

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. 11. Fig. 11 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 ± 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; and has the distinctive features that the main housing has a pair of first and second side wall 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 predetermined distance and being fitted in between the first and second side wall frames, and the first and second lid frames each having one end being provided with a pivot inserted into and rotatably pivoted in the slits of the first and second sidewall frames; and the lid-tray being further provided with a push-up spring between the other end of the first and second lid frames for lifting the lid-tray up by a particular angle when the card is inserted and removed.

[0011]

With the above aspect of the invention, the lid-tray is provided with a push-up springs that lift the tray up by a particular angle, so that when a card is inserted or removed, the lid-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 push-up spring may be formed from resilient plate material and have a support piece being installed to lie across the space between the first and second lid frames and a spring piece extending in a direction orthogonal to the support piece; the spring piece having a spring force in a direction of lifting the first and second lid frames up when the support piece is installed between the first and second lid frames.

[0013]

With the foregoing alternative, thanks to being structured with a support piece that is installed to lie across the space between the first and second lid frames, and with a spring piece that extends in a direction orthogonal to such support piece,

the push-up spring can be formed in a simple manner by processing resilient plate material.

[0014]

Alternatively again in such card connector of the invention, the first and second sidewall frames may have inner wall faces being provided with a latching portions for latching the first and second lid frames of the lid-tray, and the first and second lid frames of the lid-tray will be latched with the latching portions when the pivots are slidably installed inside the slits and the lid-tray is pushed into the main housing.

[0015]

As a further alternative in such card connector of the invention, at least one of the latching portions of each of the first and second sidewall frames may be provided with a latching tab, and the lid-tray may be provided with retaining parts at the pivots, the retaining parts being latched with the latching tabs when the lid-tray is pulled out of the main housing.

[0016]

With the foregoing alternatives, when the lid-tray is pushed into the main housing, the first and second lid frames will be latched by the latching portions, with the result that the reliability of the electrical contacting between the contacts of the card fitted and the contact elements of the connector will be assured, even against impacts or vibration.

[0017]

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.

[0018]

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

[0019]

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 card connector in an embodiment of the invention.

Fig. 2 is a perspective view of the card connector in Fig. 1, separated into a main housing and a lid-tray.

Fig. 3 is a perspective view of the main housing.

Fig. 4 illustrates the parts installed to the main housing, Fig. 4A being a perspective view of all such parts, Fig. 4B being a perspective view of one of the contact terminals in Fig. 4A, Fig. 4C being a perspective view of one of the sidewall covers in Fig. 4A, and Fig. 4D being a perspective view of the other sidewall cover in Fig. 4A.

Fig. 5 illustrates the lid-tray, Fig. 5A being a perspective view of the lid-tray, and Fig. 5B being an enlarged view of portion VB in Fig. 5A.

Fig. 6 is a perspective view of the push-up spring that is installed to the lid-tray.

Fig. 7 illustrates the state where the connector has been installed to a board and the lid-tray has been pushed into the main housing, Fig. 7A being a perspective view of such state and Fig. 7B being a side view of the connector in Fig. 7A seen from one side.

Fig. 8 illustrates the state, subsequent to Fig. 7, where the lid-tray has been drawn rearward from the main housing, Fig. 8A being a perspective view of such state and Fig. 8B being a side view of the connector in Fig. 8A seen from one side.

Fig. 9 illustrates the state, subsequent to Fig. 8, where the lid-tray has been lifted up, Fig. 9A being a perspective view of such state and Fig. 9B being a side view of the connector in Fig. 9A seen from one side.

Fig. 10 is a continuation of views of the state in Fig. 9, Fig. 10A being a top view of Fig. 9A, Fig. 10B being a cross-sectional view along line XB – XB in Fig. 10A, and Fig. 10C being an enlarged cross-sectional view of XC in Fig. 10B.

Fig. 11 is a perspective view of a card connector of the related art.

DESCRIPTION OF EXEMPLARY EMBODIMENT

[0020]

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.

[0021]

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.

[0022]

Fig. 1 is a perspective view of a connector in an embodiment of the invention. Fig. 2 is a perspective view of the connector in Fig. 1, separated into a

main housing and a lid-tray. Fig. 3 is a perspective view of the main housing. Fig. 4 illustrates the parts installed to the main housing, Fig. 4A being a perspective view of all such parts, Fig. 4B being a perspective view of one of the contact terminals in Fig. 4A, Fig. 4C being a perspective view of one of the sidewall covers in Fig. 4A, and Fig. 4D being a perspective view of the other sidewall cover in Fig. 4A. Fig. 5 illustrates the lid-tray, Fig. 5A being a perspective view of the lid-tray, and Fig. 5B being an enlarged view of portion VB in Fig. 5A. Fig. 6 is a perspective view of the push-up spring that is installed to the lid-tray. Figs. 7 to 10 are explanatory views setting forth the operations of the card connector. Fig. 7 illustrates the state where the connector has been installed to a board and the lid-tray has been pushed into the main housing, Fig. 7A being a perspective view of such state and Fig. 7B being a side view of the connector in Fig. 7A seen from one side. Fig. 8 illustrates the state, subsequent to Fig. 7, where the lid-tray has been drawn rearward from the main housing, Fig. 8A being a perspective view of such state and Fig. 8B being a side view of the connector in Fig. 8A seen from one side. Fig. 9 illustrates the state, subsequent to Fig. 8, where the lid-tray has been lifted up, Fig. 9A being a perspective view of such state and Fig. 9B being a side view of the connector in Fig. 9A seen from one side. Fig. 10 is a continuation of views of the state in Fig. 9, Fig. 10A being a top view of Fig. 9A, Fig. 10B being a cross-sectional view along line XB – XB in Fig. 10A, and Fig. 10C being an enlarged cross-sectional view of XC in Fig. 10B.

[0023]

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

A connector 1 is so structured as to be installable inside the battery receiving cavity of a mobile telephone terminal. The connector 1 has: 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 coupled to the main housing 2 and in which a SIM card (“card” below) can be removably fitted; and is so configured that a push-up spring 13 that pushes the

lid-tray 8 up by a particular angle during fitting or taking-out of a card is installed to the lid-tray 8. 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 push-up spring 13 are each described in turn below.

[0024]

The structure of the main housing is now described, with reference to Fig. 3.

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.

[0025]

As Fig. 3 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. 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. At the lower part of the first retaining protrusion 22, below a position proximate to the slit 21, there is formed a latching tab 22a, onto which the latching ledge 12a of the lid-tray 8 (see Fig. 5B).

[0026]

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. When the lid-tray 8 has been fitted to the housing 2 and positioned in the normal position, these retaining protrusions 22 and 23 act as stoppers that inhibit upward movement of the lid-tray 8 – that is, fulfill a locking function. 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 25. The attaching piece 7c of the sidewall cover 7A (see Fig. 4C) to be described hereafter contacts against this cut-away portion 25. At the bottom of the other end 2b of the first sidewall frame 2A – or more precisely, proximate to the bottom wall 2f – there is formed a protrusion 24 that raises up the other end 2b. The sidewall cover 7A (see Fig. 4C) to be described hereafter contacts against this protrusion 24. Toward the other end 2b of the first sidewall frame 2A, there is provided a latching protuberance 26 onto which the engaging hollow 7₁ of the sidewall cover 7A latches.

[0027]

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. The main housing 2 is fixed to a board P (see Fig. 7) for equipment or the like. The board P is housed inside the battery receiving cavity of a mobile telephone terminal.

[0028]

The parts that are installed to the main housing 2 will now be described with reference to Fig. 4.

As Fig. 4A 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.

[0029]

As Fig. 4A 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. 4B, 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.

[0030]

As Fig. 4C 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 7₂ that contacts with the contact portion 6a of the sensing terminal 6. As Fig. 4D 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 7₂ 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.

[0031]

The structures of the lid-tray 8 and the push-up spring 13 that is installed to the lid-tray 8 will now be described with reference to Figs. 5 and 6.

As Fig. 5A 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 a card therebetween.

[0032]

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. 5A 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. 5B, there are formed a pivot 11 that fits into and rotates in the slit 21 in the main housing 2 and moreover is able to slide, and a latching part 12. In the latching part 12 there is formed an angled latching ledge 12a. This latching ledge 12a latches onto the latching tab 22a of the main housing 2. At the other end of the first lid frame 8A, there is formed a 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, latching protrusions 8₁ and 8₂ that latch onto the first and second retaining protrusions 22 and 23 of the main housing 2 are formed on the outer wall face of the first lid frame 8A.

[0033]

In the connecting plate 9, toward the rear end of the first and second lid frames 8A and 8B, there is formed a relatively large bay-like opening 9₀. More

precisely,

the connection plate 9 is made up of plate-form portions 9a and 9b extending substantially to the mid-portion of the first and second lid frames 8A and 8B, and a connecting portion 9c that links the ends of the plate-form portions 9a, 9b; and the bay-like opening 9₀ is formed by the edges of the plate-form portions 9a, 9b and of the connecting portion 9c. The push-up spring 13 is disposed into this opening 9₀. 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.

[0034]

The push-up spring 13 is formed from resilient metal plate material and has a spring body 15 and a support piece 14 that supports the spring body 15, as Fig. 6 shows. The support piece 14 has a length a little longer than the distance between the first and second lid frames 8A, 8B, and a predetermined width, and at the two ends thereof in the longitudinal direction there are formed attaching portions 14a and 14b that attach to the first and second lid frames 8A, 8B of the lid-tray 8, and fixing holes 14₁ for fixing to the plate-form portions 9a and 9b.

The spring body 15 is formed as a tongue-like resilient body that projects down from roughly the central portion of one edge of the support piece 14, that is, downward from the horizontal support piece 14. This tongue-like spring body 15 has a predetermined projection length L and width W, and in the inner portion thereof there is formed a hollow 15₁ for regulation of the spring force. The spring body 15 projects from the support piece 14 in such a manner as to form an inclination angle θ with the horizontal plane.

The fact that the spring body 15 is inclined at a particular angle θ means that when the lid-tray 8 has been installed to the main housing 2 and is pushed downward, the spring body 15 is forcibly pressed so that the angle becomes roughly

zero, and with such state the lid-tray 8 is locked to the main housing 2. When such locking is subsequently released, the spring body 15 returns to its original state and the lid-tray 8 is lifted upward by an amount equivalent to the angle α . Thus, by determining particular values for the length L and angle α of the spring body 15, the lift-up motion of the lid-tray 8 is regulated.

[0035]

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 (see Fig. 2). The sensing terminal 6 is installed to the compartment 31 via a similar procedure.

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 push-up spring 13 is installed to the lid-tray 8. Specifically, the push-up spring 13 is placed so that the spring body 15 is positioned in the opening 9₀ of the lid-tray 8, and the attaching portions 14a and 14b of the support piece 14 are fixed to the first and second lid frames 8A, 8B (see Fig. 2). 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 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. Also, in such assembled state, the tip edge of the spring body 15 will contact against the surface of the board P and the lid-tray 8 will be lifted up by a particular angle (see Fig. 1).

[0036]

Next will be described, with reference to Figs. 7 to 10, 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. 7 illustrates the state where the lid-tray 8 has been pushed into the main housing 2. This state is such that the pair of first and second lid frames 8A, 8B of the lid-tray 8 are latched – that is, locked – by the first and second retaining protrusions 22, 23 of the main housing 2, and the spring body 15 of the push-up spring 13 is pressed in the direction of the board P. With the device in such state, when a card (not shown in the drawings) is installed in the receiving space S of the lid-tray 8, the contacts of the card will be in contact with and electrically connected to the contact terminals 5 of the connector 1. Because the lid-tray 8 is locked, the electrical contacting between the contacts of the card 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.

Following on from the state in Fig. 7, when the lid-tray 8, still pressed in the direction of the board P, is pulled rearward, as a result of such pulling the pivots 11 of the first and second lid frames 8A and 8B will move rearward in guided motion inside the slits 21 (see Figs. 8A and 8B).

With the lid-tray 8 in the retracted state (the state in Fig. 8), when the pushing force on the lid-tray 8 is stopped, the lid-tray 8 will be lifted upward by a particular angle due to the resilience of the push-up spring 13. More precisely, the pivots 11 of the lid tray 8 will rotate inside the slits 21 in the first and second sidewall frames 2A, 2B, and the lid-tray 8 will be lifted upward by an amount equal

to the distance that the spring body 15 of the push-up spring 13 moves in returning to its original state (see Fig. 9). With such state, the lid-tray 8 is lifted up by a particular angle from the board P, so that the card installed to the lid-tray 8 can be pulled out in a simple manner by utilizing such inclination angle. Moreover, with the lid-tray 8 in the state retracted rearward from the main housing 2, the latching ledges 12a proximate to the pivots 11 will be latched onto the latching tabs 22a on the retaining protrusions 22 of the sidewall frames 2A, 2B, so that the lid-tray 8 will not fall out from the main housing 2. The latching ledges 12a and latching tabs 22a can be disengaged from each other by pushing the lid-tray 8 toward the board P, then inward toward the main housing 2, whereupon push-in motion in the direction of the main housing 2 will be enabled.

[0037]

Above, removal of a card from the connector 1 has been described. To perform the reverse operation of installing a card, one inserts a card (not shown in the drawings) into the receiving space S of the lid-tray when the lid-tray 8 is in the lifted-up state (Figs. 9 and 10), and applies the removal procedure in reverse so as to fix the lid-tray 8 to the main housing 2. In such state, the lid-tray 8 will be lifted up by a particular angle from the board P, and consequently the card can be inserted into the lid-tray 8 in a simple manner by utilizing such inclination angle.

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 side wall 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 predetermined distance and being fitted in between the first and second side wall frames, and the first and second lid frames each having one end being provided with a pivot inserted into and rotatably pivoted in the slits of the first and second sidewall frames; and
the lid-tray being further provided with a push-up spring between the other end of the first and second lid frames for lifting the lid-tray up by a particular angle when the card is inserted and removed.
- 2 The card connector according to claim 1, wherein the push-up spring is formed from resilient plate material and has a support piece being installed to lie across the space between the first and second lid frames and a spring piece extending in a direction orthogonal to the support piece; the spring piece having a spring force in a direction of lifting the first and second lid frames up when the support piece is installed between the first and second lid frames.
3. The card connector according to claim 1, wherein the first and second sidewall frames have inner wall faces being provided with a latching portions for

latching the first and second lid frames of the lid-tray, and the first and second lid frames of the lid-tray are latched with the latching portions when the pivots are slidably installed inside the slits and the lid-tray is pushed into the main housing.

4. The card connector according to claim 3, wherein at least one of the latching portions of each of the first and second sidewall frames is provided with a latching tab, and the lid-tray is provided with retaining parts at the pivots, the retaining parts being latched with the latching tabs when the lid-tray is pulled out of the main housing.

5. 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.