Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).
Description

Field of the Invention

[0001] The present invention relates to modular jacks for mating with modular plugs for providing connection between the modular plugs and the modular jacks.

Description of the Related Art

[0002] Previously proposed modular jacks are arranged to connect a modular plug from a telephone network or an LAN network, and are provided with a casing made of synthetic resin having an insertion recessed portion for inserting and drawing a modular plug. Inside the insertion recessed portion, there is contained a contact pin for being brought into contact with a contact of the modular plug.

[0003] Each of the contact pins includes a fixed portion fixedly inserted into a fixing hole penetrating a side wall of the casing in a front and rear direction and an elastic contact portion bent to constitute an acute angle from a front end of the fixed portion and extended in an inclined shape toward a back face of the casing.

[0004] When the modular plug is connected to the modular jack, a contact of the modular plug is brought into press contact with an elastic contact portion of the modular jack and the elastic contact portion is elastically deformed such that an inclination angle thereof constitutes a steeper slope. Therefore, a rear end of the elastic contact portion is moved further in a rear direction. When a moving stroke of the rear end of the elastic contact portion is to be ensured, a height of the casing is increased in casing.

[0005] The constitution is opposedly against a request of a low height in a modular jack applied to an apparatus of a notebook type personal computer, a game machine or the like.

[0006] US Patent 4286835 describes a modular jack receptacle comprising a housing of insulating material having a plug receiving opening extending into one end thereof. The receptacle is mounted on a circuit board with a plug receiving end in the plane of the circuit board.

Summary of the Invention

[0007] The invention has been carried out in view of the above-described problem. Embodiments of the present invention can provide a combination of a modular jack and a printed wiring board capable of achieving a low height and its attaching structure.

[0008] Various aspects and features of the present invention are defined in the appended claims. The embodiment of the present invention include a combination of a modular jack and a printed wiring board according to claim 1.

[0009] Embodiments of the present invention relate to a modular jack which can be mounted on an apparatus such as, for example a notebook type personal computer, a game machine or the like, and arranged to mate with a modular plug corresponding thereto.

[0010] When the modular plug is connected to the modular jack, the front end of the elastic contact portion of the contact pin can be projected rearward from the casing and therefore, a moving stroke of the front end of the elastic contact portion in connecting the modular plug to the modular jack can also be ensured at the outside of the casing. As a result, by that amount, the height of the casing can be lowered.

[0011] In embodiments the modular jack is characterized in that the lead-out opening includes a plurality of slits for guiding the front ends of the elastic contact portions of the respective contact pins in a direction of dislocating the front ends in bending the elastic contact portions. According to these embodiments, when the front end of the elastic contact portion is projected to the outside of the casing, a vicinity of the front end is guided by the slit.

Brief Description of the Drawings

[0012] The invention will now be described by way of example with reference to the accompanying drawings, throughout which like parts are referred to by like references, and in which:

Fig. 1 is a partially broken side view showing a state of attaching a modular plug to a modular jack.

Fig. 2 is a disassembled perspective view of the modular jack.

Fig. 3 is a plane view of the modular jack. Fig. 4 is a sectional view taken along a line IV-IV of Fig. 3.

Fig. 5 is a sectional view taken along a line V-V of Fig. 3.

Fig. 6 is a rear view of the modular jack.

Fig. 7 is an outline sectional view of the modular jack in a state of being connected to the modular plug.

Fig. 8 is a side view of the modular jack.

Fig. 9 is a sectional view of a side wall of a shell and a side plate of a reinforcement tab engaged with each other.

Fig. 10 is a disassembled perspective view of a modular jack.

Fig. 11 is a sectional view of a modular jack.

Fig. 12 is an outline sectional view of the modular jack and the printed wiring board according to the invention in a state of being connected to the modular plug.

Detailed Description of the Preferred Embodiments

[0013] An explanation will be given of preferable embodiments of the invention in reference to the attached drawings.

[0014] Fig. 1 is an outline side view showing a state in which a modular plug is mounted to a modular jack.
reference to Fig. 1, the modular jack 1 is for connecting a modular plug 2 of a standardized product. The modular plug 2 is provided with a plug main body 3 for holding a plurality of contact pins (not illustrated) and an elastically deformable engaging lever 4 supported by the plug main body 3 in a cantilever shape.

Although according to the embodiment, an explanation will be given in conformity to an example of a vertical modular jack in which a front side of the modular jack 1 constitutes an upper direction X1 and a rear side thereof constitutes a lower direction X2, the invention is not limited thereto but the invention may be applied to a horizontal modular jack in which a front side of the modular jack is directed in a horizontal direction.

The modular jack 1 is provided with a casing 6 having an insulating performance made of, for example, synthetic resin and arranged above a printed wiring board 5; a shell 7 made of a metal for electromagnetic shielding for covering at least a portion of the casing 6; an insulating cover 8 made of, for example, synthetic resin for covering at least a portion of the shell 7; a plurality of contact pin 10 respectively having lead portions 9; and a reinforcement tab 11 soldered to a conductive portion above the printed wiring board 5 while reinforcing the casing 6.

As shown by Fig. 7, the main characteristics of the embodiment resides in that in connecting the modular plug, a front end 24 of an elastic contact portion 22 of the contact pin 10 is projected rearward from the casing 6 via a slit 23 and that the printed wiring board 5 is formed with a through hole 25 as escaperament for permitting the front end 24 to project.

In reference to Fig. 2, Fig. 4 and Fig. 5, the casing 6 is provided with an insertion recessed portion 12 opened in the upper direction X1 via an insertion opening 6b formed at a front face 6a thereof, and the modular plug 2 is inserted into the insertion recessed portion 12 to thereby connect thereto electrically and mechanically. In reference to Fig. 4 and Fig. 6, a rear face 6i of the casing 6 constitutes an attaching face opposed to a surface 5a of the printed wiring board 5.

In reference to Fig. 6, the rear face 6i of the case 6 is formed with an opening portion 6k. The opening portion 6k permits to introduce a base end portion (not illustrated) of the engaging lever 4 of the module plug 2 disposed at a mostly push-in position at inside of the insertion recessed portion 12 of the modular jack 1 to thereby minimize a depth dimension of the modular jack 1 and contribute to low back formation. In reference to Fig. 6 and Fig. 8, numeral 28 designates a rib inserted into an insertion hole (not illustrated) formed at the printed wiring board 5 for positioning the casing 6 to the printed wiring board 5.

In reference to Fig. 2 through Fig. 5, the shell 7 includes a front plate 7a having a rectangular contour for covering the front face 6a of the casing 6, and the insertion opening 7b for the modular plug communicating with the insertion recess portion 12 is partitioned at the front plate 7a. Side walls 7c, 7d, 7e and 7f respectively provided along corresponding side walls 6c, 6d, 6e and 6f of the casing 6, are extended from four sides of the front plate 7a. Further, elastic contact pieces 7m constituting a mountain shape, are respectively extended from a pair of opposed edge portions of the insertion opening 7b toward inside of the insertion recessed portion 12. In reference to Fig. 2 and Fig. 5, guide grooves 6j having a long vertical length for guiding the corresponding elastic contact pieces 7m, are formed at inner faces of the side walls 6e and 6f of the casing 6 (In Fig. 2, only the guide groove 6j of the side wall 6f is shown.). The respective elastic contact pieces 7m are for connecting to a metal shell (not illustrated) of the modular plug 2 to thereby connect to the ground. The shell is totally formed of sheet metal.

In reference to Fig. 2 and Fig. 4, left and right pairs of engaging holes 7g constituting, for example, a rectangular shape, are formed at the opposed side walls 7c and 7d of the shell 7. As shown by Fig. 2, the shell 7 is mounted to the casing 6 to cover the casing 6 from the upper side in the lower direction X2 and at this occasion, as shown by Fig. 4, the shell 7 is locked to the casing 6 by engaging locking projections 6g formed at the corresponding side walls 6c and 6d of the casing 6, with the respective engaging holes 7g.

In reference to Fig. 2 and Fig. 5, left and right pairs of window portions are formed at the opposed side walls 7e and 7f of the shell 7, and elastic contact pieces 7h are cut to rise in the respective window portions (in Fig. 2, only the elastic contact pieces 7h of the side wall 7e are shown). As shown by Fig. 5, the elastic contact piece 7h is brought into elastic contact with a chassis 27 made of a metal provided along a rear face of a cabinet 26 made of synthetic resin of an apparatus for operating to electrically conduct the shell 7 with the chassis 27 and match the ground level.

In reference to Fig. 1, there are formed first extended portions 7i extended from central portions of the respective side walls 7e and 7f in the lower direction X2 (side of the printed wiring board 5) and there are further formed second extended portions 7j extended from central portions of the first extended portions 7i in the lower direction X2.

A pair of side portions of the first extended portions 7i are respectively fitted to a pair of groove portions 13 formed at the side walls 6e and 6f of the casing 6 to respectively open in the upward direction X1 and in inward side directions. The second extended portions 7j are fitted to groove portions 17 formed between side plates 14 of the corresponding reinforcement tabs 11 and 12.
the corresponding side walls 6e and 6f of the casing 6.

In reference to Fig. 1 and Fig. 9, an outer side face of the second extended portion 7j, is formed with an engaging projection 7k engaged with a back face of the side plate 14 of the reinforcement tab 11.

In reference to Fig. 1, the reinforcement tab 11 is constituted by pressing a conductive sheet metal member and is provided with the side plate 14 and a leg portion 15 in a plate-like shape extended outwardly and orthogonally to a lower end of the side plate 14. Arm portions 16 are extended from upper portions of a pair of side portions of the side plate 14 to both sides, thereby, the side plate 14 is constituted substantially by a T-like shape.

According to the respective reinforcement tabs 11, the side plates 14 are fitted to the pair of groove portions 17 of the corresponding side walls 6e and 6f by moving the side plate 14 from the upper side in the lower direction X2 along central portions of the side walls 6e and 6f of the shell 7 previously mounted to the casing 6. At this time, the arm portions 16 of the side plate 14 are brought into contact with positioning stepped portions 18 in the groove portion 17 to thereby position a height position of the reinforcement tab 11. Press-fitting projections 19 are formed at side edges downward from the respective arm portions 16 of the side plate 14. The respective press-fitting projections 19 are press-fitted to corresponding groove walls of the groove portion 17 to thereby lock the side plate 14 from being drawn in the upper direction X1. As shown by Fig. 9, the engaging projection 7k of the shell 7 is brought into press contact with the side plate 14 of the reinforcement tab 11 prevented from drawing in this way to thereby ensure to prevent the shell 7 from being drawn in the upward direction.

In reference to Fig. 3 and Fig. 4, the side wall 6c holds the plurality of contact pins 10 to align horizontally. Specifically, each of the contact pins 10 is provided with a fixed portion 21 fixedly inserted to a fixing hole 20 penetrating the side wall 6c in the up and down direction, an elastic contact portion 22 in a cantilever shape bent to constitute an acute angle from an upper end of the fixed portion 21 and extended in an inclined shape toward the side of the printed wiring board 5 on the lower side and the lead portion 9 bent to constitute substantially right angle from a lower end of the fixed portion 21 and projected to an outer side of the side wall 6c along the surface 5a of the printed wiring board 5.

Meanwhile, as shown by Fig. 4, Fig. 5 and Fig. 6, at a rear wall 6h forming a rear face 6i of the casing 6, there are formed a plurality of slits 23 in parallel with each other as lead-out openings for opening the insertion recessed portion 12 to the side of the printed wiring board 5 on the rear side. The slits 23 as the lead-out openings are slidably fitted with front ends 24 of the corresponding elastic contact portions 22.

As shown by Fig. 7, when the modular jack 1 is connected with the modular plug 2 and the respective elastic contact portions 22 are bent, the front ends 24 of the elastic contact portions 22 are projected to the rear side of the casing 6 via the slits 23. The printed wiring board 5 is formed with through holes 25 substantially in a rectangular shape as escapement for permitting the front ends 24 of the plurality of the elastic contact portions 22 to project to the rear side of the casing 6. The slits 23 guide the front ends 24 of the elastic contact portions 22 to smoothly dislocate when the front ends 24 of the elastic contact portions 22 are deformed to bend.

In reference to Fig. 2 through Fig. 5, the insulating cover 8 is provided with a front plate 8a having the insertion opening 8b and having substantially a rectangular contour and four side walls 8c, 8d, 8e and 8f extended from four sides of the front plate 8a and constituting a square ring shape.

In reference to Fig. 4, the insertion opening 8b of the insulating cover 8 is formed by a similar shape slightly smaller than the insertion opening 7b of the shell 7 (opening diameter L1 < L2), as a result, the edge portion of the insertion opening 7b of the shell 7 is prevented from being exposed by the edge portion of the insertion opening 8b of the insulating cover 8.

The respective side walls 8c through 8f of the insulating cover 8 are made to cover the corresponding side walls 7c through 7f of the shell 7. Ranges of the respective side walls 8c through 8f of the insulating cover 8 of covering the corresponding side walls 7c through 7f of the shell 7, correspond to ranges of exposing the shell 7 from the cabinet 26 of the apparatus in a state in which the modular jack 1 is actually attached to the apparatus as shown by Fig. 4 and Fig. 5. An exposed portion of the shell 7 is covered by the insulating cover 8 and its appearance is excellent or at least improved. Further, a foreign matter is prevented or at least hindered from being brought into contact with the exposed portion and electromagnetic shielding is ensured or at least improved.

In reference to Fig. 2 and Fig. 5, the side walls 8e and 8f are formed with cutout portions 8h as escapement for preventing interference with the respective elastic contact pieces 7h of the shell 7.

Meanwhile, in reference to Fig. 2 and Fig. 4, the side walls 8c and 8d are formed with respective pairs of engaging holes 8g for engaging with the locking projections 6g of the casing 6 projected from the engaging holes 7g of the shell 7. By the engagement, there is achieved to prevent the insulating cover 8 from drawing from the shell 7. The locking projections 6g of the casing 6 achieve to unitarily lock the shell 7 and the insulating cover 8 to thereby achieve to prevent or hinder from being drawn, and the structure can be simplified.

As described above, according to the embodiment, as shown by Fig. 7, in connecting the modular plug 2, the front end 24 of the elastic contact portion 22 of the contact pin 10 can be projected rearward from the casing 6 via the slit 23. Therefore, the moving stroke of the front end 24 of the elastic contact portion 22 in connecting the modular plug 2 can be ensured also at the outside of the casing 6. Therefore, the height of the casing 6 can be
lowered by that amount, and a low height of the modular jack 1 can be achieved.

[0038] By combining the printed wiring board 5 having the through hole 25 as the escapement capable of permitting the front end 24 to project with the modular jack 1, a low height of the modular jack 1 is substantially enabled.

[0039] Further, when the front end 24 of the elastic contact portion 22 is projected to the outside of the casing 6, a vicinity of the front end 24 is guided by the slit 23 and accordingly, the elastic contact portion 22 can smoothly be dislocated.

[0040] Fig. 10 shows an inverse insertion preventive portion 8i extended in the lower direction may be extended from the side wall 8d of the insulating cover 8. In this case, when the direction of the insulating cover 8 is assumedly changed from a regular direction by 180 degrees and the side wall 8d of the insulating cover is going to cover the side wall 7c of the shell 7, a lower end of the inverse insertion preventive portion 8i is brought into contact with a stepped portion 6m of the side wall 6c of the casing 6. Thereby, mounting of the insulating cover 8 is hampered and therefore, assembly by so-to-speak inverse insertion cannot be carried out. In the embodiment of Fig. 10, constitutions similar to those of Fig. 2 are attached with similar notations and an explanation thereof is omitted.

[0041] Further, as shown by Fig. 11, there may be constructed a structure in which there is provided an attached piece 31 extended from a lead 9 of a contact pin 10A in parallel with the fixed portion 21 and a lower portion of the side wall 6c is sandwiched by the fixed portion 21 and the attached piece 31 to thereby fix the contact pin 10A to the casing 6. Although according to the embodiment of Fig. 4, the fixed portion 21 is inserted into the fixing hole 20 of the casing 6, in this embodiment, the fixed portion 21 is mounted to a holding groove 32 opened to inside of the casing 6 and the lower side of the casing 6. The holding groove 32 communicates with the slit 23. In this embodiment, assembling can easily be carried out by mounting the contact pin 10A from the lower side of the casing 6. That is, the elastic contact portion 22 and the fixed portion 21 of the contact pin 10A are inserted into the casing 6 via the slit 23 and the lower portion of the side wall 6c of the casing 6 is press-fitted into a space between the fixed portion 21 and the attached piece 31 to thereby fix thereto. In the embodiment of Fig. 11, constitutions similar to those of the embodiment of Fig. 4 are attached with similar notations.

[0042] As shown in Fig. 12, the escapement provided at the printed wiring board 5 does not penetrate through but is a recessed portion 125 formed at the surface 5a so far as the recessed portion can permit the front end 24 of the elastic contact portion 22 to project. Otherwise, various changes can be carried out within the range of the invention as defined in the claims.

Claims

1. A combination of a modular jack and a printed wiring board, wherein the modular jack includes:

   - a casing having an insulating performance for partitioning an insertion recessed portion opened in a front direction for inserting a modular plug; and
   - a plurality of contact pins (10) arranged to align in the insertion recessed portion (12)

   wherein each of the contact pins (10) includes a fixed portion (21) for engaging with a side wall (61) of the casing 6 and an elastic contact portion bent to constitute an acute angle from a front end of the fixed portion and extended in an inclined shape toward a rear face of the casing, and

   wherein when the casing is connected to the modular plug (2), a front end of the elastic contact portion pressed by a contact of the modular plug (2) is projected rearward from the casing via a lead-out opening formed at the rear face of the casing, and wherein a surface of the printed wiring board is provided with an escapement for permitting the front end of the elastic contact portion to project from the rear face of the casing in a rear direction, characterized in that the escapement of the printed wiring board is a recessed portion not penetrating through the printed wiring, board.

2. The combination according to Claim 1, wherein the lead-out opening includes a plurality of slits for guiding the front ends of the elastic contact portions of the respective contact pins in a direction of dislocating the front ends in bending the elastic contact portions.

Patentansprüche

1. Eine Kombination einer Modularsteckerbuchse und einer Leiterplatte, wobei die Modularsteckerbuchse umfasst:

   - ein Gehäuse mit isolierender Eigenschaft zum Aufteilen eines vertieften Einführungsteils, der in vorderseitiger Richtung zum Einführen eines modularen Steckers geöffnet ist;
   - eine Mehrzahl von Kontaktstiften (10), die derart angeordnet sind, dass sie in dem vertieften Einführungsteil (12) ausgerichtet sind;
   - wobei jeder Kontaktstift (10) einen festen Teil (21) zum Eingreifen in eine Seitenwand (61) des Gehäuses und einen elastischen Kontaktteil umfasst, der derart gebogen ist, dass er von einem vorderen Ende des festen Teils einen spit-
zen Winkel bildet und sich schräg in Richtung einer Hinterseite des Gehäuses erstreckt, und
wobei, wenn das Gehäuse mit dem modularen Stecker (2) verbunden ist, ein vorderes Ende des elastischen Kontaktteils, das durch einen Kontakt des modularen Steckers (2) gedrückt wird, in Richtung der Hinterseite des Gehäuses durch eine herausführende Öffnung herausragt, die auf der Hinterseite des Gehäuses gebildet ist, und wobei eine Oberfläche der Leiterplatte mit einer Ausnehmung versehen ist, die erlaubt, dass das vordere Ende des elastischen Kontaktteils aus der Rückseite des Gehäuses in einer rückwärtigen Richtung herausragt, dadurch gekennzeichnet, dass die Ausnehmung der Leiterplatte ein vertiefter Teil ist, der die Leiterplatte nicht durchdringt.

2. Die Kombination gemäß Anspruch 1, wobei die herausführende Öffnung eine Vielzahl von Schlitzten zum Führen der vorderen Enden der elastischen Kontaktteile der entsprechenden Kontaktstifte in einer Richtung umfasst, in der die vorderen Enden durch Biegen der elastischen Kontaktteile verschoben werden.

Revendications

1. Association d’un connecteur modulaire et d’une carte à circuit imprimé, dans laquelle le connecteur modulaire comprend :

un boîtier ayant une fonction isolante pour diviser une partie d’insertion en retrait, ouverte dans une direction avant pour insérer une fiche modulaire ; et
une pluralité de broches de contact (10) prévues pour s’aligner dans la partie d’insertion en retrait (12),

dans laquelle chacune des broches de contact (10) comprend une partie fixe (21) destinée à être en contact avec une paroi latérale (61) du boîtier et une partie de contact élastique courbée pour constituer un angle aigu depuis une extrémité avant de la partie fixe et étendue sous une forme inclinée vers une face arrière du boîtier, et dans laquelle, lorsque le boîtier est connecté à la fiche modulaire (2), une extrémité avant de la partie de contact élastique pressée par un contact de la fiche modulaire (2) fait saillie en arrière du boîtier par une ouverture de sortie formée dans la face arrière du boîtier, et dans laquelle une surface de la carte à circuit imprimé est pourvue d’un dégagement pour permettre à l’extrémité avant de la partie de contact élastique de faire saillie depuis la face arrière du boîtier dans une direction arrière, caractérisée en ce

que le dégagement de la carte à circuit imprimé est une partie évidée qui ne traverse pas la carte à circuit imprimé.

2. Association selon la revendication 1, dans laquelle l’ouverture de sortie comprend une pluralité de fentes pour guider les extrémités avant des parties de contact élastiques des broches de contact respectives dans une direction de démontage des extrémités avant lors du pliage des parties de contact élastiques.
FIG. 6
REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

• US 4286835 A [0006]