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(54) Title: ELECTRICAL CONNECTOR ASSEMBLY WITH BACK PLATE

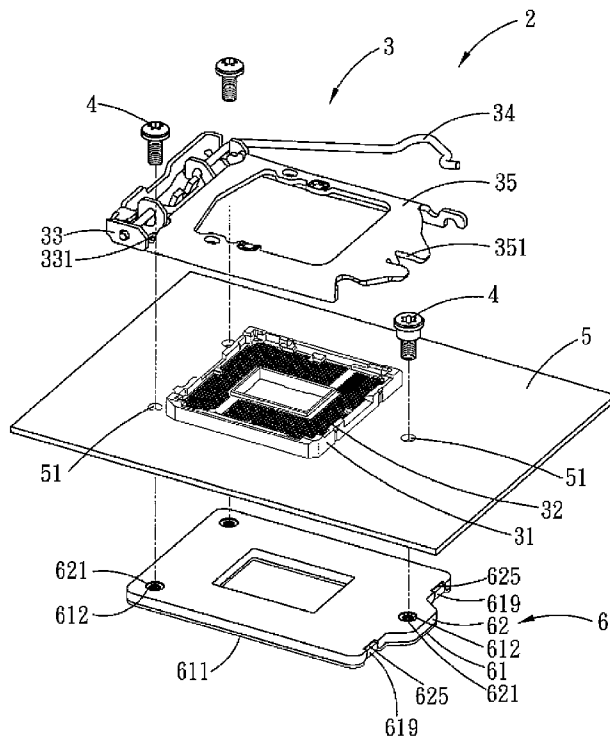


FIG. 2

(57) Abstract: An electrical connector assembly comprises an electrical connector and a back plate. The electrical connector is fastened to an upper board surface of a circuit board. The back plate is fastened to a lower board surface of the circuit board opposite to the electrical connector, and includes a rigid bottom plate, and a non-conductive plate sandwiched between the rigid bottom plate and the circuit board. The area of the non-conductive plate is approximately that of the rigid bottom plate. The elasticity coefficient of the non-conductive plate is smaller than that of the rigid bottom plate. The thickness of the non-conductive plate is greater than that of the rigid bottom plate. The specific gravity of the non-conductive plate is smaller than that of the rigid bottom plate. The cost unit weight of the non-conductive plate is smaller than that of the rigid bottom plate.



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ELECTRICAL CONNECTOR ASSEMBLY WITH BACK PLATE

BACKGROUND OF THE INVENTION

[0001] This application claims priority to Taiwan Application No. 98202334, filed February 18, 2009 and to Taiwan Application No. 98202335, filed February 18, 2009 and to Taiwan Application No. 98202337, filed February 18, 2009, all of which are incorporated herein by reference in their entirety.

FIELD OF THE INVENTION

[0002] The invention relates to an electrical connector assembly, more particularly to an electrical connector assembly having a back plate of composite structure

DESCRIPTION OF RELATED ART

[0003] Back plates are sometimes used to enhance the strength of the printed circuit board. The back plate can be locked, along with the heat sink or the CPU electrical connector, to the printed circuit board on the back surface opposite to the heat sink or the CPU electrical connector. This can provide a support structure that insures the heat sink is tightly coupled to the CPU so as to obtain sufficient thermal management at a system level. Conventional back plates include back plates formed from plastic or back plates formed from metal by stamping. Although the manufacture of plastic back plates is simple and the cost is low, the strength of such back plates is insufficient. Metal back plates have higher strength, but the cost of material is high and the manufacturing cost is high as well. Further, during use, a soft insulating piece is generally required additionally to achieve an insulation effect between the metal back plate and the printed circuit board.

[0004] With reference to figure 1, TW utility model patent no. M341950 (corresponding to CN utility model patent application no. 200820032094.0) discloses an electrical connector assembly 10 for mounting onto a printed circuit board 13 to electrically connect a chip module 12 with the printed circuit board 13, comprising an electrical connector 11 secured to the upper portion of the printed circuit board 13, and a metal back plate 15 secured to the lower portion of the printed circuit board 13, wherein an insulative plastic piece 14 is disposed between the metal back plate 15 and printed circuit board 13, and the insulative plastic piece 14 is provided with an engaging hook 141 for engagement onto the metal back plate 15.

[0005] In the above-described patent, the soft insulating piece is replaced with an insulative plastic piece 14. Although an assembly structure of metal back plate 15 and printed circuit board 13 with an insulative plastic piece disposed therebetween is disclosed therein, the insulative plastic piece 14 apparently serves the purpose of electrical insulation between the metal back plate 15 and printed circuit board 13.

[0006] As disclosed, the above-mentioned patent utilizes an engaging hook 141 on the insulative plastic piece 14 for engagement onto the metal back plate 15. It has been determined that bending deformation is created because the back plate is subjected to the effects of very large bending moment. Furthermore, as the plastic plate, which tends to be characterized by low elasticity, is somewhat brittle, it tends to crack when subjected to bending deformation, and sometimes the engaging hook 141 can even break off. Thus, certain individuals would appreciate an improved electrical connector assembly and/or back plate.

BRIEF SUMMARY OF THE INVENTION

[0007] In an embodiment, an electrical connector assembly comprises an electrical connector and a back plate. The electrical connector can be secured on a first surface of a circuit board. The back plate can be secured on a second surface of the circuit board aligned with a position of the electrical connector, and includes a rigid bottom plate and a nonconductive material plate

interposed between the rigid bottom plate and the circuit board. The rigid bottom plate is provided with a plurality of assembling elements upwardly protruding therefrom, each assembling element having an assembling part. The nonconductive material plate is provided with assembling holes thereon at positions corresponding to the assembling elements to interference fit with the assembling parts of the assembling elements, respectively.

[0008] BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Fig. 1 is an exploded perspective view illustrating a conventional electrical connector assembly;

[0010] Fig. 2 is an exploded perspective view illustrating the first preferred embodiment of an electrical connector assembly according to this utility model;

[0011] Fig. 3 is a side view of the first preferred embodiment;

[0012] Fig. 4 is an exploded perspective view of a back plate of the first preferred embodiment;

[0013] Fig. 5 is a fragmentary enlarged view of the portion (I) of Fig. 4, illustrating an assembling hole in a non-conductive plate;

[0014] Fig. 6 is a schematic view of a conventional rigid bottom plate;

[0015] Fig. 7 is a schematic view of a composite construction of a non-conductive plate and a rigid bottom plate;

[0016] Fig. 8 is a schematic view illustrating a conversion of a section of Fig. 7;

[0017] Fig. 9 is an exploded perspective view illustrating a back plate of the second preferred embodiment of an electrical connector assembly according to this utility model;

[0018] Fig. 10 is an exploded perspective view illustrating the third preferred embodiment of an electrical connector assembly according to this utility model;

[0019] Fig. 11 is an exploded perspective view of a back plate of the third preferred embodiment;

[0020] Fig. 12 is an exploded perspective view of a rigid bottom plate of the third preferred embodiment;

[0021] Fig. 13 is a perspective view of an assembling member of the third preferred embodiment;

[0022] Fig. 14 is an exploded perspective view illustrating a back plate of the fourth preferred embodiment of an electrical connector assembly according to this utility model;

[0023] Fig. 15 is an exploded perspective view illustrating a back plate of the fifth preferred embodiment of an electrical connector assembly according to this utility model;

[0024] Fig. 16 is an exploded perspective view illustrating a back plate of the sixth preferred embodiment of an electrical connector assembly according to this utility model;

[0025] Fig. 17 is an exploded perspective view at another angle;

[0026] Fig. 18 is a sectional view of a back plate of the sixth preferred embodiment;

[0027] Fig. 19 is an exploded perspective view illustrating a back plate of the seventh preferred embodiment of an electrical connector assembly according to this utility model;

[0028] Fig. 20 is an exploded perspective view at another angle;

[0029] Fig. 21 is a bottom view of the seven preferred embodiment;

[0030] Fig. 22 is a sectional view taken along line XXII-XXII in Fig. 21;

[0031] Fig. 23 is a sectional view taken along line XXIII-XXIII in Fig. 21;

[0032] Fig. 24 is an exploded perspective view illustrating a back plate of the seventh preferred embodiment of an electrical connector assembly according to this utility model;

[0033] Fig. 25 is an exploded perspective view of Fig. 24 at another angle; and

[0034] Fig. 26 is an exploded perspective view illustrating a back plate of the eighth preferred embodiment of an electrical connector assembly according to this utility model.

DETAILED DESCRIPTION OF THE INVENTION

[0035] The detailed description that follows describes exemplary embodiments and is not intended to be limited to the expressly disclosed combination(s). Therefore, unless otherwise noted, features disclosed herein may be combined together to form additional combinations that were not otherwise shown for purposes of brevity.

[0036] As the figures and follow discussion show, it is possible to provide an electrical connector assembly utilizing a thicker non-conductive plate and a thinner rigid plate that are interconnected so to form a composite back plate that can provide sufficient bending rigidity and stabilizing effects. This can help increase the structural strength of the back plate so that it is capable of providing sufficient flexural rigidity while also providing the possibility of being able to significantly lowering costs and to reduce weight.

[0037] As illustrated, a composite structure of the back plate can be formed from combination of a nonconductive material plate and a rigid bottom plate. It has been found that the use of the direct interference fit of the assembling elements with the corresponding assembling holes in the nonconductive material plate can provide improve the assembly of the back plate while at the same time can provide a structure that is even more stable than conventional back plates..

[0038] Referring to Figs. 2 through 4, a first embodiment of an electrical connector assembly 2 includes an electrical connector 3, a back plate 6, and a plurality of fasteners 4 for fastening the

electrical connector 3 and the back plate 6 to upper and lower board surfaces of a circuit board 5, respectively.

[0039] The electrical connector 3 is fastened to the upper board surface of the circuit board 5, and is used to connect a chip module (not shown) to the circuit board 5. The electrical connector 3 includes an insulating body 31, a plurality of terminals 32 disposed fixedly on the insulating body 31, a base 33, a cover plate 35 disposed pivotally on the base 33 for covering the insulating body 31, and an operating lever 34 for pressing the cover plate 35 against the chip module. The base 33 is provided with a plurality of fixing portions 331 permitting extension of the fasteners 4 therethrough. The cover plate 35 is provided with a retaining portion 351 at an end thereof aligned with one of the fasteners 4.

[0040] The back plate 6 is fastened to the lower board surface of the circuit board 5 opposite to the electrical connector 3, and includes a rigid bottom plate 61, and a non-conductive plate 62 sandwiched between the rigid bottom plate 61 and the circuit board 5. The area of the non-conductive plate 62 is approximate to that of the rigid bottom plate 61. The elasticity coefficient of the non-conductive plate 62 is smaller than that of the rigid bottom plate 61. The thickness of the non-conductive plate 62 is greater than that of the rigid bottom plate 61. The specific gravity of the non-conductive plate 62 is smaller than that of the rigid bottom plate 61. The cost per unit weight of the non-conductive plate 62 is smaller than that of the rigid bottom plate 61.

[0041] As depicted, the rigid bottom plate 61 is made of a metal material, and the non-conductive plate 62 is made of a plastic material. The metal material of the rigid bottom plate 61 can be stainless steel or carbon steel, and the plastic material of the non-conductive plate 62 can be liquid crystal polymer (LCP), polybutylene terephthalate (PBT), or acrylonitrile – butadiene – styrene (ABS). However, other appropriate materials may also be used as desired.

[0042] The rigid bottom plate 61 has a body 611, a plurality of assembling member 612 connected to and projecting upwardly from the body 611, and two hooking sheets 619 extending upwardly from a side edge of the body 611. As depicted, the assembling members 612 are formed integrally with the body 611. Each of the assembling members 612 has an assembling portion 615, and a locking portion 616 is defined by an inner surface formed with a threaded through hole 618 engaging an external thread of the corresponding fastener 4.

[0043] The non-conductive plate 62 is provided with a plurality of assembling holes 621 that are formed at positions aligned respectively with the assembling members 612 and that engage respectively the assembling portions 615 of the assembling members 612. Each of the assembling holes 621 is defined by an inner surface formed with a plurality of engaging blocks 624 (see Fig. 5) that provide interference fit with outer surfaces of the assembling portions 615 of the assembling members 612, respectively. Due to the interference fit, the non-conductive plate 62 and the rigid bottom plate 61 can be assembled firmly and easily. The non-conductive plate 62 further has two hooked portions 625 engaging the hooking sheets 619, respectively.

[0044] In this embodiment, the assembling portions 615 of the assembling members 612 and the assembling holes 621 are generally circular in cross-section.

[0045] As such, the fasteners 4 extend through the fixing portions 331 of the electrical connector 3 and the through holes 51 in the circuit board 5, and are locked to the locking portions 616 of the assembling members 612.

[0046] Figs. 6, 7, and 8 illustrate that the composite design of the non-conductive plate 62 and the rigid bottom plate 61 can provide a bending rigidity greater than that of the prior art, which relies on the rigid bottom plate 15. To compare the two designs, the flexural rigidity (EI) of the two designs will be compared. The comparison will be based on the using the elasticity coefficient of the rigid bottom plates 61, 15 as being E_m while the elasticity coefficient of the non-conductive plate 62 is E_p , assuming that $E_m = 15 E_p$.

[0047] Fig. 6 illustrates the size of a bottom plate 15, for which the second moment of inertia I_1 and the flexural rigidity $(EI)_1$ of the neutral axis can be calculated as follows:

$$I_1 = (1/12) (b) (1.8^3) = 0.486b$$

$$(EI)_1 = (E_m) (0.486b) = 0.486E_m b$$

[0048] Fig. 7 illustrates the size of the composite back plate 6 consisting of the rigid bottom plate 61 and the non-conductive plate 62. To calculate the second moment of inertia of the cross-section thereof, it is helpful to first convert the cross-section into that shown in Fig. 8 (i.e., convert the rectangular composite beam of two materials into a homogeneous T-beam), and calculate the position y of the neutral axis, the second moment of inertia I_2 and the flexural rigidity $(EI)_2$ of the neutral axis as follows:

$$y = \frac{\left(2.6 \times b \times \left(\frac{2.6}{2} + 0.8 \right) \right) + \left(0.8 \times 15b \times \left(\frac{0.8}{2} \right) \right)}{2.6 \times b + 0.8 \times 15b} = 0.703$$

$$I_2 = (1/3) \times 15b \times 0.703^3 + (1/3) \times 14b \times 0.097^3 + (1/3) \times b \times 2.697^3$$

$$= 8.281b$$

$$(EI)_2 = (E_p) (8.281b) = (1/15) (E_m) (8.281b) = 0.552E_m b$$

[0049] From the comparison, it can be appreciated that the flexural rigidity $(EI)_2$ of the composite back plate 6 is greater than the flexural rigidity $(EI)_1$ of the conventional bottom plate 15, even though the conventional bottom plate is 1.8 mm thick while the bottom plate 61 of the composite back plate 6 at 0.8 mm thick is less than half the thickness. Thus, the calculated results illustrate that the depicted composite back plate 6 design can provide a sufficient bending rigidity.

[0050] Referring to Fig. 9, a second embodiment of a back plate 6 is depicted and includes from the bottom to the top, a first rigid bottom plate 61, a non-conductive plate 62, a second rigid bottom

plate 63, and an insulating film 64. Unlike the first preferred embodiment, the back plate 6 of which includes only a rigid bottom plate 61 and a non-conductive plate 62, the back plate 6 of this embodiment includes two rigid bottom plates 61, 63, a non-conductive plate 62, and an insulating film 64 disposed on an upper plate surface of the rigid bottom plate 63 for providing electrical insulation for the circuit board 5.

[0051] Figs. 10, 11, and 12 shows a third embodiment of an electrical connector assembly 10. In the third embodiment, the rigid bottom plate 61 has a body 611, and a plurality of assembling members 612 projecting upwardly from the body 611. Each of the assembling members 612 (see Fig. 13) has an assembling portion 615, a locking portion 616 located at an upper end of the assembling portion 615, and a riveting portion 617 located at a bottom end of the assembling portion 615.

[0052] An outer surface of the locking portion 616 is formed with an outer thread engaging the corresponding fastener 4. The riveting portion 617 is riveted into the through hole 614 of the body 611 so as to connect the assembling member 612 to the body 611.

[0053] The non-conductive plate 62 is provided with a plurality of assembling holes 621 that are formed at positions aligned respectively with the assembling members 612 and that engage respectively the assembling portions 615 of the assembling members 612. Each of the assembling holes 621 is defined by an inner surface formed with a plurality of engaging blocks 624 (see Fig. 5) that provide interference fit with outer surfaces of the assembling portions 615 of the assembling members 612, respectively.

[0054] In this third embodiment, the assembling portions 615 of the assembling members 612 and the assembling holes 621 are generally circular in cross-section.

[0055] As such, the locking portions 616 of the assembling members 612 of the back plate 6 extend through the through holes 51 in the circuit board 5, and locked to the fixing portions 331 of the electrical connector 3.

[0056] Fig. 14 shows a fourth embodiment of a back plate 6. As depicted, the fourth embodiment includes a different shape of the assembling portions 615 of the assembling members 612 of the rigid bottom plate 61 and the assembling holes 621 in the non-conductive plate 62. In this embodiment, the assembling portions 615 of the assembling members 612 and the assembling holes 621 are generally rectangular in cross-section. Each of the assembling holes 621 is defined by an inner surface formed with a plurality of engaging blocks 624 that provide interference fit with outer surfaces of the assembling portions 615 of the assembling members 612, respectively.

[0057] Fig. 15 shows a fifth embodiment of a back plate 6. In this fifth embodiment, the rigid bottom plate 61 has two types of assembling members 612, 612'. Each of the assembling members 612 located at an outer side has an assembling portion 615 and a locking portion 616 located at an upper end of the assembling portion 615. Each of the assembling members 612' located at an inner side has an assembling portion 615', and a locking portion 616' located at an upper end of the assembling portion 615'. Outer surface of the locking portions 616' are formed with external threads for locking purposes.

[0058] The non-conductive plate 62 is provided with a plurality of assembling holes 621 that are formed at positions aligned respectively with the assembling members 612 and that engage respectively the assembling portions 615 of the assembling members 612. Each of the assembling holes 621 is defined by an inner surface formed with a plurality of engaging blocks 624 that provide interference fit with outer surfaces of the assembling portions 615 of the assembling members 612, respectively. The non-conductive plate 62 is provided with a plurality of through holes 626 that are formed at positions thereof aligned respectively with the assembling members 612' and that engage respectively the assembling members 612'.

[0059] It should be noted that, in this embodiment, only the assembling portions 615 of the assembling members 612 located at the outer side are interference fit into the assembling holes 621 to achieve firm connection between the non-conductive plate 62 and the rigid bottom plate 61.

The assembling members 612' located at the inner side extend through the through holes 626, and do not distribute to the assembling function.

[0060] Figs. 16, 17, and 18 show a sixth embodiment of a back plate 6, which while similar to the third embodiment, includes two reinforcing ribs 613 formed on an upper plate surface of the rigid bottom plate 61. As depicted, a lower plate surface of the non-conductive plate 62 is formed with two concaved portions 622 for receiving the reinforcing ribs 613. As depicted, the reinforcing ribs 613 are rectangular in shape, and one of the reinforcing ribs 613 is disposed inside the other one of the reinforcing ribs 613. Because the reinforcing ribs 613 project away from surface, which would tend to increase the second moment of inertia, the strength of the composite back plate 6 can be increased. Furthermore, the lower plate surface of the non-conductive plate 62 can include a plurality of concaved portions 623 to help provide reduced weight.

[0061] Figs. 19 to 23 show a seventh embodiment of a back plate 6. While the seventh embodiment is similar to the fifth embodiment, the upper plate surface of the rigid bottom plate 61 is formed with a plurality of reinforcing ribs 613. The lower plate surface of the non-conductive plate 62 is formed with a plurality of concaved portions 622 for receiving the reinforcing ribs 613, respectively. As depicted there are five reinforcing ribs 613, one of which is disposed at an inner side and is rectangular. The remaining four reinforcing ribs 613 are stripe-shaped.

[0062] Since the reinforcing ribs 613 project away from the surface of the top surface, they act to increase the second moment of inertia and thus help increase the strength of the composite back plate 6. Furthermore, the lower plate surface of the non-conductive plate 62 is further formed with a plurality of concaved portions 623 to help provide reductions in weight.

[0063] Figs. 24, 25, and 26 depicted an eighth embodiment of a back plate 6. The eighth embodiment, while similar to the first embodiment, is different because that the upper plate surface of the rigid bottom plate 61 is formed with a plurality of reinforcing ribs 613. The lower plate surface of the non-conductive plate 62 is formed with a plurality of concaved portions 622 for

receiving the reinforcing ribs 613, respectively. In this embodiment, the reinforcing ribs 613 are rectangular, and one of the reinforcing ribs 613 is disposed inside the other one of the reinforcing ribs 613.

[0064] Since the reinforcing ribs 613 project in a direction which would tend to increase the second moment of inertia, the strength of the composite back plate 6 can be increased. Furthermore, the lower plate surface of the non-conductive plate 62 is further formed with a plurality of concaved portions 623 to achieve weight-reducing purposes.

[0065] In view of the above, it can be appreciated that a thicker non-conductive plate 62 can be connected to the thinner rigid bottom plate 61 to provide a composite back plate 6, which is able to provide a sufficient flexural rigidity and stability while potentially reducing cost and weight.

[0066] The disclosure provided herein describes features in terms of preferred and exemplary embodiments thereof. Numerous other embodiments, modifications and variations within the scope and spirit of the appended claims will occur to persons of ordinary skill in the art from a review of this disclosure.

We claim:

1. An electrical connector assembly, comprising:
an electrical connector fastened to an upper board surface of a circuit board; and
a back plate fastened to a lower board surface of the circuit board opposite to the electrical connector, the back plate including:
a rigid bottom plate, and
a non-conductive plate sandwiched between the rigid bottom plate and the circuit board, the area of the non-conductive plate being approximate to that of the rigid bottom plate, the elasticity coefficient of the non-conductive plate being smaller than that of the rigid bottom plate, the thickness of the non-conductive plate being greater than that of the rigid bottom plate, the specific gravity of the non-conductive plate being smaller than that of the rigid bottom plate, the cost unit weight of the non-conductive plate being smaller than that of the rigid bottom plate.
2. The electrical connector assembly according to Claim 1, wherein the rigid bottom plate is made of a metal material.
3. The electrical connector assembly according to Claim 2, wherein the metal material of the rigid bottom plate is selected from the group consisting of stainless and carbon steel.
4. The electrical connector assembly according to Claim 2, wherein the non-conductive plate is made of a plastic material.
5. The electrical connector assembly according to Claim 4, wherein the plastic material of the non-conductive plate is selected from liquid crystal polymer, polybutylene terephthalate, and acrylonitrile – butadiene – styrene.
6. The electrical connector assembly according to Claim 4, wherein the rigid bottom plate is provided with a plurality of assembling members projecting upwardly therefrom, each of the assembling members having an assembling portion, the non-conductive plate being provided with a plurality of assembling holes that are formed in positions thereof aligned respectively with the assembling members and that engage respectively the assembling portions of the assembling

members.

7. The electrical connector assembly according to Claim 6, wherein each of the assembling holes is defined by an inner surface formed with a plurality of engaging projections that provides interference fit with an outer surface of the assembling portion of a corresponding one of the assembling members.

8. The electrical connector assembly according to Claim 7, wherein the rigid bottom plate has an upper plate surface formed with a plurality of reinforcing ribs, the non-conductive plate having a lower plate surface formed with a plurality of concaved portions for receiving the reinforcing ribs, respectively.

9. The electrical connector assembly according to Claim 4, wherein the rigid bottom plate has an upper plate surface formed with a plurality of reinforcing ribs, the non-conductive plate having a lower plate surface formed with a plurality of concaved portions for receiving the reinforcing ribs, respectively.

10. The electrical connector assembly according to Claim 4, wherein the back plate further includes, from the bottom to the top, another rigid bottom plate sandwiched between the non-conductive plate and the circuit board, and an insulating film.

11. A back plate comprising:

a rigid bottom plate, and

a non-conductive plate sandwiched between the rigid bottom plate and the circuit board, the area of the non-conductive plate being approximate to that of the rigid bottom plate, the elasticity coefficient of the non-conductive plate being smaller than that of the rigid bottom plate, the thickness of the non-conductive plate being greater than that of the rigid bottom plate, the specific gravity of the non-conductive plate being smaller than that of the rigid bottom plate, the cost unit weight of the non-conductive plate being smaller than that of the rigid bottom plate.

12. The back plate according to Claim 11, wherein the rigid bottom plate is made of a metal material.

13. The back plate according to Claim 12, wherein the metal material of the rigid bottom plate is selected from the group consisting of stainless and carbon steel.
14. The back plate according to Claim 12, wherein the non-conductive plate is made of a plastic material.
15. The back plate according to Claim 14, wherein the plastic material of the non-conductive plate is selected from liquid crystal polymer, polybutylene terephthalate, and acrylonitrile – butadiene – styrene.
16. The back plate according to Claim 11, wherein the rigid bottom plate is provided with a plurality of assembling members projecting upwardly therefrom, each of the assembling members having an assembling portion, the non-conductive plate being provided with a plurality of assembling holes that are formed in positions thereof aligned respectively with the assembling members and that engage respectively the assembling portions of the assembling members.
17. The back plate according to Claim 16, wherein each of the assembling holes is defined by an inner surface formed with a plurality of engaging projections that provides interference fit with an outer surface of the assembling portion of a corresponding one of the assembling members.
18. The back plate according to Claim 17, wherein the rigid bottom plate has an upper plate surface formed with a plurality of reinforcing ribs, the non-conductive plate having a lower plate surface formed with a plurality of concaved portions for receiving the reinforcing ribs, respectively.
19. The back plate according to Claim 11, wherein the rigid bottom plate has an upper plate surface formed with a plurality of reinforcing ribs, the non-conductive plate having a lower plate surface formed with a plurality of concaved portions for receiving the reinforcing ribs, respectively.
20. The back plate according to Claim 11, wherein the back plate further includes, from the bottom to the top, another rigid bottom plate sandwiched between the non-conductive plate and

the circuit board, and an insulating film.

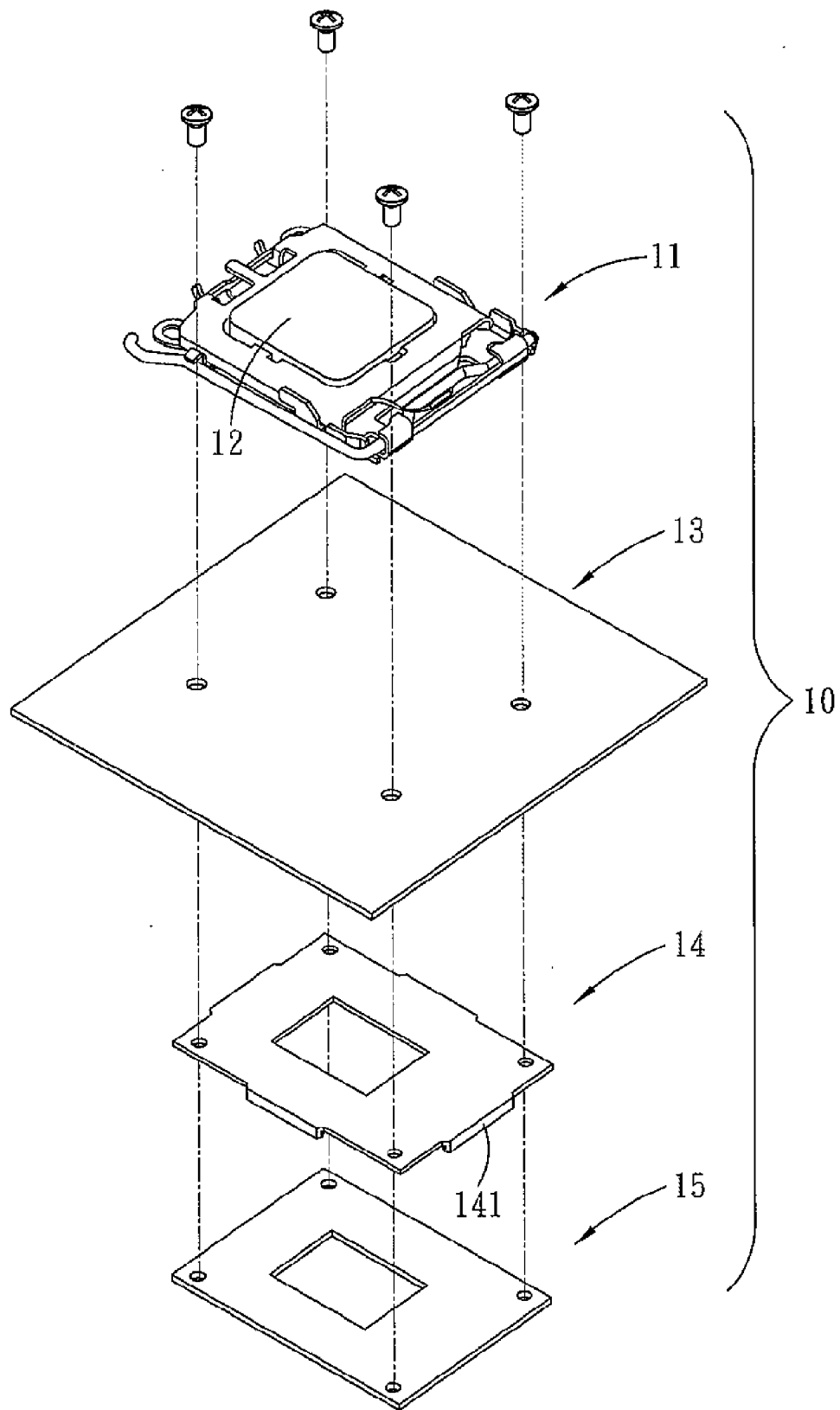


FIG. 1

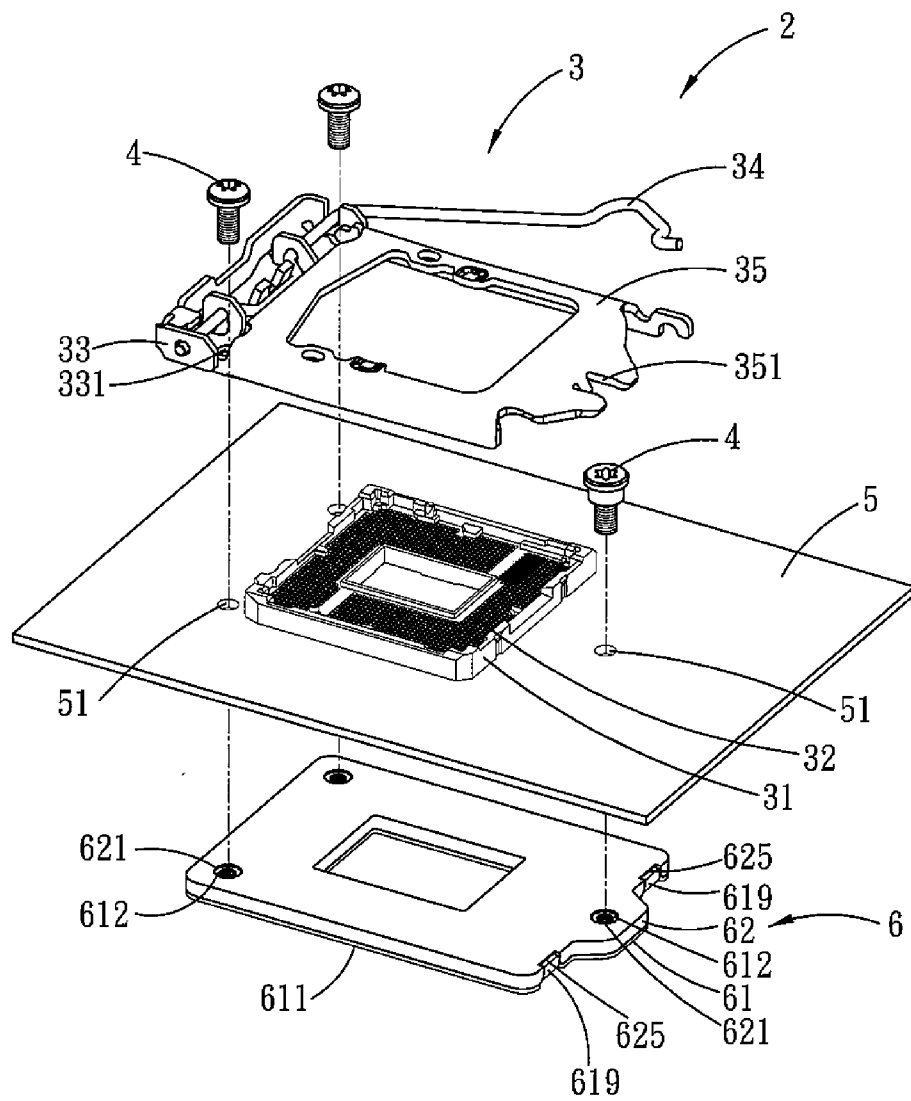


FIG. 2

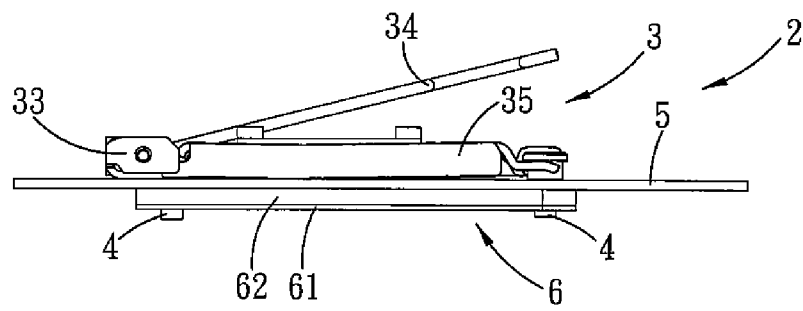


FIG. 3

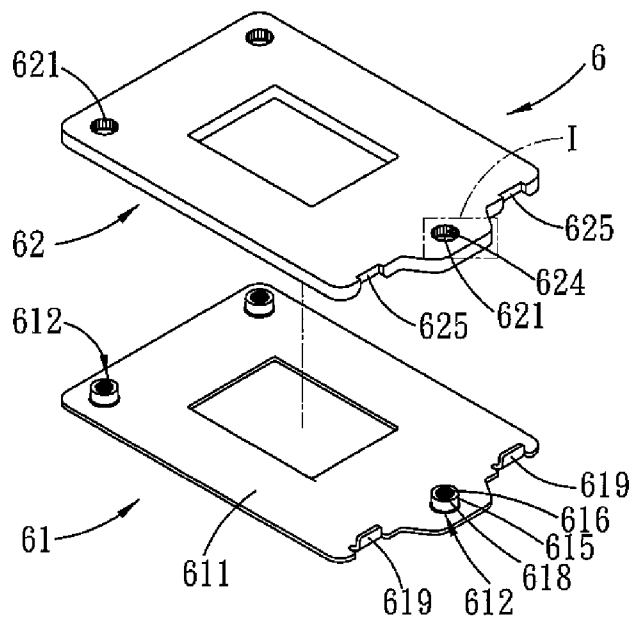


FIG. 4

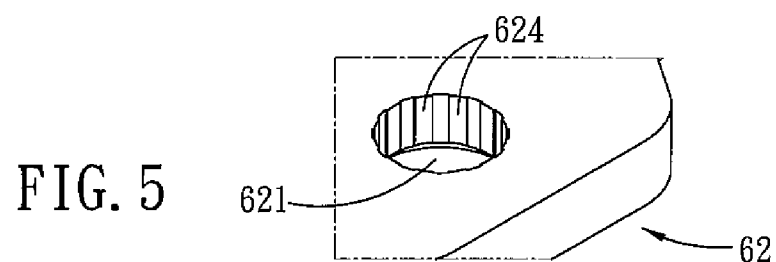


FIG. 5

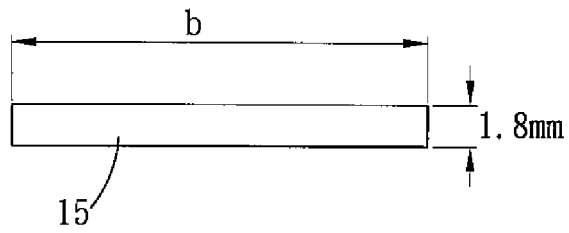


FIG. 6

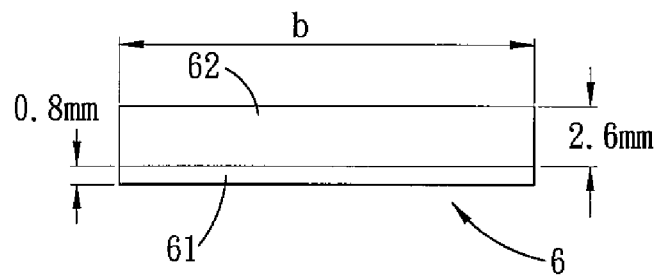


FIG. 7

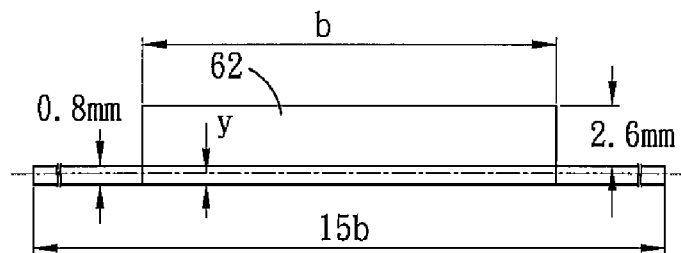


FIG. 8

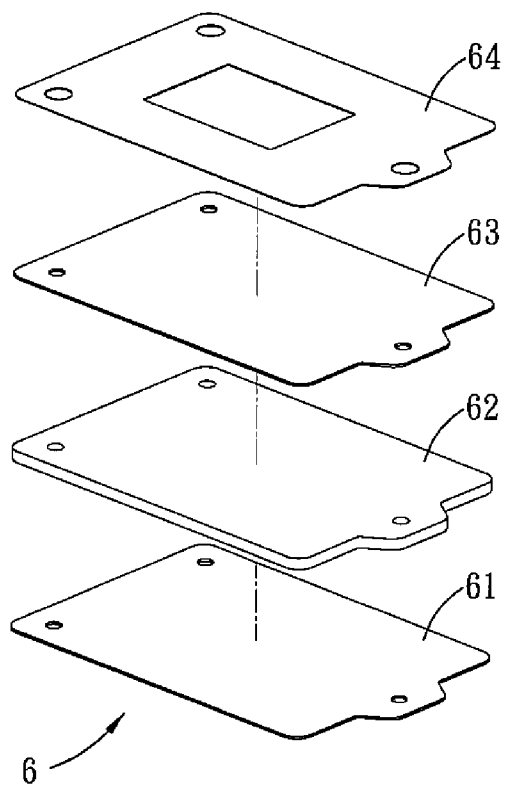


FIG. 9

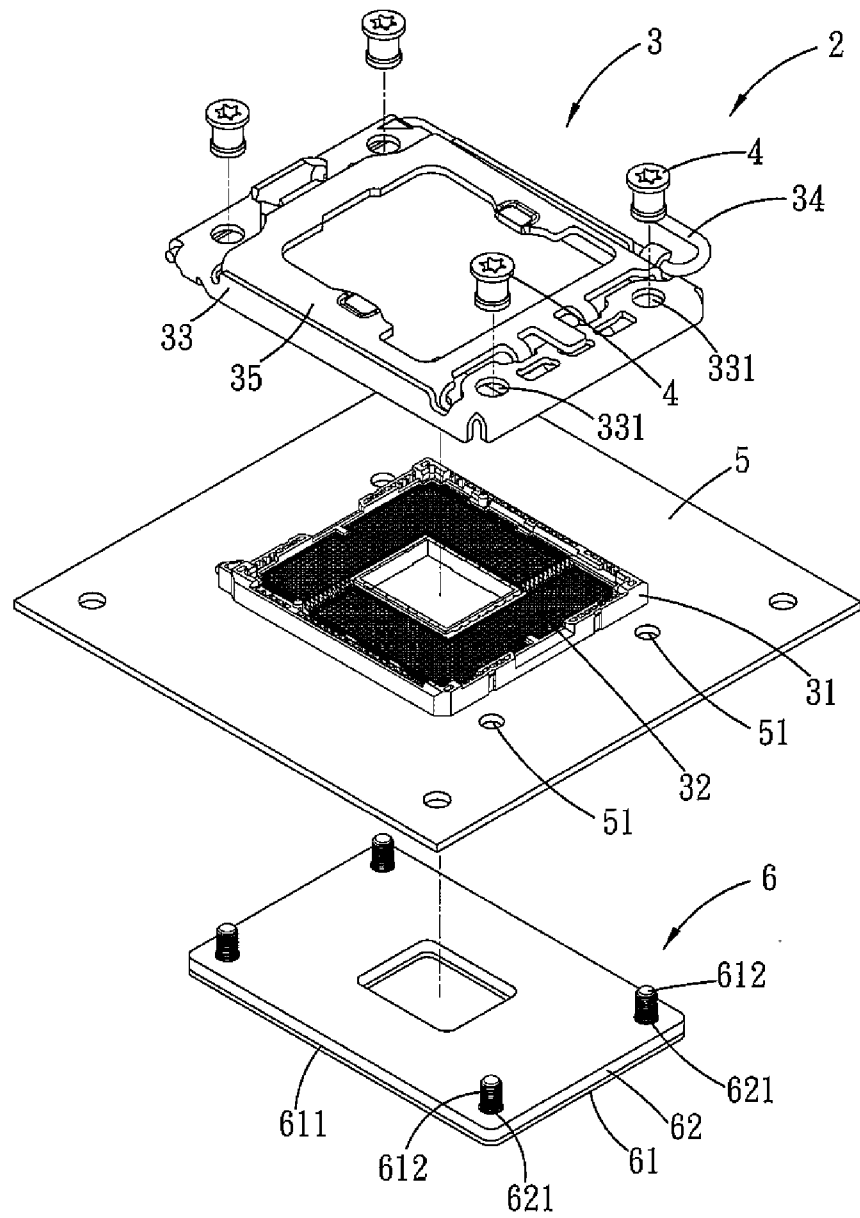


FIG. 10

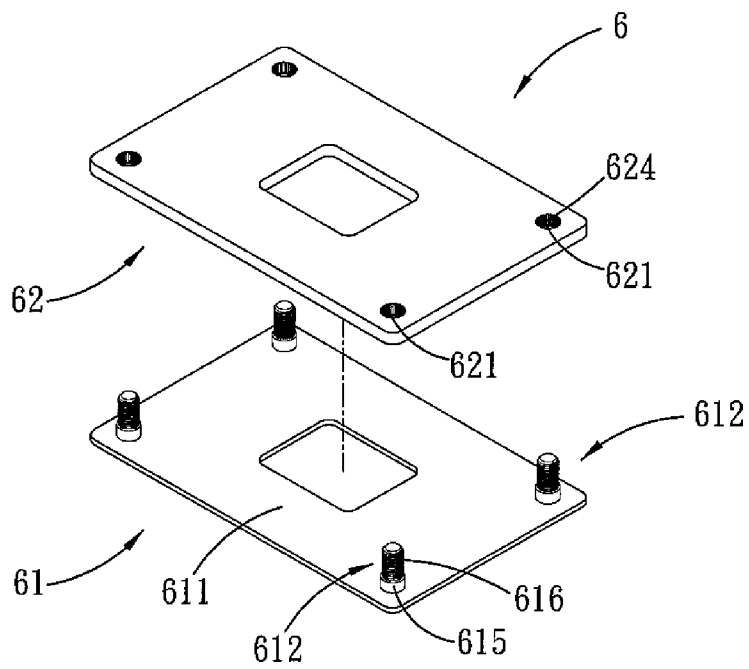


FIG. 11

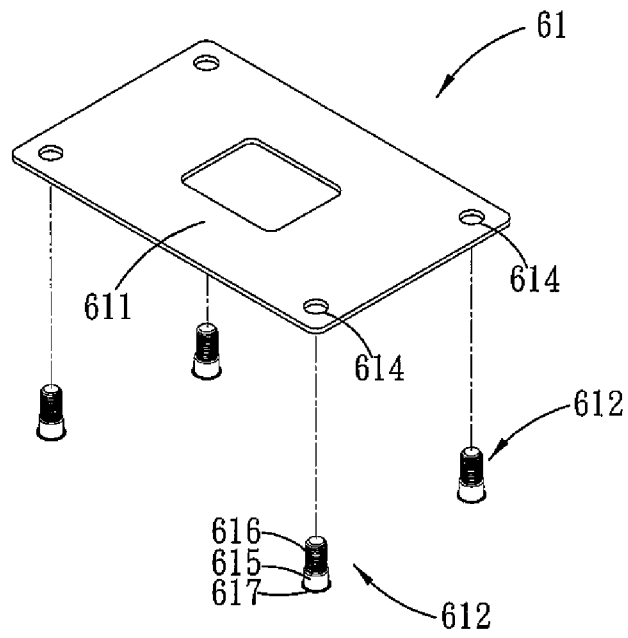


FIG. 12

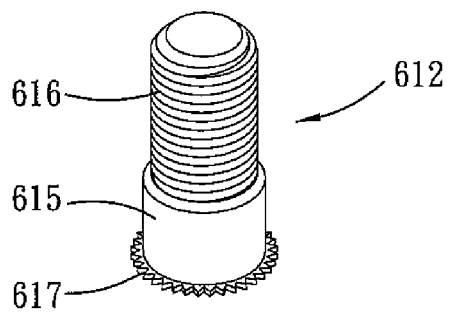


FIG. 13

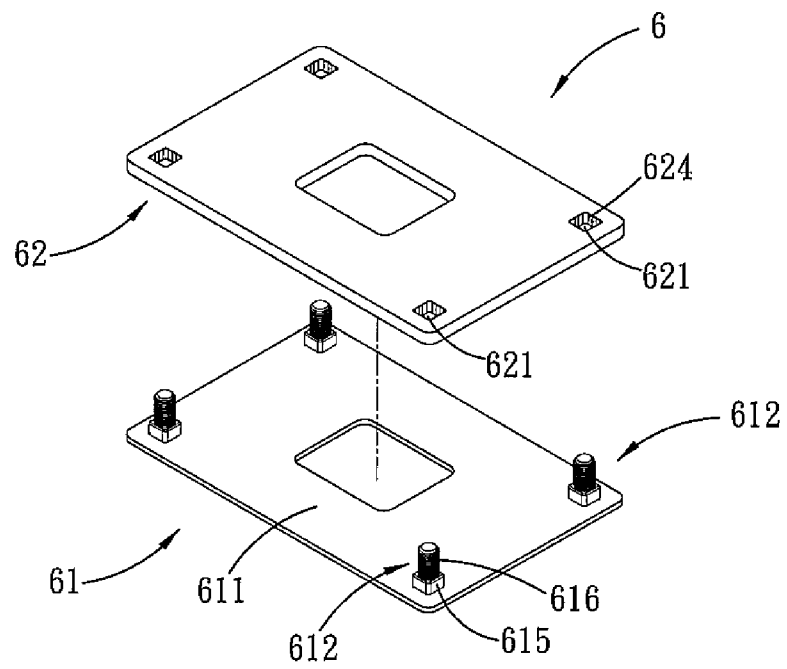


FIG. 14

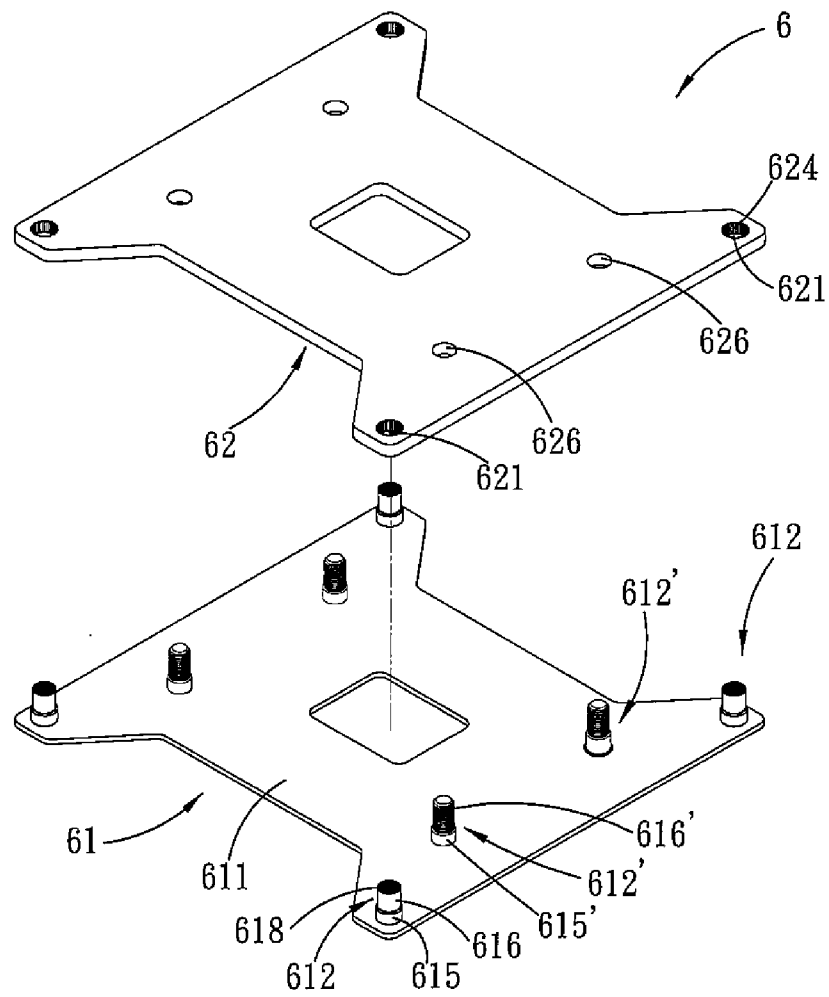


FIG. 15

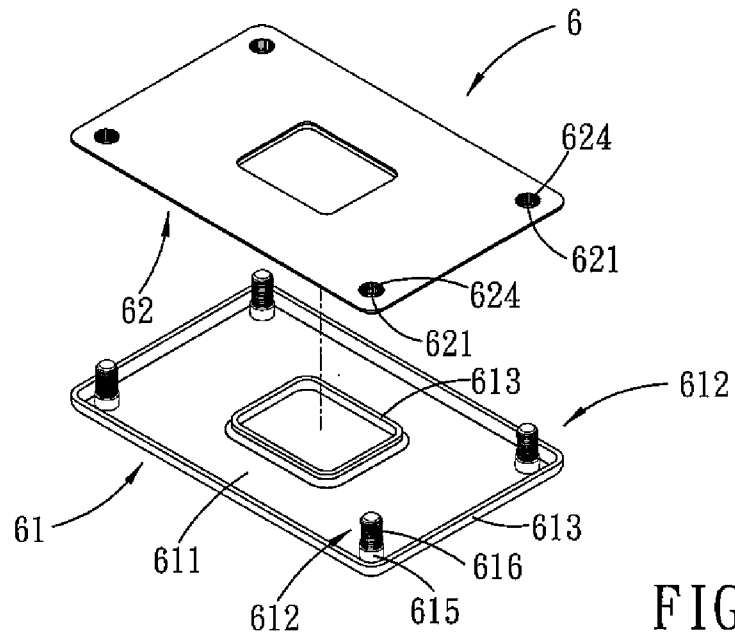


FIG. 16

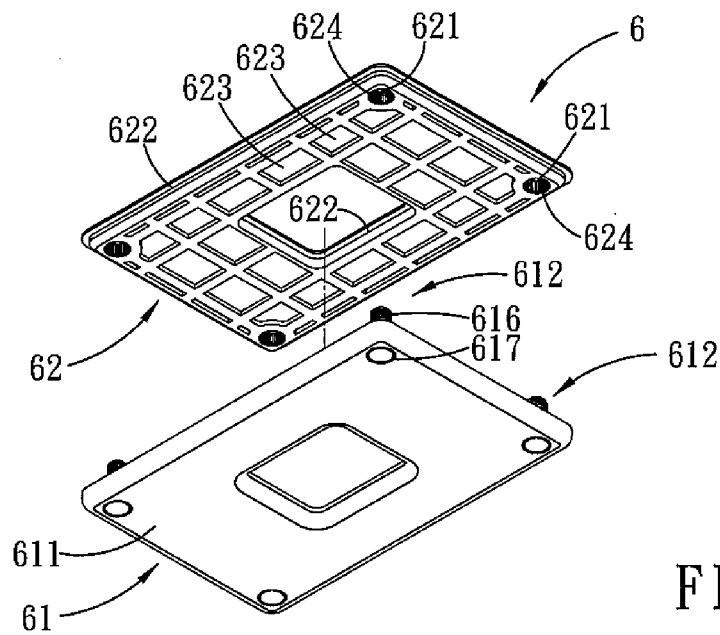


FIG. 17

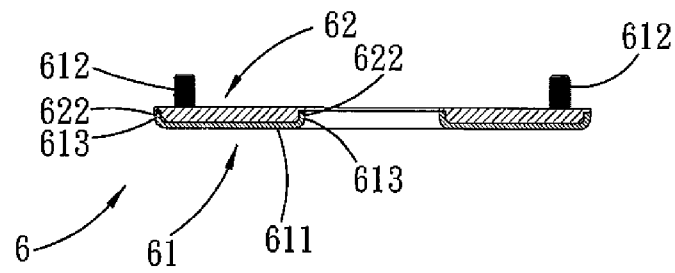


FIG. 18

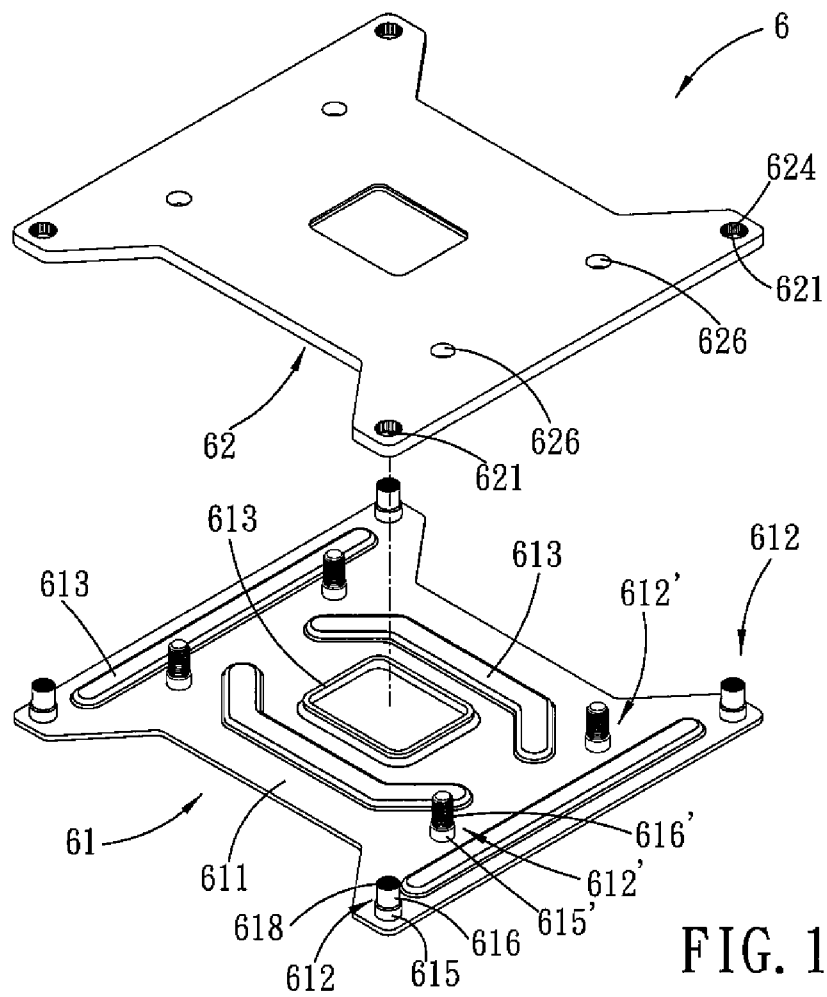


FIG. 19

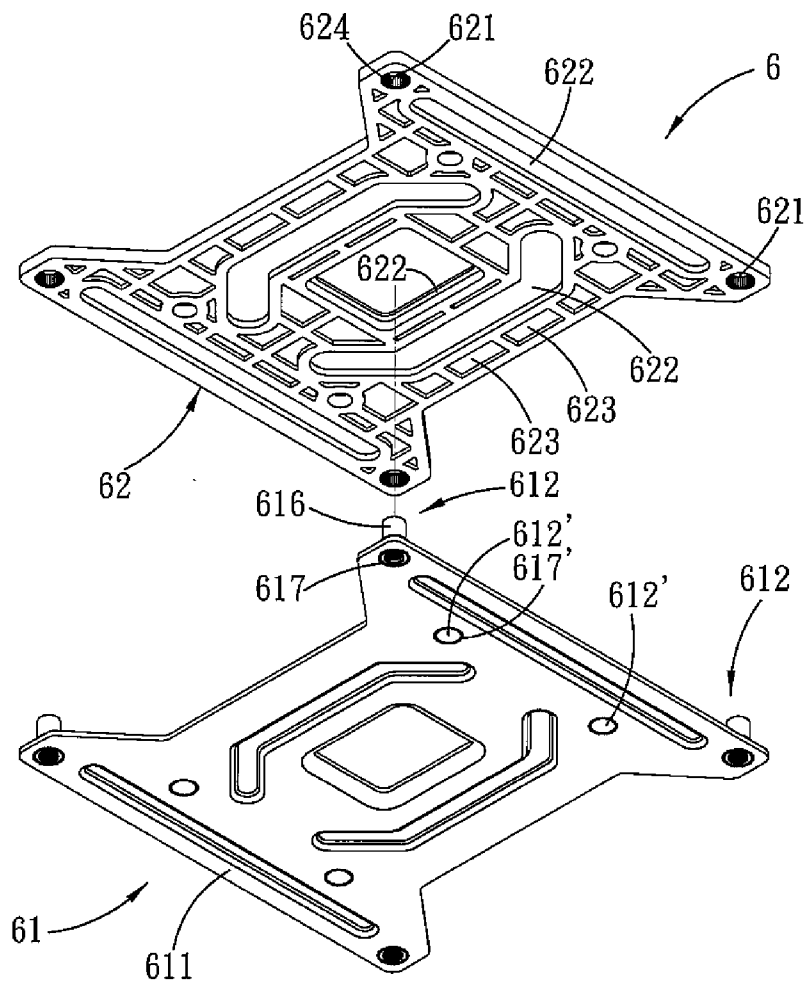


FIG. 20

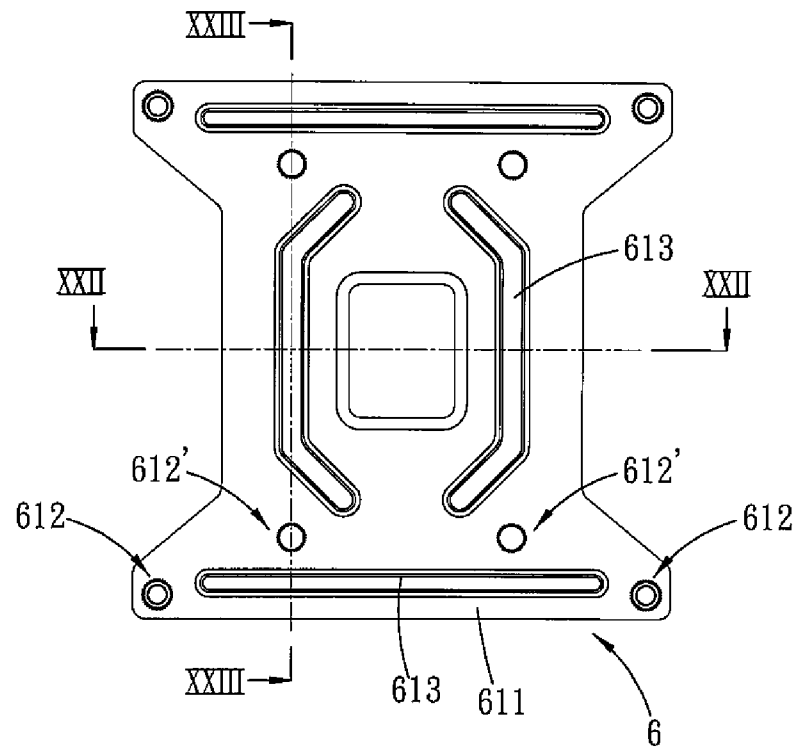


FIG. 21

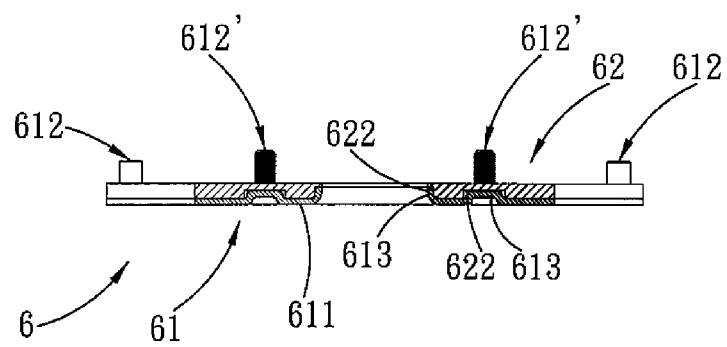


FIG. 22

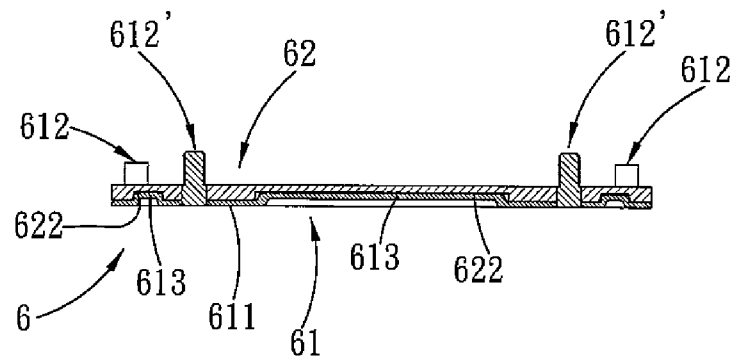


FIG. 23

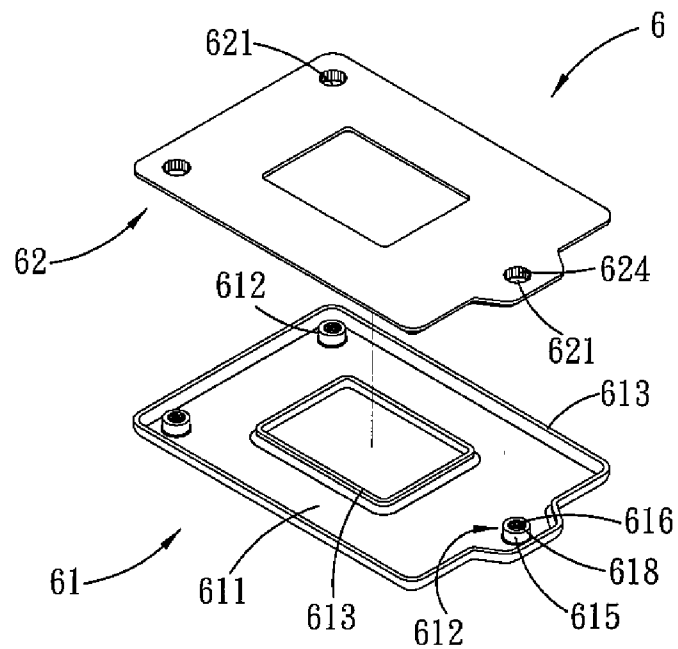


FIG. 24

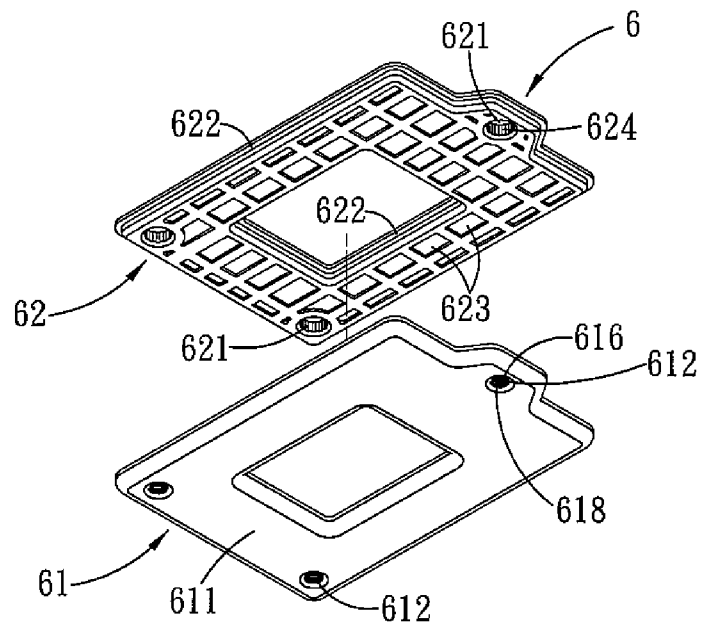


FIG. 25

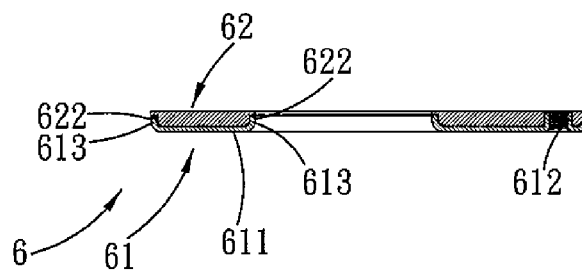


FIG. 26

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2010/024515

A. CLASSIFICATION OF SUBJECT MATTER

INV. H05K3/30 H05K7/10 H01L23/40 H05K7/12 H01R12/00
 ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01L H05K H01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2005/111190 A1 (WANG JACK [TW] ET AL) 26 May 2005 (2005-05-26) paragraphs [0003], [0018], [0 23]; figures 3,5	1-5, 11-15
X	CN 201 191 663 Y (FOXCONN KUNSHAN COMP INTERFACE [CN]) 4 February 2009 (2009-02-04) cited in the application	1-5, 9-15, 19, 20
A	abstract; figure 2.4	6-8, 16-18
A	US 2007/121300 A1 (XIA WAN-LIN [CN] ET AL) 31 May 2007 (2007-05-31) abstract; figures 2,4	8,9,18, 19
	----- -/--	



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See patent family annex.

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Date of the actual completion of the international search

19 May 2010

Date of mailing of the international search report

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Schweiger, Dietmar

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2010/024515

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2003/106708 A1 (MA HAO-YUN [TW]) 12 June 2003 (2003-06-12) abstract; figure 1 -----	8,9,18, 19
A	US 5 528 462 A (PENDSE RAJENDRA D [US]) 18 June 1996 (1996-06-18) abstract; figure 2 -----	10,20

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2010/024515

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US 2005111190	A1	26-05-2005	NONE		
CN 201191663	Y	04-02-2009	NONE		
US 2007121300	A1	31-05-2007	NONE		
US 2003106708	A1	12-06-2003	NONE		
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			JP	8045985 A	16-02-1996