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(54) **Title:** TERMINAL AND CONNECTOR

(57) **Abstract:** The terminal has a base portion held by a terminal holding member, and a contact arm portion extending from the base portion and contacting the contact portion of another terminal. In this terminal, the contact arm portion includes a cantilevered first frame portion and second frame portion extending from the base portion, a connecting frame portion connecting a free end of the first frame portion and a free end of the second frame portion, a contact protruding portion formed in the first frame portion, and a contact face formed in the contact protruding portion; and the contact face moves in a parallel direction and maintains contact with a contact face of a contact portion of another terminal when the contact arm portion is elastically deformed by contact with the contact portion of the other terminal.



TERMINAL AND CONNECTOR

REFERENCE TO RELATED APPLICATIONS

[0001] The Present Disclosure claims priority to prior-filed Japanese Patent Application No. 2012-08626, entitled "Terminal And Connector," filed on 19 January 2012 with the U.S. Patent And Trademark Office. The content of the aforementioned Patent Application is incorporated in its entirety herein.

BACKGROUND OF THE PRESENT DISCLOSURE

[0002] The Present Disclosure relates, generally, to a terminal and a connector, and, more particularly, to a terminal and connector having a contact face on a contact arm portion which is able to follow and maintain contact with a contact face of another terminal.

[0003] In order to connect wiring such as a cable to a circuit board such as a printed circuit board, wire-to-board connectors are used. One example is disclosed in Japanese Patent Application No. 2003-324071, the content of which is incorporated by reference in its entirety herein. When wire-to-board connectors are used, one connector is mounted on a circuit board, and then mated with another connector connected to the end of a cable.

[0004] Fig. 8 is a diagram showing a terminal with a conventional connector. In this drawing, 863 is the main body portion of the terminal attached to a connector (not shown). A contact portion 864 is connected to the free end of the connector that makes contact with a terminal attached to another connector (also not shown). A thin gold sheet 871 is fixed to the curved surface of the contact portion 864 to conform to the uneven surface of the other terminal. In order to improve conformity to the uneven surface, a recessed portion 869 is press-molded in the surface of the contact portion 864, and the recessed portion 869 is crimp-filled with layers of gold foil 872. In this way, the thin gold sheet 871 can be deformed according to the surface unevenness of the other terminal, and the contact area with the surface of the other terminal can be ensured.

[0005] In a conventional terminal, the thin gold sheet 871 has to be fixed to the surface of the contact portion 864 along with gold foil 872. This increases costs. Also, the slender plate-shaped main body portion 863 does not possess sufficient spring action, and it is difficult to increase the contact pressure between the contact portion 864 and the other terminal. Because the thickness and width of the main body portion 863 have to be increased in order to increase the contact pressure between the contact portion 864 and the other terminal, the overall size of the terminal is increased.

SUMMARY OF THE PRESENT DISCLOSURE

[0006] The purpose of the Present Disclosure is to solve the aforementioned disadvantages associated with a conventional terminal by providing a low-cost, compact and reliable
5 terminal and connector having a contact face on a contact arm portion which is able to follow and maintain contact with a contact face of another terminal.

[0007] The terminal of the Present Disclosure has a base portion held by a terminal holding member and a contact arm portion extending from the base portion and contacting the contact portion of another terminal. In this terminal, the contact arm portion includes a cantilevered
10 first frame portion and second frame portion extending from the base portion, a connecting frame portion connecting a free end of the first frame portion and a free end of the second frame portion, a contact protruding portion formed in the first frame portion, and a contact face formed in the contact protruding portion; and the contact face moves in a parallel
15 direction and maintains contact with a contact face of a contact portion of another terminal when the contact arm portion is elastically deformed by contact with the contact portion of the other terminal.

[0008] In another terminal of the Present Disclosure, the contact arm portion includes an open portion whose periphery is defined by the base portion, the first frame portion, the second frame portion, and the connecting frame portion. In another terminal of the Present
20 Disclosure, the contact protruding portion is thicker than the first frame portion. In another terminal of the Present Disclosure, a pair of left and right contact arm portions extend from a single base portion, and are arranged so the contact faces of the contact protruding portions face each other. In another terminal of the Present Disclosure, the contact face is flat.

[0009] The Present Disclosure is also a connector having a terminal of the Present Disclosure and a housing including the terminal holding member. This connector is mated with another
25 connector having a terminal. In another connector of the Present Disclosure, the other terminal has a plate-shaped conductive pattern, the contact portion is a rectangular solid member protruding from the surface of the other terminal, and the other contact face is a flat side face of the contact portion.

[0010] Because the contact face of the contact arm portion of a terminal of the Present
30 Disclosure is able to follow the contact face of another terminal and maintain contact, an electrical connection with the other terminal can be securely established, and reliability is improved. Further, because the configuration is simple, both the cost and size of the terminal can be reduced.

BRIEF DESCRIPTION OF THE FIGURES

[0011] The organization and manner of the structure and operation of the Present Disclosure, together with further objects and advantages thereof, may best be understood by reference to the following Detailed Description, taken in connection with the accompanying Figures, wherein like reference numerals identify like elements, and in which:

[0012] Figure 1 is a diagram showing a connector according to an embodiment of the Present Disclosure, in which Fig. 1(a) is a perspective view and Fig. 1(b) is a top view;

[0013] Figure 2 is a diagram showing the connector of Fig. 1 mounted on a board, in which Fig. 2(a) is a perspective view from the rear and Fig. 2(b) is a perspective view from the front;

[0014] Figure 3 is a diagram showing another connector according to an embodiment of the Present Disclosure, in which Fig. 3(a) is a perspective view and Fig. 3(b) is a top view;

[0015] Figure 4 is a perspective view showing the connector of Fig. 1 mated to that of Fig. 3;

[0016] Figure 5 is a diagram showing a terminal according to an embodiment of the Present Disclosure, in which Fig. 5(a) is a top view and Fig. 5(b) is a side view;

[0017] Figure 6 is a diagram showing the essential portions of the terminal of Fig. 5, in which Fig. 6(a) is a top view, Fig. 6(b) is a bottom view, Fig. 6(c) is a perspective view from the rear and Fig. 6(d) is a perspective view from the front;

[0018] Figure 7 is a diagram used to explain the deformity of the essential portions of a terminal according to an embodiment of the Present Disclosure, in which Fig. 7(a) shows the deformity of essential portions of a terminal according to an embodiment of the Present Disclosure and Fig. 7(b) shows the deformity of essential portions of a terminal according to a comparative example;

[0019] Figure 8 is a diagram showing a terminal with a conventional connector of the prior art, in which Fig. 8(a) is a plan view and Fig. 8(b) is a cross-sectional side view.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0020] While the Present Disclosure may be susceptible to embodiment in different forms, there is shown in the Figures, and will be described herein in detail, specific embodiments, with the understanding that the Present Disclosure is to be considered an exemplification of the principles of the Present Disclosure, and is not intended to limit the Present Disclosure to that as illustrated.

[0021] As such, references to a feature or aspect are intended to describe a feature or aspect of an example of the Present Disclosure, not to imply that every embodiment thereof must have the described feature or aspect. Furthermore, it should be noted that the description illustrates a number of features. While certain features have been combined together to
5 illustrate potential system designs, those features may also be used in other combinations not expressly disclosed. Thus, the depicted combinations are not intended to be limiting, unless otherwise noted.

[0022] In the embodiments illustrated in the Figures, representations of directions such as up, down, left, right, front and rear, used for explaining the structure and movement of the
10 various elements of the Present Disclosure, are not absolute, but relative. These representations are appropriate when the elements are in the position shown in the Figures. If the description of the position of the elements changes, however, these representations are to be changed accordingly.

[0023] Referring to the Figures in general, and to Figs. 1-4 specifically, 1 is a first connector.
15 This is one of the connectors according to the present embodiment. The first connector is for a wire-to-board connector, and is mounted on the surface of a board 91 such as a printed circuit board. Also, 101 is a second connector. This is the other connector according to the present embodiment. The second connector is connected to the end of a cable 191 containing a plurality of wires 192. The first connector 1 and the second connector 101 are mated as
20 shown in Fig. 4.

[0024] The board 91 can be any type of board used in electronic devices such as personal computers, cell phones, personal digital assistants (PDAs), digital cameras, video cameras, music players, gaming devices and car navigation systems, and in the electronic components of electric devices such as digital televisions and DVD players. These boards include printed
25 circuit boards and flexible printed circuit boards, and flat cables such as flexible flat cables. In this explanation, a printed circuit board is used inside a cell phone.

[0025] The cable 191 can be any type of cable used in electronic devices such as personal computers, cell phones, PDAs, digital cameras, video cameras, music players, gaming
30 devices and car navigation systems, and in the electronic components of electric devices such as digital televisions and DVD players. These cables include twisted cables, coaxial cables, and flat cables. In this explanation, a flexible circuit board or flexible flat cable is used inside a cell phone.

[0026] Here, the second connector 101 is a plug connector made out of an insulating material such as a resin, and has a plate-like second main body portion 111 with a rectangular planar

shape, and a plate-like conductive portion 160 arranged on the surface of the second main body portion 111 (on the mated side). The conductive portion 160 is separated into a plurality of conductive patterns 161 (four in the example shown in Fig. 3) by a pattern separating portion 112 protruding from the surface of the second main body portion 111.

5 [0027] The conductive patterns 161 function as the other terminal, and are formed, for example, by patterning copper foil using the etching process. These extend longitudinally in the second connector 101 in the short-axis direction of the second main body portion 111, and are arranged parallel to each other laterally in the second connector 101 in the long-axis direction of the second main body portion 111. Adjacent conductive patterns 161 are
10 separated by a pattern separating portion 112.

[0028] Each conductive pattern 161 functions as a plurality of conductive wires arranged in parallel. Each one is exposed on the surface of the second main body portion 111, and has a single protruding portion 164 serving as the contact portion. In the example shown in Fig. 3, the two conductive patterns 161 arranged to the inside of the second connector 101 in the
15 width direction are narrow and are assumed to be connected to signal lines for transmitting signals. The two conductive patterns 161 arranged to the outside of the second connector 101 in the width direction are wider and are assumed to be connected to a power line for supplying current and to a ground line for grounding. However, the width of each conductive pattern 161 is not limited to the example shown in Fig. 3. The conductive patterns can have
20 any width. For example, the width of the conductive patterns 161 arranged to the inside in the width direction can be wider, or the width of all of the conductive patterns 161 can be equal. Also, the number of conductive patterns 161 is not limited to the example shown in Fig. 3. Any number of conductive patterns can be formed.

[0029] Each protruding portion 164 is a member protruding from the surface of a conductive pattern 161. These can be integrally formed with the conductive patterns 161 using a method
25 such as etching performed using a photolithographic technique. The protruding portions 161 are rectangular solid members extending in the short axis direction of the second main body portion 111, which is the longitudinal direction of the second connector 101. The pair of side faces 164a facing each other are flat, and function as contact faces for contacting the first
30 terminal 61 of the first conductor 1. These side faces extend in the longitudinal direction of the second connector 101 and are orthogonal to the surface of the conductive patterns 161. The corners at the upper end of the side faces 164a can be beveled or inclined. Also, dimensions of the protruding portions 164 can be changed. In this example, the width is

approximately 0.5 mm, the height is approximately 0.5 mm, and the length is approximately 1.5 mm.

[0030] A second holding portion 113 serving as a band-shaped terminal holding member is made of an insulating material such as a resin and extends over the upper face of a conductive patterns 161 in the width direction of the second connector 101, which is the long axis direction of the second holding portion 113. The conductive pattern 161 is pinched from above and below by the second holding portion 113 and the second main body portion 111, and is secured to the second main body portion 111.

[0031] Each conductive pattern 161 has a tail portion 162 extending in the short axis direction of the second main body portion 111. Each tail portion 162 protrudes to the rear and to the outside beyond the second main body portion 111 and the second holding portion 113. The end portion of the cable 191 is connected by soldering each flat electric wire 192 in the cable 191. The width of each electric wire 192 conforms to the width of the corresponding conductive pattern 161 and tail portion 162. As in the case of the conductive patterns 161, the width and number of electric wires 192 are not limited to the example shown in Fig. 3. Any width and number can be selected.

[0032] The flat cable 191 has an insulating layer 195 formed on the same face (the face mated with the second connector 101). However, an opening 195a is formed in the insulating layer 195 in the end portion of the cable to expose a portion of each electric wire 192 in the opening 195a and enable connection of the tail portion 162. A flat, thin reinforcing plate 193 is arranged on the other face in the end portion of the cable 191 (the face on the opposite side of the mated second connector 101). The reinforcing plate 193 can be made of any material. Examples include a metal sheet such as a stainless steel plate, a resin sheet, or a composite sheet containing glass fibers or carbon fibers.

[0033] A locking protruding portion 118 is formed on the side face of the second main body portion 111 which serves as another locking portion protruding to the outside. The locking protruding portion 118 engages the locking piece 18 of the first connector 1 to lock the mated first connector 1 and second connector 101.

[0034] The first connector 1 is a receptacle connector including a first housing 11, which is molded into a substantially rectangular solid shape using an insulating material such as a resin, and first terminals 61, which are metal terminals attached to the first housing 11.

[0035] In the present embodiment, each first terminal 61, as described below, has a tuning fork planar shape, and includes a single base portion 63, a pair of contact arm portions 64 extending forward from the base portion 63, a contact protruding portion 64d formed in the

contact arm portions 64, and a single tail portion 62 extending to the rear from the base portion 63.

[0036] Also, the first housing 11 includes a first holding portion 13, which is a terminal holding member with a slender rectangular solid shape extending in the width direction of the first connector 1, and a first main body portion 15, which is the main body portion extending from the first holding portion 13 to the front of the first connector 1. The first main body portion 15 has a flat bottom plate portion 14, and a mating protruding portion 12 with a slender rectangular solid shape connected to the surface of the bottom plate portion 14 and extending from the first holding portion 13 to the front of the first connector 1. There is more than one mating protruding portion 12 (five in the example shown in Figs. 1-2), and these extend in the longitudinal direction of the first connector 1, and are parallel to each other in the width direction of the first connector 1. Adjacent mating protruding portions 12 are separated by a mating recessed portion 12a. In other words, the mating protruding portions 12 are arranged in comb shape. The width of each mating recessed portion 12a is the same, but the width of each mating protruding portion 12 does not have to be the same.

[0037] Each first terminal 61 is attached to the first housing 11 so that the base portion 63 is held inside the first holding portion 13, the contact arm portions 64 are accommodated by the mating protruding portion 12, a portion of the contact protruding portion 64d protrudes into the mating recessed portion 12a, and the tail portion 62 extends outward to the rear of the first holding portion 13.

[0038] In the example shown in Figs. 1-2, the two first terminals 61 arranged on the inside in the width direction of the first connector 1 are assumed to be connected to signal lines for transmitting signals and have a narrow base portion 63 and tail portion 62, and the two first terminals 61 arranged on the outside in the width direction of the first connector 1 are assumed to be connected to a power line for supplying current and to a ground line for grounding and have a wider base portion 63 and tail portion 62. However, the width of the base portion 63 and tail portion 62 of each first terminal 61 is not limited to the example shown in Figs. 1-2. The terminals can have any width. For example, the width of the base portion 63 and the tail portion 62 of the first terminals 61 arranged to the inside in the width direction can be wider, or the width of the base portions 63 and tail portions 62 of all first terminals 61 can be equal. Also, the number of first terminals 61 is not limited to the example shown in Fig. 3. Any number of terminals can be formed.

[0039] Each tail portion 62 is connected to a connecting pad 92 formed on the surface of the board 91 using, for example, solder. This establishes an electrical connection with the

conductive traces connected to connecting pads 92. The conductive traces in the board 91 are not shown in the drawings. The width of each connecting pad 92 conforms to the width of the tail portion 62 of the corresponding first terminal 61. The width and number of connecting pads 92 are not limited to the example shown in Fig. 2. Any width and number
5 can be used.

[0040] As shown in Fig. 2(b), a groove portion 12b is formed in the side face of the mating protruding portion 12 on both sides of the mating recessed portions 12a in the boundary portion with the bottom plate portion 12. The groove portions 12b are formed inside the mating protruding portion 12 and extend in the longitudinal direction of the first connector 1 to serve as a contact arm portion accommodating groove. A contact arm portion 64 of a first
10 terminal 61 is accommodated inside each groove portion 12b, and a portion of a contact protruding portion 64d protrudes from the side face of the mating protruding portion 12 inside the mating recessed portion 12a. As shown in Fig. 1(b), the position of each mating recessed portion 12a with respect to the width direction of the first connector 1 corresponds to the position of the tail portion 62 of each first terminal 61 with respect to the width
15 direction of the first connector 1. The position of each mating recessed portion 12a with respect to the width direction of the first connector 1 also corresponds to the position of each first terminal protruding portion 164 on a second connector 101 mated with a first connector 1 with respect to the width direction of the second connector 101. A pair of contact arm
20 portions 64 on each first terminal 61 is present on both sides of the mating recessed portion 12a in the corresponding position.

[0041] The first connector 1 also has a pair of metal auxiliary brackets 81. Each auxiliary bracket 81 is arranged to the outside of the first main body portion 15 on the left and right sides, and are held by the first housing 11. The front end of each auxiliary bracket 81
25 protrudes forward on the outside of the first main body portion 15 and functions as a front connection portion 83. This is secured to a securing pad 93 formed on the surface of the board 91 using, for example, soldering. Also, the rear end of each auxiliary bracket 81 protrudes rearward on the outside of the first holding portion 13 and functions as a rear connection portion 82. This is secured to a connecting pad 92 connected to the tail portion 62
30 of the adjacent first terminal 61 using, for example, soldering. The rear connection portion 82 does not have to be secured to a connecting pad 92 connected to the tail portion 62 of the adjacent first terminal 61. It can also be secured to a securing pad 93 separate from the connecting pad 92. By securing the front connecting pads 83 of the auxiliary brackets 81 to

securing pads 93 or connecting pads 92 on the board 91, the first connector 1 is reliably secured to the surface of the board 91.

[0042] The first housing 11 has a side wall portion 17 which is formed to the outside of the auxiliary bracket 81 on the first main body portion 15. The side wall portion 17 includes a locking piece 18 which engages the locking protruding portion 118 of the second connector 101.

[0043] When the first connector 1 and the second connector 101 are to be mated, the operator aligns the mating face of the first connector 1 (the face shown in Fig. 1(b)) with the mating face of the second connector 101 (the face shown in Fig. 3(b)), the first connector 1 and/or the second connector 101 is moved closer to the other one, each protruding portion 164 of the second connector 101 is inserted into the corresponding mating recessed portion 12a in the first connector 1, and the protruding portions 164 are pushed between contact protruding portions 64d on contact arm portions 64 protruding into the mating recessed portions 12a from the side faces of the mating protruding portions 12 on both sides of the mating recessed portions 12a. In this way, the contact protruding portions 64d of the contact arm portions 64 of the first terminals 61 are brought into contact with the side faces 164a of the protruding portions 164 protruding from the surface of the conductive patterns 161, and an electrical connection is established between corresponding conductive patterns 161 and first terminals 61.

[0044] Here, the interval between opposing contact protruding portions 64d is pushed apart by the protruding portions 164, and the contact arm portions 64 are elastically deformed. Because the contact protruding portions 64d are pushed against the side faces 164a of the protruding portions 164 by the spring action generated by the elastically deformed contact arm portions 64, contact between the contact protruding portions 64d and the side faces 164a can be reliably maintained.

[0045] When the first connector 1 and the second connector 101 are mated as shown in Fig. 4, the locking piece 18 on the first connector 1 and the locking protruding portion 118 on the second connector 101 engage each other. In this way, the first connector 1 and the second connector 101 are locked together, and are kept from becoming unintentionally disengaged.

[0046] Referring to Figs. 5-7, a first terminal 61, as shown in FIG. 5, is a metal plate with a substantially tuning fork-shaped planar profile. This terminal has a single base portion 63, a pair of contact arm portions 64 extending forward from the base portion 63, and a single tail portion 62 extending rearward from the base portion 63.

[0047] In the example shown in Fig. 5, the connecting portion between the tail portion 62 and the base portion 63 has a crank-shaped side profile. However, this side profile can also be linear. Also, an engaging protruding portion 63a and an engaging uneven portion 63b are formed in the top face and side face of the base portion 63 to hold the engaged first holding
5 portion 13 of the first housing 11. However, the engaging protruding portion 63a and engaging uneven portion 63b can be omitted.

[0048] There does not have to be a pair of left and right contact arm portions 64 as shown in Fig. 5. There can also be a single contact arm portion as shown in Fig. 6. Here, when the first connector 1 and the second connector 101 are mated, the contact protruding portion 64d
10 of the contact arm portion 64 makes contact with the left or right side face 164a of the protruding portion 164 protruding from the surface of the conductive pattern 161, and the contact protruding portion 64d of the contact arm portion 64 does not make contact with the other side face 164a of the protruding portion 164. In the example shown in Fig. 6, depiction of the tail portion 62 has been omitted.

[0049] Each contact arm portion 64 is a member integrally formed using a method such as etching performed with a photolithographic technique, and is integrated with the base portion 63. The dimensions of each contact arm portion 64 can be changed. In this example, the width is approximately 0.5 mm, the height is approximately 0.3 mm and the length is approximately 2.5 mm.
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[0050] The contact arm portion 64 is a slender, substantially rectangular plate member extending forward from the base portion 63, and a slender slit-shaped open portion 64e is formed in the center of the plate in the width direction (longitudinally in Figs. 6(a)-(b)) and extends in the length direction (laterally in Figs. 6(a)-(b)). The open portion 64e passes through the contact arm portion 64 in the thickness direction of the plate. One side of the
25 open portion 64e is a first frame portion 64a serving as a slender rod-shaped frame portion extending forward from the base portion 63, and the other side of the open portion 64e is a second frame portion 64b serving as a slender rod-shaped frame portion extending forward from the base portion 63. The tip of the open portion 64e is at the free ends of the first frame portion 64a and the second frame portion 64b. In other words, it is the connecting frame
30 portion 64c serving as the slender rod-shaped frame portion connecting the tips. Put another way, the cantilevered contact arm portion 64 extending forward from the base portion 63 consists of a first frame portion 64a and a second frame portion 64b, which are two slender cantilevered members extending forward from the base portion 63, and a connecting frame portion 64c connecting the free ends of the first frame portion 64a and the second frame

portion 64b. The slit-shaped open portion 64e is defined by the base portion 63, the first frame portion 64a, the second frame portion 64b, and the connecting frame portion 64c.

[0051] A contact protruding portion 64d is formed near the free end of the first frame portion 64a. The contact protruding portion 64d is thicker than the first frame portion 64a, that is,
5 has a greater thickness than the first frame portion 64a. It has a trapezoidal planar profile, and protrudes further to the outside than the first frame portion 64a. The side face 64f of the protruding portion of the contact protruding portion 64d is flat and functions as the contact face which makes contact with the side face 164a of the protruding portion 164 function as the opposing side face. Because the contact protruding portion 64d is thicker than the first
10 frame portion 64a as shown in Fig. 6(d), the side face 64f is also thicker than the side face of the first frame portion 64a. As a result, the contact area of the side face 64f is greater. This widens the contact area with respect to the side face 164a of the protruding portion 164, and can reduce the contact resistance between the contact protruding portion 64d and the protruding portion 164. If necessary, the thickness of both the contact protruding portion 64d
15 and the first frame portion 64a can be equal.

[0052] As shown in Fig. 7(a), when the first connector 1 and the second connector 101 are mated and an electrical connection has been established between the first terminals 61 and corresponding conductive patterns 161, the side faces 64f of the contact protruding portions 64d of the contact arm portions 64 of the first terminals 61 make contact with the side faces
20 164a of the protruding portions 164 protruding from the surface of the conductive patterns 161. Here, the contact protruding portions 64d are displaced by the protruding portions 164 in the direction opposite that of the protruding portions 164 (to the right in the Figure). As a result, the cantilevered contact arm portions 64 are elastically deformed so that the free end is displaced in the direction opposite that of the protruding portions 164. The deformation of
25 the contact arm portion 64 can be more readily understood by comparing Fig. 7(a) to Fig. 6(a).

[0053] When a deformed contact arm portion 64 is more closely examined, it is clear that the direction of extension for the side face 64f of the contact protruding portion 64d is nearly the same as the direction of extension before deformation. In other words, the side face 64f of
30 the contact protruding portion 64d remains nearly parallel before and after deformation. Before deformation, as shown in Figs. 5(a) and 6(a), the longitudinal axis of the contact arm portion 64 is orthogonal to the width direction of the base portion 63 connected at the base end, and the direction of extension of the side face 64f of the contact protruding portion 64d is nearly parallel to the longitudinal axis of the contact arm portion 64 and orthogonal to the

width direction of the base portion 63. After deformation, as shown in Fig. 7(a), the longitudinal axis of the contact arm portion 64 is inclined and curved in the direction opposite that of the protruding portion 164 with respect to the width direction of the base portion 63 (to the right in the drawing). However, the direction of extension of the side face 64f of the contact protruding portion 64d is still nearly orthogonal to the width direction of the base portion 63. In other words, the side face 64f of the contact protruding portion 64d have moved in the parallel direction while maintaining the same orientation.

[0054] Also, when the first connector 1 and the second connector 101 have been mated, the longitudinal axis of the protruding portion 164 of the conductive pattern 161 and the side face 164a of the protruding portion are substantially parallel to the longitudinal axis of the mating recessed portion 12a of the first connector 1. Therefore, when the protruding portion 164 displaces the contact protruding portion 64d in the direction opposite that of the protruding portion 164, the side face 64f of the contact protruding portion 64d moves on a substantially parallel direction while maintaining the same orientation with respect to the side face 164a of the protruding portion 164. As a result, good contact can be maintained with the side face 164a of the protruding portion 164. Because, as mentioned above, the side face 164a of the protruding portion 164 and the side face 64f of the contact protruding portion 64d are flat, the side face 64f of the contact protruding portion 64d can maintain good contact with the side face 164a of the protruding portion 164 over a wide area. Therefore, as shown in Fig. 7(a), the side face 64f of the contact protruding portion 64d can maintain good contact with the side face 164a of the protruding portion 164 and low contact resistance can be maintained.

[0055] The side face 64f of the contact protruding portion 64d is able to move in a parallel direction because the first frame portion 64a in which the contact protruding portion 64d has been formed is a cantilevered member that is narrower than the contact arm portion 64 as a whole. This gives it greater flexibility and a greater degree of deformational freedom. As a result, it can be freely deformed near the connecting portion with the base portion 63 or near the connecting portion with the side end of the base portion 64 of the contact protruding portion 64d (the lower end in Fig. 7(a)). This allows the contact protruding portion 64d to be displaced in a direction other than the overall direction of displacement of the first frame portion 64a. Also, the second frame portion 64b functions as a backup, which supports the first frame portion 64a from the rear side of the first frame portion 64a, that is, from the side opposite that of the protruding portion 164 (the right side in Fig. 7(a)). Because resisting force is applied to the free end of the first frame portion 64a, that is, towards the protruding portion 164, via the connecting frame portion 64c, the opposite end of the base portion 63

with respect to the contact protruding portion 64d (the upper end in Fig. 7(a)) is pushed in the direction of the protruding portion 164 (to the left in Fig. 7(a)).

[0056] The function of the second frame portion 64b can be more readily understood with reference to the comparative example shown in Fig. 7(b). In the comparative example shown in Fig. 7(b), the connecting frame portion 64c and the second frame portion 64b have been omitted. In other words, in the comparative example, the contact arm portion 264 is a cantilevered member with the same width as the first frame portion 64a, and the base end is connected to a base portion 263 identical to base portion 63. A contact protruding portion 264d identical to contact protruding portion 64d is formed near the free end of the contact arm portion 264. In the comparative example, when the protruding portion 164 of the conductive pattern 161 pushes to the left in Fig. 7(b) and the contact protruding portion 264d is displaced to the right, the side face 264f of the contact protruding portion 264d becomes significantly skewed with respect to the side face 164a of the protruding portion 164 and most of it moves away from the side face 164a. As a result, sufficient contact area cannot be maintained, and contact resistance increases.

[0057] In the comparative example shown in Fig. 7(b), the skew of the side face 164a with respect to the other side face 264f can be reduced and the coming apart of the side face 164a from the other side face 264f can be prevented to a certain extent by reducing the amount of displacement of the contact protruding portion 264d to the right. However, because the amount of displacement of the contact arm portion 264 is reduced, the deformation gives the contact arm portion 264 less spring action, and the contact pressure from the side face 264f on the other side face 164a is reduced. As a result, it is difficult to maintain contact between side face 264f and side face 164a.

[0058] In contrast, because the contact arm portion 64 in the present embodiment has the structure shown in Figs. 5-6, the side face 64f of the contact protruding portion 64d can maintain contact with the side face 164a of the protruding portion 164 over a wide contact area even when the contact arm portion 64 is deformed significantly and the contact protruding portion 64d is also displaced significantly. Thus, sufficient contact pressure can be maintained while reliably maintaining contact over a wide contact area. As a result, low contact resistance can be maintained.

[0059] In the present embodiment, as mentioned above, a first terminal 61 has a base portion 63 held by a first holding portion 13, and a contact arm portion 64 extending from the base portion 63 and making contact with the protruding portion 164 of the conductive pattern 161. The contact arm portion 64 includes a cantilevered first frame portion 64a and second frame

portion 64b extending from the base portion 63, a connecting portion 64c connecting the free end of the first frame portion 64a and the free end of the second frame portion 64b, a contact protruding portion 64d formed on the first frame portion 64a, and a side face 64f formed in the contact protruding portion 64d. The side face 64f moves parallel and maintains contact
5 with the side face 164a of the protruding portion 164 of the conductive pattern 161 when the contact arm portion 64 is elastically displaced by contact with the protruding portion 164 of the conductive pattern 161.

[0060] Because the side face 64f of the contact protruding portion 64d can follow and maintain contact with the side face 164a of the protruding portion 164 of the conductive
10 pattern 161, an electrical connection can be reliably maintained between a first terminal 61 and a conductive pattern 161. Also, because the structure of the first terminal 61 is simple, both its cost and size can be reduced.

[0061] Also, the contact arm portion 64 has an open portion 64e whose periphery is defined by the base portion 63, the first frame portion 64a, the second frame portion 64b, and the
15 connecting portion 64c. Because this improves the flexibility of the first frame portion 64a, the side face 64f of the contact protruding portion 64d formed in the first frame portion 64a can reliably maintain contact with the side face 164a of the protruding portion 164 of the conductive pattern 161.

[0062] The contact protruding portion 64d is thicker than the first frame portion 64a. This
20 maintains the flexibility of the first frame portion 64a as well as the rigidity of the contact protruding portion 64d. It thus maintains flat contact with the side face 64f. Also, the area of the side face 64f can be widened. As a result, the contact area with the side face 164a of the protruding portion 164 of the conductive pattern 161 can be widened, and low contact resistance can be maintained with the side face 164a of the protruding portion 164 of the
25 conductive pattern 161.

[0063] Also, a pair of left and right contact arm portions 64 extend from a single base portion 63, and are arranged so the contact faces 64f of the contact protruding portions 64d face each other. In this way, the protruding portion 164 of a conductive pattern 161 can be elastically
30 pinched from both sides, and contact with the protruding portion 164 of the conductive pattern 161 can be reliably maintained.

[0064] Also, the first connector 1 has a first terminal 61, and a first housing 11 including a first holding portion 13, and is mated with a second connector 101 with a conductive pattern 161. In this way, the first connector 1 can be reliably mated with the second connector 101 to establish an electrical connection.

[0065] Also, the conductive pattern 161 is a plate-shaped, the contact portion 164 is a rectangular solid member protruding from the surface of the other conductive pattern 161, and the side face 164a is a flat side face of the contact portion 164. In this way, contact can be maintained between the side face 64f of the contact protruding portion 64d of the first terminal 61 and the side face 164a of the protruding portion 164 of the conductive pattern 161 over a wide contact area, and low contact resistance can be maintained between the first terminal 61 and the conductive pattern 161.

[0066] While a preferred embodiment of the Present Disclosure is shown and described, it is envisioned that those skilled in the art may devise various modifications without departing from the spirit and scope of the foregoing Description and the appended Claims.

CLAIMSWHAT IS CLAIMED IS:

- 5 1. A terminal, the terminal comprising:
 a base portion held by a terminal holding member; and
 a contact arm portion extending from the base portion and contacting the
 contact portion of another terminal, the contact arm portion including a cantilevered first
 frame portion and second frame portion extending from the base portion, a connecting frame
10 portion connecting a free end of the first frame portion and a free end of the second frame
 portion, a contact protruding portion formed in the first frame portion, and a contact face
 formed in the contact protruding portion;
 wherein the contact face moves in a parallel direction and maintains contact
 with a contact face of a contact portion of another terminal when the contact arm portion is
15 elastically deformed by contact with the contact portion of the other terminal.
2. The terminal of Claim 1, wherein the contact arm portion further includes an
 open portion whose periphery is defined by the base portion, the first frame portion, the
 second frame portion, and the connecting frame portion.
- 20 3. The terminal of Claim 2, wherein the contact protruding portion is thicker than
 the first frame portion.
4. The terminal of Claim 3, wherein a pair of left and right contact arm portions
25 extend from a single base portion, and are arranged so the contact faces of the contact
 protruding portions face each other.
5. The terminal of Claim 4, wherein the contact face is flat.
- 30 6. A connector, the connector comprising:
 a terminal, the terminal including:
 a base portion held by a terminal holding member; and
 a contact arm portion extending from the base portion and contacting the
 contact portion of another terminal, the contact arm portion including a

5 cantilevered first frame portion and second frame portion extending from the base portion, a connecting frame portion connecting a free end of the first frame portion and a free end of the second frame portion, a contact protruding portion formed in the first frame portion, and a contact face formed in the contact protruding portion;

the contact face moves in a parallel direction and maintains contact with a contact face of a contact portion of another terminal when the contact arm portion is elastically deformed by contact with the contact portion of the other terminal; and

10 a housing including the terminal holding member, the connector being mated with another connector having a terminal.

7. The connector of Claim 6, wherein the other terminal has a plate-shaped conductive pattern, the contact portion is a rectangular solid member protruding from the surface of the other terminal, and the other contact face is a flat side face of the contact portion.

15

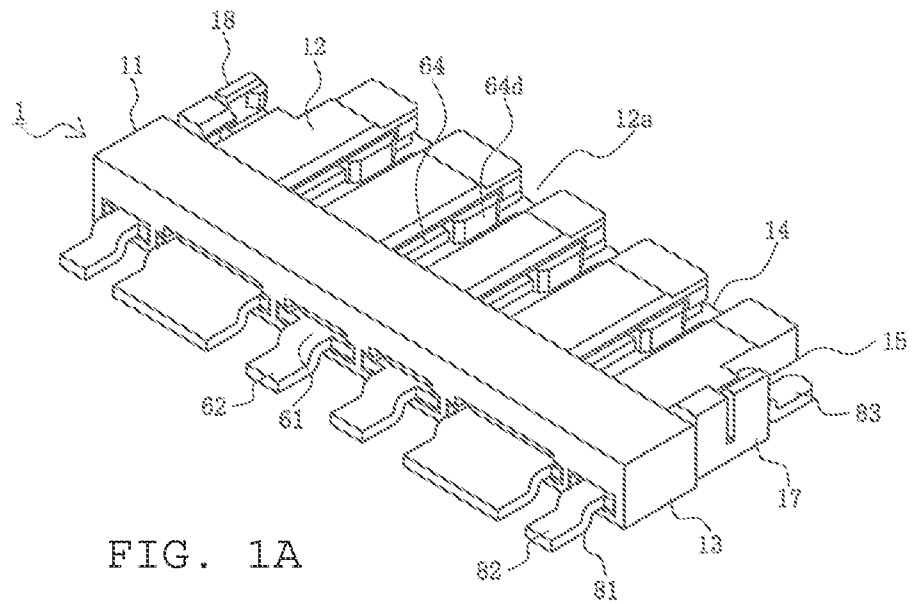


FIG. 1A

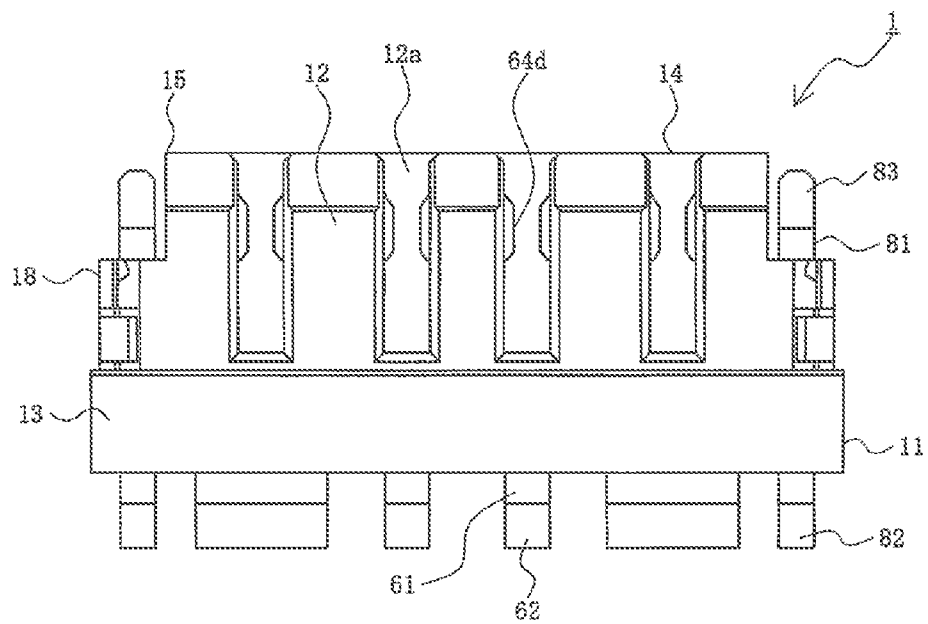


FIG. 1B

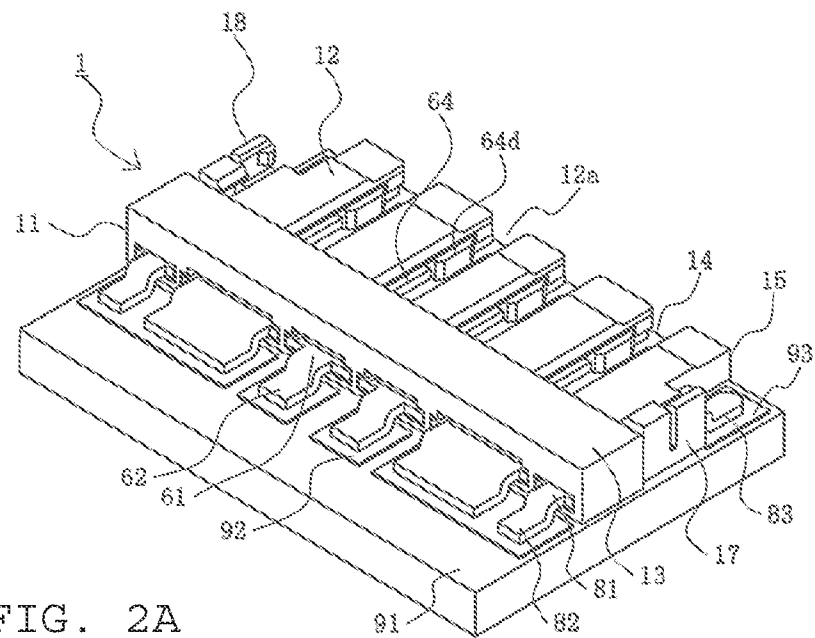


FIG. 2A

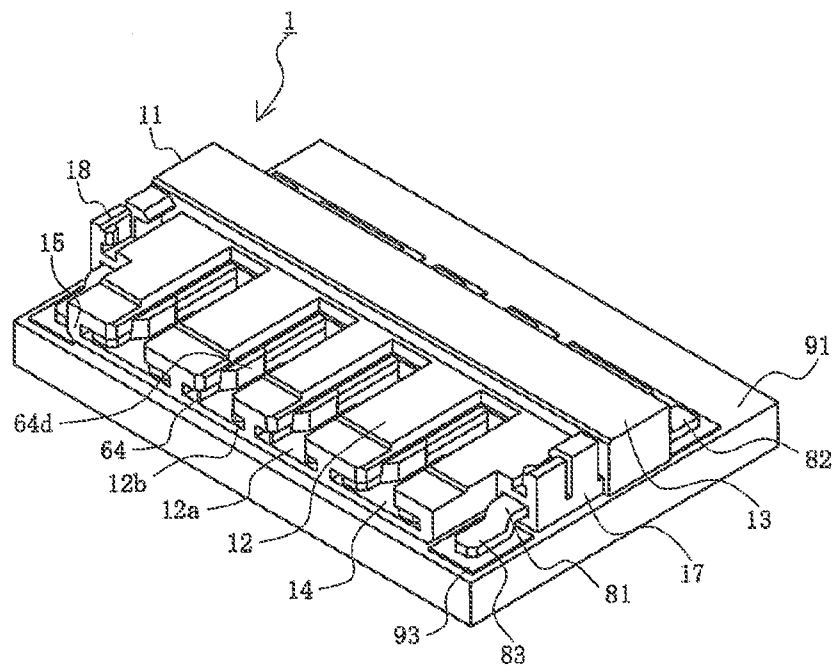
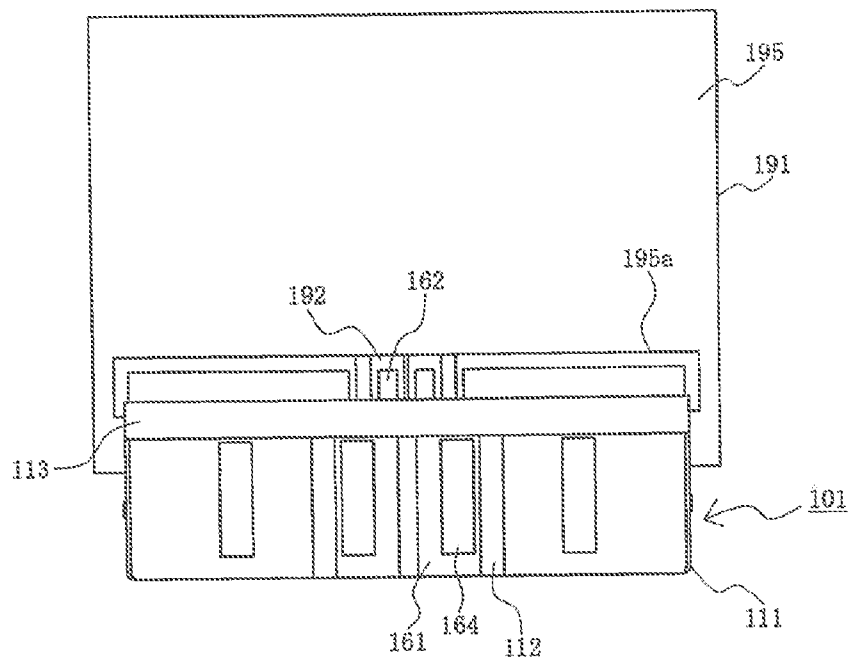
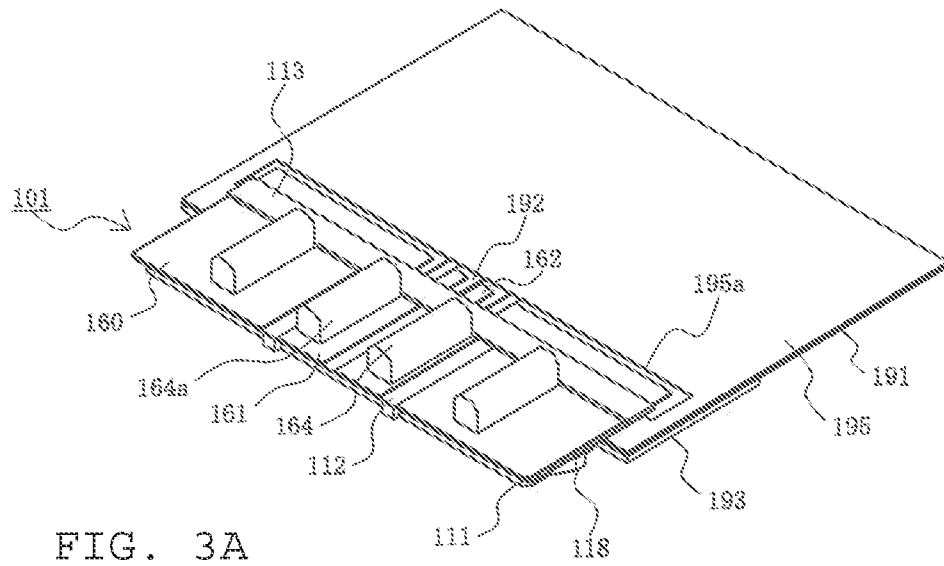


FIG. 2B



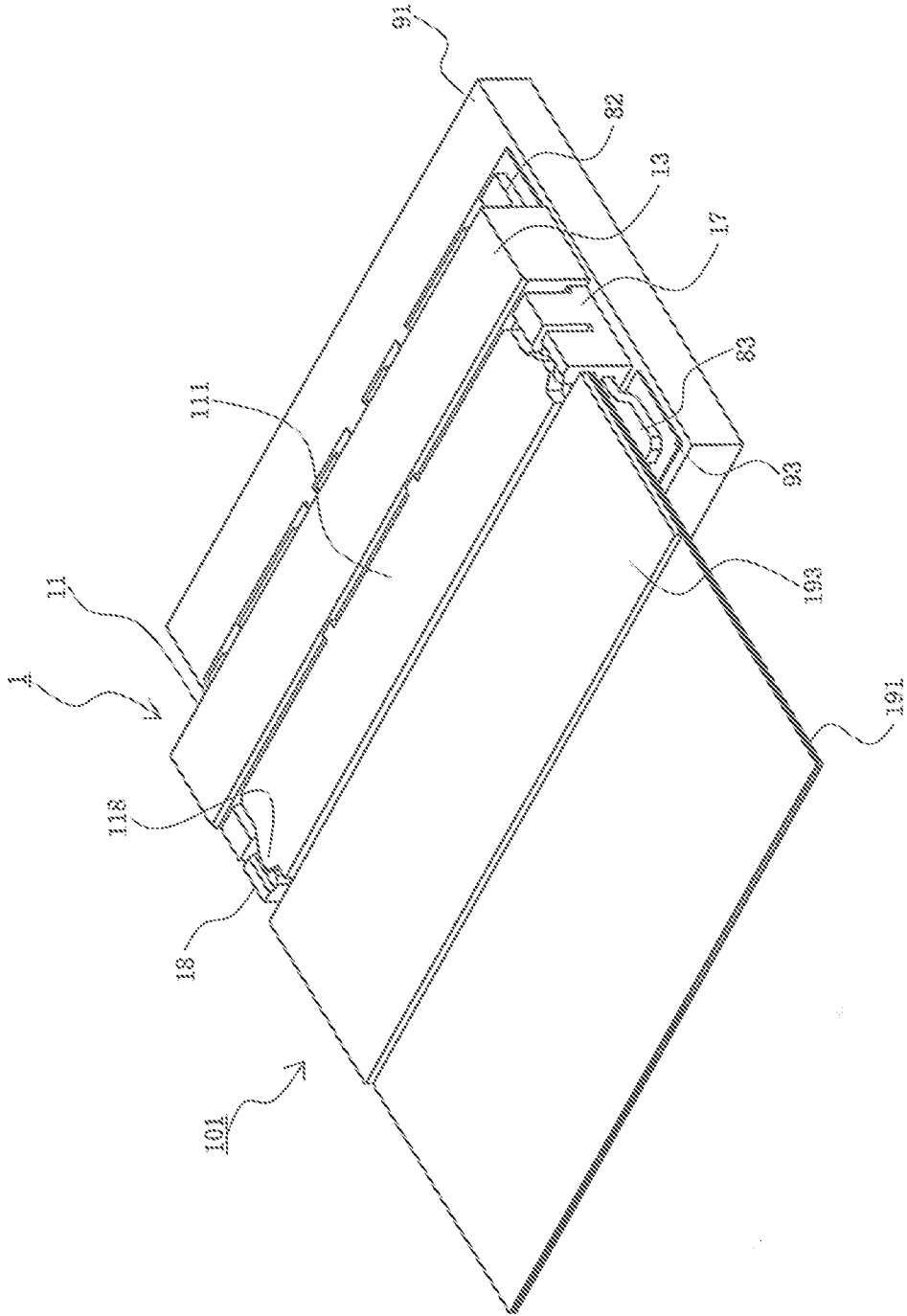


FIG. 4

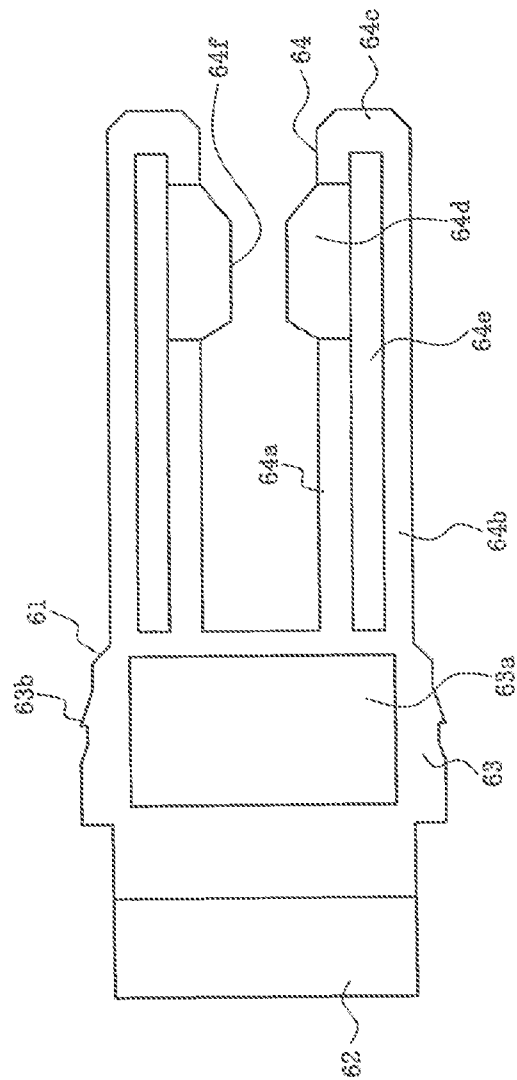


FIG. 5A

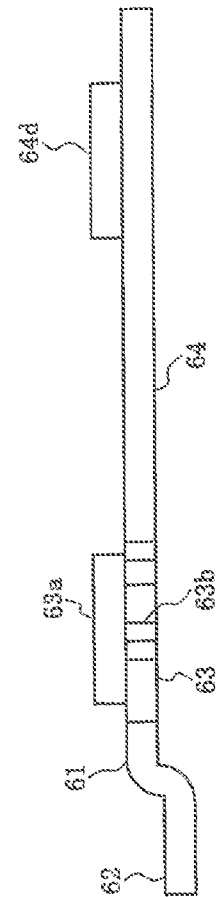


FIG. 5B

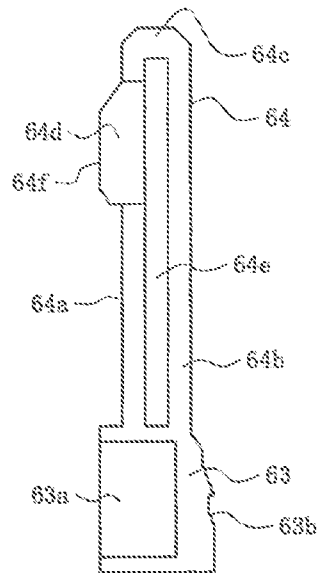


FIG. 6A

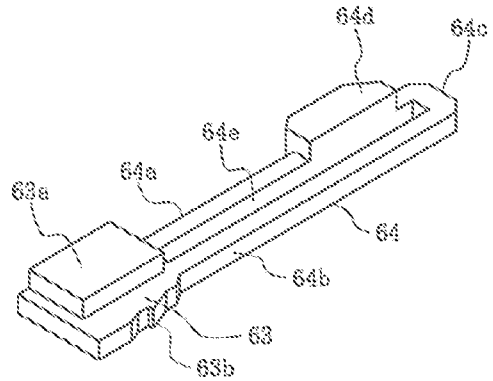


FIG. 6C

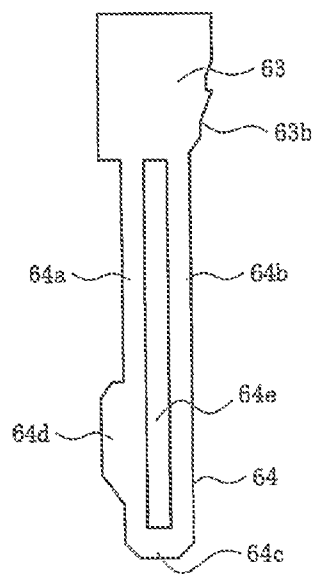


FIG. 6B

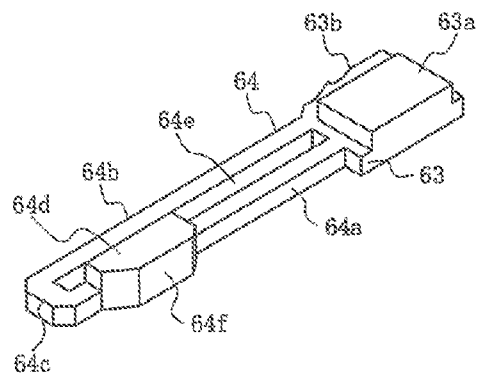


FIG. 6D

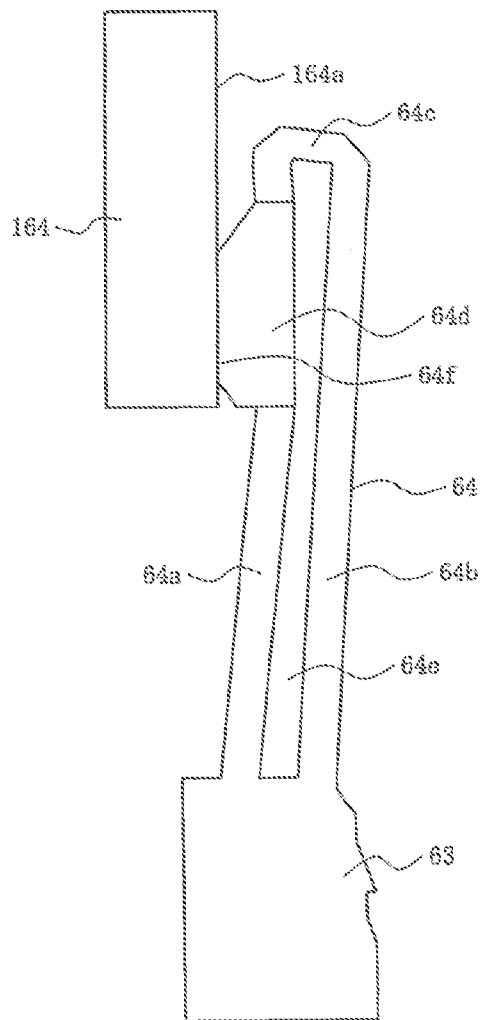


FIG. 7A

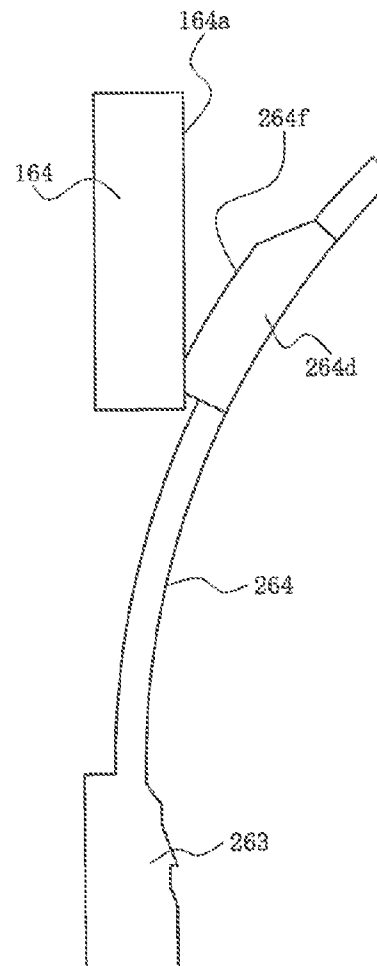


FIG. 7B

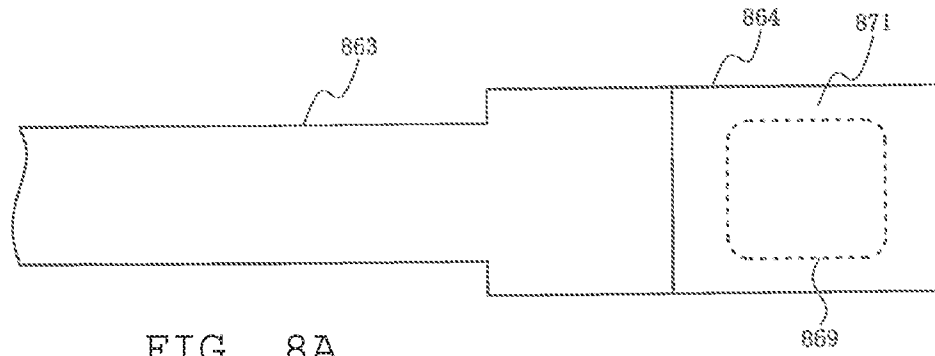


FIG. 8A

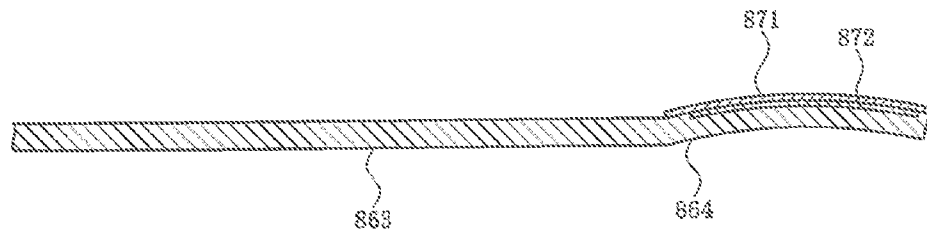


FIG. 8B

PRIOR ART