

## CARD CONNECTOR

### TECHNICAL FIELD

[0001]

The present invention relates to a card connector into which an IC card such as a SIM card, a SD card, a mini SD card and a micro SD card is fitted, and more particularly to a card connector into and from which a compact memory card can be fitted and removed with ease.

### BACKGROUND ART

[0002]

Mobile telephone terminals have spread rapidly all over the world in recent years. One of the mobile telephone systems used for mobile telephone terminals is, for instance, GSM (Global System for Mobile Communication). With GSM, users conclude a contract with a telecommunications carrier, have a memory card termed a SIM (Subscriber Identity Module) card memorize user registration information that enables their identification as contracted users, and by fitting this card into a telephone that they carry about, are able to connect to a telephone network. Thus, the user uses a mobile telephone with the SIM card fitted in it, which means that if the telecommunications carrier with which the user currently has a contract should change, or if the user moves to a different service area with a different telecommunications carrier, and in similar cases, the user will only be able to connect to a telephone network run by the new telecommunications carrier by concluding a contract with the new telecommunications carrier and obtaining its SIM card.

[0003]

In order to fit the SIM card, a mobile telephone terminal has a card fitting structure such as for example that disclosed in JP-A-2004-228694. In the mobile

telephone terminal disclosed in JP-A-2004-228694, a card connector into which the SIM card is fitted is provided inside the battery receiving cavity. The battery receiving cavity is so contrived as to be closed off by the installation of a rear lid, which also used for the battery, after the SIM card has been inserted. This connector has contact elements that contact with the contacts of the SIM card, and when the SIM card is inserted, these contact elements electrically contact with the contacts of the SIM card and the subscriber identity code memorized in the SIM card is read out.

[0004]

An example of such a card connector fitted in a mobile telephone terminal is that disclosed in U.S. Patent No. 7,232,326.

The card connector disclosed in U.S. Patent No. 7,232,326 will now be described with reference to Fig. 10. Fig. 10 is a perspective view of the card connector disclosed in U.S. Patent No. 7,232,326.

This card connector 40 is configured with a cover 41 that holds the SIM card at both lateral portions, and a contacting support part 51 that has contact elements 49 that are disposed in a panel portion 44 and have a spring property. The cover 41 has arms 42 at one end. At the tip of each arm 42 there is provided a hinge piece 43 which engages with an opening 46 in a support block 47 of the contacting support part 51. Further, at the other end of the cover 41 there are provided locking tabs 41a. The contacting support part 51 is provided with slots 50 at the opposite end to the support blocks 47.

[0005]

In the card connector 40 configured as described above, when a SIM card C is fitted into the cover 41 and the cover 41 is closed, the cover 41 is pushed down toward the contacting support part 51, against the spring force of the contact elements 49 and with the rotating pins 45 of the hinge pieces 43 rotating. Then, when the cover 41 is slid toward the slots 50 in the contacting support part 51, the locking tabs 41a on the cover outer end are inserted into the slots 50. Thereby the contacts of the SIM card C and the contact elements 49 are brought into contact,

and in such state the SIM card C is firmly held. More precisely, with the cover 41 and contacting support part 51 engaged and held together, the locking tabs 41a on the outer end of the cover 41 are inserted into the slots 50 in the contacting support part 51, movement of the cover 41 is restricted by the spring force of the contact elements 49, and moreover, movement in the horizontal direction (forward-rearward direction) is inhibited by the contacting of the hinge pieces 43 against cams 48 provided inside the openings 46. With such state where the SIM card C is held in the card connector 40, the contact elements 49 of the connector contact with the contacts of the SIM card and the subscriber identity information memorized in the SIM card is read out.

[0006]

With recent rapid-spreading use of mobile terminals including mobile telephones, IC cards such as SIM cards, SD cards, mini SD cards and micro SD cards have been used therewith. Along with this widespread of use, the card connector has been designed to be more compact and slimmer.

At the same time, since the dimensional tolerance of the IC cards that are inserted into the card connector is small, the tolerance, for example, is  $\pm 0.1$  mm or so, slight movement – known as “rattle” – of the SIM card once inserted into the card connector is liable to occur. If such rattle occurs, there will be poor electrical contacting which will cause failure of the equipment. With the card connector 40 disclosed in U.S. Patent No. 7,232,326 for example, the structure is such that the open or closed state is maintained solely by means of movement of the cover 41 in the forward-rearward direction, and because of this, if any impact or vibration occurs in the forward-rearward direction the cover 41 will be liable to slide, with the result that the cover 41 could become disengaged from the contacting support part 51 and rattle, and thus poor electrical contacting could occur.

[0007]

An example of a card connector contrived so as to eliminate such inconvenience is that disclosed in U.S. Patent No. 6,951,472. This connector has a structure such that the forward-rearward movement of the cover – in other words

of the tray – into which the card is fitted is restricted. Thanks to such structure the reliability of the electrical contacting between the contacts of the card fitted and the contact elements of the connector is assured even if impacts or vibration should occur.

[0008]

As mentioned above, mobile telephone terminals are being made more compact and slimmer, and consequently card connectors too are being made more compact and slimmer. Because connectors of this kind are usually provided inside the battery receiving cavity of a mobile telephone terminal, the space for disposition of the connector is extremely limited. Thus it is necessary to provide the connector card in this limited space and moreover to enable fitting and removal of the card to/from the interior of the battery receiving cavity. However, with the card connectors disclosed in both U.S. Patent No. 7,232,326 and U.S. Patent No. 6,951,472, the structure is such that the cover is not lifted automatically, and the card cannot be fitted to or removed from the connector unless the cover is lifted manually, which makes fitting/removal of the card exceedingly bothersome. The cover is lifted a little by the spring resilience of the contact elements when the lock of the cover is released, but lifting of this degree does not facilitate fitting or removal of the card.

## SUMMARY

[0009]

An advantage of some aspects of the present invention is to provide a card connector that renders fitting and removal of a card easy.

[0010]

According to an aspect of the invention, a card connector includes: contact terminals electrically contacting with the contacts of a card, an electrically insulative main housing accommodating the contact terminals installed therein, and an electrically insulative and

open-and-closable lid-tray covering the main housing from above and being removably inserted a card; the main housing having a pair of first and second sidewall frames opposing each other at a predetermined spacing, and a bottom plate portion connecting the first and second sidewall frames and being installed the contact terminals thereon; the first and second sidewall frames each having one end being provided with a slit having a predetermined length; the lid-tray being provided with a pair of first and second lid frames opposing each other at a spacing and being fitted in between the first and second sidewall frames, and the first and second lid frames each having one end provided with pivots inserted into and rotatably pivoted in the slits of the first and second sidewall frames; the pivots being provided with flip-up springs for lifting the lid-tray up by a particular angle when the card is inserted or removed; and the lid-tray being lifted up by a particular angle between the other ends of the first and second lid frames by means of the flip-up springs and pivoting the pivots in the slits of the first and second side wall frames when the card is inserted or removed.

[0011]

With the above aspect of the invention, the lid-tray is provided with flip-up springs, so that when a card is inserted or removed, the tray lifts automatically by a particular angle, and thereby insertion and removal, or in other words fitting and taking out, of the card are rendered easy.

[0012]

Alternatively in such card connector of the invention, the main housing may have gaps G between the inner wall faces of the first and second sidewall frames and the bottom portion of the housing for slidably receiving the first and second lid frames therethrough, and be provided with first and second retaining protrusions at the rearward of the main housing with a predetermined spacing therebetween. With such arrangement the lid tray will be provided with first and second restricting protrusions on the outer wall faces of the first and second lid frames with a predetermined spacing therebetween in a forward and rearward direction for restricting upward movement by being pushed by the first and second

retaining protrusions; and the length L of the second retaining protrusion located to the rearward of the first retaining protrusion and the gap W between the first and second restricting protrusions will be in relation  $W > L$ .

[0013]

With the foregoing alternative, the lid-tray is locked to the main housing by means of simple retaining protrusions and restricting protrusions. Also, such locking can be released in a simple manner by sliding the lid-tray.

[0014]

Alternatively again in such card connector of the invention, the flip-up springs may be formed from resilient metal plate material, each of the flip-up spring having a fixing portion fixed to the pivot of the first or second lid frame, and a spring portion extending from the fixing portion and being curved into an arch form; the height H of the apex of the spring portion being greater than the gap G.

[0015]

With the foregoing alternative, thanks to being structured with a fixing portion that is fixed to the pivot of the lid frame and a spring portion that extends from the fixing portion and is curved into an arch form, the flip-up springs can be fabricated in a simple manner by processing resilient plate material.

[0016]

As a still further alternative in such card connector of the invention, a card sensing terminal may be provided in the bottom plate portion of the main housing, and each of the first and second sidewall frames may have outer wall face covered by an electrically conductive sidewall cover, either one of the sidewall covers being electrically connected to the card sensing terminal.

[0017]

With the foregoing alternative, the presence of a card fitted into the lid-tray can be sensed in a simple manner.

## BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

The invention will be described with reference to the accompanying drawings, wherein like numbers reference like elements.

Fig. 1 is a perspective view of a connector in an embodiment of the invention, separated into a main housing and a lid-tray.

Fig. 2 is a perspective view of the main housing.

Fig. 3 illustrates the parts installed to the main housing in FIG. 2, Fig. 3A being a perspective view of all such parts, Fig. 3B being a perspective view of one of the contact terminals in Fig. 3A, Fig. 3C being a perspective view of one of the sidewall covers in Fig. 3A, and Fig. 3D being a perspective view of the other sidewall cover in Fig. 3A.

Fig. 4 illustrates the lid-tray, Fig. 4A being a perspective view of the lid-tray, and Fig. 4B being an enlarged view of portion IVB in Fig. 4A.

Fig. 5 illustrates a flip-up spring and installation thereof, Fig. 5A being a perspective view of a flip-up spring and Fig. 5B being a perspective view of the flip-up spring installed to the lid-tray.

Fig. 6 illustrates the connector when assembled, Fig. 6A being a top view thereof, Fig. 6B being a front view, and Fig. 6C being a cross-sectional view along line VIC – VIC in Fig. 6B.

Fig. 7 illustrates pulling out of the lid-tray from the main housing, or in other words taking out of the card, Figs. 7A to 7C being perspective views of successive steps in the lid-tray pulling-out procedure.

Fig. 8 is a cross-sectional view cut along line VIII – VIII in Fig. 6A, illustrating the operation of the connector.

Fig. 9 illustrates pushing in of the lid-tray into the main housing, or in other words fitting of the card, Figs. 9A to 9C being perspective views of successive steps in the card fitting procedure.

Fig. 10 is a perspective view of a card connector of the related art.

## DESCRIPTION OF EXEMPLARY EMBODIMENT

[0019]

An exemplary embodiment of the present invention will now be described with reference to the accompanying drawings. It should be understood however that the embodiment below is intended by way of an example of a card connector that carries out the technical concepts of the invention, not by way of limiting the invention to this particular card connector. The invention could equally well be adapted to yield other embodiments without departing from the scope and spirit of the claims.

[0020]

The card connector of the following embodiment of the invention ("connector" below) is used for a SD card, a mini SD card, or a micro SD card etc. The connector adapted for the SIM card will be explained hereinafter as an example. The SIM cards come in standardized sizes. More precisely, a SIM card is constituted as a rectangular plate-form body having a predetermined length in the longitudinal direction, a predetermined width in the forward-rearward direction, and a predetermined thickness (not indicated in the drawings), houses an IC chip in its interior, and has an exterior formed as a molding of electrically insulative plastic. On one edge of the card, at a corner portion, there is provided a positioning means such as a cut-away. On one face of the card, multiple contacts are provided to which the IC chip in the interior is connected.

[0021]

Fig. 1 is an exploded perspective view of a connector in an embodiment of the invention, separated into a main housing and a lid-tray. Fig. 2 is a perspective view of the main housing. Fig. 3 illustrates the parts installed to the main housing in Fig. 2, Fig. 3A being a perspective view of all such parts, Fig. 3B being a perspective view of one of the contact terminals in Fig. 3A, Fig. 3C being a perspective view of one of the sidewall covers in Fig. 3A, and Fig. 3D being a perspective view of the other sidewall cover in Fig. 3A. Fig. 4 illustrates the lid-tray, Fig. 4A being a perspective view of the lid-tray, and Fig. 4B being an

enlarged view of portion IVB in Fig. 4A. Fig. 5 illustrates a flip-up spring and installation thereof, Fig. 5A being a perspective view of a flip-up spring and Fig. 5B being a perspective view of the state where the flip-up spring is installed to the lid-tray. Fig. 6 illustrates the connector when assembled, Fig. 6A being a top view thereof, Fig. 6B being a front view, and Fig. 6C being a cross-sectional view along line VIC – VIC in Fig. 6B. Figs. 7 to 9 are explanatory views setting forth the operations of the card connector. Fig. 7 illustrates pulling out of the lid-tray from the main housing, or in other words taking out of the card, Figs. 7A to 7C being perspective views of successive steps in the lid-tray pulling-out procedure. Fig. 8 is a cross-sectional view illustrating the operation of the connector cut along line VIII – VIII in Fig. 6A. Fig. 9 illustrates pushing in of the lid-tray into the main housing, or in other words fitting of the card, Figs. 9A to 9C being perspective views of successive steps in the card fitting procedure.

[0022]

A connector of an embodiment of the invention will now be described with reference to Figs. 1 to 6.

A connector 1 is configured to include: multiple contact terminals 5 that electrically contact with the contacts of a card, a main housing 2 in which the contact terminals are housed, and a lid-tray 8 that is installed to the main housing 2 and in which a card – say a SIM card – can be removably fitted. The lid-tray 8 is provided with a flip-up spring 13 that lift up the lid-tray 8 by a particular angle when fitting or removing the card. This connector 1 is so structured as to be installable inside the battery receiving cavity of a mobile telephone terminal. The term “lid-tray” is used for this component because a card can be fitted into and removed from it, and moreover it is installed to the main housing 2 and has the function of covering the main housing 2. The connector is adapted not only for use with a SIM card, but also for use with other IC card, for example, a SD card, mini SD card and a micro SD card, and the connector is modified in its dimensions, in a number of contact terminals and in its configuration, adapting for each specification of the cards, when the connector is adapted to use with each card.

The structures of the main housing 2, contact terminals 5, lid-tray 8 and flip-up springs 13 are each described in turn below.

[0023]

The structure of the main housing is now described, with reference to Fig. 2.

The main housing 2 is formed as a molding of electrically insulative synthetic resin molding and has a pair of sidewall frames, first and second, 2A and 2B, that oppose each other with a predetermined spacing therebetween, and a bottom plate portion 3 of a particular area that connects the sidewall frames 2A and 2B. The main housing 2 is opened in the forward and rearward direction at the portion between the first and second sidewall frames 2A and 2B. The first and second sidewall frames 2A and 2B both have a predetermined thickness and are disposed roughly in parallel with a predetermined spacing therebetween. The term “sidewall frame” is used because the sidewall frames constitute the sidewalls of the main housing 2 and moreover are pieces of a frame. The first and second sidewall frames 2A and 2B both have the same structure. Below, the structure of the first sidewall frame 2A only will be described, as it is representative of the structures of both the first and second sidewall frames 2A and 2B.

[0024]

As Fig. 2 shows, the first sidewall frame 2A is formed as an elongated plate-form body that has a predetermined width and length and is relatively thick. At one end 2a of the first sidewall frame 2A – more precisely, at the end where the lid-tray 8 is pivoted – there is formed a slit 21 extending a predetermined distance rearward from the end 2a. On the inner wall face 2c, in two locations at the upper part thereof – more precisely, alongside the upper wall 2e – there are formed a first and a second retaining protrusion 22 and 23, one in a forward and one in a rearward position with a predetermined spacing therebetween. The first retaining protrusion 22 is in a location proximate to the slit 21 and is formed as a protuberance rising with a predetermined width and height and extending a predetermined distance rearward. The longitudinal length L1 of the first

retaining protrusion 22 is longer than the length L3 of the spring portion 13A of the flip-up springs 13 to be described hereafter (see Fig. 5). Due to such length L3, the apex of the spring portion 13A will be compressed.

[0025]

The second retaining protrusion 23 is in a location proximate to the other end 2b and is formed as a protuberance rising with roughly the same predetermined width and height as the first retaining protrusion 22 and extending a predetermined distance forward. The longitudinal length of the second retaining protrusion 23 is L2. This length L2 is smaller than the gap W2 of the lid-tray 8. By making the length L2 smaller than W2, which is to say by making W2 broad, the lid-tray 8 will be able to lift up by a particular angle when pulled out, without colliding with the second retaining protrusion 23. Further, a predetermined spacing W1 is created between the first and second retaining protrusions 22 and 23. This spacing W1 is larger than the length L3 of the spring portion 13A of the flip-up spring 13 (see Fig. 5). This spacing W1 enables the spring portion 13A to recover its original shape after being compressed. Also, a gap G is formed between the first retaining protrusion 22 and the bottom plate portion 3. This gap G is the gap through which the flip-up spring 13 passes when in the compressed state. The upper wall 2e face of the first sidewall frame 2A is cut away, except for portions at the front and rear, to form a cut-away portion 24. The attaching piece 7c of the sidewall cover 7A (see Fig. 3C) to be described hereafter contacts against this cut-away portion 24.

[0026]

The bottom plate portion 3 is formed as a plate-form body that is located between the first and second sidewall frames 2A, 2B, extending from one end 2a thereof toward the other end 2b and connecting the two sidewall frames up to a location approaching the other end 2b. In the bottom plate portion 3, toward the other ends 2b, there is formed a bay-like opening 4 enclosed by edges of the first and second sidewall frames 2A, 2B and of the bottom plate portion 3. The connecting plate 9 of the lid-tray 8 is disposed into this opening 4. In the upper

surface of the bottom plate portion 3 there are formed a compartment 31 where the sensing terminal 6 is housed, and multiple slits 32 through which the contacting portions 5a of the multiple contact terminals 5 protrude. The lengths of the multiple slits 32 differ so as to correspond to the lengths of the multiple contact terminals 5.

[0027]

The parts that are installed to the main housing 2 will now be described with reference to Fig. 3.

As Fig. 3A shows, the parts that are installed to the main housing 2 includes: multiple contact terminals 5 that contact with the multiple contacts of a card; a sensing terminal 6 that senses the card inserted/removed status; and a pair of sidewall covers, first and second, 7A and 7B, that are installed to the outer wall faces of the first and second sidewall frames 2A and 2B of the main housing 2, with the sensing terminal 6 being adjacent to one of the sidewall covers, namely the second, 7B. These contact terminals 5, sensing terminal 6 and sidewall covers 7A and 7B are formed from a metallic material of good conductivity, say phosphor bronze.

[0028]

As Fig. 3A shows, the multiple contact terminals 5 have differing lengths in the longitudinal direction, so as to match the positions of the contacts of the card, not shown in the drawing. As shown in Fig. 3B, which illustrates one thereof, each of these contact terminals 5 is formed as an elongated plate-form strip that has a contact portion 5a that is located at the tip and is constituted of a resilient strip of a predetermined length, an installation portion 5b that has a relatively broad area and extends rearward from the contact portion 5a, and a connection portion 5c, for a lead, that is provided further rearward from the installation portion 5b. The installation portion 5b is formed to have a larger width than the other portions – the contact portion 5a and connection portion 5c.

[0029]

As Fig. 3C shows, one of the sidewall covers – the first, 7A – has a sidewall

7a that contacts against the sidewall face of the first sidewall frame 2A, and attaching pieces 7b and 7c that are bent to extend a predetermined distance, in the same direction, each from one of the two longitudinal edges of the sidewall 7a; and is formed from metal plate of good conductivity. This first sidewall cover 7A contacts against the sidewall face of the first sidewall frame 2A, and is fixed to the first sidewall frame 2A by means of the attaching pieces 7b and 7c. The other sidewall cover – the second, 7B – has approximately the same structure as the first sidewall cover 7A, but has the structural difference of being provided with a contact portion 7d that contacts with the contact portion 6a of the sensing terminal 6. As Fig. 3D shows, the sensing terminal 6 is formed as an elongated plate-form strip that has a contact portion 6a that is located at the tip and is constituted of a resilient strip of a predetermined length, an installation portion 6b that has a relatively broad area and extends rearward from the contact portion 6a, and a connection portion 6c, for a lead, that is provided further rearward from the installation portion 6b. The installation portion 6b is formed to have a larger width than the other portions – the contact portion 6a and connection portion 6c. The contact portion 7d of the second sidewall cover 7B and the contact portion 6a of the sensing element together constitute a sensing switch SW that senses the card inserted/removed status. The card inserted/removed status is sensed via the opening/closing of this sensing switch SW. The sensing terminal 6 is formed from metal plate of good conductivity.

[0030]

The structures of the lid-tray 8 and the flip-up springs 13 that are installed to the lid-tray 8 will now be described with reference to Figs. 4 and 5.

As Fig. 4A shows, the lid-tray 8 has a pair of opposed lid frames, first and second, 8A and 8B, that are spaced by a distance roughly equal to the width of a card, and is formed as an electrically insulative synthetic resin molding, in which the bottom surfaces at one end of the lid frames 8A and 8B are connected by a connecting plate 9 of a particular shape, the top surfaces at the other end are covered by a cover plate 10 of a particular area, and in the interior there is

provided a receiving space S into which the card is received. The first and second lid frames 8A and 8B both have a predetermined thickness, and are disposed roughly in parallel, with a spacing of the width of the card therebetween.

[0031]

The first and second lid frames 8A and 8B both have the same structure. Below, the structure of the first lid frame 8A only will be described, as it is representative of the structures of both the first and second lid frames 8A and 8B.

As Fig. 4A shows, the first lid frame 8A is formed as an elongated plate-form body that has a length slightly longer than the first sidewall frame 2A of the main housing and a predetermined thickness. At one end 8a of the first lid frame 8A, as shown in Fig. 4B, there is formed a pivot 11 that fits into and rotates in the slit 21 in the main housing 2 and moreover is able to slide therein. In this pivot 11 there is formed a fitting hole 12 into which a flip-up spring 13 is fitted. This fitting hole 12 is a slot that penetrates through the pivot 11 and communicates with a slot 8d' provided in the sidewall 8d. At the other end of the first lid frame 8A, there is formed an elevated manipulation protrusion 8b that facilitates pulling-out and pushing-in of the lid-tray 8. In the second lid frame 8B too there is formed a manipulation protrusion, 8b', but of a shape that differs from that of manipulation protrusion 8b. Also, first and second restricting protrusions 8<sub>1</sub> and 8<sub>2</sub> that contact against the first and second retaining protrusions 22 and 23 of the main housing 2 and restrict upward springing are formed on the outer wall face of the first lid frame 8A, in forward and rearward positions respectively. Between the first and second restricting protrusions 8<sub>1</sub> and 8<sub>2</sub> there is a predetermined gap 8<sub>0</sub>. This gap 8<sub>0</sub> is formed with a length W2 which is in the relation  $W2 < W1$  with the gap W1 between the first and second retaining protrusions 22 and 23. Also, the length L2 of the second retaining protrusion 23 is in the relation  $W2 > L2$  with the gap W2.

[0032]

The cover plate 10 covers a particular extent of the forward portion of the first and second lid frames 8A and 8B. The card receiving space S is formed by

the first and second lid frames 8A and 8B, the connecting plate 9, and the cover plate 10. The second lid frame 8B and the cover plate 10 are connected by an inclined surface 10a. This inclined surface 10a serves as a guide surface that guides the card so as to be inserted in the normal state.

[0033]

Each flip-up spring 13 is formed from resilient metal plate material and has a spring portion 13A and a support portion 13B that supports the spring portion 13A, as Fig. 5 shows. The support portion 13B is formed as a plate-form strip that fits into the fitting hole 12 in the pivot 11 and the slot 8d' in the sidewall 8d. The spring portion 13A is formed as an arched, curved spring that extends from one end of the support portion 13B. More precisely, the spring portion 13A is an arched, curved spring that has: an inclining portion 13<sub>1</sub> that inclines from one end of the support portion 13B over a predetermined distance and at a particular angle toward the apex above; an apical portion 13<sub>2</sub> at the end of such inclining portion 13<sub>1</sub>; and a descending portion 13<sub>3</sub> that falls away downward from the apical portion at a particular angle; and is so formed that the height H of the apical portion 13<sub>2</sub> is greater than the gap G between the first retaining protrusion 22 and the bottom plate portion 3. The employment of such height means that when the lid-tray 8 is pulled rearward from the main housing 2 and the curved spring portion 13A is inserted into the gap G, the apical portion 13<sub>2</sub> will be compressed and a predetermined spring force will be stored therein. Subsequently when the lid-tray 8 is pulled further rearward and the spring portion 13A passes out through the gap G, the lid-tray 8 will be lifted upward by a particular angle by this spring force. The length L3 of the spring portion 13A and the length L1 of the first retaining protrusion 22 are in the relation  $L1 > L3$ .

[0034]

Next, assembly of the connector 1 will be described with reference to Figs. 1 to 6.

First of all, the multiple contact terminals 5 and the pair of first and second sidewall covers 7A and 7B are installed to the main housing 2. To install the

contact terminals 5, the contact terminals 5 are positioned to the rear of the main housing 2, then the contact portions 5a are passed through the slits 32 so as to protrude from the top surface of the bottom plate portion 3, and the installation portions 5b are fixed to the bottom surface of the bottom plate portion 3 using a particular fixing means. The sensing terminal 6 is installed to the compartment 31 of the bottom plate portion 3 via a similar procedure (see Figs. 1 and 2).

The pair of first and second sidewall covers 7A and 7B are installed to the sidewall faces of the pair of first and second sidewall frames 2A and 2B. The first sidewall cover 7A is brought into contact with the sidewall face of the first sidewall frame 2A and secured by means of the attaching pieces 7b and 7c. Likewise the second sidewall cover 7B is brought into contact with the sidewall face of the second sidewall frame 2B and secured by means of the attaching pieces 7b and 7c. The flip-up springs 13 are installed to the lid-tray 8, as shown in Fig. 5. Such installation is carried out by fitting the support portions 13A of the spring portion 13 into the fitting holes 12 in the pivots 11 and into the slots 8d' in the sidewalls 8d (see Fig. 5B). After that, the lid-tray 8 is installed to the main housing 2. Such installation is carried out by inserting the pivots 11 at one end of the first and second lid frames 8A, 8B of the lid-tray 8 into the slits 21 in the main housing 2. Such insertion enables the pivots 11 to slide inside the slits 21, and the first and second lid frames 8A, 8B to move in the forward-rearward direction. As Fig. 6 shows, with the lid-tray 8 thus pushed into the main housing 2, the first and second restricting protrusions 8<sub>1</sub> and 8<sub>2</sub> of the pair of first and second lid frames 8A and 8B of the lid-tray 8 strike against the first and second retaining portions 22 and 23 of the main housing 2, so that upward lifting is restricted, or in other words locked, and moreover the spring portions 13A of the flip-up springs 13 project out from the end 2a of the main housing (see Fig. 6C).

[0035]

Next will be described, with reference to Figs. 7 to 9, the movement of the lid-tray 8 relative to the main housing 2, and the fitting and removal of the card that are associated with such movement.

Fig. 7A illustrates the state where the lid-tray 8, without a card therein, has been pushed into the main housing 8. This state is such that the first and second restricting protrusions  $8_1$  and  $8_2$  of the pair of first and second lid frames 8A, 8B of the lid-tray 8 contact against the first and second retaining protrusions 22, 23 of the main housing 2, so that upward lifting is restricted, or in other words locked, as shown in Fig. 8A. Also, the spring portions 13A – tip portions – of the flip-up springs 13 protrude outward from the end 2a of the main housing 2. Further, the distance L4 between the angled portion  $8_3$  of the sidewall 8d of the lid-tray 8 (see Figs. 4A and 8A) and the end of the second retaining protrusion 23 is close to zero. When, subsequent to such state, the lid-tray 8 is drawn rearward by a predetermined distance L4, the pivots 11 of the first and second lid frames 8A, 8B move rearward in guided motion inside the slits 21 (see Figs. 7B and 8B). As a result of such retraction, the spring portions 13A of the flip-up springs 13 are inserted into the gaps G, and the apical portions  $13_2$  of the spring portions 13A are compressed, so that a predetermined spring force is stored therein. With such state, the first and second restricting protrusions  $8_1$  and  $8_2$  of the pair of first and second lid frames 8A, 8B of the lid-tray 8 contact against the first and second retaining protrusions 22, 23 of the main housing 2, so that the lid-tray 8 is restricted from lifting upward. When the lid-tray 8 is drawn further rearward beyond the distance L4, the second retaining portions 23 of the main housing 2 and the second restricting protrusions  $8_2$  of the lid frames 8A and 8B move apart by an amount equal to the gap  $8_0$ . When this happens, the first and second lid frames 8A, 8B are – or in other words, the lid-tray 8 is – lifted upward by a particular angle due to the spring action of the spring portions 13A, which are inserted in the gaps G (see Figs. 7C and 8C). With such state, the lid-tray 8 is lifted up and inclined from the main housing 2 by a particular angle, and hence a card can be fitted to the lid-tray 8 in a simple manner by utilizing such inclination angle.

[0036]

To fit a card C, one inserts the card C into the receiving space S of the lid-tray 8 when the lid-tray 8 is in the lifted-up state, and applies the removal

procedure in reverse so as to fix the lid-tray 8 to the main housing 2, as shown in Fig. 9. With a card C thus fitted in the receiving space S of the lid-tray 8, the contacts of the card C will be in contact with and electrically connected to the contact terminals 5 of the connector 1. Also, because in this state the lid-tray 8 is locked, the electrical contacting between the contacts of the card C fitted and the contact terminals 5 of the connector will be reliable and endurance with regard to impacts and vibration will be secured. Note that when a card is inserted into the receiving space S, the sensing switch SW will operate and such status will be communicated. Since the communicating means is in the public domain, a description thereof is omitted.

What is claimed is:

1. A card connector comprising:
  - contact terminals electrically contacting with the contacts of a card,
  - an electrically insulative main housing accommodating the contact terminals installed therein, and
  - an electrically insulative and open-and-closable lid-tray covering the main housing from above and being removably inserted a card;
  - the main housing having a pair of first and second sidewall frames opposing each other at a predetermined spacing, and a bottom plate portion connecting the first and second sidewall frames and being installed the contact terminals thereon;
  - the first and second sidewall frames each having one end being provided with a slit having a predetermined length;
  - the lid-tray being provided with a pair of first and second lid frames opposing each other at a spacing and being fitted in between the first and second sidewall frames, and the first and second lid frames each having one end provided with pivots inserted into and rotatably pivoted in the slits of the first and second sidewall frames;
  - the pivots being provided with flip-up springs for lifting the lid-tray up by a particular angle when the card is inserted or removed; and
  - the lid-tray being lifted up by a particular angle between the other ends of the first and second lid frames by means of the flip-up springs and pivoting the pivots in the slits of the first and second side wall frames when the card is inserted or removed.
2. The card connector according to claim 1, wherein
  - the main housing further comprises gaps G between the inner wall faces of the first and second sidewall frames and the bottom portion of the housing for slidably receiving the first and second lid frames therethrough, and is further provided with first and second retaining protrusions at the rearward of the main housing with a predetermined spacing therebetween;

the lid tray is further provided with first and second restricting protrusions on the outer wall faces of the first and second lid frames with a predetermined spacing therebetween in a forward and rearward direction for restricting upward movement by being pushed by the first and second retaining protrusions; and

the length  $L$  of the second retaining protrusion located to the rearward of the first retaining protrusion and the gap  $W$  between the first and second restricting protrusions are in relation  $W > L$ .

3. The card connector according to claim 2, wherein the flip-up springs are formed from resilient metal plate material, each of the flip-up spring having a fixing portion fixed to the pivot of the first or second lid frame, and a spring portion extending from the fixing portion and being curved into an arch form; the height  $H$  of the apex of the spring portion being greater than the gap  $G$ .

4. The card connector according to claim 1, wherein a card sensing terminal is provided in the bottom plate portion of the main housing, and each of the first and second sidewall frames have outer wall face covered by an electrically conductive sidewall cover, either one of the sidewall covers being electrically connected to the card sensing terminal.