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(54) **Fixing heat dissipating unit and electronic device having fixing heat dissipating unit**

Fixierende Wärmeableitungseinheit und elektronische Vorrichtung mit fixierender Wärmeableitungseinheit

Unité de dissipation de chaleur fixable et dispositif électronique doté d'une unité de dissipation de chaleur fixable

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Description

BACKGROUND OF THE INVENTION

Field of Invention

[0001] The present invention relates to a fixing heat dissipating unit with integrated functions of holding and heat dissipating, and an electronic device having the fixing heat dissipating unit.

Related Art

[0002] As the electronic devices are operating, the elements inside, such as the chips, usually generate heat energy. The accumulating heat energy may, however, easily overheat the electronic device and hence lead to the malfunction of the electronic device. Thus, the electronic device usually has a heat dissipating element, such as a fan, a metal heat dissipation sheet, a ceramic heat dissipation sheet, or a heat pipe, for heat dissipation. Nevertheless, the fan or the heat pipe takes a lot of space in the electronic device; and as for the fan, the heat flow is also another factor to be considered while designing. Hence other than the material cost, the design cost will as well be increased.

[0003] Additionally, shaking, which usually occurs while moving the electronic device, may damage the elements in the electronic device. Therefore, the fixing glue or a fixing element is normally used to hold or fix the elements for increasing the reliability of the electronic device. For the elements needed to be held, the metal fixing elements usually provide better steadiness for the elements.

[0004] The above heat dissipating element and fixing element are usually separate elements, so the design cost or the testing time cannot be effectively controlled. US 6,151,115 discloses an electronic device according to the preamble of claim 1. Two printed circuit boards (PCB) are held inside of the electronic device in parallel to each other by means of heat conducting plate, which is held in between the two PCBs and pressed against electronic components disposed on the PCBs.

SUMMARY OF THE INVENTION

[0005] It is an object of the present invention to provide an electronic device including an improved heat dissipating element and fixing element to reduce design and materials costs and testing time.

[0006] This problem is solved by an electronic device according to claim 1. Further advantageous embodiments are the subject-matter of the dependent claims.

[0007] According to the present invention there is provided an electronic device including a fixing heat dissipating unit having integral design and an electronic device having this fixing heat dissipating unit, wherein the fixing heat dissipating unit is disposed in the electronic device. The fixing heat dissipating unit that is connected to a substrate and a heat source includes a fixing element and a heat conducting element. The fixing element is connected to the substrate to hold the substrate in the electronic device. The heat conducting element is connected to the heat source and the fixing element respectively. The heat source is a part of the electronic device, and the fixing element is integrated with the heat conducting element as a single component.

[0008] In the electronic device of the present invention the heat source is disposed on a surface of the first substrate, and the second substrate is disposed adjacent to the first substrate.

[0009] The fixing heat dissipating unit is connected to the second substrate and the heat source respectively. The fixing heat dissipating unit includes a fixing element and a heat conducting element. The fixing element is connected to the second substrate to hold the second substrate in the electronic device, and the heat conducting element is connected to the heat source and the fixing element respectively. The fixing element is integrated with the heat conducting element as a single component.

[0010] As described above, with the integrated functions of holding and heat dissipating, the fixing heat dissipating unit and the electronic device having the fixing heat dissipating unit according to the present invention transmit the heat energy generated by the heat source through the heat conducting element to the entire fixing heat dissipating unit so as to enhance the heat dissipating efficiency by increasing the heat dissipating area. Compared to the prior art, the fixing heat dissipating unit and the electronic device of the present invention can match the positions of different substrates to provide the functions of heat dissipating and holding. Therefore, this can lower the design cost, reduce the testing time and effectively increase the reliability of the electronic product.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The invention will become more fully understood from the detailed description and accompanying drawings, which are given for illustration only, and thus are not limitative of the present invention, and wherein:

[0012] FIG. 1A is an exploded view of an electronic device according to a preferred embodiment of the present invention;

[0013] FIG. 1B is an assembled view of a part of the electronic device in FIG. 1A;

[0014] FIG. 2 is a schematic view of another aspect of the fixing heat dissipating unit according to the preferred embodiment of the present invention; and

[0015] FIG. 3 is a schematic view of yet another aspect of a fixing heat dissipating unit.

DETAILED DESCRIPTION OF THE INVENTION

[0016] The present invention will be apparent from the following detailed description, which proceeds with ref-

erence to the accompanying drawings, wherein the same references relate to the same elements.

[0017] FIG. 1A is an exploded view of an electronic device according to a preferred embodiment of the present invention. FIG. 1B is an assembled view of a part of the electronic device in FIG. 1A.

[0018] Referring to FIGS. 1A and 1B, an electronic device 1 includes a first substrate 10, a heat source 20, a second substrate 30, and a fixing heat dissipating unit 40. The electronic device 1 may be a desktop, a laptop, an internet communication device, or a display device. In the embodiment, the electronic device 1 is an internet communication device applied to, for example, ADSL or VDSL.

[0019] The heat source 20 is disposed on a surface 11 of the first substrate 10. In the embodiment, the heat source 20 is, for example, a chip or an active electronic element such as a transistor, which usually produces high temperature while operating. The first substrate 10 is a printed circuit board (PCB) or a glass circuit board (GCB) for example. Additionally, a socket 12 is disposed on the surface 11 of the first substrate 10. The second substrate 30 is connected to the socket 12 and disposed adjacent to the first substrate 10. The first substrate 10 and the second substrate 30 are substantially perpendicular to each other. The second substrate 30 is electrically connected to the first substrate 10 through the socket 12 for signal transmission. In the embodiment, the second substrate 30 may be a PCB or GCB for example.

[0020] It is noted that the first substrate 10 and/or the second substrate 30 further includes one or more subsystems with an independent function, and the first substrate 10 and/or the second substrate 30 is electrically connected to the electronic device 1 to become an integrated system with an integrated function. The independent function of the subsystem may be, for example, an operating function, signal receiving/transmitting function, or control function. The integrated system is, for example, a system having the integrated function of the above independent functions of the subsystems. Furthermore, the electronic device 1 may also include more substrates (not shown) in order to have various functions.

[0021] The fixing heat dissipating unit 40 is disposed in the electronic device 1 and connects to the second substrate 30 and the heat source 20, respectively. The fixing heat dissipating unit 40 includes a fixing element 41 and a heat conducting element 42 that are connected to each other. The material of the fixing element 41 and the heat conducting element 42 may be a heat conducting material selected from at least one of a metal, an alloy, or a polymer material. The metal may be at least one of stannum (Sn), copper (Cu), aluminum (Al), or tin.

[0022] The fixing element 41 at least includes a first opening 411 and a second opening 412, each of which is linked to at least one corner of the second substrate 30 to hold the second substrate 30 in the electronic device 1. That is, two corners of the second substrate 30 pass through the first opening 411 and the second opening 412 respectively. Moreover, the heat conducting element 42 is connected to the heat source 20 and the fixing element 41 respectively. The heat source 20 is a part of the electronic device 1, and the fixing element 41 is integrated with the heat conducting element 42 as a single component. Thus the heat conducting element 42 may contact the heat source 20 to conduct the heat energy generated by the heat source 20 to the fixing element 41, so as to dissipate the heat through the fixing heat dissipating unit 40. Additionally, a heat dissipation sheet or a heat dissipation paste (not shown) may be disposed between the heat conducting element 42 and the heat source 20 so as to enhance the heat conduction.

[0023] In the embodiment, the electronic device 1 further includes a housing having a lower housing 51 and an upper housing 52. The space formed by the housing is to contain the first substrate 10, the heat source 20, the second substrate 30, and the fixing heat dissipating unit 40. The positions and the dispositions of the first substrate 10, the second substrate 30, and the fixing heat dissipating unit 40 may be changed depending on the design of the lower housing 51 and the upper housing 52.

[0024] In the embodiment, two ends of the fixing unit 41 further have screw holes 413 and 414, respectively, for enhancing the structure of the electronic device 1. Screws 61 and 62 pass through the screw holes 413 and 414, respectively, and are screwed to the lower housing 51 so as to fix the fixing heat dissipating unit 40 to the lower housing 51. Although the fixing element 41 in the embodiment is fixed to the lower housing 51 by screwing, it can also be fixed to the lower housing 51 or the upper housing 52 by clipping or riveting according to the actual design needs. Naturally, the fixing heat dissipating unit 40 may also, for example but not limited to, be screwed on the first substrate 10, for the prime concern is the structure stability.

[0025] Moreover, the assembled appearance of the lower housing 51 and the upper housing 52 in the embodiment is a triangle-like cylinder for example. It has a certain height so that after the electronic device 1 is connected to at least one peripheral expansion module or at least one connecting line (not shown), the structure of the electronic device 1 would still have a certain level of stability. If the fixing heat dissipating unit 40 is made of a metal or alloy, a weight allocating function may be provided after disposition so as to make the electronic device 1 more steady.

[0026] With reference to FIG. 2, it is another aspect of the fixing heat dissipating unit according to the preferred embodiment of the present invention. A fixing element 41 a of a fixing heat dissipating unit 40a has only the first opening 411 for at least one corner of the second substrate 30 to pass through, hence to hold the second substrate 30 in the electronic device. One end of the fixing element 41 a also includes the screw hole. The fixing heat dissipating unit 40a and the lower housing 51 are locked by the screw 61, and the heat conducting element

42 is still integrated with the fixing element 41 as a single component. Similarly, the heat conducting element 42 also contacts with the heat source 20 so as to conduct the heat energy generated by the heat source 20 to the fixing heat dissipating unit 40a for dissipating the heat. In addition, a heat dissipation sheet or a heat dissipation paste (not shown) may be disposed between the heat conducting element 42 and the heat source 20 for enhancing the heat conduction.

[0027] With reference to FIG. 3, it is yet an example of a fixing heat dissipating unit. The difference between this aspect and the above aspect is that a second substrate 30a is disposed in parallel to a first substrate 10a, and two corners of the second substrate 30a pass through the first opening 411 and the second opening 412 of a fixing element 41b of a fixing heat dissipating unit 40b, respectively. The second substrate 30a is disposed substantially in parallel to the first substrate 10a, which further includes two supporting elements 13 and 14 for supporting the second substrate 30a. The second substrate 30a includes two openings 31 and 32, and two screws 63 and 64 pass through the openings 31 and 32, respectively, for connecting with the supporting elements 13 and 14. Therefore the second substrate 30a is held on the first substrate 10a by the fixing heat dissipating unit 40b and the supporting elements 13 and 14.

[0028] In addition, the two ends of the fixing element 41b of the fixing heat dissipating unit 40b also have the screw holes respectively (not shown). The difference between this aspect and the above aspect is that the screws 61 and 62 pass through the two screw holes of the fixing element 41 b and then fix the fixing heat dissipating unit 40b on the first substrate 10a. However, the fixing heat dissipating unit 40b may also be fixed in the housing (not shown) according to the actual needs.

[0029] To sum up, a fixing heat dissipating unit and an electronic device having such according to the present invention integrate the fixing element and the heat dissipating element so that the heat energy generated by the heat source can be conducted to the entire fixing heat dissipating unit by contacting the heat conducting element, so as to enhance the heat dissipating efficiency by increasing the heat dissipating area. Compared to the prior art, the present invention is able to lower the design cost and reduce the testing time of the fixing element and the heat dissipating element to control the production cost. The fixing heat dissipating unit and the electronic device of the present invention can provide the functions of heat dissipating, holding, and weight allocating, thereby effectively increasing the reliability of the electronic product.

[0030] Although the invention has been described with reference to specific embodiments, this description is not meant to be construed in a limiting sense. Various modifications of the disclosed embodiments, as well as alternative embodiments, will be apparent to persons skilled in the art. It is, therefore, contemplated that the appended claims will cover all modifications that fall within the true scope of the invention.

Claims

1. An electronic device (1), comprising:

a first substrate (10); a heat source (20) being disposed on a surface of the first substrate;
a second substrate (30) disposed adjacent to the first substrate; and
a heat dissipating unit (40) for dissipating heat of said heat source (20); wherein
said heat dissipating unit (40) comprises a fixing element (41) and a heat conducting element (42), which is connected to the heat source and integrated with the fixing element (41) as a single component;
said first substrate (10) and said second substrate (30) are substantially perpendicular to each other and connected to each other, wherein
said fixing element (41) is connected to a housing of said electronic device (1); **characterized in that** said fixing element comprises at least one opening (411, 412) through which an associated corner of said second substrate (30) passes to thereby form a fixing heat dissipating unit (40) holding said first and second substrate (10, 30) in said electronic device (1) and dissipating heat of said heat source (40).

2. The electronic device according to claim 1, wherein the heat source (20) is an active electronic element.

3. The electronic device according to claim 1 or 2, wherein the fixing element of the fixing heat dissipating unit comprises a first opening (411) linked to a corner of the second substrate (30) and a second opening (412) linked to another corner of the second substrate (30).

4. The electronic device according to any of the preceding claims, wherein the material of the fixing element and the heat conducting element of the fixing heat dissipating unit is a metal, an alloy and/or a polymer material.

5. The electronic device according to any of the preceding claims, wherein
said housing contains the heat source (20), the first substrate (10), the second substrate (30), and the fixing heat dissipating unit (40).

6. The electronic device according to any of the preceding claims, wherein the fixing element (40) and the first substrate (10) are combined by clipping,

locking, or riveting, and the fixing element is fixed to the housing by clipping or locking.

7. The electronic device according to any of the preceding claims, further comprising:

a heat dissipation paste or a heat dissipation sheet disposed between the heat conducting element (42) and the heat source (70).

8. The electronic device according to any of the preceding claims, wherein the first and/or second substrate (10, 30) includes one or more subsystems for implementing an independent operating, signal receiving/transmitting or control function.

9. The electronic device according to any of the preceding claims, wherein the first substrate (10) is electrically connected to the second substrate (30) through a socket for signal transmission.

Patentansprüche

1. Elektronische Vorrichtung (1), umfassend:

ein erstes Substrat (10), wobei eine Wärmequelle (20) auf einer Oberfläche des ersten Substrats angeordnet ist;
ein zweites Substrat (30), das benachbart zu dem ersten Substrat angeordnet ist; und
eine Wärmeableitungseinheit (40) zum Ableiten von Wärme von der Wärmequelle (20); wobei die Wärtneableitungseinheit (40) ein Befestigungselement (41) und ein wärmeleitendes Element (42) aufweist, das mit der Wärmequelle verbunden ist und in welches das Befestigungselement (41) als einzelnes Bauteil integriert ist; wobei das erste Substrat (10) und das zweite Substrat (30) im Wesentlichen senkrecht zueinander sind und miteinander verbunden sind,
wobei das Befestigungselement (41) mit einem Gehäuse der elektronischen Vorrichtung (1) verbunden ist, **dadurch gekennzeichnet, dass** das Befestigungselement mindestens eine Öffnung (411, 412) aufweist, durch die sich eine zugeordnete Ecke des zweiten Substrats (30) erstreckt, um dadurch eine Befestigung für die Wärmeabführungseinheit auszubilden (40), welche das erste und das zweite Substrat (10, 30) in der elektronischen Vorrichtung (1) hält und von Wärme von der Wärmequelle (40) ableitet.

2. Elektronische Vorrichtung nach Anspruch 1, wobei die Wärmequelle (20) ein aktives elektronisches Element ist.

3. Elektronische Vorrichtung nach Anspruch 1 oder 2, wobei die Befestigung für die Wärmeabfuhrungseinheit eine erste Öffnung (411), die mit einer Ecke des zweiten Substrats (30) verbunden ist, und eine zweite Öffnung (412) aufweist, die mit einer anderen Ecke des zweiten Substrats (30) verbunden ist.

4. Elektronische Vorrichtung nach einem der vorhergehenden Ansprüche, wobei das Material des Befestigungselementes und des wärmeleitenden Elements der Befestigung für die Wärmeabführungseinbeit ein Metall, eine Legierung und/oder ein Polymermaterial ist.

5. Elektronische Vorrichtung nach einem der vorhergehenden Ansprüche, wobei
das Gehäuse die Wärmequelle (20), das erste Substrat (10), das zweite Substrat (30) und die Befestigung für die Wärmeabführungseinheit (40) enthält.

6. Elektronische Vorrichtung nach einem der vorhergehenden Ansprüche, wobei das Befestigungselement (40) und das erste Substrat (10) durch Einclipsen, Verrasten oder Vernietung miteinander verbunden sind und wobei das Befestigungselement an dem Gehäuse durch Einclipsen oder Einrasten befestigt ist.

7. Elektronische Vorrichtung nach einem der vorhergehenden Ansprüche, weiterhin umfassend:

eine Wärmeableitungs-Paste oder ein Wärmeableitungs-Blech, die bzw. das zwischen dem wärmeleitenden Element (42) und der Wärmequelle (70) angeordnet ist.

8. Elektronische Vorrichtung nach einem der vorhergehenden Ansprüche, wobei das erste und/oder zweite Substrat (10, 30) eines oder mehrere Untersysteme zur Realisierung einer unabhängigen Betriebsfunktion, Signal-Empfangs-/Sende-Funktion oder Steuerfunktion aufweist.

9. Elektronische Vorrichtung nach einem der vorhergehenden Ansprüche, wobei das erste Substrat (10) elektrisch mit dem zweiten Substrat (30) über eine Buchse zur Signalübertragung verbunden ist.

Revendications

1. Un dispositif électronique (1), comprenant :

un premier substrat (10) ; une source de chaleur (20) étant disposée sur une surface du premier substrat ;
un second substrat (30) disposé de manière adjacente par rapport au premier substrat ; et

une unité de dissipation de chaleur (40) pour la dissipation de chaleur de ladite source de chaleur (20) ; dans laquelle
ladite unité de dissipation de chaleur (40) comporte un élément de fixation (41) et un élément conducteur de chaleur (42), qui est en contact avec la source de chaleur et intégré à l'élément de fixation (41) sous la forme d'un composant unique ;
lesdits premier (10) et second substrats (30) étant respectivement perpendiculaires l'un par rapport à l'autre et connectés l'un à l'autre, dans lequel ledit élément de fixation (41) est connecté à un logement dudit dispositif électronique (1) ;
caractérisé en ce que ledit élément de fixation comporte au moins une ouverture (411, 412) au travers de laquelle passe un coin associé dudit second substrat (30) pour former une unité de dissipation de chaleur (40) et de fixation maintenant lesdits premier et second substrats (10, 30) au sein dudit dispositif électronique (10) et dissipant la chaleur de ladite source de chaleur (40).

2. Le dispositif électronique selon la revendication 1, dans lequel la source de chaleur (20) est un élément électronique active.

3. Le dispositif électronique selon la revendication 1 ou 2, dans lequel l'élément de fixation de l'unité de dissipation de chaleur et de fixation comporte une première ouverture (411) en liaison avec un coin du second substrat (30) ainsi qu'une seconde ouverture (412) en liaison avec un autre coin du second substrat (30).

4. Le dispositif électronique selon l'une quelconque des revendications précédentes, dans lequel le matériau de l'élément de fixation et de l'élément conducteur de chaleur de l'unité de dissipation de chaleur et de fixation est un métal, un alliage et/ou un matériau polymère.

5. Le dispositif électronique selon l'une quelconque des revendications précédentes, dans lequel ledit logement comporte la source de chaleur (20), le premier substrat (10), le second substrat (30), et l'unité de dissipation de chaleur et de fixation (40).

6. Le dispositif électronique selon l'une quelconque des revendications précédentes, dans lequel l'élément de fixation (40) et le premier substrat (10) sont combinés par attache, blocage ou rivetage, et l'élément de fixation est fixé au logement par attache ou blocage.

7. Le dispositif électronique selon l'une quelconque des revendications précédentes, comportant en outre ;
une pâte de dissipation de chaleur ou une feuille de dissipation de chaleur disposée entre l'élément conducteur de chaleur (42) et la source de chaleur (70).

8. Le dispositif électronique selon l'une quelconque des revendications précédentes, dans lequel le premier et/ou le second substrat (10, 30) comporte un ou plusieurs
Sous-systèmes pour l'implémentation d'une fonctionnalité indépendante de fonctionnement, de réception/transmission du signal ou de commande.

9. Le dispositif électronique selon l'une quelconque des revendications précédentes, dans lequel le premier substrat (10) est électriquement connecté au second substrat (30) via un connecteur de transmission de signal.

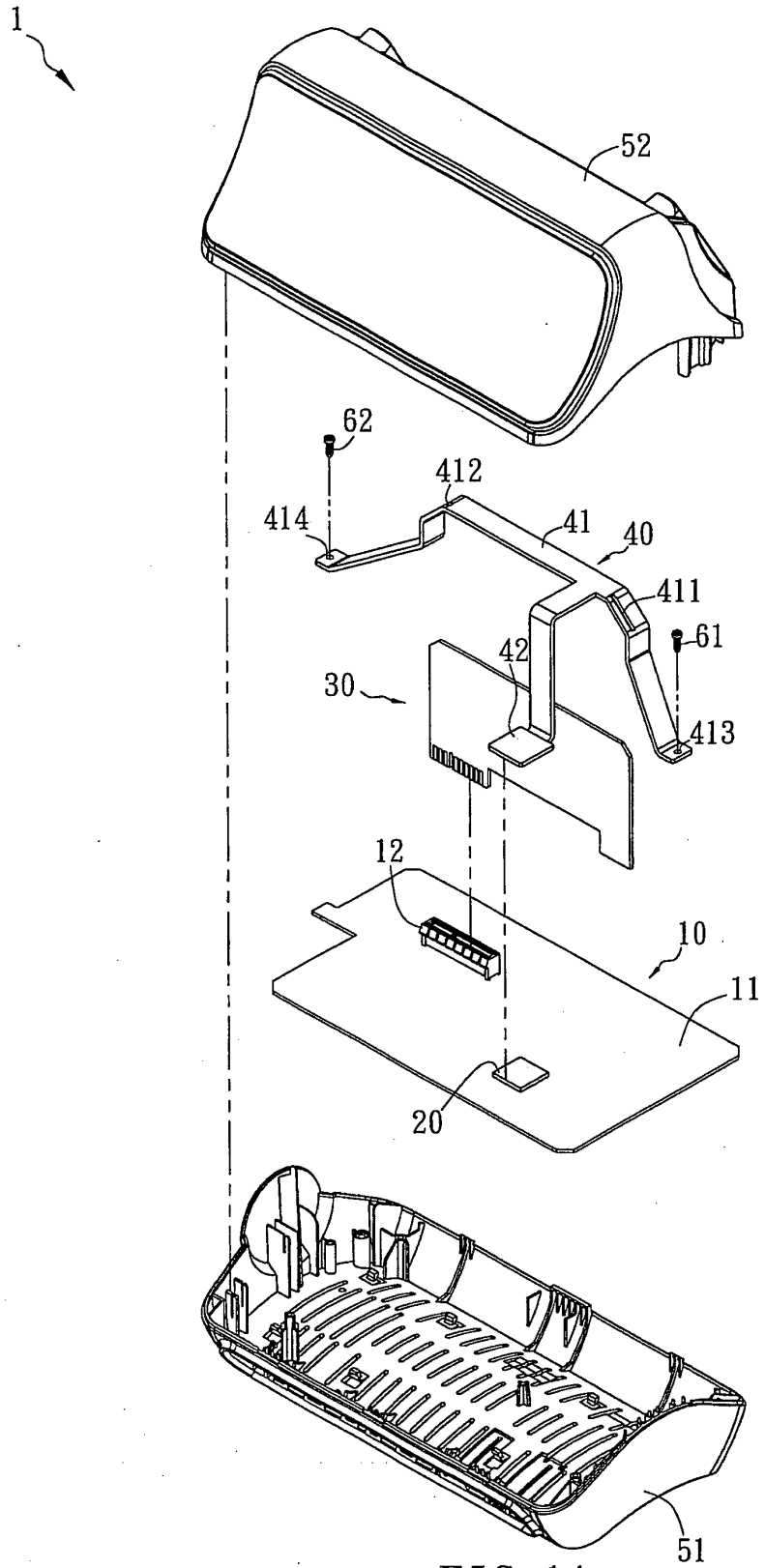

FIG. 1A

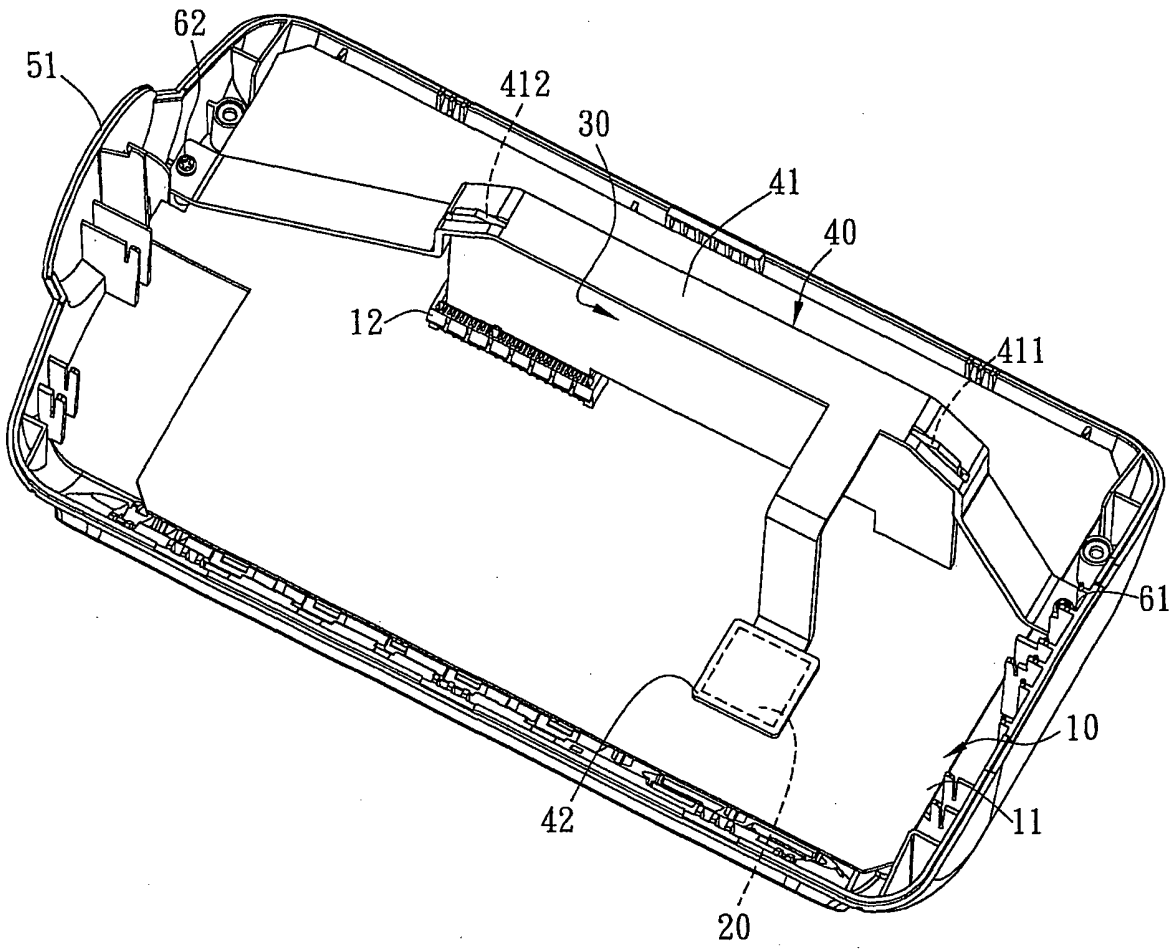

FIG. 1B

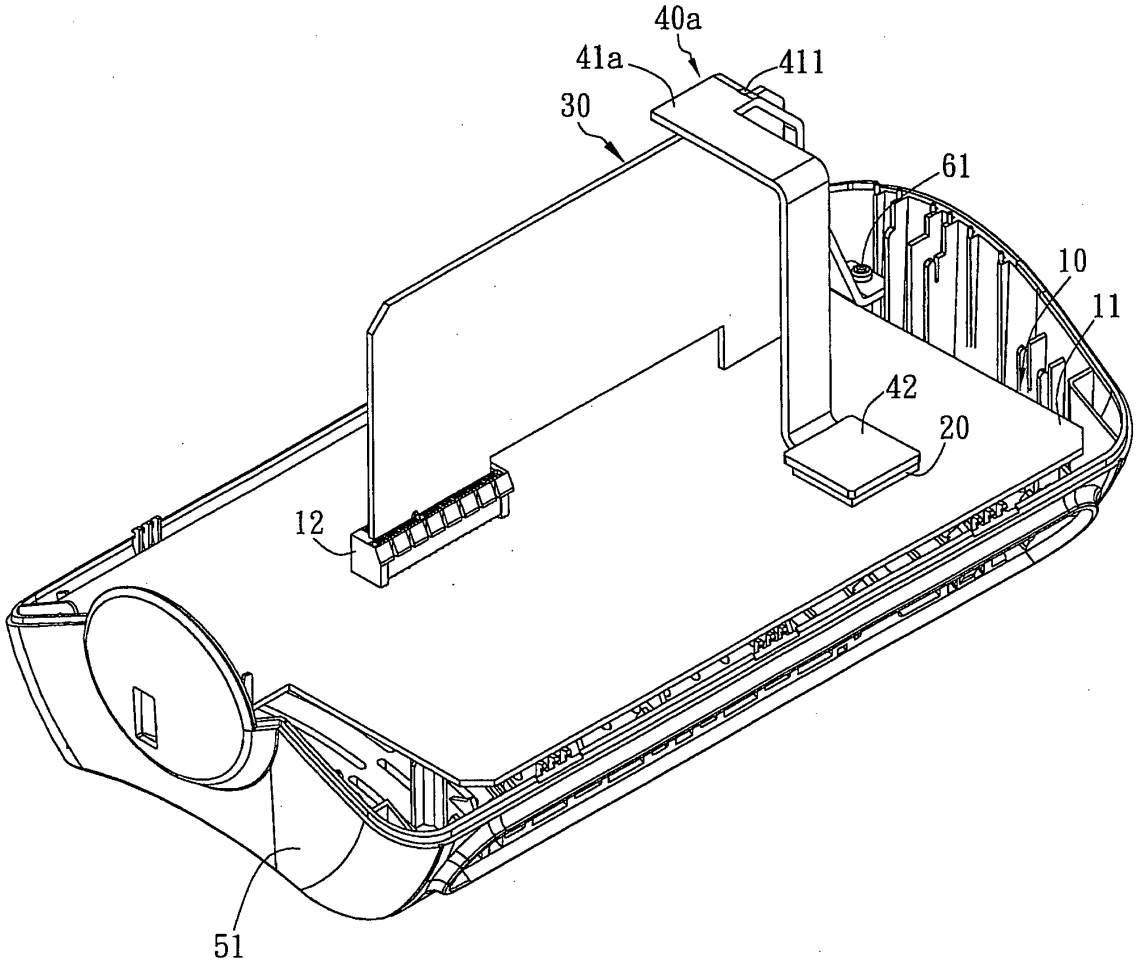

FIG. 2

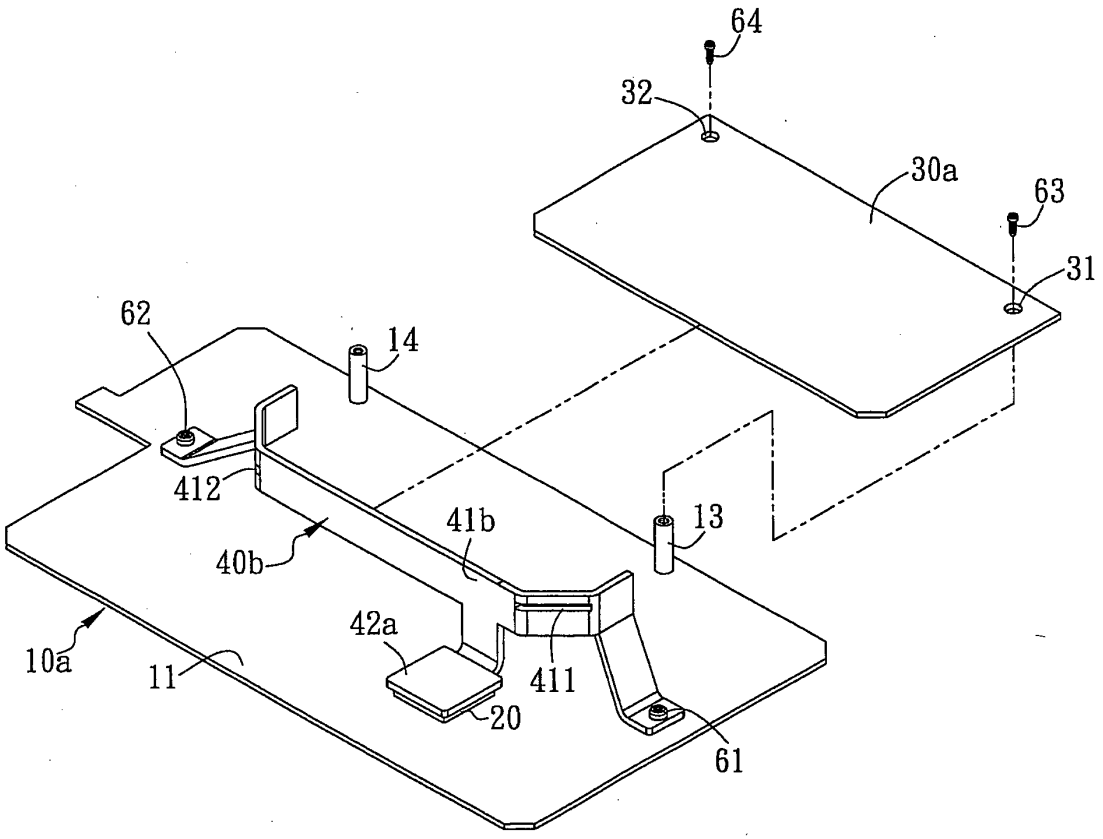

FIG. 3

REFERENCES CITED IN THE DESCRIPTION

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