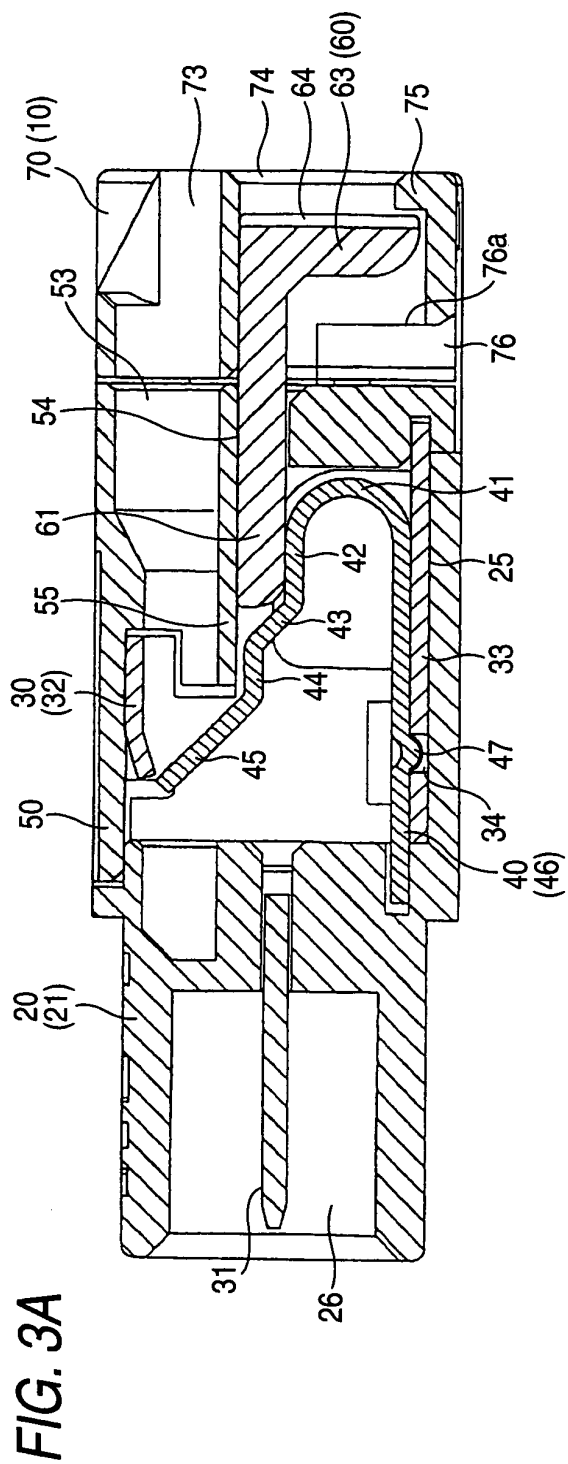


FIG. 4B

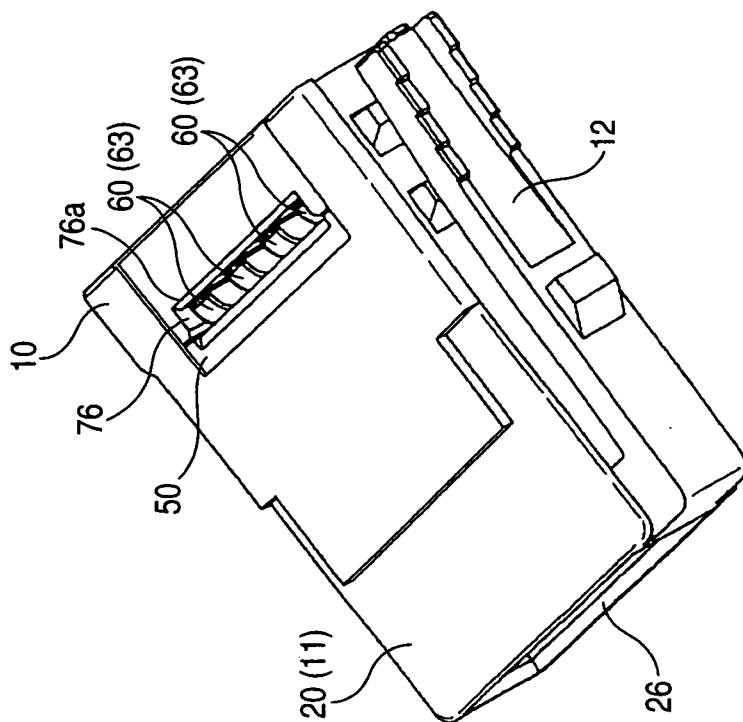


FIG. 4A

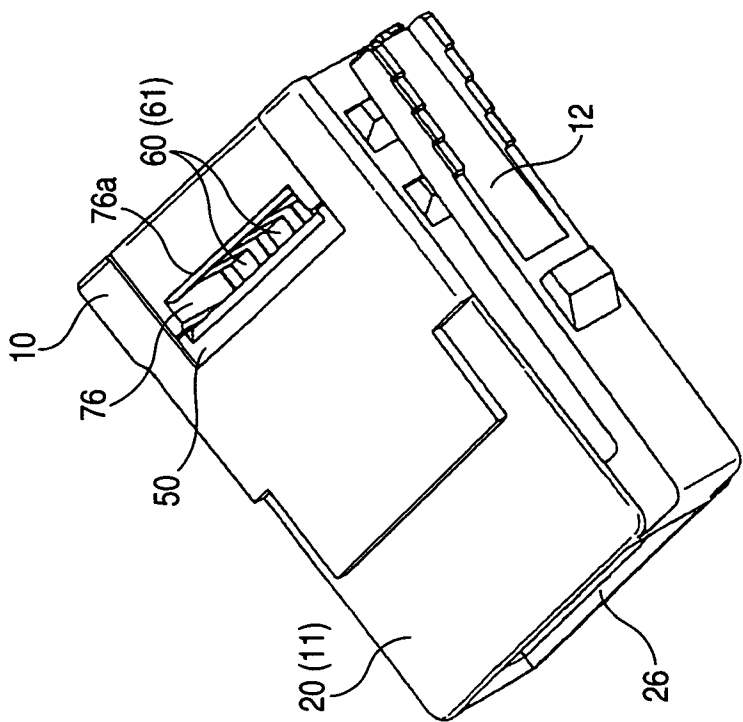


FIG. 5A

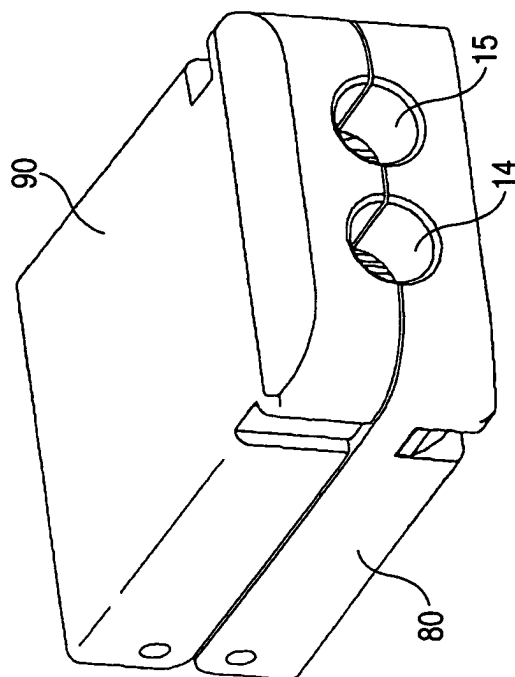


FIG. 5B

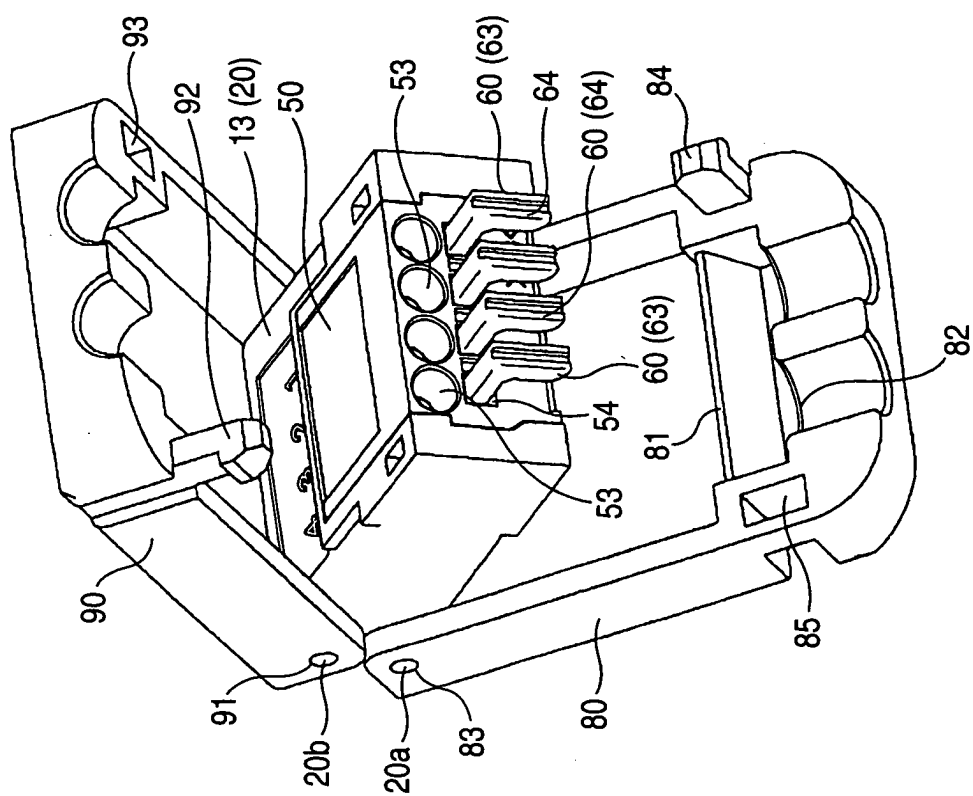


FIG. 6

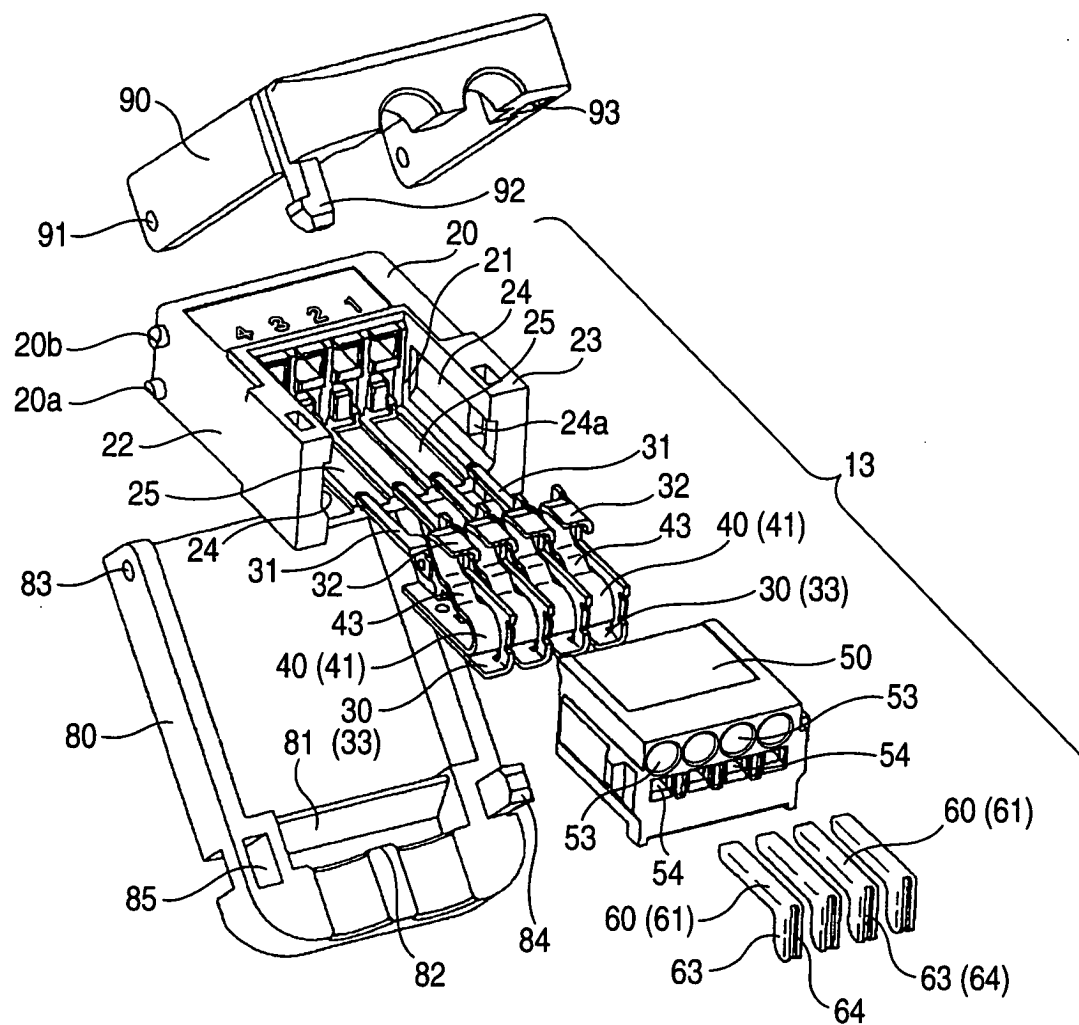


FIG. 7A

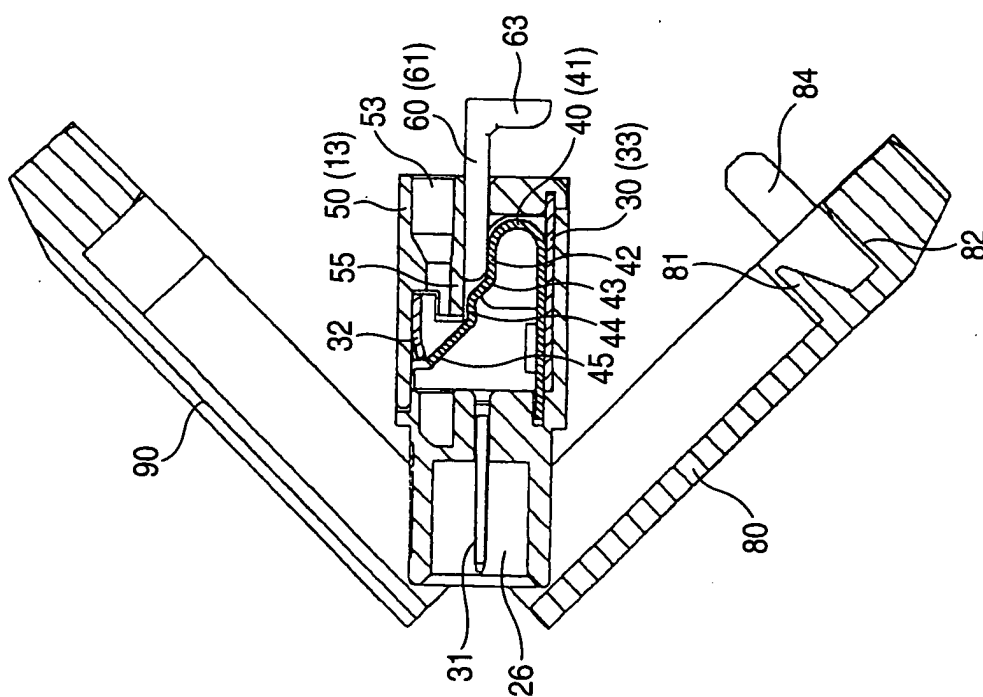


FIG. 7B

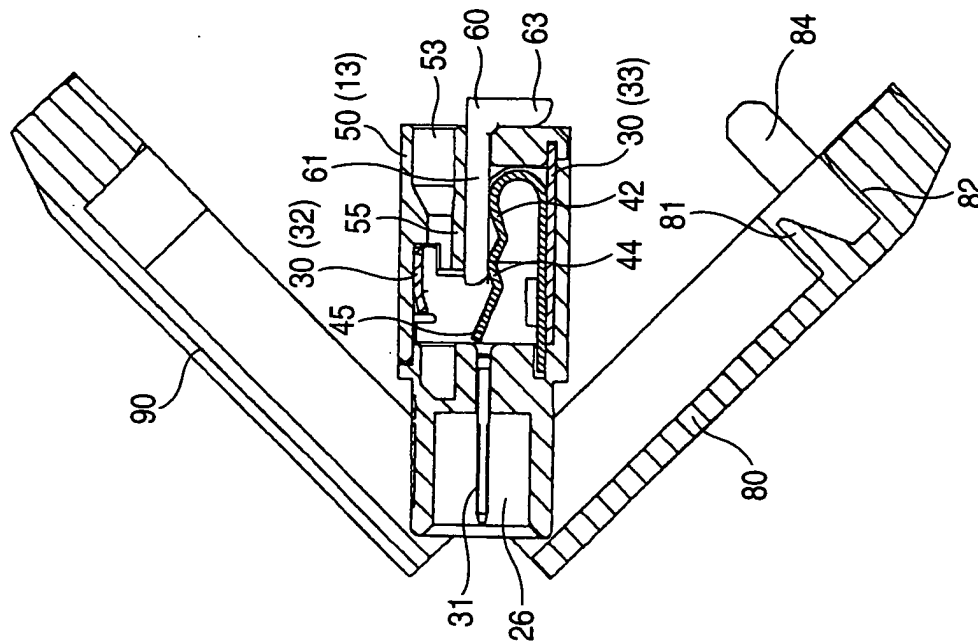


FIG. 8A

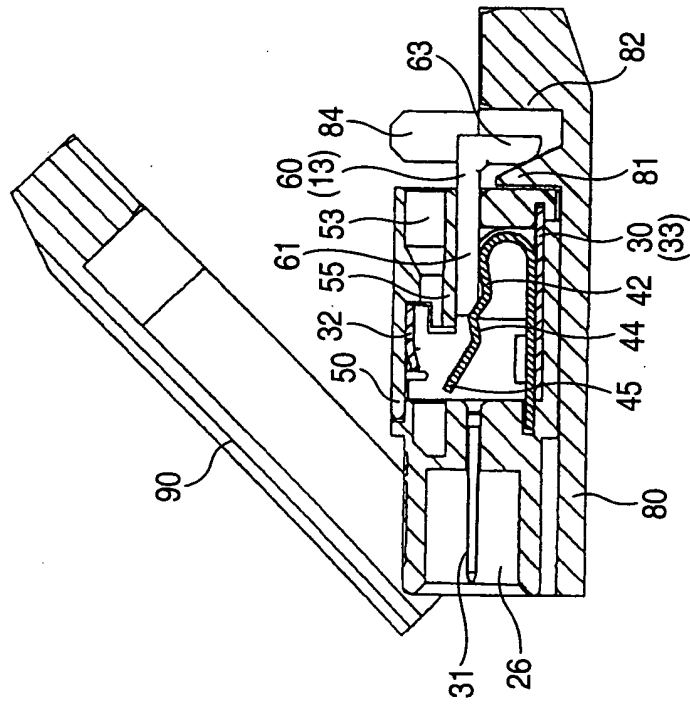


FIG. 8B

